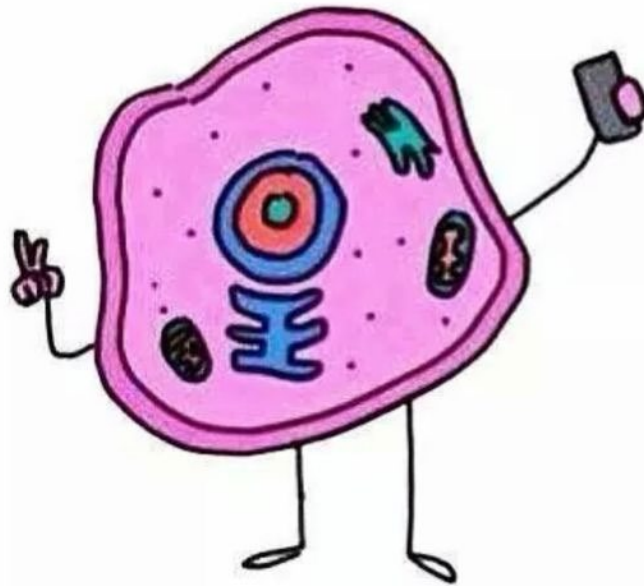


Science 9

UNIT 4: BIOLOGY



Cell-fie

BOOK 1: CELLS & DNA

name: _____

block: _____

Sustainability + Reproduction

_____ refers to the ability of the environment and the living things it supports to endure into the _____. Imagine for a moment that all living things on Earth are no longer able to reproduce-to make more of their own kind. Picture, for example, the last bear eating the last berry on the last berry bush. Or catching the last trout that moments earlier snapped up the last crayfish. Imagine this same scenario for _____.
_____. In this grim "thought experiment", it would not be long before all life on Earth starved and came to an end.

_____ is critical as it ensures that organisms have a source of nutrients and energy to _____.

The sustainability of _____ depends on _____.

Introduction – How Many Cells do Humans Have?

- All living things are made up of _____, which are the _____ unit in all organisms.

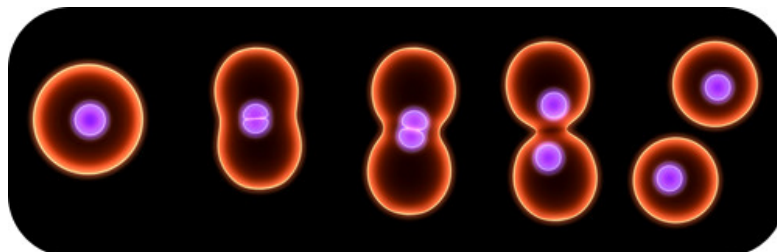


- In fact, you are made up of _____ (_____) cells.
 - To give that number of context, _____

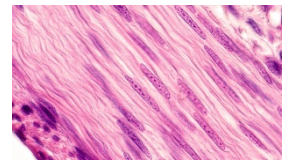


The Importance of Cell Division

- All cells come from _____ cells.
- Our cells are _____ - and being _____.

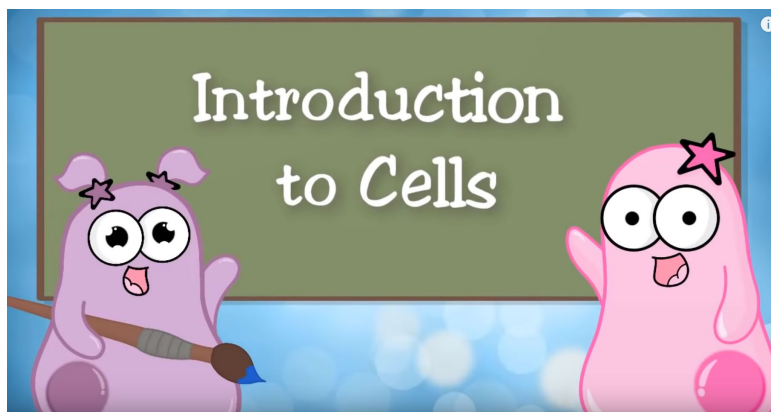


- By the time you finish this sentence, _____ of your cells have died.
- In total we lose between _____ cells every day.
- But our cells divide to produce 300 billion _____.
- We make 100 million _____ every minute.
- And an entirely new layer of skin every _____.
- Some cells only divide under _____:
 - _____ only divide if a piece has been removed. This allows for _____ as the missing tissue will grow back in the donor and the transplanted piece will grow new cells in the recipient.
- Some cells don't divide:
 - _____ – This is why people with brain or spinal damage do not naturally recover
 - _____ – When you build muscle through exercise you are damaging the existing cells and rebuilding them bigger and stronger.
- We need cell division for:
 - _____ of individual organisms
 - _____ damaged and dead cells
 - _____ in unicellular organisms



Amoeba Sisters: Introduction to Cells: The Grand Cell Tour

<https://www.youtube.com/watch?v=8IlzKri08kk>



Amoeba Sisters Video Recap: Introduction to Cells

Directions: For each statement, write a "P" if it best applies to **prokaryotes only**, "E" if it best applies to **eukaryotes only**, and "both" if it applies to **both prokaryotes and eukaryotes**.

1. _____ I have a **cell membrane (plasma membrane)**.

2. _____ I have a **nucleus**.

3. _____ **Bacteria** are an example of me.

4. _____ **Fungi** are an example of me.

5. _____ **Animals** are an example of me.

6. _____ I contain **ribosomes**.

7. _____ I contain **membrane-bound organelles**.

8. _____ I contain **cytoplasm**.

9. _____ **Your body cells** are made of this type of cell.

10. _____ **Protists** are an example of me.

11. _____ **Plants** are an example of me.

12. _____ I contain **genetic material** such as **DNA**.

13. The **cell theory** makes several fascinating statements about cells! What are three statements mentioned in the video that are included in the cell theory?

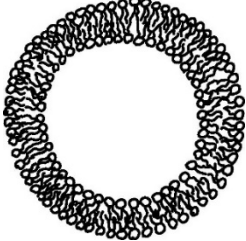
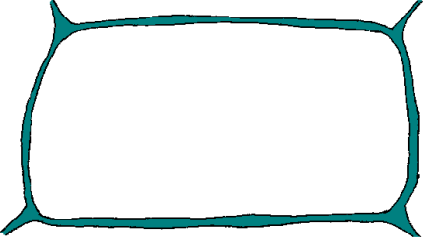
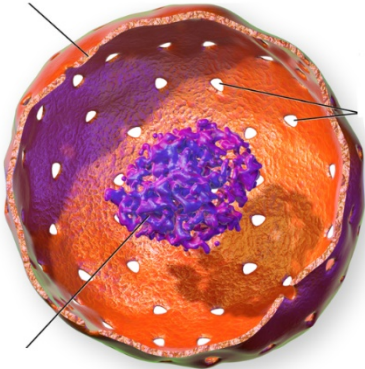
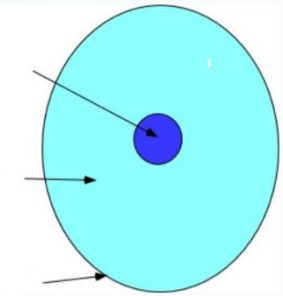

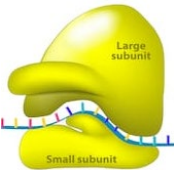


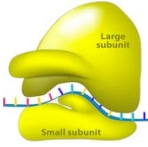

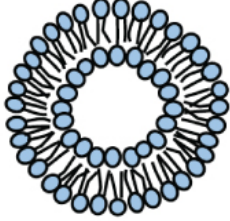
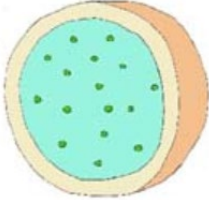
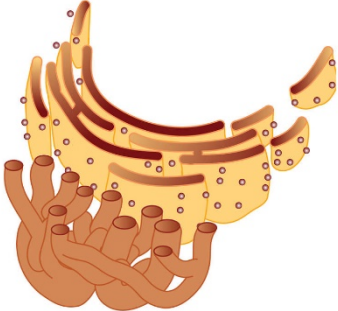
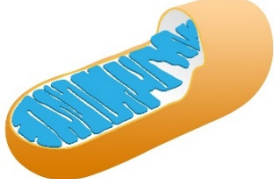

A Tour Inside the Cell!

Let's do a recap of the structures discovered inside the cell after the video tour! Fill in the below chart to help you organize what was visited! Remember there are more functions and structures that you can discover online.

Structure or Organelle on the Tour:	Makes Me Think of... <i>(provide an illustration or analogy!)</i>	Function(s):	*Type of Cell? <i>*Is it in both prokaryotes and eukaryotes? Or just eukaryotes?</i>
Cell Membrane	14.	15.	16.
Cytoplasm	17.	18.	19.
Ribosome	20.	21.	22.
Nucleus	23.	24.	25.
Endoplasmic Reticulum (Rough and Smooth)	26.	27.	28.
Golgi apparatus	29.	30.	31.
Mitochondria (Singular: Mitochondrion)	32.	33.	<i>Eukaryote Cells (in both animal and plant cells)</i>
Cell Wall	34.	35.	36.
Chloroplast	37.	38.	39.
Vacuole	40.	41.	42.

Cell Structures and Organelles: What important cell structures need to be taken into consideration during _____?

Name	Picture	Function
		<ul style="list-style-type: none"> - _____ of cells have a cell membrane - The cell membrane creates a _____ around that cell - It will allow certain things to _____ through, but not others (_____)
		<ul style="list-style-type: none"> - Only found in _____ - Give the plants some _____ so when cells are full of _____ the plant can stand up straight (cells go together like building blocks) - It is _____ (has holes) so materials can go through it
		<ul style="list-style-type: none"> - Directs all cell's _____ (including cell division) - _____ of the cell
		<ul style="list-style-type: none"> - It _____ the nucleus - Allows material to _____ or _____ the nucleus (_____)
		<ul style="list-style-type: none"> - Site for production and assembly of _____
		<ul style="list-style-type: none"> - Located inside the _____ - Most of the cells _____ happen here - Nutrients are _____, processed, and _____ here
		<ul style="list-style-type: none"> - Contained in the _____ - They are made of special _____ (think: _____) - These are found only in _____ cells and are active during _____
		<ul style="list-style-type: none"> - Tiny organelles in the _____ which make _____

		<ul style="list-style-type: none"> - They are either _____ or attached to the _____
		<ul style="list-style-type: none"> - _____ and modifies materials produced by the cell that need to be _____ out of the cell
		<ul style="list-style-type: none"> - Both are used for _____ and _____ - _____ are smaller than _____
		<ul style="list-style-type: none"> - Special type of _____ that contains _____ - Used for digestion of complex molecules, so their parts can be _____.
		<ul style="list-style-type: none"> - SMOOTH _____ produces _____ and steroid hormones like _____ - ROUGH _____ (its rough because it is covered in _____) is where _____ are mass produced
		<ul style="list-style-type: none"> - Where food _____ and the _____ you breathe in come together to make _____ that your cells can use - The _____ of the cell
		<ul style="list-style-type: none"> - Only found in _____ cells - This is where _____ occurs (chloroplasts use energy from the _____ to _____)

Eukaryotic Cell Structure: Organelles in Animal & Plant Cells

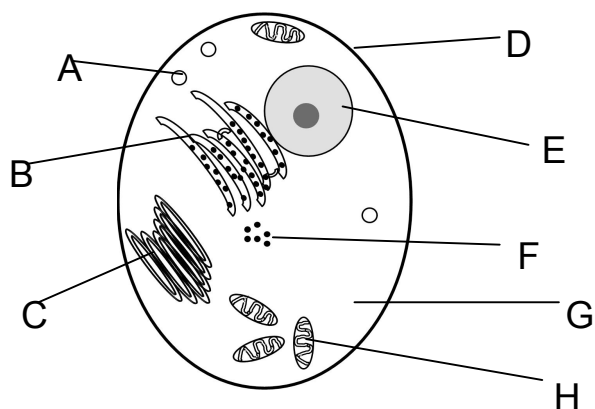
Why are organelles important and how are plants and animals different?

Why?

The cell is the basic unit and building block of all living things. Organisms can be unicellular or multicellular. Large multicellular organisms have many cells, and many types of cell. In order to survive both unicellular and multicellular organisms rely on the cell to perform all the necessary life functions. To do this certain functions must be separated within different areas of the cell.

A cell is often compared to a factory or other large structured organization, to help us understand how different parts of the cell perform different tasks.

Model 1: Animal Cell and Organelles



Part of factory	Cell organelle
Control Room (E)	Nucleus
Factory Manager	DNA/Chromosomes
Assembly line (B)	Endoplasmic reticulum (ER)
Assembly line workers (F)	Ribosomes
Janitor (A)	Lysosomes
Generator (H)	Mitochondria
Packing Line (C)	Golgi Body
Factory Floor (G)	Cytoplasm
Shipping department	Vesicles
Warehouse	Vacuole
Loading dock	Pores/gated channels
Security Fence (D)	Cell membrane

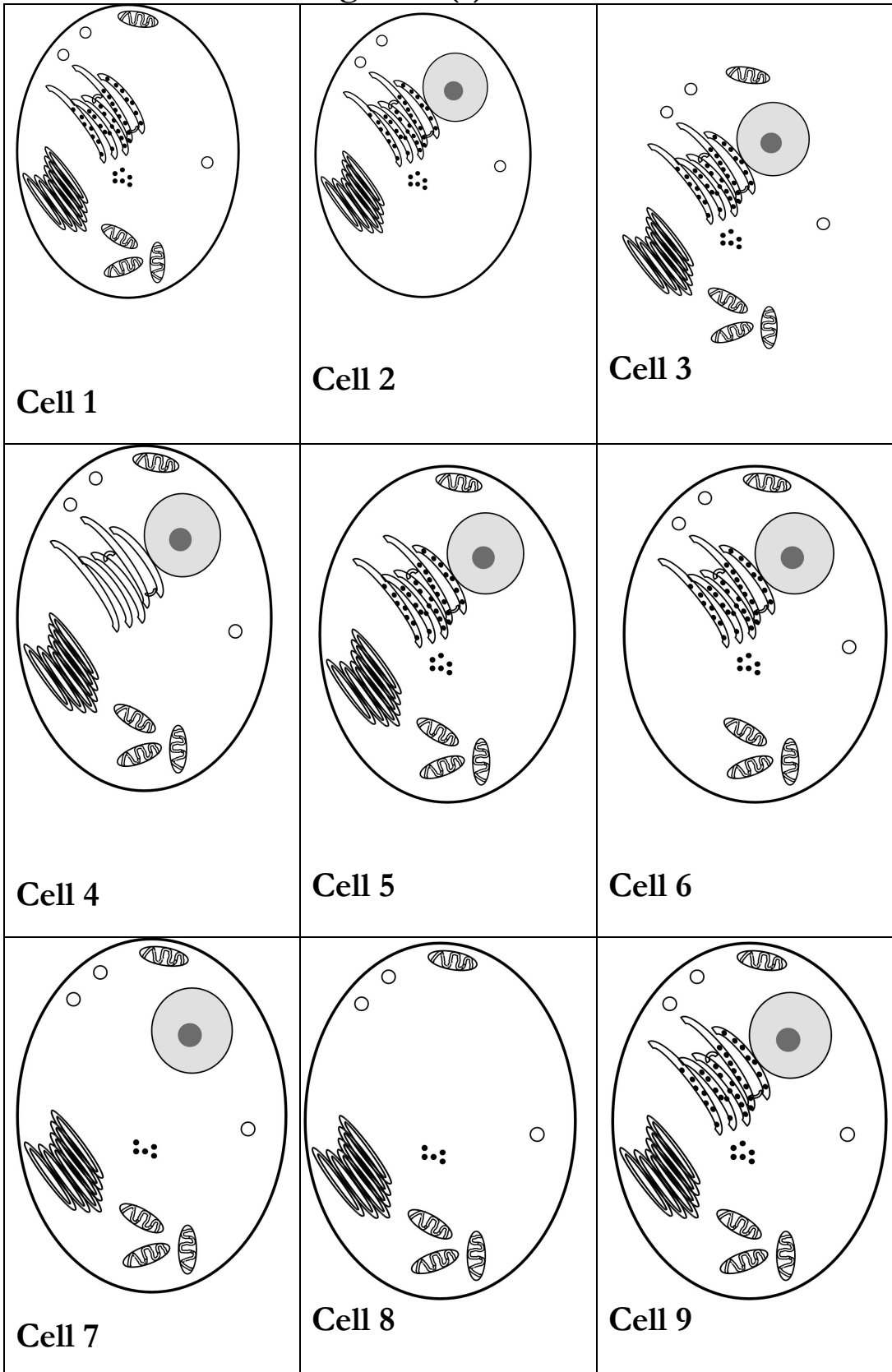
1. Using the letters from the table above, label the cell diagram with the organelle names.
2. Which cell organelle controls the activities of the entire cell?
3. In a factory, where would you expect to find the manager?
4. In a cell what substance is analogous to a factory manager and where would it be found?
5. Which organelle would generate energy to power cellular activities?
6. Which organelle would be responsible for assembling cell products?
7. Once these products have been assembled, to which organelle would they go next?
8. What container might the cellular products be placed in to?



9. Starting with instructions from the factory manager (DNA/Chromosomes), create a flow chart to show how a product is produced and shipped from a cell. All parts of the cell from the table above must be used in your flow chart.

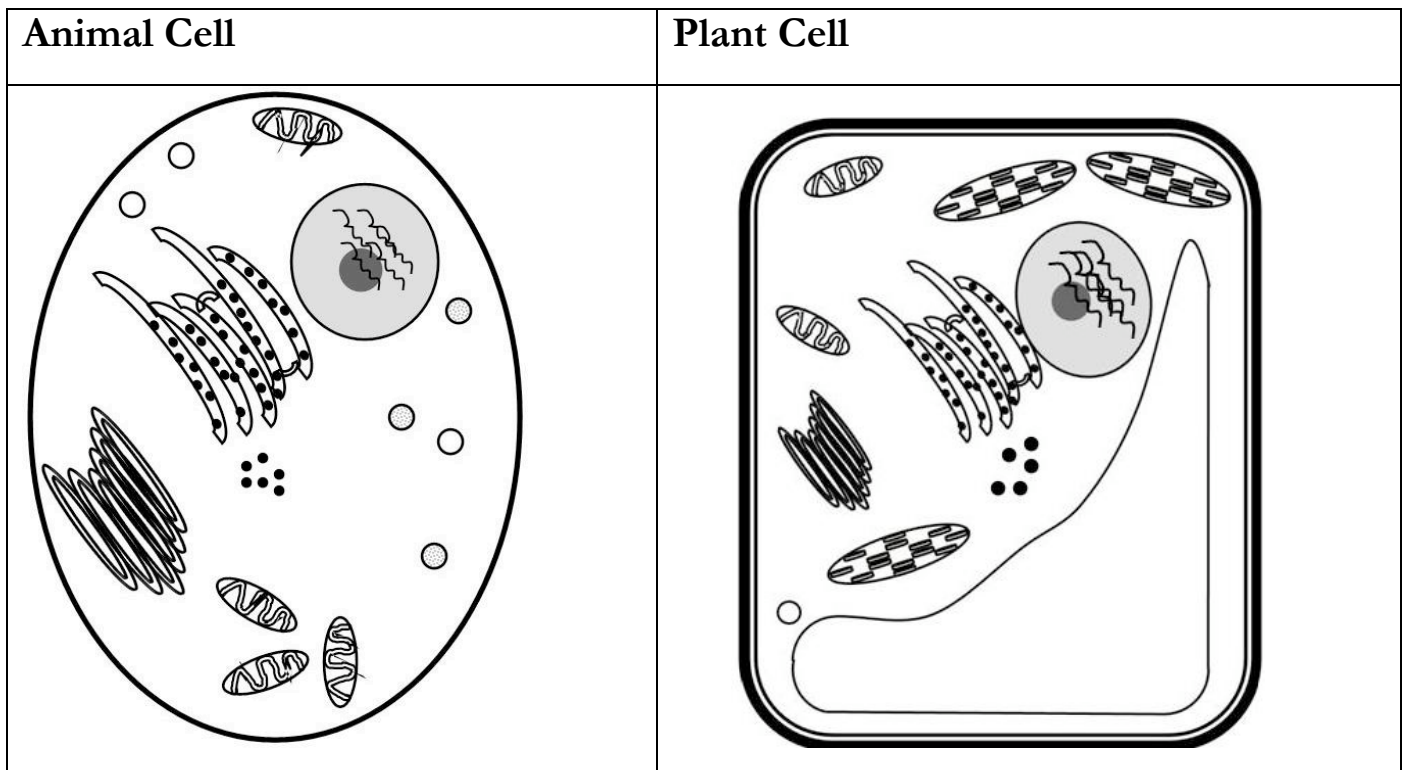


Model 2: Animal Cells with organelle(s) removed



10. Which cell is not missing any organelles?
11. What organelle in Cell 2 is missing?
12. Using grammatically correct sentences, describe why Cell 2 would not function normally.
13. Which two cells 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 7 & Cell 4 will not be able to synthesize a major bio-molecule. What molecule is this?

Model 3: Animal vs. Plant Cells



16. Do both of these cells have a nucleus?

17. Do both of these cells have mitochondria?

18. Describe 3-5 differences between the plant and animal cells. Circle or locate each of these differences on the diagram above.

Read This!

Plant cells have these three organelles not found in animal cells. They include Cell Wall, Large Central Vacuole, and Plastids (including Chloroplasts).



19. Complete the table below using the three plant organelles.

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; one type transfers energy from light to organic compounds

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



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

22. Have everyone read their answer to question 15. As a group, rewrite the answer combining all of your answers.

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

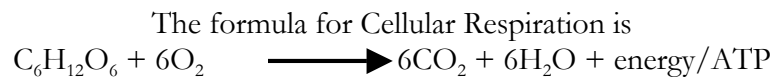
24. Describe the appearance of the vacuole in a well-watered plant. What effect would this have on the cell wall of the plant?

25. Using your response to question 18, construct an explanation for why a plant has both a rigid cell wall and a cellular membrane.

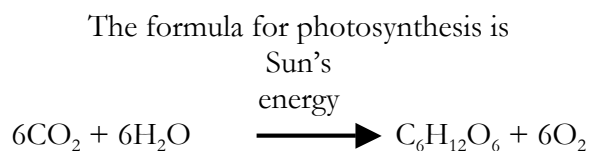
Extension Questions

Read This!

All cells undergo cellular respiration for the production of energy. Energy is necessary for all metabolic activity within the cell.



Plants carry out photosynthesis for the production of glucose. The glucose then becomes the energy source for cellular respiration.



26. In what organelle does cellular respiration occur? Do plants and animals both have that structure?
27. In what organelle does photosynthesis occur? Do plants and animals both have that structure?
28. Using the equations above, explain the relationship between mitochondria and chloroplasts.
29. Plants have both mitochondria and chloroplasts so they can produce their own source of glucose to fuel cellular respiration, whereas animal cells have only mitochondria. If an animal eats only meat what would be their source of glucose?
30. Where in the human body would you find cells with more mitochondria? Why?

Cell Membrane

Thin layer that _____ the cell. It provides _____ and _____. It is _____, meaning it only lets certain substances in or out of the cell.

Golgi Body

Packages _____ and _____ into _____ for transport _____ of the cell.

Name: _____

Date: _____

ANIMAL CELLS

Cells are the basic building blocks of all living things.

Endoplasmic Reticulum (Smooth)

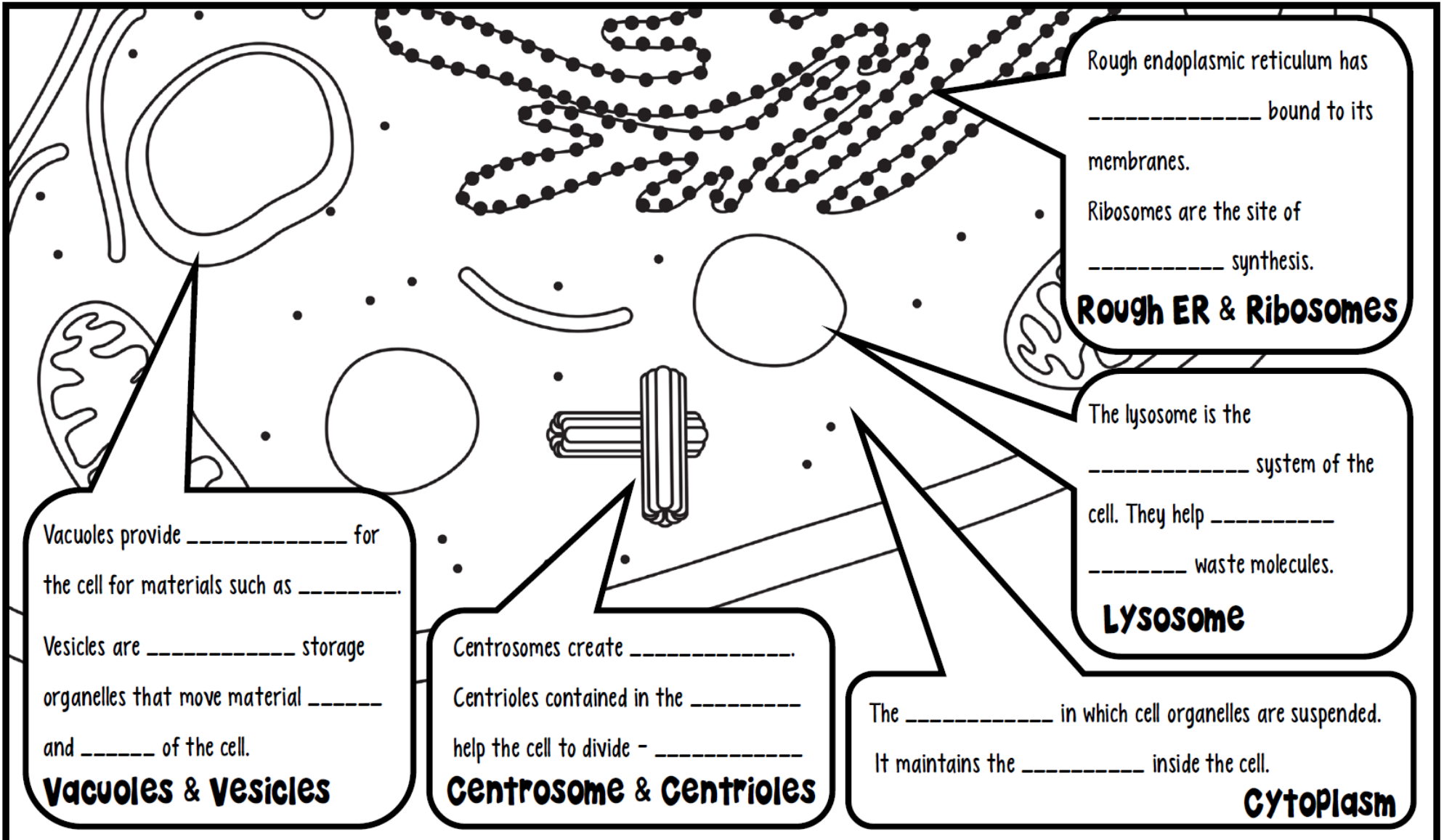
Makes _____ (fats) and modifies _____. It then _____ these materials throughout the cell.

Mitochondria

Nicknamed the _____ of the cell because they provide _____ for the cell. The site of _____.

Nucleus & Nucleolus

The nucleus is the _____ of the cell. It directs many of the _____ of the cell. It also holds the cells _____. The nucleolus is inside of the _____. It aids in the production of _____.



1. Some human cells, such as muscle cells, have more mitochondria. Why would these cells need more mitochondria?

2. When an animal eats, food is stored in the stomach for a period of time. What organelle acts as temporary storage for a cell?

3. Why is it important that the cell membrane is semi-permeable?

Cell Membrane

Thin layer that _____ the cell. It provides _____ and _____. It is _____, meaning it only lets certain substances in or out of the cell.

Golgi Body

Packages _____ and _____ into _____ for transport _____ of the cell.

Name: _____

Date: _____

PLANT CELLS

Cells are the basic building blocks of all living things.

Cell Wall

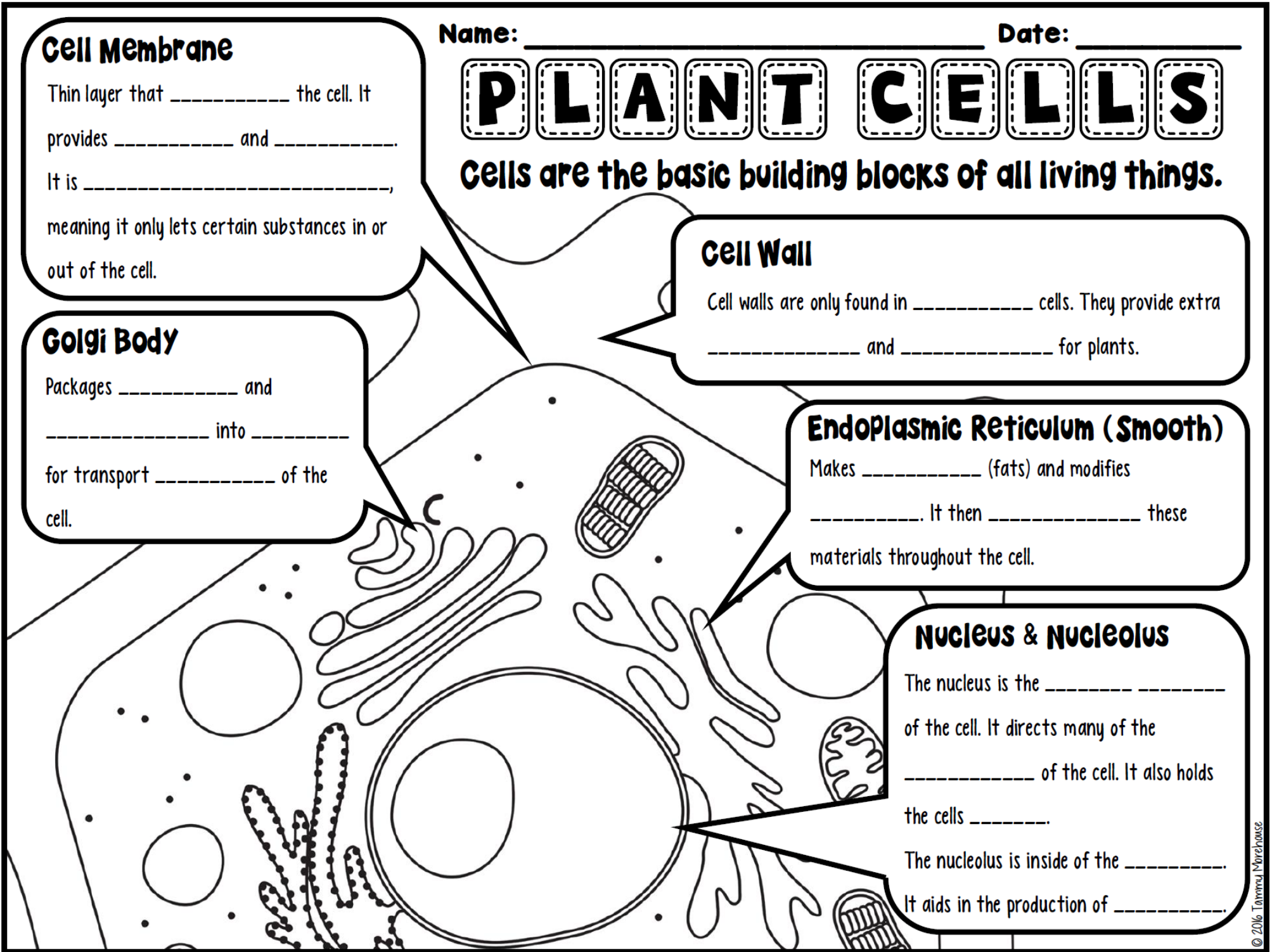
Cell walls are only found in _____ cells. They provide extra _____ and _____ for plants.

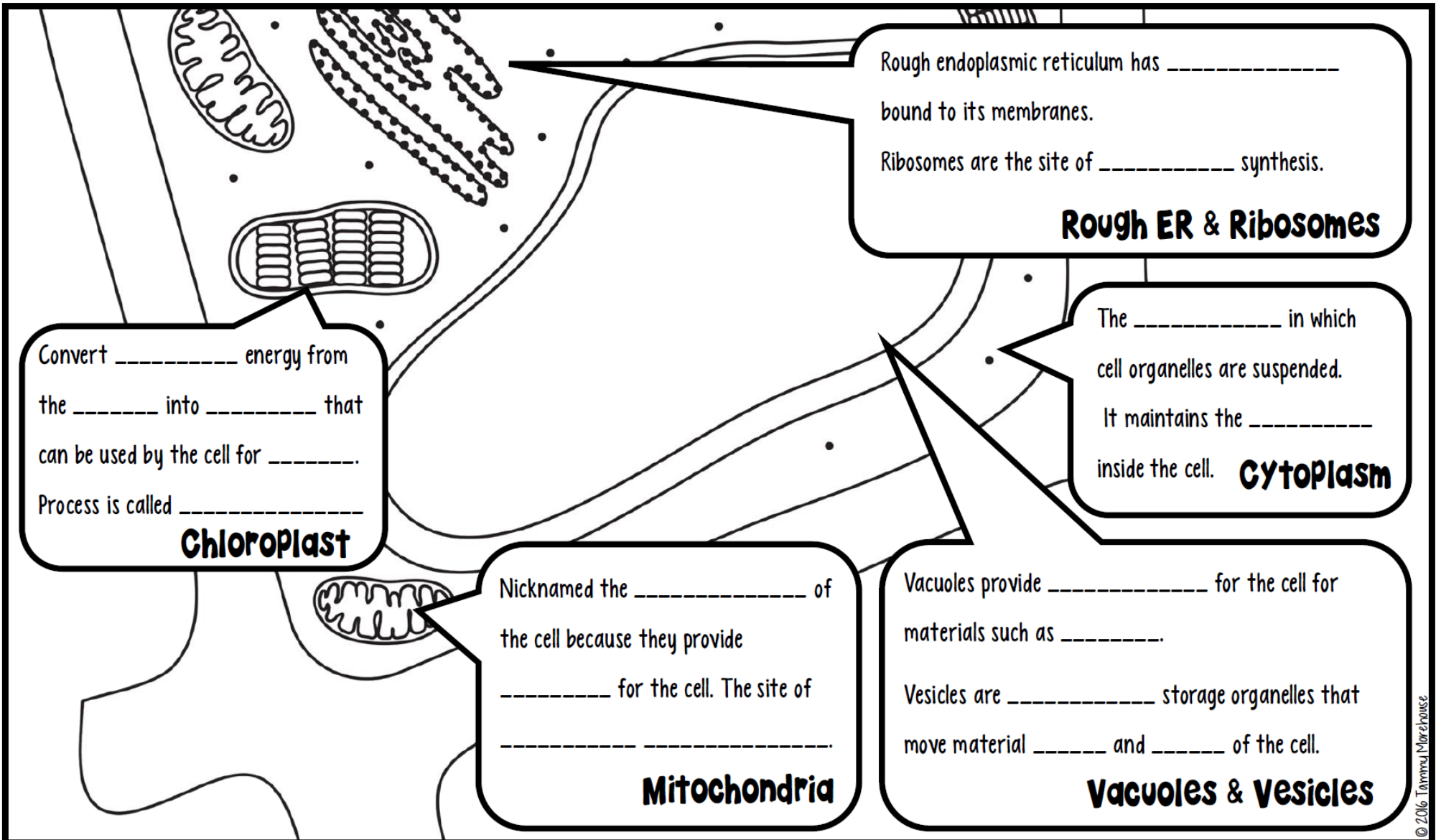
Endoplasmic Reticulum (Smooth)

Makes _____ (fats) and modifies _____. It then _____ these materials throughout the cell.

Nucleus & Nucleolus

The nucleus is the _____ of the cell. It directs many of the _____ of the cell. It also holds the cells _____.
The nucleolus is inside of the _____. It aids in the production of _____.





Rough endoplasmic reticulum has _____ bound to its membranes.
 Ribosomes are the site of _____ synthesis.

Rough ER & Ribosomes

Convert _____ energy from the _____ into _____ that can be used by the cell for _____.
 Process is called _____

Chloroplast

The _____ in which cell organelles are suspended.
 It maintains the _____ inside the cell.

Cytoplasm

Nicknamed the _____ of the cell because they provide _____ for the cell. The site of _____

Mitochondria

Vacuoles provide _____ for the cell for materials such as _____.
 Vesicles are _____ storage organelles that move material _____ and _____ of the cell.

Vacuoles & Vesicles



1. What organelle is present in both plant and animal cells but is usually much larger in plant cells? Why?

2. Photosynthesis creates sugar for the cell. What organelle does the sugar then need to go to and why?

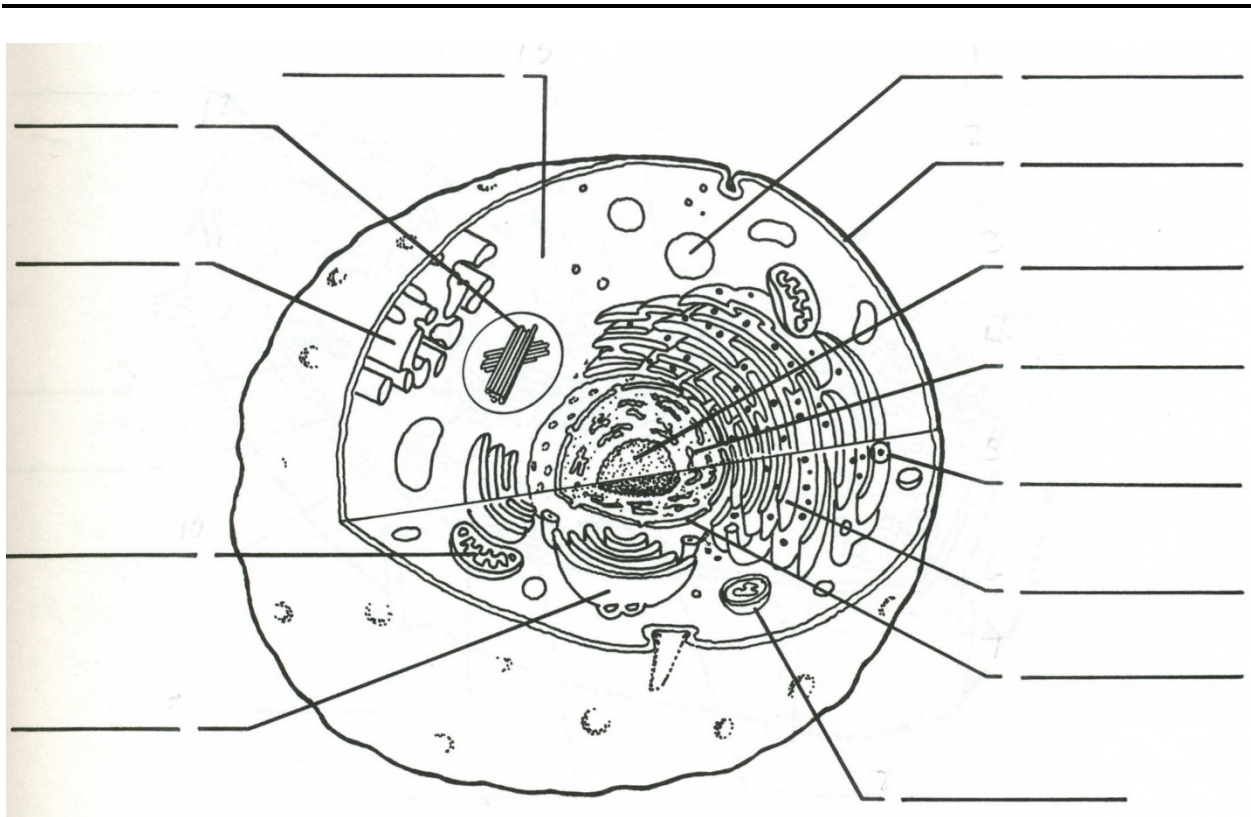
3. Why is it important that plant cells have both a cell membrane and a cell wall?

Part 1: Colouring and Labelling Animal and Plant Cells

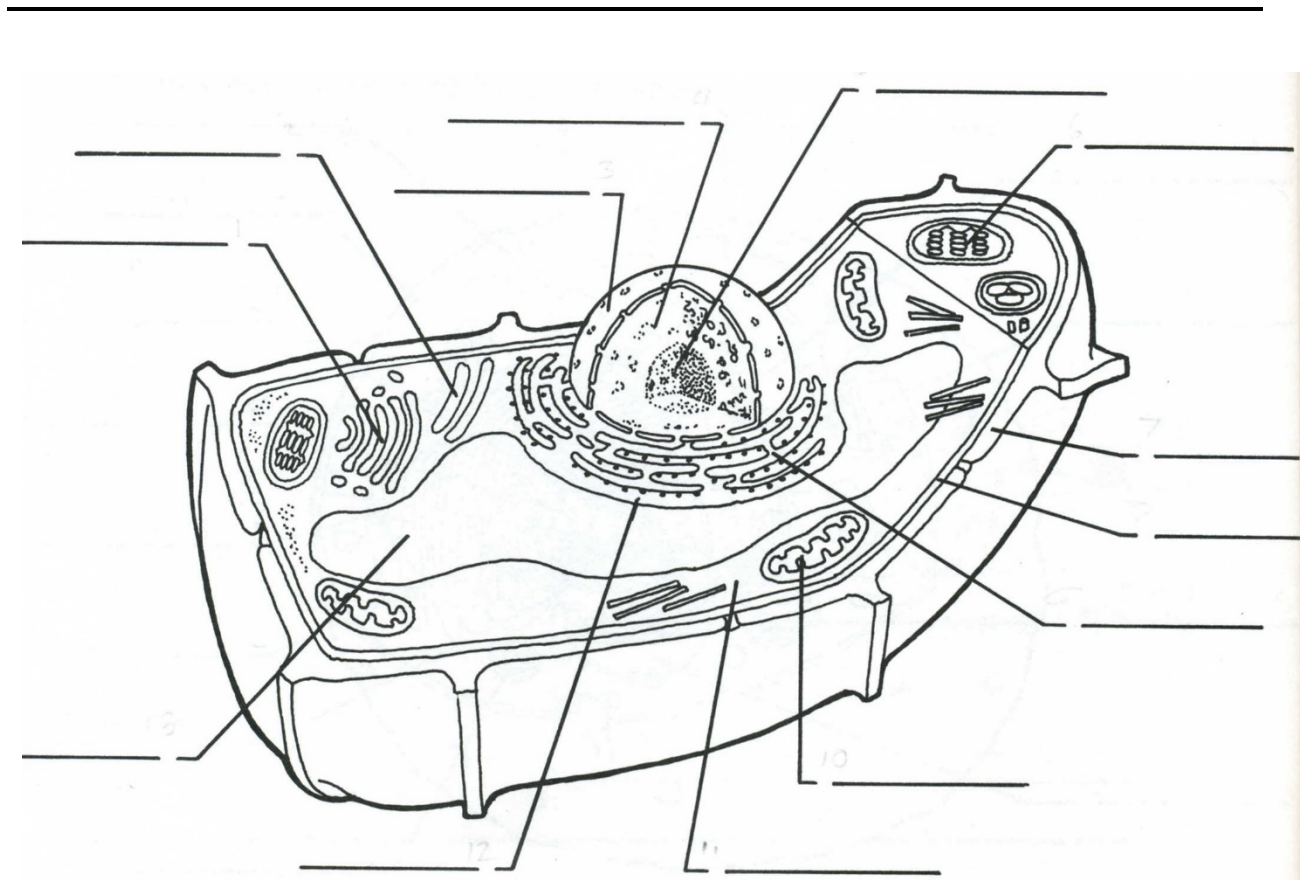
- **Title** each cell given as either an animal or a plant cell
- **Color** and **label** the organelles on both the animal and plant cells provided

Part 2: Organelle Function

- Underneath each cell, write the function of each organelle listed **in your own words**



- Vesicle: _____
- Lysosomes: _____
- Golgi Body: _____
- Cytoplasm: _____
- Nucleus: _____
- Cell Membrane: _____
- Mitochondria: _____
- Smooth Endoplasmic Reticulum: _____
- Centriole: _____



- a. Ribosomes: _____
- b. Nucleus: _____
- c. Nucleolus: _____
- d. Nuclear Membrane: _____
- e. Rough Endoplasmic Reticulum: _____
- f. Vacuole: _____
- g. Cell Wall: _____
- h. Chloroplast: _____

Animal vs Plant Cells

Animal Cells HAVE

- _____
- Lots of _____

Animal Cells DO NOT HAVE

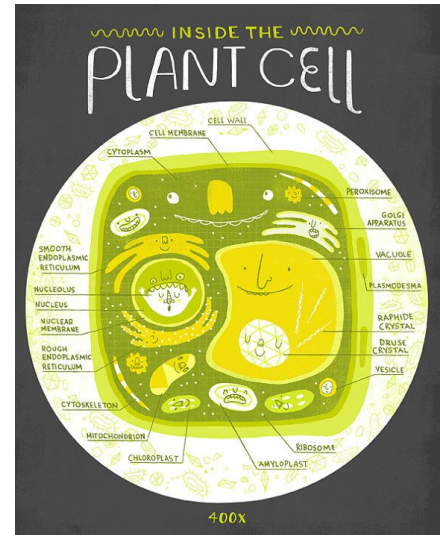
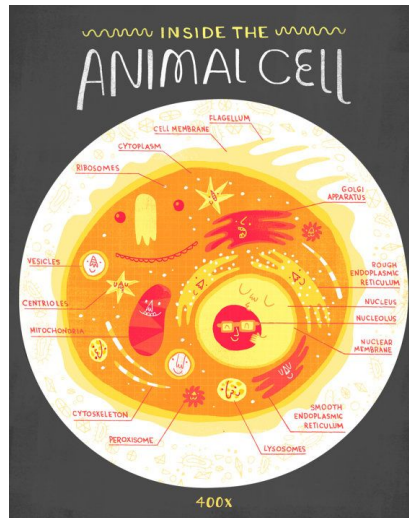
- _____
- _____

Plant Cells HAVE

- _____
- _____
- _____
- Few _____

Plant Cells DO NOT HAVE

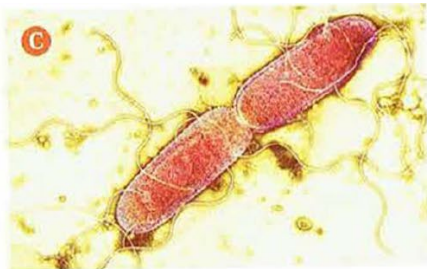
- _____



Reproduction Transfers GENETIC INFORMATION from Parents to Offspring

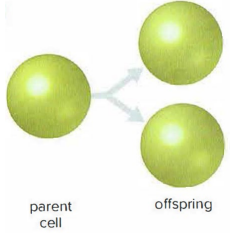
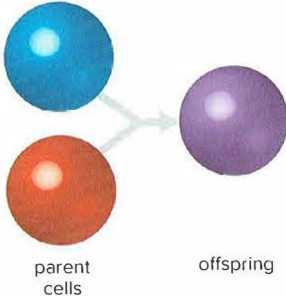
Every species has its own strategies for _____.

For Example in Figure 1.3:



- A. The flowers of many plants have colours and scents that _____
_____ so that they can pick up and _____ to other flowers
- B. Many animals have _____ that enable sexually
mature individuals of a species to become mating pairs
- C. Microbes such as bacteria reproduce on their own and form offspring by _____

There are just **two basic ways that living things reproduce.**

<p>Asexual Reproduction</p>  <p>parent cell offspring</p>	<ul style="list-style-type: none"> • Offspring come from a _____ parent • Each offspring receives a copy of the parent's _____ • Offspring are _____ to the parent and to each other.
<p>Sexual Reproduction</p>  <p>parent cells offspring</p>	<ul style="list-style-type: none"> • Two parents _____ of the offspring's genetic material. • Offspring have genetic information that is _____ from either parent's • Offspring are _____ to their parents or, in most cases, to each other.

In both asexual and sexual reproduction, the _____ and the information it holds is _____ to the offspring.

This information is contained within what is often called the molecule of life: _____

Inside the Nucleus

- The control center of the WHOLE cell is the _____
- The nucleus contains _____ on how to perform all activity in the cell.
- This is _____ for in the DNA.
- DNA stands for _____



What is DNA and How Does it Work?

<https://www.youtube.com/watch?v=zwibgNGe4aY>



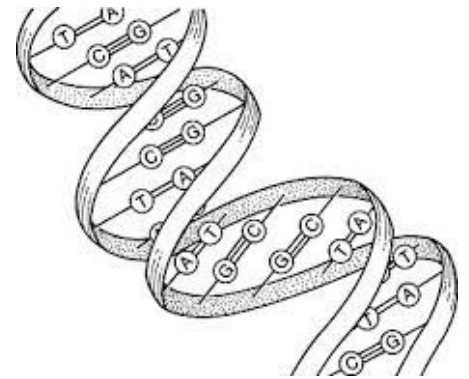
Controlling the Cell's Activity

It is the **nucleus** that controls all activity that occurs in and around the cell. Let's review the structure and function of the nucleus...

What Are the Structures Found Inside the Nucleus?

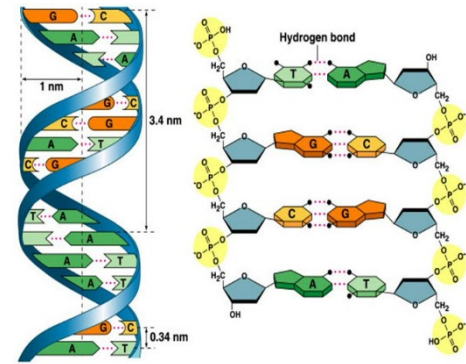
DNA =

- a **double helix** (twisted ladder)
- Contains the _____ code or the basic messages that control cell function (maintenance, growth, repair etc.)



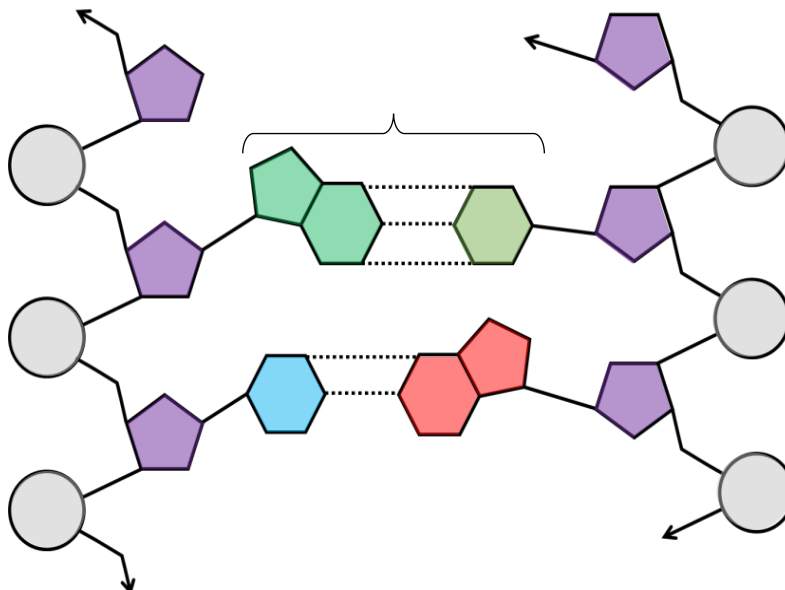
Facts about DNA

1. DNA is a two stranded molecule shaped like a _____ into a spiral double helix
2. DNA stores _____ that is passed on to each generation
3. DNA is packed into _____
4. DNA has a _____
5. DNA is made up of _____
 - _____
 - These bases are always bound together as _____



(a) Key features of DNA structure

(b) Partial chemical structure



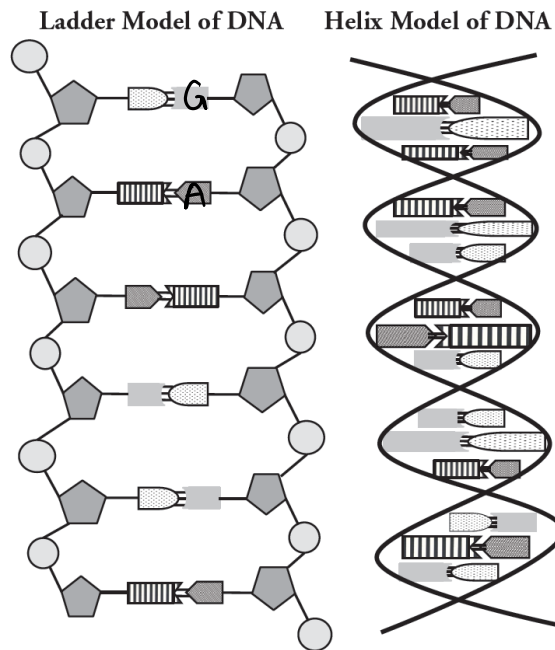


1. What do the letters of DNA stand for? _____

2. What are the three parts of a nucleotide? _____

3. Which nucleotide component contains nitrogen? _____

4. Name the four bases. _____



5. DNA is often drawn in a “ladder model.” Locate this drawing above.

- a. Label a sugar molecule and a phosphate molecule on the ladder model.
- b. What part(s) of the nucleotides make up the rungs (steps) of the “ladder”?

c. What part(s) of the nucleotides make up the sides (backbone) of the “ladder”?

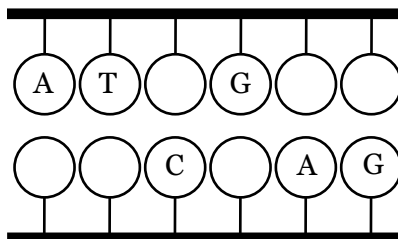
6. On the ladder model of DNA label each of the bases with the letter A, T, C or G (that are not already labeled).

7. When one nucleotide contains thymine, what type of base is the thymine attached to on the opposite nucleotide strand?

8. When one nucleotide contains cytosine, what type of base is the cytosine attached to on the opposite nucleotide strand?

9. The way in which the nitrogen-containing bases pair up across the DNA molecule follows a very specific set of rules. Write a description of the base pairing rules.

10. Fill in the missing bases on the DNA below according to complementary base pairing.

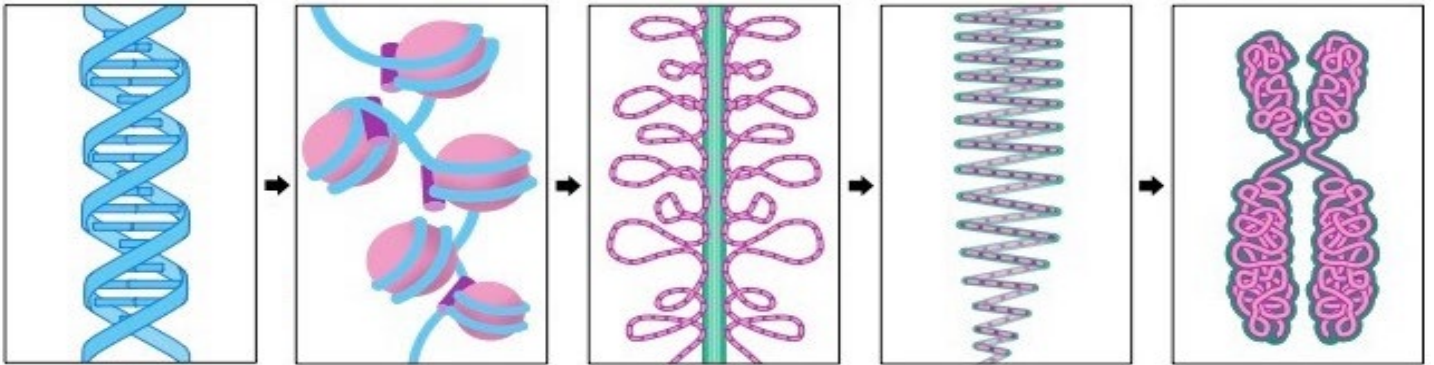


11. The proportions of the bases are consistent within a species; however they do vary between species. Using complementary base pairing, complete the following table to show the percentage of each type of base in the five different organisms.

Organism	Percentage of each type of base			
	Adenine	Guanine	Cytosine	Thymine
Human	31		19	
Cow	28	22		
Salmon			21	29
Wheat	27			
Yeast	31			

The Organization of DNA

- If all the DNA in a cell was laid out in a straight line, it would be _____ long
- If all the DNA in EVERY cell in your body was laid out in a continuous straight line, it would be about _____
- So, how do the cells _____ all the DNA to fit into our bodies?

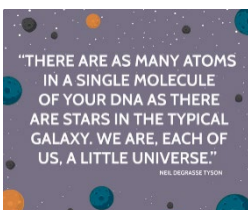
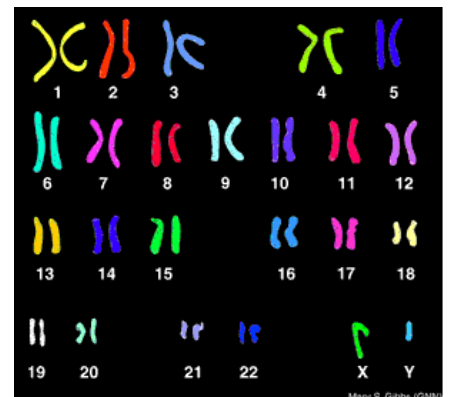
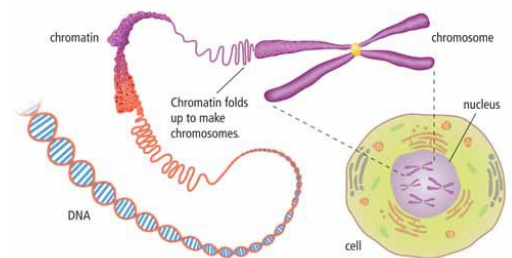


STEP 1: Form Chromatin

- DNA is wrapped around _____ to make _____
 - Chromatin: A thread-like structure made of _____ and _____

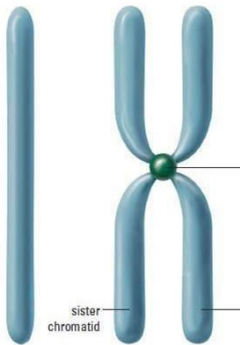
STEP 2: Form Chromosomes

- Chromatin _____ up on itself to make _____
 - _____: tightly coiled chromatin found in the _____.
- Every organism has a characteristic _____ of chromosomes
- Chromosomes within the nucleus are found in _____.
- Most human cells have _____ chromosomes arranged in _____ pairs, including one pair of chromosomes that help determine _____
- How does the DNA _____?



Chromosomes - Single Strand Shape vs “X” Shape

Sister chromatids = replicated form of chromosomes



- Two strands of **replicated** chromosomes that are physically attached together in the _____ by a **centromere**
- Each strand of the X shape is called a _____ **chromatid**
- Each chromatid contains identical genetic information to its “sister”

Our Chromosomes

Homologous chromosomes = _____ of chromosomes (one from each parent)

- similar length/gene position

We have _____ chromosomes, in _____ pairs.

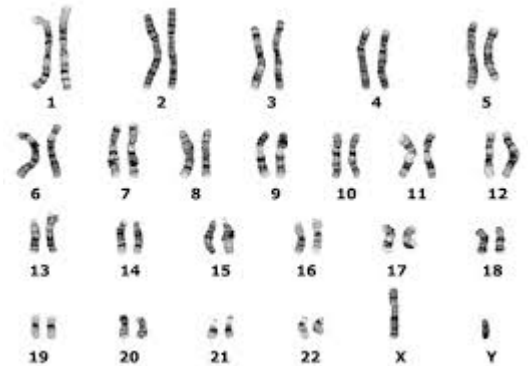
Every organism has a specific number of chromosomes.

For example:

Mosquitos have _____ chromosomes (_____ pairs)

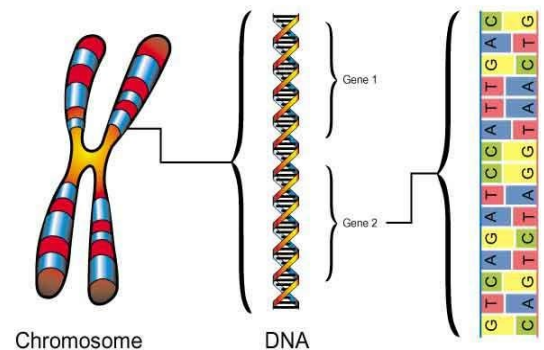
Chickens have _____ chromosomes (_____ pairs)

Potatoes have _____ chromosomes (_____ pairs)



Genes

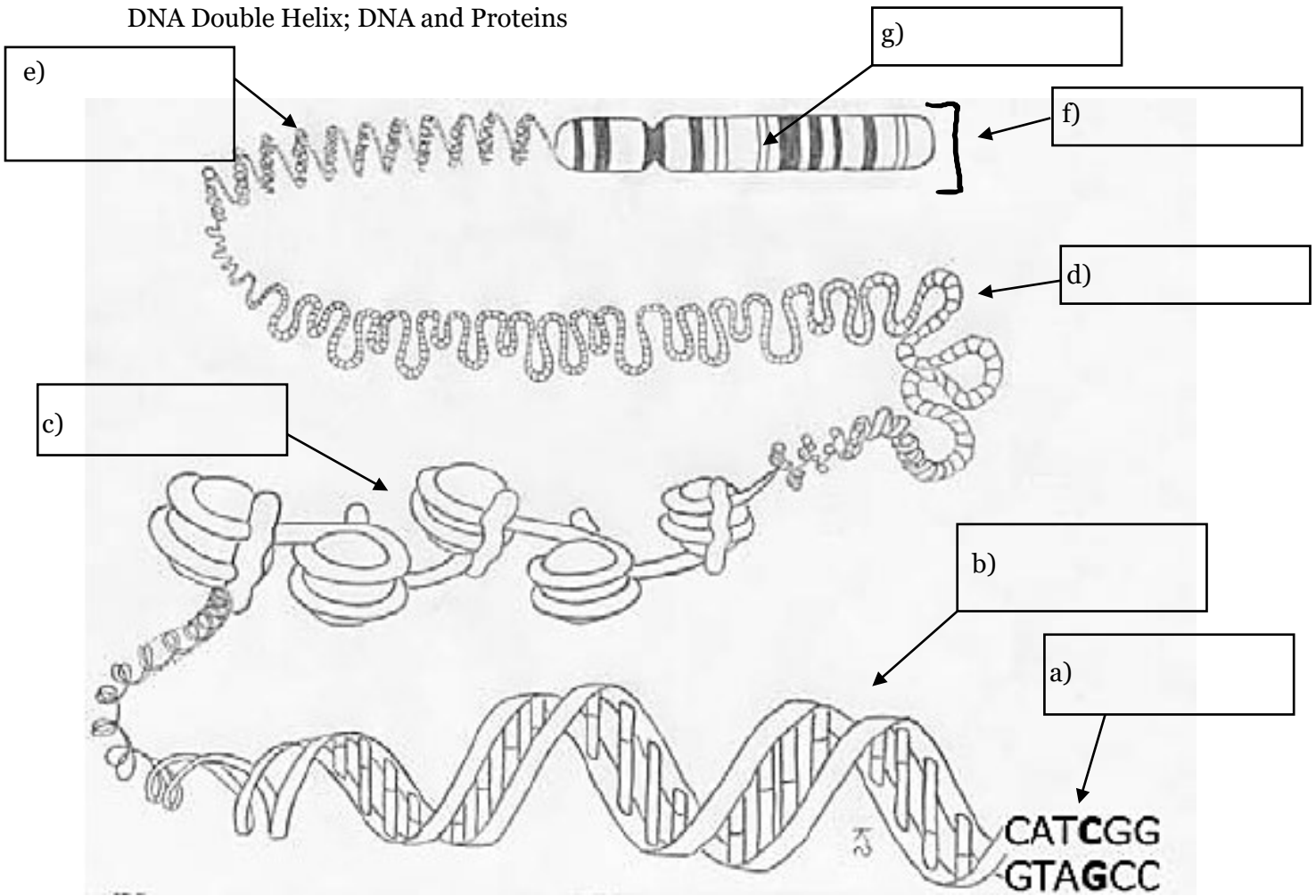
- Genes: A _____ of DNA that encodes for a specific _____
- The unit of _____ for all organisms.
- Genes store the information needed to produce _____ different proteins used in the cells of your body.



Genes

PRACTICE

1. Write what each arrow is pointing at in the diagram below. Choose from the following:
 Condensing of Chromatin; Nitrogen Base Pairs; Chromosome; Chromatin; Gene;
 DNA Double Helix; DNA and Proteins



2. Where in the human cell is DNA stored? _____

3. Organize the following terms based on size, from smallest to largest: *chromatin, nucleus, chromosome, cell, nucleotide, nitrogens containing bases, DNA double helix.*



READING ABOUT: THE FUNCTION OF THE NUCLEUS WITHIN THE CELL P929-30

Complete the following reading about the nucleus.

Be sure to "Mark the Text" and highlight KEY DEFINITIONS as you read along.

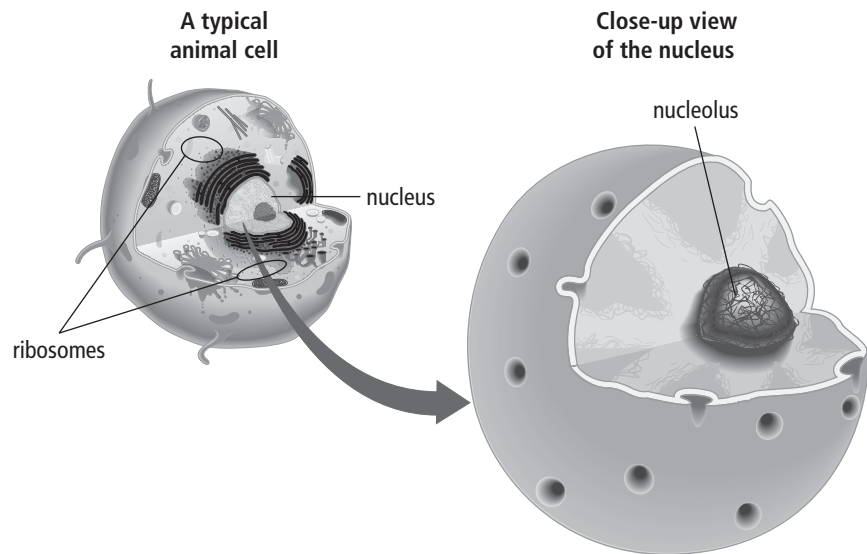
ALSO, answer the "Reading Check" questions in the side margin as you go! ✓

Before You Read

Which parts of the cell bring in food and get rid of waste? Which parts of a cell control its ability to grow, develop, and make new cells? Record your ideas on the lines below.

Create an Outline

Make an outline of the information in this section. Use the headings in the reading and the labels in the diagrams to help you. Include the boldface terms and any other terms that you think are important.



What does the cell nucleus do?

The **nucleus** is the control centre of the cell. This means that the nucleus directs and controls all of the cell's activities. These activities include the ability of the cell to grow, develop, and replicate (make copies of itself).

How does the nucleus perform its job?

In the nucleus, the instructions for how to perform all cell activities are carried in molecules of **DNA**. DNA is a long, two-stranded molecule with a shape like a ladder that has been twisted into a spiral. DNA stores instructions for how to form cells, for the chemicals and structures that cells must make, and for everything that the cell does. DNA also stores genetic material—information that is passed on from one generation to another when organisms reproduce. ✓

✓ Reading Check

1. What are the functions of DNA?

How is DNA related to chromosomes and genes?

Strands of DNA are packaged tightly into structures called **chromosomes**. Each type of organism has a specific number of chromosomes. For example, humans have 46 chromosomes that are arranged in 23 pairs. One of these pairs helps determine if a person will be born as a male or a female.

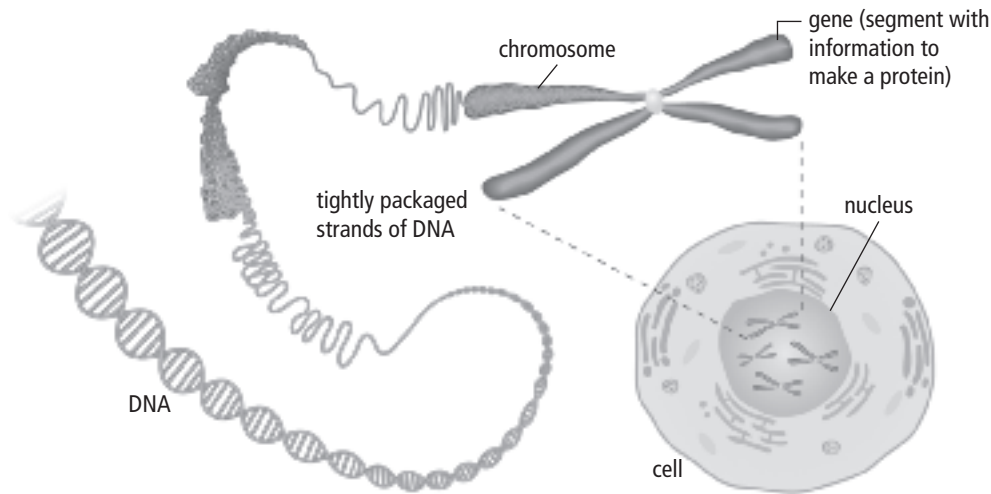
Genes are found at specific places on a chromosome. **Genes** are small segments of DNA that carry instructions for making proteins. **Proteins** are molecules that all the cells of the body need in order to work properly. Some proteins carry out cell functions. Other proteins are parts of cell structures. There are as many as 100 000 proteins in the human body. ✓

Where are proteins made?

Proteins are made in the cell by **ribosomes**. Ribosomes are made by a large structure in the nucleus called the **nucleolus**.

✓ Reading Check

2. Why are proteins important to cells?



This illustration shows DNA packaged in a chromosome, and the chromosome in the nucleus.



Assignment #3: Practice Worksheets pages 31 - 33
Complete this assignment in the space provided below.

Inside the nucleus

Vocabulary

23	nucleolus
46	nucleus
chromosomes	number
DNA	proteins
genes	ribosomes
genetic	type
molecule	

Use the terms in the vocabulary box to fill in the blanks. Each term may be used more than once. You will not need to use every term.

1. The _____ directs and controls the ability of the cell to grow, develop, and replicate (make copies of itself).
2. The instructions for how to carry out all cell activities are carried in _____, which is a long, two-stranded _____ with a shape like a ladder that has been twisted into a spiral shape.
3. _____ stores instructions for everything that the cell does. It also stores _____ material—information that is passed on from one generation to another when organisms reproduce.
4. Strands of DNA are packaged tightly into structures called _____.
5. Each type of organism has a specific _____ of chromosomes.
6. Humans have _____ chromosomes that are arranged in _____ pairs. One of these pairs helps determine if a person will be born as a male or a female.
7. _____ are small segments of DNA that carry instructions for making proteins. They are found at specific places on _____.
8. Proteins are a type of _____ that all the cells of the body need in order to work properly.
9. Proteins are made in the cell by _____, which are made by a large structure in the nucleus called the _____.

The control centre of the cell

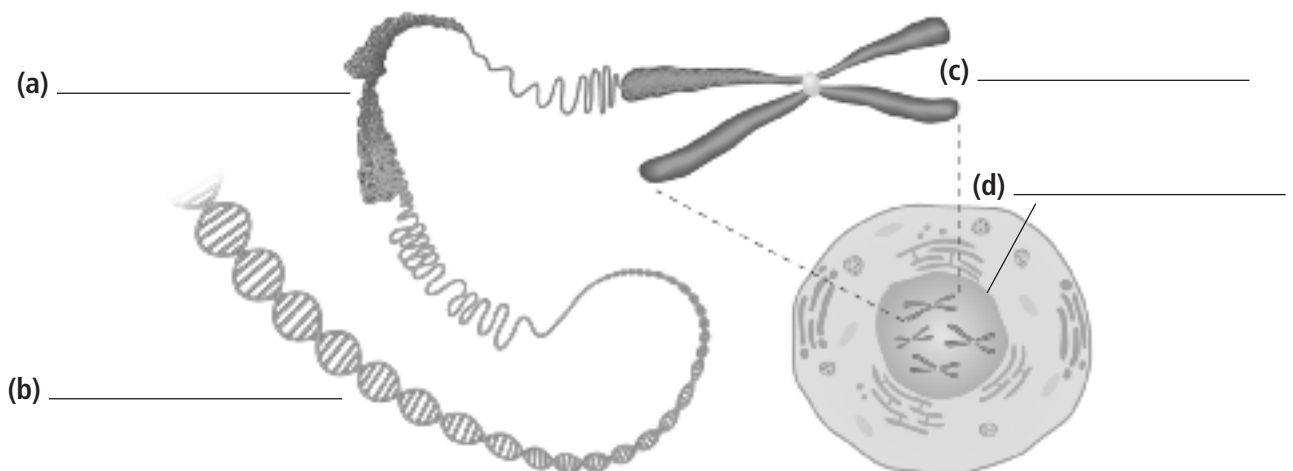
Use the diagram to help you answer question 1.



1. Describe the structure of DNA.

Fill in the blanks with the correct terms. Then use your answers to questions 2–5 to label the diagram below.

2. The control centre of the cell _____
3. Molecule containing instructions for everything the cell does _____
4. Tightly packaged structures of DNA _____
5. Segment with information to make a protein _____



True or false?

Read the statements given below. If the statement is true, write “T” on the line in front of the statement. If it is false, write “F” and rewrite the statement to make it true.

1. _____ The nucleolus directs and controls all of the cell’s activities.

2. _____ Instructions for how to carry out all cell activities are carried in molecules of DNA.

3. _____ DNA stores information that is passed on from one generation to another when organisms reproduce.

4. _____ Humans have 46 pairs of chromosomes.

5. _____ One pair of chromosomes helps determine if a person will be born as a male or female.

6. _____ The nucleolus makes ribosomes.

7. _____ Ribosomes make proteins.

8. _____ Genes make chromosomes.
