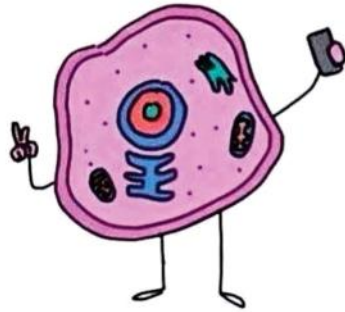


Science 9

UNIT 4: BIOLOGY



Cell-fie

BOOK 1: CELLS & DNA

name: Key block: _____

Science 9 Assignment Log



Date	Assignment/Worksheet/Lab	Completed?

Concepts to Review	Facts to Remember

Sustainability + Reproduction

Sustainability refers to the ability of the environment and the living things it supports to endure into the future. 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 every organism on the planet. In this grim "thought experiment", it would not be long before all life on Earth starved and came to an end.

Reproduction is critical as it ensures that organisms have a source of nutrients and energy to sustain their life processes.
The sustainability of Living Things depends on Reproduction.

Introduction – How Many Cells do Humans Have?

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



- In fact, you are made up of ~75 trillion (75 000 000 000 000) cells.

To give that number of context, if I gave you 1 trillion dollars, you would have to spend 10 million/day for 273 yrs to spend it all.



The Importance of Cell Division

- All cells come from pre-existing cells. (other already living)
- Our cells are constantly dividing and being replaced. (not all of our cells, but most)



- By the time you finish this sentence, 50 million (50 000 000) of your cells have died.
- In total we lose between 50-70 billion (50 000 000 000) cells every day.
- But our cells divide to produce 300 billion NEW cells every day.
- We make 100 million RBC (red blood cells) every minute.

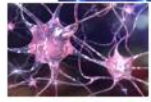
- And an entirely new layer of skin every 25-27 years.
- Some cells only divide under special circumstances
 - Liver cells only divide if a piece has been removed.

Donate PART of your liver

This allows for tissue transplants 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:
 - Brain + nerve cells - This is why people with brain or spinal damage do not naturally recover
 - muscle cells - When you build muscle through exercise you are damaging the existing cells and rebuilding them bigger and stronger.



make more cells

- We need cell division for:
 - growth of individual organisms
 - repair / replace damaged and dead cells
 - reproduction in unicellular organisms



Amoeba Sisters: Introduction to Cells: The Grand Cell Tour
<https://www.youtube.com/watch?v=8llzKri08kk>



Prokaryote
No nucleus

Eukaryotes
Do have a
nucleus.

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. **B** I have a cell membrane (plasma membrane).

2. **E** I have a nucleus.

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

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

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

6. **E** I contain ribosomes.

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

8. **B** I contain cytoplasm.

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

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

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

12. **B** 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?

- 1. CELLS ARE THE SMALLEST LIVING THING
- 2. LIVING THINGS ARE MADE OF CELLS
- 3. CELLS MUST COME FROM CELLS

HW May 28th



AMOEBASISTERS: VIDEO RECAP

INTRODUCTION TO CELLS

A Tour Inside the Cell!

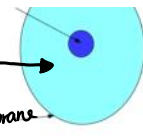


Let's do a recap of the structures discovered inside the cell after the video tour! Fill in the below chart to help you organize what was visited! Remember there are more functions and structures that you can discover online.


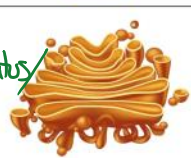
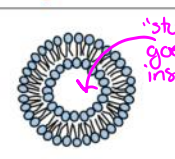
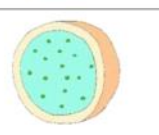
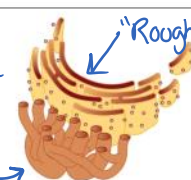

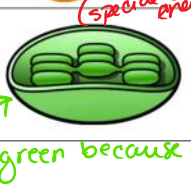
Structure or Organelle on the Tour:	Makes Me Think of... <i>(provide an illustration or analogy!)</i>	Function(s):	*Type of Cell? <i>*Is it in both prokaryotes and eukaryotes? Or just eukaryotes?</i>
Cell Membrane	14. A HOUSE FENCE	15. BORDER OF THE CELL	16. BOTH
Cytoplasm	17. THE YARD AROUND THE HOUSE	18. PLACE WHERE OTHER ORGANELLES ARE LOCATED; SPACE BETWEEN NUCLEUS AND CELL MEMBRANE	19. BOTH
Ribosome	20. KITCHEN: WHEN FOOD IS MADE.	21. PLACE OF PROTEIN SYNTHESIS	22. EUKARYOTE
Nucleus	23. MOM'S ROOM	24. WHERE RULES AND INSTRUCTIONS TO RUN THE HOUSE COME FROM	25. EUKARYOTE
Endoplasmic Reticulum (Rough and Smooth)	26. THE KITCHEN COUNTER: WHERE LUNCH IS PACKED FOR SCHOOL	27. WHERE PROTEINS ARE PACKAGED FOR TRANSPORT IN THE CELL	28. EUKARYOTE
Golgi apparatus	29. THE LUNCHBOX	30. WHERE PROTEINS ARE CARRIED AWAY TO SCHOOL	31. EUKARYOTES
Mitochondria (Singular: Mitochondrion)	32. THE ELECTRIC CIRCUIT BOX	33. PROVIDES POWER TO RUN THE HOUSE	Eukaryote Cells (in both animal and plant cells)
Cell Wall	34. THE SECOND FENCE AROUND THE FENCE: A BRICK FENCE AROUND THE WEAKER WOOD FENCE	35. TO PROVIDE STRUCTURE TO THE PLANT CELL	36. EUKARYOTIC
Chloroplast	37. THE GARDEN	38. PLACE OF PHOTOSYNTHESIS	39. EUKARYOTIC
Vacuole	40. THE SWIMMING POOL	41. PLACE OF WATER STORAGE	42. EUKARYOTIC



Cell Structures and Organelles: What important cell structures need to be taken into consideration during cell division? all types!

Name	Picture	Function
cell membrane	phospholipids	- <u>all types</u> of cells have a cell membrane - The cell membrane creates a <u>barrier</u> around that cell - It will allow certain things to <u>get</u> through, but not others (<u>semi-permeable</u>)
cell wall	vacuole	- Only found in <u>plant cells</u> - Give the plants some <u>structure</u> so when cells are full of <u>water</u> the plant can stand up straight (cells go together like building blocks) - It is <u>porus</u> (<u>has holes</u>) so materials can go through it (<u>like water</u>)
Nucleus	nuclear membrane, nucleolus, nuclear pores	- Directs all cell's <u>activities</u> (including cell division) - " <u>Powerhouse</u> " of the cell
Nuclear membrane		- It <u>surrounds</u> the nucleus - Allows material to <u>pass into</u> or <u>out of</u> the nucleus (<u>nuclear pores</u>)
Nucleolus		* Site for <u>production and assembly of</u> <u>ribosomes</u>
Cytoplasm	nucleus	- Located <u>inside</u> the <u>cell membrane</u> - Most of the cells <u>activity</u> happen here - Nutrients are <u>absorbed</u> , processed, and <u>transported</u> here

Cytoplasm		<ul style="list-style-type: none"> - Most of the cells <u>activity</u> happen here - Nutrients are <u>absorbed</u>, processed, and <u>transported</u> here
Centrioles		<ul style="list-style-type: none"> - Contained in the <u>cytoplasm</u> - They are made of special <u>micro-tubules</u> (think: <u>lego</u>) - These are <u>found only in ANIMAL</u> cells and are active during <u>cell division</u>
Ribosomes		<ul style="list-style-type: none"> - Tiny organelles in the <u>cytoplasm</u> which make <u>proteins</u>

Ribosomes		<ul style="list-style-type: none"> - They are either <u>"free"</u> or <u>attached</u> to the <u>endoplasmic reticulum (ER)</u> ↳ "free in cytoplasm" ↳ "Rough E.R."
Golgi Body/Apparatus/complex		<ul style="list-style-type: none"> - <u>Packages</u> and modifies materials produced by the cell that need to be <u>exported</u> out of the cell
Vacuole (or vesicle)		<ul style="list-style-type: none"> - Both are used for <u>storage</u> and <u>transport of materials</u> - <u>vesicles</u> are <u>smaller</u> than <u>vacuoles</u> ↳ eg. large + filled with H₂O in plant cells.
Lysosome		<ul style="list-style-type: none"> - Special type of <u>vesicle</u> that contains <u>digestive enzymes</u> - Used for digestion of complex molecules, so their parts can be <u>re-used by the cell</u>. (explode to cause cell death...when its time)
Endoplasmic Reticulum		<ul style="list-style-type: none"> - SMOOTH ER produces <u>fats</u> and steroid hormones like <u>testosterone</u> - ROUGH ER (its rough because it is covered in <u>ribosomes</u>) is where <u>proteins</u> are mass produced
Mitochondria		<ul style="list-style-type: none"> - Where food <u>energy</u> and the <u>oxygen</u> you breathe in come together to make <u>ENERGY</u> that your cells can use The <u>"Powerhouse"</u> of the cell
Chloroplast		<ul style="list-style-type: none"> - Only found in <u>Plant</u> cells - This is where <u>photosynthesis</u> occurs (chloroplasts use energy from the <u>SUN</u> + CO₂ to <u>create sugars</u>) → glucose ↳ green because it contain "chlorophyll"

Homework

Assignment #1: Eukaryotic Cell Structure Assignment pg. 9 - 14
Complete this assignment with a partner in the space provided below

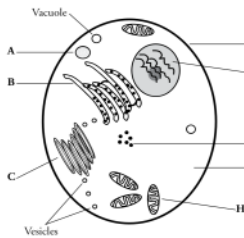
Organelles in Eukaryotic Cells

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/chromosomes	Information for making proteins
Assembly workers (F)	Ribosomes	Make proteins
Production line (B)	Endoplasmic reticulum (ER)	Transports and finishes proteins and other biological molecules
Custodians (A)	Lysosomes	gets rid of waste
Power generators (H)	Mitochondria	provides energy
Shipping department (C)	Golgi apparatus	packs and transports
Factory interior (G)	Cytoplasm	Space for work to be done
Items to be shipped	Vesicles	Cellular package containing products such as protein
Warehouse for storage of products	Vacuole	stores molecules
Loading dock	Pores/gated channels	Points of entry and exit for materials
Security fence (D)	Cell membrane	controls entry and exit

Organelles in Eukaryotic Cells

1

- Using the letters from the table in Model 1, label the cell diagram with the organelle names.
- According to the table,
 - what substance is analogous to a factory manager?
DNA
 - in what organelle would this substance be found?
Nucleus
- Using the information in Question 2, which cell organelle controls the activities of the entire cell?
Nucleus
- Which organelle generates energy to power cellular activities?
Mitochondria
- Which organelle is responsible for assembling proteins?
Ribosomes
- Once proteins have been assembled, to which organelle would they go next?
Rough ER
- Into what organelle might the cellular products be placed?
Vacuole



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

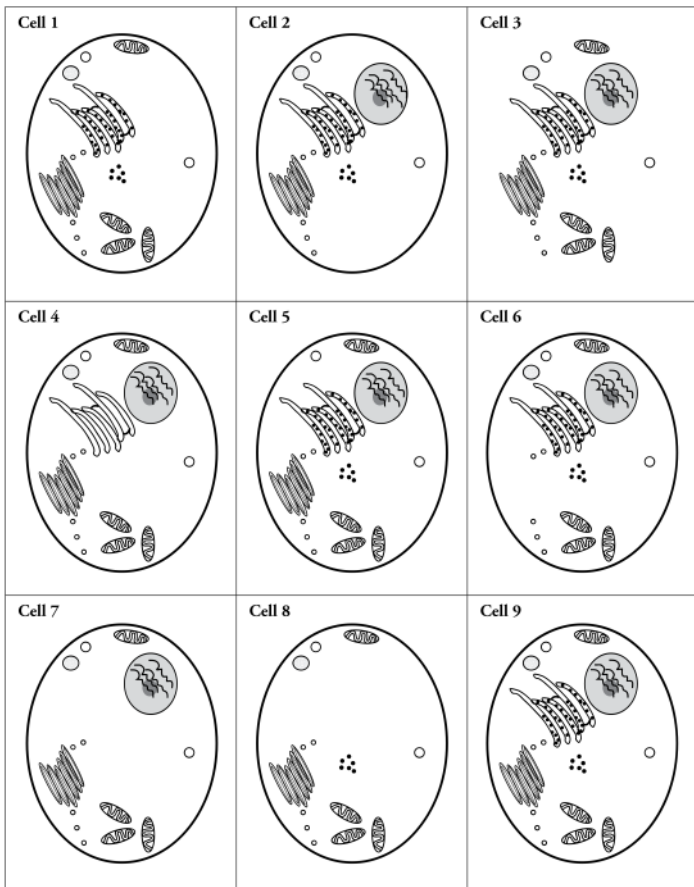


- Starting with instructions from the factory manager (DNA/chromosomes), create a flow chart to show how a protein is produced and shipped from a cell.

DNA in Nucleus Rough ER Golgi Cell Membrane



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?

Cell 9

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

Mitochondria

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

Cell 2 would not have energy to function.

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

Cells 5 and 6 because they are missing lysosomes.

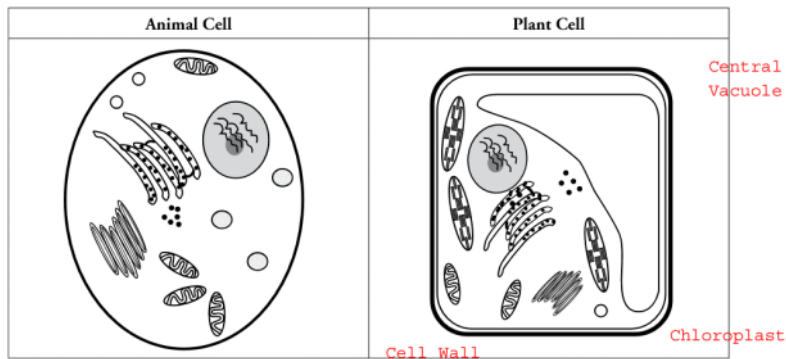
14. Cell 1 is missing one organelle. List as many reasons as possible why Cell 1 will not survive.

Cell one has no nucleus or DNA. Thus, it will not be able to create proteins or control any actions or properties of the cell.

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

These cells have no ribosomes. Consequently, they will not be able to build any proteins.

Model 3 – Animal Cell vs. Plant Cell



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

Yes

17. Do both cells in Model 3 have mitochondria?

Yes

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

Plant cells have a cell wall, chloroplasts and a large vacuole. Additionally plant cells are more of a box shape because of their rigid cell wall.

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 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
Vacuole	Fluid-filled organelle stores water, enzymes, and waste products. Size of this organelle can change.
Cell Wall	Supports and protects the cell.
Chloroplasts	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.

Plants have chloroplasts to produce carbohydrate because they have no other way to get food.

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

N/A

23. The central vacuole stores water. What would happen to the size of the central vacuole if a plant

N/A

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

The plant would dehydrate and wilt (shriveled).

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

The vacuole would be full and large not shriveled. The plant would be plump, not wilted.

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

The cell wall keeps the shape of the cell and plant. The cell membrane controls the entry and exit of nutrients and waste.

Extension Questions

Read This!

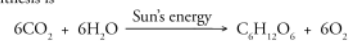
All cells undergo cellular respiration for the production of energy. Energy is necessary for all metabolic activity within the cell.

The formula for cellular respiration is



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

The formula for photosynthesis is



26. Study the information given in the *Read This!* box.

a. In what organelle does cellular respiration occur?

Mitochondria

b. Do plant and animal cells both have this structure?

Both plant and animal cells need energy/ATP.

27. In what organelle does photosynthesis occur? Do plant and animal cells both have this structure?

Chloroplasts which are only found in plant cells.

28. Using the equations above, explain the relationship between mitochondria and chloroplasts.

Chloroplasts make carbohydrates and mitochondria convert the carbohydrates into energy/ATP.

29. Plants have both mitochondria and chloroplasts; they can produce their own glucose to fuel cellular respiration. Animal cells, on the other hand, have only mitochondria. If an animal eats only meat what would be its source of glucose?

The glucose that has not been broken down yet in the animal tissue. This would probably not be a sufficient source of glucose.

30. Where in the human body would you find cells with a large number of mitochondria? Why?

I would expect a lot of mitochondria in muscle tissue. Muscles take a lot of energy to contract, the mitochondria supply energy.

Name: _____

Date: _____

ANIMAL CELLS

Cells are the basic building blocks of all living things.

Cell Membrane

Thin layer that surrounds the cell. It provides structure and protection. It is "semi-permeable" meaning it only lets certain substances in or out of the cell.

Endoplasmic Reticulum (Smooth)

Makes lipids (fats) and modifies proteins. It then transports these materials throughout the cell. (or out)

Mitochondria

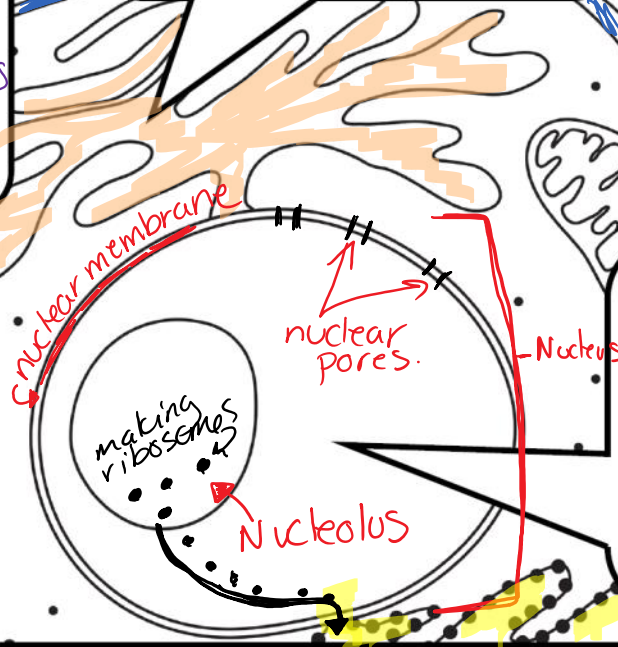
Nicknamed the "powerhouse" of the cell because they provide Energy for the cell. The site of cellular respiration
 $O_2 + \text{glucose} \rightarrow \text{ENERGY}$

Golgi Body

Packages proteins and carbohydrates into vesicles for transport out of the cell.

Nucleus & Nucleolus

The nucleus is the control centre of the cell. It directs many of the functions of the cell. It also holds the cell's DNA (genetic info). The nucleolus is inside of the nucleus. It aids in the production of ribosomes.



Rough endoplasmic reticulum has ribosomes bound to its membranes. (attached)

Ribosomes are the site of Protein ("making") synthesis.

Rough ER & Ribosomes

The lysosome is the digestive system of the cell. They help break down waste molecules. (with enzymes)

Lysosome

Vacuoles provide storage for the cell for materials such as water. Vesicles are smaller storage organelles that move material into and out of the cell.

Vacuoles & Vesicles

Centrosomes create microtubules. Centrioles contained in the centrosome help the cell to divide - mitosis.

Centrosome & Centrioles

The Fluid in which cell organelles are suspended. It maintains the pressure inside the cell. + shape

Cytoplasm

1. Some human cells, such as muscle cells, have

2. When an animal eats, food is stored in the

3. Why is it important that the cell membrane

You try:

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

muscle cells need more energy for movement => so need more mitochondria to make it.

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?

The vacuole is the cell's storage facility.

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

The cell needs things like water to enter, but also needs to keep things out - like bacteria

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 PLANT cells. They provide extra structure and protection for plants.

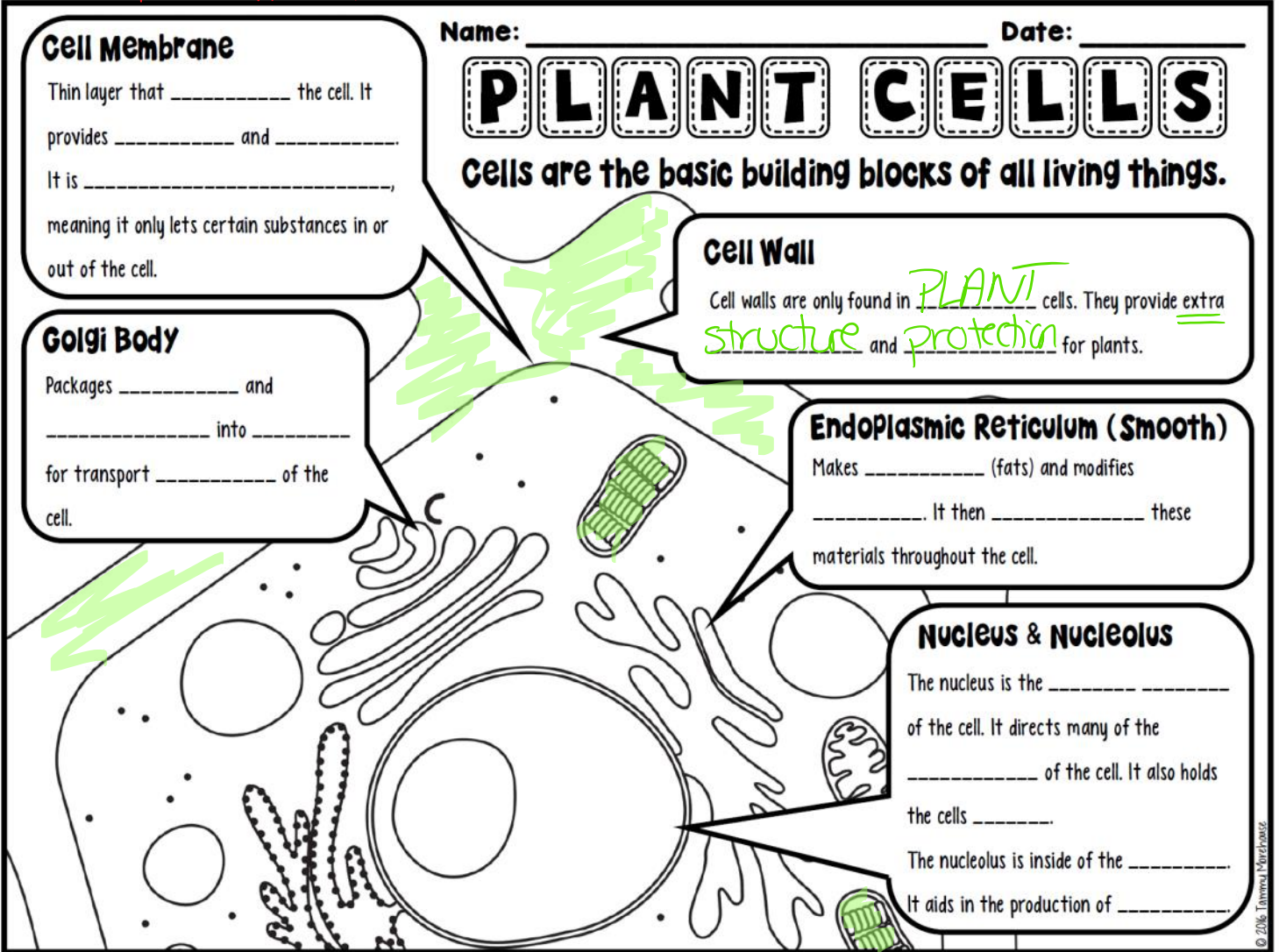
Endoplasmic Reticulum (Smooth)

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

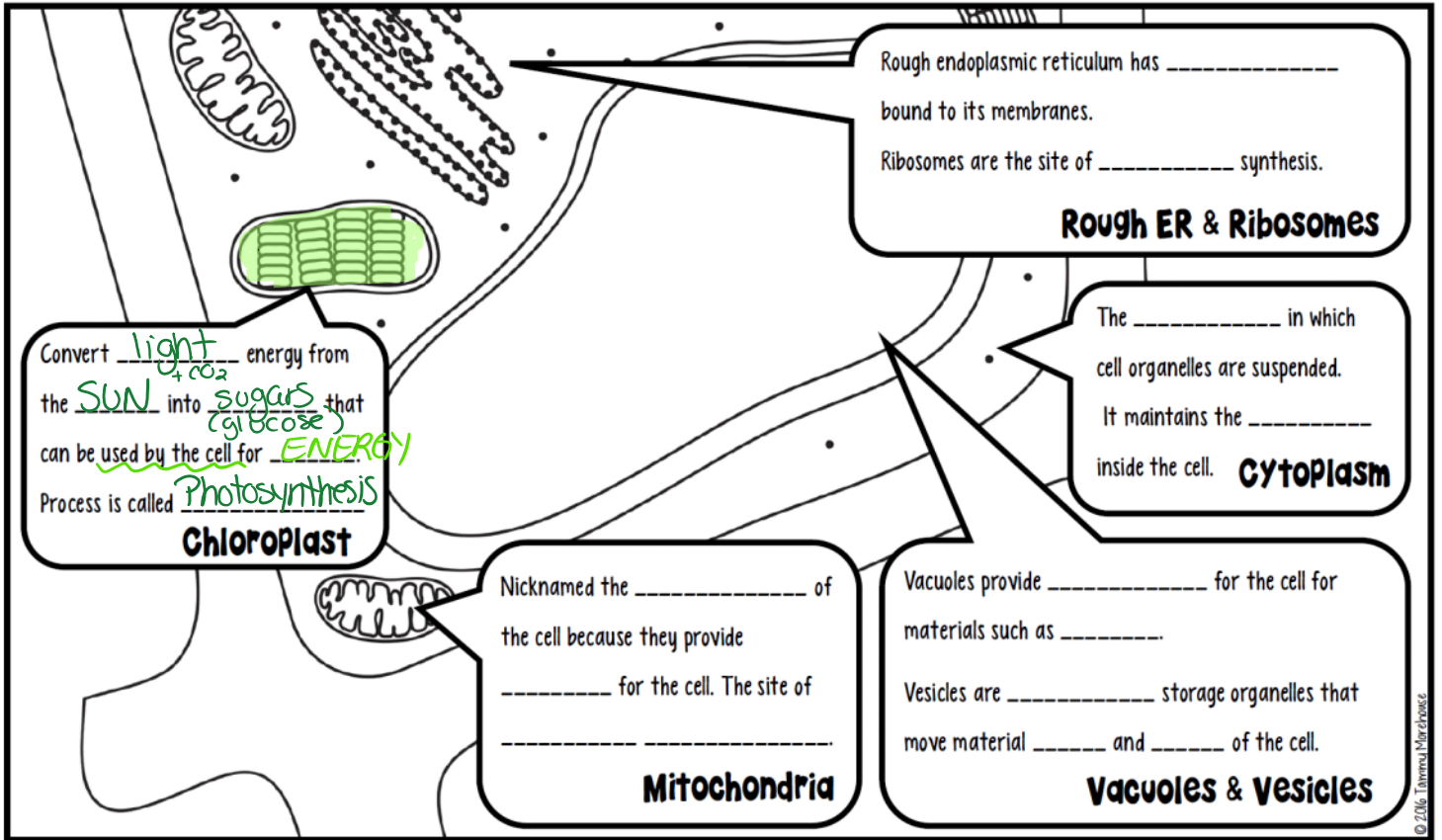
Nucleus & Nucleolus

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 _____.



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You try:

1. What organelle is present in **both plant and animal cells** but is usually much larger in plant cells? Why?
 The vacuole - the plant needs to be able to store a lot of H₂O for times when water is not available.
2. Photosynthesis creates sugar for the cell. What organelle does the sugar then need to go to and why?
 The sugar created needs to go to the mitochondria so that it can be made into ATP-energy.
3. Why is it important that plant cells have both a cell membrane and a cell wall?
 Plants need both b/c they do not have an internal skeletal system. The cell wall helps the plant keep its shape.

Homework

Assignment #2: Labeling & Colouring the Organelles

Complete this assignment in the space provided below

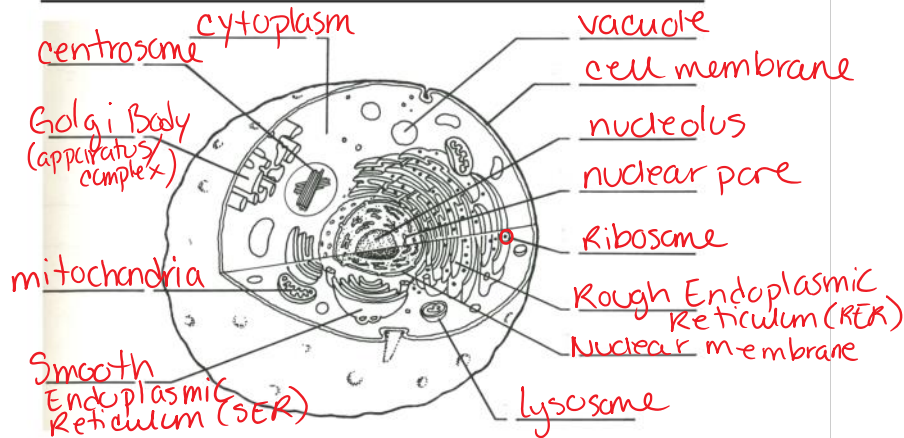
Part 1: Colouring and Labelling Animal and Plant Cells

- 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

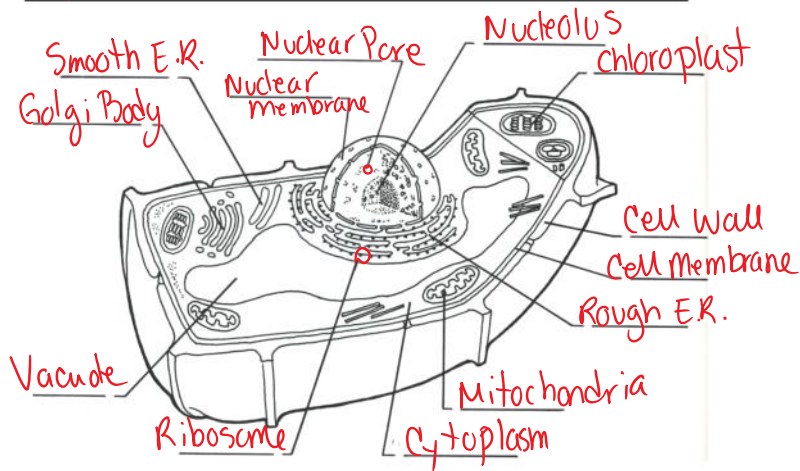
- Underneath each cell, write the function of each organelle listed in your own words

Animal Cell



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

Plant Cell



- 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

- centriole
- Lots of lysosomes

Animal Cells DO NOT HAVE

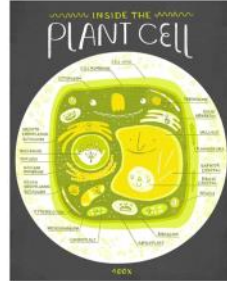
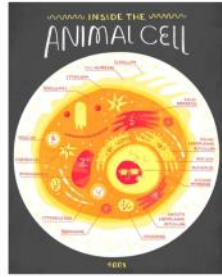
- cell wall
- chloroplast

Plant Cells HAVE

- chloroplast
- cell wall
- Large vacuoles
- Few lysosomes

Plant Cells DO NOT HAVE

- centrioles



Reproduction Transfers GENETIC INFORMATION from Parents to Offspring



Every species has its own strategies for reproduction

For Example in Figure 1.3:



- A. The flowers of many plants have colours and scents that attract animals so that they can pick up and transfer pollen to other flowers
- B. Many animals have courtship rituals 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 dividing in 2

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

<p>Asexual Reproduction</p> 	<ul style="list-style-type: none"> • Offspring come from a <u>single</u> parent • Each offspring receives a copy of the parent's <u>genetic information</u> • Offspring are <u>genetically identical</u> to the parent and to each other.
<p>Sexual Reproduction</p> 	<ul style="list-style-type: none"> • Two parents <u>each contribute half</u> of the offspring's genetic material. • Offspring have genetic information that is <u>different</u> from either parent's • Offspring are <u>NOT identical</u> to their parents or, in most cases, to each other. <p style="text-align: right;">(offspring have similarities)</p>

In both asexual and sexual reproduction, the genetic material and the information it holds is passed on to the offspring.

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

Inside the Nucleus

- The control center of the WHOLE cell is the nucleus
- The nucleus contains the instructions on how to perform all activity in the cell.
 (are a "code")
- This is coded for in the DNA.
- DNA stands for Deoxyribonucleic Acid.



What is DNA and How Does it Work?
<https://www.youtube.com/watch?v=zwibgNGe4aY>



Controlling the Cell's Activity

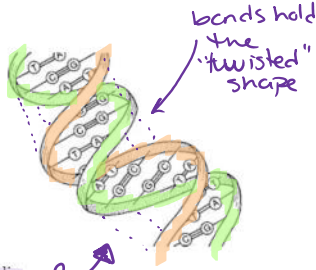
It is the **nucleus** that controls all activity that occurs in and around the cell. Let's review the structure and function of the nucleus...

- found in Eukaryotic cells only
- enclosed in its own membrane
- contains the DNA (instructions for all cell functions)

What Are the Structures Found Inside the Nucleus?

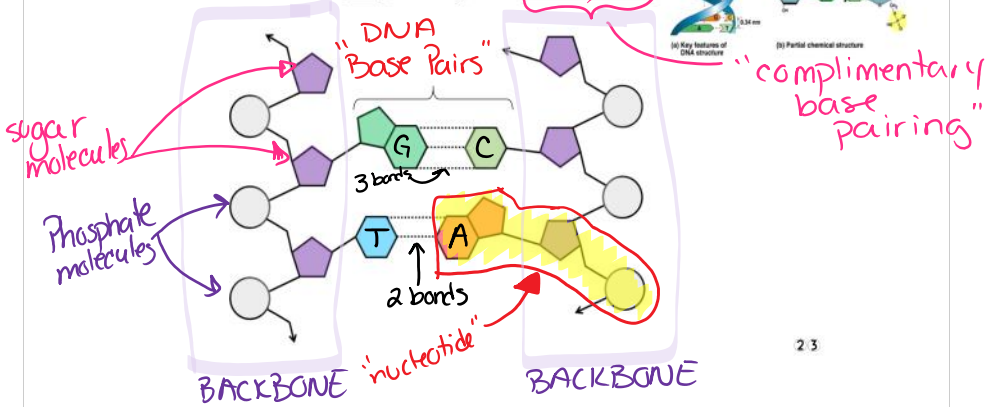
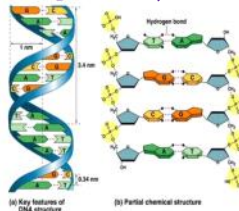
DNA = **deoxyribonucleic acid**

- a **double helix** (twisted ladder)
- Contains the **genetic** 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 **twisted ladder** into a spiral **double helix**
2. DNA stores **genetic info** that is passed on to each generation **parent** → **offspring**
3. DNA is packed into **chromosomes**
4. DNA has a **sugar + phosphate backbone**
5. DNA is made up of **4 different nitrogenous bases**
 - Adenine (A), Thymine (T), Cytosine (C), Guanine (G)
 - These bases are **always** bound together as **A-T, G-C**





→ HW May 31st.

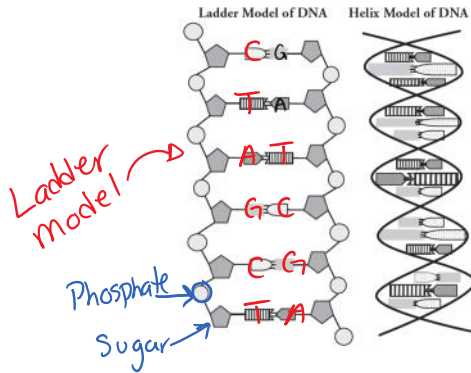
1. What do the letters of DNA stand for?
2. What are the three parts of a nucleotide?
3. Which nucleotide component contains nitrogen?
4. Name the four bases.

deoxyribonucleic acid

Sugar
Phosphate
Nitrogenous Base (A, T, C, G)

nitrogenous base

A - adenine
T - thymine
C - cytosine
G - guanine



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. (see above)
 - b. What part(s) of the nucleotides make up the rungs (steps) of the "ladder"?
the nitrogenous bases
 - c. What part(s) of the nucleotides make up the sides (backbone) of the "ladder"?
sugar + phosphate
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). (see above)

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

(T-A) must always be attached to Adenine

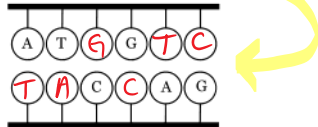
8. When one nucleotide contains cytosine, what type of base is the cytosine attached to on the opposite nucleotide strand?

(C-G) must always be attached to Guanine

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.

complimentary base pairing means that T pairs with A, and G pairs with C

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	19	31
Cow	28	22	22	28
Salmon	29	21	21	29
Wheat	27	23	23	27
Yeast	31	19	19	31

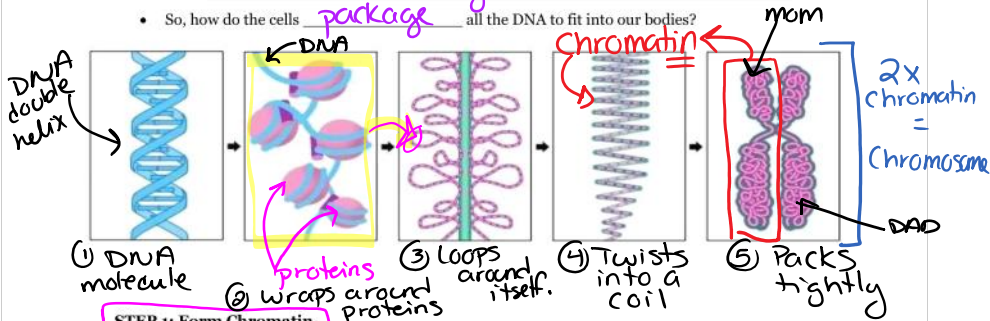
$27+27=54$
 $100-54=46 \div 2=23$

$31+31=62$
 $100-62=38 \div 2=19$

equal b/c C pairs with G
if A pairs with T, the amounts will be equal.

The Organization of DNA

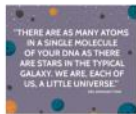
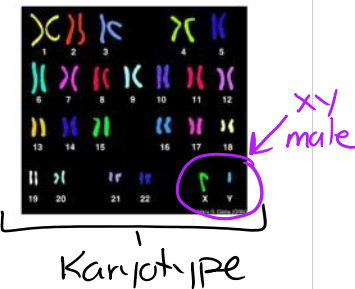
- If all the DNA in a cell was laid out in a straight line, it would be 2 m long
- If all the DNA in EVERY cell in your body was laid out in a continuous straight line, it would be about twice the way around the whole Solar system!
- So, how do the cells package all the DNA to fit into our bodies?



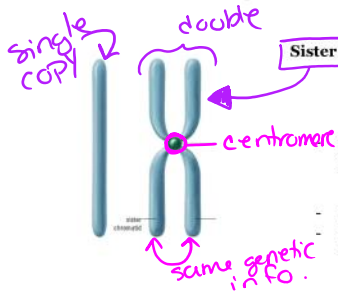
- DNA is wrapped around proteins to make chromatin
- Chromatin: A thread-like structure made of DNA and proteins

STEP 2: Form Chromosomes

- Chromatin twists up on itself to make chromosomes
 - chromosomes: tightly coiled chromatin found in the nucleus. (only seen during cell division)
- Every organism has a characteristic number of chromosomes
- Chromosomes within the nucleus are found in pairs
- Most human cells have 46 chromosomes arranged in 23 pairs, including one pair of chromosomes that help determine genetic sex (xx, xy)
 - Female: male
- How does the DNA CODE for protein?



Chromosomes - Single Strand Shape vs "X" Shape



Sister chromatids = replicated form of **chromosomes**
 replication occurs before the cell divides so that both cells get the genetic info

Two strands of **replicated** chromosomes that are physically attached together in the **centre** by a **centromere**

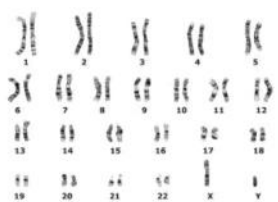
- Each strand of the X shape is called a **sister chromatid**
- Each chromatid contains identical genetic information to its "sister"

Our Chromosomes

Homologous chromosomes = **Pairs** of chromosomes (one from each parent)
 - similar length/gene position

"same" →

We have 46 chromosomes, in 23 pairs.



Every organism has a specific number of chromosomes.

For example:

- Mosquitos have 6 chromosomes (3 pairs)
- Chickens have 78 chromosomes (39 pairs)
- Potatoes have 48 chromosomes (24 pairs)

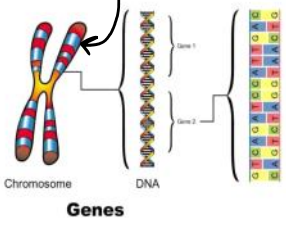
DNA

Genes

- Genes: A region of DNA that encodes for a specific protein
- The unit of heredity for all organisms.
- Genes store the information needed to produce 90 000 - 100 000 different proteins used in the cells of your body.

"space"

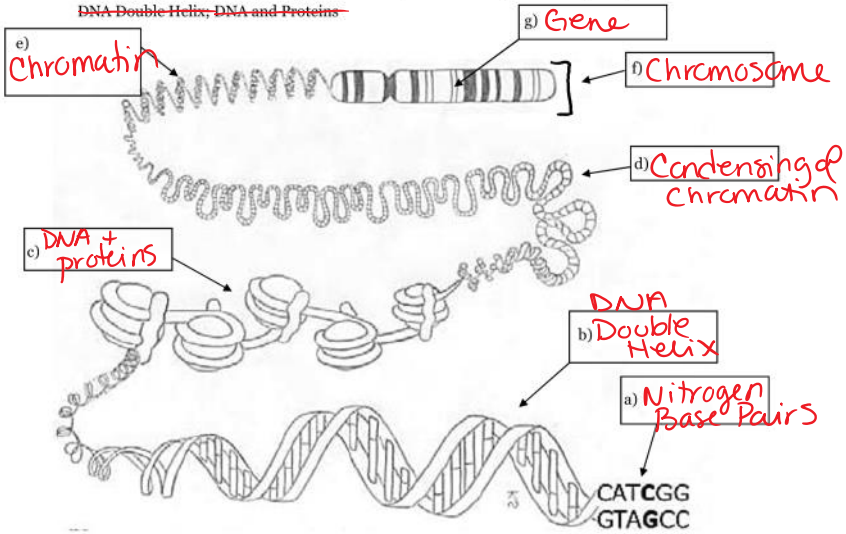
stripe = gene



HW: May 31st

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? in the nucleus

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

smallest → Largest

nitrogen containing bases - nucleotide - DNA double helix - chromatin - chromosome - nucleus - cell



READING ABOUT: THE FUNCTION OF THE NUCLEUS WITHIN THE CELL PG 29-30

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

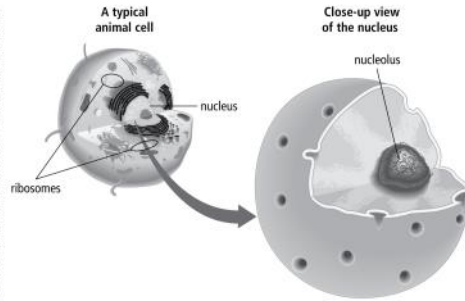
→ vesicles, golgi body, vacuole, lysosome

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.

→ Nucleus, ribosomes, RER

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?

1. stores instructions for how to make cells, for chemicals and structures that cells must make, and for everything else the cell does

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. ✓

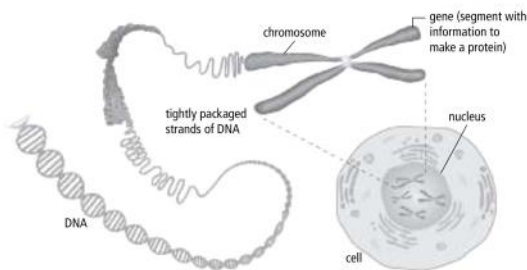
✓ Reading Check

2. Why are proteins important to cells?

2. cells need proteins in order to work properly

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**.



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



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 _____.

Cloze Activity Inside the nucleus Page 58

1. nucleus
2. DNA, molecule
3. DNA, genetic
4. chromosomes
5. number
6. 46, 23
7. genes, chromosomes
8. molecule
9. ribosomes, nucleolus

The control centre of the cell

Use the diagram to help you answer question 1.



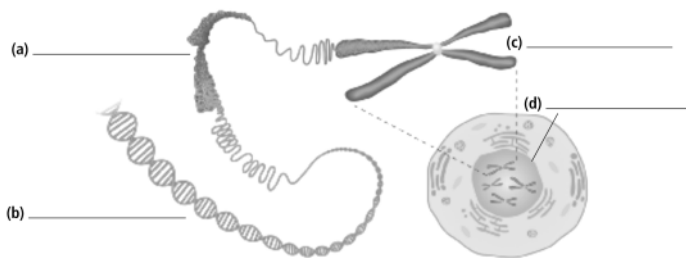
1. Describe the structure of DNA.

The control centre of the cell Page 59

1. Students' answers may vary, but should include some or all of the following: long, two-stranded molecule with a shape like a ladder that has been twisted into a spiral
2. nucleus
3. DNA
4. chromosomes
5. gene
6. (a) chromosome
(b) DNA
(c) chromosome
(d) nucleus

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 ribosomes 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.

True or false?

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1. False. The **nucleus** directs and controls all of the cell's activities.

2. True

3. True

4. False. Humans have **23** pairs of chromosomes, or Humans have **46 chromosomes in each body cell.**

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

6. True

7. True

8. False. Genes are part of chromosomes.