

UNIT 1

Life processes are performed at the cellular level

TOPIC 1.3

How are cells different from one another?

**TOPIC 1.3** How are cells different from one another?**Topic 1.3: How are cells different from one another?**

- Endeavour Hydrothermal Vents (near Vancouver Island)
 - Water temperature up to 300°C and no light
 - Bacteria and other organisms live here
 - How can different types of cells survive this extreme environment?

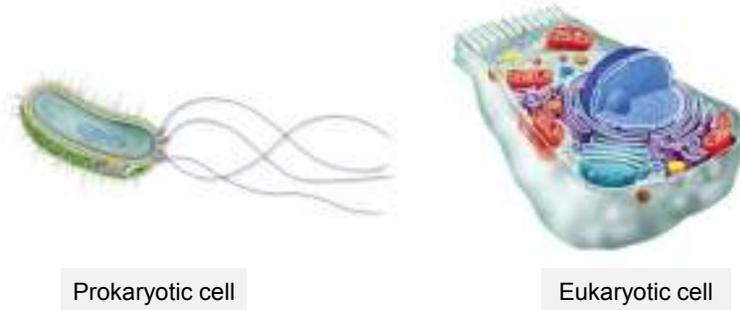


Endeavour hydrothermal vents

TOPIC 1.3 How are cells different from one another?

Concept 1: Scientists classify cells into two types based on the presence or absence of a nucleus.

- Two main types of cells:
 - **Prokaryotic cell:** a cell without a nucleus
 - **Eukaryotic cell:** a cell with a nucleus



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TOPIC 1.3 How are cells different from one another?

Prokaryotic Cells

- **Prokaryotic cells:**
 - Do not have a nucleus
 - Simpler than eukaryotic cells
 - Have fewer internal structures

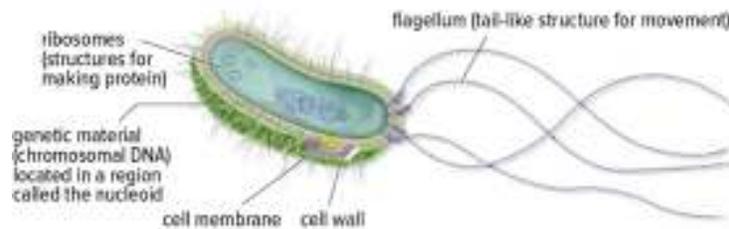


Figure 1.10: Prokaryotic cell

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Eukaryotic Cells

- **Eukaryotic cells:**
 - Have a nucleus, which contains genetic material
 - Have organelles (internal structures surrounded by membranes which carry out cell processes)
 - Larger and more complex than prokaryotic cells

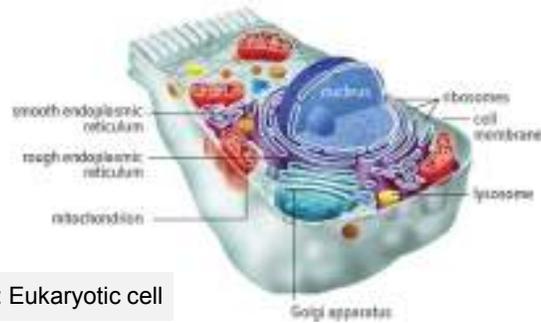


Figure 1.10: Eukaryotic cell

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Comparison of Prokaryotic and Eukaryotic Cells

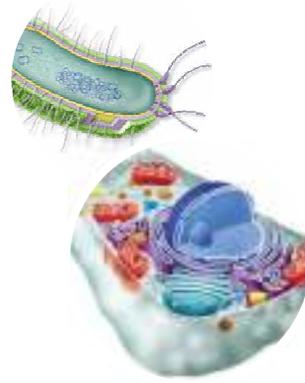
Characteristic	Prokaryotic Cell	Eukaryotic Cell
Genetic material contained in nucleus surrounded by a membrane	no	yes
Organelles surrounded by membranes	no	yes
Size and complexity	smaller and less complex	about 10 times as large and more complex
Can carry out all processes needed to stay alive	yes	yes
Example	bacterium	liver cell of an animal

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Discussion Questions

- Use a Venn diagram to compare and contrast prokaryotic and eukaryotic cells.
- Write three statements that are true of both prokaryotic and eukaryotic cells.



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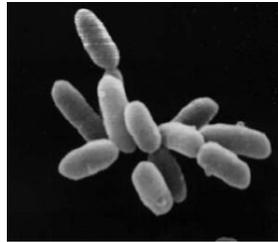
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Concept 2: Bacteria are prokaryotic cells.

- Prokaryotic organisms include bacteria and archaea



Bacteria



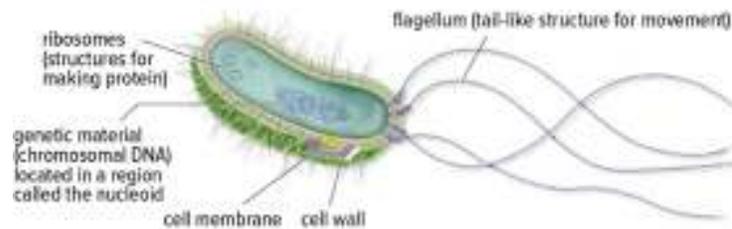
Haloarchaea
(a type of archaea)

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TOPIC 1.3 How are cells different from one another?

Bacteria

- Typical bacterial cell:
 - Does not have a nucleus
 - Has a cell wall, cell membrane, and jelly-like cytoplasm
 - Genetic material and ribosomes float in the cytoplasm
 - Some bacteria have flagella for movement



Typical bacterial cell

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Archaea

- Typical archaea cell:
 - Does not have a nucleus
 - Has a cell wall
 - Some molecules in archaea are similar to those in eukaryotic cells
 - Has molecules in cytoplasm that are not found in any other type of organism
 - Can live in extreme environments (e.g., hydrothermal vents)



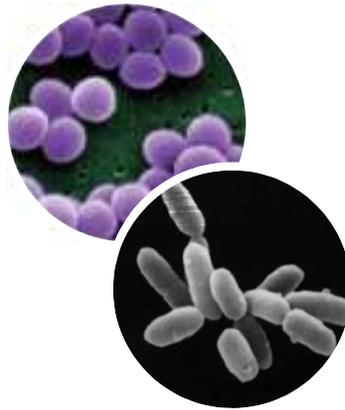
Haloarchaea
(a type of archaea)

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Discussion Questions

- Make a T-chart to compare and contrast bacteria and archaea.
- What new questions do you have about bacteria and archaea?



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Concept 3: Plant and animal cells are eukaryotic cells.

- **Two main types of eukaryotic cells:**
 - Plant cells
 - Animal cells
- Both types of cells have organelles that carry out life processes



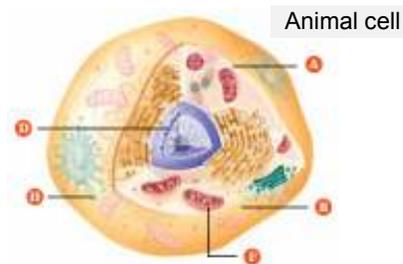
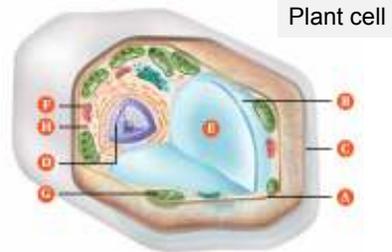
Figure 1.11: Plant cell (top) and animal cell (bottom)

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TOPIC 1.3 How are cells different from one another?

Cell Organelles: Cell Membrane

- **(A) Cell membrane**
 - Surrounds and protects contents of the cell
 - Helps control movement of foods, wastes, and other substances into and out of the cell

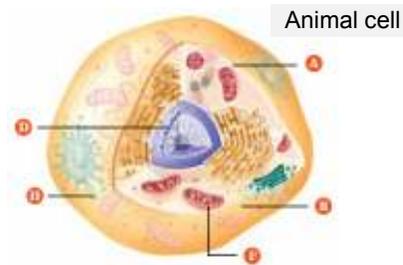
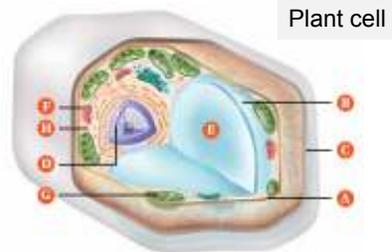


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Cell Organelles: Cytoplasm

- **(B) Cytoplasm**
 - Jelly-like fluid in which internal organelles float

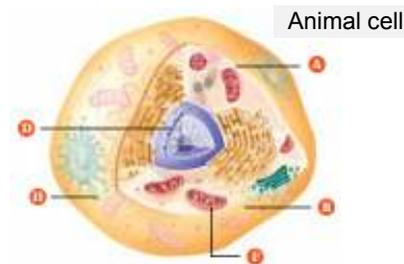
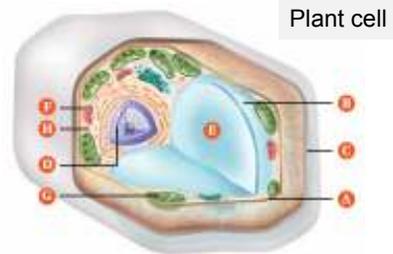


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Cell Organelles: Cell Wall

- **(C) Cell wall**
 - Found in plant cells
 - Tough, rigid structure surrounding the cell membrane
 - Gives plant cells a regular, box-like shape

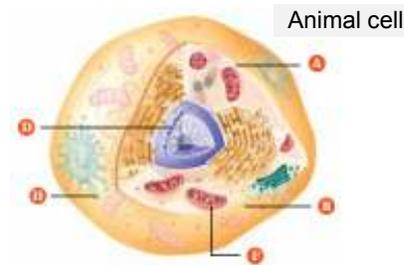
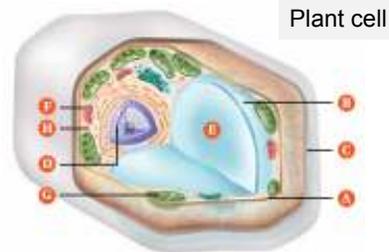


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Cell Organelles: Nucleus

- **(D) Nucleus**
 - Large, round structure containing genetic material
 - Genetic material controls cell growth, reproduction, and other cell processes

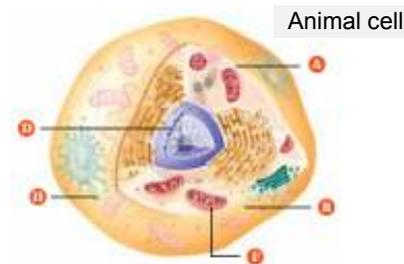
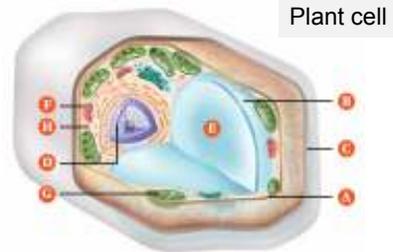


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Cell Organelles: Vacuoles

- **(E) Vacuoles**
 - Balloon-like spaces within the cytoplasm to store wastes and food
 - Smaller and more numerous in animal cells

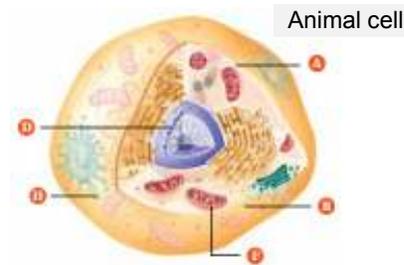
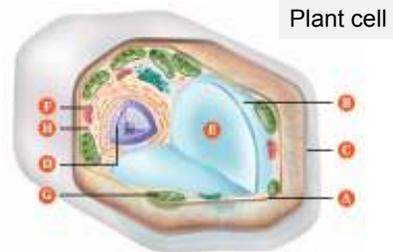


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Cell Organelles: Mitochondria

- **(F) Mitochondria**
 - Bean-shaped structures
 - Release energy from food molecules to power cell processes

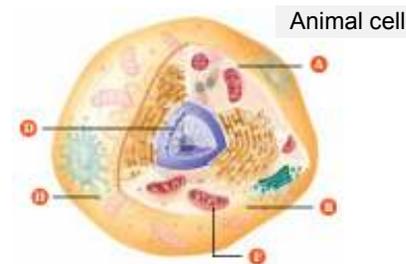
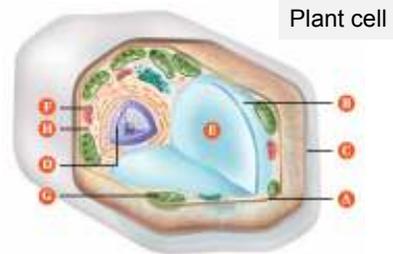


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Cell Organelles: Chloroplasts

- **(G) Chloroplasts**
 - Found in plant cells
 - Structures containing chlorophyll (green substance)
 - Chlorophyll captures energy from the sun to produce food (sugars) in the leaves and stems of plants

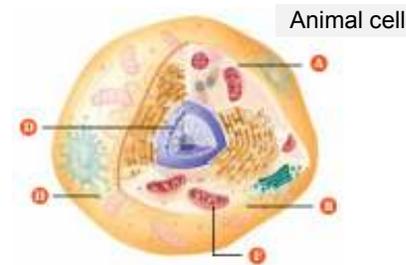
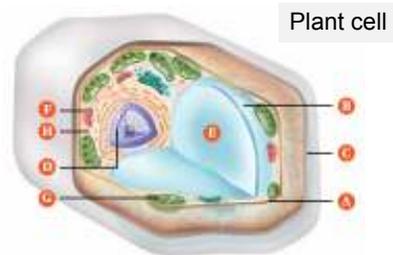


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Cell Organelles: Vesicles

- **(H) Vesicles**
 - Small sacs that transport materials
 - Help materials enter and leave the cell

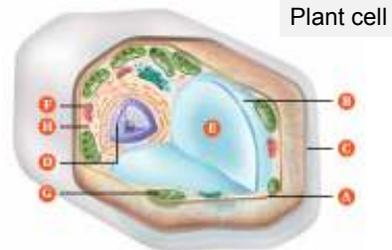


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TOPIC 1.3 How are cells different from one another?

Plant Cells and Photosynthesis

- Plant cells have chloroplasts
- Chloroplasts capture light energy from the Sun and convert it into chemical energy for the plant (photosynthesis)

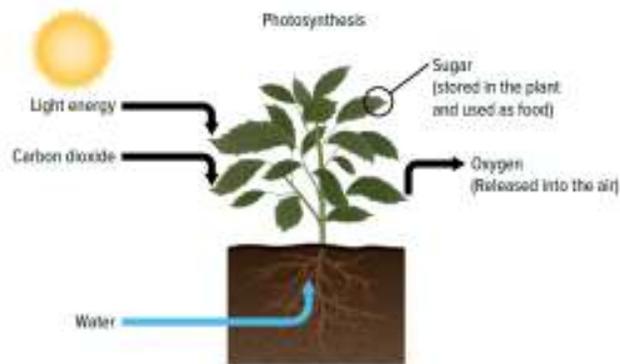


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TOPIC 1.3 How are cells different from one another?

Photosynthesis

- **Photosynthesis:**
 - A chemical reaction in plant cells that converts the Sun's light energy into chemical energy (sugar) that organisms can use

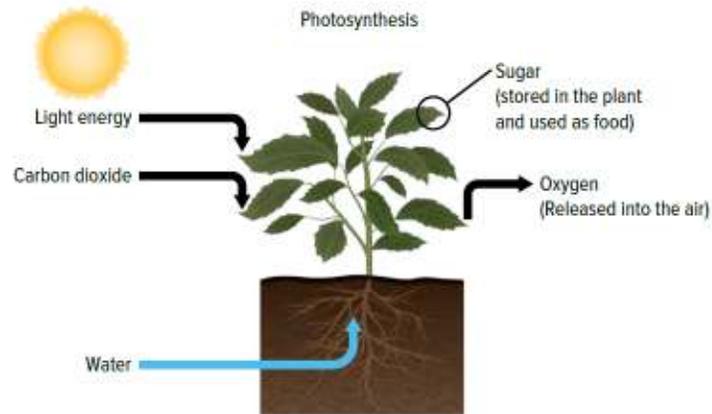


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TOPIC 1.3 How are cells different from one another?

Photosynthesis

- **Chemical reaction equation for photosynthesis:**
Carbon dioxide + water + light energy \rightarrow sugar + oxygen

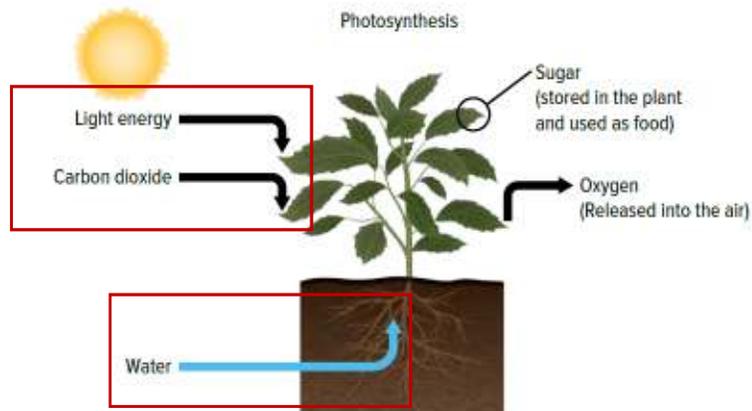


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Photosynthesis

- Plants take in carbon dioxide from the air
- Plants absorb water through roots

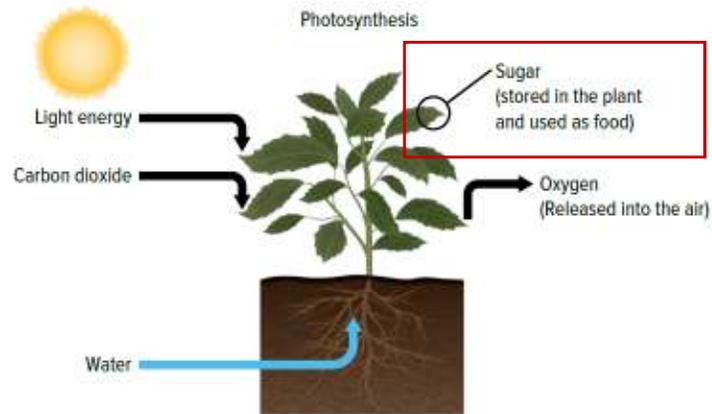


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TOPIC 1.3 How are cells different from one another?

Photosynthesis

- Plants convert light energy into chemical energy (sugar)
- Sugar is food for the plant

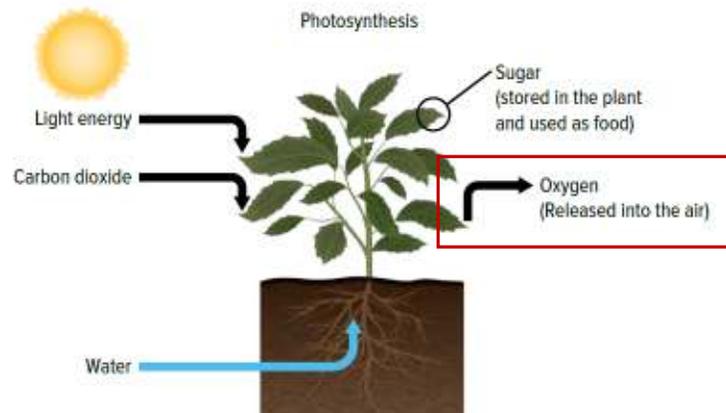


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Photosynthesis

- Oxygen is released into the air as a waste by-product

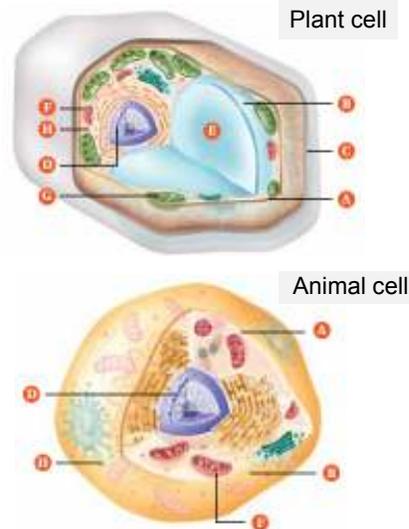


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TOPIC 1.3 How are cells different from one another?

Cellular Respiration

- Both plant and animal cells have mitochondria
- Mitochondria are organelles where **cellular respiration** takes place

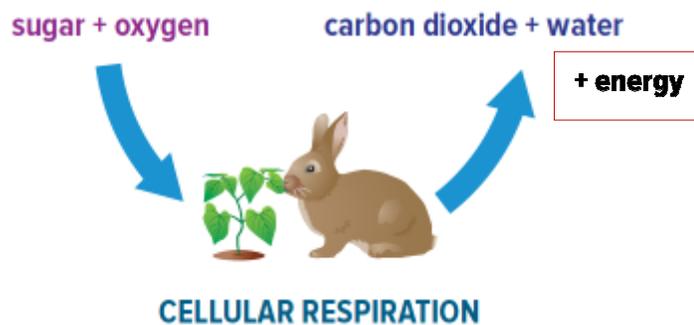


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Cellular Respiration

- **Cellular respiration:**
 - A chemical reaction in the cells of most organisms that release the energy needed to carry out life processes

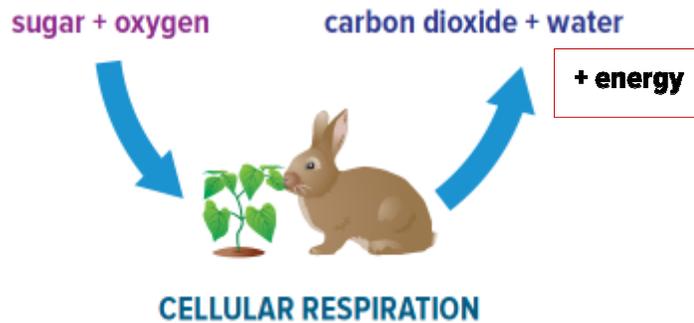


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Cellular Respiration

- **Chemical reaction equation for cellular respiration:**
sugar + oxygen → carbon dioxide + water + energy

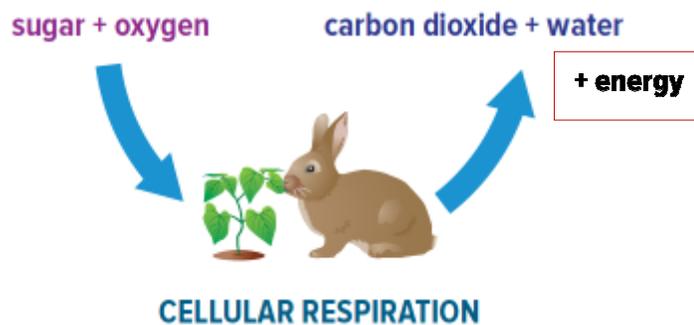


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Cellular Respiration

- Sugar and oxygen are converted into carbon dioxide and water (waste products)
- Energy is released in this reaction
 - Used to power cell processes



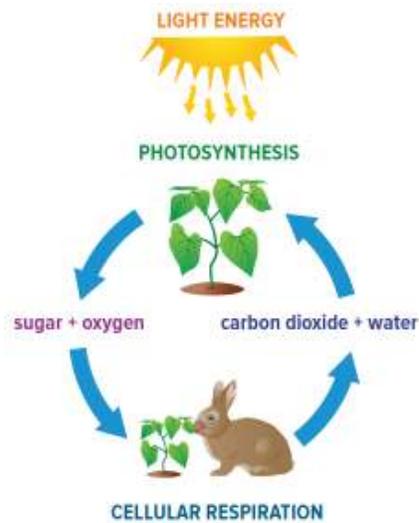
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TOPIC 1.3 How are cells different from one another?

Photosynthesis and Cellular Respiration

- Photosynthesis and cellular respiration
 - Function in a cycle
 - Most living things depend on this cycle to survive
- Photosynthesis: stores energy
- Cellular respiration: releases energy

Figure 1.14: Photosynthesis and cellular respiration cycle



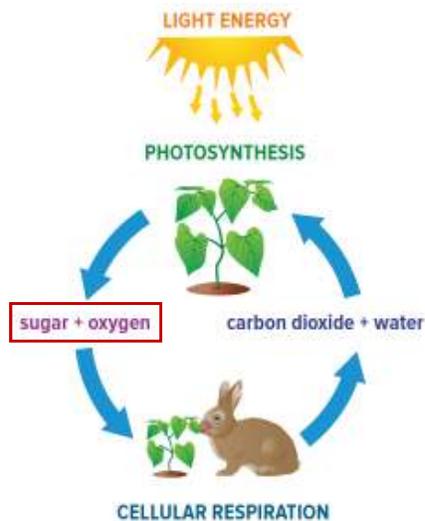
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Photosynthesis and Cellular Respiration

- Plants, animals, and other organisms:
 - Use the sugar and oxygen produced by photosynthesis as part of cellular respiration

Figure 1.14: Photosynthesis and cellular respiration cycle



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TOPIC 1.3 How are cells different from one another?

Photosynthesis and Cellular Respiration

- Plants and other organisms:
 - Use the carbon dioxide and water produced by cellular respiration as part of photosynthesis

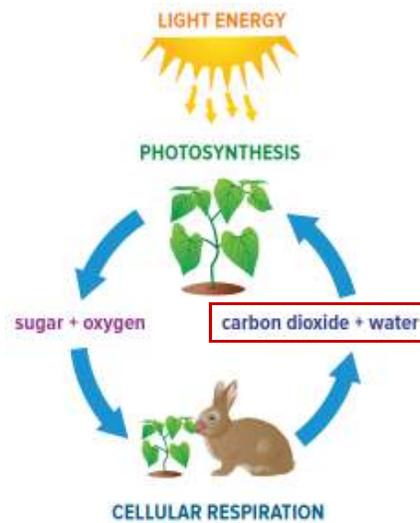


Figure 1.14: Photosynthesis and cellular respiration cycle

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TOPIC 1.3 How are cells different from one another?

Discussion Questions

- Identify and describe the key similarities and difference of plant and animal cells.
- Explain how chloroplasts are related to cellular processes.



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TOPIC 1.3 How are cells different from one another?

Discussion Questions

- Some people describe photosynthesis and cellular respiration as the reverse of each other.
 - Explain why you agree or disagree with this idea.



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TOPIC 1.3 How are cells different from one another?

Summary: How are cells different from one another?

- Scientists classify cells into two types based on the presence or absence of a nucleus
- Bacteria are prokaryotic cells (do not have a nucleus)
- Plant and animal cells are eukaryotic cells (have a nucleus)
- Photosynthesis and cellular respiration function together in a cycle



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