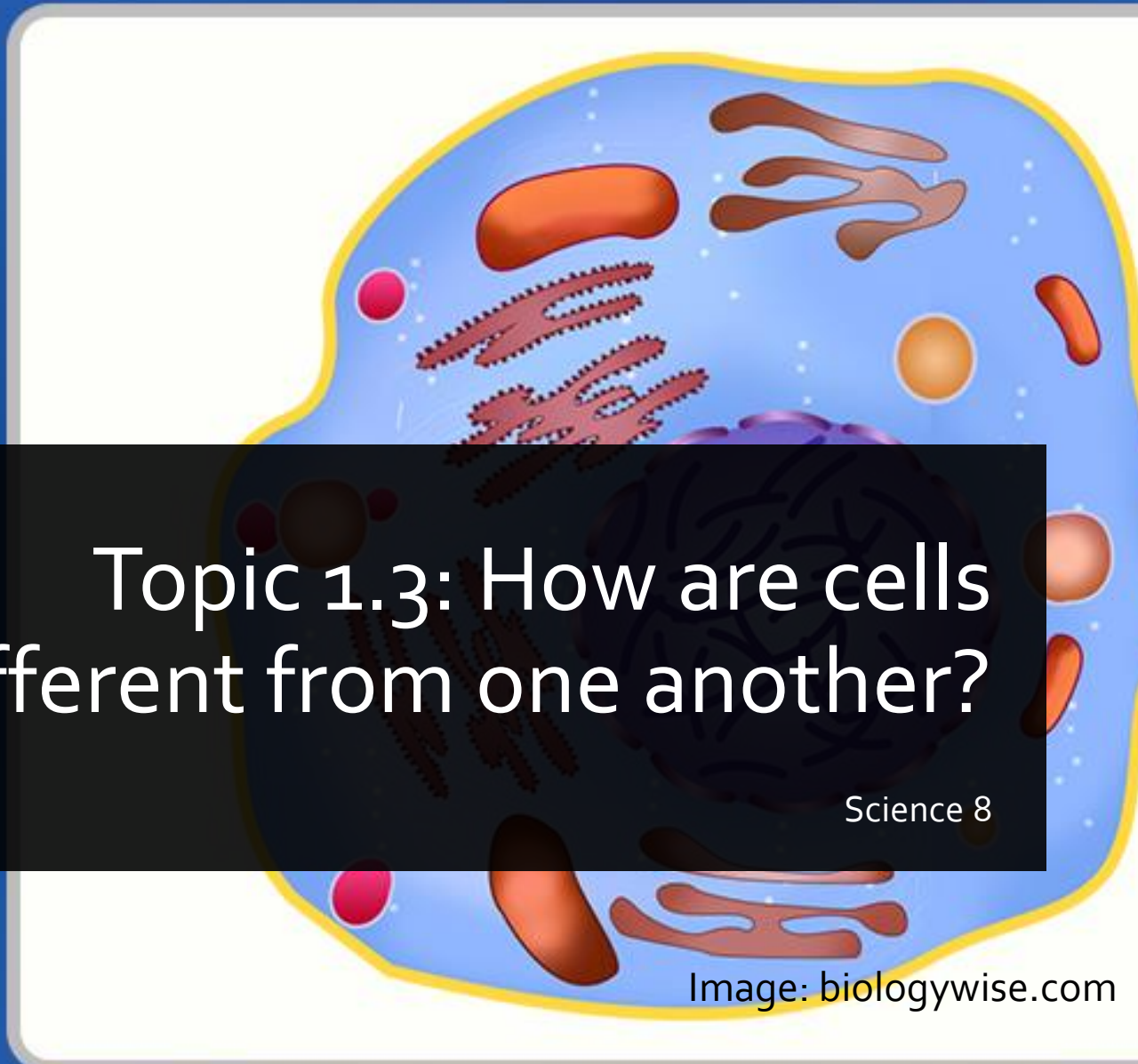


Topic 1.3: How are cells different from one another?

Science 8

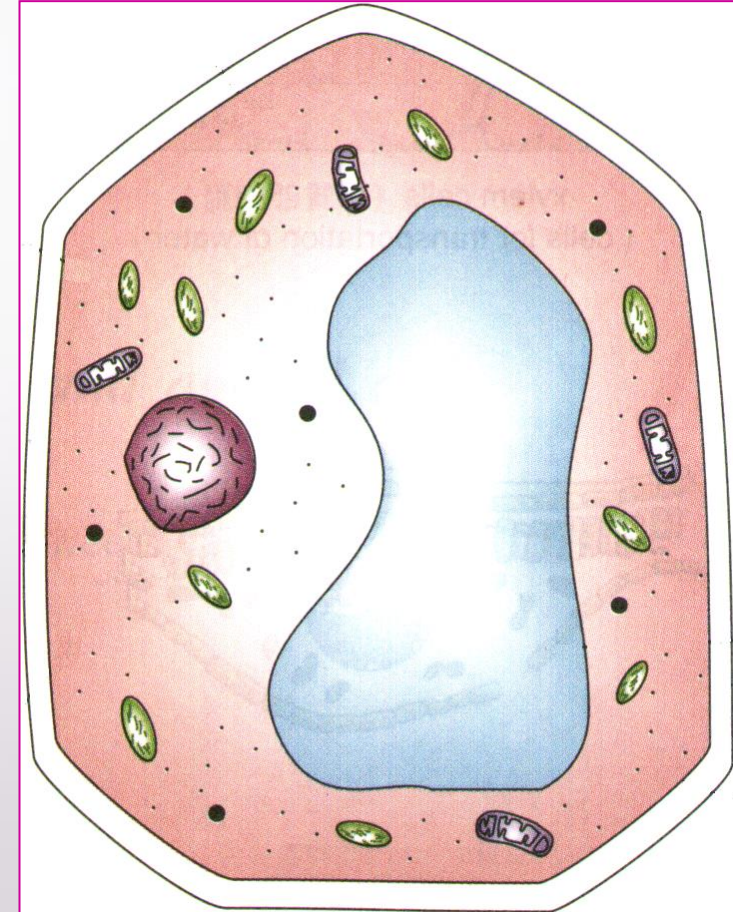
Image: biologywise.com



Cell Structures and Organelles

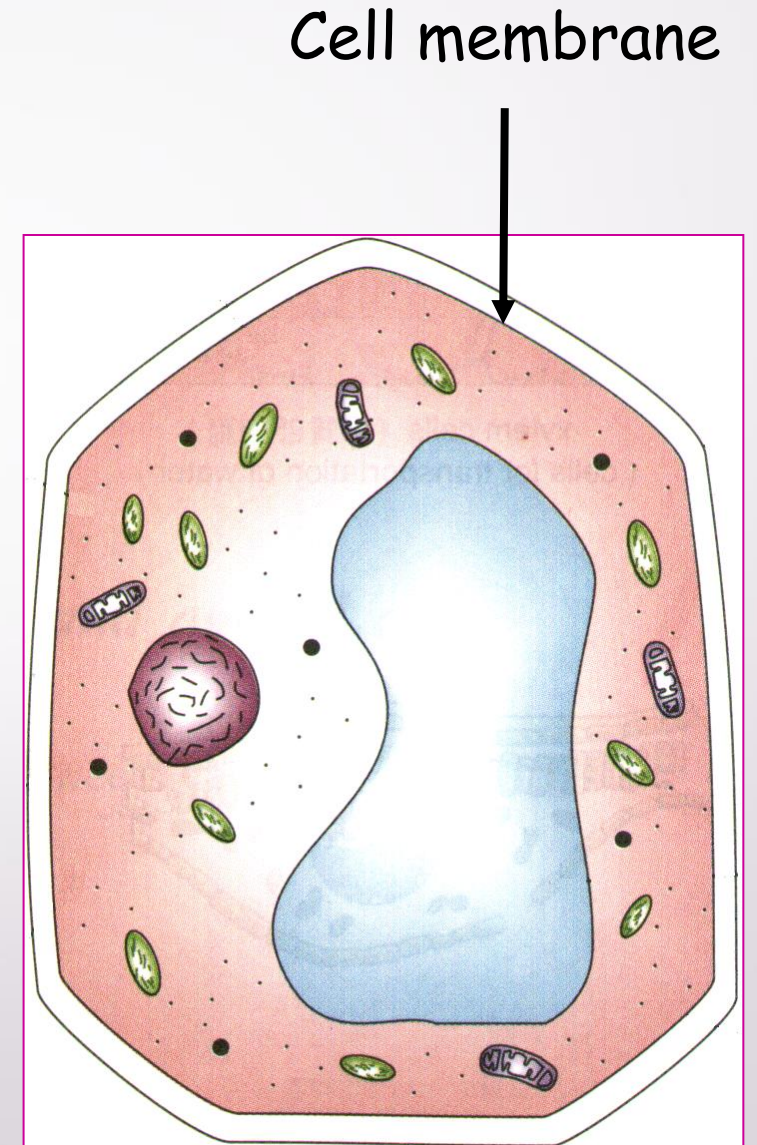
Cells have different cell structures.

- Basic cell structures (cell wall, cell membrane, cytoplasm) give the cell its **shape**.
- **Organelle** (“little organ”):
 - Structure *inside the cell* that performs a **special function**
 - Can be membrane-bound (have its own membrane)



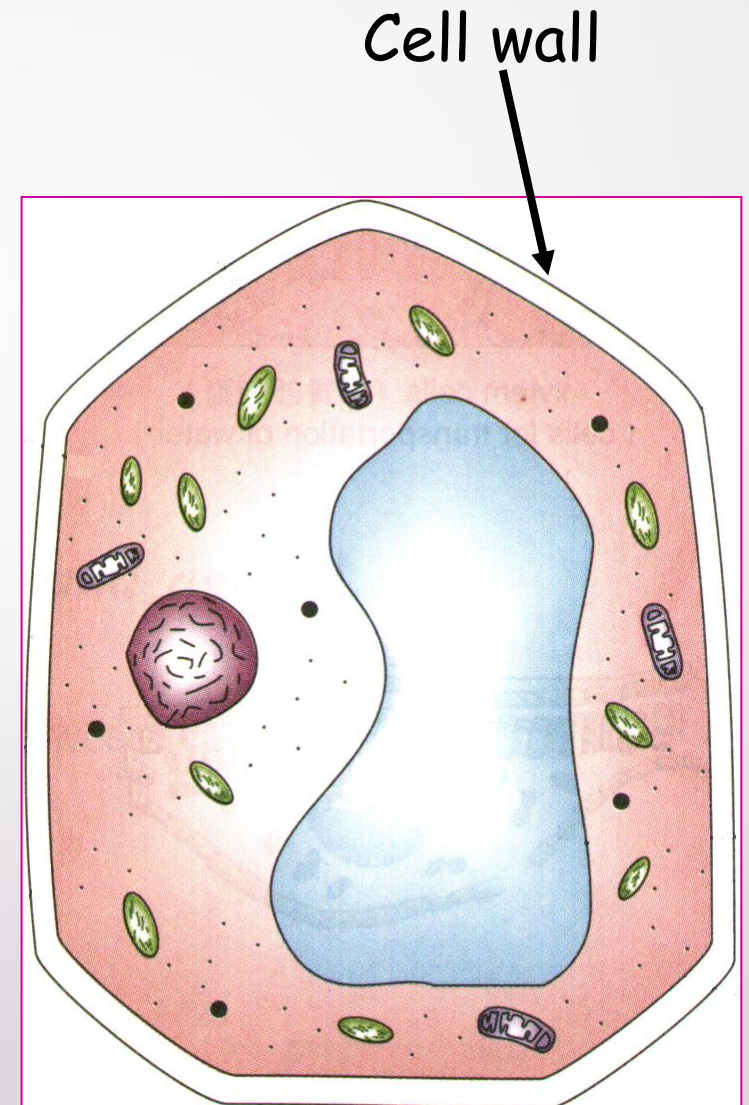
Cell Membrane

- Maintains cell **shape**
- Separates and helps **protect** cell from its environment
- Controls movement of important **nutrients and wastes** (e.g. sugar, oxygen, carbon dioxide) into and out of the cell



Cell Wall

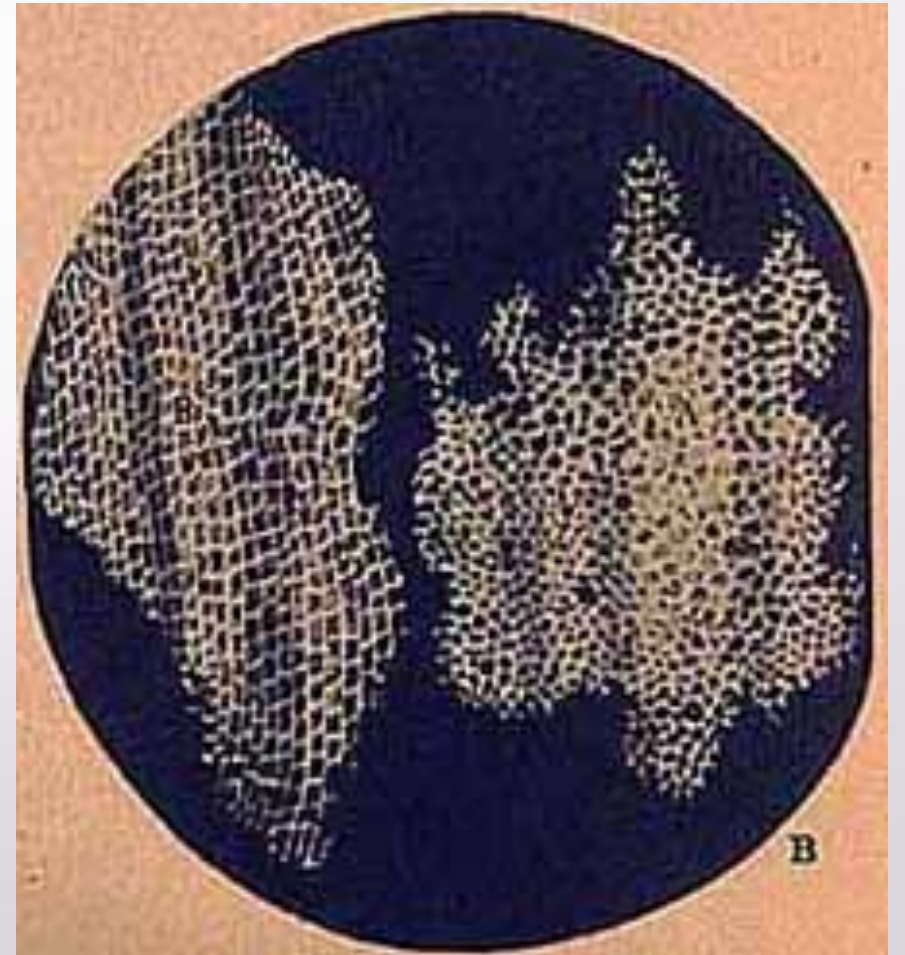
- In **plants**, fungi, some bacteria (prokaryotes)
- Found **outside cell membrane**
- **Supports** and **protects** cell
 - Is strong and long-lasting! Sometimes remains behind even after cell has died.



Cell Wall

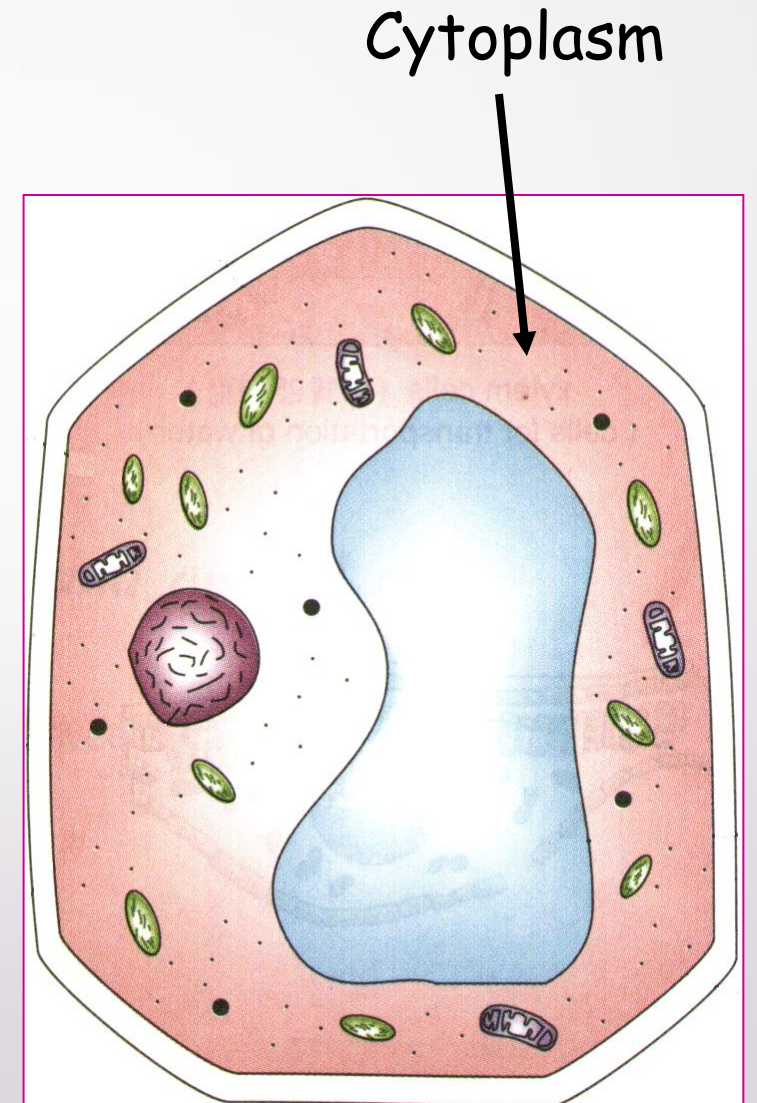
Connection to Past Learning:

Robert Hooke's tree samples were not cells at all, but the remaining **cell walls** from long-dead tree cells

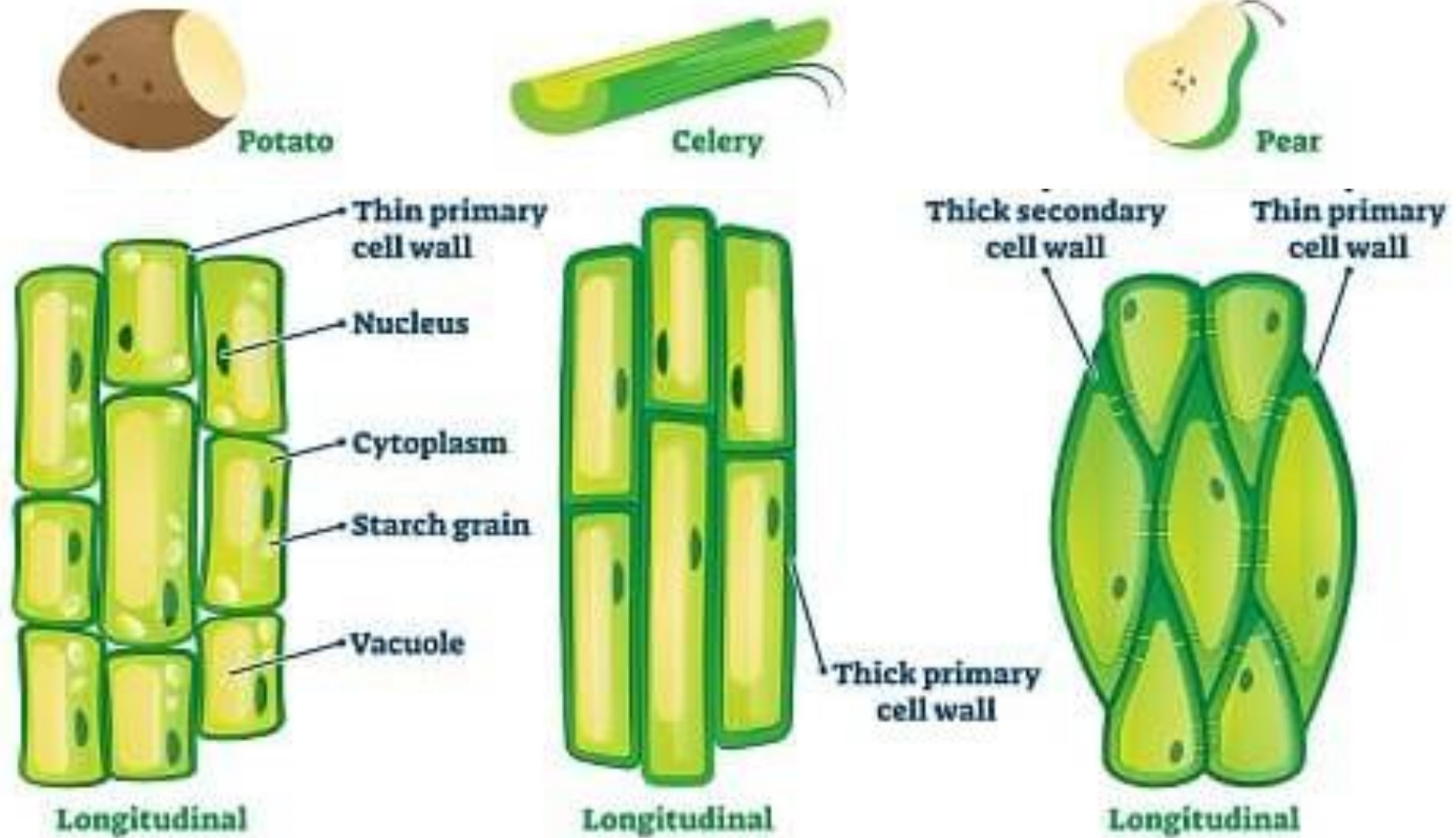


Cytoplasm

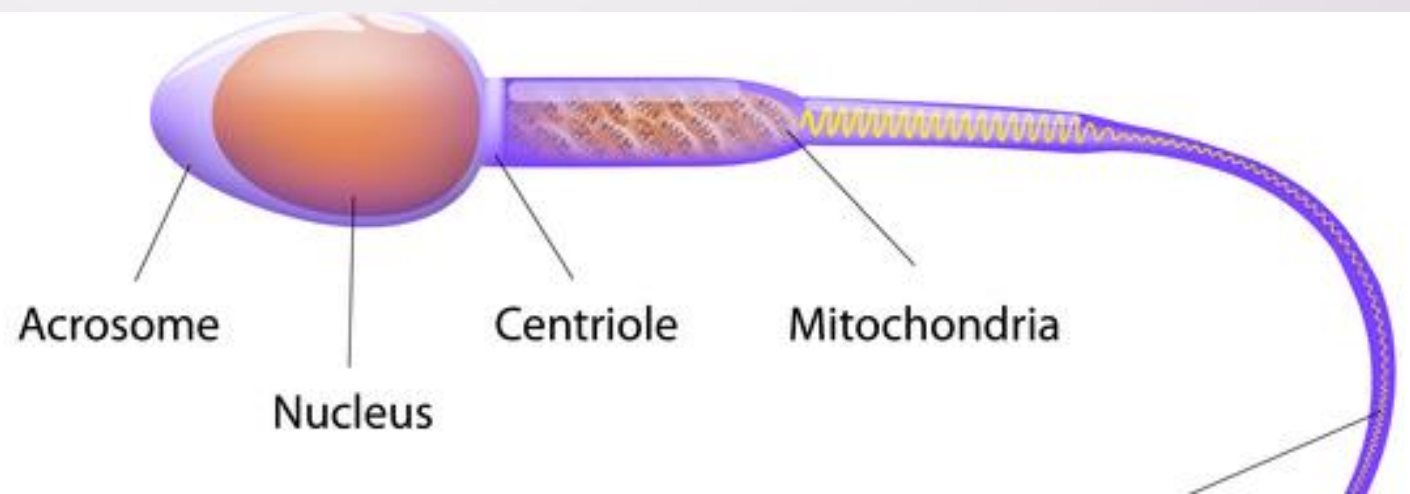
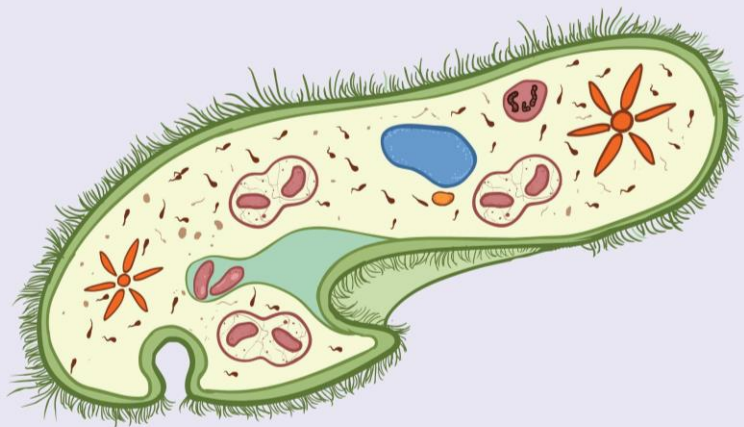
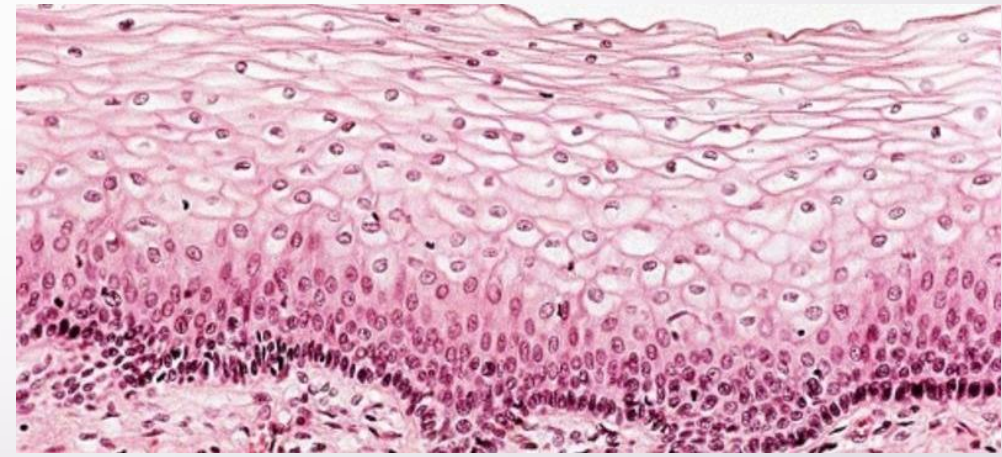
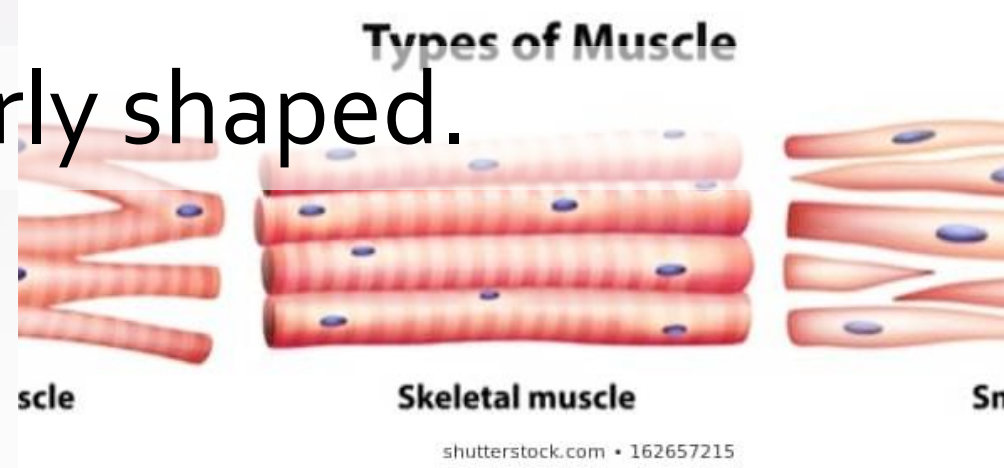
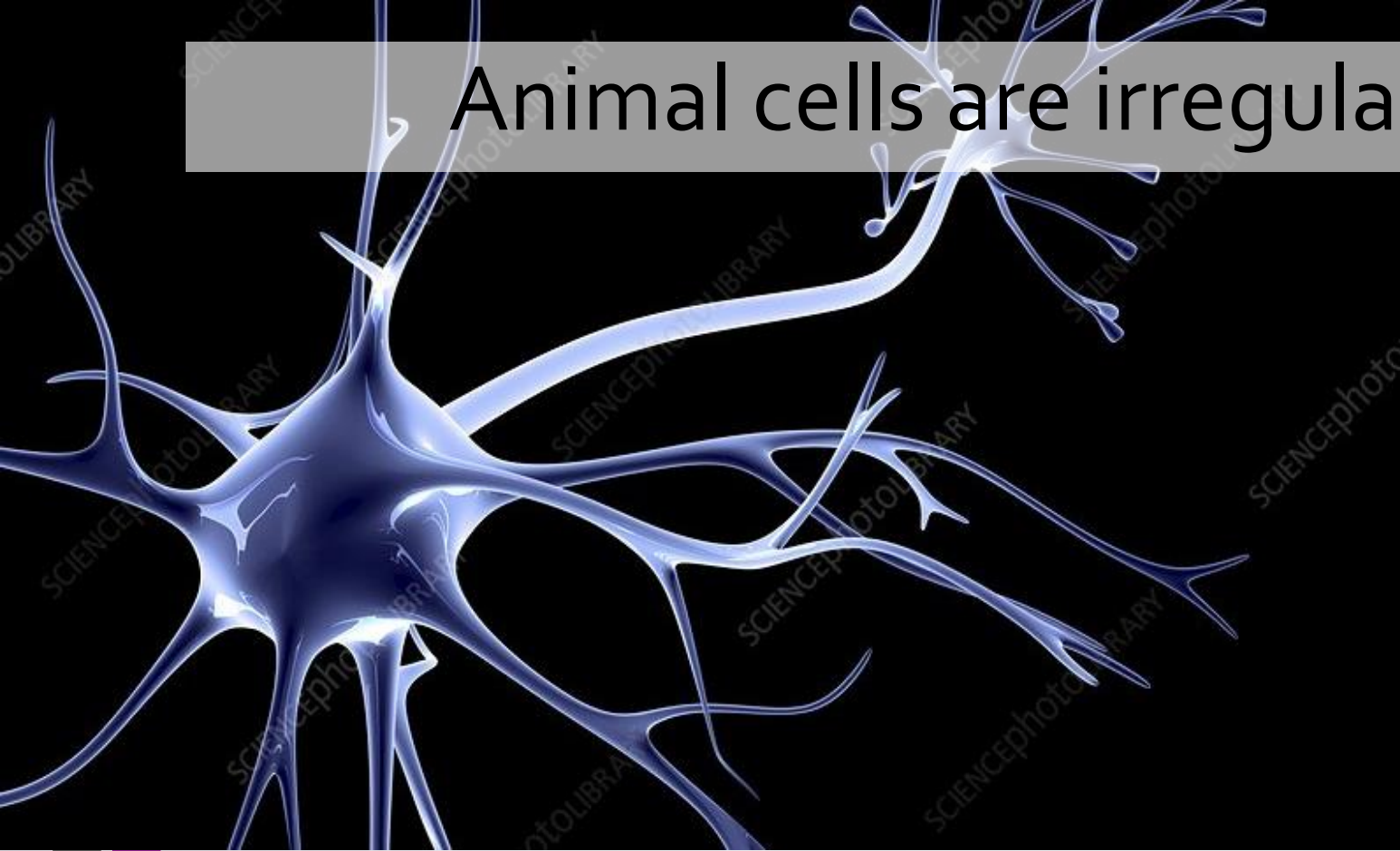
- **Jelly-like** substance (80% water)
- Makes up most space inside cell; has **organelles** inside
- Surrounded by **cell membrane**
- Maintains **cell shape**



Plant cells are regularly shaped (limited by cell wall).

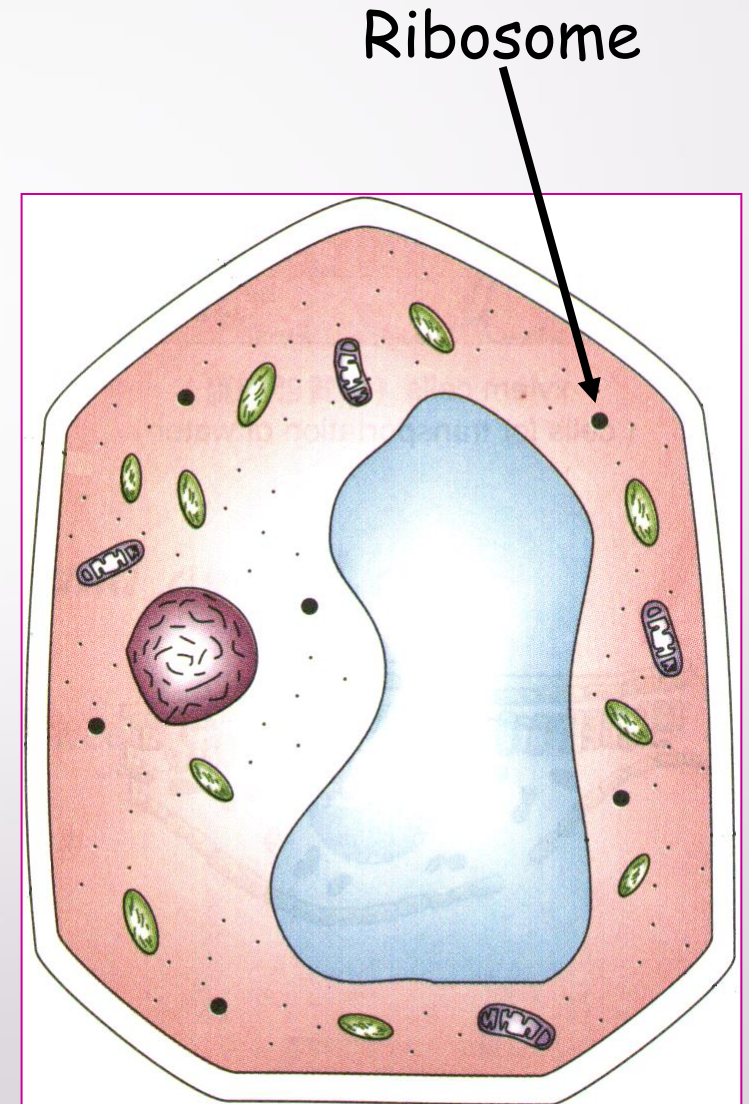


Animal cells are irregularly shaped.



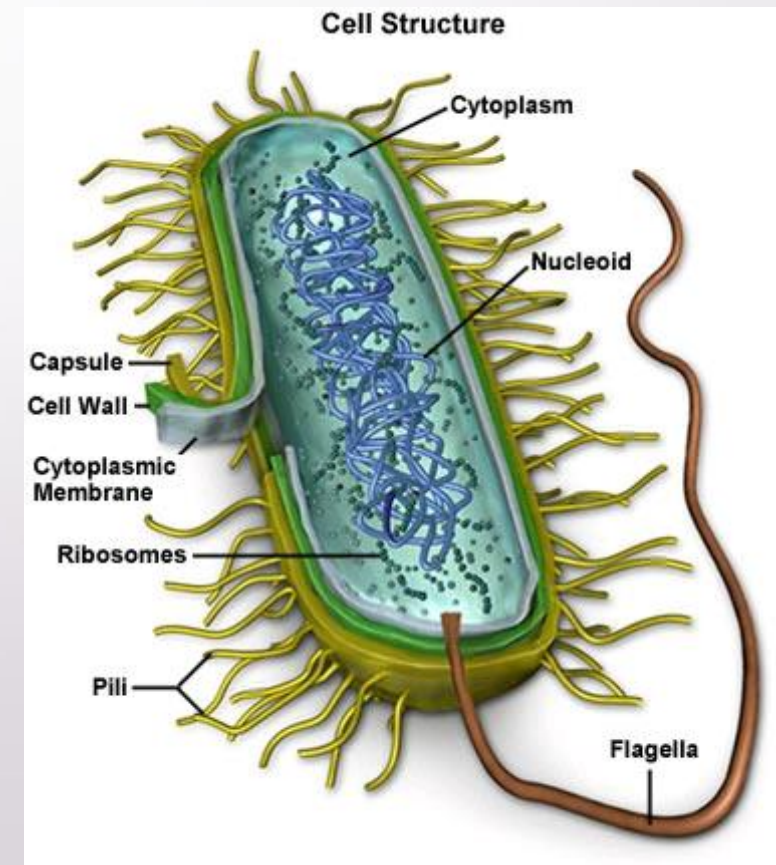
Ribosome

- Very small, usually dark-coloured
- Found in all cells (prokaryotes and eukaryotes)
- Makes proteins
 - Cells use proteins for *everything!* Growth, structure, taking in nutrients, getting rid of wastes...you name it!



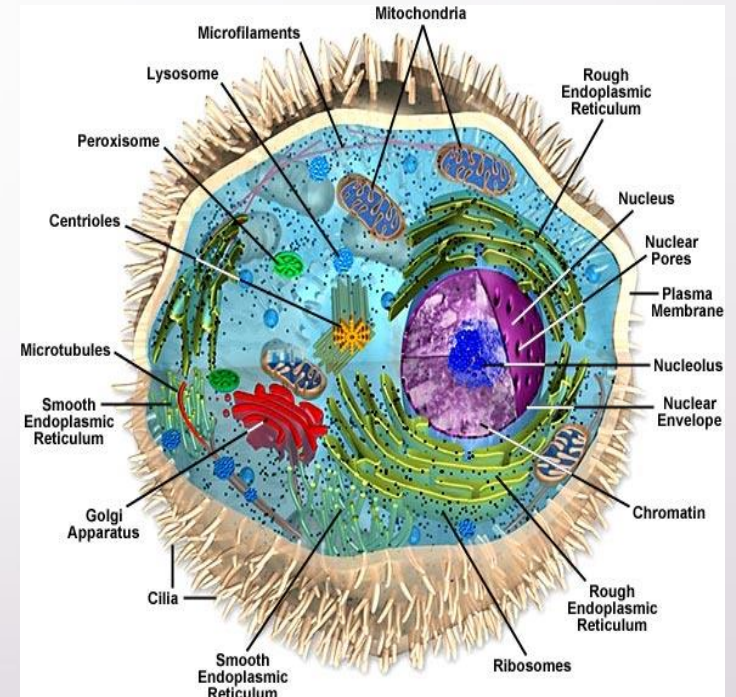
Prokaryotes: The First Cells

- Are **unicellular** organisms
- **Bacteria** are prokaryotes
- Simplest, smallest type of cell
- Have **cell membrane, cytoplasm, ribosomes**. Can have cell wall.



Eukaryotes: More Complex Cells

- Can be **unicellular** or **multicellular** organisms
- Includes **amoeba**, **plants**, **animals**, **fungi**
- Complex, larger cells (approx. 10x larger than prokaryotic cells)
- Have membrane-bound organelles (nucleus, ER, mitochondria, vacuole, sometimes chloroplast)

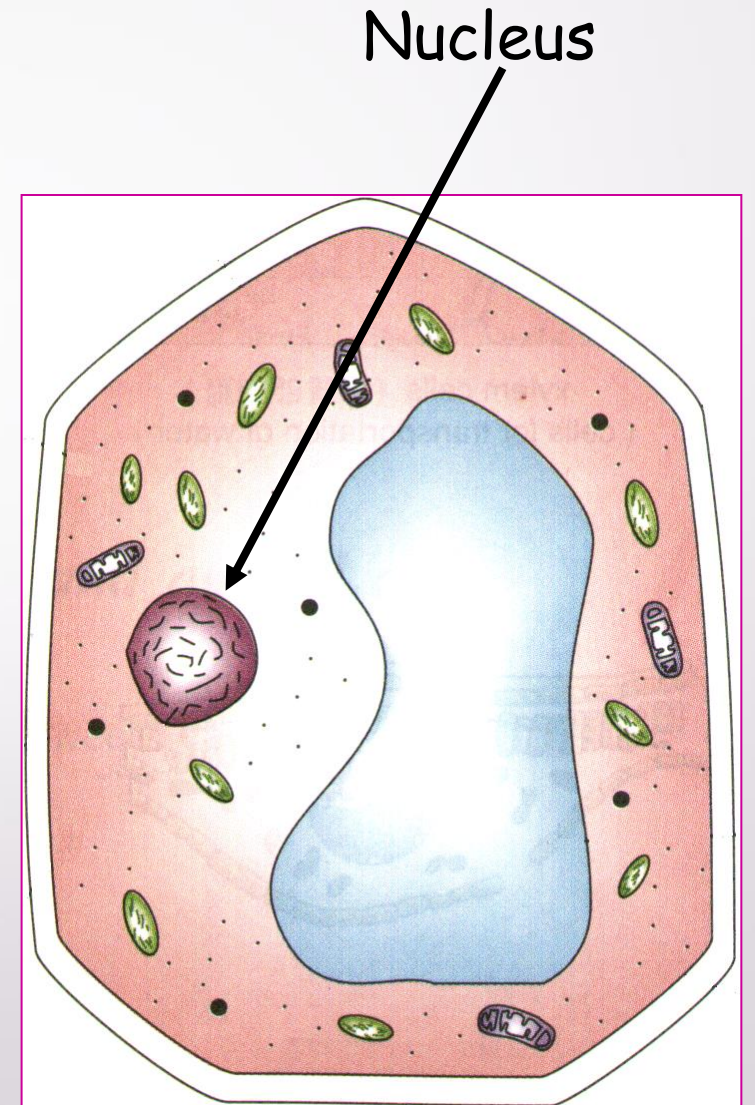


Prokaryotes vs Eukaryotes

	Prokaryotes	Eukaryotes
Cell membrane		
Cell wall		
Cytoplasm		
Ribosomes		
Nucleus		
Membrane-bound organelles (e.g. nucleus, mitochondria, chloroplasts, vacuoles, endoplasmic reticulum, lysosomes)		

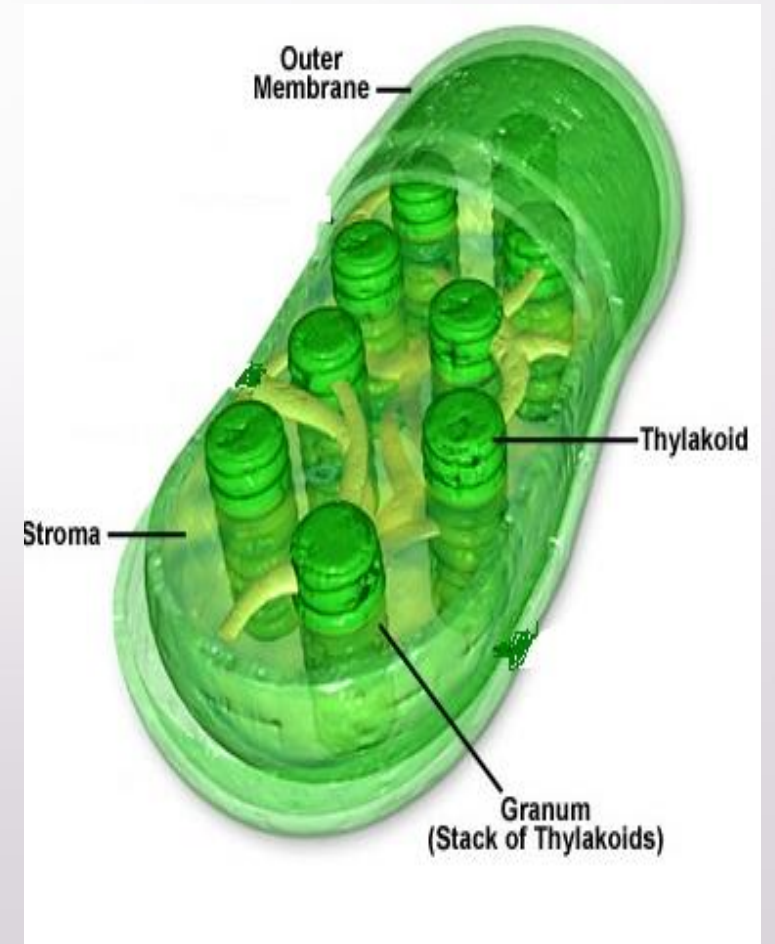
Nucleus

- Controls the cell's activities
- Contains **genetic material (DNA)**
- Surrounded by nuclear membrane
- In all **eukaryotic** cells
 - "eu-" = true; "karyon" = nucleus

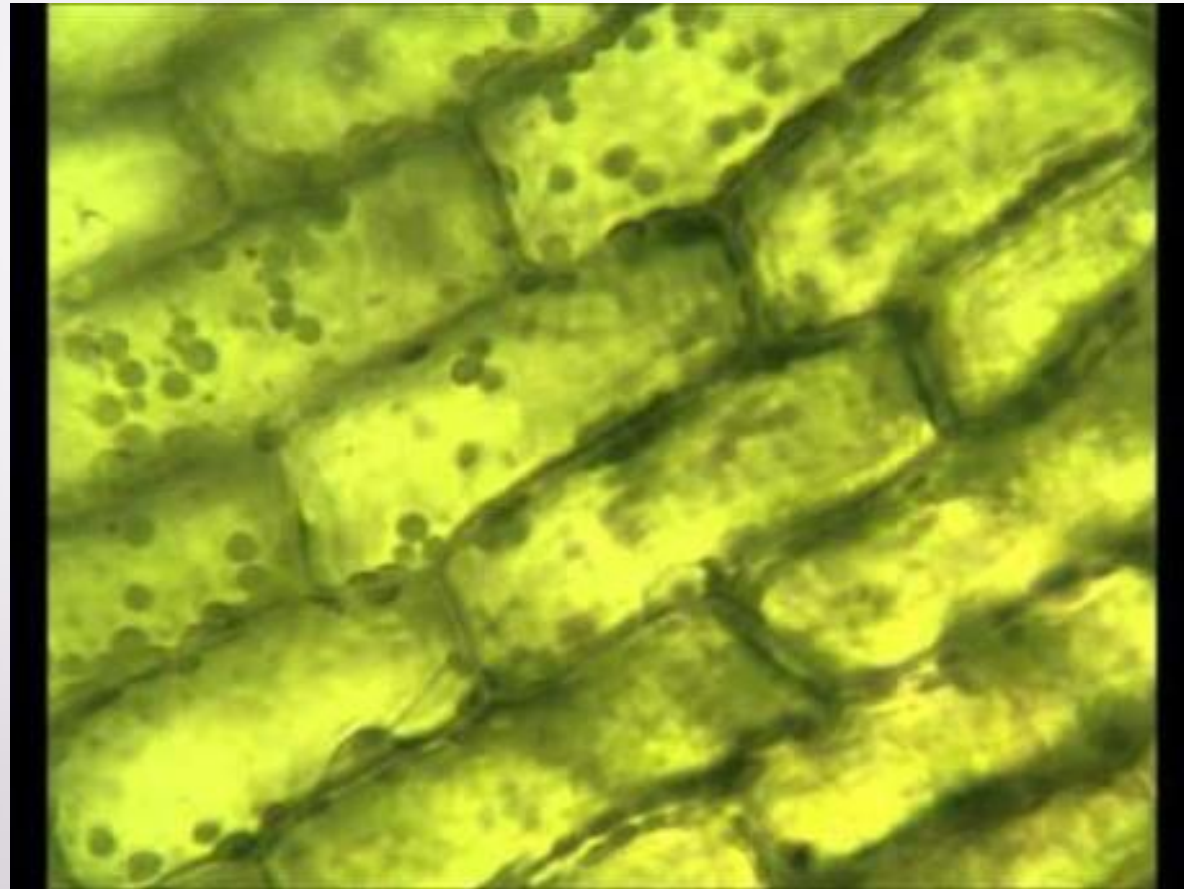


Chloroplasts

- Found only in **producers** (living things that make their own food, e.g. plants)
- Site of **photosynthesis**: converts solar energy to sugar



Chloroplasts



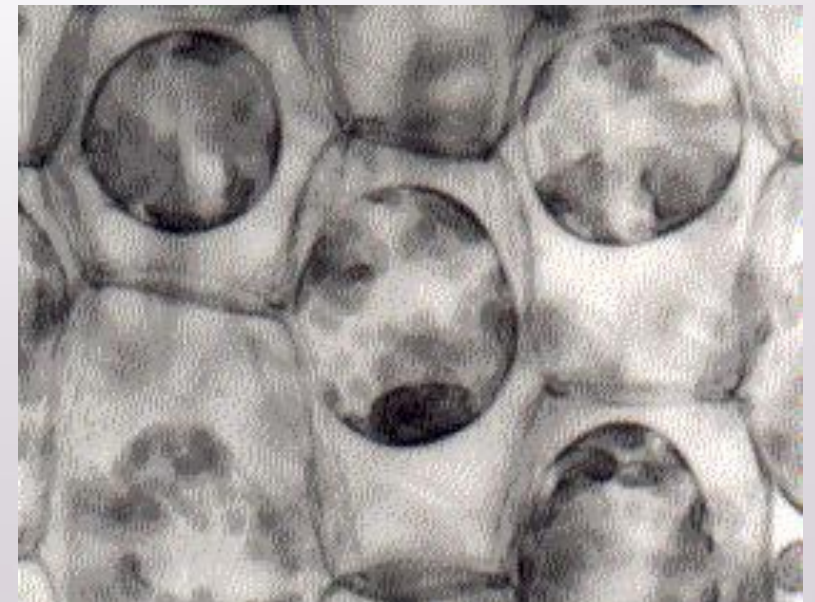
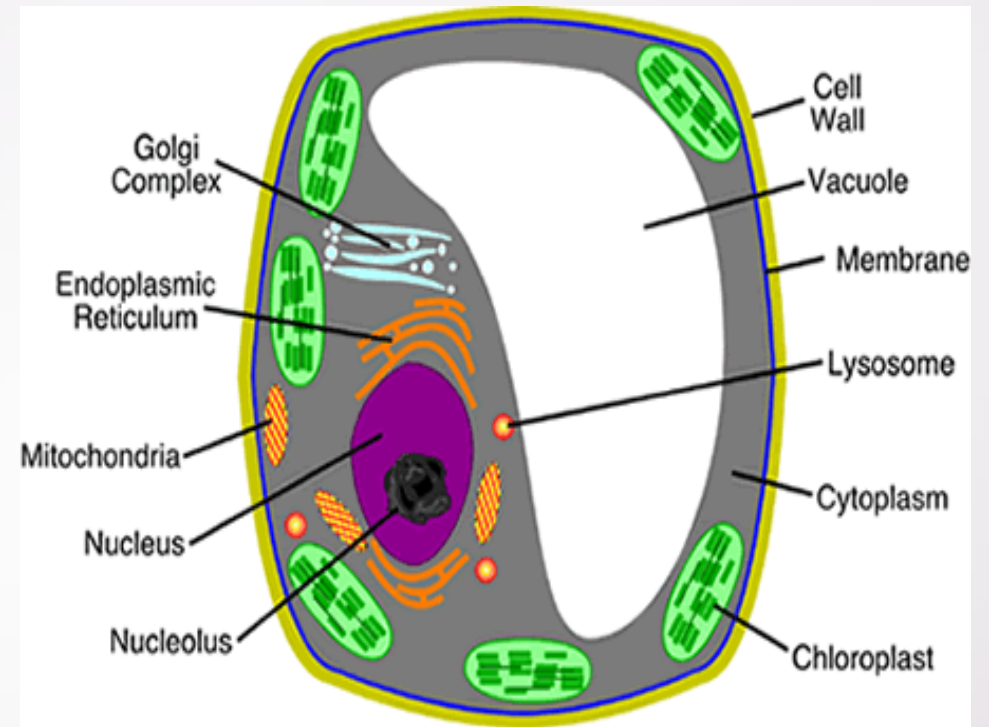
Mitochondrion (pl. mitochondria)

- “Powerhouse of the cell”
- Is the site of **cellular respiration**: converts sugar to useable ATP energy
- In all eukaryotic cells



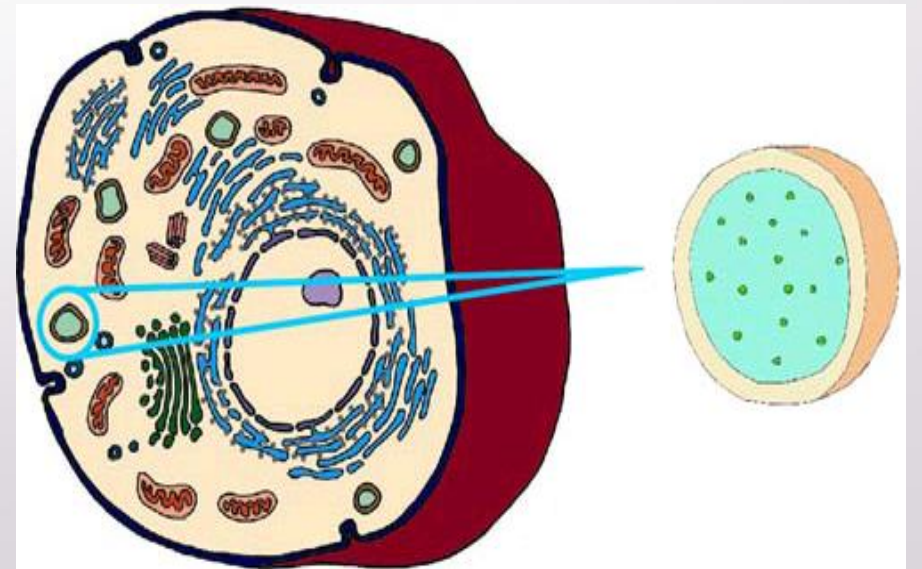
Vacuole

- Fluid-filled sac for storage
 - Water, sugar, proteins, minerals, lipids, wastes, enzymes
- Plants have a large central vacuole (and smaller ones)
- Animals have many small vacuoles



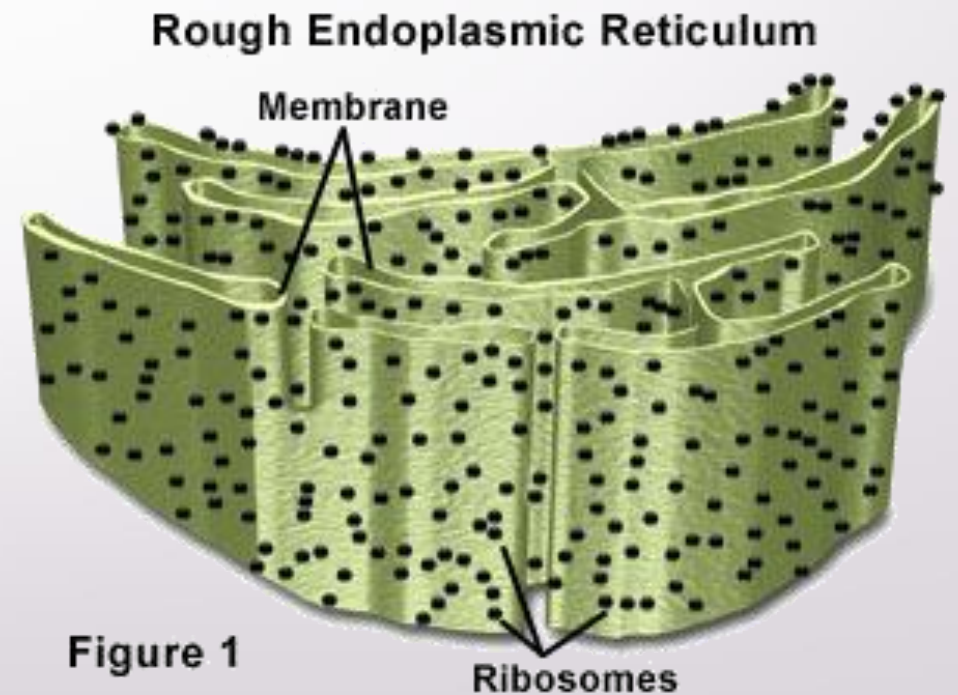
Lysosomes


- **Digest food** (to get nutrients)
- **Destroys wastes** and invaders such as bacteria and viruses
- **Breaks down and recycles** worn out cell parts
- In all eukaryotic cells*



Endoplasmic Reticulum (ER)

- Network of hollow membrane tubes
- **Transports** materials around the cell
- ER often has **ribosomes attached** (to transport proteins after they are made)
- In all eukaryotic cells





me: what are taxes and how do
I pay them?

school system: worry not

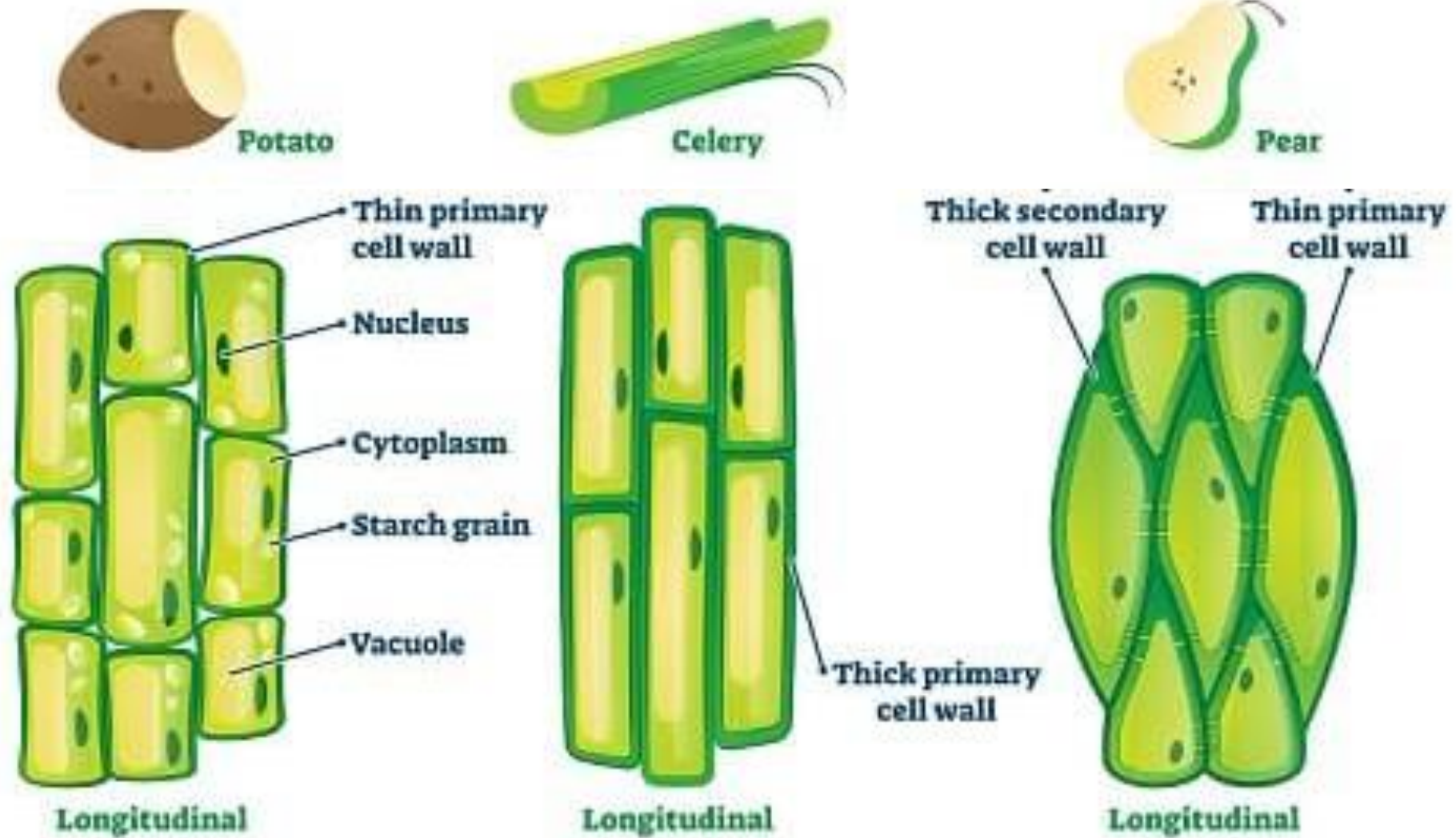
school system: mitochondria
is the powerhouse of the cell

featured on [iFunny.com](https://www.ifunny.com)

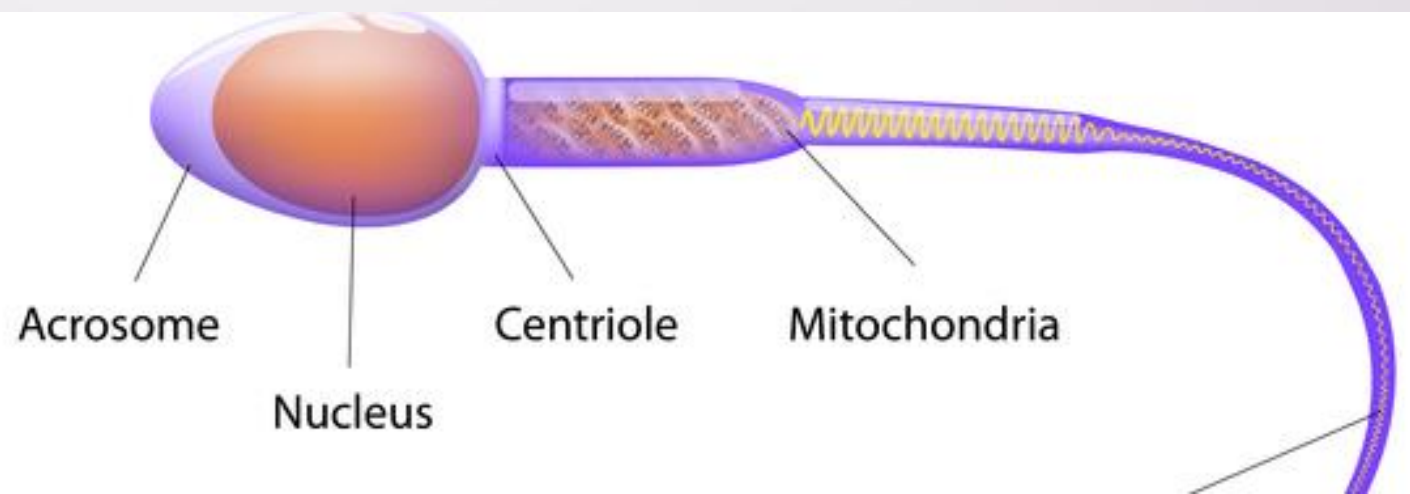
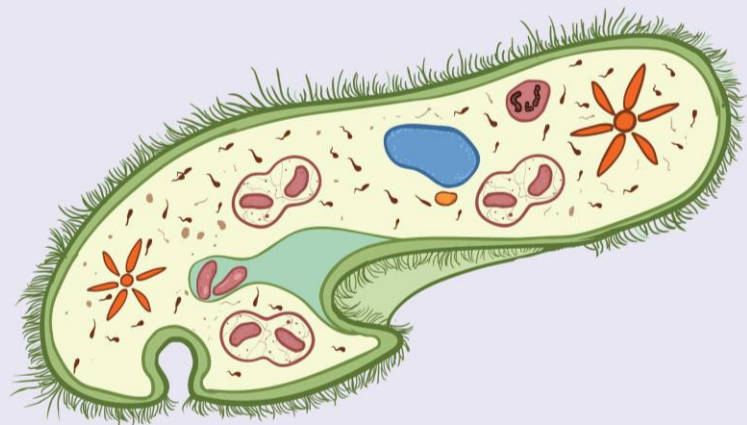
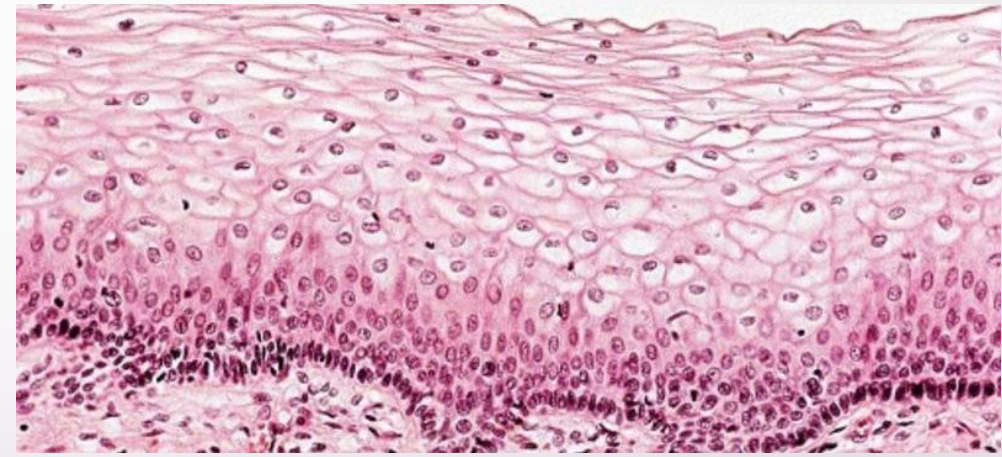
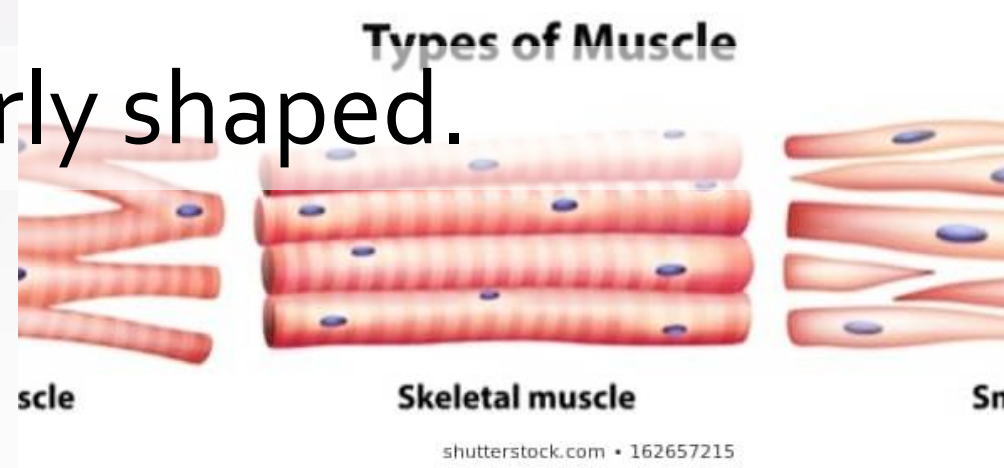
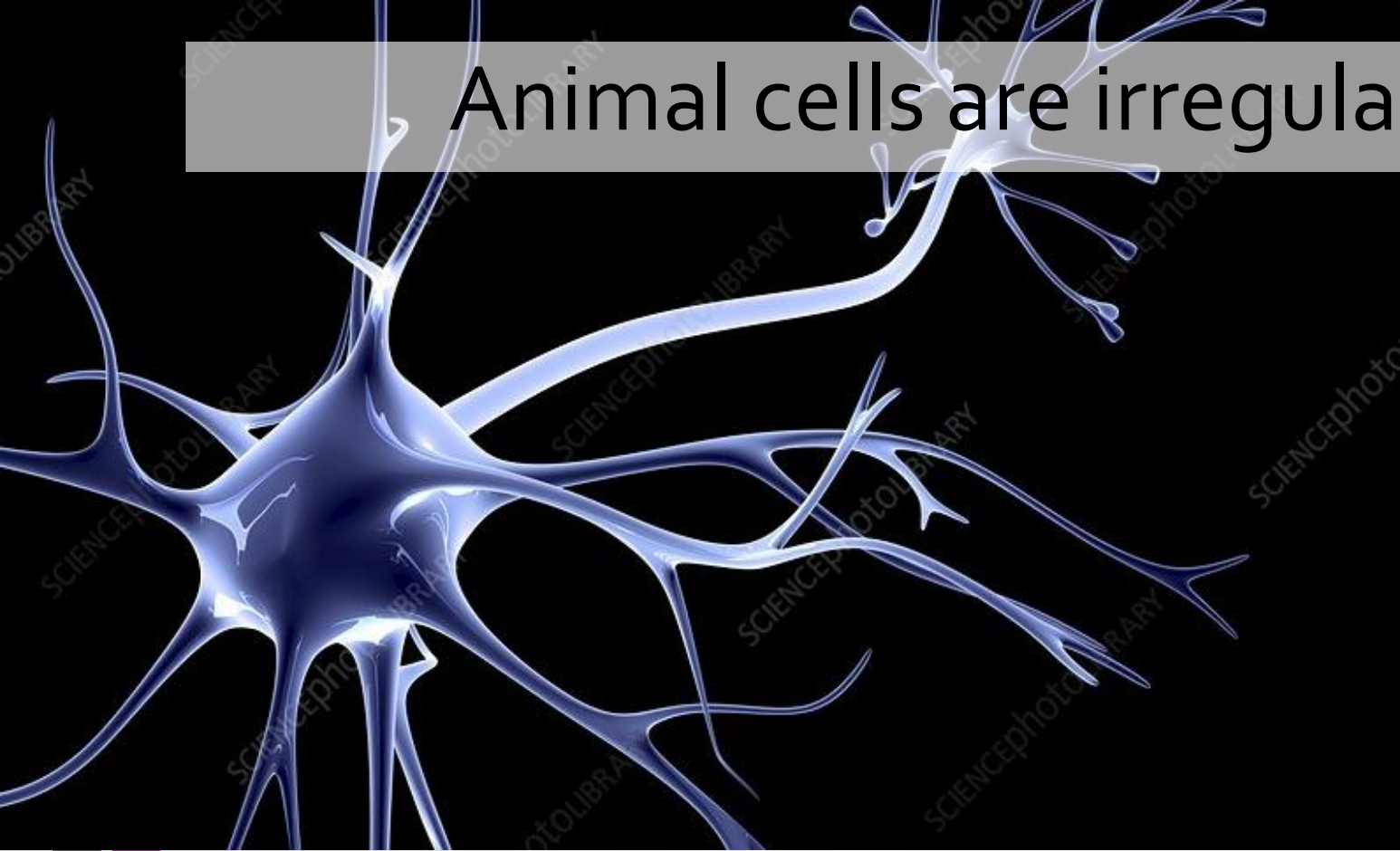
Plants vs Animal Cells

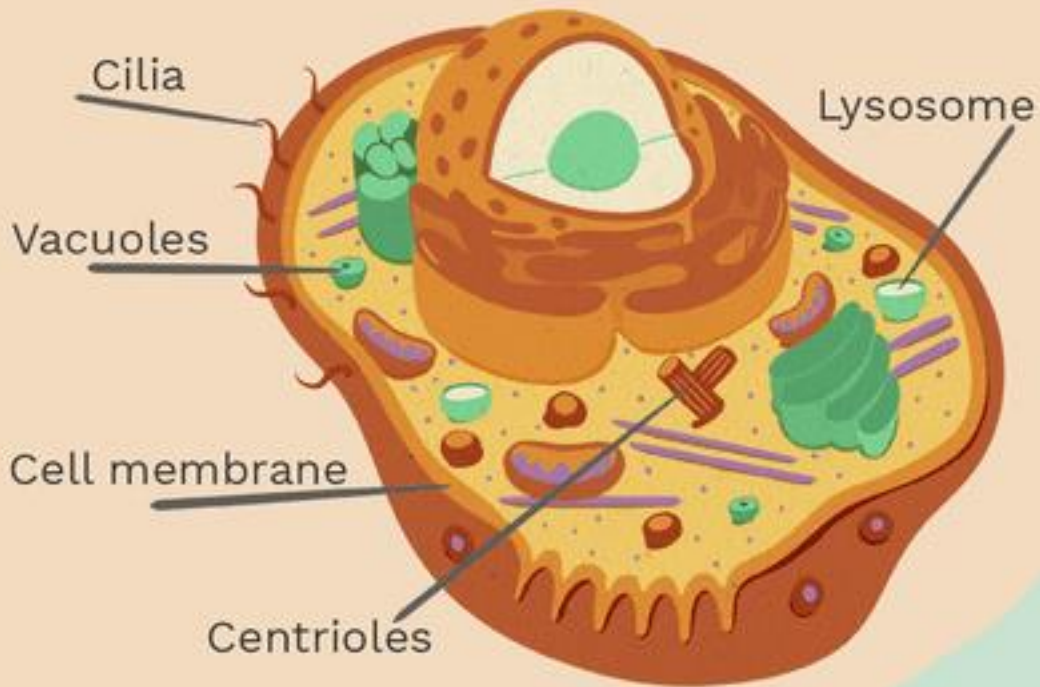
- Make a venn diagram to compare plant and animal cells. Use your notes to help you.

Plant cells are regularly shaped (limited by cell wall).



Animal cells are irregularly shaped.



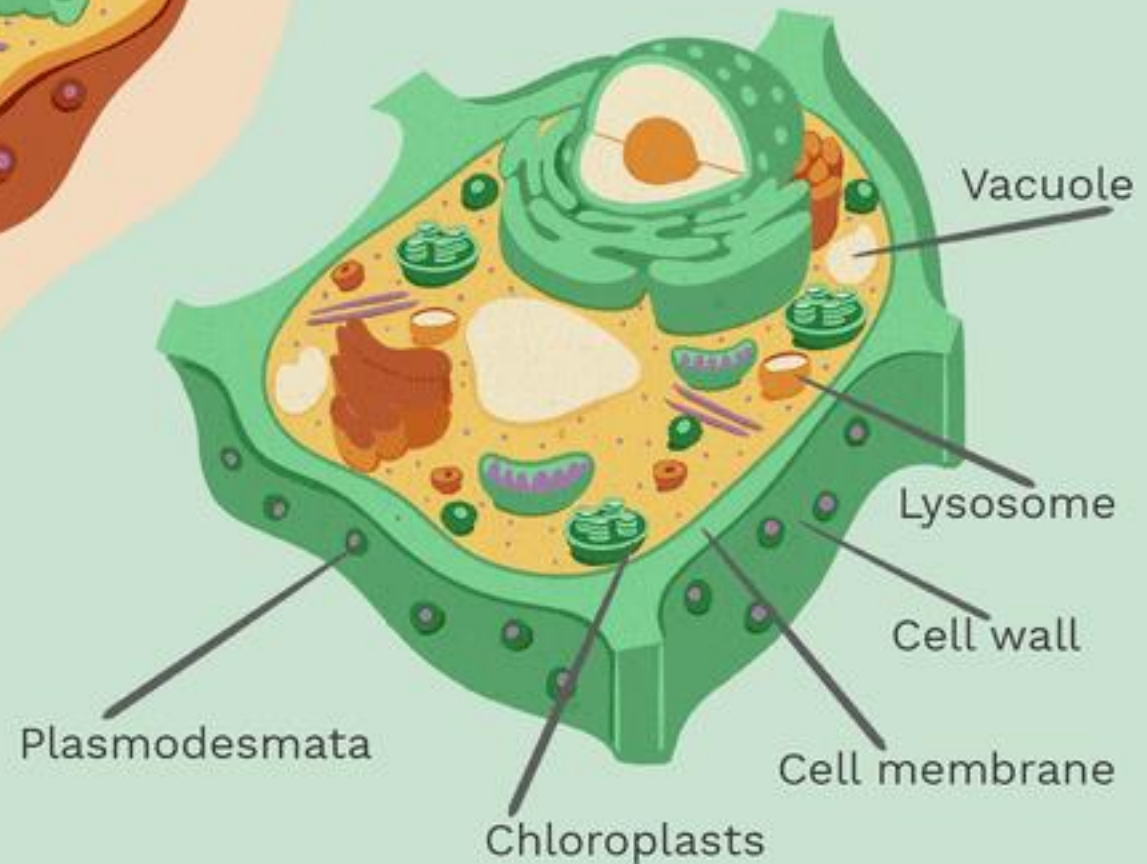


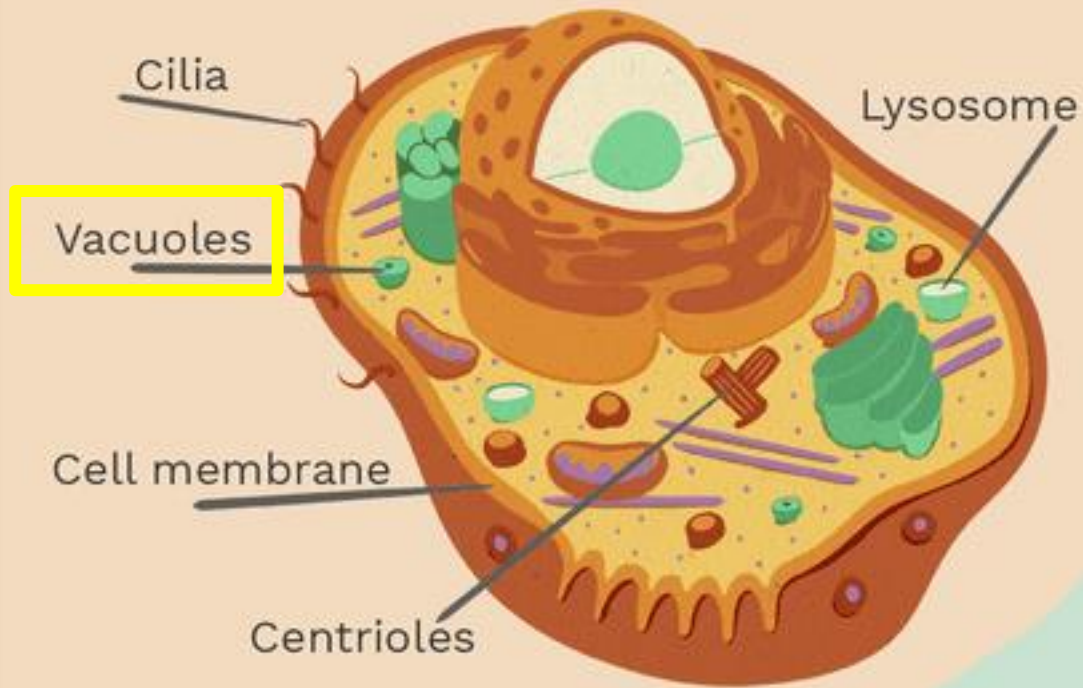
Animal Cell

- 10-30 micrometers in length
- Typically round or irregular in shape

Plant Cell

- 10-100 micrometers in length
- Typically rectangular or cubic in shape



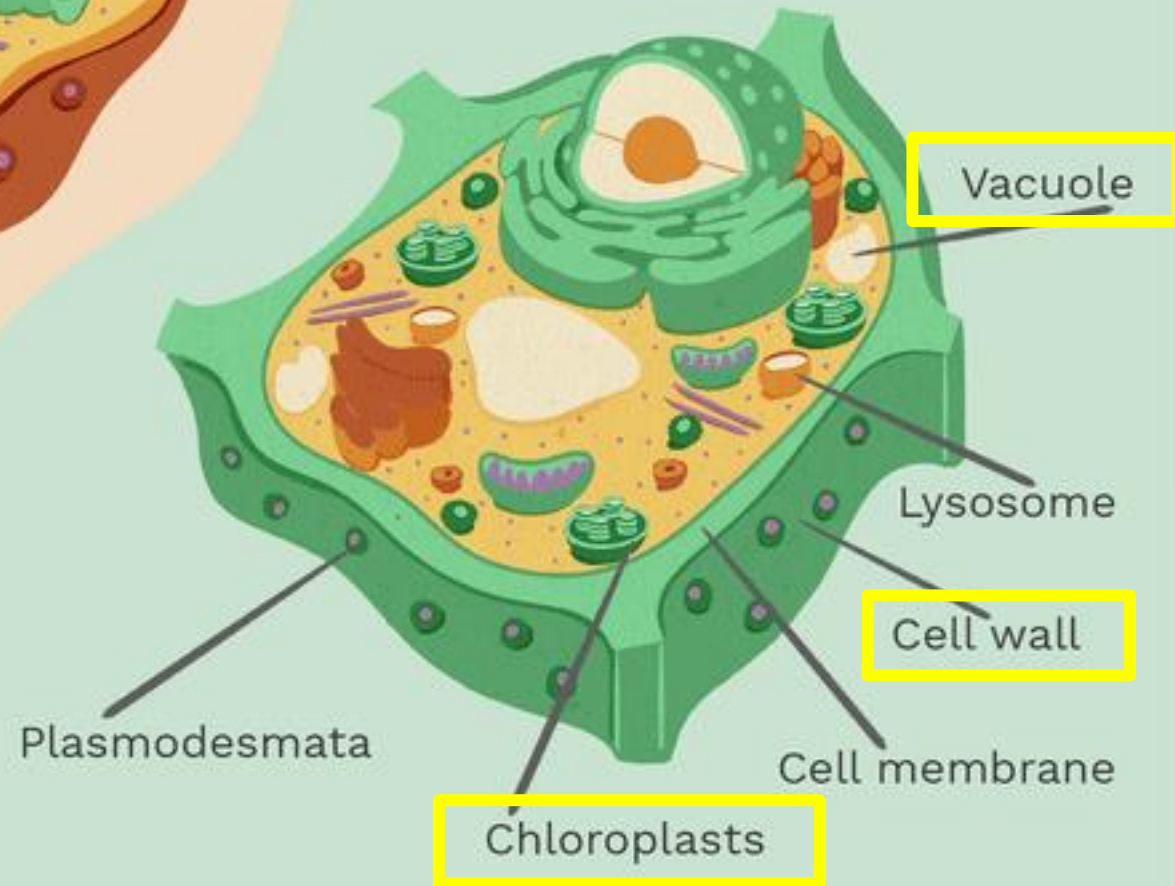


Animal Cell

- 10-30 micrometers in length
- Typically round or irregular in shape

Plant Cell

- 10-100 micrometers in length
- Typically rectangular or cubic in shape



Plant vs Animal Cells

Plant Cells

- Cell wall
- Have chloroplasts (photosynthesis)
- Usually one large vacuole + multiple smaller ones
- Regularly shaped

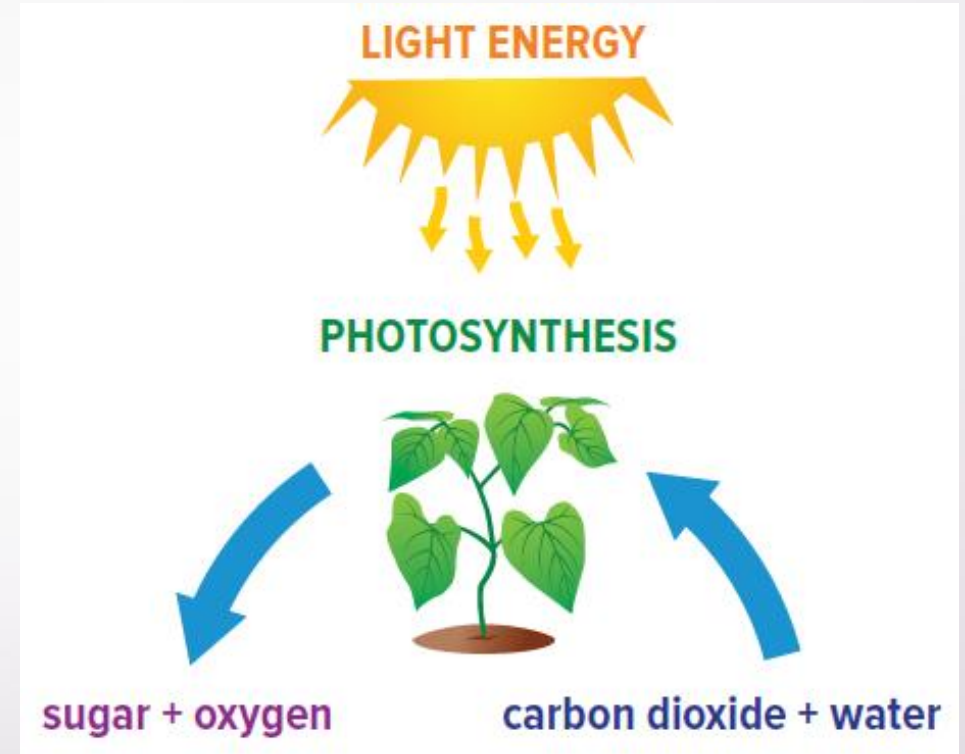
- Eukaryotic cells
- Cytoplasm
- Cell membrane
- Nucleus
- Ribosomes
- Endoplasmic Reticulum
- Vacuole(s)
- Mitochondria (cellular respiration)

Animal Cells

- No cell wall
- No chloroplasts
- Many small vacuoles
- Round or irregularly shaped

Photosynthesis

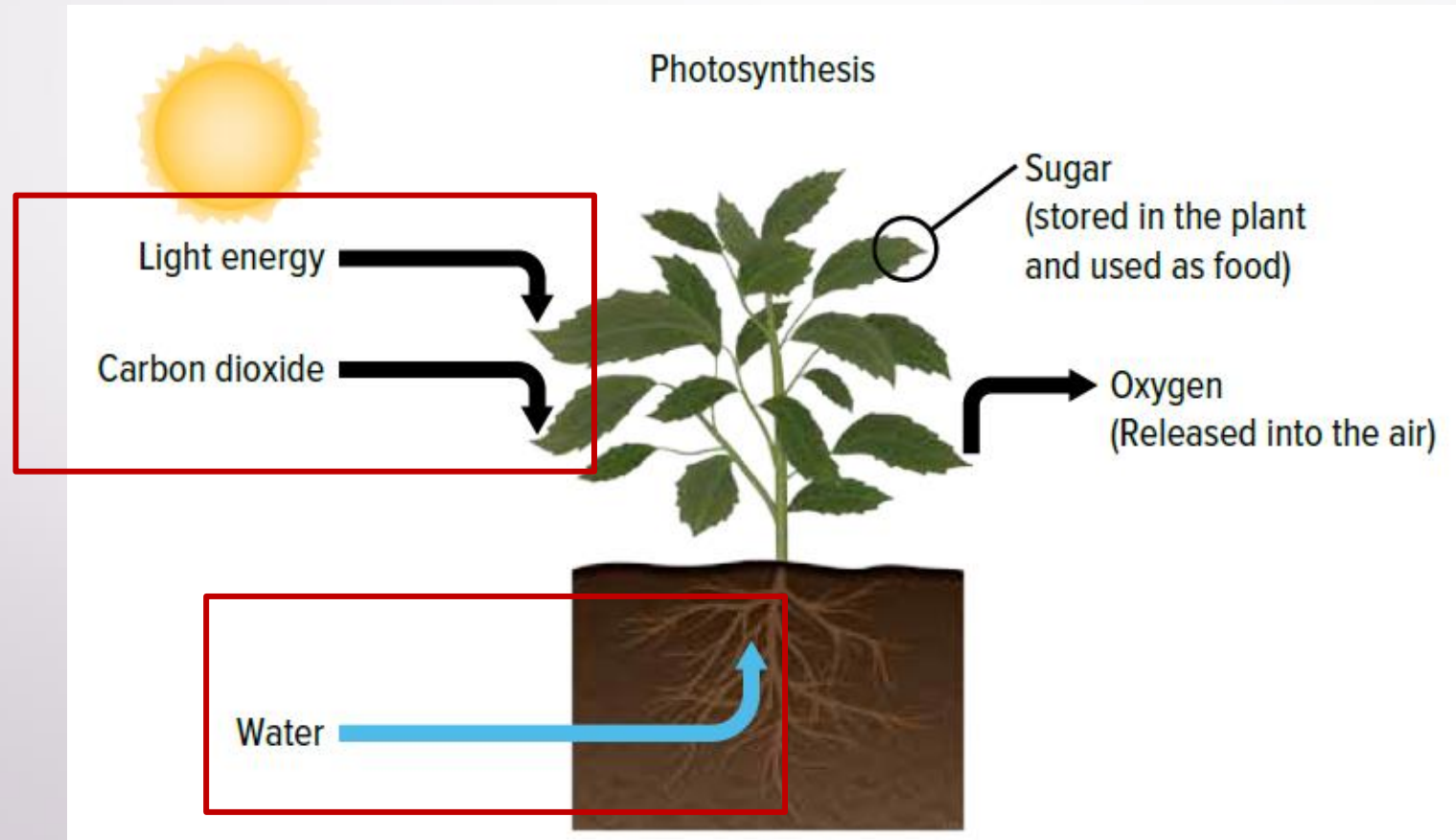
- *Photo* = light;
synthesis = making something
- Occurs in **chloroplasts**
- A chemical reaction in plant cells that converts the **Sun's light energy** into **chemical energy (sugar)** that organisms can use



- Carbon dioxide + water + light energy → sugar + oxygen

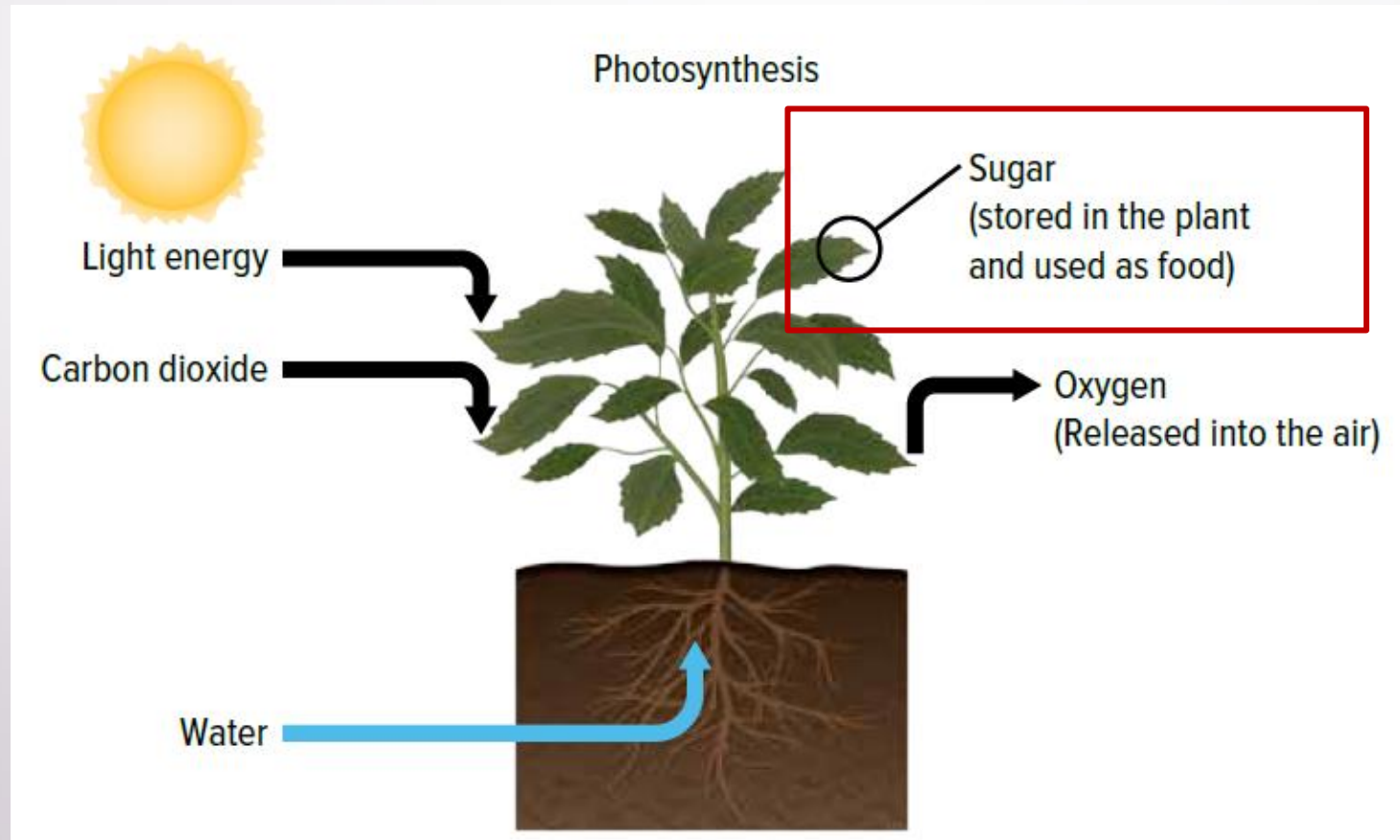
Photosynthesis

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



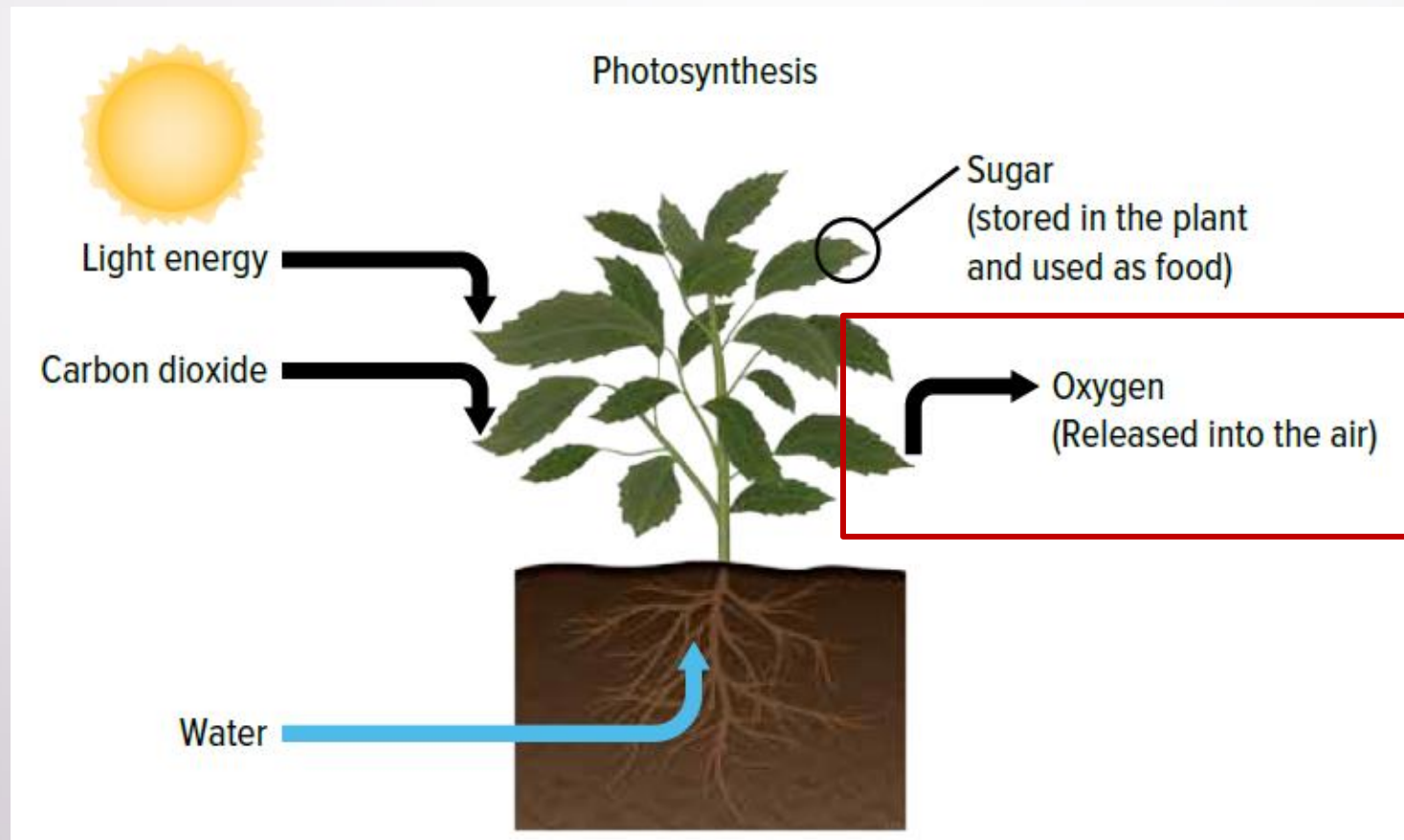
Photosynthesis

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



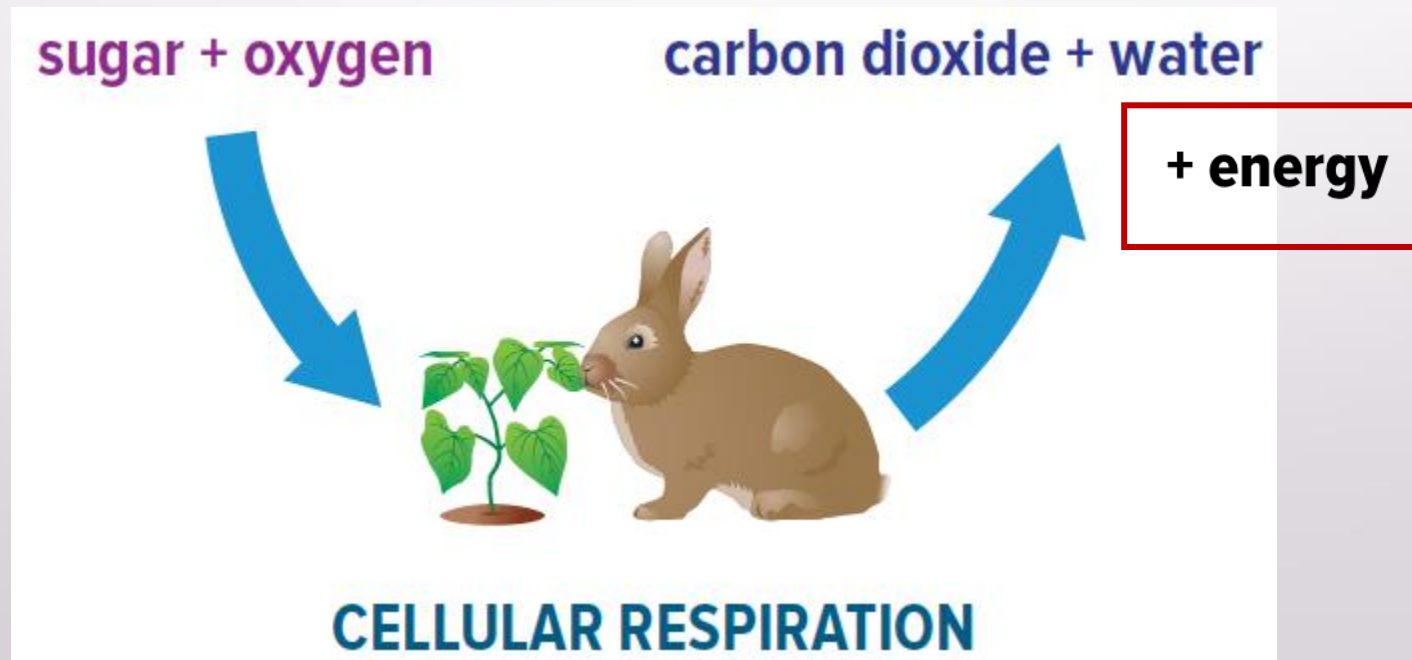
Photosynthesis

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



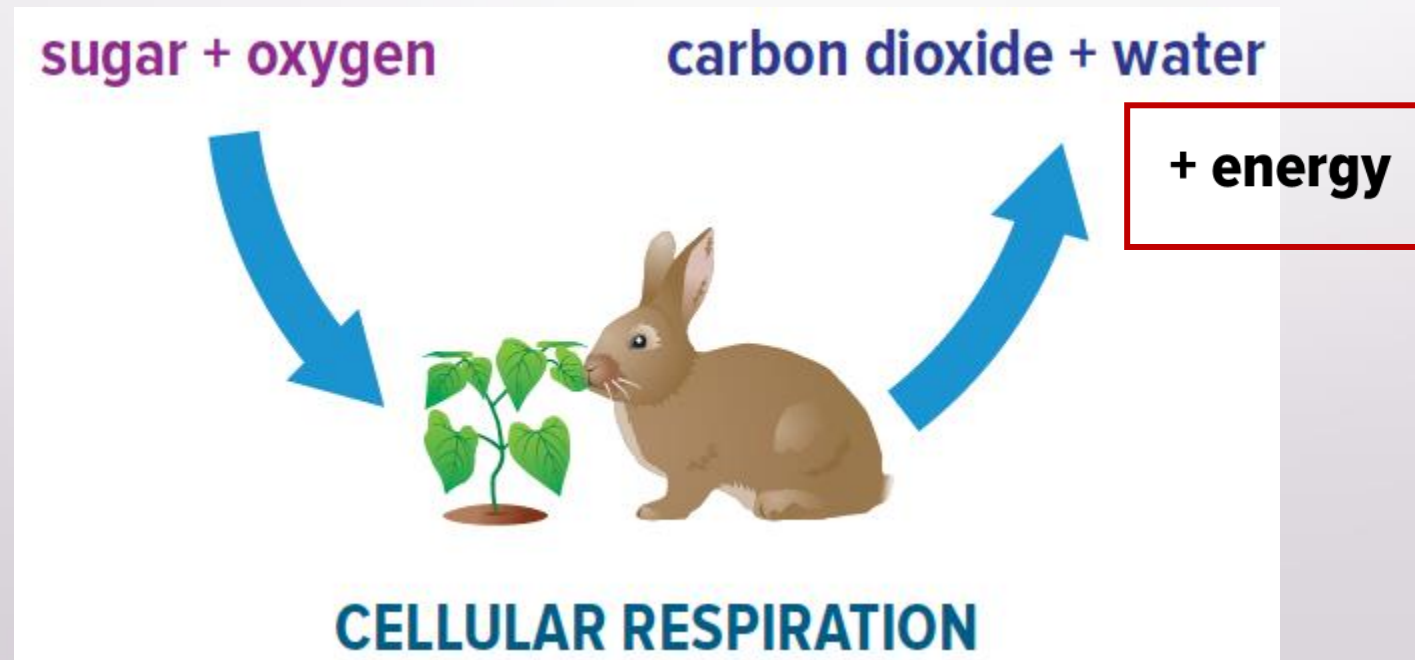
Cellular Respiration

- Occurs in **mitochondria**
- A chemical reaction in the cells of **all eukaryotes** that release the energy needed to carry out life processes



Cellular Respiration

- Sugar + oxygen \rightarrow carbon dioxide + water + energy
- Sugar and oxygen are converted into carbon dioxide and water (waste products)
- Energy is released (used to power cell processes)



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

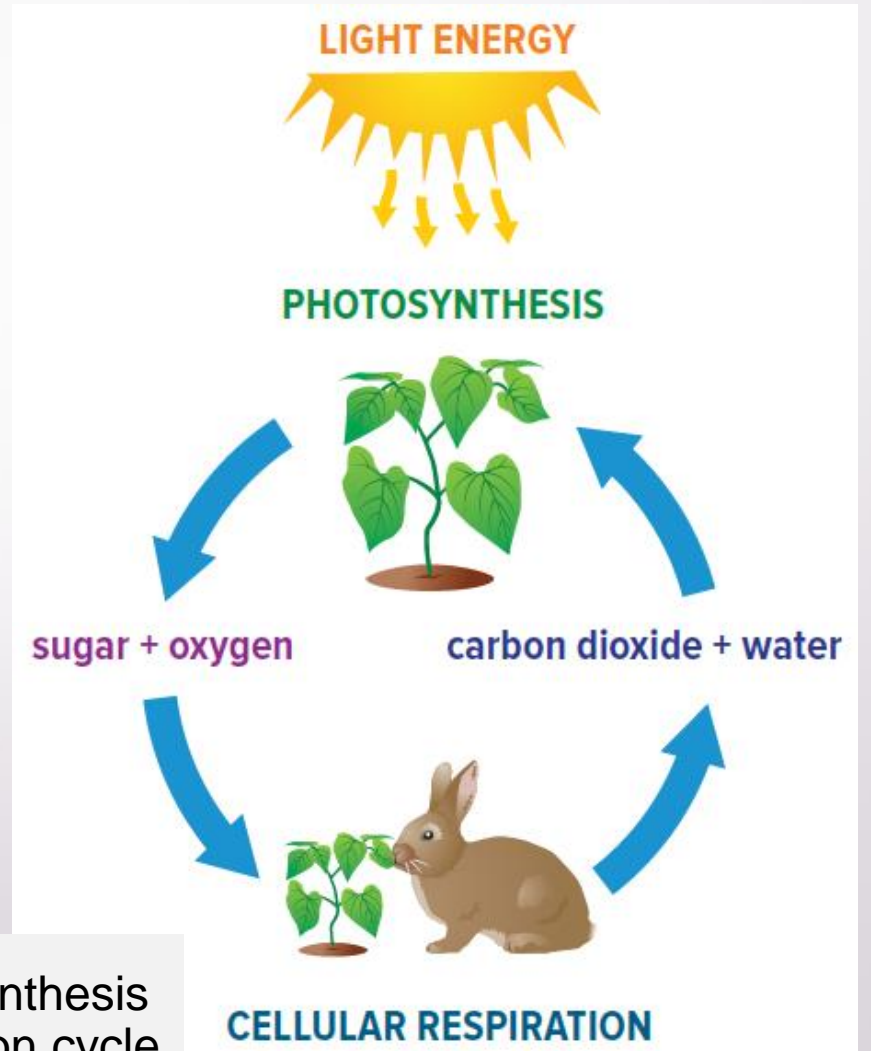
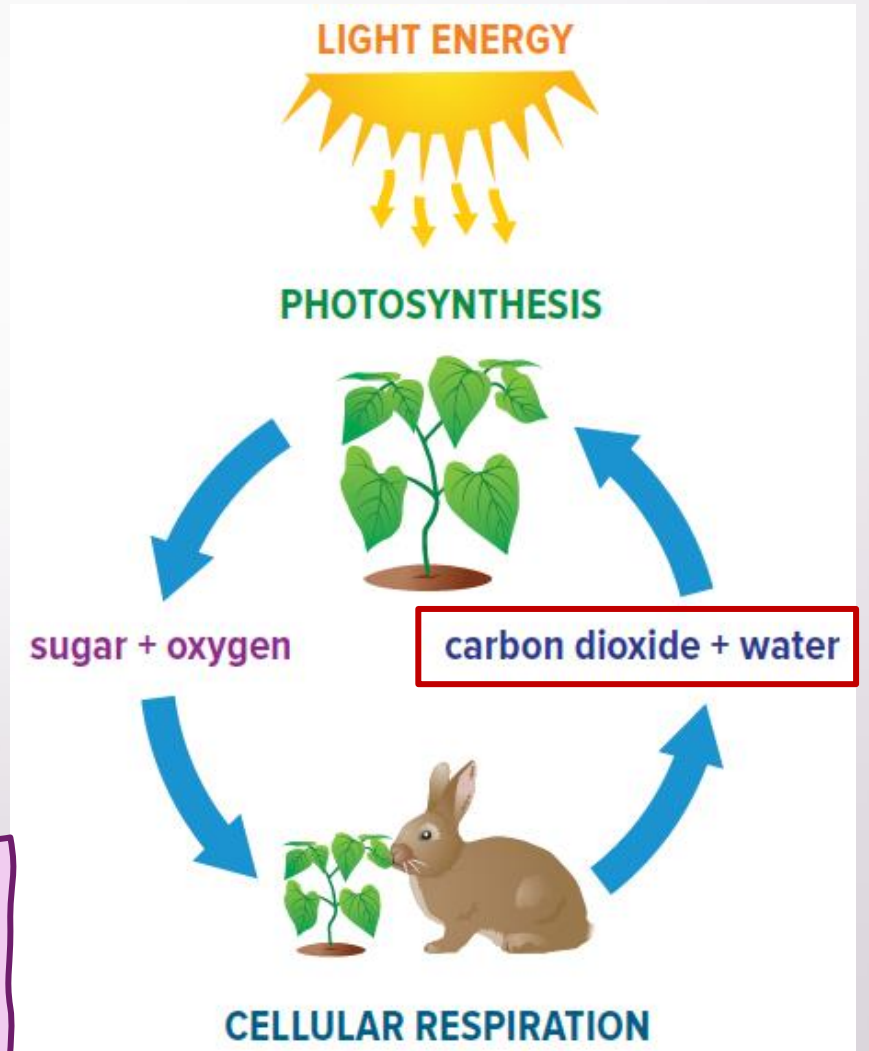


Figure 1.14: Photosynthesis and cellular respiration cycle

Photosynthesis and Cellular Respiration

Producers (e.g. plants, algae):

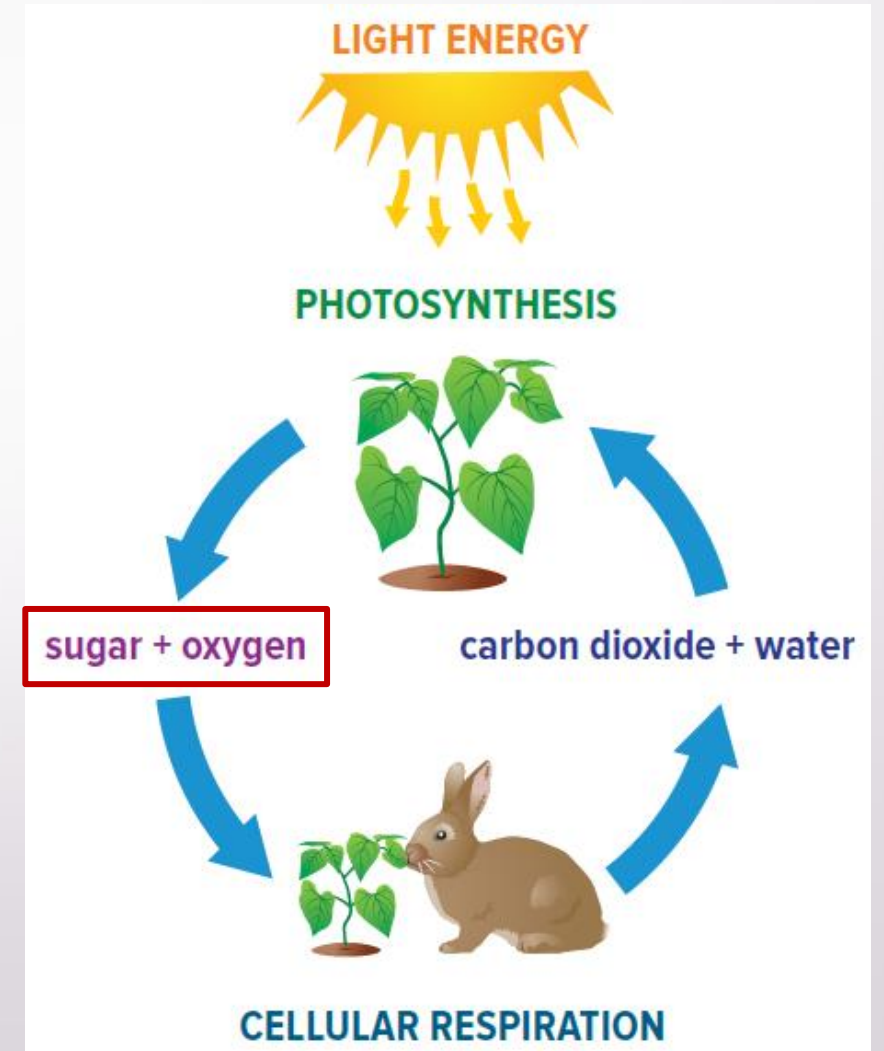
- Use the carbon dioxide and water produced by cellular respiration as part of photosynthesis



Fun fact: Plants evolved first, releasing oxygen into the atmosphere. Cellular respiration evolved after that, to use the oxygen.

Photosynthesis and Cellular Respiration

- All living things use the sugar and oxygen produced by photosynthesis as part of cellular respiration
- Obtaining sugar and oxygen:
 - Plants do photosynthesis
 - Animals consume other plants or animals, and breathe in oxygen



Cells

Cell Theory:

1. The cell is the basic unit of life.
2. All living things are made of cells.
3. Cells come from pre-existing cells.

7 characteristics of living things
(all living things made of cells; use nutrients; use energy; make wastes; respond to stimuli; grow; reproduce)

All cells have ribosomes, cytoplasm, cell membrane.

Prokaryotic Cell

- Simple, small
- Has ribosome, cytoplasm, cell membrane
- No nucleus
- All prokaryotes are unicellular organisms (e.g. bacteria, archaea)
- Sometimes has cell wall

Eukaryotic Cell

- Large, complex
- Has ribosome, cytoplasm, cell membrane
- Has nucleus and other organelles (endoplasmic reticulum, mitochondria: can do cellular respiration, vacuoles, lysosome)
- Can belong to unicellular (amoeba) or multicellular (fungi, plant, animal) organism
- Sometimes has cell wall

Fungal Cell

Plant Cell

Animal Cell

Amoeba

- Large central vacuole
- Cell wall
- Chloroplasts (can photosynthesize)
- "Boxy" shape

- Many smaller vacuoles
- No cell wall
- No chloroplasts
- Round or irregular shape