

Section 2.0: Cells play a vital role in living things.

Learning Outcomes:

- Explain the role of cells as a basic unit of life
- Identify plant and animal cells
- Identify the difference between one-celled and multicelled organisms
- Explain osmosis and diffusion
- Recognize the roles of cells

Cells

A cell is the basic unit of structure and performs all the processes that life depends on.

All living organisms are made of one or more cells, and all cells are created by cells.

If you look closely at any organism you can see that it is made of cells.
Non-living things are NOT made of cells.

Exceptions: A piece of wood. Why?

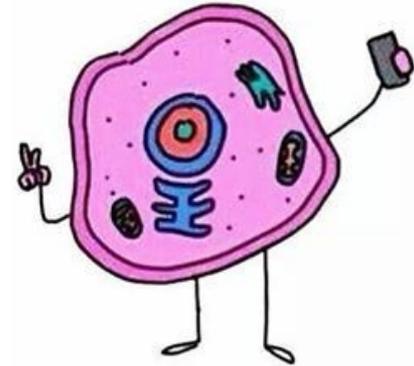
Parts of a cell

Organelles are specialized structures within each cell that carry out specific functions.

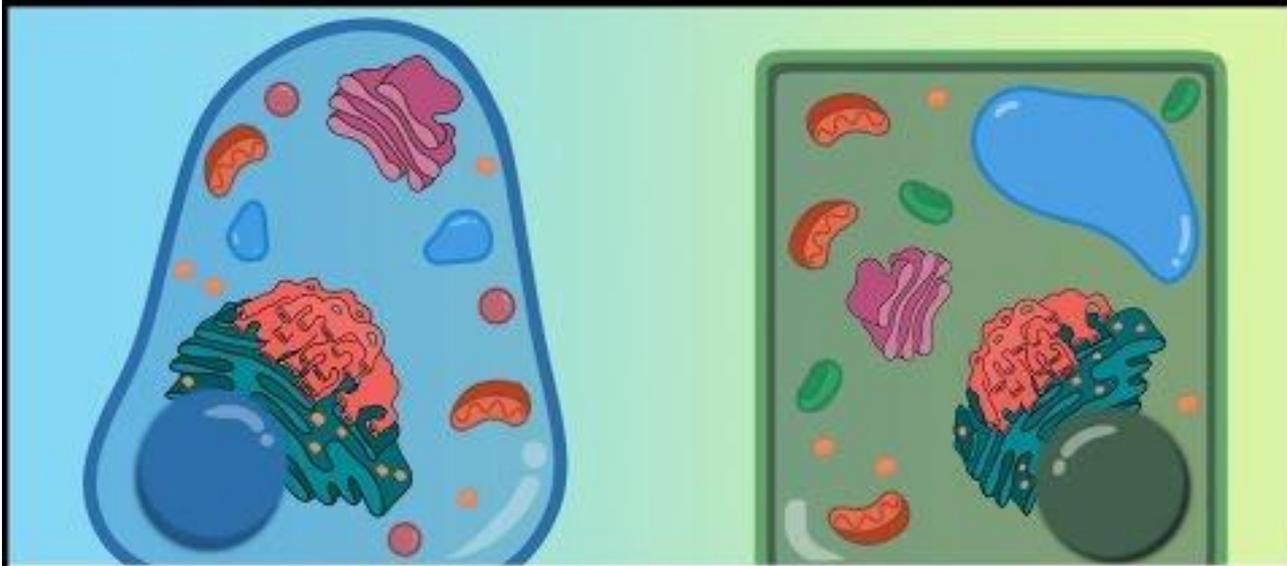
Think of a cells' organization as a living factories, making all the necessary items for survival.

There are MANY organelles however, we will focus mainly on the;

- 1) Cell membrane
- 2) Cell wall
- 3) Cytoplasm
- 4) Chloroplasts
- 5) Mitochondria
- 6) Vacuoles
- 7) Nucleus



Cell-fie



Introduction to Cells

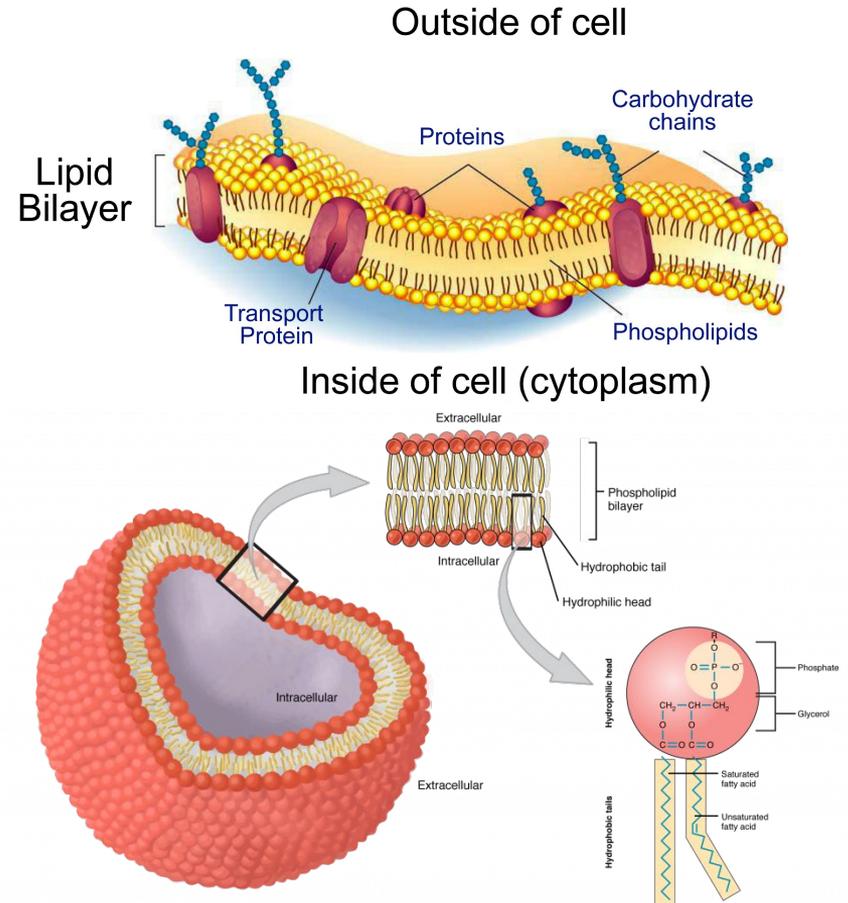
with the Amoeba Sisters

1. Cell Membrane

The **cell membrane** is a “controllable gateway” that allows needed materials to go in and out of the cell.

The cell membrane is present in both plant and animal cells, but **it is the outermost layer of an animal cell.**

Structure of the Cell Membrane



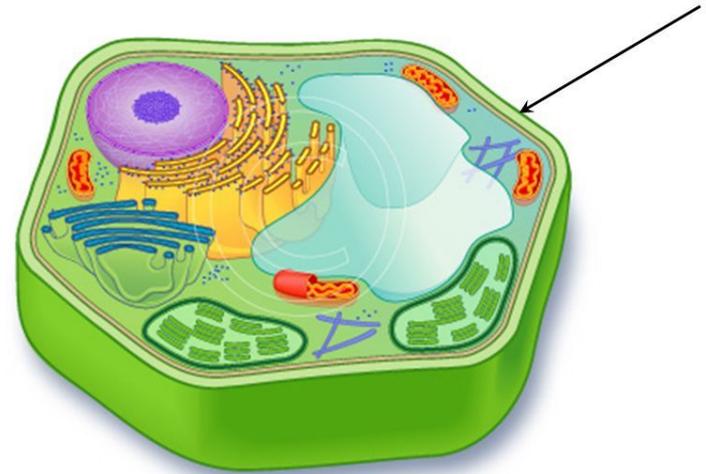
2. Cell Wall - Plants Only

The **cell wall** is a “frame” that protects and supports the cell. It is made of a tough, rigid, non-living material that surrounds the cell and provides support and strength to plants.

The cell wall lets water, oxygen, and other materials pass through it.

The cell membrane is located right behind the cell wall in plants.

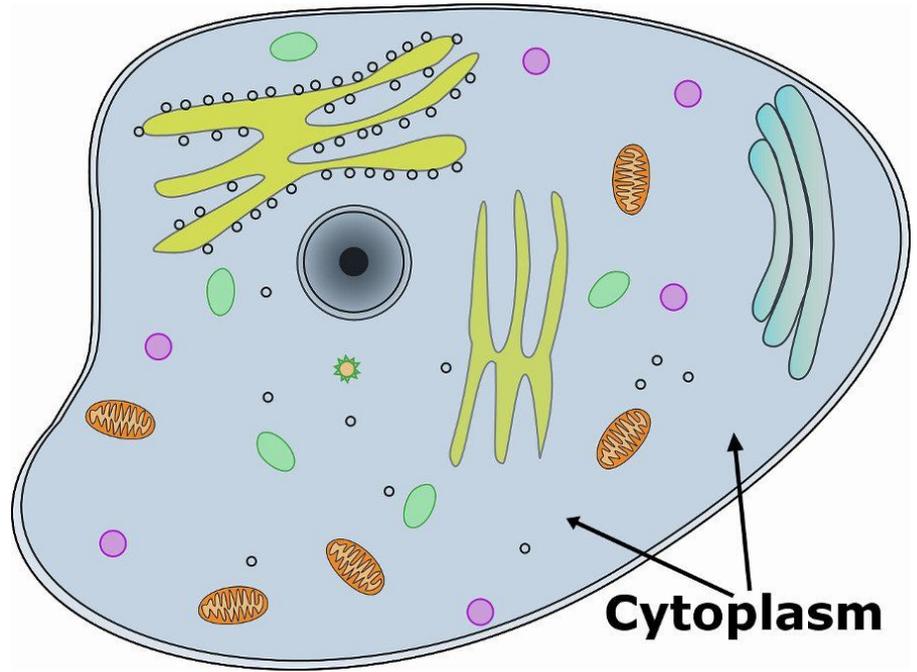
Cell Wall (plant cell only)



3. Cytoplasm

Cytoplasm is the “kitchen” of the cell. It is a jelly-like substance inside the cell.

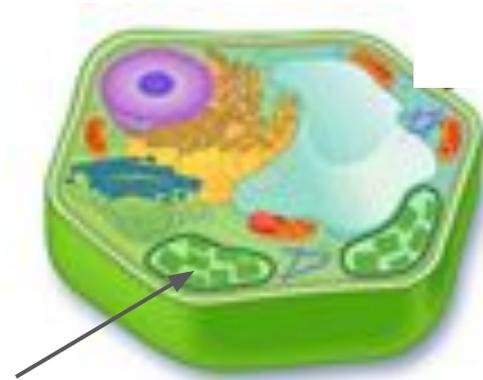
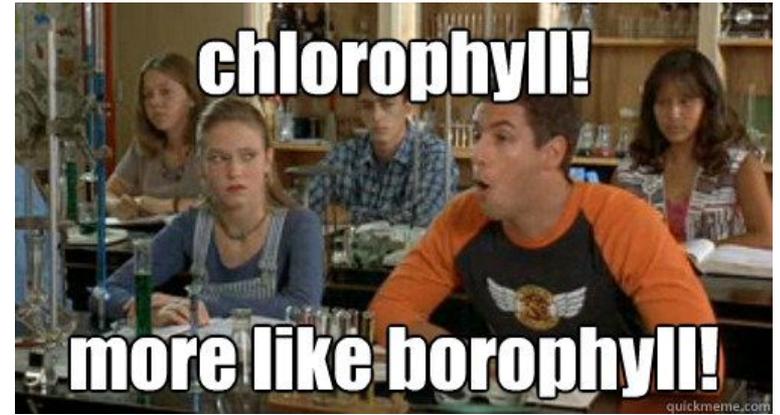
All of the cells organelles and nutrients are located within the cytoplasm.



4. Chloroplasts - Plants Only

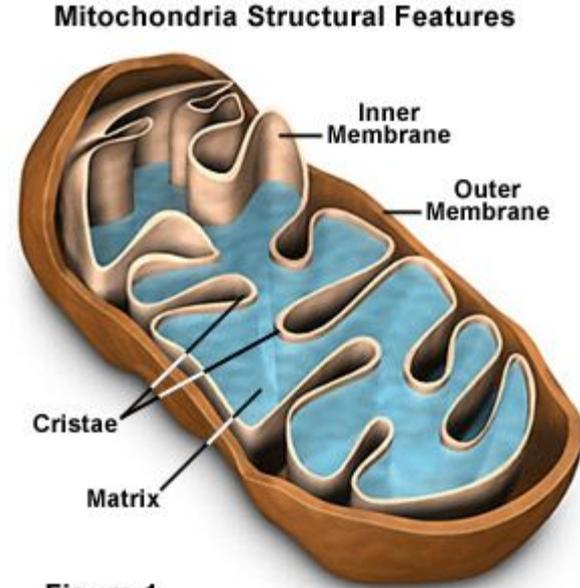
Chloroplasts are the “solar panels”, they get energy from the sun and use it to make food.

Chloroplasts contain chlorophyll, which is a green pigment largely responsible for the process of photosynthesis and gives plants the green colour.



5. Mitochondria

The **mitochondria** is the “powerhouse” of the cell. The mitochondria is where chemical reactions convert food into energy for the cell.



Fun Fact

For years the mitochondria was thought of being just a powerhouse for the cell. It is now known that the mitochondria is also responsible for; storing calcium, choosing which cells will be destroyed, and producing heat from brown fat.

It is also thought that Parkinson's disease, Alzheimer's disease, bipolar disorder, and schizophrenia are linked to a malfunctioning mitochondria.

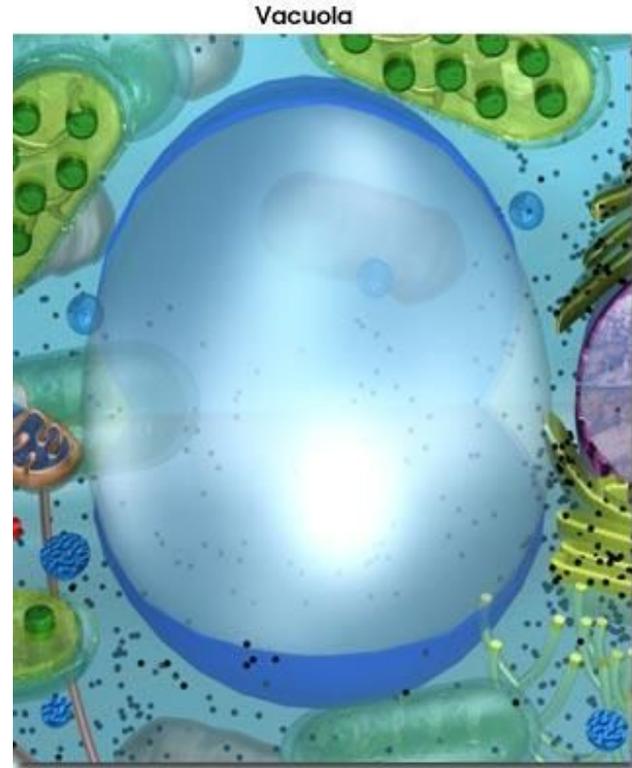
When teacher starts talking about science but all you know is that mitochondria is the powerhouse of the cell



6. Vacuoles

Vacuoles store water, food, and waste in the cell. They are a “storage room”.

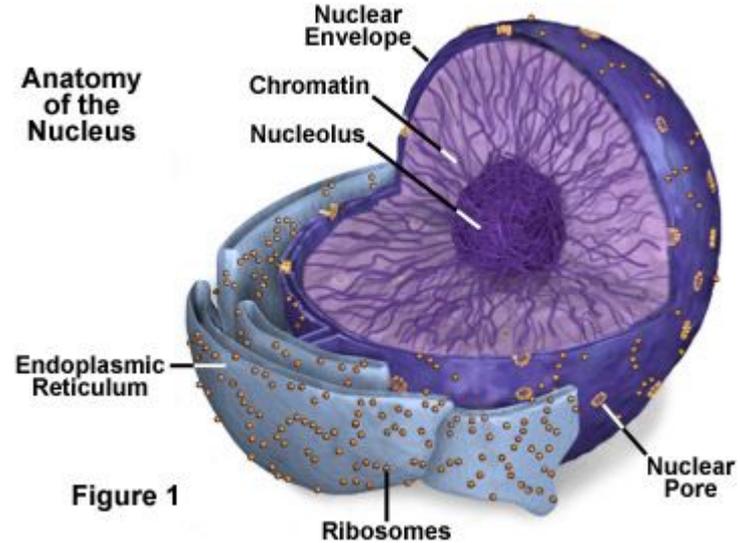
Animal cells have a few very small vacuoles, while plant cells have one large vacuole.



7. Nucleus

The **nucleus** controls all of the cell's activity such as movement, growth, and other life functions. It is considered to be the brain or “command centre” of the cell.

DNA is stored in the nucleus. The DNA found in the nucleus is the same in all cells of the organism.



What happens during a bacterial infection?



Review

- a) What organelle is referred to as the powerhouse?
- b) What are the seven characteristics of all living things?
- c) What is cytoplasm?

might-ochondria

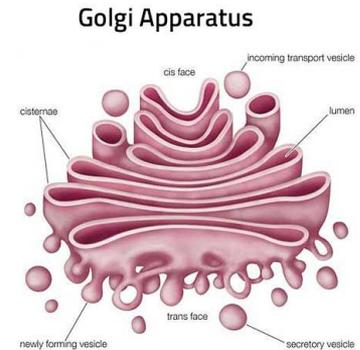
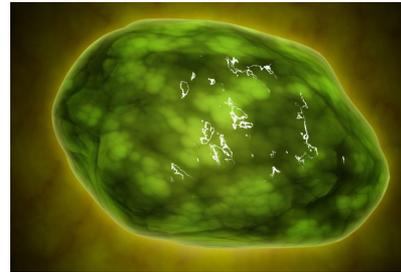
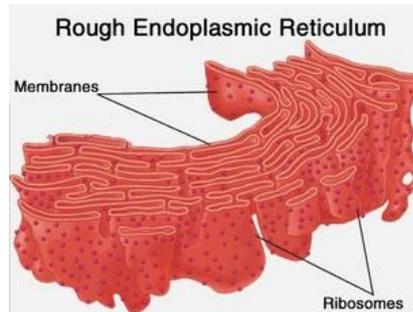


definitely-chondria



Other Organelles

Here are just a few more organelles that it is good to be aware of and will become very important in future biology classes.



Endoplasmic Reticulum

The endoplasmic reticulum carries proteins and other materials from one part of the cell to another.

The endoplasmic reticulum is attached to the outside of the nucleus.

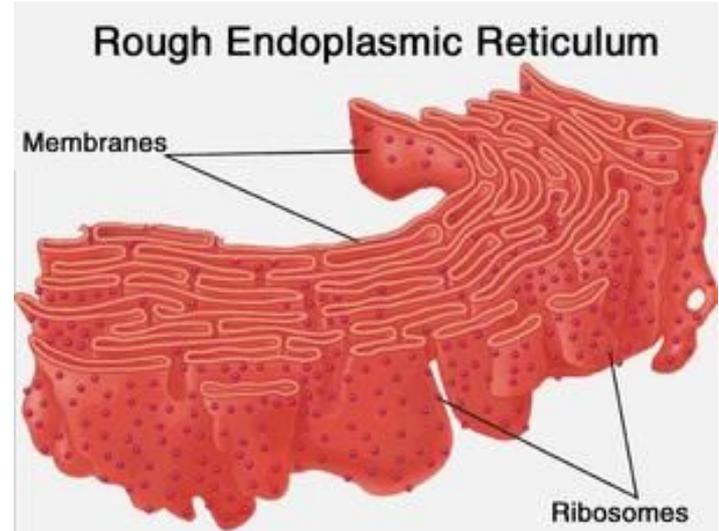


Ribosomes

Ribosomes are found both floating in the cytoplasm of a cell, and attached to the endoplasmic reticulum.

Ribosomes are responsible for making proteins for the cell.

In turn, proteins are used to make and repair parts of the cell.

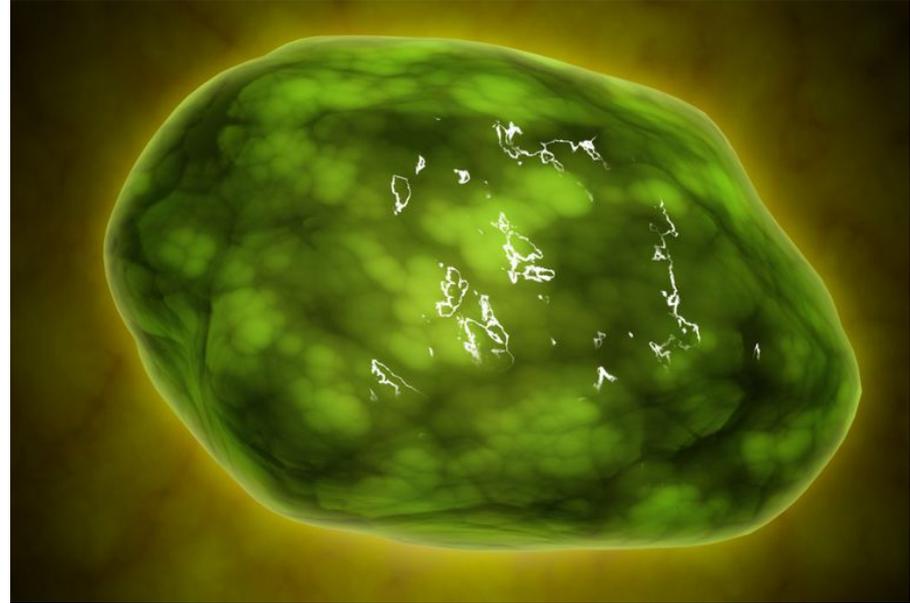


Lysosomes

Lysosomes contain chemicals that break down materials in the cell.

They are responsible for breaking down large food particles, and old cell parts.

Lysosomes are thought of as the clean up crew of the cell.

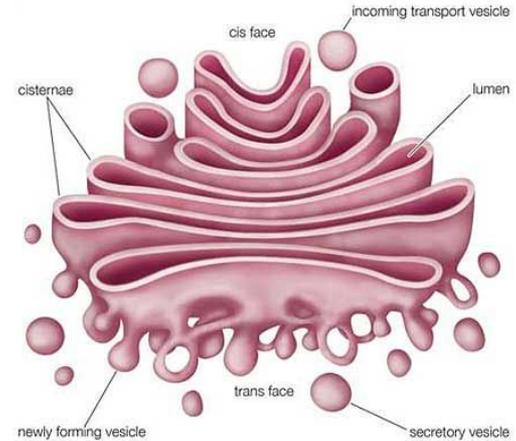


Golgi Body

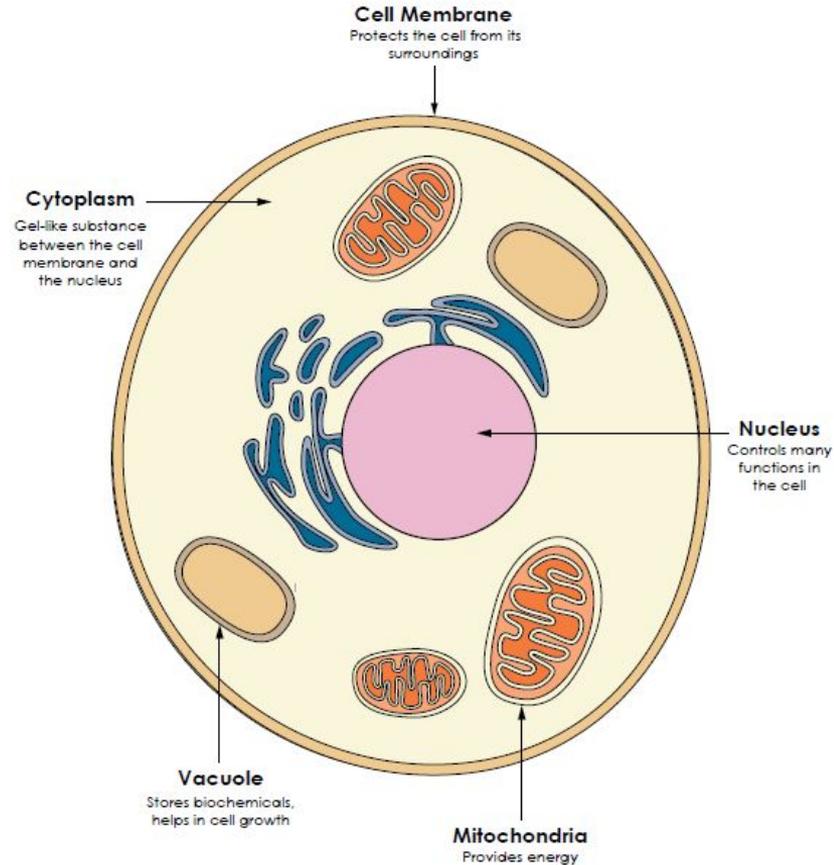
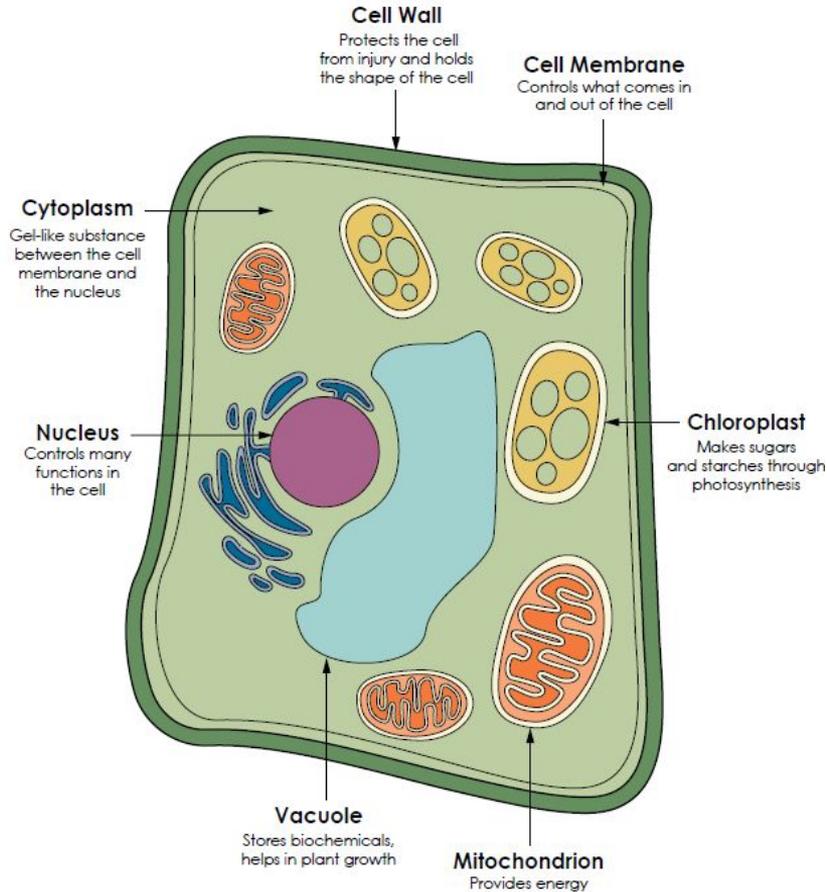
The golgi body is responsible for collecting proteins and other newly created materials from the endoplasmic reticulum and packaging them to send to other parts of the cell.

The golgi body is located next to the endoplasmic reticulum.

Golgi Apparatus

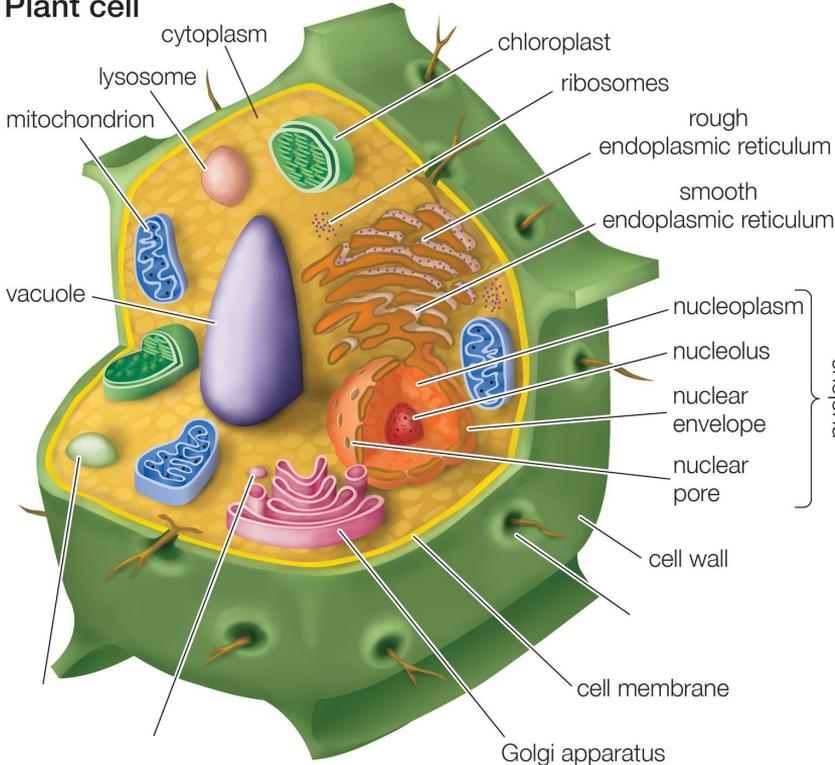


Plant and Animal Cells

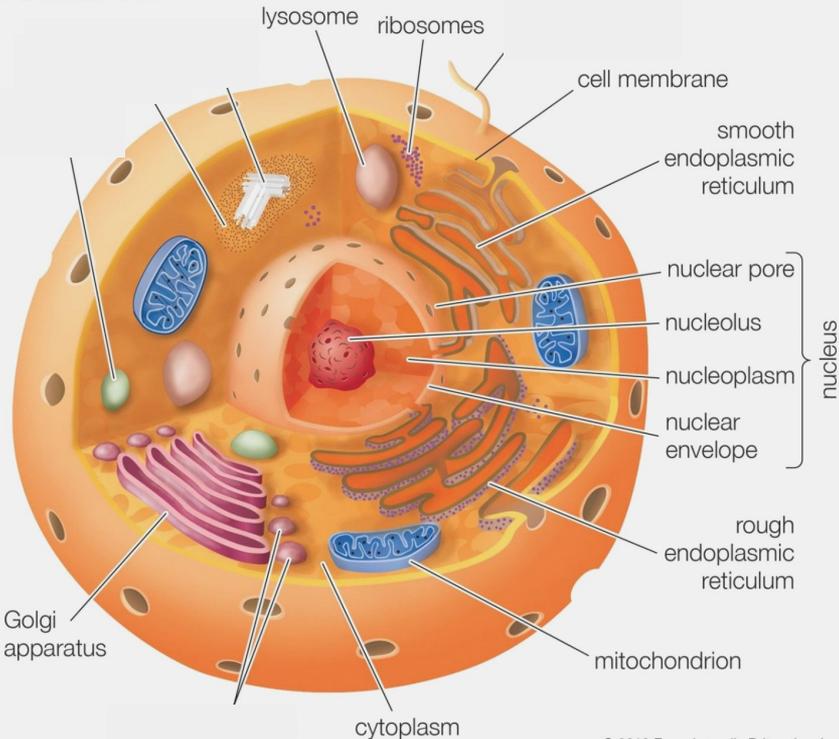


Plant and Animal Cells

Plant cell



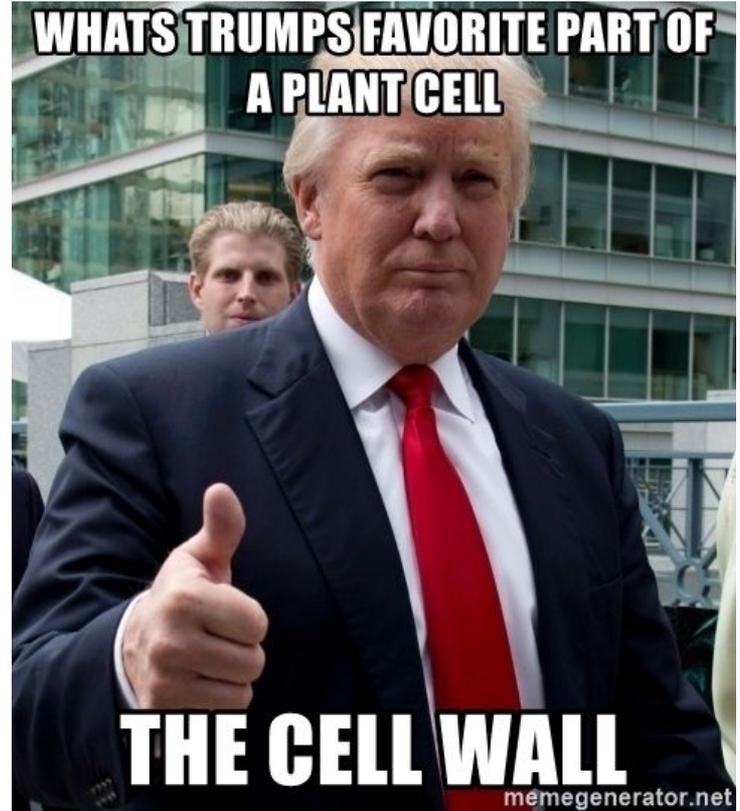
Animal cell



Difference between plant and animal cells

There are a few differences between animal and plant cells;

- 1) A plant cell has a cell wall.
- 2) A plant cell has chloroplasts.
- 3) Animal cells have many smaller vacuoles while plants have one larger vacuole.



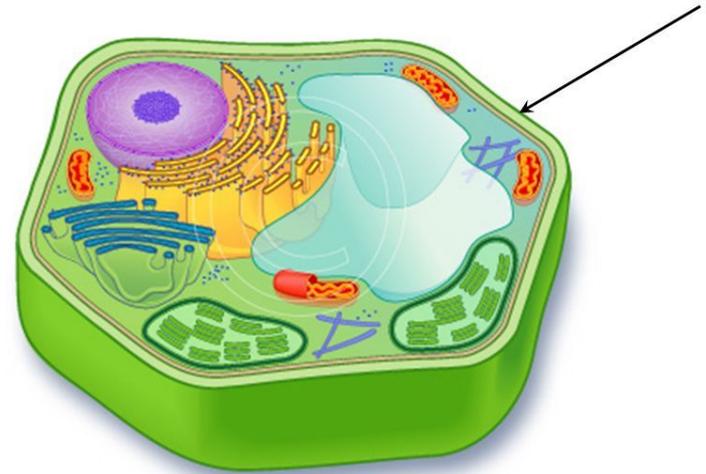
Cell wall

The cell wall protects and supports the cell. It is made of a tough, rigid, non-living material that surrounds the cell.

The cell wall lets water, oxygen, and other materials pass through it.

The cell membrane is located right behind the cell wall.

Cell Wall (plant cell only)

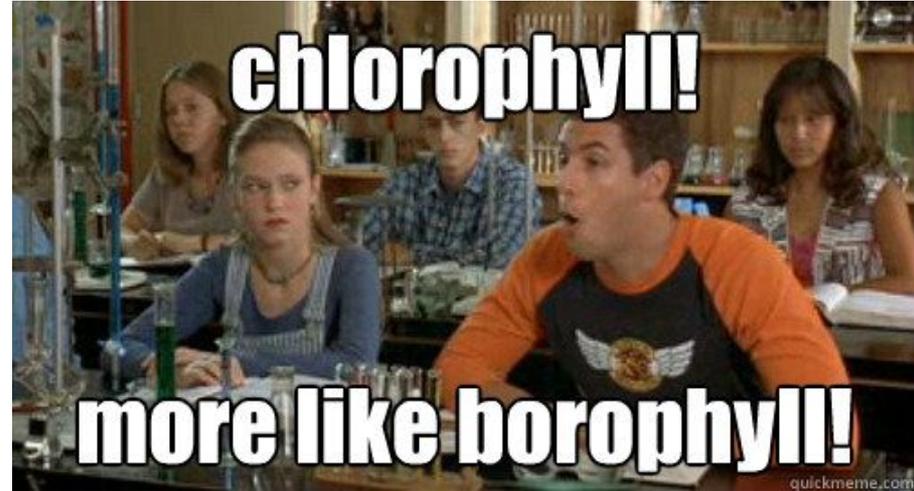


Chloroplasts

Chloroplasts get energy from the sun and use it to make food.

Chloroplasts contain chlorophyll, which is a green pigment largely responsible for the process of photosynthesis.

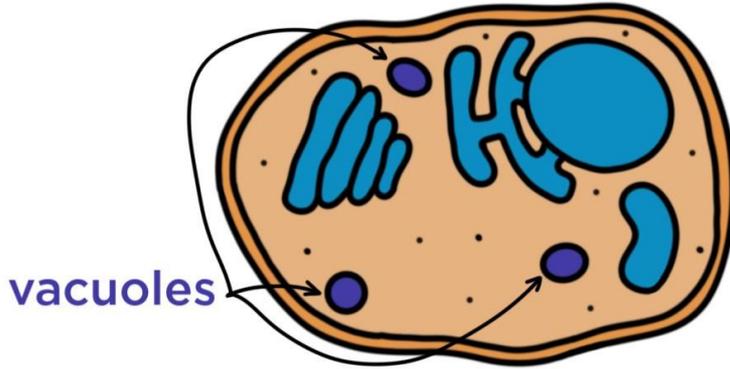
Chlorophyll gives the plants their green color.



Vacuoles

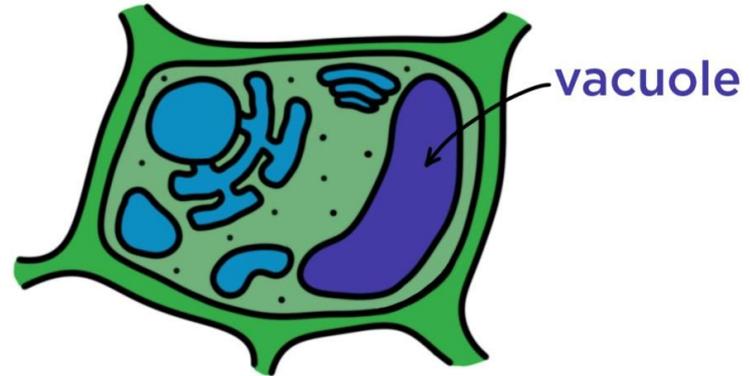
ORGANELLES: VACUOLE

ANIMAL CELL



- several small vacuoles
- used for storage
- can contain nutrients, water, or waste

PLANT CELL



- one large vacuole
- used to store water and push against the cell wall
- keeps the plant rigid

Why are you so tired?

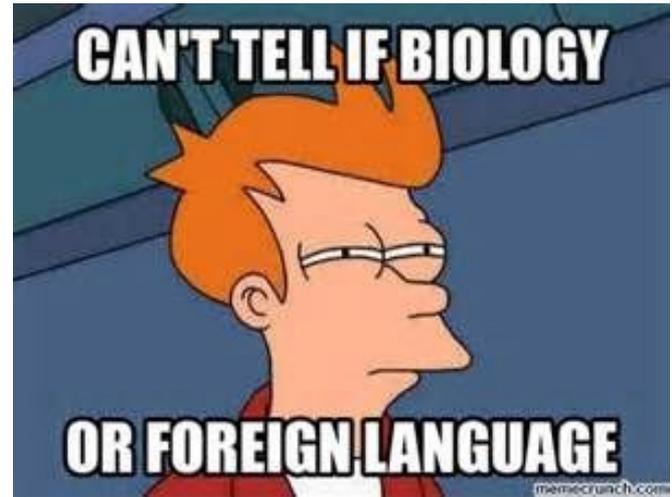


Review

- a) What organelle is referred to as the powerhouse?

- b) What are the main differences between plant and animal cells?

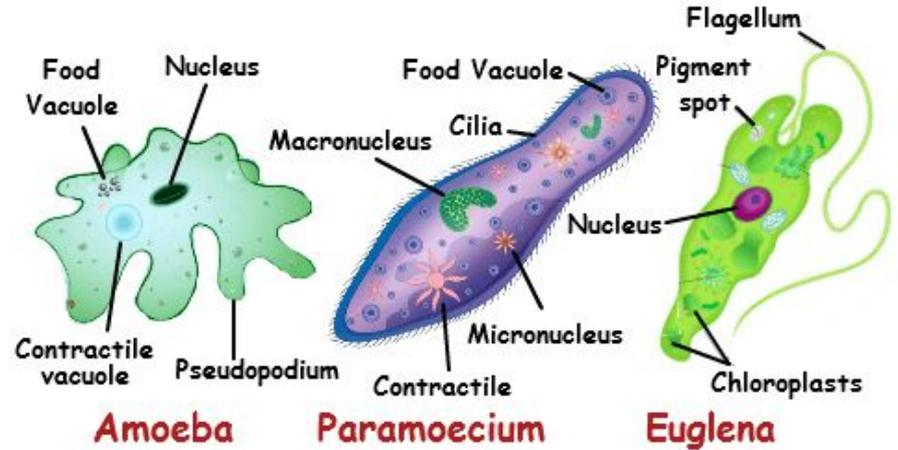
- c) What is contained in the nucleus?



Unicellular

A **unicellular organism**, is an organism that consists of only one cell. Unicellular organisms fall into two general categories;

Prokaryotic organisms and eukaryotic organisms.



Fun Fact!

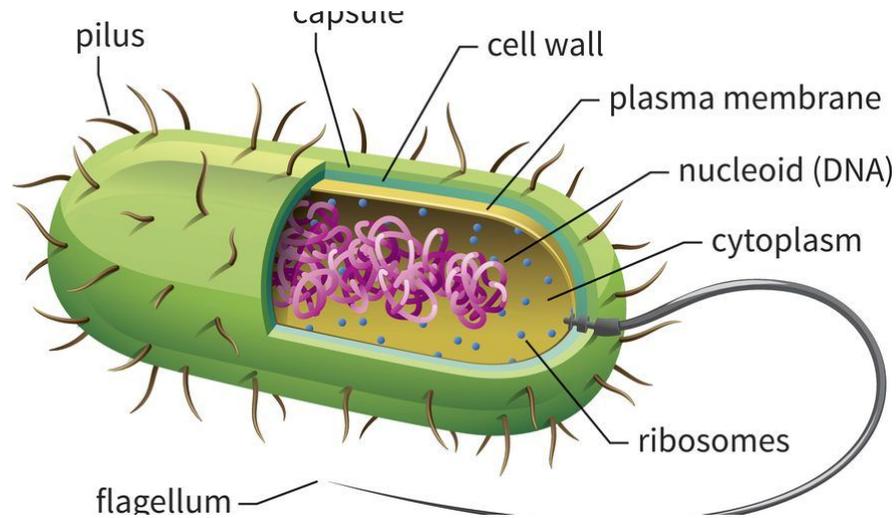
One of the largest unicellular organisms the *Valonia ventricosa*, a species of algae has a diameter anywhere from 1cm to 4cm.



Prokaryotes

Prokaryotes do not have some membrane-bound organelles, such as mitochondria or a nucleus. Instead, most prokaryotes have an irregular region that contains DNA. They are covered in hair-like structures called **cilia**.

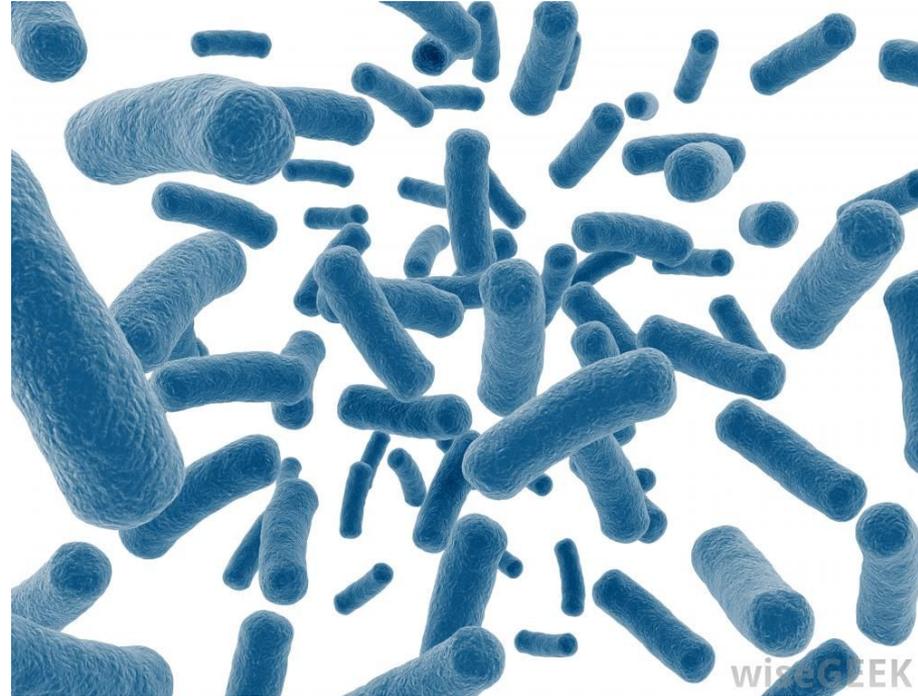
Prokaryotes have the ability to utilize a wide range of organic and inorganic material for use in metabolism, including sulfur, cellulose, ammonia, or nitrite.



Prokaryotes

Examples of prokaryotes include many bacterium.

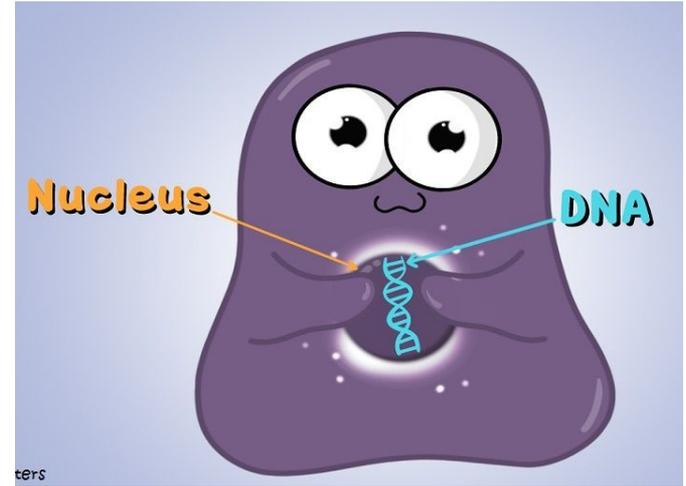
For example E. coli and strep throat lack a nucleus and mitochondria, so are classified as prokaryotes.



Eukaryotic

Eukaryotic cells contain membrane bound organelles, such as mitochondria, a nucleus, and chloroplasts.

Single celled organisms like yeast, paramecia and amoebae are all eukaryotes. Grass, potatoes, tapeworms and animals are also examples of eukaryotes.



Amoeba Eating



Multicellular

Multicellular organisms are made up of two or more cells.

Plants and animals are examples of multicellular organisms.





**Unicellular and Multicellular
Organisms**

What happens if you stop brushing your teeth?

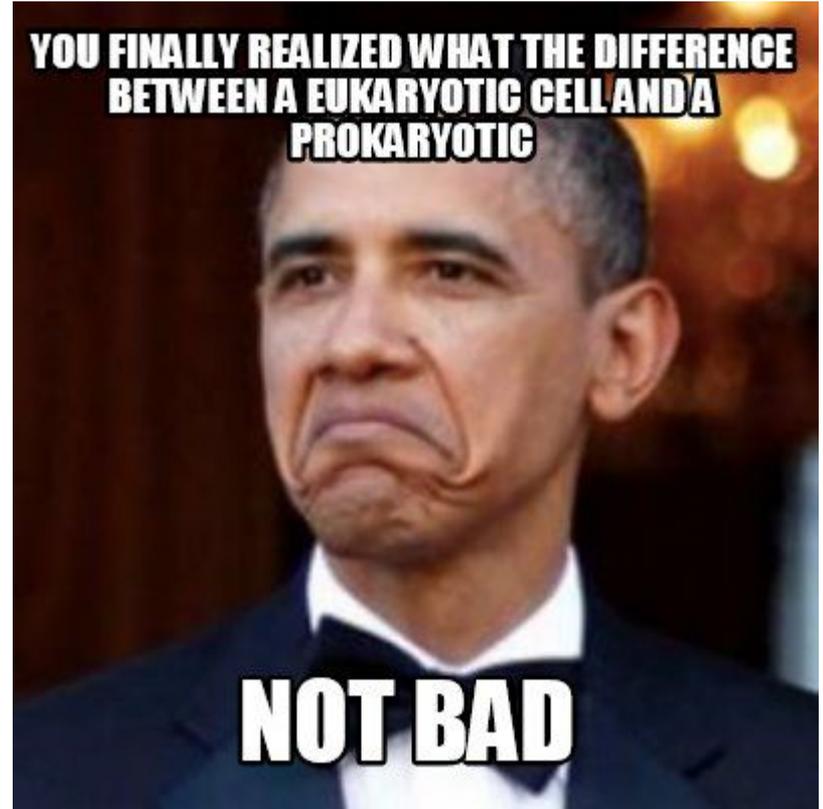


Review

- a) What is the difference between eukaryotic and prokaryotic cells?

- b) How do cells replicate?

- c) What are the seven characteristics of living things?



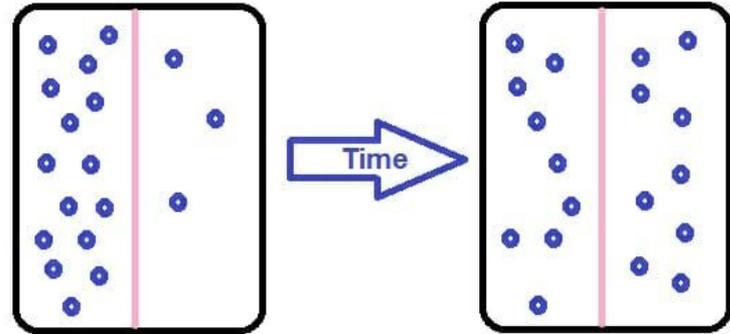
Substance Movement

Every cell brings in water, gases, and food inside itself. It also removes waste. The cell structure that permits this movement is the **cell membrane**.

Cell Membrane and Diffusion

Diffusion is the movement of particles from an area of high concentration to an area of low concentration. This process is a “balancing out” until the concentration is the same everywhere.

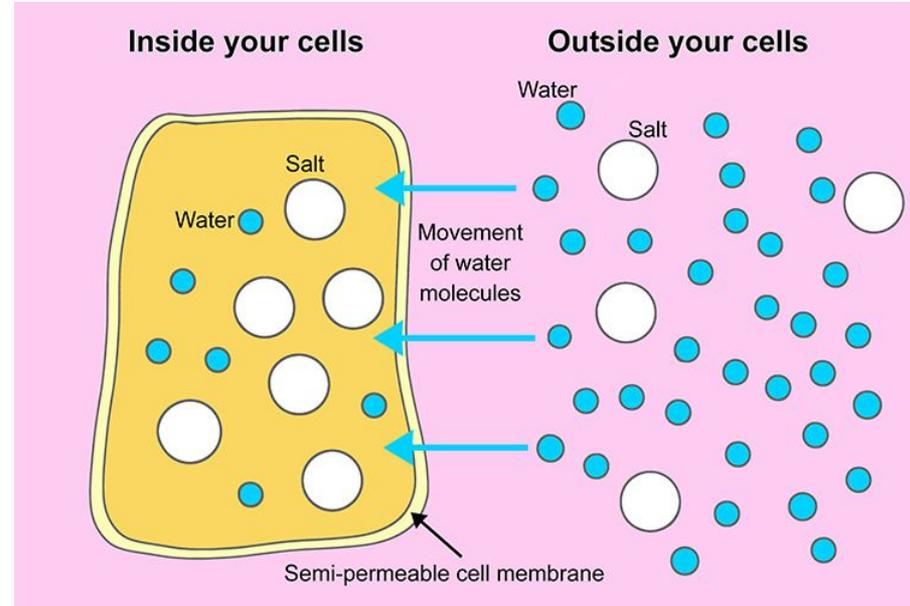
The cell membrane acts like a filter allowing necessary materials in and waste out, while keeping the organelles and cytoplasm in. A cell membrane is **selectively permeable**.

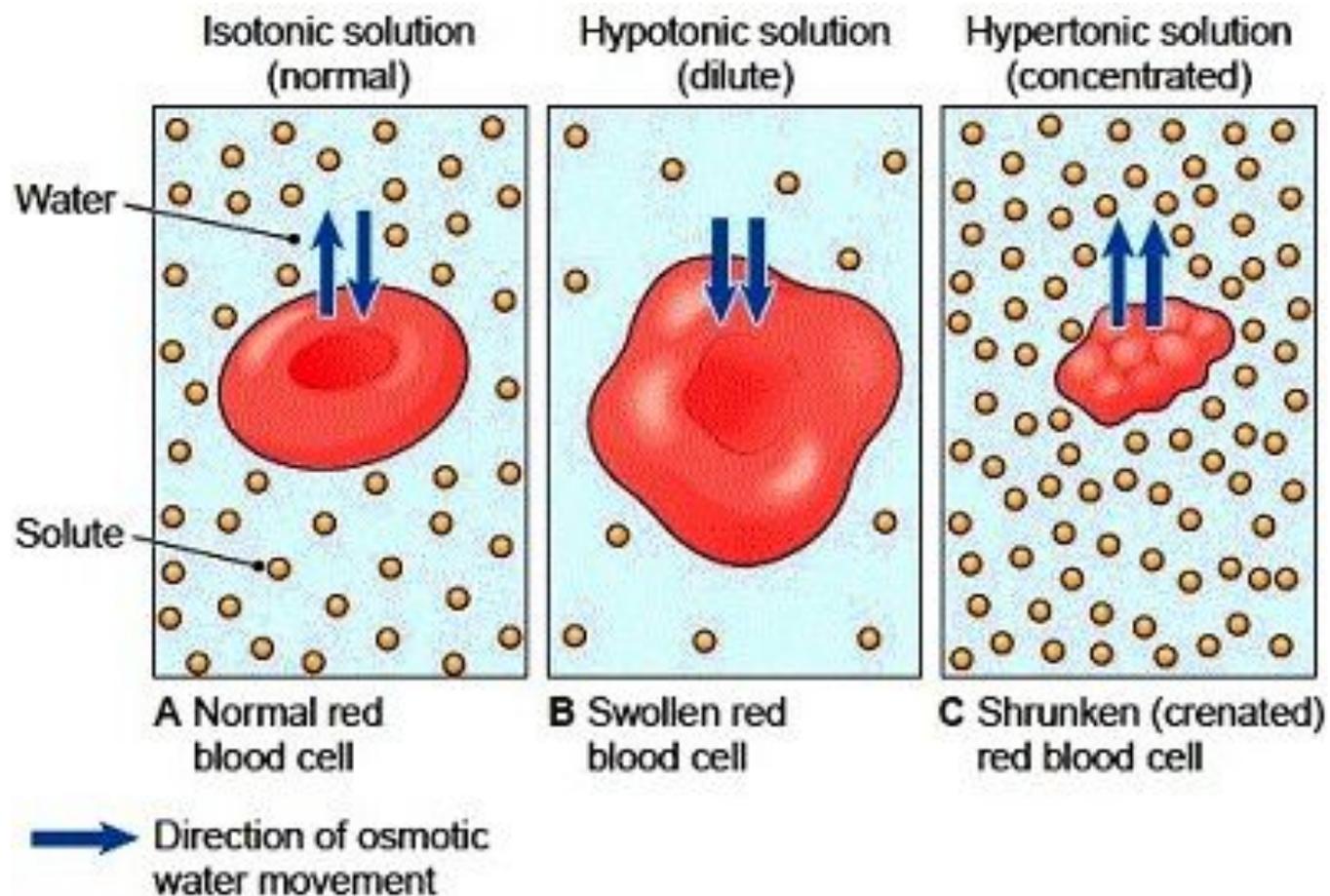


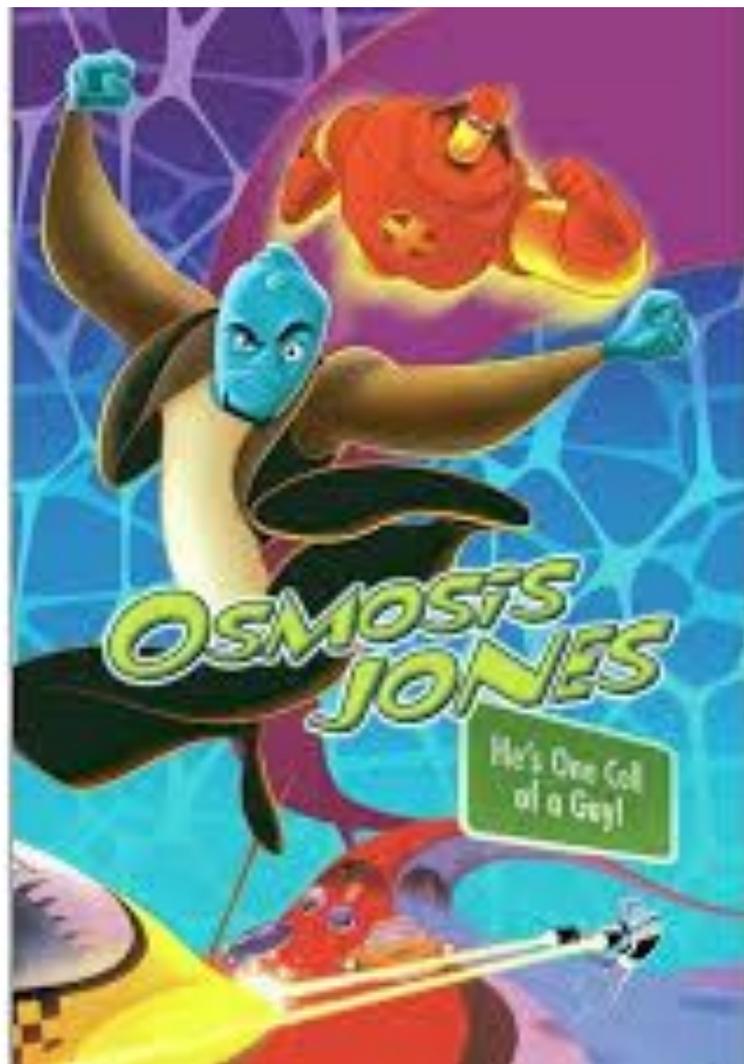
Osmosis

Osmosis is the diffusion of water particles through a selectively permeable membrane.

Water must stay fairly constant within a cell. The diffusion of water is vital to survival.







OSMOSIS
JONES

He's One Cell
of a Guy!

Remember!

An individual living creature is called an **organism**. There are 7 characteristics that all living organisms share. All organisms;

- 1) Are made up of one or more cells
- 2) Require energy
- 3) Grow and develop
- 4) Reproduce
- 5) Possess adaptations that evolved over time
- 6) Respond to their environment
- 7) Maintain homeostasis

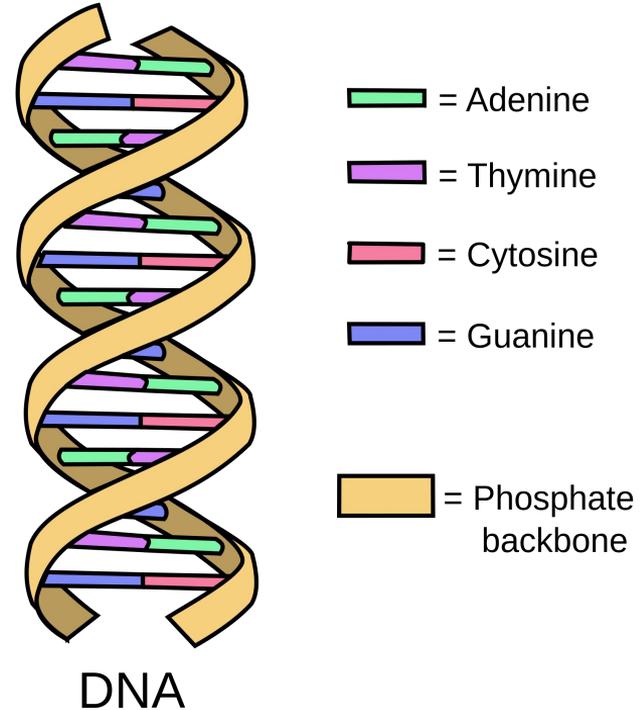


DNA

DNA stands for **deoxyribonucleic acid** it is found in the nucleus of all cells and is a carrier of genetic information.

DNA is considered a blueprint for a living thing, and is the backbone for cell replication.

DNA holds the shape of a double helix.



Nucleotides

Each chain of DNA is made up of repeating subunits called nucleotides.

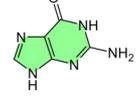
There are four different types of nucleotides in DNA they are;

Adenine, Thymine, Guanine, and Cytosine.

Cytosine **C**



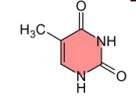
Guanine **G**



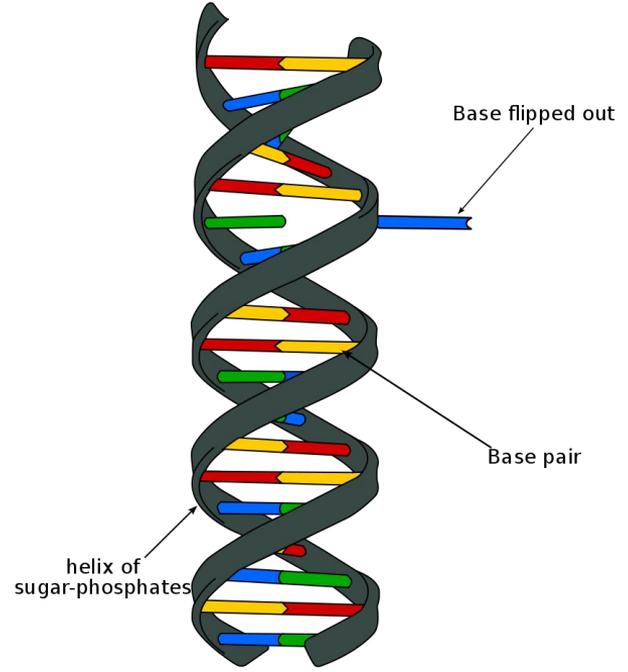
Adenine **A**



Thymine **T**



Nucleobases of DNA



DNA
Deoxyribonucleic acid

Complementary Bases

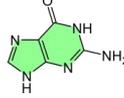
In DNA each nucleotide has a pairing. These pairings are called complementary bases.

Cytosine will always be paired with guanine, and adenine will always be paired with thymine.

Cytosine **C**



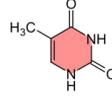
Guanine **G**



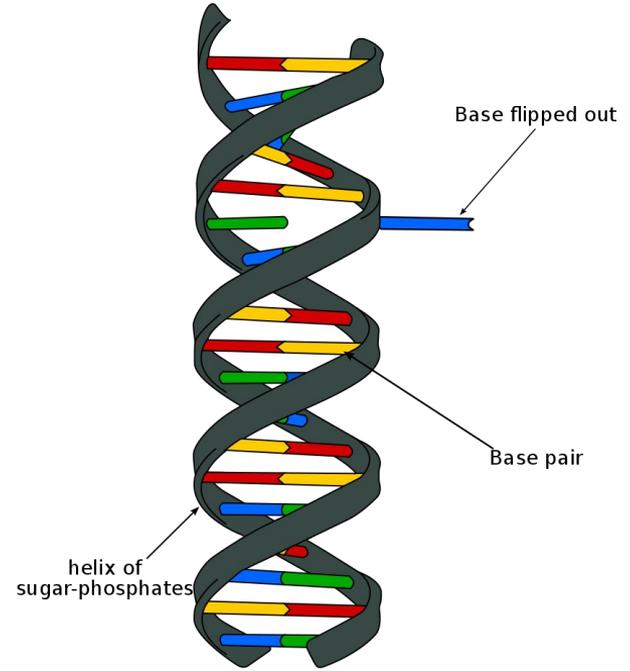
Adenine **A**



Thymine **T**



Nucleobases
of DNA

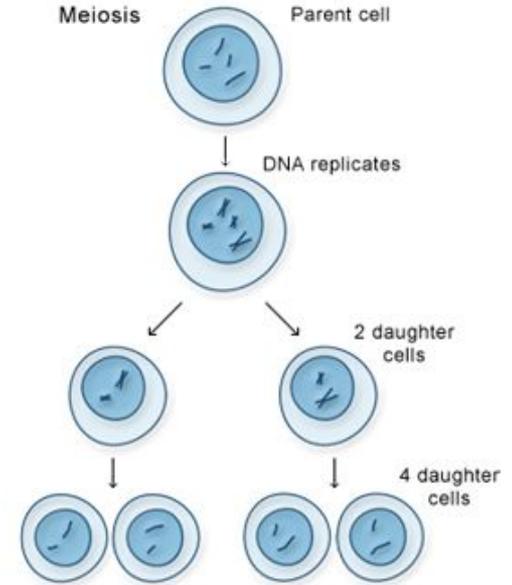
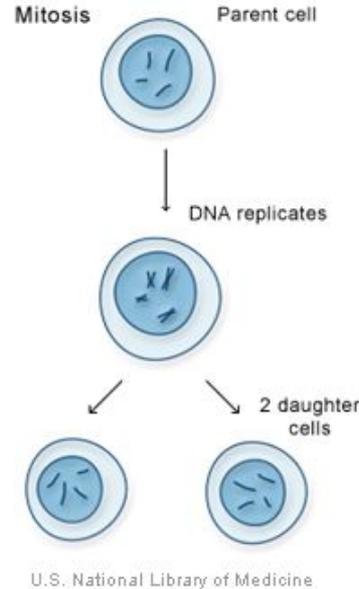


DNA
Deoxyribonucleic acid

Cell Replication

To allow an organism to grow and develop, cells reproduce.

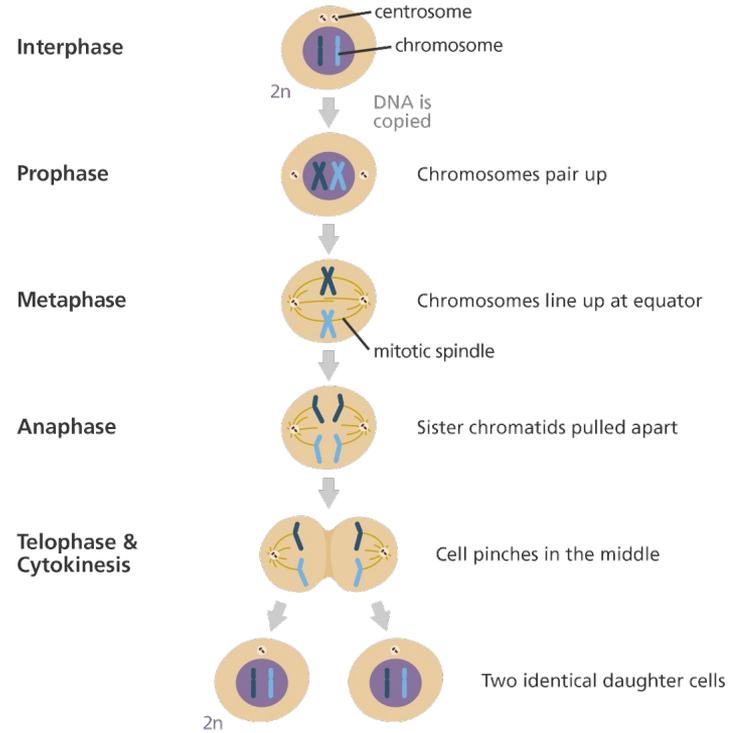
There are two types of cell division; mitosis and meiosis.



Mitosis

Mitosis is the process of making new body cells, a single cell divides into two identical daughter cells. During mitosis one cell divides once to form two identical cells.

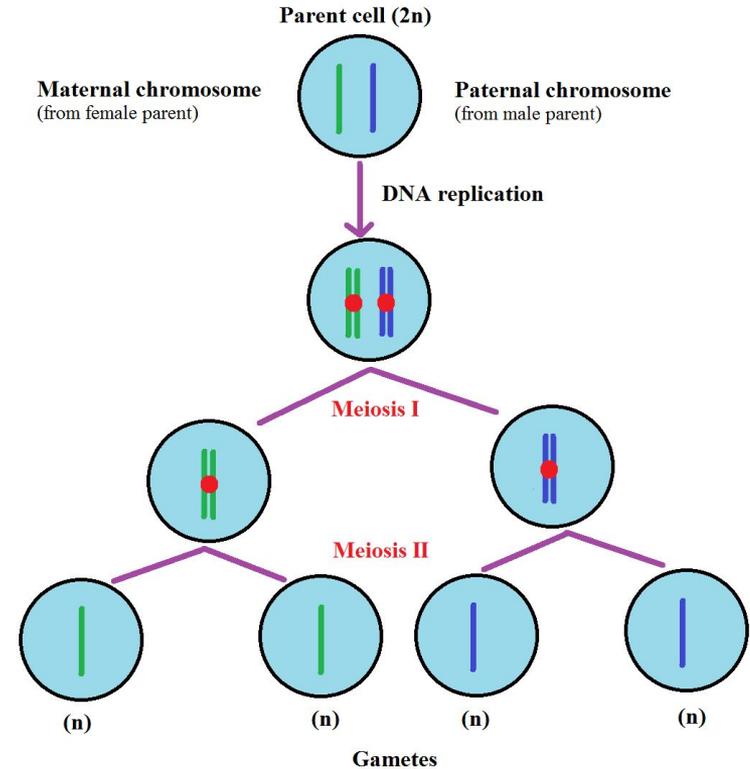
If not corrected in time, mistakes made during mitosis can result in changes in the DNA that can potentially lead to genetic disorders and cancers.



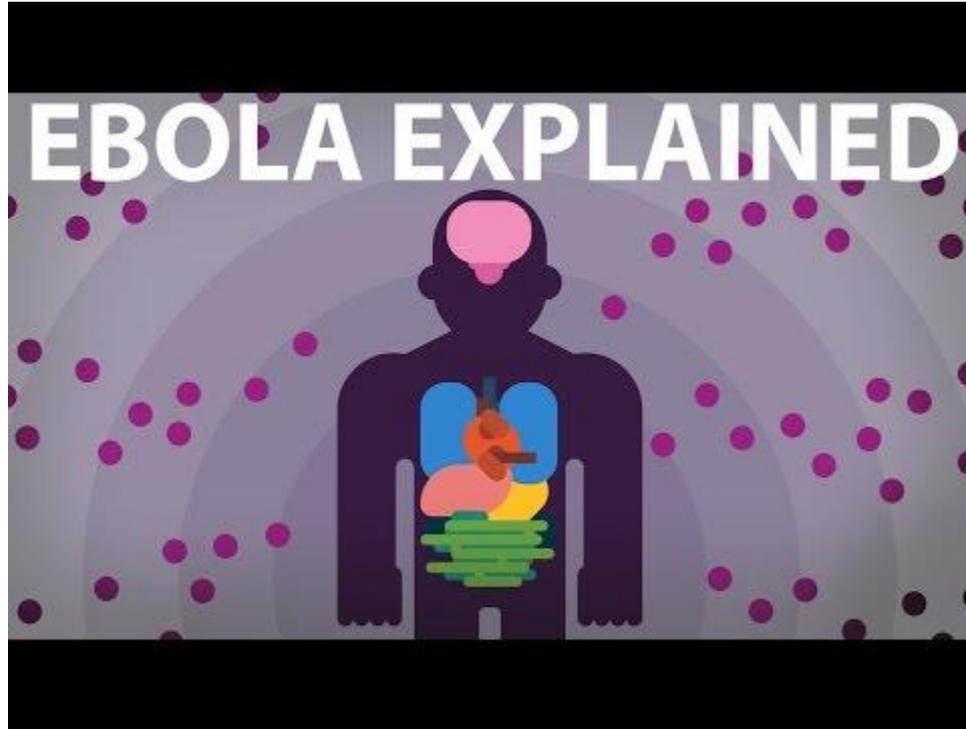
$2n$ - diploid

Meiosis

Meiosis is a special type of cell division that reduces the chromosome number by half, creating cells, each genetically distinct from the parent cell that gave rise to them. Meiosis is the type of cell division that creates egg and sperm cells.



Why are viruses so dangerous?



Review

- a) What is mitosis?
- b) What are complementary bases?
- c) Where is DNA located?

