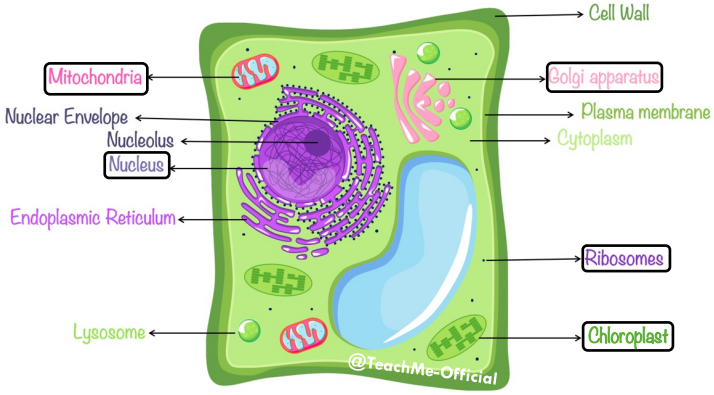
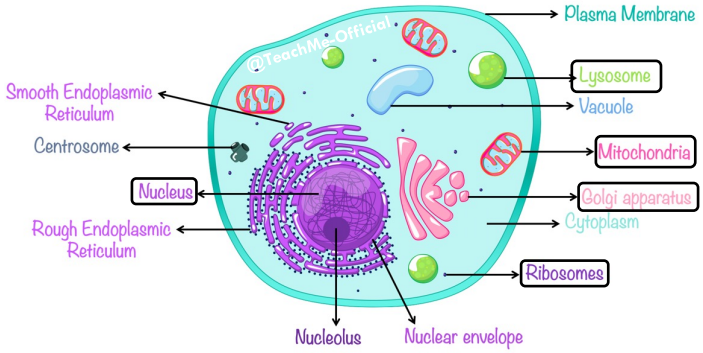
Organelles & Compartmentalization (HL)



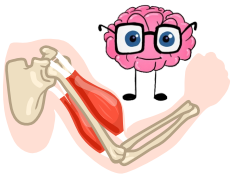


Make sure you remember all the cell structures found in **EUKARYOTIC CELLS**, both **PLANT** and **ANIMAL**. Refer to **A2.2**.
Now let's look at some of these organelles in more detail!

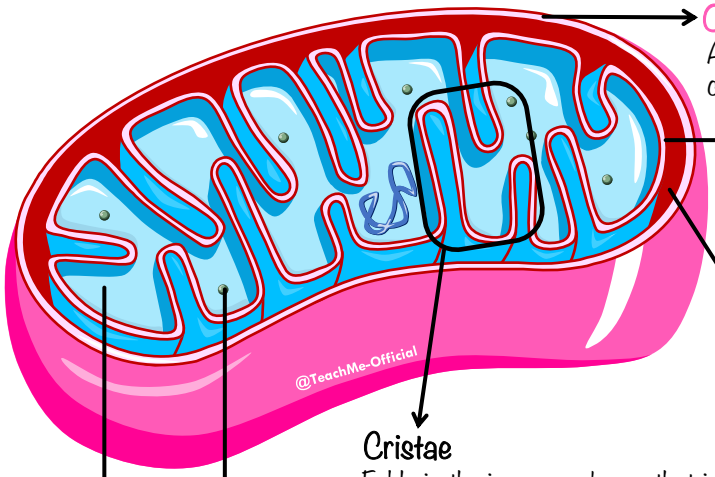
THE MITOCHONDRIA

Used in cellular respiration (to make **ATP**) – The POWERHOUSE of the cell!

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$



Cells that need a lot of **ATP** have more mitochondria!
For example muscle & brain cells



Outer membrane
A membrane that separates the mitochondrial contents from the rest of the cell.

Inner membrane
Contains the proteins and enzymes for the **FINAL STAGES** (**ELECTRON TRANSPORT CHAIN AND CHEMIOSMOSIS**) of respiration.

Double Membrane

Inter membrane space
A reservoir for hydrogen ions (protons), allowing a high concentration of protons.

Cristae
Folds in the inner membrane that increase the surface area for reactions that take place towards the end of respiration (**OXIDATIVE PHOSPHORYLATION**).

Ribosome
(70s)

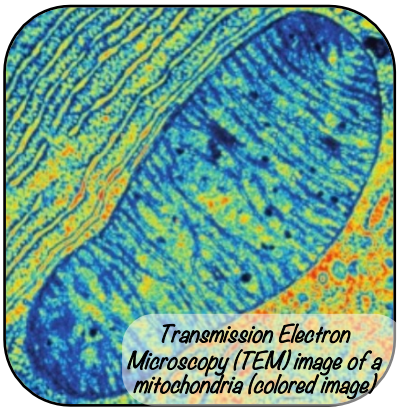
Matrix
A cytoplasm-like substance that contains the enzymes for the **FIRST STAGES** (**LINK REACTION** and **KREBS CYCLE**) of respiration.

ATP

Defects in mitochondria may result in diminished (or reduced) ATP production. Which may cause muscle weakness & poor mental development.

NOTE!

You will learn in section **C1.2** more details about the process of cell respiration, for now focus on the big picture.



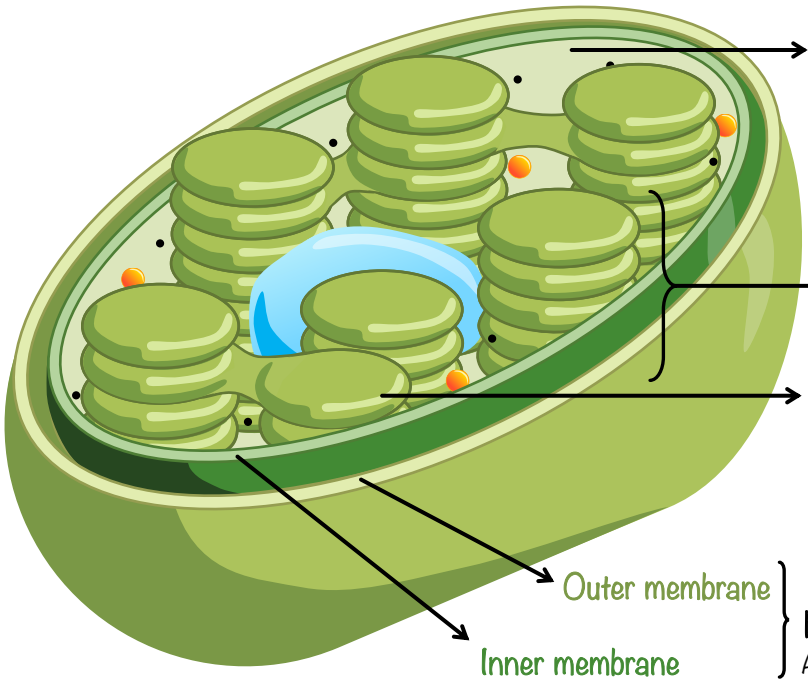
Transmission Electron Microscopy (TEM) image of a mitochondria (colored image)

Remember in section **A2.2** where the mitochondria and chloroplast come from:
ENDOSYMBIOTIC THEORY

Organelles & Compartmentalization (HL)

The Chloroplast

Found in plant cells (mostly leaves). The organelle responsible for **photosynthesis**: $6CO_2 + 6H_2O \xrightarrow{\text{+ light energy}} C_6H_{12}O_6 + 6O_2$
Use of light energy to convert light energy into chemical energy (in the form of glucose).
Used by autotrophs: organisms that make their own food.



Stroma
Similar to the cytoplasm of the cell and matrix of the mitochondria. Provides a region where the enzymes necessary for the Calvin cycle can work. Light independent reactions of photosynthesis location.

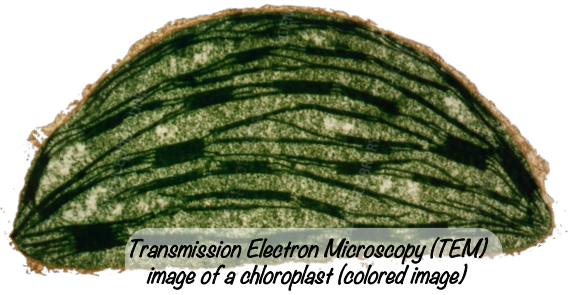
Granum
A stack of thylakoids.

Thylakoid
Extensive surface area, for greater absorption of light by photosystems. Small lumen for faster accumulation of protons to create a concentration gradient. Light dependent reaction of photosynthesis location.

Outer membrane
Inner membrane

Double membrane
A membrane that separates the chloroplast contents from the inside of the rest of the cell.

NOTE!
You will learn in section **C1.3** more details about the process of photosynthesis, for now focus on the big picture.

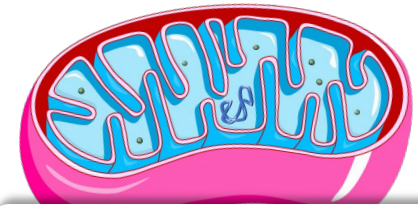


Transmission Electron Microscopy (TEM) image of a chloroplast (colored image)

Remember: **CAT**aboslism – **CAT**s destroy / break down things

Catabolism vs. Anabolism

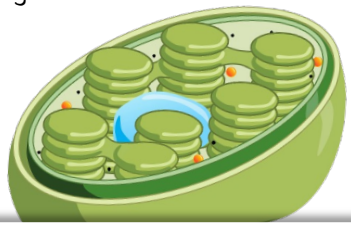
When a larger molecule (macromolecule) is broken down into smaller sub-parts (monomers). Forms ATP.



$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$

Example: Cellular Respiration

When a small sub-parts (monomers) are combined to form larger molecules (macromolecules). Use ATP.



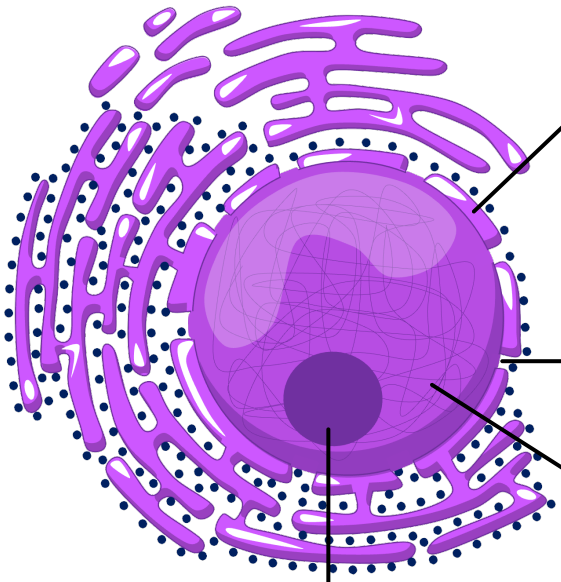
$6CO_2 + 6H_2O \xrightarrow{\text{+ light energy}} C_6H_{12}O_6 + 6O_2$

Example: Photosynthesis

Organelles & Compartmentalization (HL)

The Nucleus

Place of storage for the genetic material (DNA). Normally the nucleus is found in the center of a cell except for plant cells which typically have a large vacuole which causes the nucleus to be found on the periphery of the cell.



Nuclear Envelope (a double membrane)
Separating DNA from other parts of the cell. Can also disintegrate and reform (mitosis & meiosis)

Outer membrane
Continuous with the ER. Same function as ER.

Inner membrane
Interacts with DNA. Also important for shape.

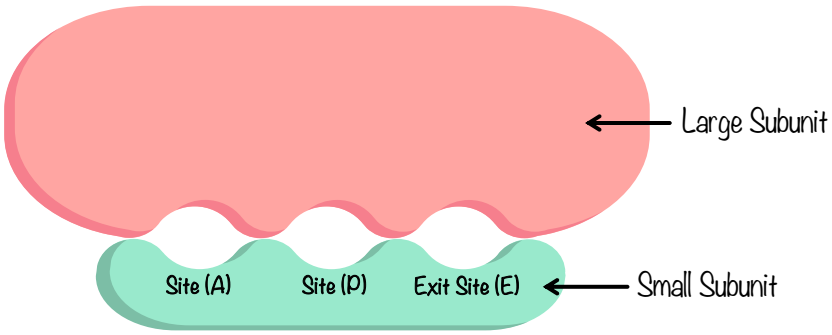
Nuclear Pore
Allows ions and small molecules (like mRNA, proteins etc.) to diffuse between the genetic material, nucleoplasm and cytoplasm.

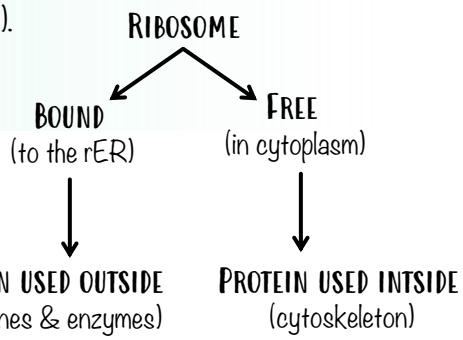
Nucleoplasm
Jelly-like substance within the nucleus (like the cytoplasm).

Nucleolus
Make ribosomes (RNA protein complexes)

The Ribosome

Responsible for protein synthesis. Made up of protein and rRNA (ribosomal RNA).
Two kinds of ribosomes exist: bound ribosomes and free ribosomes.
Eukaryotic cells have **80S** ribosomes and prokaryotes have **70S** ribosomes.



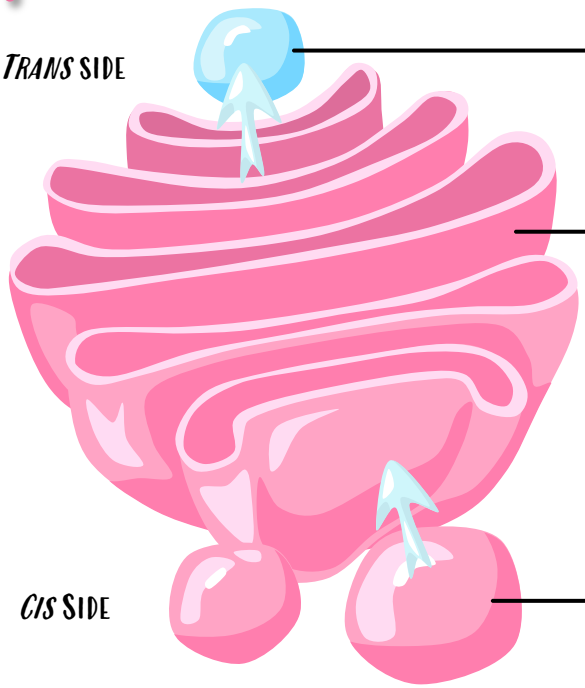


NOTE!
You will learn in section **C1.3** more details about the process of protein synthesis, for now focus on the big picture.

Organelles & Compartmentalization (HL)

The Golgi Apparatus

Organelle responsible for collecting, modification, packaging and distribution of newly synthesized proteins. Vesicles are received from smooth endoplasmic reticulum (sER) or rough endoplasmic reticulum (rER) and vesicles are sent to be used either inside or outside of the cell (if outside, contents are excreted via exocytosis).



Trans side

Vesicles with modified materials
The vesicles get a chemical signal (like a stamp on a letter) attached depending on where they should be sent to.

Cisternae
Stacks of flattened sacks

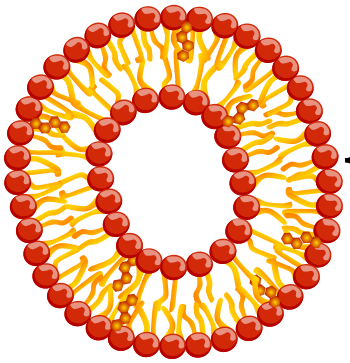
Did you know?
Actively secreting cells have more Golgi Apparatus. For example; plasma cells to be able to produce antibodies (a protein)

Cis side

Vesicles with unmodified materials
The vesicles are originated from the sER or rER

Cellular Vesicles

Small membrane bound sacs in which various substances are transported or stored in the cell. Many different types exist depending on their purpose. Surrounded by a lipid bilayer.



Peroxisomes — Vesicle that contains enzymes used to break down fatty acids.

Lysosomes — Contains enzymes necessary for cellular digestion and for destroying defective or damaged organelles.

Secretory Vesicles — These contain materials that are to be excreted from the cell, such as neurotransmitter (involved with nerve and muscle action) and hormones (many general functions)

Transport Vesicles — Move molecules around within a cell.

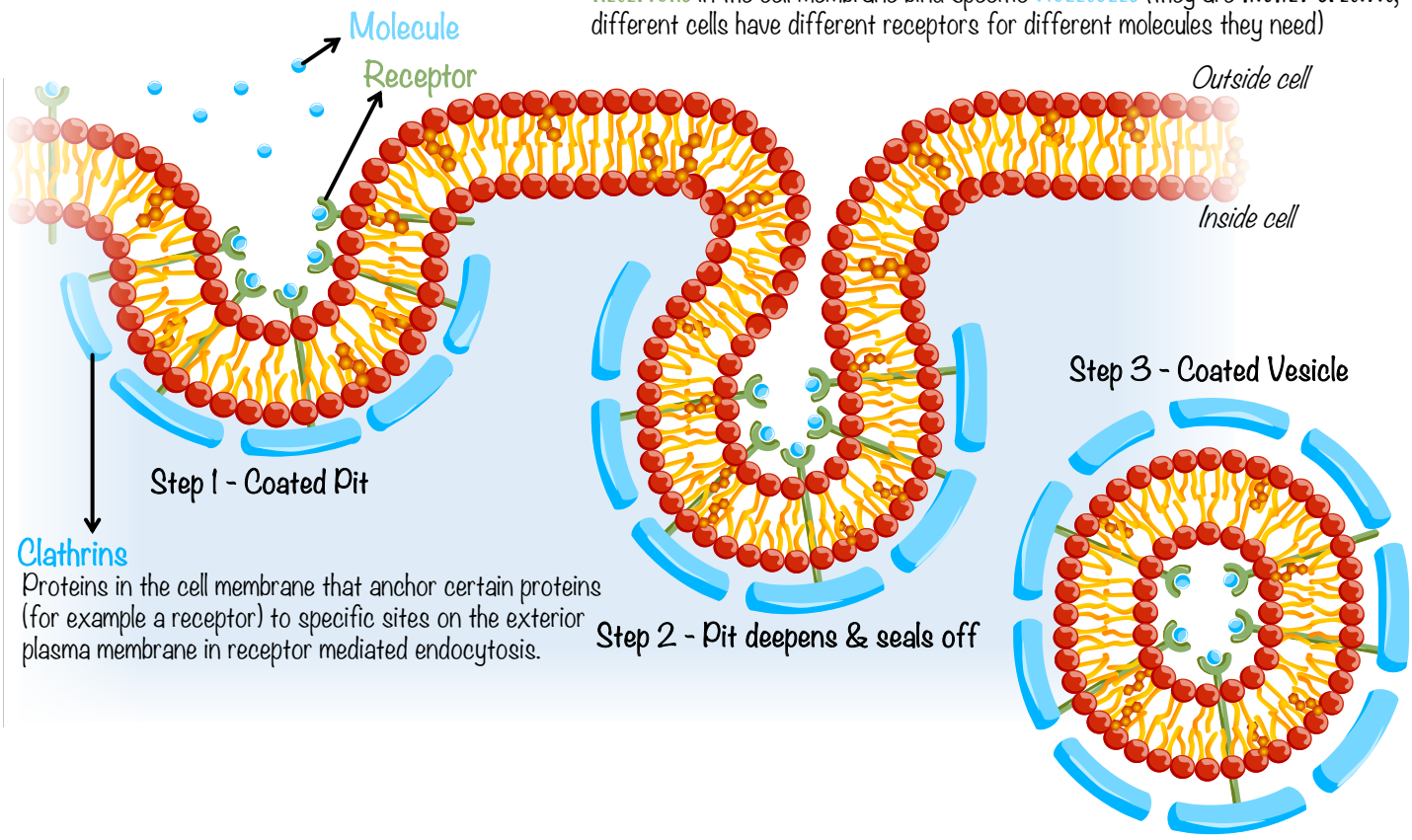
Tip!
Vesicle = Vehicle

Organelles & Compartmentalization (HL)

How are these vesicles formed?

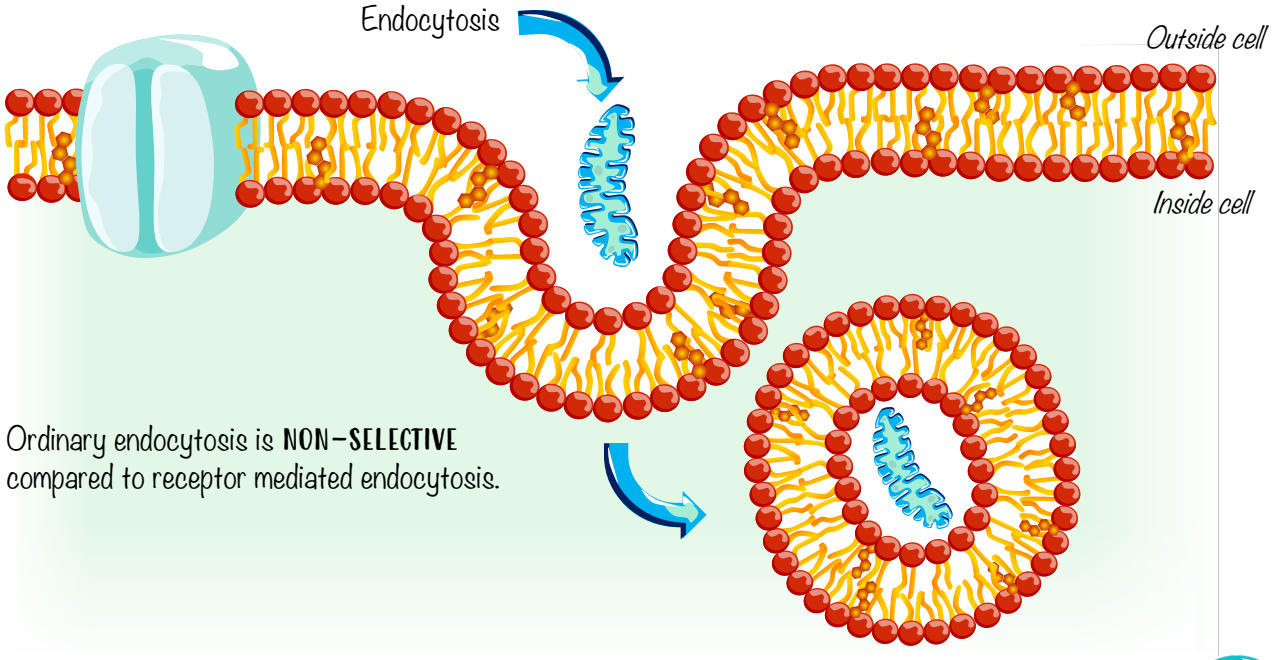
I. Receptor Mediated Endocytosis

Receptors in the cell membrane bind specific molecules (they are **highly specific**, different cells have different receptors for different molecules they need)



Clathrins
Proteins in the cell membrane that anchor certain proteins (for example a receptor) to specific sites on the exterior plasma membrane in receptor mediated endocytosis.

II. Endocytosis



Ordinary endocytosis is **non-selective** compared to receptor mediated endocytosis.

notes