THE CELL THEORY

PART 1

All living things are made of cells.

PART 2

Cells are the basic unit of structure and function in living things.

PART 3

Living cells only come from other living cells.

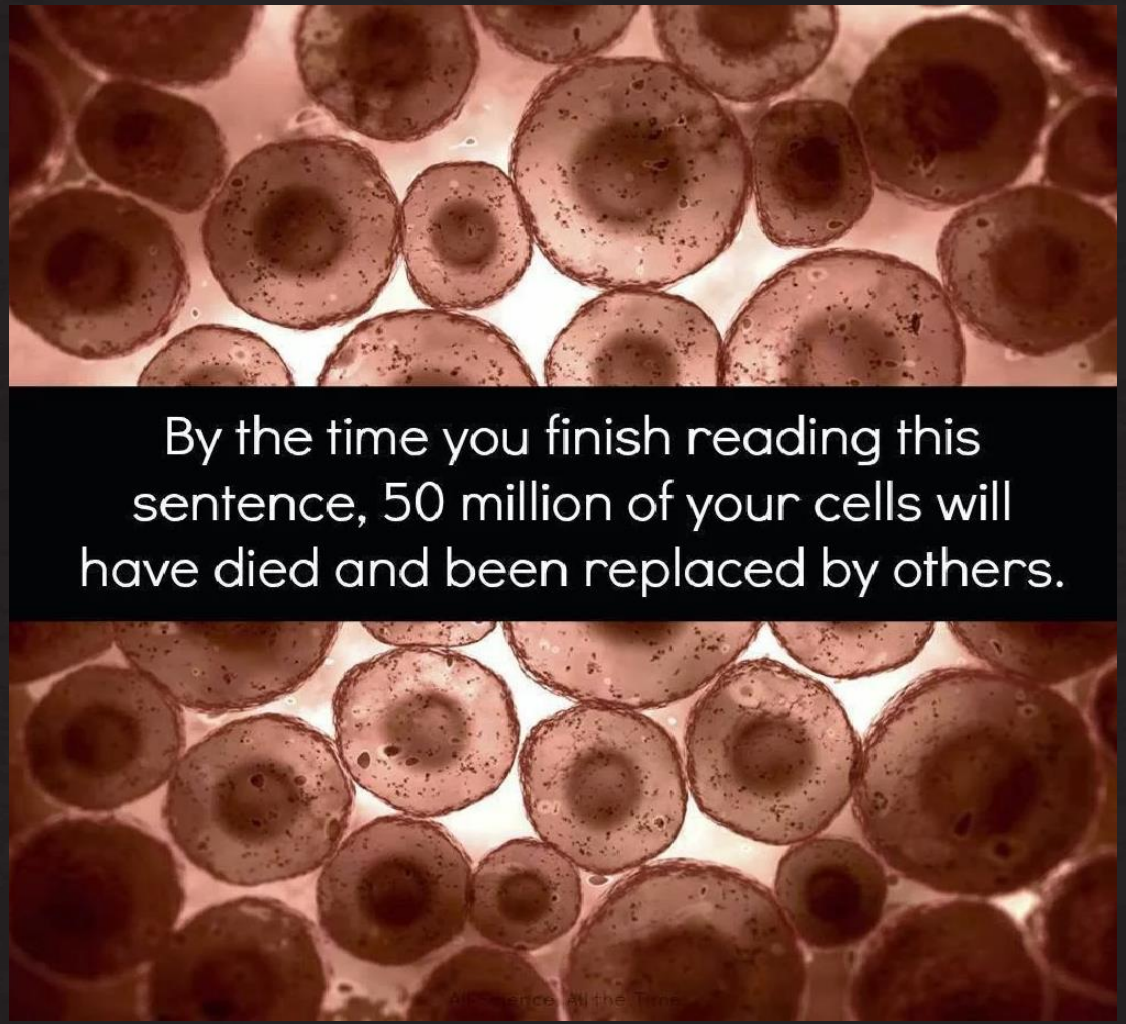
Structure and Function

Structure

The structure refers to what it is made of and how its parts are put together

Function

The function refers to what it does and how it does that


By the time you finish reading this
sentence, 50 million of your cells will
have died and been replaced by others.

We are made of cells but cells are super tiny.

So how do we organize humans, or any living organism?

Hierarchy in organisms

x+y

2^x

1

Cells

Cells are the basic unit of structure and function in organisms

2

Tissue

Tissues are made up of cells

3

Organ

Organs are made up of tissues

4

Organ system

An organism is made of organ systems

x+y

But what are cells made up of?

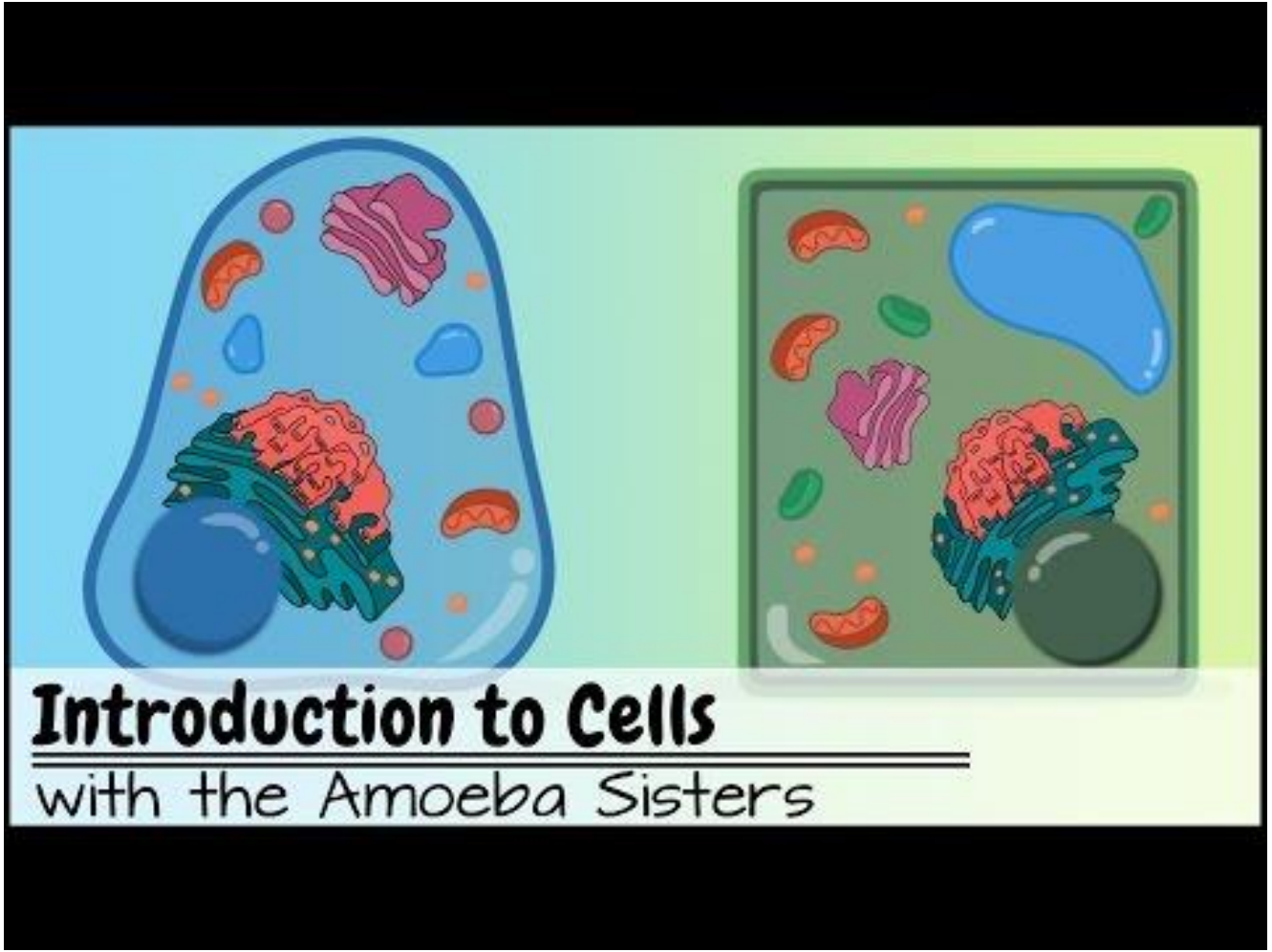
Organelles!

2x

x+y

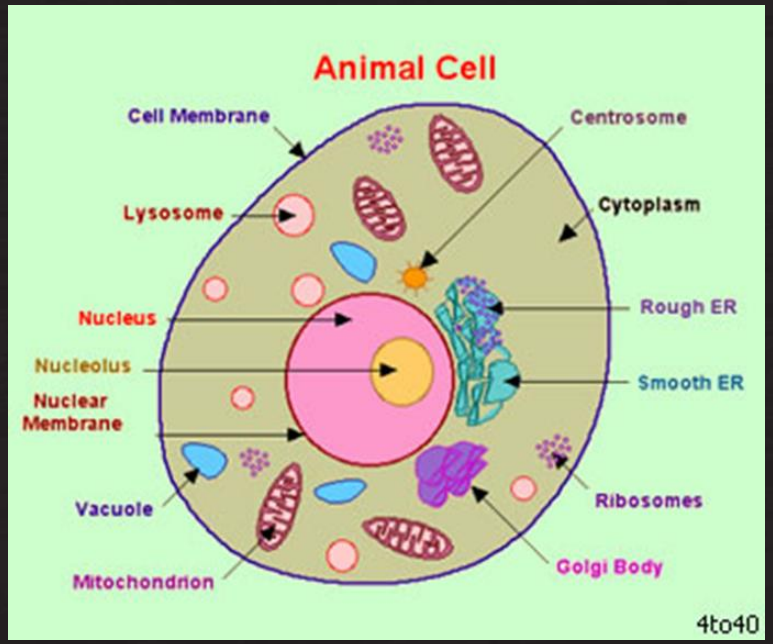
Organelles

- Like tiny organs in a cell
- Each has a specific structure and function
- Work together to keep the cell alive and healthy

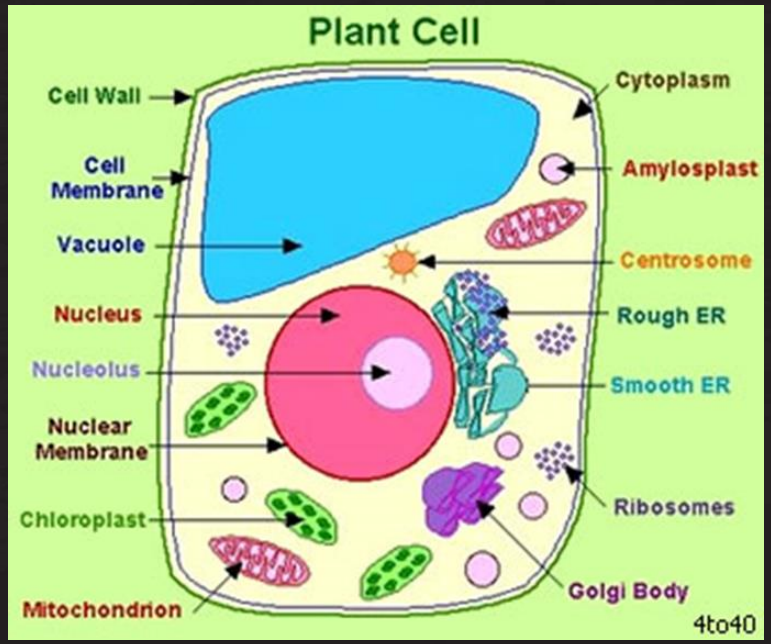

Introduction to Cells
with the Amoeba Sisters

Types of Cells

Animal Cell

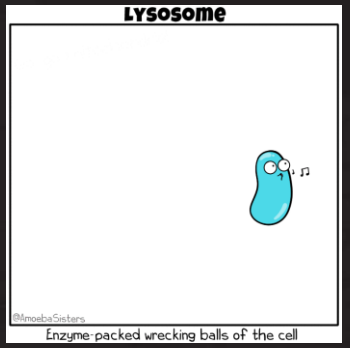


Plant Cell



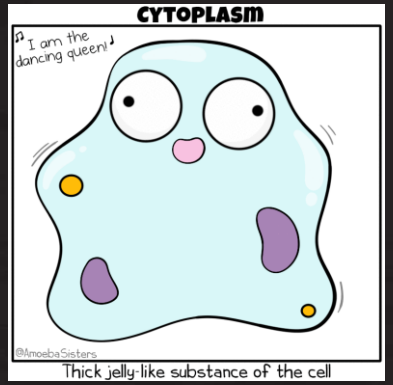
1. Cell membrane

- Surrounds the cell
- Supports and protects the cell
- Controls movement in and out of the cell



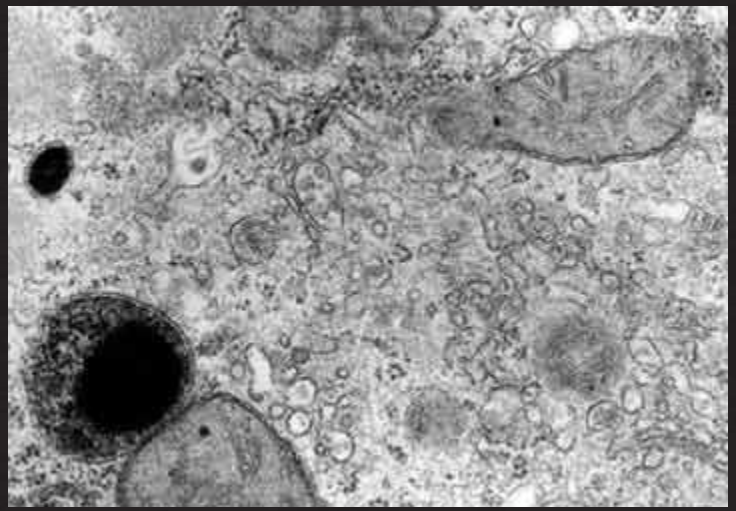
2. Lysosomes

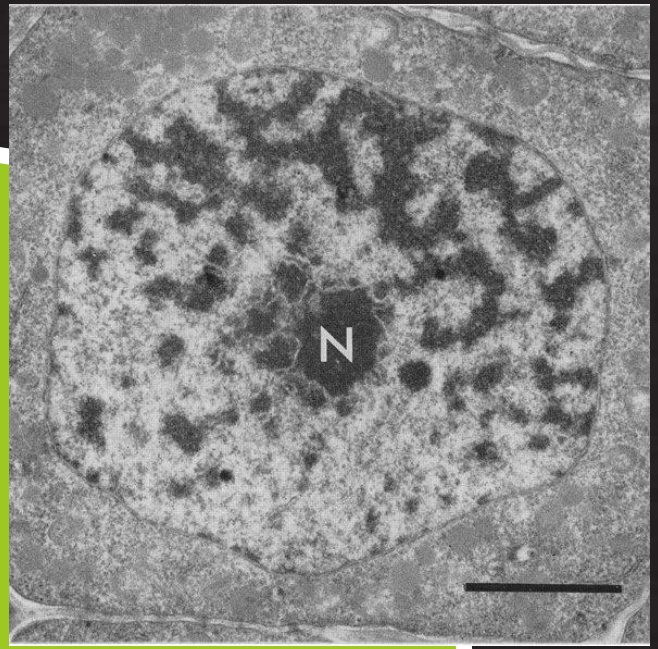
- Breaks down large food
- Digests old cell parts
- Cell's recycler

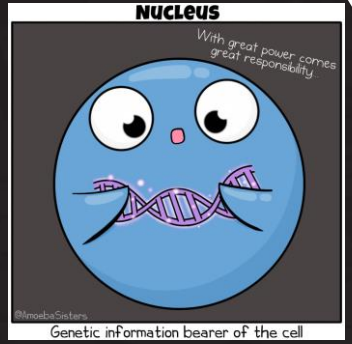


3. CYTOPLASM

- The cell's inner space
- Mostly made of water
- Organelles float in it





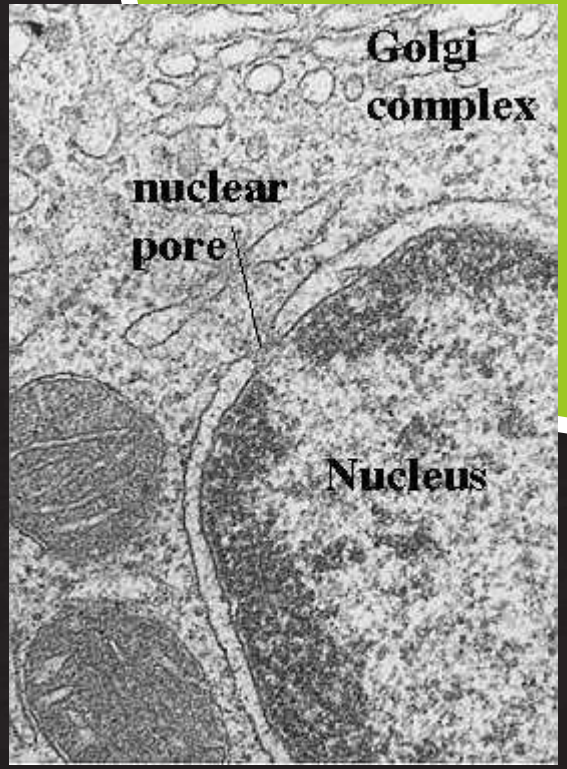


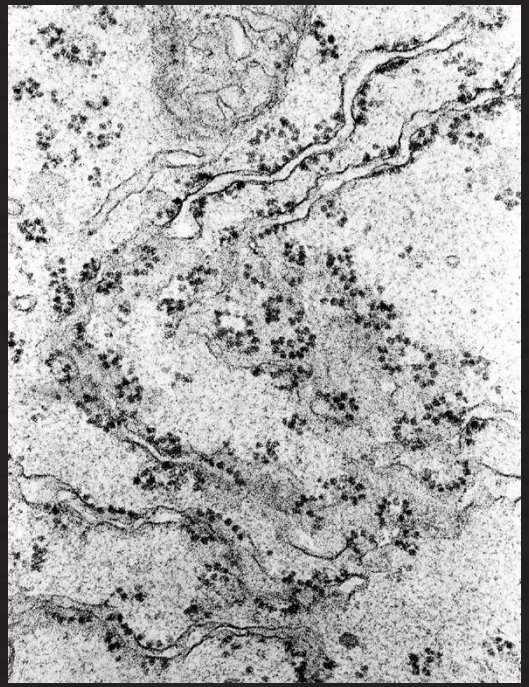
4. Nucleus

- The cell's manager
- Uses DNA to control the cell's activity

5. Nuclear membrane

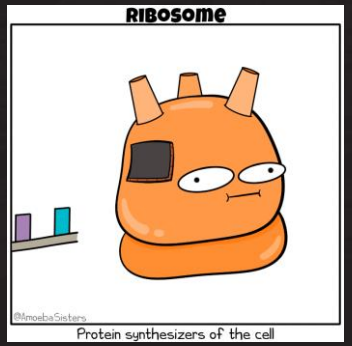
- Surrounds the nucleus
- Guards and protects the nucleus
- Allows materials to pass in and out

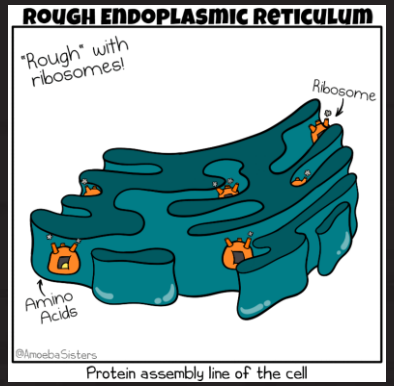




6. Ribosomes

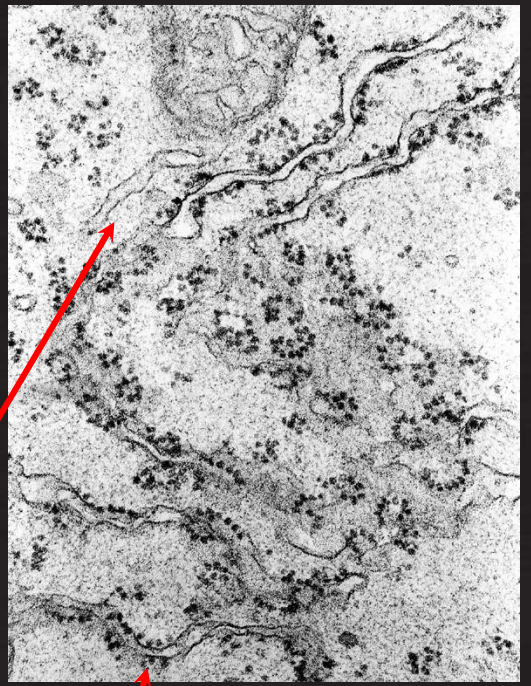
- Produces protein (which is the product of the cell)

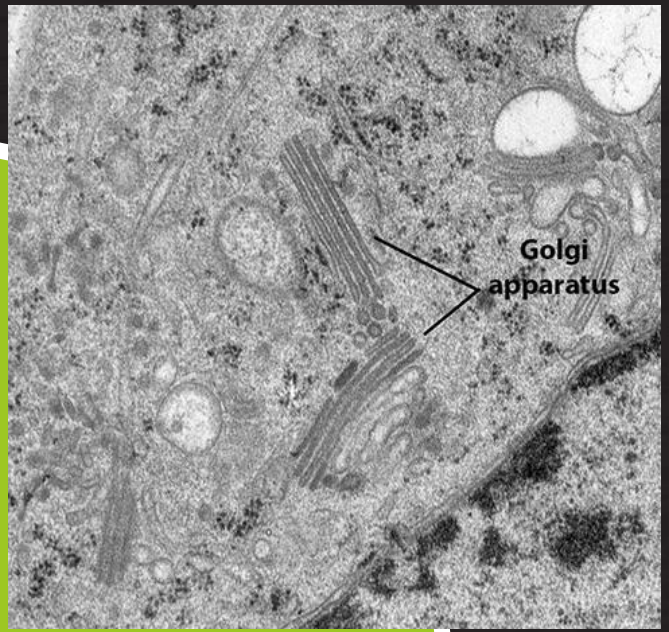


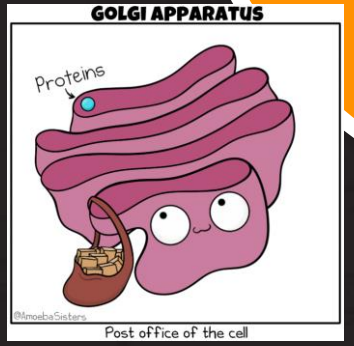


7. Endoplasmic Reticulum

- Carries material throughout the cell
- There are Rough ER and Smooth ER

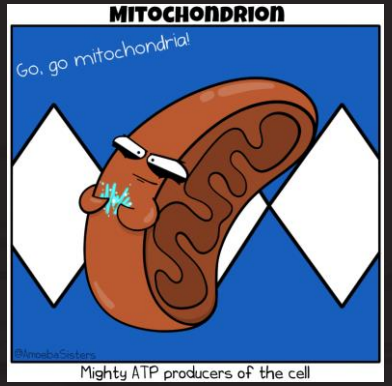






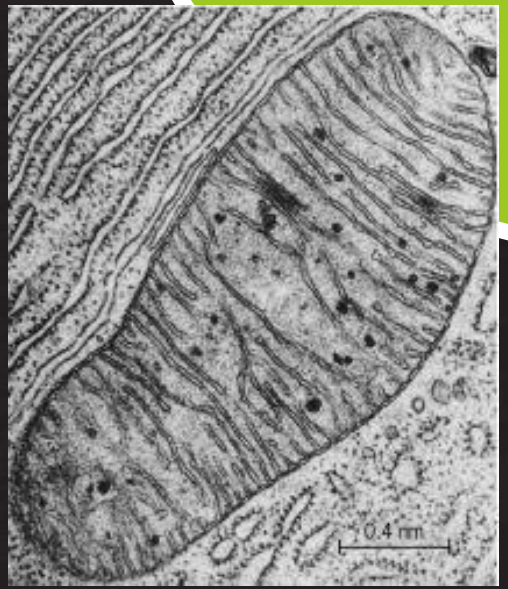
8. Golgi Bodies

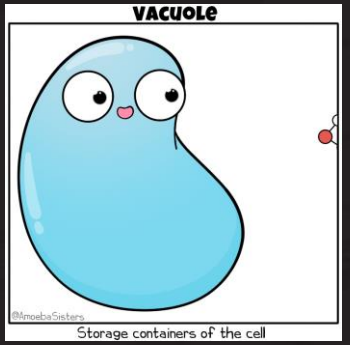
- Packs and carries proteins
- Prepares the proteins for use of delivery outside of the cell

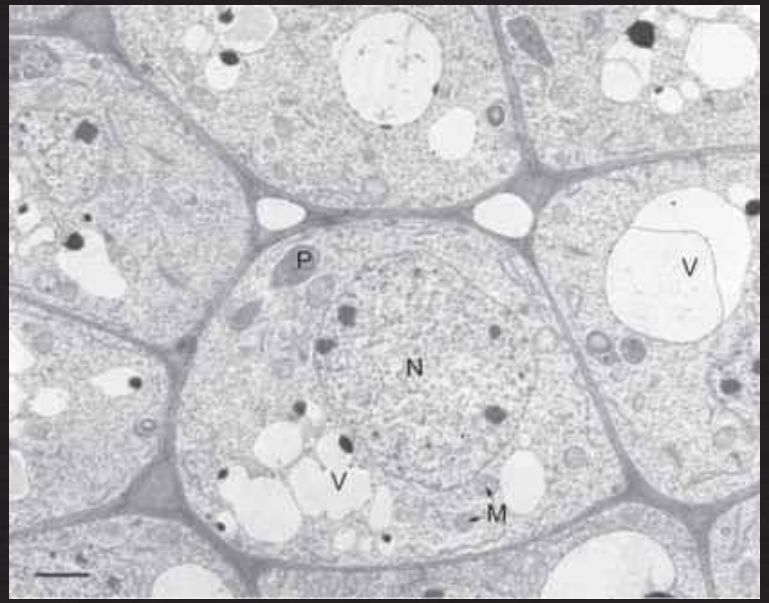


9. MITOCHONDRIA

- Supplies energy for the cell
- Breaks down sugar molecules into energy
- Needs oxygen and gives off carbon dioxide as waste







10. VACUOLES

- Storage bubbles found in the cell
- Stores food, nutrients, or waste

x+y

2x

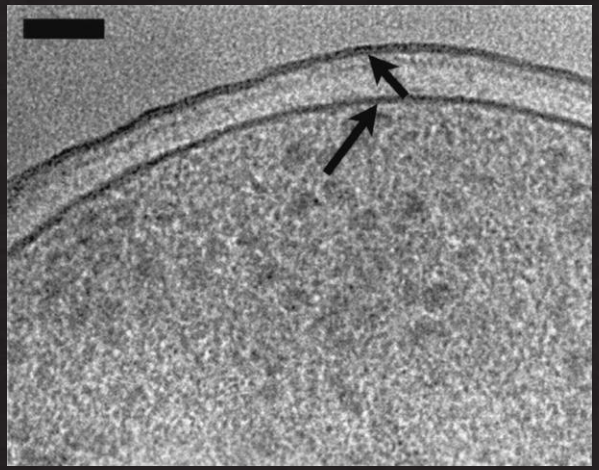
Next two are plant cell organelles only

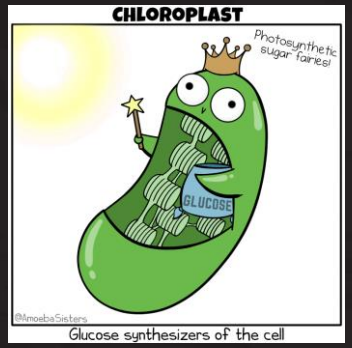
2x

x+y

11. Cell Wall

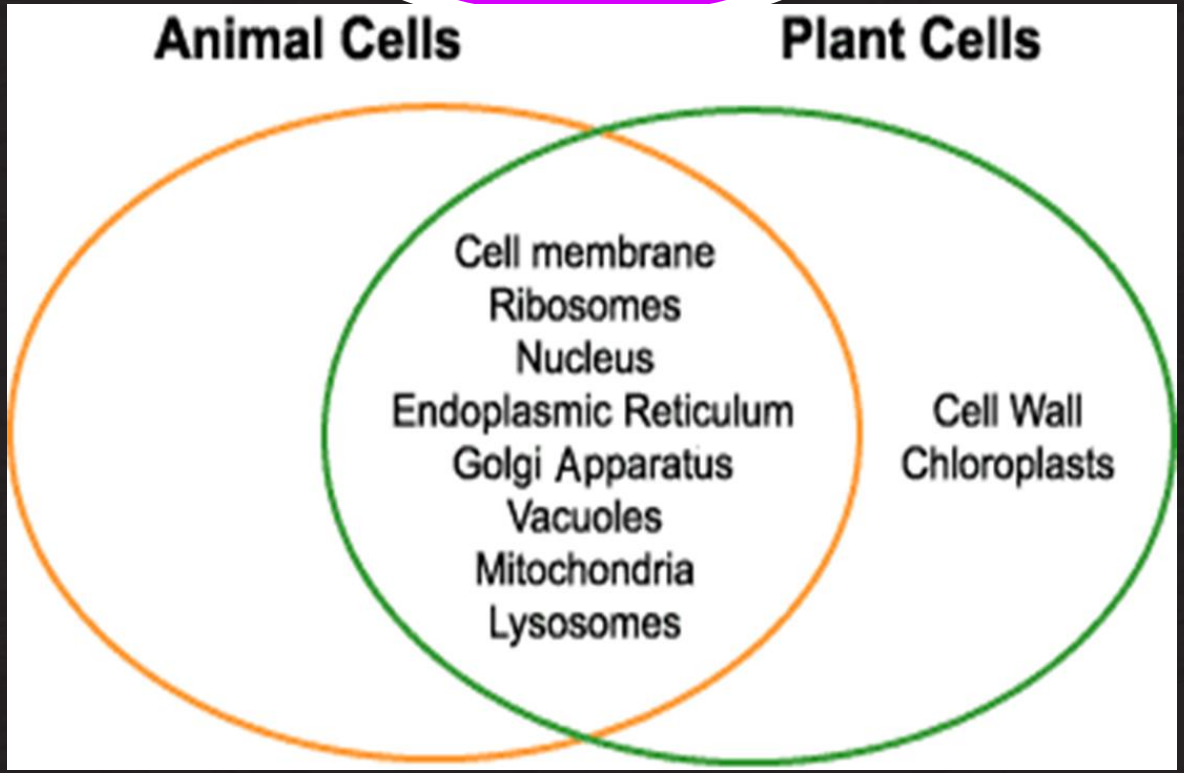
- Plant cells only
- Surrounds the cell membrane
- Gives plants their shape, structure, support and protection

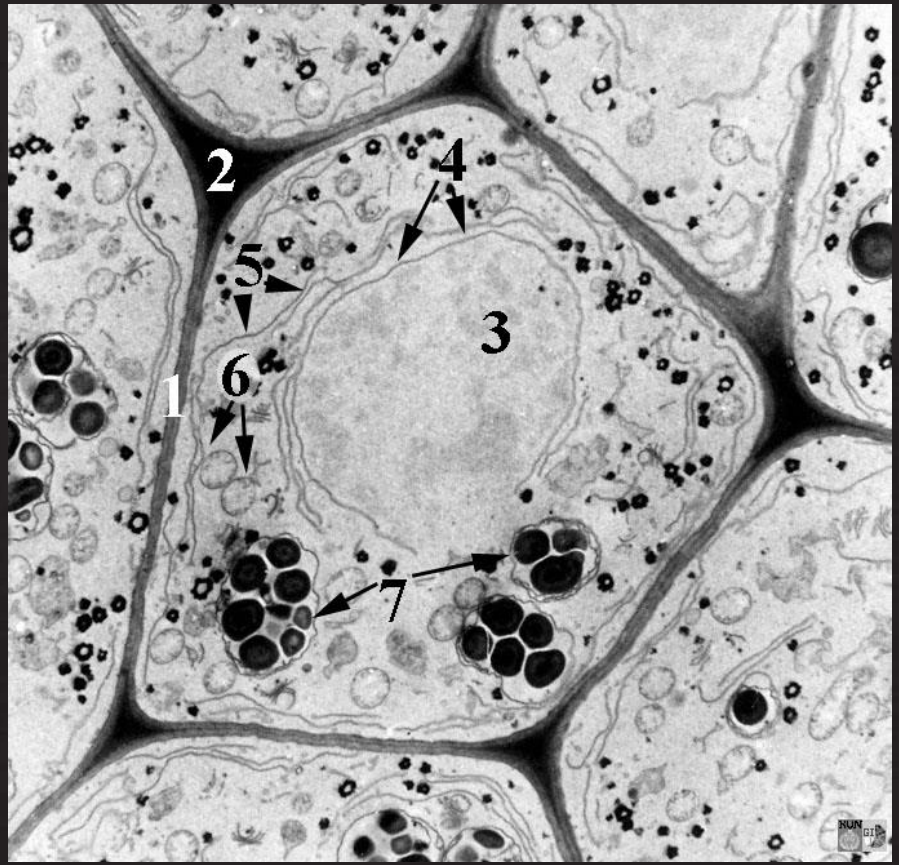


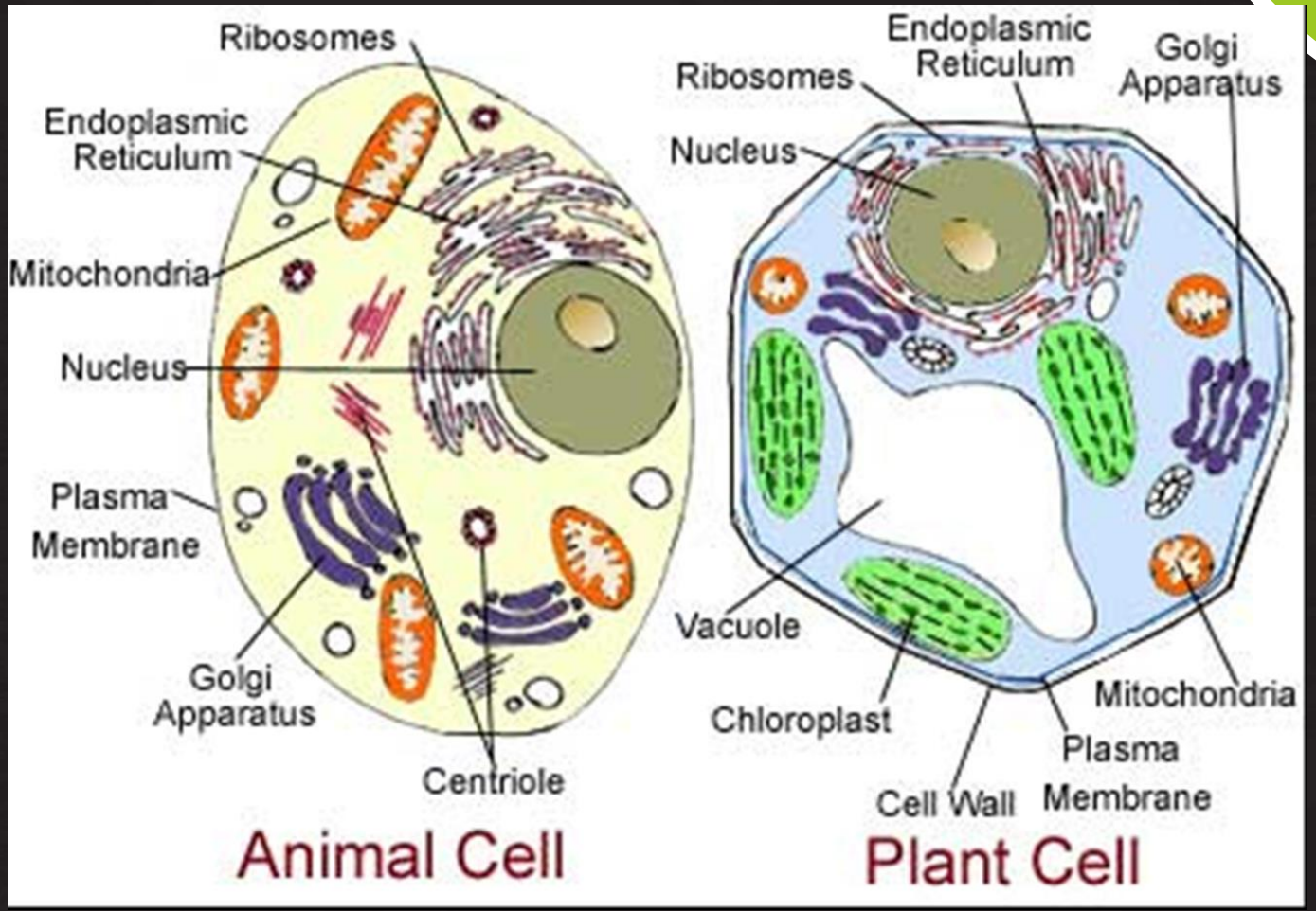


12. CHLOROPLASTS

- Plant cells only
- Where photosynthesis takes place
- Makes food for the plant and gives plants their green color


Animal Cells
Plant Cells
Cell membrane
Ribosomes
Nucleus
Endoplasmic Reticulum
Golgi Apparatus
Vacuoles
Mitochondria
Lysosomes
Cell Wall
Chloroplasts


1
2
3
4
5
6
7


Ribosomes
Endoplasmic Reticulum
Mitochondria
Nucleus
Plasma Membrane
Golgi Apparatus
Centriole
Animal Cell
Ribosomes
Endoplasmic Reticulum
Golgi Apparatus
Nucleus
Vacuole
Chloroplast
Mitochondria
Plasma Membrane
Cell Wall
Plant Cell

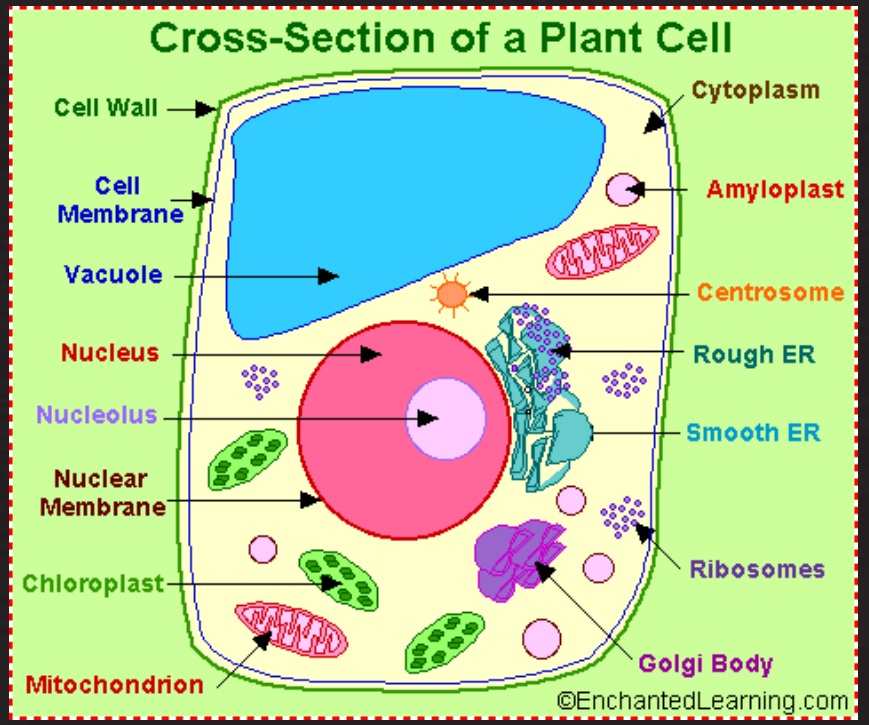
Organelles You Should Know

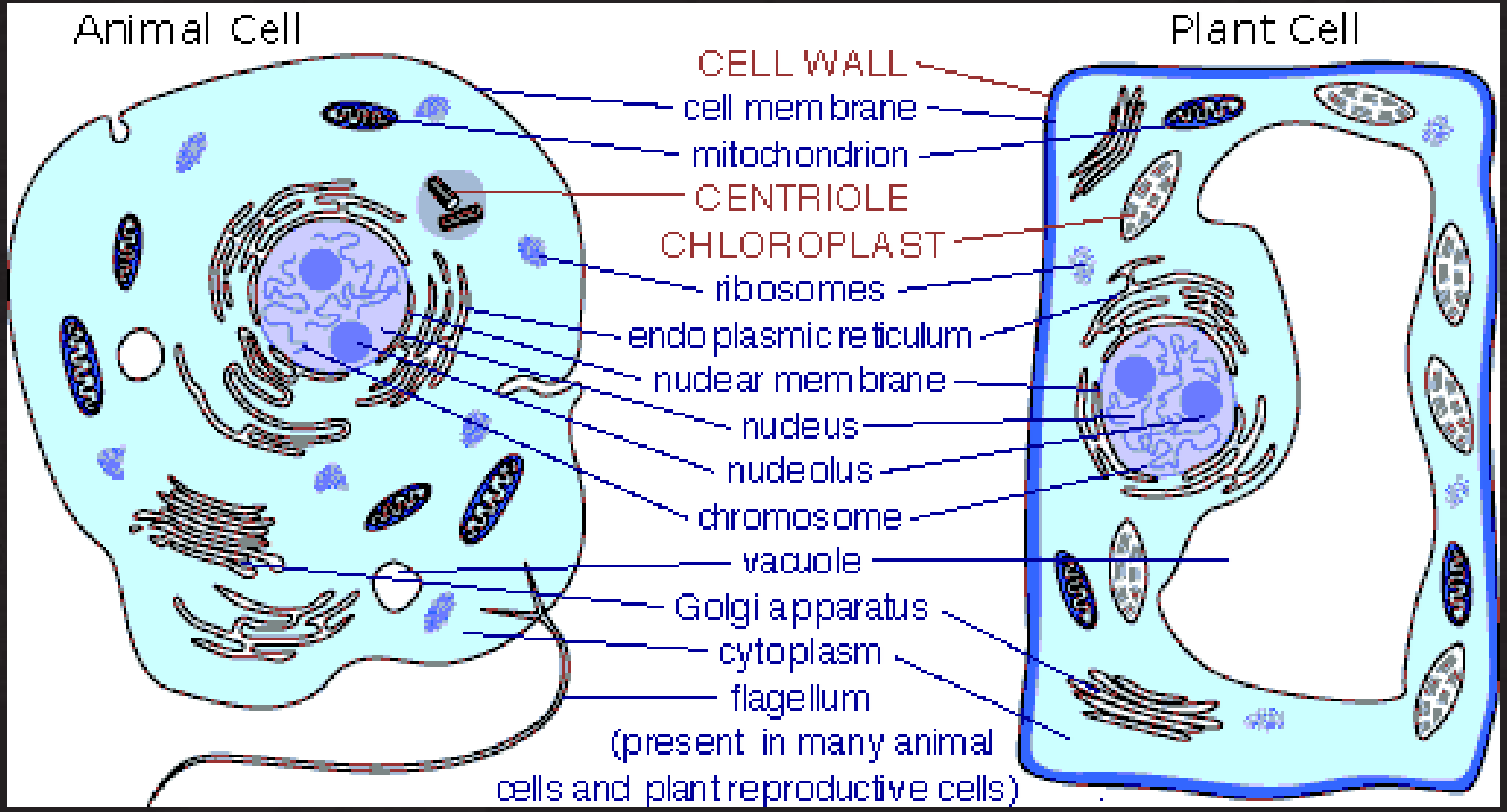
All Cells:

1. Cell Membrane
2. Lysosomes
3. Cytoplasm
4. Nucleus
5. Nuclear Membrane
6. Ribosomes
7. Endoplasmic Reticulum
8. Golgi Bodies
9. Mitochondria
10. Vacuoles

Plant Cells Only:

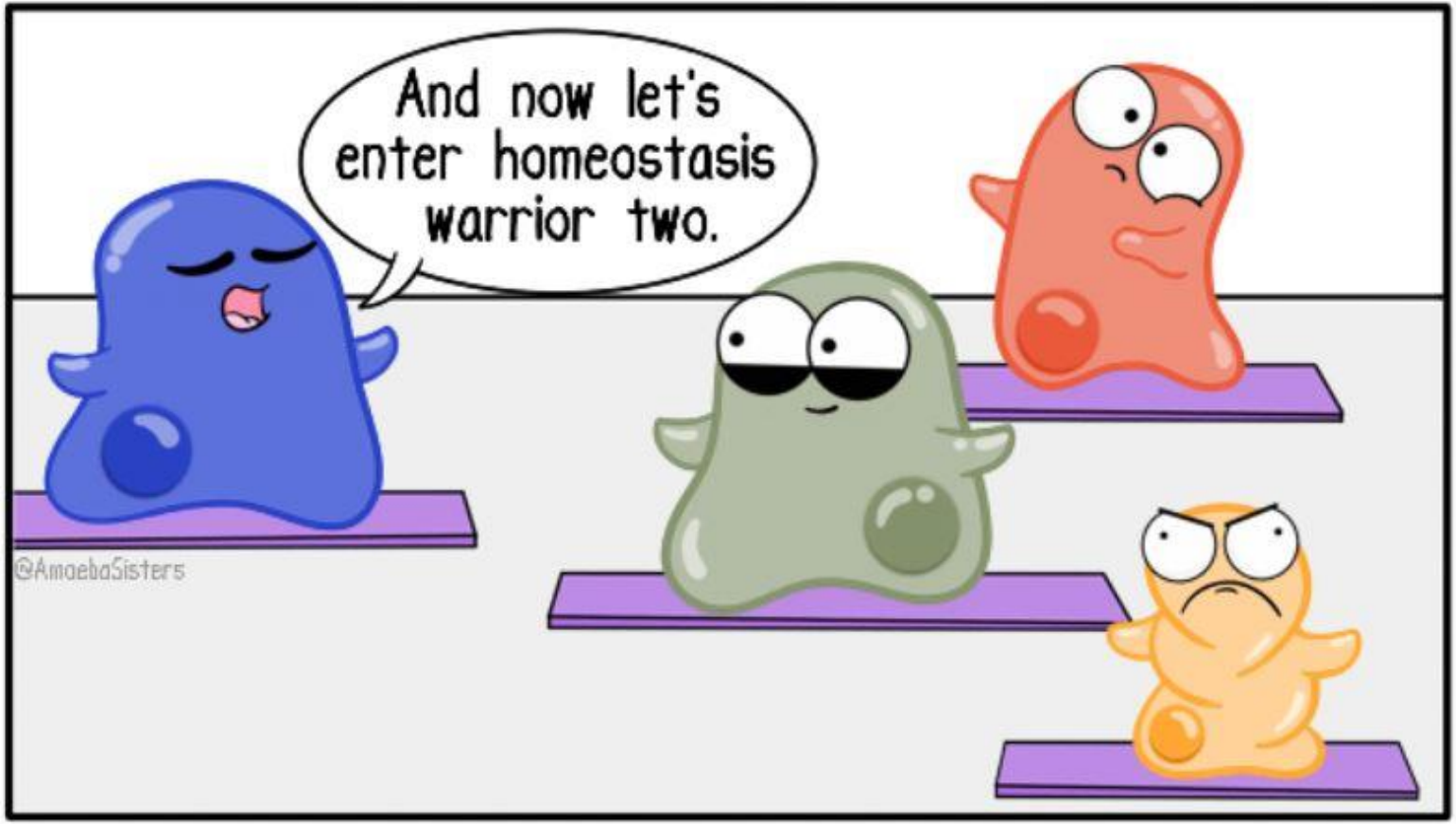
1. Cell Wall
2. Chloroplasts




Animal Cell
Plant Cell
CELL WALL
cell membrane
mitochondrion
CENTRIOLE
CHLOROPLAST
ribosomes
endoplasmic reticulum
nuclear membrane
nucleus
nucleolus
chromosome
vacuole
Golgi apparatus
cytoplasm
flagellum
(present in many animal
cells and plant reproductive cells)

WHAT TO READ MORE?

Check out your textbook starting on page 73



Cell membranes working hard to maintain homeostasis.

x+y

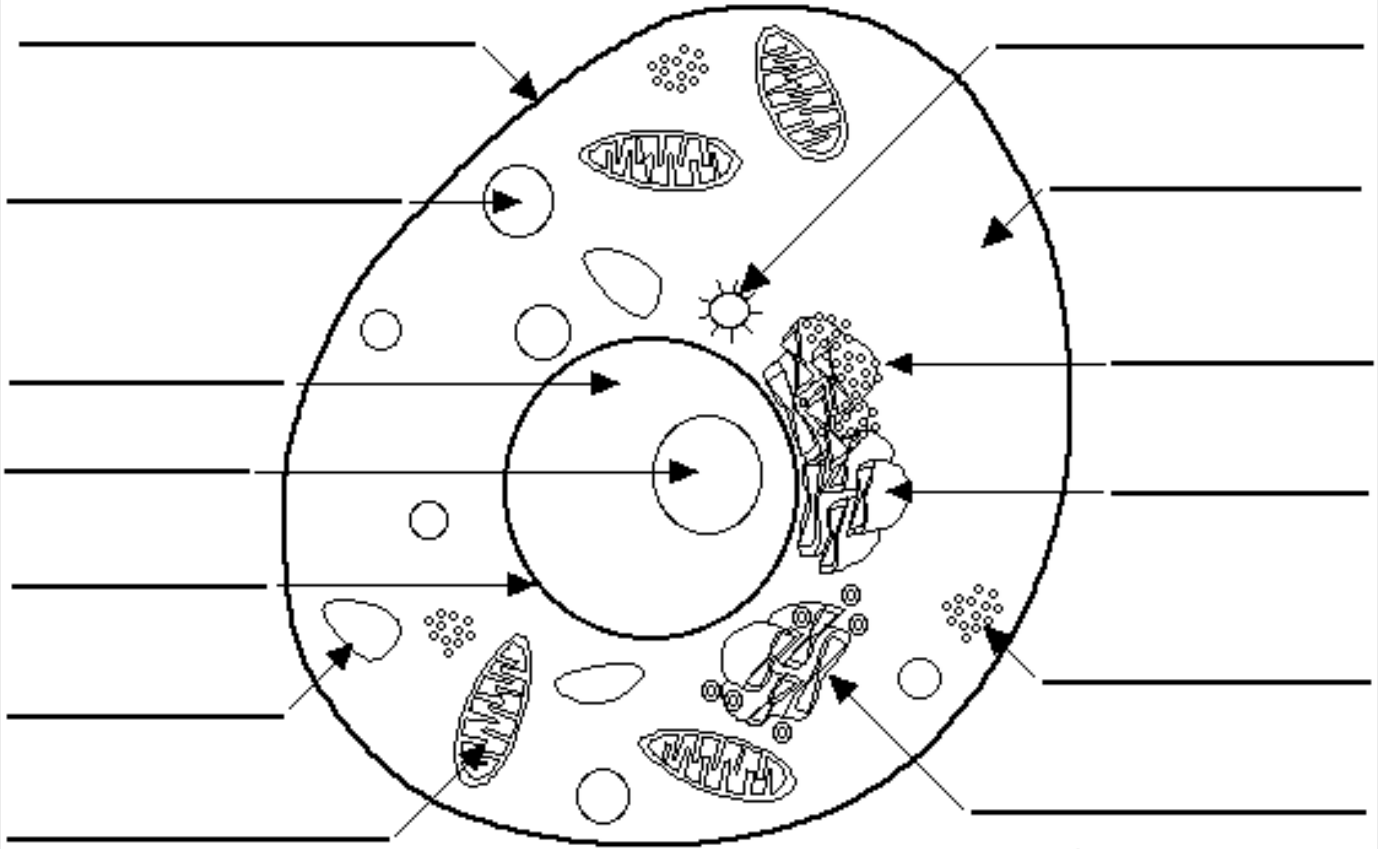
2x

Let's finish our notes!

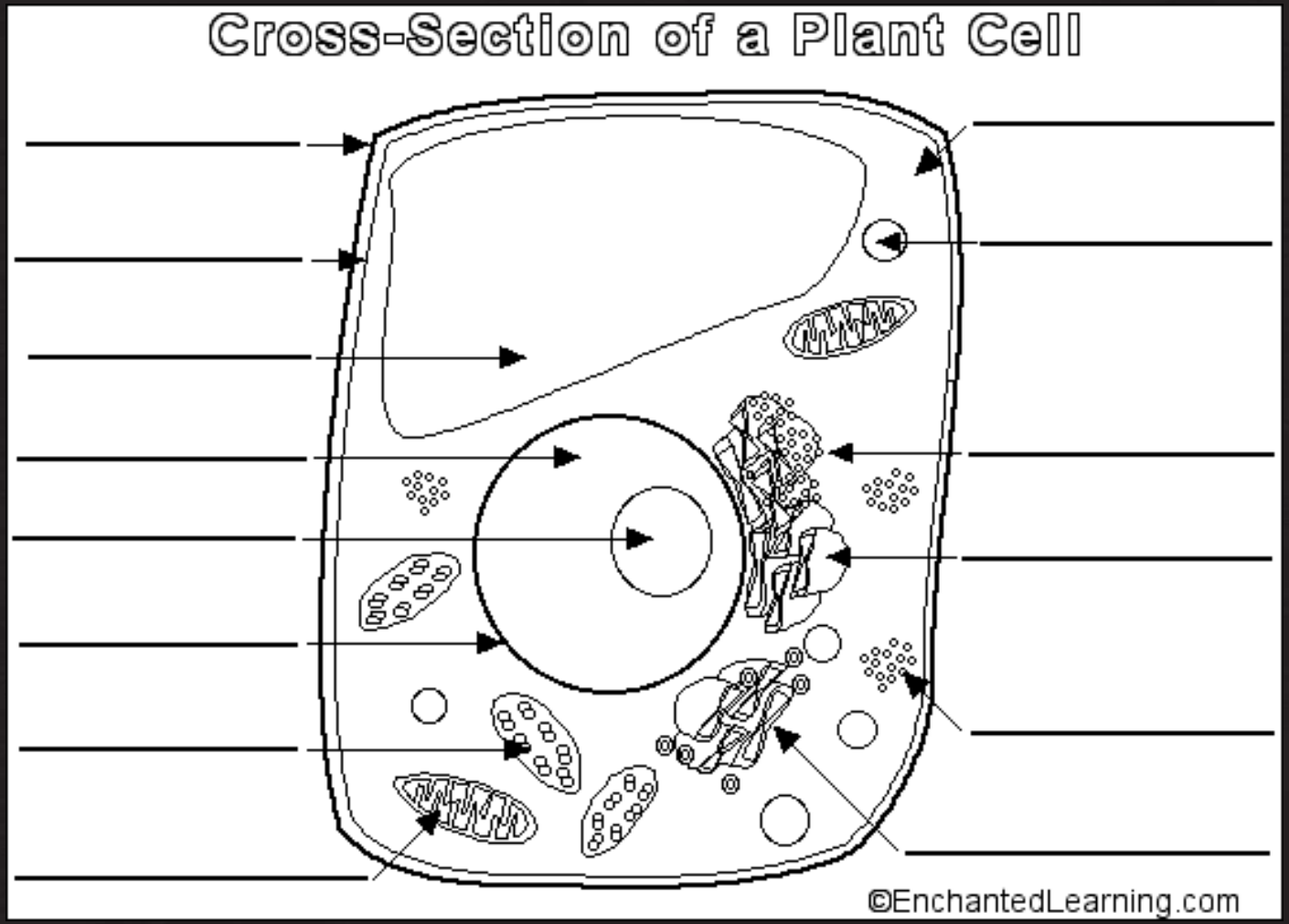
2x

x+y

Cross-Section of an Animal Cell



Cross-Section of a Plant Cell



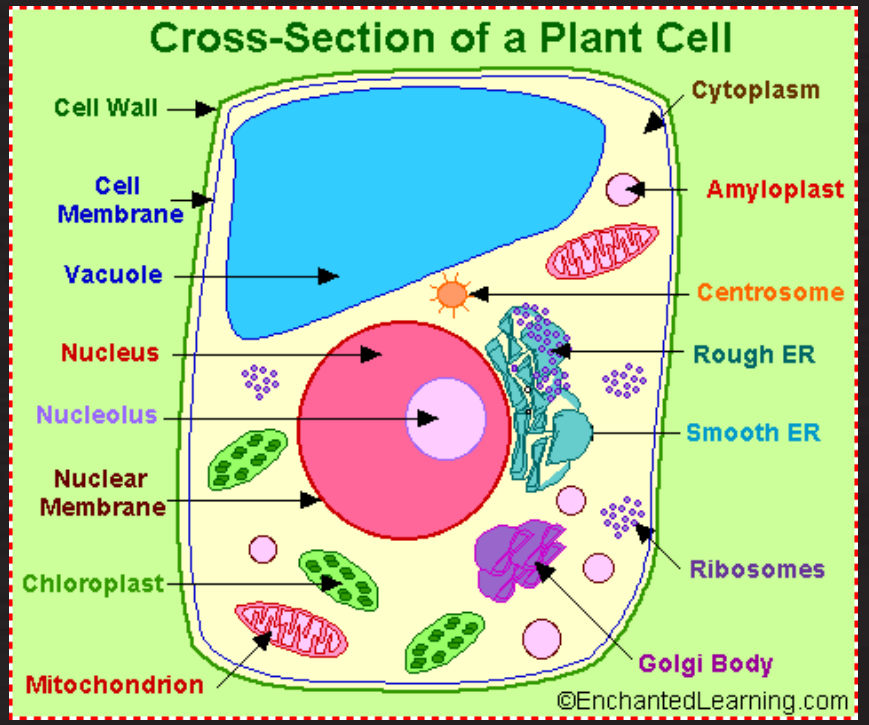
Organelles You Should Know

All Cells:

1. Cell Membrane
2. Lysosomes
3. Cytoplasm
4. Nucleus
5. Nuclear Membrane
6. Ribosomes
7. Endoplasmic Reticulum
8. Golgi Bodies
9. Mitochondria
10. Vacuoles

Plant Cells Only:

1. Cell Wall
2. Chloroplasts



x+y

2x

WHAT ARE EACH ORGANELLE'S FUNCTION?

2x

x+y

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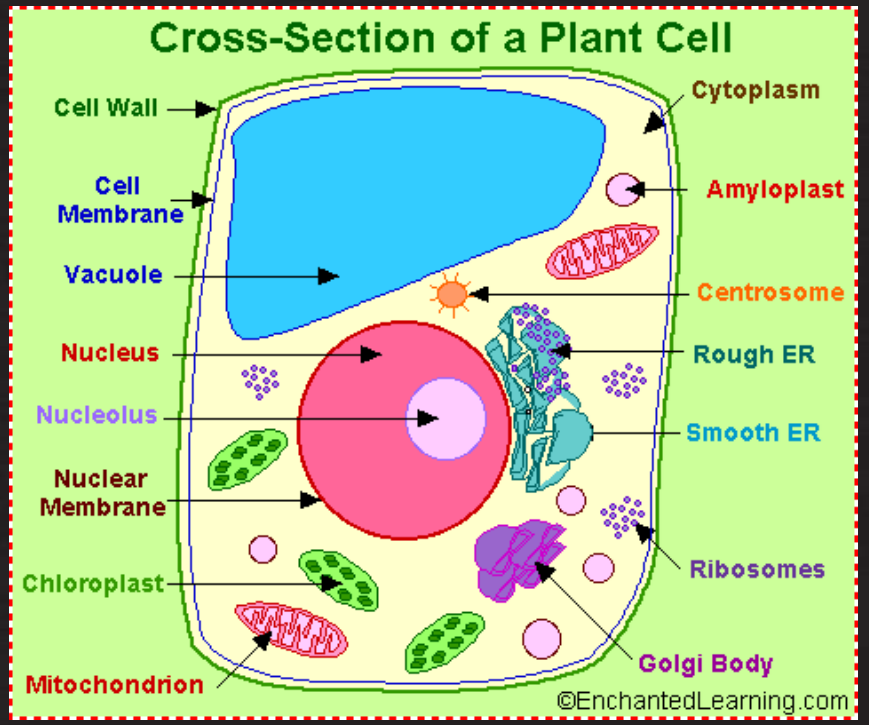


Explore cell structures!

01 Build a cell

Compare animal and plant cells by creating cells here

02 Learn more

Get more information on organelles here

03 Test yourself

Find out if you know the organelles of cells here

04 Even more!

Learn about even more organelles in cells here

Add to your notes from yesterday if needed

Explore more

- Build a cell: https://sepuplhs.org/middle/third-edition/simulations/cell_sim.html
- Learn more about each: https://www.cellsalive.com/cells/cell_model_js.htm
- Test yourself on organelles: https://askabiologist.asu.edu/cell-viewer-game/
- Even more organelles: https://www.wisc-online.com/learn/natural-science/life-science/ap11403/a-typical-animal-cell
- Want more advanced content?: https://www.biointeractive.org/taxonomy/term/191

Done early? Check out drawings and then microscope images of our organelles
http://www.cellimagelibrary.org/pages/cell_illustration.

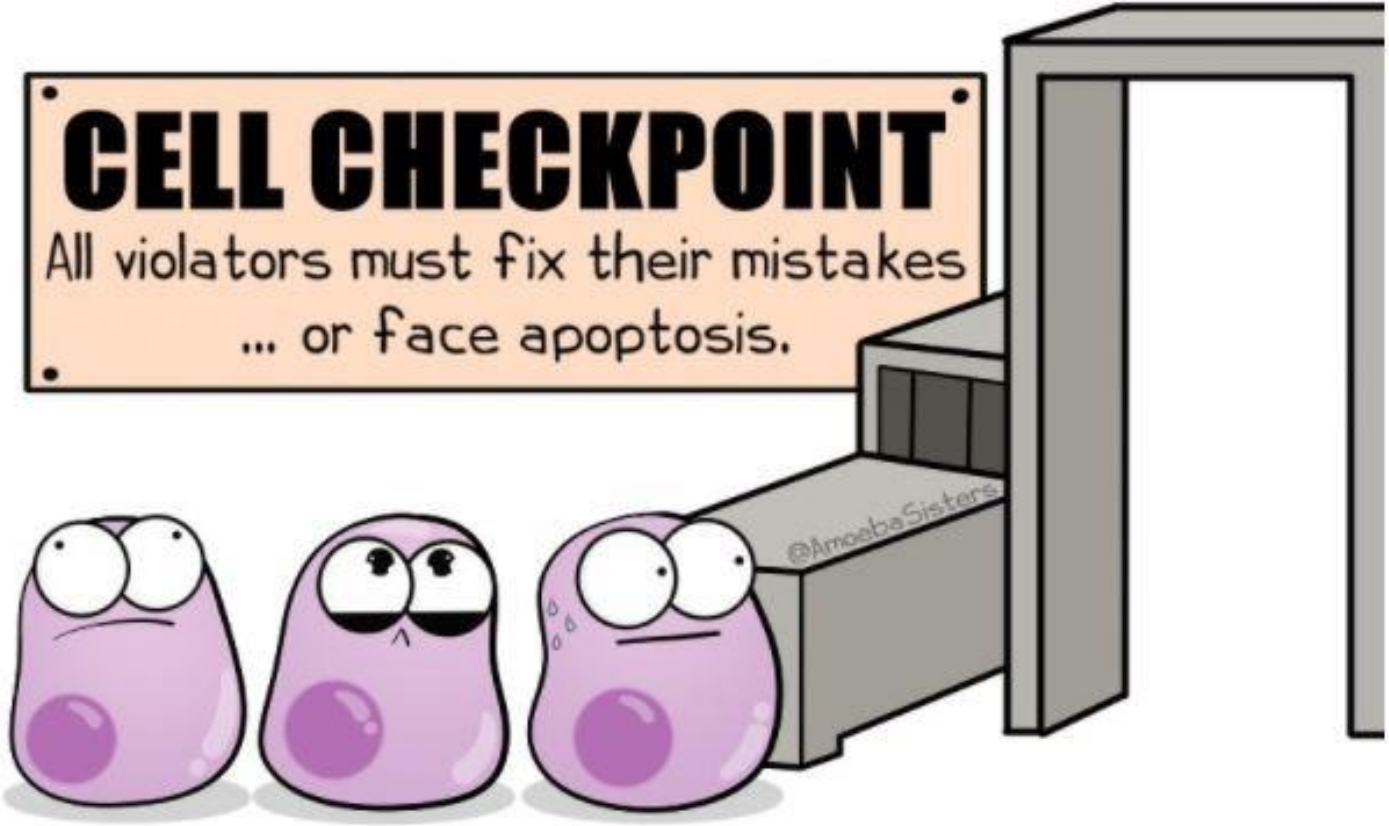
https://www.youtube.com/watch?v=8IlzKri08kk

WHAT IS THE FUNCTION OF EACH ORGANELLE?

2^x

$x+y$

1. Cell Membrane
2. Lysosomes
3. Cytoplasm
4. Nucleus
5. Nuclear Membrane
6. Ribosomes
7. Endoplasmic Reticulum
8. Golgi Bodies
9. Mitochondria
10. Vacuoles
11. Cell Wall
12. Chloroplasts



The cell checkpoints were always a site of intense scrutiny.

2^x

Have you noticed that the cell organelles kind of work together to function like a city?

$x+y$

Plant Cell

Golgi Bodies

Kind of like the mail or shipping trucks

Mitocondria

Kind of like the power plant of the city

Nucleus

Kind of like the mayor's office of a city

WHAT IS THE FUNCTION OF EACH ORGANELLE?

2^x

$x+y$

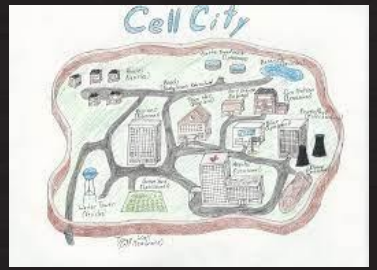
1. Cell Membrane
2. Lysosomes
3. Cytoplasm
4. Nucleus
5. Nuclear Membrane
6. Ribosomes
7. Endoplasmic Reticulum
8. Golgi Bodies
9. Mitochondria
10. Vacuoles
11. Cell Wall
12. Chloroplasts

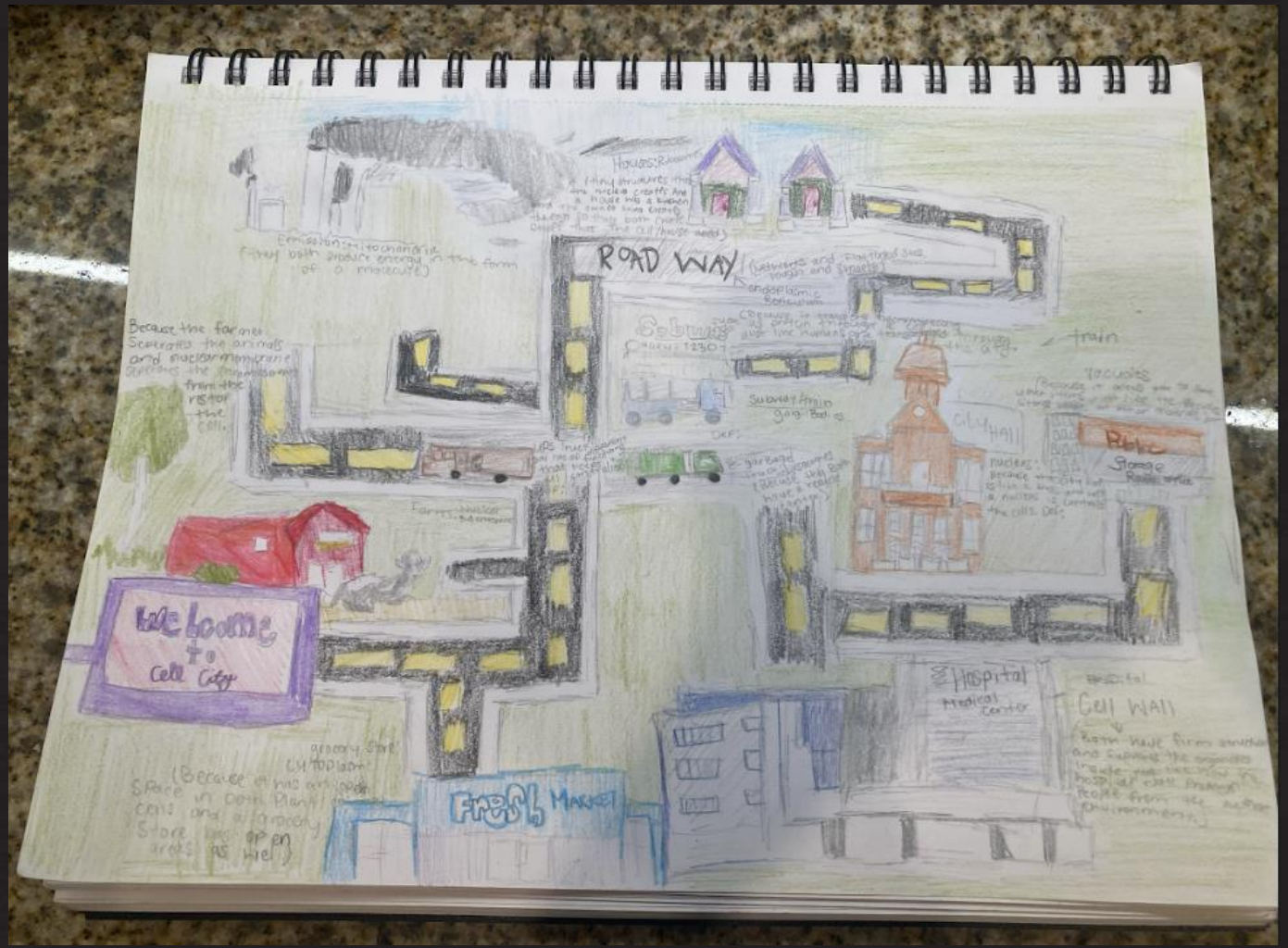
Cell City Assignment

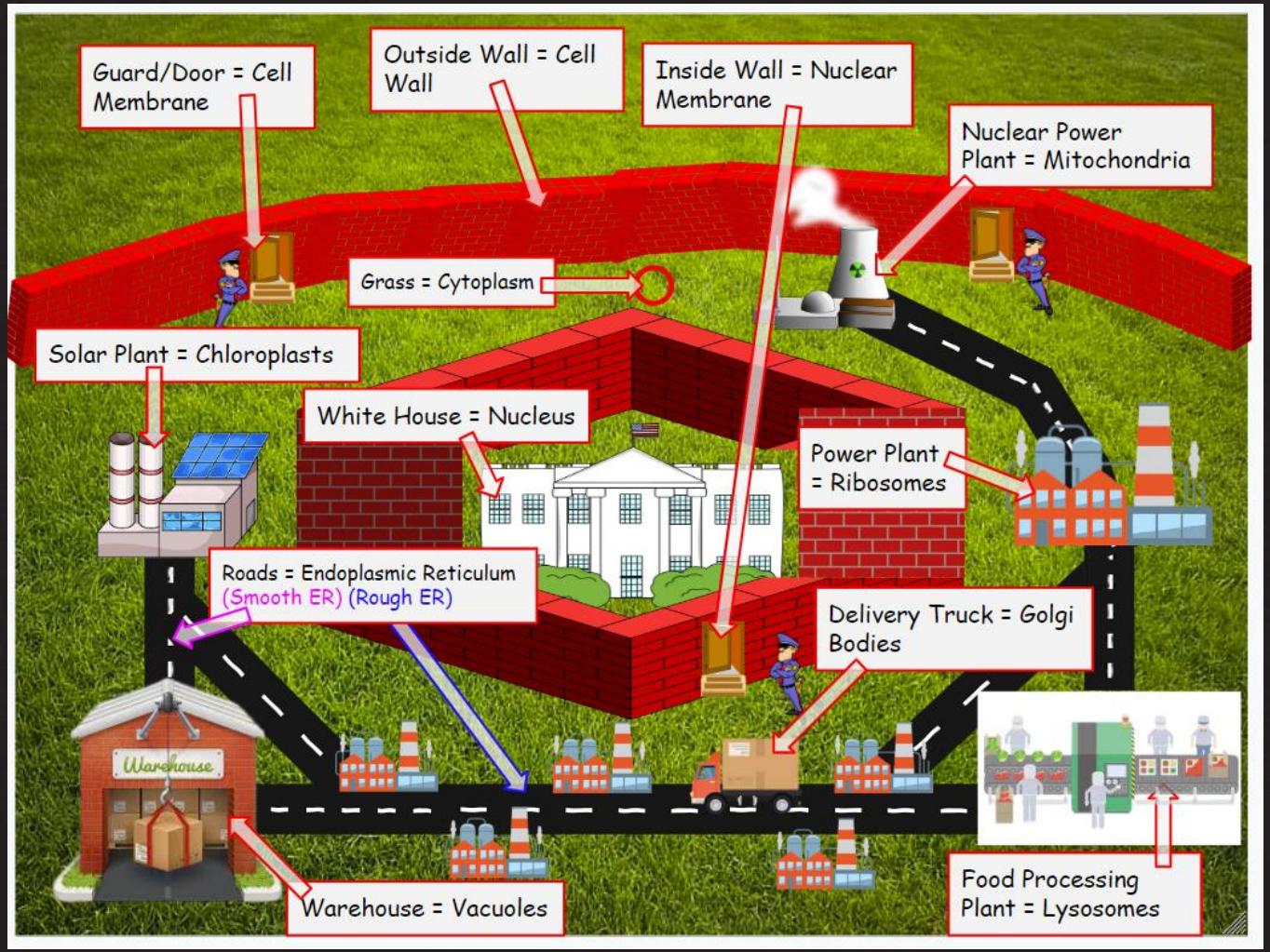
Using your knowledge of the organelles of a plant cell, create a city (modern day city, ancient city, specific city, or make up your own) that uses all twelve organelles in a unique way as a metaphor for how the organelle works in the cell.

Think about the function of the organelle in a cell and then think about how that same function could be done in a city.

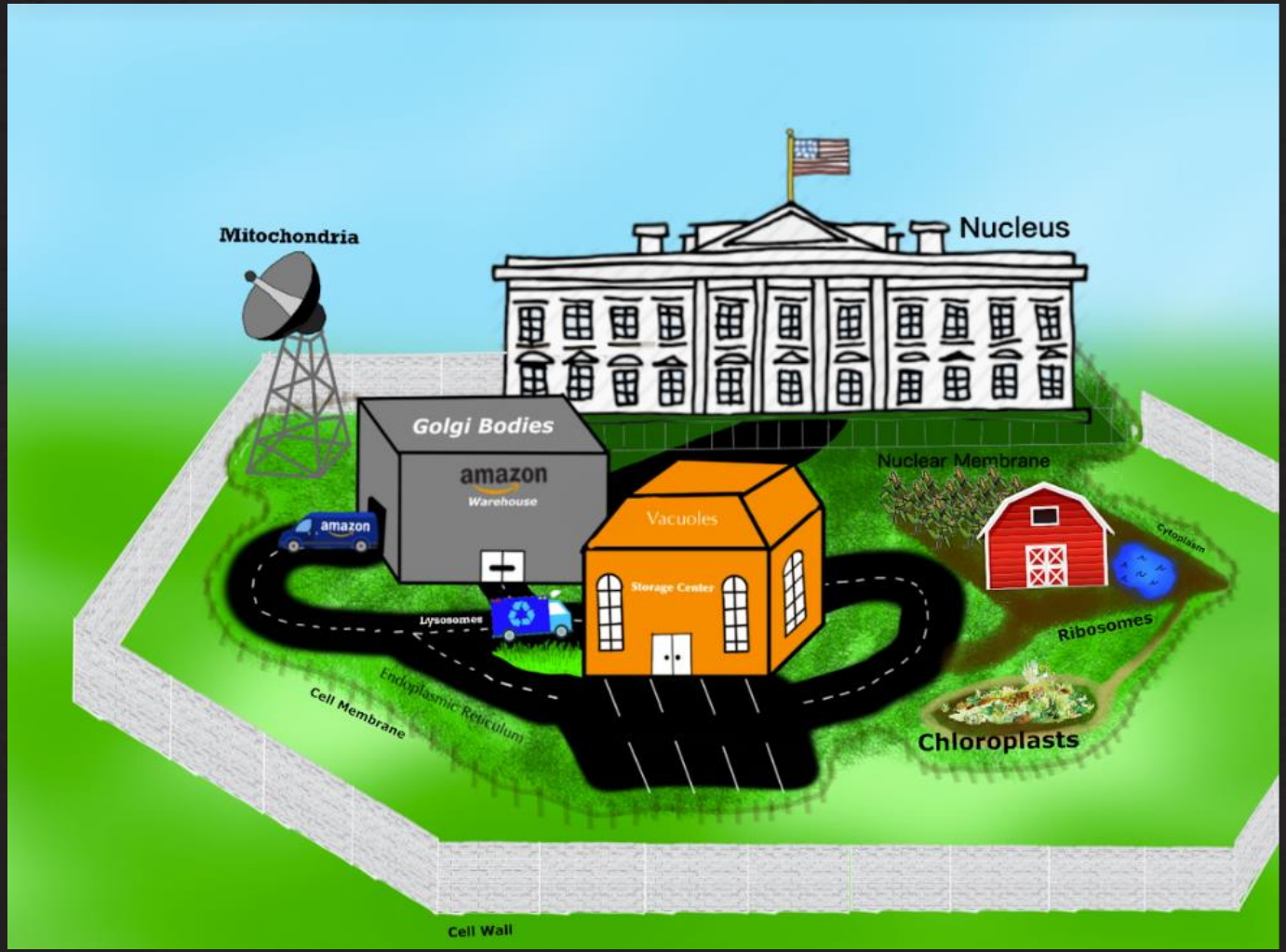
You have to use all twelve organelles with each organelle having a different job in the city (you cannot have one part of your city being two different organelles).




ROAD WAY
train
Hospital
Medical Center
Cell Wall
Fresh Market

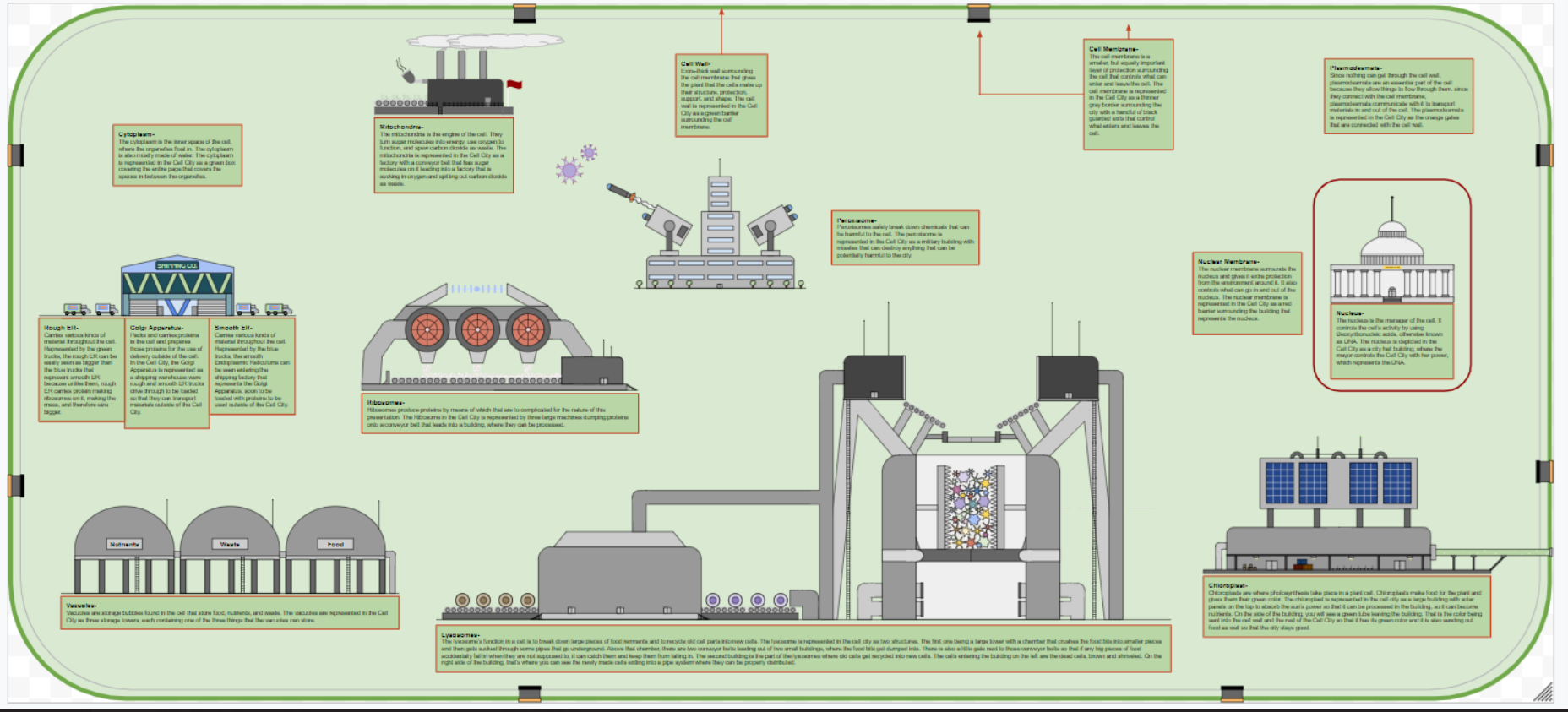


1. **Cell Membrane as the Guard/Door**:
   The cell membrane as the Guard/Door makes sense because both control movement in and out of them.
2. **Lysosomes as the Food Processing Plant**:
   The Lysosomes as the Food Processing Plant makes sense because both break down food and use them to make something else.
3. **Cytoplasm as the Grass**:
   The Cytoplasm as the Grass makes sense because the grass is the inner space between the buildings like the cell's cytoplasm between the organelles.
4. **Nucleus as the White House**:
   The Nucleus as the White House makes sense because like the White House, the nucleus controls the things that go on inside.
5. **Nuclear Membrane as the Inside Wall**:
   The Nuclear Membrane as the Inside Wall makes sense because they both guard the main control unit, or in the Nuclear Membrane's case, the nucleus.
6. **Ribosomes as the Power Plant**:
   The Ribosomes as the Power Plant makes sense because they both produce things.
7. **Endoplasmic Reticulum as the Road**:
   The Endoplasmic Reticulum as the Road makes sense because both of them create ways of transporting things.
8. **Golgi Bodies as the Delivery Truck**:
   The Golgi Bodies as the Delivery Truck makes sense because they both pack and carry things.
9. **Mitochondria as the Nuclear Power Plant**:
   The Mitochondria as the Nuclear Power Plant makes sense because both create energy.
10. **Vacuoles as the Warehouse**:
    The Vacuoles as the Warehouse makes sense because they both store stuff.
11. **Cell Wall as the Outside Wall**:
    The Cell Wall as the Outside Wall makes sense because both give shape, structure, support, and protection to the inside.
12. **Chloroplasts as the Solar Plant**:
    The Chloroplasts as the Solar Plant makes sense because both the Chloroplast and the



Cell City (Click for City)

- [ ] The Cell Membrane is the fence around the cell city. It is supporting the cell and controlling what comes in and out.
- [ ] The Lysosomes are recycling trucks. (I only drew 1 though) They break down food and remains of cell parts.
- [ ] The Cytoplasm in this city is represented by a pond. Cytoplasm is mostly made of water and organelles can float in it. Cytoplasm makes up the cells innerspace which I did not accomplish in this drawing.
- [ ] The Nucleus is the White House. It tells all of the other organelles what to do. In a human it uses DNA to control activity but in this city it uses power and dominance I guess.
- [ ] The Nuclear Membrane is the fence around the White House or Nucleus. It protects and decides what goes in and out of the Nucleus.
- [ ] Most food starts out from a farm of some sort which is why Ribosomes are represented by a farm. They produce protein and are the food factory of the cell.
- [ ] The roads of the cell city are the cell's Endoplasmic Reticulum or ER. They carry materials throughout the cell and can be rough or smooth like real roads.
- [ ] Golgi Bodies pack protein and prepare them for delivery. I made them the Amazon Warehouse because that is where things are packed and prepared for delivery.
- [ ] Mitochondria is represented by a cell tower because Mitochondria supplies energy for the cell. Cell towers supply power and energy to our devices so I think it is a good fit.
- [ ] The Storage Center, aka, the Vacuoles, store food, waste, and nutrients. In a real city it makes sense for them to store our junk!
- [ ] The Cell Wall is the brick wall around the entire city. It surrounds everything in the city including the Cell Membrane. It supports, protects, and gives the city its shape.
- [ ] The Chloroplasts are the garden in the cell city. Photosynthesis takes place in gardens just like in Chloroplasts. They color and give food to plants.


Cytoplasm-
The cytoplasm is the inner space of the cell, where the organelles float in. The cytoplasm is also mostly made of water. The cytoplasm is represented in the Cell City as a green box covering the entire page that covers the spaces in between the organelles.
Mitochondria-
The mitochondria is the engine of the cell. They turn sugar molecules into energy, use oxygen to function, and spew carbon dioxide as waste. The mitochondria is represented in the Cell City as a factory with a conveyor belt that has sugar molecules on it leading into a factory that is sucking in oxygen and spitting out carbon dioxide as waste.
Cell Wall-
Extra-thick wall surrounding the cell membrane that gives the plant that the cells make up their structure, protection, support, and shape. The cell wall is represented in the Cell City as a green barrier surrounding the cell membrane.
Cell Membrane-
The cell membrane is a smaller, but equally important layer of protection surrounding the cell that controls what can enter and leave the cell. The cell membrane is represented in the Cell City as a thinner gray barrier surrounding the city with a handful of black guarded exits that control what enters and leaves the cell.
Plasmodesmata-
Since nothing can get through the cell wall, plasmodesmata are an essential part of the cell because they allow things to flow through them, since they connect with the cell membranes. plasmodesmata communicate with it to transport materials in and out of the cell. The plasmodesmata is represented in the Cell City as the orange gates that are connected with the cell wall.
Peroxisome-
Peroxisomes safely break down chemicals that can be harmful to the cell. The peroxisome is represented in the Cell City as a military building with missiles that can destroy anything that can be potentially harmful to the city.
Nuclear Membrane-
The nuclear membrane surrounds the nucleus and gives it extra protection from the environment around it. It also controls what can go in and out of the nucleus. The nuclear membrane is represented in the Cell City as a red barrier surrounding the building that represents the nucleus.
Nucleus-
The nucleus is the manager of the cell. It controls the cell's activity by using Deoxyribonucleic acids, otherwise known as DNA. The nucleus is depicted in the Cell City as a city hall building, where the mayor controls the Cell City with her power, which represents the DNA.
SHIPPING CO.
Rough ER-
Carries various kinds of material throughout the cell. Represented by the green trucks, the rough ER can be easily seen as bigger than the blue trucks that represent smooth ER because unlike them, rough ER carries protein making ribosomes on it, making the mass, and therefore size bigger.
Golgi Apparatus-
Packs and carries proteins in the cell and prepares those proteins for the use of delivery outside of the cell. In the Cell City, the Golgi Apparatus is represented as a shipping warehouse were rough and smooth ER trucks drive through to be loaded so that they can transport materials outside of the Cell City.
Smooth ER-
Carries various kinds of material throughout the cell. Represented by the blue trucks, the smooth Endoplasmic Reticulums can be seen entering the shipping factory that represents the Golgi Apparatus, soon to be loaded with proteins to be used outside of the Cell City.
Ribosomes-
Ribosomes produce proteins by means of which that are to complicated for the nature of this presentation. The Ribosome in the Cell City is represented by three large machines dumping proteins onto a conveyor belt that leads into a building, where they can be processed.
Nutrients
Waste
Food
Vacuoles-
Vacuoles are storage bubbles found in the cell that store food, nutrients, and waste. The vacuoles are represented in the Cell City as three storage towers, each containing one of the three things that the vacuoles can store.
Lysosomes-
The lysosome's function in a cell is to break down large pieces of food remnants and to recycle old cell parts into new cells. The lysosome is represented in the cell city as two structures. The first one being a large tower with a chamber that crushes the food bits into smaller pieces and then gets sucked through some pipes that go underground. Above that chamber, there are two conveyor belts leading out of two small buildings, where the food bits get dumped into. There is also a little gate next to those conveyor belts so that if any big pieces of food accidentally fall in when they are not supposed to, it can catch them and keep them from falling in. The second building is the part of the lysosomes where old cells get recycled into new cells. The cells entering the building on the left are the dead cells, brown and shriveled. On the right side of the building, that's where you can see the newly made cells exiting into a pipe system where they can be properly distributed.
Chloroplast-
Chloroplasts are where photosynthesis take place in a plant cell. Chloroplasts make food for the plant and gives them their green color. The chloroplast is represented in the cell city as a large building with solar panels on the top to absorb the sun's power so that it can be processed in the building, so it can become nutrients. On the side of the building, you will see a green tube leaving the building. That is the color being sent into the cell wall and the rest of the Cell City so that it has its green color and it is also sending out food as well so that the city stays good.

10. **Vacuoles:** I represented vacuoles as a grocery store because vacuoles store food, nutrients, or waste. A grocery store stores food. That food gives you nutrients, and the store might have a restroom too.

11. **Cell wall:** I represented the cell wall as the ocean. The cell wall is an extra layer of protection and surrounds the membrane, like the ocean. The ocean can keep a barrier between the island and other places around the world.

12. **Chloroplasts:** Chloroplasts make food for a plant. A bakery can be similar because a chef makes the bread which gives people food.

x+y

2x

WHAT QUESTIONS DO YOU HAVE?

2x

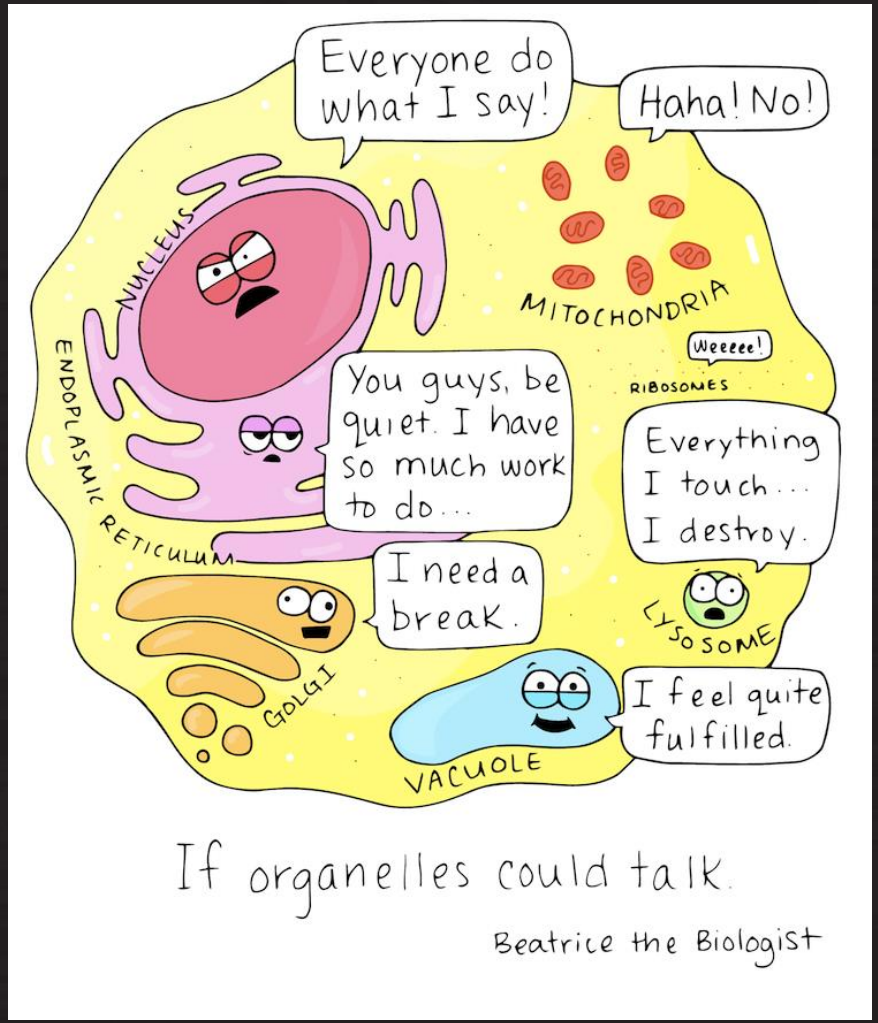
x+y

Cell City Assignment

Using your knowledge of the organelles of a plant cell, create a city (modern day city, ancient city, specific city, or make up your own) that uses all twelve organelles in a unique way as a metaphor for how the organelle works in the cell.

Think about the function of the organelle in a cell and then think about how that same function could be done in a city.

You have to use all twelve organelles with each organelle having a different job in the city (you cannot have one part of your city being two different organelles).


Everyone do what I say!
Haha! No!
NUCLEUS
MITOCHONDRIA
Weeeee!
RIBOSOMES
ENDOPLASMIC RETICULUM
You guys, be quiet. I have so much work to do...
Everything I touch... I destroy.
I need a break.
LYSOSOME
GOLGI
I feel quite fulfilled.
VACUOLE
If organelles could talk.
Beatrice the Biologist