CHAPTER 29

In this unit, you will be exploring the tiny world of **cells**! If you remember in chapter 25, you first learned that your cells make up everything that is in your body!

Your cells act just like building blocks...you can put them together to make all kinds of things like your skin, muscles, organs, blood and all other kinds of things as well.

But you can find cells in every living creature, not just in humans! That's right...

Every organism in every kingdom is made up of at least one cell!

In this unit, you will be looking at how animal cells, plant cells and bacteria cells look, act and work.

But first, I think it would help if we reviewed some topics...

There is so much biodiversity on the planet (don't forget that "biodiversity" means "all of the different kinds of life that exist on the world") scientists have placed all living things into groups. They do this to make it easier to study them! These groups can be put in order from largest to smallest:

Kingdoms
Populations
Organisms
Organs
Tissues
Cells

Out of all of these groups, **kingdoms** are the largest of them all! In fact, kingdoms are made up of many **populations**. These populations are made up of individual **organisms**. Some organisms use **organs** to stay alive. These organs are made up of **tissues**. Tissues are made up of large groups of **cells**!

Cells can be placed into two different groups:

Prokaryotic ("pro-carry-ot-ik")

and

Eukaryotic ("u-carry-ot-ik")

There are many things about prokaryotic and eukaryotic cells that are the same:

- They both must use food to keep them alive.
- They both must be able to grow.
- They both react to changes in the environment
- They both can make another of its own kind (which is known as "reproduction")
- They both can let air in and out of themselves (for example...breathing)

Do these things look familiar to you? They should! These are the basic needs for all living organisms you learned about in chapter one!

And...

- They both have a **membrane** around them.

  A membrane is a covering that surrounds the cell and protects it! It also lets nutrients, water and air into and out of the cell!

- They both have **DNA**.

  DNA is a group of chemicals that contain all of the instructions for making all the structures and materials an organism needs to survive!

- They both have **cytoplasm**.

  cytoplasm ("sight-o-plaz-m") is a gooey fluid that fills up the inside of a cell, just like a water balloon!

Not all things are the same between prokaryotic and eukaryotic cells...

Let's look at what makes them different!

If you are prokaryotic, you are made up of only one cell and belong to the...

Archaebacteria Kingdom

or

Eubacteria Kingdom

If you are eukaryotic, you are made up of more than one cell and you belong to...

Fungi Kingdom
Protist Kingdom
Plant Kingdom

or the
Animal Kingdom

But the main difference between prokaryotic and eukaryotic organisms is this...

Eukaryotic cells have organelles and prokaryotic cells do not!

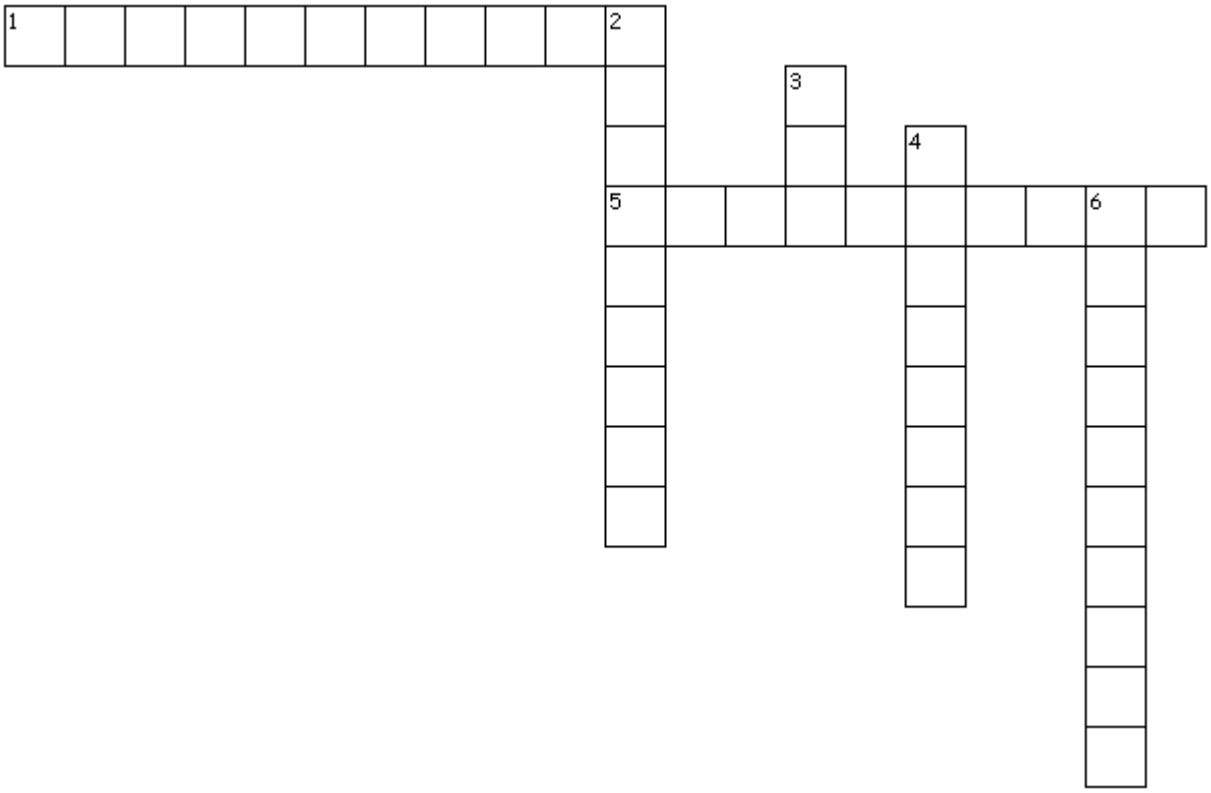
Organelles ("or-ga-nells") are small structures inside of cells that have a specific job. One kind of organelle makes all of the energy for the cell to work! Another organelle stores all of the food! And so on...

Prokaryotic cells, like bacteria, do not have organelles.

Eukaryotic cells have more parts in them. They are responsible for keeping large organisms, like us, alive! They have to be better organized in order to work well! The organelles in the eukaryotic cells are very good at their jobs.

You are going to learn about many of the organelles in the cells of animals and plants in the next chapters.

Place the answers to the following clues in the boxes below. Each box should contain one letter.



Across

1. cells or organisms that belong to the Kingdoms Archaebacteria or Eubacteria
5. small structures inside of cells that have a specific job

Down

2. a gooey fluid that fills up the inside of a cell
3. a group of chemicals that contain all of the instructions for making all the structures and materials the organism needs to survive
4. a covering that surrounds the cell and protects it
6. cells or organisms that belong to the Kingdoms Animal, Plant, Protist or Fungi

Match the words in the first column to the best available answer in the second column.

_____ Prokaryotic	1) a covering that surrounds the cell and protects it
_____ Eukaryotic	2) cells or organisms that belong to any Kingdoms except Archaebacteria and Eubacteria
_____ Membrane	3) cells or organisms that belong to the Kingdoms Archaebacteria or Eubacteria
_____ DNA	4) a group of chemicals that contain all of the instructions for making all the structures and materials the organism needs to survive
_____ Cytoplasm	5) small structures inside of cells that have a specific job
_____ Organelles	6) a gooey fluid that fills up the inside of a cell

Which one is right? Circle the correct answer.

1. The following list is in order from smallest to largest:
    a. cells, tissues, organs, organisms, populations
    b. populations, organisms, organs, tissues, cells
    c. cells, tissues, organisms, organs, populations

2. The main difference between prokaryotic and eukaryotic cells is:
    a. only prokaryotic cells have a membrane
    b. only eukaryotic cells have organelles
    c. only eukaryotic cells have DNA

3. All prokaryotic cells belong to the following kingdoms:
    a. archaebacteria and eubacteria
    b. fungi, protist, plant and animal
    c. archaebacteria, eubacteria and fungi

4. The cytoplasm inside a prokaryotic cell contains:
    a. organelles
    b. DNA
    c. tissues

5. If an organism is only made of one cell, it is known as...
    a. an organelle
    b. prokaryotic
    c. eukaryotic

6. Organelles are larger than cells.
    a. true
    b. false

CHAPTER 30

In the last chapter, you learned about the difference between prokaryotic cells (bacteria) and eukaryotic cells (all other living organisms). This week… let's take a closer look at what makes a eukaryotic cell work!

I'm certain you have seen all kinds of plants and animals in your life.

Some of these organisms can be very small, like a blade of grass…

…while others can be very large, like an elephant!

Both the grass and the elephant are made up of cells that work together to keep them alive!

As you learned from the last chapter, all organisms in the plant and animal kingdoms are eukaryotic. Because of this, each of their cells contains organelles.

Remember that organelles are small structures inside of cells that have a specific job. In eukaryotic cells, there are at least a dozen different organelles each working to keep the cell alive! In this chapter, you are not going to have to learn all of them! But there are a few that you really need to know…

Here is a list of the organelles you are going to learn today:

Nucleus ("new-klee-us")

Ribosomes ("ri-bow-sowm")

"ER" (the real name for this organelle is really long. So instead just say the two letters…E and R.)

Mitochondria ("might-o-con-dree-ah")

I know some of the words are long, but keep practicing!
You are going to see these words a lot in this unit!

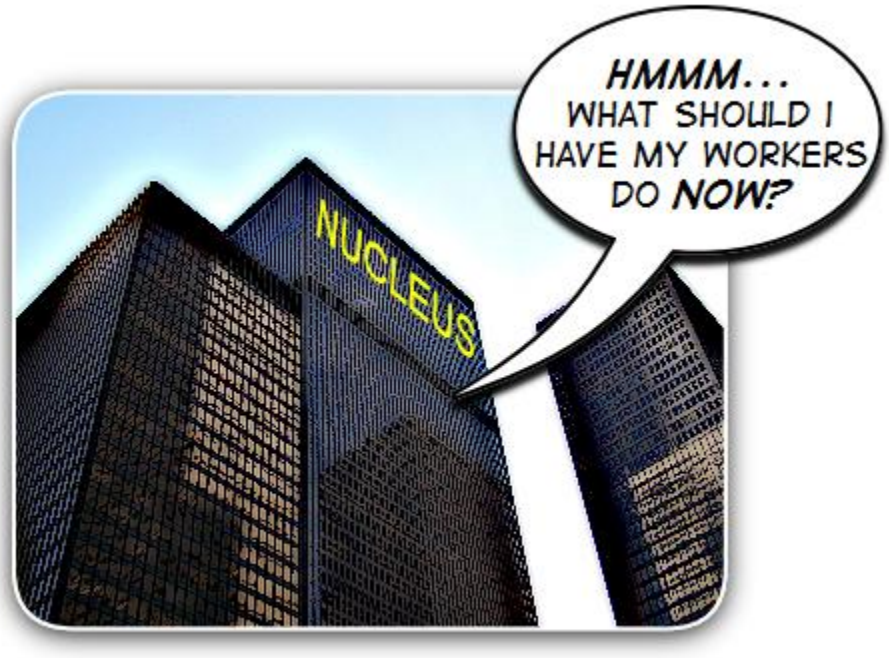
First, let's take a look at the **nucleus**…

The nucleus is the largest organelle in a plant or animal cell. Like most organelles, the nucleus floats inside the **cytoplasm** of the cell.

(Remember that cytoplasm is a gooey fluid that fills up the inside of a cell, just like a water balloon!)

The most important job that the nucleus has is to hold onto **DNA**. Think of the nucleus as the office of a building. In reality, DNA is a group of chemicals that contain all of the instructions for making all the structures and materials the organism needs to survive!

Think of DNA as "the boss". The DNA tells the rest of the cell what to do and when to do it! DNA is always sending out "messages" to the cell. These "messages" are called "**RNA**". Once the RNA is made, it is sent out of the nucleus to float around in the cytoplasm.



These messages can only be read by our next organelle... **ribosomes!**

The job for each ribosome is to read the RNA... since no other organelle can read these messages! Once this message is read, the ribosome sends out new messages that the other organelles can read. These new messages are called **proteins**!

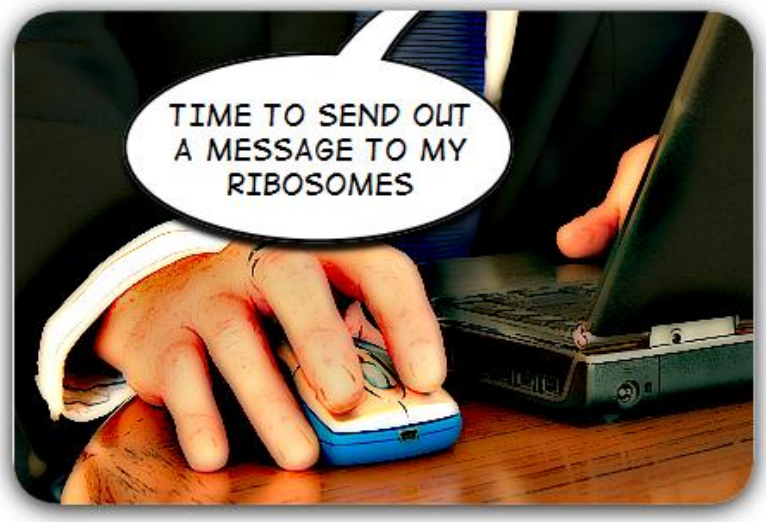
Think of a ribosome as "the decoder" since its job is to read the special code of the RNA. After reading the RNA, it then makes new messages that the other organelles can read.

You learned in chapter 28 that Proteins are the most important part of the food that you eat. These proteins are digested by your body, broken down into small pieces and recycled!!! These smaller pieces are reused by the organelles in your cells... like the ribosomes!

Remember!

The DNA **(the boss)** wants to send out messages but it cannot leave its office **(the nucleus).** So it makes RNA **(the message)** and sends it out into the cytoplasm for the ribosomes **(the decoders)** to read. The ribosomes read the message **(RNA)** and make new messages **(proteins)** that can be read by the other organelles. These new messages will tell the organelles what to do and when to do it.

These proteins can float around in the cytoplasm for a long time before they reach an organelle. There is a way to get the proteins to the organelles faster! If you want this to happen, you have to use another organelle, called **"ER"**.



Think of the "ER" as **"the highway"** that helps to deliver the messages throughout the cell faster.

So... just to be certain that you are understanding how this works:

The DNA **(the boss)** wants to send out messages but it cannot leave its office **(the nucleus).** So it makes RNA **(the message)** and sends it out into the cytoplasm for the ribosomes **(the decoders)** to read. The ribosomes read the message **(RNA)** and make new messages **(proteins)** that can be read by the other organelles. These new messages will tell the organelles what to do and when to do it.

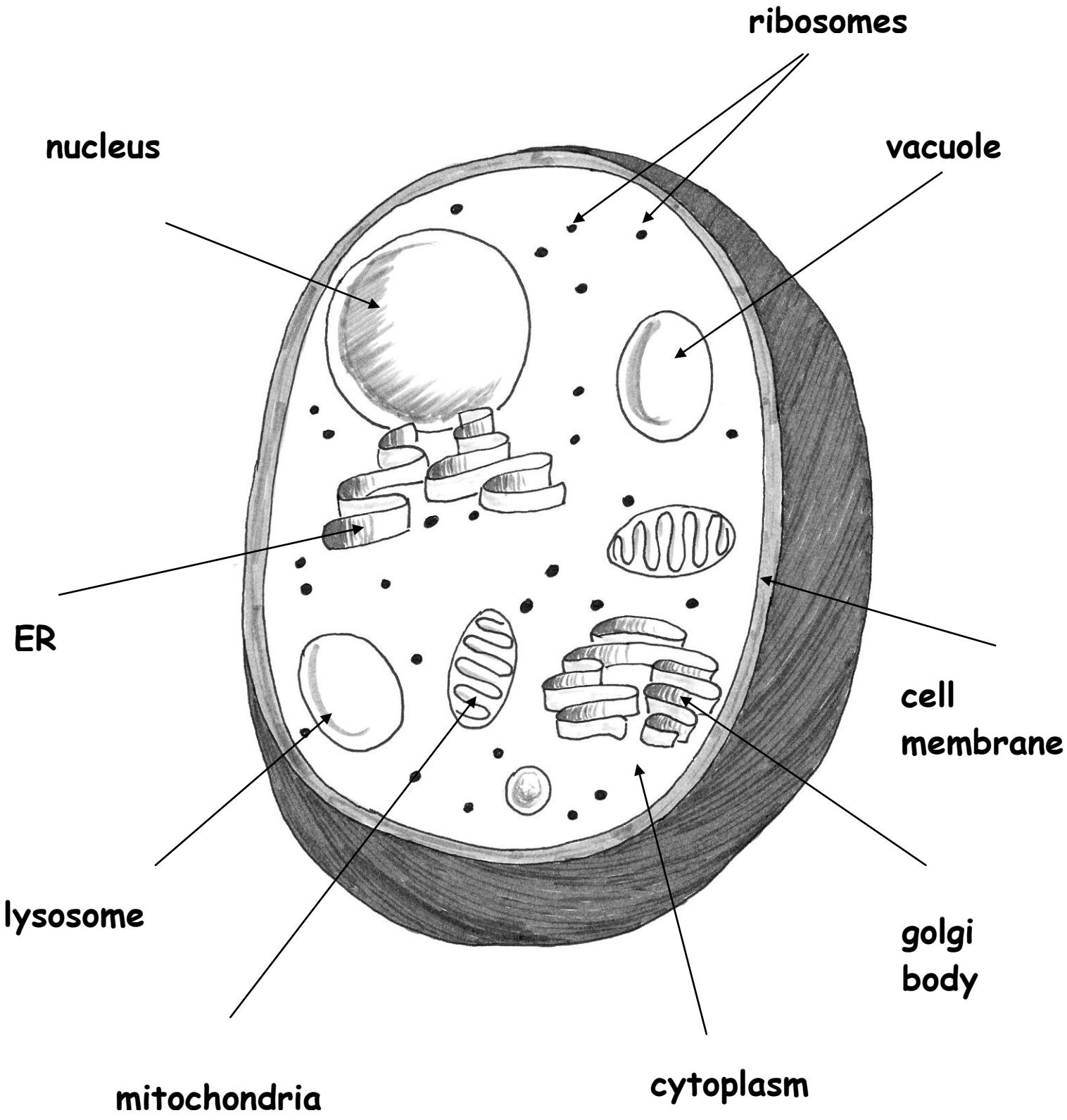
Sometimes, these messages **(proteins)** are delivered faster by traveling on the "ER" **(the highway)**.

What if your cell needs more energy to breathe, grow or to reproduce?

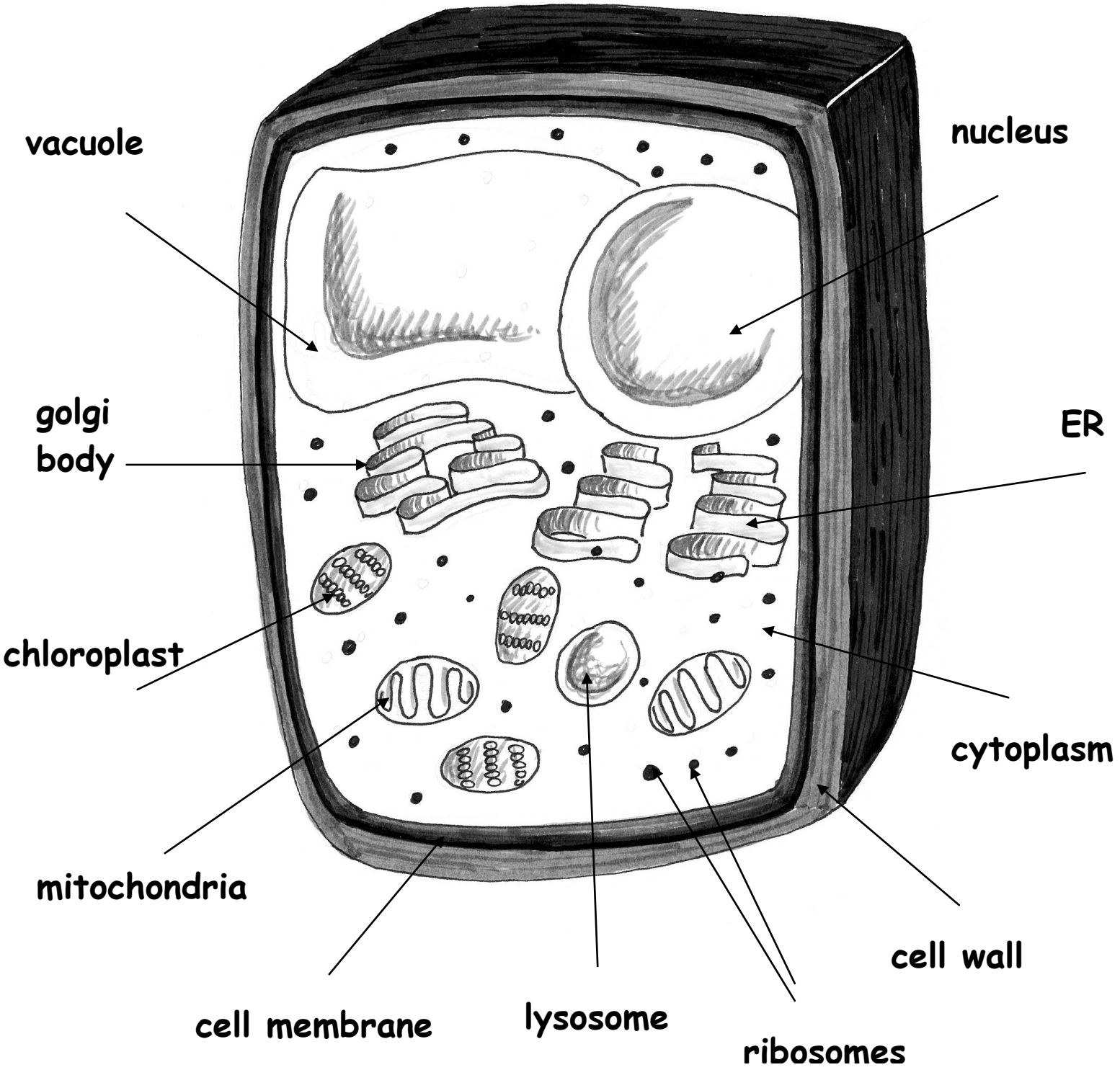
A message is sent to the **mitochondria** if you need more energy! Mitochondria ("might-o-con-dree-ah") are the "energy creators" of the cell. When your body needs energy, it turns to mitochondria to make it! This organelle uses the nutrients that organisms have in their bodies and changes it into energy. This energy can be used for the cell to breathe, to grow and to reproduce (as well as many other things!)

In the next chapter, you are going to learn about three other organelles that both plants and animals have in common.

Animal cell


ribosomes
nucleus
vacuole
ER
cell membrane
lysosome
golgi body
mitochondria
cytoplasm

Plant cell


vacuole
nucleus
golgi body
ER
chloroplast
cytoplasm
mitochondria
cell wall
cell membrane
lysosome
ribosomes

The table below contains words and phrases that have been chopped in half. Find the pieces that fit together and write them in the answer area below.

Nuc	Mitoch	ondria	leus
e	r	somes	Ribo

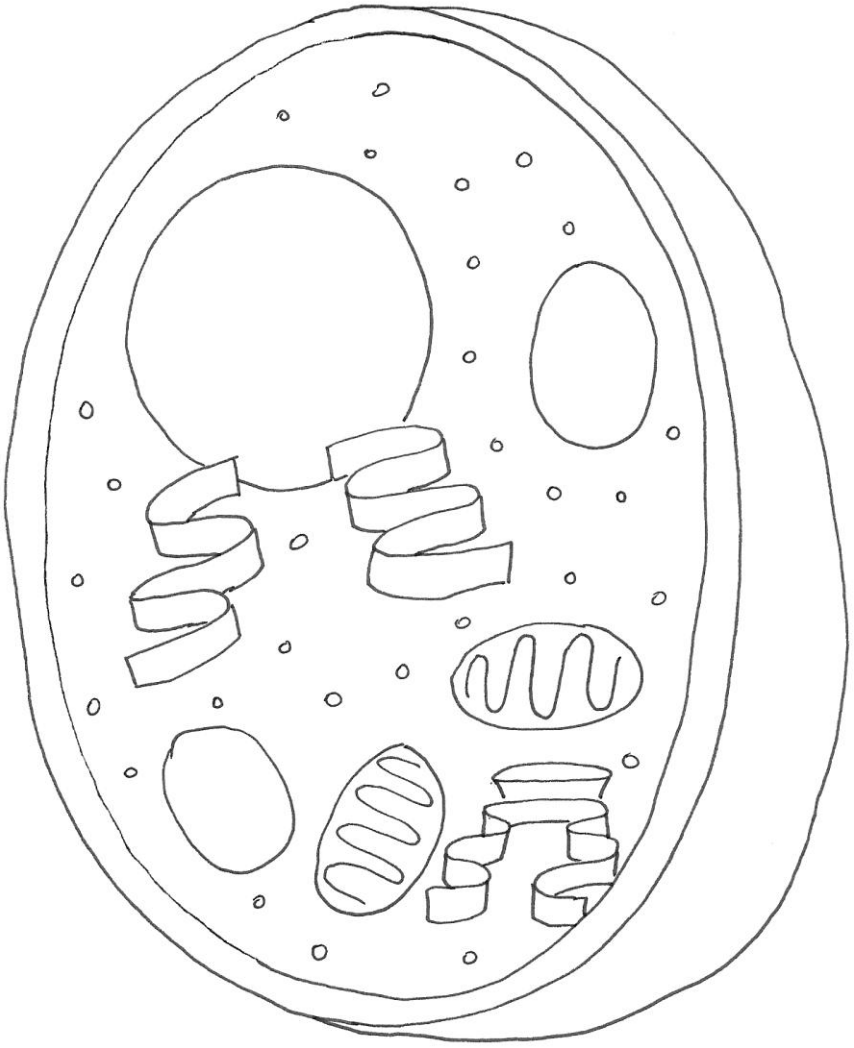
Answers:

1. _____
2. _____
3. _____
4. _____

Match the words in the first column to the best available answer in the second column.

___ Nucleus	1) makes protein for the cell
___ Ribosomes	2) quickly sends protein messages to organelles
___ ER	3) an organelle that takes nutrients from plants and animals and changes it into energy for the cell
___ Mitochondria	4) the largest organelle in a plant or animal cell; contains the DNA

Color the animal cell below



Color the organelles these colors:

Nucleus – red
Ribosomes – brown
ER – blue
Vacuole – purple
Lysosome – orange
Mitochondria – yellow
Golgi body - blue

CHAPTER 31

So far, you have looked at four organelles that you can find in both plant and animal cells: the nucleus, ribosomes, "ER", and mitochondria. Every eukaryotic cell uses these small structures to stay alive. But there are many more for you to study...

In this chapter, you are going to look at three more organelles that can be found in both plant and animal cells:

Lysosome ("lie-so-so-m")
Golgi body ("goal-gee")
Vacuole ("vack-u-ol")

In addition, you are going to explore one more organelle that you would never find in an animal cell:

Chloroplast ("klor-o-plasts")

In the last chapter you were asked to think of the cell as a business... you have a boss, messages being sent, and ways to deliver these messages.

Most businesses work with other businesses, don't they? So how does a cell work with other cells?

The ribosomes have a hard time sending out their protein messages to other cells on their own. So, the ribosomes use another organelle...

...the Golgi body.

The Golgi body acts like a **"packing station"** by wrapping up proteins into a bundle. This "packing station" collects a large group of messages into a bundle and sends them outside of the cell. When the bundle reaches another cell, the bundle releases its protein into the new cell.

AFTER PACKING EVERYTHING UP, THE GOLGI BODY SENDS OUT ITS MESSAGES TO OTHER CELLS.

Please do not confuse the Golgi body With the "ER"!

The Golgi body sends bundles of protein messengers **outside** of the cell. The "ER" can only send messages within the same cell!

But every business has some kind of waste?

So how does a cell get rid of its waste?

Getting rid of waste is the job of the **lysosome**. Think of this organelle as the "garbage disposal" of the cell. Whenever you put garbage in the garbage disposal, it breaks it apart into smaller pieces. When the pieces are small enough, it gets flushed down the drain! A lysosome does the same thing with the waste inside a cell.

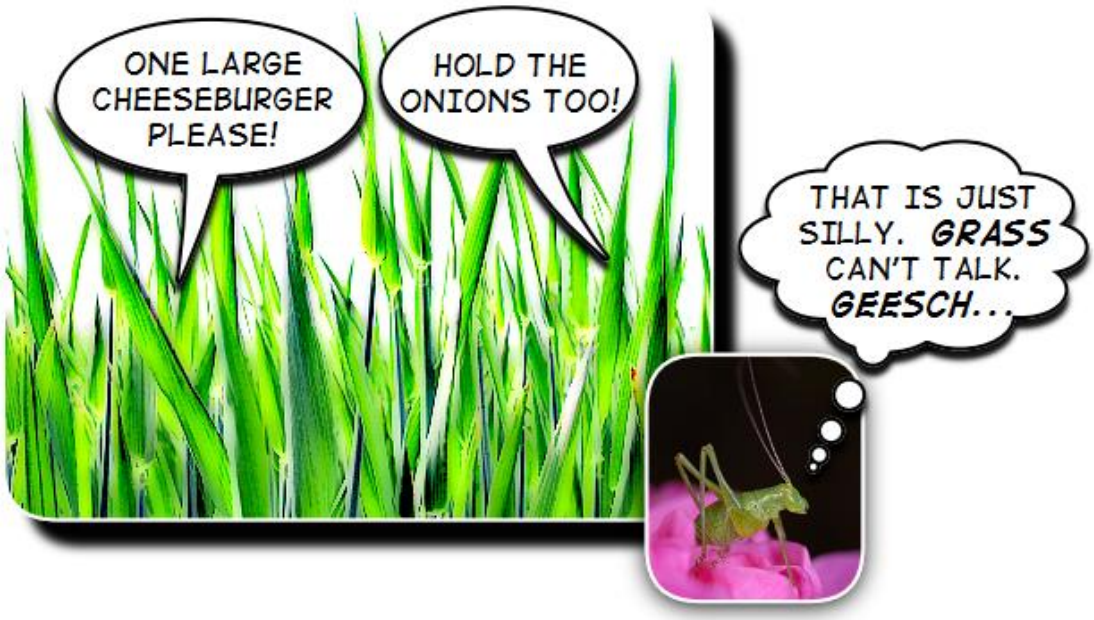
Inside this organelle you will find **enzymes** that break down the waste that is trapped in the cell.

Remember that enzymes are chemicals that your body uses to do all kinds of things...including breaking down your waste into smaller, more usable pieces.

Most businesses store their materials somewhere. How does a cell store its materials?

Plant and animal cells store extra water and nutrients in an organelle called a **vacuole**. The vacuole is known as the **"the warehouse"** of the cell.

The vacuoles inside animal cells are not very large. There is no need for an animal cell to have a large vacuole because an animal can always eat more food!



In plant cells, the vacuole is much larger! A plant cannot pick up a cheeseburger and fries whenever it gets hungry. So the plant must store as many nutrients as it can.

A little review…

The DNA (the boss) wants to send out messages but it cannot leave its office (the nucleus). So it makes RNA (the message) and sends it out into the cytoplasm for the ribosomes (the decoders) to read. The ribosomes read the message (RNA) and make new messages (proteins) that can be read by the other organelles. These new messages will tell the organelles what to do and when to do it.

Sometimes, these messages (proteins) are delivered faster by traveling on the "ER" (the highway).

Other times, these proteins are sent outside of the cell after they are bundled up in the Golgi body (packing station).

If any extra protein, nutrients or water is needed to be stored, it goes into the vacuole **(the warehouse).**

When there is any waste that the cell makes, it goes to the lysosome **(garbage disposal)** to be broken down into smaller pieces.

Now, let's take a look at an organelle that you will never find in an animal cell!

Chloroplasts

("klor-o-plasts")

Chloroplasts are special organelles that can be found in plants and many organisms in the Protista and Eubacteria kingdoms.

What makes chloroplasts so special?

Chloroplasts contain a chemical called **chlorophyll** ("klor-o-fill"). Chlorophyll soaks up as much sunlight as possible.

What does it do with all of the sunlight?

It takes a lot of energy to keep a plant growing. The sun provides a **huge** amount of energy to the plant to make its food!

Chlorophyll uses sunlight, nutrients and water to make their own food. This is called **photosynthesis**.

And since a plant cannot pick up a cheeseburger when it gets hungry, it has to make its own food to stay alive!

If you do not believe me, try putting a plant into a dark closet. Without any light reaching its leaves, you are certain to find a dead plant wilting by your coats in a couple of days!

By the way, if you ever wondered why plants almost always look green, it is because green is the color of chlorophyll. The next time you look at a leaf on a tree, all of the green that you see is coming from chlorophyll!

Also...

Plant cells have a special way to protect themselves by using...

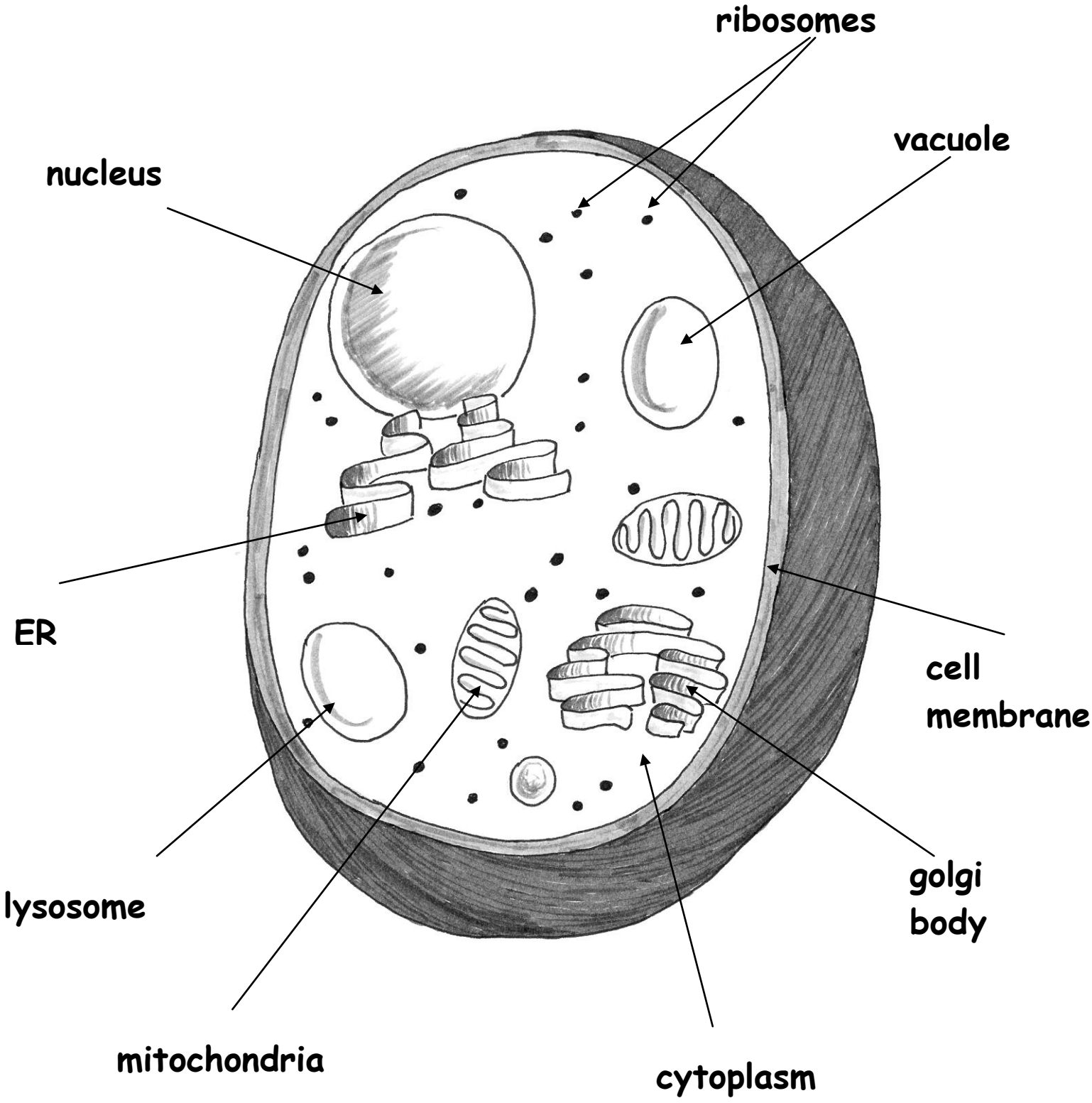
Cell walls

Plant cells have **cell walls**. So do most organisms from the kingdom fungi and a few organisms from the kingdom Eubacteria. The cell wall is a stiff structure that surrounds the cell and protects it from harm.

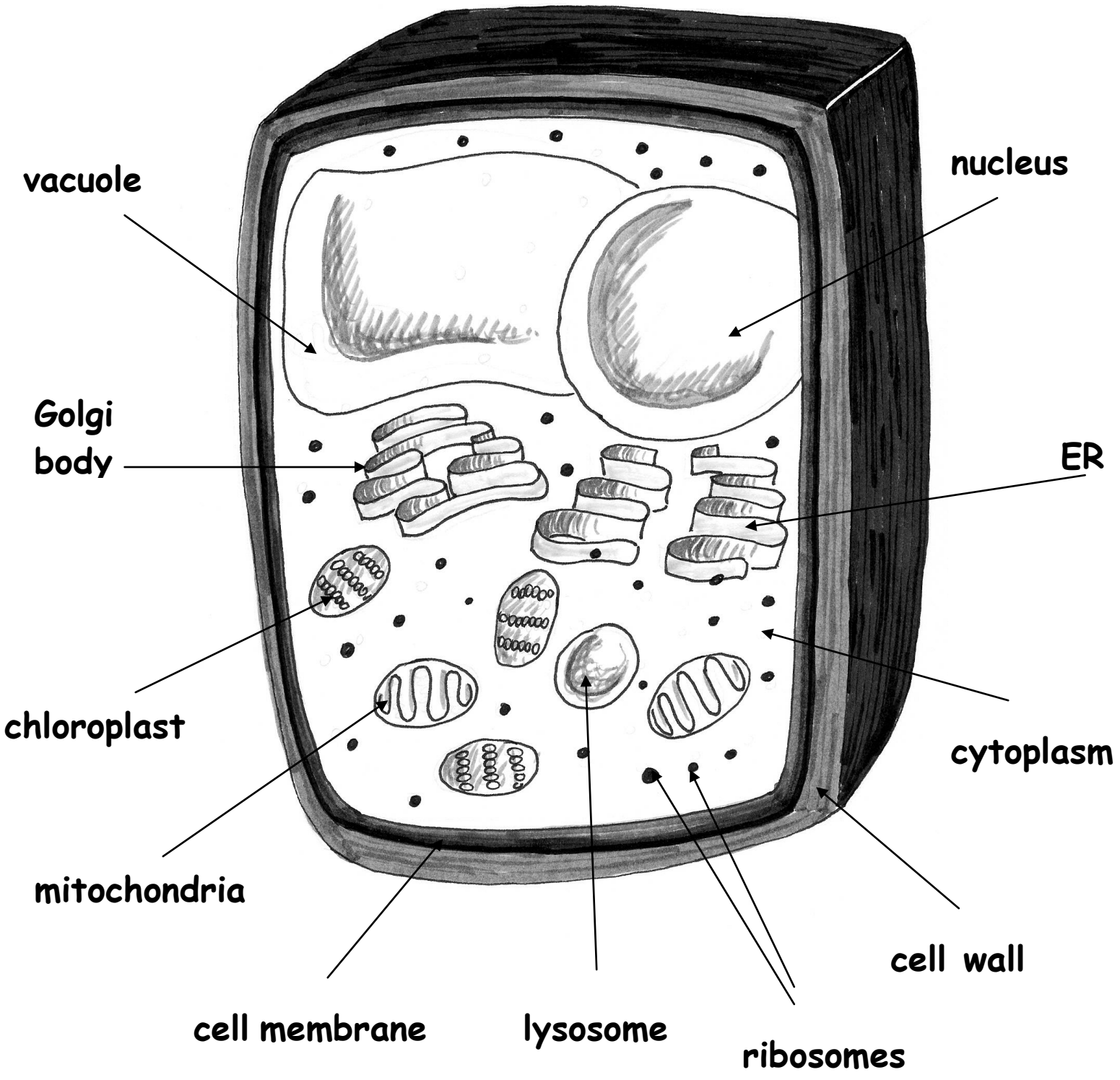
In addition to protecting the cell, the cell wall also gives an organism the ability to remain stiff, like the trunk of a tree! Cell walls connect to each other just like a brick wall! This gives plants and fungi a strong body that does not break in half during a windstorm and can straighten up when it gets knocked down!

In the next chapter, you are going to explore what makes a plant cell, animal cell and bacterial cell the same...and what makes them different!

Animal cell


ribosomes
vacuole
nucleus
ER
cell membrane
lysosome
golgi body
mitochondria
cytoplasm

Plant cell


vacuole
nucleus
Golgi body
ER
chloroplast
cytoplasm
mitochondria
cell wall
cell membrane
lysosome
ribosomes

Unscramble the words below:

1. odgoyilgb _____
2. cotahllpros _____
3. ouecalv _____
4. yhrplhlcolo _____
5. llcaewll _____
6. yoosesml _____

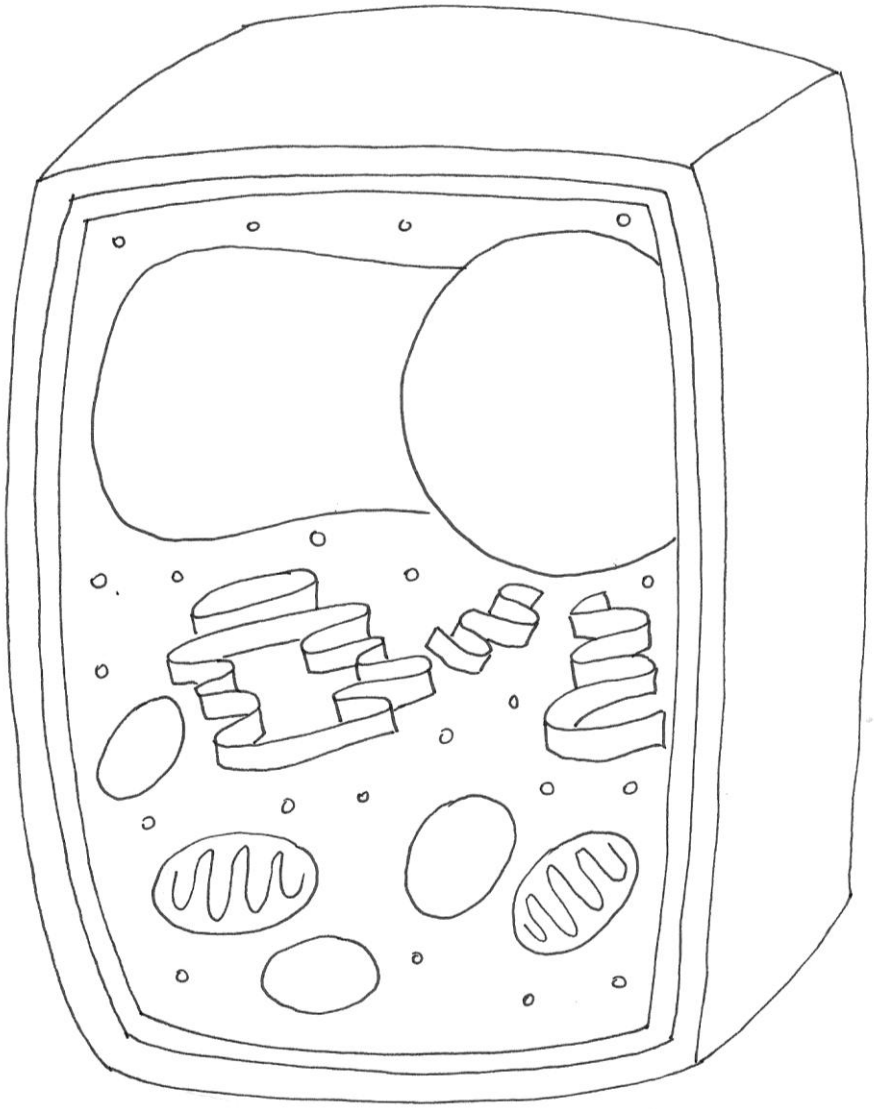
Write the definitions for each word:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

Match the words in the first column to the best available answer in the second column.

_____ Lysosome	1) an organelle that stores extra water and nutrients
_____ Golgi body	2) an organelle that gets rid of the waste inside a cell
_____ Vacuole	3) special organelles that contain chlorophyll
_____ Cell wall	4) an organelle that wraps up proteins into a bundle inside a cell
_____ Chloroplast	5) a chemical found inside chloroplasts that uses sunlight to make food for the cell
_____ Chlorophyll	6) a stiff structure that surrounds a plant cell and protects it from harm

Color the plant cell below



Color the organelles these colors:

Nucleus – red
Ribosomes – brown
ER – blue
Vacuole – purple
Lysosome – orange
Mitochondria – yellow
Golgi body - blue
Chloroplast - green

CHAPTER 32

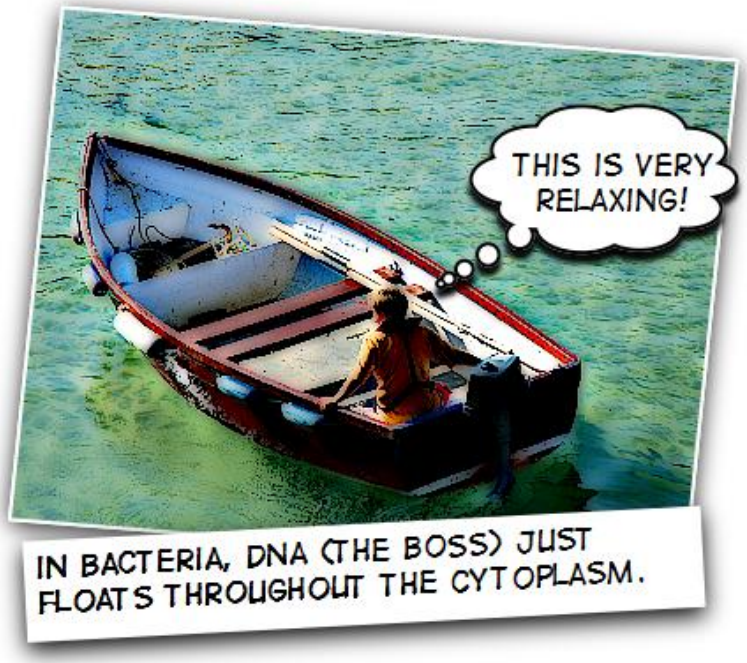
In the past two chapters, you have explored the organelles that can be found in both plant and animal cells. You have also learned that plant cells contain an organelle that is not found in animal cells. Don't forget... plant and animal cells are eukaryotic because they have organelles!

But what about the prokaryotic cells?

If you remember from chapter 29, bacterial cells are known as **prokaryotic**. Each prokaryotic cell is one organism that does not have any organelles!!

Even though bacteria do not have any organelles, they still have the same needs as any other organism:

- They must use food to keep them alive.
- They must be able to grow.
- They react to changes in the environment
- They must reproduce
- They must use air to survive



And... just like eukaryotic cells, every bacteria has a membrane which holds in the gooey fluid called cytoplasm.

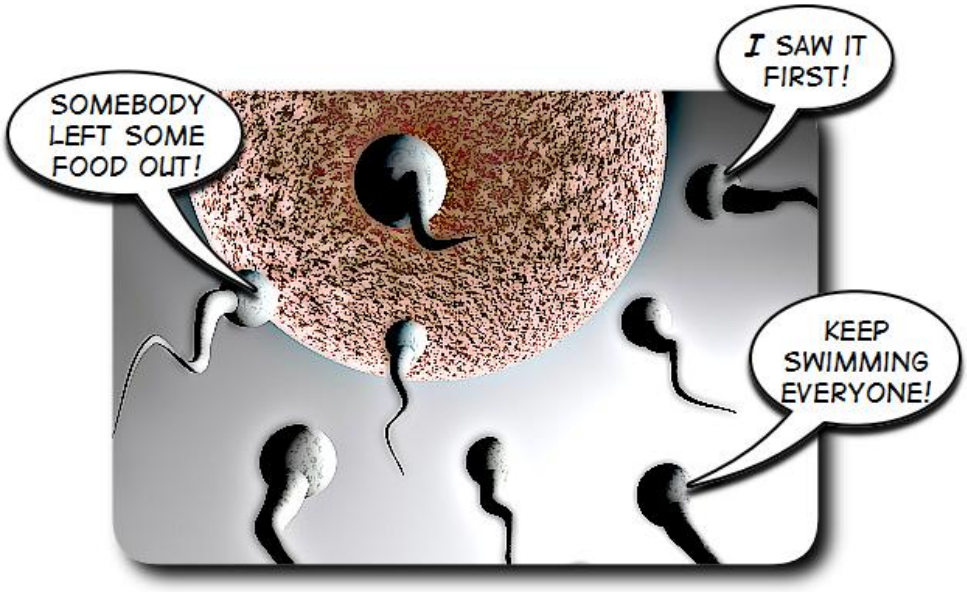
However, the DNA **("the boss")** that is inside a bacteria is not protected inside a nucleus...

...it just floats around in the cytoplasm!

Ok...so how do bacteria survive without any organelles?

First of all, prokaryotic cells are protected the same way a plant cell is protected... **with a cell wall!** The cell wall surrounds the bacteria and keeps the bacteria safe.

In addition, many bacteria can move with the help of a tail known as **flagella**. The flagella of a bacteria looks like a long whip that helps to push the bacteria through a liquid...just like the tail of a fish!



How do bacteria get their food?

Well, they can always move with the help of their flagella to where the food is. But some bacteria do not have flagella! These bacteria must be able to get the nutrients it needs in order to survive. One way that the bacteria can do this is to make its own food...just like a plant cell!

That is right! Some bacteria can make their own food, just like plants do.

In these bacteria, sunlight is used by its chlorophyll to go through photosynthesis. in bacteria, photosynthesis can take place anywhere inside the gooey cytoplasm!!!

Aarrghhh!!! There is so many things to learn! How can I make it easier to remember?

The following table may help you understand all of these cells a little better:

	Plant cell	Animal cell	Bacterial cell
DNA	YES	YES	YES
Cell membrane	YES	YES	YES
Cytoplasm	YES	YES	YES
Nucleus	YES	YES	NO
Ribosomes	YES	YES	NO
"ER"	YES	YES	NO
Mitochondria	YES	YES	NO
Lysosome	YES	YES	NO
Golgi body	YES	YES	NO
Vacuole	YES	YES	NO
Cell wall	YES	NO	YES
Chloroplast	YES	NO	NO
Chlorophyll	YES	No	Some do

You started off looking at "everything in the world" which is known as the **environment**. Since the world is such a huge place, scientists break it down into sections called **biomes**. Each biome is different from the others. Each of these biomes contain so many different organisms, scientists have placed them into six different groups called **kingdoms**. Within each kingdom there are thousands of different **species** of organism. Each species is a group of similar organisms that you can find anywhere in the world.

When you get a group of similar organisms living in one place, you call this group of organisms a **population**. Since each population is a group of similar **organisms**, we need to look closely at each one!

Most organisms (except for bacteria!) use **organs** to stay alive. These organs are made up of **tissues**. Tissues are nothing more than a large group of **cells!** And, you have been learning that eukaryotic cells are all made up of **organelles** that work together to keep the cell alive.

If you were to put these words in order from largest to smallest, this is what it looks like:

Environment
Biomes
Kingdoms
Species
Populations
Organisms
Organs
Tissues
Cells
Organelles

You can pat yourself on the back! You have learned quite a lot this year!

But you are not done yet. In the next unit, you are going to explore how you can keep yourself healthy and happy!

Fill in the blanks with the correct words from the bank at the bottom of the page.

A _____ _____ a _____ _____ _____ that _____ to _____ the bacteria through a liquid.

Word Bank:

flagella
is
long
helps
tail
push
whip-like

Fill in the blanks in the following table. You may write "yes" or "no"

	Plant cell	Animal cell	Bacterial cell
DNA	YES	YES	
Cell membrane		YES	YES
Cytoplasm	YES	YES	YES
Nucleus		YES	NO
Ribosomes	YES	YES	
"ER"	YES		NO
Mitochondria	YES	YES	
Lysosome		YES	NO
Golgi body	YES	YES	
Vacuole	YES		NO
Cell wall			
Chloroplast	YES	NO	
Chlorophyll	YES	No	Some do

Unit Eight review

Match the words in the first column to the best available answer in the second column.

_____	Mitochondria	1. the largest organelle in a plant or animal cell; contains the Dna
_____	ER	2. an organelle that gets rid of the waste inside a cell
_____	Vacuole	3. an organelle that turns nutrients into energy for the cell
_____	Nucleus	4. an organelle that wraps up proteins into a bundle inside a cell
_____	Golgi body	5. organelle that sends protein messages to other organelles
_____	Lysosome	6. an organelle that stores extra water and nutrients

Fill in the missing boxes with "yes" or "no".

	Plant cell	Animal cell	Bacterial cell
DNA			
Cell membrane			
Cytoplasm			
Nucleus			
Chloroplast			
Cell wall			

Be certain to go over your definitions for the test!