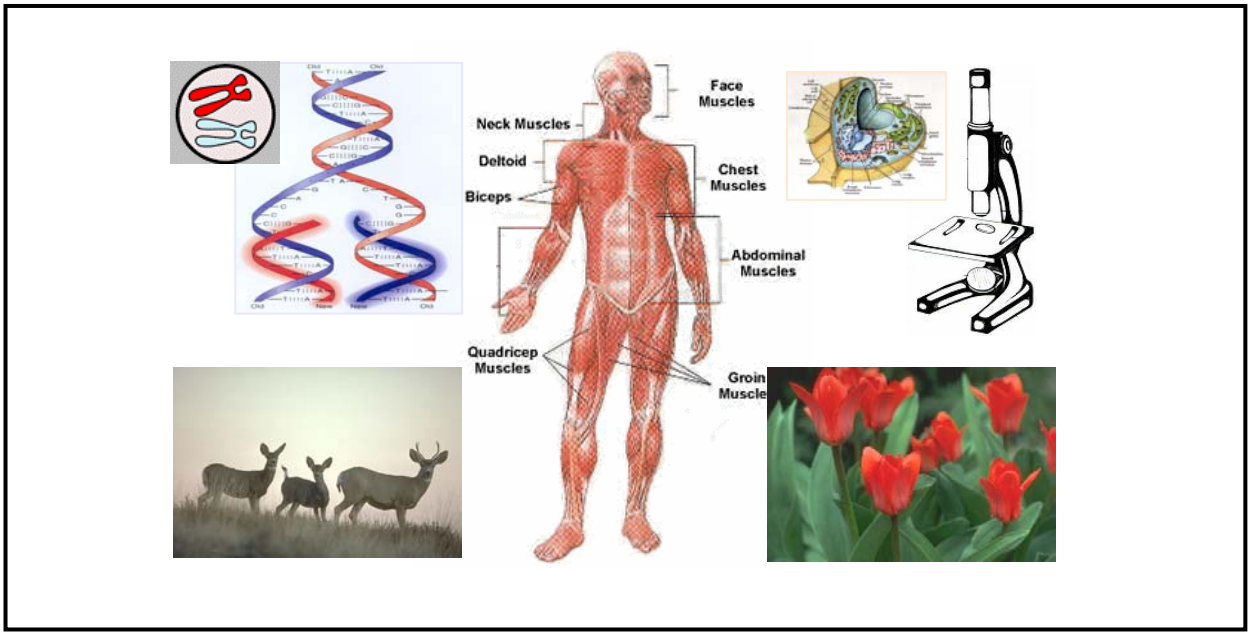
Project EASE

(Effective Alternative Secondary Education)

BIOLOGY



MODULE 2

Cell Structure and Function

BUREAU OF SECONDARY EDUCATION
Department of Education
DepED Complex, Meralco Avenue
Pasig City

Module 2
Cell Structure and Function

What this module is about

This module will help you gain knowledge about the cell: the basic unit of life on earth. Cells are the fundamental units of living organisms. The cell is the key to biology because it is at this level that life truly springs. As you read this, you will learn more about the activities of the cell, the structures and the material of life that fills them. Later on, you will discover what a living material is made of.

This module has the following lessons:

- **Lesson 1 – Cell Theory**
- **Lesson 2 – Cell: The Basis of Life**
- **Lesson 3 – Cell Types**

What you are expected to learn

After going through this module, you are expected to:

1. identify the different parts of the cell;
2. differentiate plant cells from animal cells;
3. differentiate unicellular organisms from multicellular organisms;
4. differentiate prokaryotic from eukaryotic cells;
5. state the cell theory;
6. appreciate the cell as a highly organized structure.

How to learn from this module

I know you are excited to start this adventure just as I am but remember to do the following tips to successfully achieve the objectives of this self-learning kit.

1. Read the instructions carefully.

2. Follow the instructions carefully.
3. Answer the pretest before you start the lesson.
4. Take note and record points for clarifications.
5. Try to achieve at least a 75% level of proficiency in the tests.
6. Work diligently and honestly.
7. Answer the posttest.

What to do before (Pretest)

To start off, you have to answer the pre-test for you to measure how much you know about the topic. You can start now.

- There are 20 questions. Each question has ONLY ONE CORRECT ANSWER. Choose the one you believe to be best.
- Each question is worth 2 points.
- Read each question fully and carefully. Take your time.
- GOOD LUCK!

1. Where is the site of protein synthesis?
   a. nucleus
   b. lysosome
   c. ribosome
   d. mitochondria

2. Organisms whose cells do not have a nucleus are called
   a. plants
   b. organelles
   c. eukaryotes
   d. prokaryotes

3. What type of cell has these characteristics: contains DNA but no nucleus, contains flagella, ribosomes, cytoplasm, and a cell membrane.
   a. plant
   b. fungi
   c. animal
   d. bacteria

4. A cell with relatively few energy needs will probably have a relatively small number of
   a. ribosomes
   b. lysosomes
   c. mitochondria
   d. chromosomes

5. In which of the following items would you expect to find cells?
    a. strawberry
    b. eyeglasses
    c. silver dollar
    d. plastic flower

6. Which of the following organelles transports materials inside the cell
    a. lysosome
    b. chloroplast
    c. mitochondria
    d. endoplasmic reticulum

7. Which of the following structures are common to both eukaryotic and prokaryotic cells?
    a. nucleus
    b. ribosomes
    c. both b and c
    d. cell membrane

8. Which of the following forms of life is not eukaryotic?
    a. a bacterial cell
    b. protist such as an amoeba
    c. a plant cell like gumamela
    d. a human cell such as a red blood cell

9. Plant cells often have a box-like shape because of the
    a. nucleus
    b. cell wall
    c. cytoplasm
    d. cell membrane

10. Which organelle has no membrane?
    a. vacuole
    b. lysosome
    c. ribosome
    d. chloroplast

11. Which of the following statements is always true?
    a. All cells have a cell wall.
    b. All cells contain a nucleus.
    c. All cells contain a chloroplast.
    d. All cells have a cell membrane.

12. A cell is observed to contain a nucleus, mitochondria and chloroplasts. From this information you can conclude that the cell is:
    a. a plant cell
    b. an animal cell
    c. a bacterial cell
    d. a prokaryotic cell

13. Which of the following is found in the nucleus?
    a. vacuoles
    b. chloroplasts
    c. mitochondria
    d. chromosomes

14. Digestive enzymes or hydrolytic enzymes are terms associated with
    a. ribosomes
    b. lysosomes
    c. golgi apparatus
    d. smooth endoplasmic reticulum

15. What site regulates what goes in and out of the cell?
    a. cell wall
    b. vacuole
    c. cell membrane
    d. nuclear membrane

16. The site of ATP production and the site of photosynthesis are the _____ and _____.
    a. ribosomes and vacuoles
    b. chloroplast and lysosome
    c. mitochondria and chloroplast
    d. Golgi complex and chloroplast

17. Which is the “brain” of the cell?
    a. nucleus
    b. chloroplast
    c. golgi bodies
    d. mitochondria

18. A cell that lacks a nucleus and membrane bound organelles is known as a(an) _____ cell.
    a. plant
    b. animal
    c. eukaryote
    d. prokaryote

19. What is the outermost boundary of an animal cell?
    a. the cell wall
    b. the cytoplasm
    c. the cell membrane
    d. the nuclear envelope

20. Which of the following is not true of chloroplasts?
    a. They synthesize sugar
    b. They contain pigments
    c. They are only found in plants
    d. They appear green because of the chlorophyll

Got a perfect score? Check it out!

Key to answers on page 21.

Lesson 1. Cell Theory

The **CELL THEORY**, or cell doctrine, states that all organisms are composed of similar units of organization, called cells. The concept was formally articulated in 1839 by Schleiden & Schwann and has remained as the foundation of modern biology. The idea predates other great paradigms of biology including Darwin's theory of evolution (1859), Mendel's laws of inheritance (1865), and the establishment of comparative biochemistry (1940).

Ultrastructural research and modern molecular biology have added many tenets to the cell theory, but it remains as the preeminent theory of biology. The Cell Theory is to Biology as the Atomic Theory is to Physics.

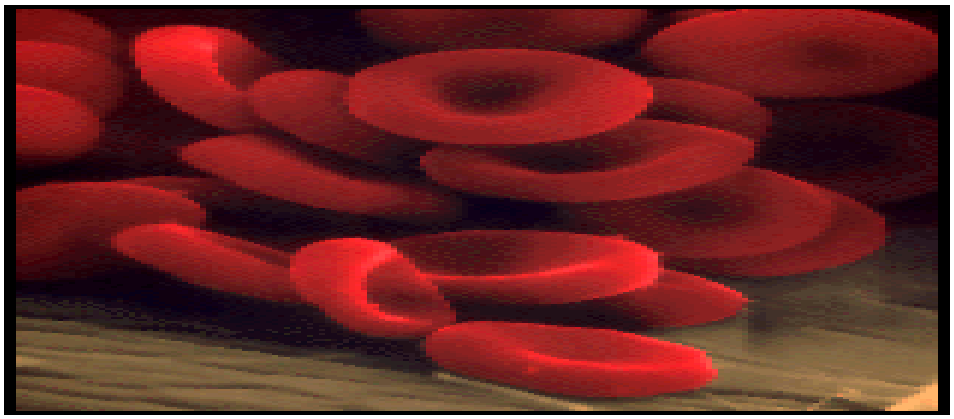


Figure 1.1 Red blood cells
Source: fig.cox.Miami.edu/~cmallery/150/unity/cell.text.htm

Formulation of the Cell Theory

In 1838, Theodor Schwann and Matthias Schleiden were enjoying after-dinner coffee and talking about their studies on cells. It has been suggested that when Schwann heard Schleiden describe plant cells with nuclei, he was struck by the similarity of these plant cells to cells he had observed in animal tissues. The two scientists went immediately to Schwann's lab to look at his slides. Schwann published his book on animal and plant cells (Schwann 1839) the next year, a treatise lacking of acknowledgments of anyone else's contribution, including that of Schleiden (1838). He summarized his observations into three conclusions about cells:

1. The cell is the unit of structure, physiology, and organization in living things.
2. The cell retains a dual existence as a distinct entity and a building block in the construction of organisms.
3. Cells form by free-cell formation, similar to the formation of crystals (spontaneous generation).

We know today that the first two principles are correct, but the third is clearly wrong. The correct interpretation of cell formation by division was finally promoted by others and formally announced in Rudolph Virchow's powerful statement, "Omnis cellula e cellula"... "All cells only arise from pre-existing cells".

The modern principles of the Cell Theory include the following:

1. All known living things are made up of cells.
2. The cell is the structural and functional unit of all living things.
3. All cells come from pre-existing cells by division. (Spontaneous generation does not occur).
4. Cells contain hereditary information which is passed from cell to cell during cell division.
5. All cells are basically the same in chemical composition.
6. All energy flow (metabolism and biochemistry) of life occurs within cells.

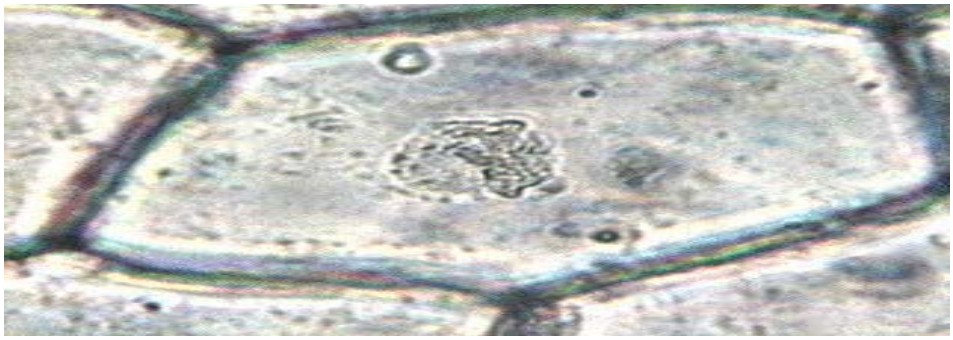


Figure 1.2 Plant cells
Source: fig.cox.Miami.edu/~cmallery/150/unity/cell.text.htm

Landmarks in the Study of Cell Biology

1595	Jansen credited with first compound microscope
1626	Redi postulated that living things do not arise from spontaneous generation.
1655	Hooke described 'cells' in cork.
1674	Leeuwenhoek discovered protozoa. He saw bacteria some 9 years later.
1833	Brown descibed the cell nucleus in cells of the orchid.
1838	Schleiden and Schwann proposed cell theory.
1840	Albrecht von Roelliker realized that sperm cells and egg cells are also cells.
1856	N. Pringsheim observed how a sperm cell penetrated an egg cell.
1858	Rudolf Virchow (physician, pathologist and anthropologist) expounds his famous conclusion: *omnis cellula e cellula*, that is *cells develop only from existing cells* [cells come from preexisting cells]
1857	Kolliker described mitochondria.
1869	Miescher isolated DNA for the first time.
1879	Flemming described chromosome behavior during mitosis.
1883	Germ cells are haploid, chromosome theory of heredity.
1898	Golgi described the golgi apparatus.
1926	Svedberg developed the first analytical ultracentrifuge.
1938	Behrens used differential centrifugation to separate nuclei from cytoplasm.
1939	Siemens produced the first commercial transmission electron microscope.

1941	Coons used fluorescent labeled antibodies to detect cellular antigens.
1952	Gey and co-workers established a continuous human cell line.
1953	Crick, Wilkins and Watson proposed structure of DNA double-helix.
1955	Eagle systematically defined the nutritional needs of animal cells in culture.
1957	Meselson, Stahl and Vinograd developed density gradient centrifugation in cesium chloride solutions for separating nucleic acids.
1965	Ham introduced a defined serum-free medium. Cambridge Instruments produced the first commercial scanning electron microscope.
1976	Sato and colleagues publish papers showing that different cell lines require different mixtures of hormones and growth factors in serum-free media.
1981	Transgenic mice and fruit flies are produced. Mouse embryonic stem cell line established.
1987	Creation of first knockout mouse which contains an artificially introduced mutation in their cells.
1998	Mice are cloned from somatic cells.
2000	Human genome DNA sequence draft

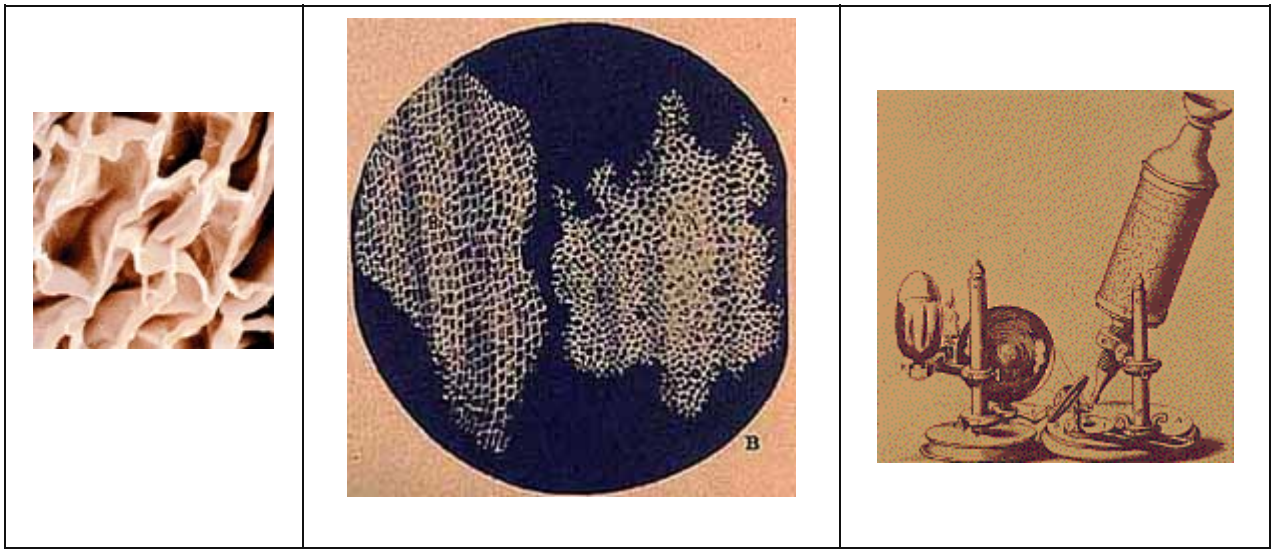


Figure 1.3 Cork cells and the early microscope
Source: fig.cox.miami.edu/~cmallery/150/unity/cell.text.htm

Prior to 1931 when the first electron microscope was developed, magnification of microscopes was limited to about 2 000 times. The small cell structures did not show up well or remained invisible. The electron microscope not only showed more detail of

previously known parts of the cell but also revealed new parts. Cells and cell structures can now be examined at magnifications of up to 500 000 times and more.

What you will do

Activity 1.1

The Street Sweepers

The air we breathe is filled with dust, smoke, and even small bacteria. How come all these materials do not accumulate in the lungs and clog their passageways?

Key to answers on page 21.

What you will do

Self-Test 1.1

Answer the following questions briefly.

1. What contributions did van Leeuwenhoek, Hooke, Schleiden, Schwann, and Virchow make to the development of the cell theory?

   _____
   _____
   _____
   _____

2. What role did the invention of the microscope play in the development of the cell theory?

   _____
   _____
   _____
   _____

Key to answers on page 21.

Lesson 2. Cell: The Basis of Life

Have you tried to look closely at something? You may have picked up a coin and looked closely at its surface. You may also have examined the face of a stamp or looked at a blade of grass.

Such curiosity led early investigators to examine living things in the hope of getting a better view of their structure. Little by little, they discovered that all living things are made of cells. Cells are the basic units of structure and function in living things. All organisms such as the birds you watch, the cork trees and so on are made of living cells.

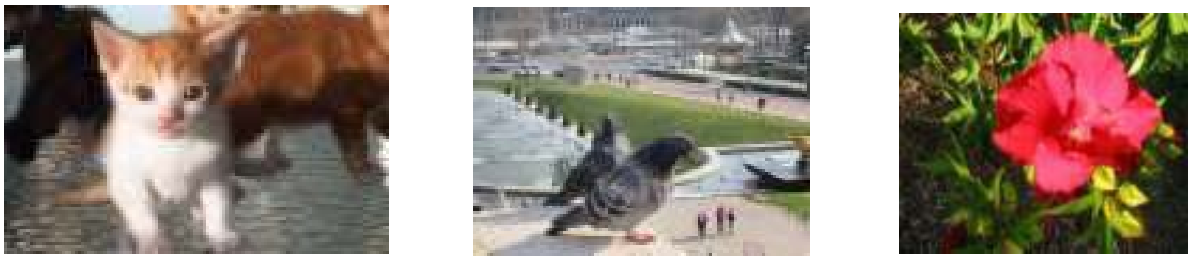


Figure 2.1 Living things
Source: www.goofyanimals.com/pictures

FIND OUT!

Break a chicken egg into a dish, and look at the yolk. How large do you think is it?

Estimate its width. Then use a metric ruler to measure the width of your chicken yolk cell.

With a hand lens, observe the yolk closely. Other cells that can be seen easily are large fish eggs.

Most cells are too small to be seen without the help of a microscope. Luckily, there are a few cells that can be seen with your naked eyes.

Cells Have Structures

Imagine that you could become smaller, down to the size of one micron (1 micron = 1/1000 inch). Your whole body would be smaller than the typical animal cell (see figure 2.2). Imagine, that you could step inside this cell and explore it. Find out some structures inside a cell. Be able to explore how bacterial cells are different from other cells such as plant and animal cells.

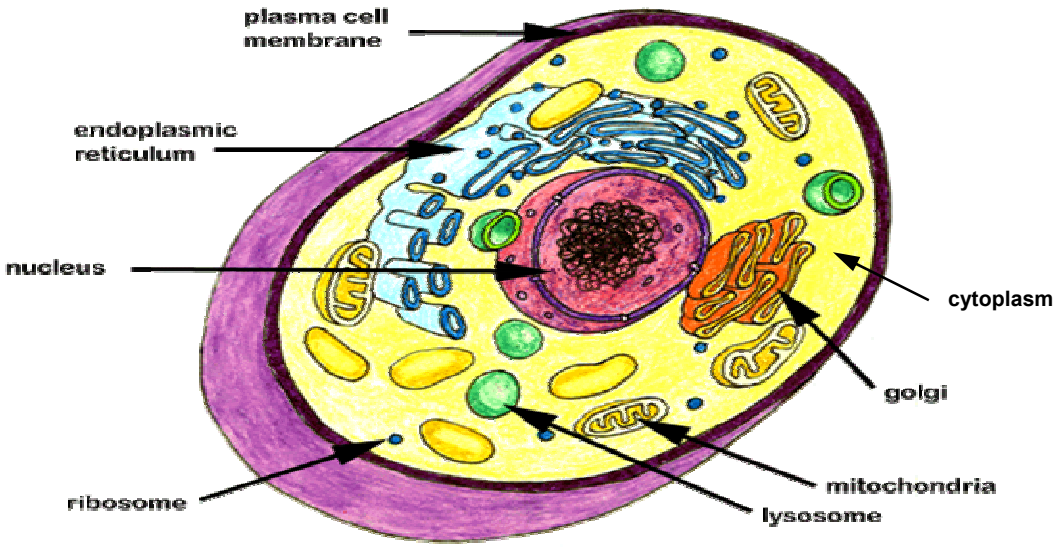


Figure 2.2 An animal cell
Source: http://www.cellsalive.com/cells/animcell.htm

While cells differ in size and shape, most of them have common structures. The cells of animals, plants, and related organisms have three basic structures:

- Cell membrane – the outer boundary of the cell.
- Nucleus – the control center of the cell.
- Cytoplasm – the material between the cell membrane and the nucleus.

The first thing you see as you approach this cell is a thin sac-like membrane. The cell membrane covers the entire surface of the cell. As you take the imaginary step through the cell membrane, you immediately come in contact with the cytoplasm. Moving through the cytoplasm would be like moving through a jar of jelly.

What you will do

Activity 2.1

Construct This

MINI-Lab (What a cytoplasm is like)

Make a model of cytoplasm. Fill a jar/wide-mouthed bottle with water. Add unflavored gulaman and stir. Shine a flashlight through the beaker. What do you see? How does a model cell help you understand what a real one is like?

A large, round **nucleus** is found somewhere in the cytoplasm. As the *"control center"* of the cell, the nucleus contains coded instructions for all of the cell's activities. These coded instructions are stored on special structures called the **chromosomes**. Chromosomes are seen when a cell is reproducing.

Just as the cell membrane covers the cell, a **nuclear membrane** covers the nucleus of the cell. It regulates the passage of materials in and out of the nucleus.

Cytoplasmic Structures

As you walk through the cytoplasm, you might bump into sausage-shaped bodies called mitochondria. They are commonly called the *"power houses"* of the cell. They trap the energy that results when food is broken down. Just as a power plant supplies energy to a business, mitochondria provide energy for the cell. Some types of cells are more active than others, that's why they can have more mitochondria.

Analyze This

Why might a muscle cell have more mitochondria than other cells?

Muscle cells are always undergoing some type of movement. Muscles are also the ones exposed to strenuous activities like doing some household chores, running, walking, etc.

Ever since you entered the cell, you have been walking on a network of canals called the **endoplasmic reticulum**. The endoplasmic reticulum extends from the nucleus to the cell membrane and takes up quite a lot of space in some cells. It moves material from one place to another place inside the cell.

Ribosomes are the tiny dots you see on the edges of some of the endoplasmic reticulum. Some cells may contain millions of ribosomes. The actual building blocks of the cell (proteins) are made on the surfaces of these very tiny structures.

In a manufacturing business, products are made, packaged, and moved to loading centers to be carried away. Structures called **golgi bodies** are the packaging and releasing structures of the cell. When something is released, it is given off by the cell.

Applying a Concept

An animal cell contains about 10 to 20 golgi bodies, while a plant cell contains several hundreds. Why do you think there is such a difference in the number of these structures in each cell type?

Compare your answer to this: The fact that plants produce so many materials (food, oils, resins, etc.), they will be in need of more golgi bodies to store the said materials.

Do you know that cells also produce wastes? In the cytoplasm, structures called **lysosomes** contain chemicals that digest wastes and worn-out/damaged cell parts. When a cell dies, chemicals in the lysosomes act to quickly break down the cell. In a healthy cell, the membrane around the lysosome keeps it from breaking down the cell itself. Plant cells do not have lysosomes.

Many businesses have warehouses for storing products until they are sold. **Vacuoles** are storage areas in cells. They may store water, food, or waste products. In plant cells, vacuoles are big. In animal cells, vacuoles are small. Why do you think so?

Feedback: Plants are said to be the producers of food in the environment. They may produce sugar, oil, nectar, etc. They are in need of bigger vacuoles to store such materials.

You have just looked at the inner workings of an animal cell. Imagine now that you are taking a microscopic tour through the green plant cell below. You will find that some structures in this cell are quite different from the structures in an animal cell. Take note of them.

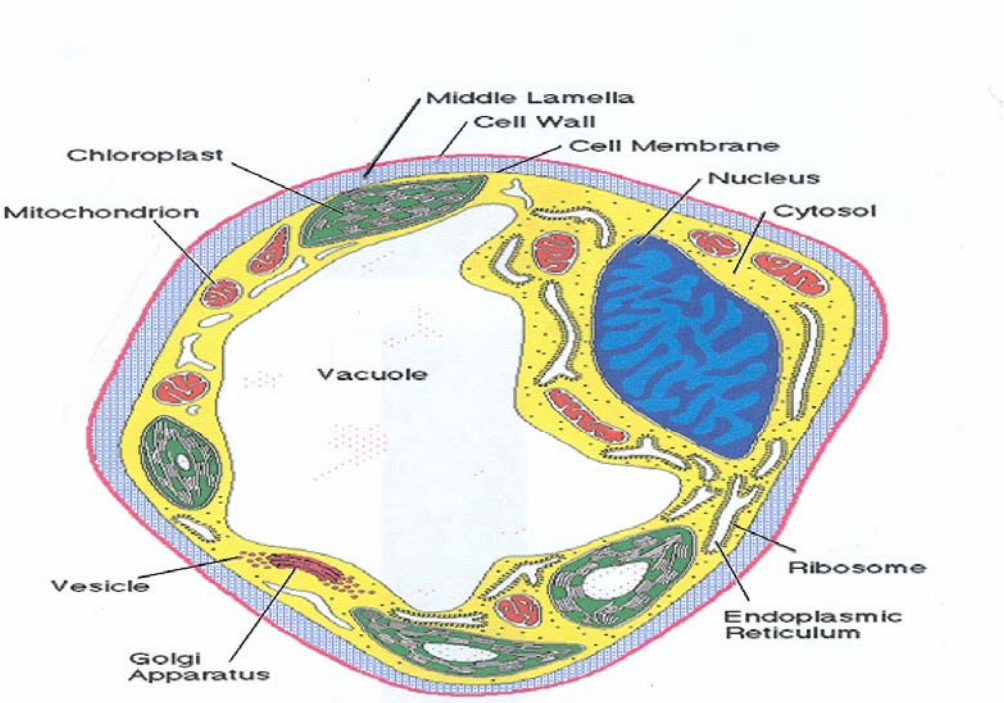


Figure 2.3 A plant cell
Source: http://www.cellsalive.com/cells/plantcell.htm

The outer covering of the plant cell is not soft and thin. Instead, it is surrounded by a rigid/tough structure called the **cell wall** that supports and protects the plant cell.

Once you pass through the cell wall, you see the same structures you saw in the animal cell.

Hold on! Something new appears. The dark green bodies you see around you are **chloroplasts**. Substances inside the chloroplast help a green plant cell trap the sun's energy and then produce food.

Imagine you could take a trip into a tiny bacterial cell. Bacteria and blue-bacteria are quite different from other cells. They have fewer structures than plant or animal cells. However, they carry out all of the life processes that other cells carry out. You can see that a bacterium has a cell wall, a cell membrane, and cytoplasm. The chromosome material (**nucleoid**), which directs the cell's activities, floats freely through the cytoplasm. The other structures are lacking.

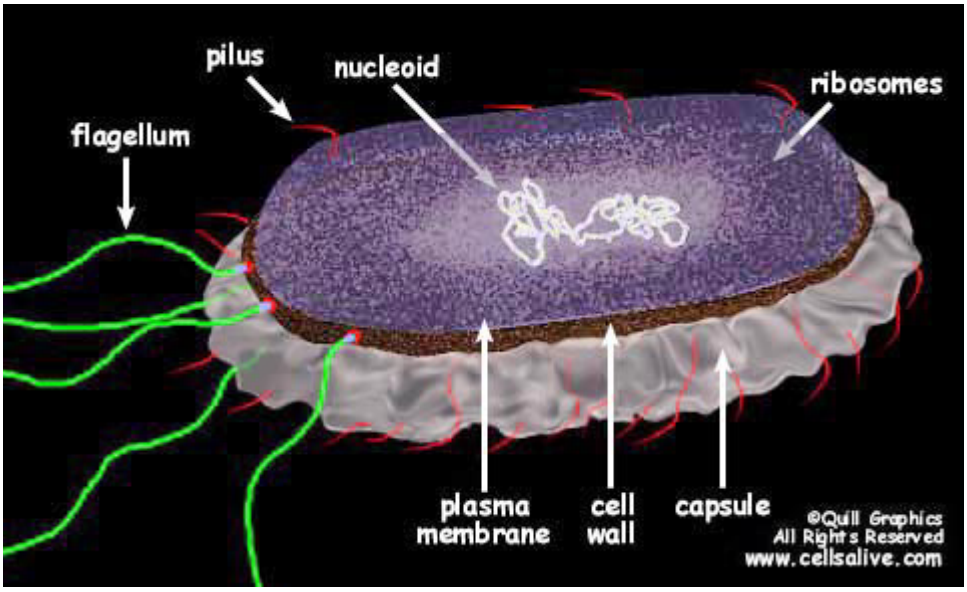


Figure 2.4 A bacterial cell
Source: http//www.cellsalive.com/cells/bactcell.htm

Remember

Cells need water to maintain health. Turning off the faucet every time you brush your teeth can conserve as much as five gallons of water. It will surely benefit a living organism somewhere!

What you will do

Activity 2.2

Challenge

Make your own model of a cell at home. Prepare a small package of gulaman and pour it into a dish. Put common foods in the gelatin to represent cell structures. You could use lettuce or shredded carrots for endoplasmic reticulum and raisins for mitochondria. Be creative! Unmold your "cell". And serve it to your family for salad or dessert.

What you will do

Self-Test 2.1

Let us see how well you can make a summary of what you know about the cell. Below is a table that lists the names of the cell structure(s). Now, compare animal, plant and bacterial cells by putting a (/) if the structure is present and an (X) if the structure is absent under each column.

Structures	Animal cell	Plant cell	Bacterial cell
1. Cell wall			
2. Cell membrane			
3. Cytoplasm			
4. Mitochondria			
5. Ribosomes			
6. Endoplasmic reticulum			
7. Golgi bodies			
8. Lysosomes			
9. Vacuoles			
10. Chloroplasts			
11. Nucleus			
12. Chromosomes			

Key to answers on page 22.

Perfect?! If yes, fantastic! If not, just try and try again. Remember, no pain, no gain.

What you will do

Self-Test 2.2

A Tale of a Tail

Mrs. Gonzales' class studied the parts of plant and animal cells. The class captured tiny tadpoles in a local stream. Mrs. Gonzales showed the students how to care for the tadpoles in the classroom. Gradually, as the animals grew, the bodies were changing in shape. Back and front legs grew out. The mouth expanded from a small hole to a large opening capable of swallowing large insects. In addition, the tails started to disappear. Mrs. Gonzales told the whole class that there would be a bonus question about the tadpoles in the test on animals. For a study clue, she told them to review their notes on cells. What do changes in the body parts of the tadpoles have to do with cells?

Think critically: Answer the bonus question:

What cell part makes the tadpole tails disappear? How?

Figure 2.5 Tadpoles
Source: http://www.sciencedaily.com/encyclopedia/tadpole

Key to answers on page 22.

Ooops! Take a deep breath. Relax for a while. What?! You want to move on? All right, your wish is granted! You may continue. Are you enjoying the module? I hope so. If yes, well and good! Hold on! We will now take the path to the next lesson. Keep on having fun as you learn!

Lesson 3. Cell Types

Cells Vary in Shape, Size, and Arrangement

- Just as there is variety among organisms, there is also variety among cells. Your own body contains over a hundred different kinds of cells. Some of these cells are round. Others are shaped like long, tangled strings.

- Cells vary greatly in size, too. The bacteria that naturally live deep inside your body are very tiny. The ostrich egg cell below is 800,000 times bigger than the bacterial cells.

Ostrich egg cell

- The living arrangement of cells also varies. The bacteria and other cells you might find in a drop of pond water live by themselves. These cells are **one-celled organisms**. You, your classmates, the cork trees and a variety of other organisms are **many-celled organisms**.

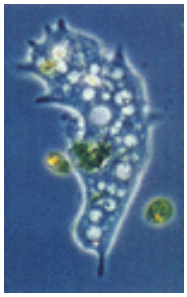
Now that we've learned all about cells and their contents, it's time to learn how cells are categorized. The first grouping is Prokaryotes and Eukaryotes. These are hard to pronounce Latin words, but their meanings are simple. **Prokaryote** refers to bacterial cells. **Eukaryote** refers to everything else. So, streptomyocin bacteria are prokaryote cells. Animals, plants and fungi (mushrooms) are made of eukaryote cells.

Figure 3.1 Eukaryotic organisms
Source: http://userpages.umbc.edu/~lruppi/project1index.shtml

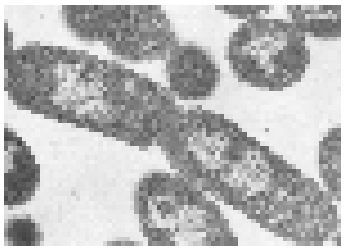
What are the differences between these cell types? A major difference between the two is the presence of membrane-bound organelles. Inside these cells we get things like mitochondria, golgi bodies, a nucleus, etc. They are clearly defined because they have internal membranes around them. The membranes hold them together. Prokaryote lacks these membranes, so consequently they don't have these organelles. Instead of a clearly defined nucleus with chromosomes, they have a single, circular piece of DNA. Thus, prokaryotes are simple and smaller than eukaryotes.

What do they have in common? Well, while the prokaryotes do not have internal membranes, they do have a cell membrane just like the eukaryotes. They are also filled with cytoplasm. Finally, they have organelles which do not require membranes, (e.g. ribosomes).

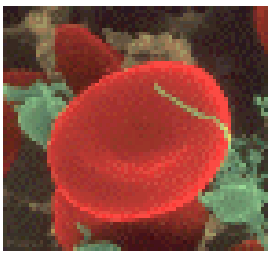
Imagine you could take a trip into a tiny bacterial cell. Bacteria and blue-bacteria are quite different from other cells. They have fewer structures than plant or animal cells. However, they carry out all of the life processes that other cells carry out. You can see that a bacteria has a cell wall, a cell membrane, and cytoplasm. The chromosome material, which directs the cell's activities, floats freely through the cytoplasm. The other structures are lacking.



A single-celled bacteria: E. coli



The one-celled organism *Amoeba proteus*



A human red blood cell

Figure 3.2 Some cell types.
Source: http://web.jjay.cuny.edu/~acarpi/NSC/13-cell.htm

The second cell grouping is Plants versus Animal cells. Both of these cell types are eukaryotes. This means they have a lot of organelles in common. One organelle they don't have in common is chloroplasts, which only plants have. Another organelle difference is the vacuoles. In animal cells the vacuoles are small and plenty. In the plant cells, there is a large central vacuole that occupies over 50% of the plant cell's volume. This vacuole is filled with water and nutrients under pressure. The pressure helps maintain the plant cell's rigid shape.

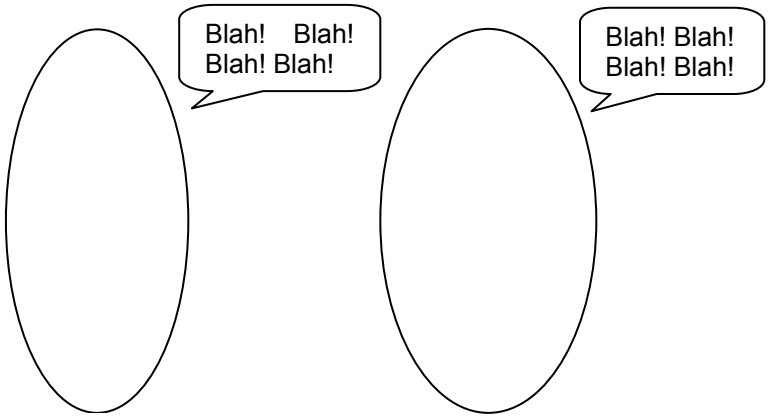
The rigid shape results in plant cells looking rectangular as compared to the round-like animal cells. While both cell types have cell membranes, the plant cell's rigidity is further maintained by an additional cell wall outside the membrane.

What you will do

Activity 3.1

Read, Think and Write

One day one-celled organisms got tired of being called simple organisms by the many-celled organisms. The one-celled organisms felt that they were rather complex individuals and should be recognized as such. In order to gain this recognition, they challenged the many-celled organisms to a debate. Pretend that you are a one-celled organism. What arguments would you use to defend your position? Write them down.



Key to answers on page 22.

What you will do

Self-Test 3.1

Answer the following questions:

1. Chloroplasts are found in which type of cell?
2. What do you call the broad group of cells that lack membrane bounded organelles?
3. What type of cell (prokaryote or eukaryote) has DNA that floats freely in the cell?
4. Mushroom is a unicellular organism. (True or false)
5. Human is a multicellular organism. (True or false)

Key to answers on page 22.

Let's Summarize

1. Cells are amazing, variable, beautiful, and functionally superb. A concept of genius, they work alone or in groups with equal ease.
2. Cells are the basic units of life. **All living things** are made up of one or more cells. Organisms that exist as single cells are called **unicellular** and organisms that are made up of groups of cells working together are called **multicellular**.
3. Because all living things are made up of cells, and because we desire to understand ourselves and the other living things around us it makes sense to learn something about cells.
4. All living things are divided into two major groups depending on how their cells are set up. These two groups are the **Prokaryotes** and the **Eukaryotes**.
5. The basic structure of plant and animal cell is almost the same except for certain differences. The basic structure of a cell is composed of the following components.

   a. Cell Membrane
   b. Cytoplasm
   c. Nucleus

   However in plants, a rigid "Cell wall" is present outside the cell membrane or plasma membrane.

6. **Cell Theory**: All living things are composed of cells. Cells are the basic units of structure and function in living things. All cells come from preexisting cells.

Whew! At last! You have finished studying the module. But, before you completely exit from this module, let us find out how much you learned from this material.

Posttest

Multiple Choice. Choose the letter of the best answer. Write the chosen letter on a separate sheet of paper.

1. Which of the following is **NOT** true of chloroplasts?
    a. They synthesize sugar
    b. They contain pigments
    c. They are only found in plants
    d. They appear green because of the chlorophyll

2. Which of the following organelles transports materials inside the cell
    a. lysosome
    b. chloroplast
    c. mitochondria
    d. endoplasmic reticulum

3. Which of the following is found in the nucleus?
    a. vacuoles
    b. chloroplasts
    c. mitochondria
    d. chromosomes

4. What type of cell has these characteristics: contains DNA but no nucleus, contains flagella, ribosomes, cytoplasm, and a cell membrane.
    a. plant
    b. fungi
    c. animal
    d. bacteria

5. What site regulates what goes in and out of the cell?
    a. cell wall
    b. vacuole
    c. cell membrane
    d. nuclear membrane

6. Digestive enzymes or hydrolytic enzymes are terms associated with
    a. ribosomes
    b. lysosomes
    c. golgi apparatus
    d. smooth endoplasmic reticulum

7. In which of the following items would you expect to find cells?
    a. strawberry
    b. eyeglasses
    c. silver dollar
    d. plastic flower

8. Where is the site of protein synthesis?
    a. nucleus
    b. lysosome
    c. ribosome
    d. mitochondria

9. A cell with relatively few energy needs will probably have a relatively small number of
    a. ribosomes
    b. lysosomes
    c. mitochondria
    d. chromosomes

10. Organisms whose cells do not have a nucleus are called
    a. plants
    b. organelles
    c. eukaryotes
    d. prokaryotes

11. Which of the following structures are common to both eukaryotic and prokaryotic cells?
    a. nucleus
    b. ribosomes
    c. both b and c

12. A cell is observed to contain a nucleus, mitochondria and chloroplasts. From this information you can conclude that the cell is:
    a. a plant cell
    b. an animal cell
    c. a bacterial cell
    d. a prokaryotic cell

13. Which of the following statements is always true?
    a. All cells have a cell wall.
    b. All cells contain a nucleus.
    c. All cells contain a chloroplast.
    d. All cells have a cell membrane.

14. Plant cells often have a box-like shape because of the
    a. nucleus
    b. cell wall
    c. cytoplasm
    d. cell membrane

15. Which is the “brain” of the cell?
    a. nucleus
    b. chloroplast
    c. golgi bodies
    d. mitochondria

16. The site of ATP production and the site of photosynthesis are the _____ and _____.
    a. ribosomes and vacuoles
    b. chloroplast and lysosome
    c. mitochondria and chloroplast
    d. Golgi complex and chloroplast

17. Which of the following forms of life is **NOT** eukaryotic?
    a. a bacterial cell
    b. protist such as an amoeba
    c. a plant cell like gumamela
    d. a human cell such as a red blood cell

18. A cell that lacks a nucleus and membrane bound organelles is known as a(an) _____ cell.
    a. plant
    b. animal
    c. eukaryote
    d. prokaryote

19. Which organelle has no membrane?
    a. vacuole
    b. lysosome
    c. ribosome
    d. chloroplast

20. What is the outermost boundary of an animal cell?

a. the cell wall
b. the cytoplasm
c. the cell membrane
d. the nuclear envelope

Got a perfect score? Check it out!

Key to answers on page 23.

Key to Answers

Pretest

1. c	6. d	11. d	16. c
2. d	7. b	12. a	17. a
3. d	8. a	13. d	18. d
4. c	9. b	14. b	19. c
5. a	10. c	15. c	20. c

Lesson 1

Activity 1.1

The Street Sweepers

Lining the passageways are special cells that release a mixture of water, carbohydrates, and salts, called mucus. The particles of dust and dirt that are inhaled are trapped in this sticky mucus. Underneath this layer of mucus is another group of specialized cells that have cilia. As the cilia move, they create a sweeping action. This action keeps the most vital passageways in the body clean and open for business.

Self-Test 1.1

1. Leeuwenhoek: discovered protozoa
   Hooke: described “cells” in cork
   Schleiden & Schwann: proposed cell theory
   Virchow: concluded that cells come from preexisting cells

2. The microscope opened up the world of the very small to biologists. It enabled scientists to discover that all living things are made up of cells.

Lesson 2

Self-Test 2.1

Cell Structures: A Summary

Structures	Animal cell	Plant cell	Bacterial cell
1. Cell wall	X	/	/
2. Cell membrane	/	/	/
3. Cytoplasm	/	/	/
4. Mitochondria	/	/	X
5. Ribosomes	/	/	/
6. Endoplasmic reticulum	/	/	X
7. Golgi bodies	/	/	X
8. Lysosomes	/	X	X
9. Vacuoles	/	/	X
10. Chloroplasts	X	/	X
11. Nucleus	/	/	X
12. Chromosomes	/	/	/

Self-Test 2.2

The body parts of the tadpoles change in response to the activity of the cells which is cell division. When cells divide, their number increases. Growth results when cells increase in number.

The tails of the tadpole disappear due to the lysosomal activity. The lysosome, if you will recall, contains powerful chemicals which are used to digest or breakdown materials

Lesson 3

Activity 3.1

Feedback: One-celled organisms may have fewer or different structures from plant or animal cells. However, they carry out all of the life processes (reproduction, digestion, excretion, respiration, etc.) that other cells carry out.

Self-Test 3.1

1. plant
2. prokaryote
3. prokaryote
4. false
5. true

Posttest

1. c	6. b	11. b	16. c
2. d	7. a	12. a	17. a
3. d	8. c	13. d	18. d
4. b	9. c	14. b	19. c
5. c	10. d	15. a	20. c

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