UNIT TWO

SIMILARITIES AMONG LIVING THINGS

LEARNING OUTCOMES: Upon completion of the study of this unit, you should be able to:

- Identify the cell as the unit common to living things.
- Describe several functions carried out by cells that promote their survival.
- Identify several cell organelles and describe their functions.
- Describe ways cells can be studied in the laboratory.
- Describe the levels of organization in living things.
- List the major elements found in living things.
- Name the main types of organic compounds in living cells.

Chapter 3: Characteristics of Living Things

A. DEFINING LIFE. The science of biology studies life and living things. Do you know what is meant by the term “life”? Scientists do not agree on one definition of life. They do agree, however, that the cells of living things (organisms) carry on certain processes that are necessary for life. These processes or activities, common to all living things, are known as life functions. An organism is considered to be alive as long as its cells perform certain life functions. Nutrition, transport, respiration, excretion, regulation, growth, reproduction, synthesis, and metabolism are the life functions or characteristics shared by living things.

REVIEW QUESTIONS

1. The science of biology studies ______ life ______ and ______ living things ______.

2. How do scientists define life? Scientists do not agree on one definition of life.

3. The term “organism” is another word for ______ living thing ______.

4. Life functions are ______ processes ______ or ______ activities ______ that are common to all living things.

5. An organism is considered alive as long as its ______ cells perform certain life functions ______.
6. Name nine life functions. Nutrition, transport, respiration, excretion, regulation, growth, reproduction, synthesis, and metabolism are the life functions or characteristics shared by living things.

7. Complete the following chart with examples of things that you think are living and nonliving. For example, a horse is living and a rock is nonliving.

<table>
<thead>
<tr>
<th>LIVING THINGS</th>
<th>NONLIVING THINGS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answers vary.</td>
<td></td>
</tr>
</tbody>
</table>

B. NUTRITION. Living things need food to supply energy for life activities and materials for the growth and repair of cells. During the life process of nutrition organisms obtain (get) and process food. Some organisms, such as green plants, can make their own food while other living things must obtain their food already formed. Organisms that are able to make their own food are called autotrophs. Heterotrophs are organisms that are not able to make their own food.

Nutrition involves ingestion and digestion. Food is taken in from the environment by ingestion. Ingested food is not usually in a form that can be used by body cells and must be changed into a usable form. Digestion is the process that changes food into a form that can be used by the cell. During digestion large complex molecules are broken down into small simple molecules.

**REVIEW QUESTIONS**

1. The life activity responsible for obtaining and processing food is called nutrition.

2. During ingestion food is taken in from the environment.
3. Digestion is a process that **changes food into a form that can be used by the cell**.

4. Explain why living things need food. **Living things need food to supply energy for life activities and materials for the growth and repair of cells.**

C. TRANSPORT. After digestion is completed **nutrients**, the parts of food that can be used by the cell, are carried to the cell. **Transport** is the life process that includes the absorption and circulation of materials throughout an organism. **Absorption** is the process by which the usable materials from food called the end products of digestion, as well as other dissolved materials, are taken into the cells and fluids of the body. **Circulation** involves the movement of materials to and from the cells, within cells, and/or throughout an organism. Along with nutrients, oxygen, water, and wastes are also transported throughout a cell or organism.

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**REVIEW QUESTIONS**

1. The usable parts of food are called **nutrients**.

2. **Transport** is the life process that includes the absorption and circulation of materials throughout an organism.

3. Circulation is the **movement of materials to and from the cells, within cells, and/or throughout an organism**.

4. Absorption occurs when **usable materials are taken into the cell**.

D. RESPIRATION. Living things need a constant supply of energy for their life activities. **Respiration** is a complex series of chemical reactions that release energy for life activities. An organism’s energy is stored in food nutrients. Most organisms need oxygen for respiration—they are called **aerobic organisms**. A few organisms, known as **anaerobic organism**, do not need oxygen for their respiratory processes.

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**REVIEW QUESTIONS**

1. Living things need **a constant supply of energy** for their life activities.

2. Respiration is defined as **a complex series of chemical reactions that release energy for life activities**.

3. What is the difference between aerobic and anaerobic organisms?

   **Most organisms need oxygen for respiration - they are called aerobic organisms. A few organisms, known as anaerobic organisms, do not need oxygen for their respiratory processes.**
E. EXCRETION. Life processes result in the formation of cellular wastes. These wastes are harmful to the organism and must be removed. **Excretion** is the removal of waste materials produced in the cells as a result of life activities. Products commonly excreted from cells are carbon dioxide and water.

**Egestion** is the process that removes undigested materials from the body. Do not confuse the process of egestion, which means to get rid of solid wastes, with excretion. Excretion is the elimination of the gaseous or liquid wastes of cellular respiration.

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**REVIEW QUESTIONS**

1. What is excretion? **Excretion is the removal of waste materials produced in the cells as a result of life activities.**

2. Why is it necessary for an organism to remove wastes? **These wastes are harmful to the organism.**

3. Egestion is the removal of __undigested materials from the body__.

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F. REGULATION. The life activity responsible for the control and coordination of all the various activities of an organism is called **regulation**. The nervous and endocrine systems are responsible for regulation. Regulation allows organisms to respond to changes in the environment. This means they can find food, avoid danger, respond to light, and perform other tasks important to their survival. A change in the internal or external environment is known as a **stimulus**. Some examples of stimuli are light and temperature.

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**REVIEW QUESTIONS**

1. Regulation is the life activity responsible for __control__ and __coordination__ in an organism.

2. The __nervous__ system and the __endocrine__ system carry on regulation.

3. A stimulus is __a change in the internal or external environment__.

4. Some examples of stimuli are __light__ and __temperature__.

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G. SYNTHESIS. Living things are able to produce complex substances from simpler substances by the process of **synthesis**. During this process the simpler food molecules produced during digestion are put together to make the complex materials needed by the organism. These complex materials become part of the structure of the organism. For example, during photosynthesis green plants “make” complex compounds (sugar) from simpler materials.

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**REVIEW QUESTIONS**

1. The process of synthesis makes __complex__ materials from __simpler__ food molecules.
2. What happens to the materials that are synthesized by an organism? During this process the simple food molecules produced during digestion are put together to make the complex materials needed by the organism.

H. GROWTH. Growth results from synthesis. Growth is an increase in the size and/or number of cells of an organism. The complex materials produced during synthesis are used for growth. When cells grow, the size of the cytoplasm changes but not the size of the nucleus (Figure 3-1).

![Figure 3-1. Cell Growth.](image)

**Review Questions**

1. Growth results from the complex materials produced during ______ synthesis ______.

2. Compare the changes in the size of the cytoplasm and the size of the nucleus that occur as a result of growth. When cells grow, the size of the cytoplasm changes but not the size of the nucleus.

3. An increase in the size or number of cells in an organism is called ______ growth ______.

I. LOCOMOTION. The ability to move from place to place is called locomotion. Organisms that are able to move from place to place are said to be motile. Most animals are motile. There are a few animals that are nonmotile (sessile) during their adult form. Sessile animals attach themselves to an object and stay there all their lives. Many small aquatic organisms cannot move around on their own. These organisms must be carried around by water currents or blown around in the air. Locomotion is important because the ability of an organism to move around on its own increases its probability of survival. It also increases its opportunity to find food, seek shelter, avoid predators, move away from toxic wastes, and find a mate.

**Review Questions**

1. What are the meanings of the terms sessile and motile? Organisms that are able to move from place to place are said to be motile. Organisms that are not capable of locomotion and that tend to remain in the same place attached to a surface are called sessile.

2. List 2 reasons why the ability to move around is advantageous for organisms. It increases its opportunity to find food, seek shelter, avoid predators, move away from toxic wastes, and find a mate. (any two)

J. REPRODUCTION. Reproduction is the production (making) of new organisms. This is the only life process that is not necessary for the life of an individual organism. It is, however, necessary for the continued existence of a particular group of organisms. For example, one cat can live a normal life
without reproducing, but if all cats stopped reproducing, the group of organisms called cats would become extinct.

Cells reproduce by cell division—one cell divides into two cells. Cell division involves a series of changes in the cell leading to the production of two new cells. In organisms made up of many cells the production of new cells also results in the growth and repair of damaged tissues. You will learn more about reproduction in Unit 5.

--- REVIEW QUESTIONS ---

1. Do individual organisms need to reproduce to stay alive? _______ no _______

2. Cells reproduce by a process called ___________ cell division ___________.

K. METABOLISM AND HOMEOSTASIS. The sum total of all the life processes taking place in an organism is known as metabolism. It includes the chemical reactions essential to the organism as well as the conversion of energy into forms needed by the cells. Metabolic activities occur all the time in every living system.

The parts of the human body and those of all multicellular organisms, from organ systems to cell organelles, interact to maintain a balanced internal environment. The structures present in some single-celled organisms act in a manner similar to the tissues and systems found in multicellular organisms. This enables them to perform all of the life processes needed to maintain a balanced internal environment. To successfully accomplish this organisms possess a diversity of control mechanisms that detect deviations and make corrective actions.

The maintenance of a stable internal (inside) environment in spite of changes in the external (outside) environment is called homeostasis or dynamic equilibrium. When the organism is in homeostasis it is in a balanced or “steady” state. If there is a disruption in any organ system there may be a corresponding imbalance in homeostasis. Homeostasis in an organism is constantly threatened—if the organism’s body fails to respond effectively, disease and/or death can occur. As a result of regulation the metabolic reactions of an organism are constantly adjusted in the direction necessary to maintain a constant internal environment. These activities are self-regulated so as to maintain a balanced state within the organism.

The mechanisms for self-regulation are known as feedback mechanisms. An example of a feedback mechanism is maintenance of body temperature. When body temperature rises above normal the increase is sensed by a part of the brain. A message is sent by the nervous system to the sweat glands of the skin to produce sweat. As sweat evaporates from the body its temperature is lowered because evaporation is a cooling process. If the body temperature of the body is low the nervous system sends a message to the sweat glands to constrict (get smaller). This action causes the body temperature to rise. Other examples include changes in heart rate or respiratory rate in response to increased activity in muscle cell, maintenance of blood sugar levels by insulin from the pancreas, and changes in openings in the leaves of plants by guard cells to regulate water loss and gas exchange.

--- REVIEW QUESTIONS ---

1. Define metabolism and homeostasis. **Metabolism is all the processes needed by an organism to maintain life. Homeostasis is the maintenance of a stable internal (inside) environment in spite of changes in the external (outside) environment.**
**Skill Practice**

**Part A.** Complete the following chart.

<table>
<thead>
<tr>
<th>LIFE ACTIVITY</th>
<th>DEFINITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transport</td>
<td>The life process involved with the circulation and absorption of nutrients.</td>
</tr>
<tr>
<td>Respiration</td>
<td>The release of energy from food.</td>
</tr>
<tr>
<td>Nutrition</td>
<td>The life process by which organisms obtain and process food.</td>
</tr>
<tr>
<td>Regulation</td>
<td>The life activity responsible for the control and coordination of all the various activities of an organism.</td>
</tr>
<tr>
<td>Excretion</td>
<td>The removal of harmful cellular wastes.</td>
</tr>
<tr>
<td>Growth</td>
<td>An increase in size and/or number of cells of an organism.</td>
</tr>
<tr>
<td>Reproduction</td>
<td>The production of new individuals.</td>
</tr>
<tr>
<td>Synthesis</td>
<td>The process of producing complex substances from simple substances.</td>
</tr>
<tr>
<td>Metabolism</td>
<td>The total of all life activities.</td>
</tr>
</tbody>
</table>
Part B. Complete the following crossword puzzle.

**Crossword Puzzle**

```
  D
2  C I R C U L A T I O N
G
5  E G E S T I O N
S
7  T
8  F S
9  B I O L O G Y
O N
N
10 A
11 T
12 R E S P I R A T I O N
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**Clues**

**ACROSS**

2. Movement of materials to cells
5. Removal of undigested materials
6. Increase in size of organism
9. Study of living things
11. Living things carry on _____ functions
12. Process that releases energy from food

**DOWN**

1. Changes food into a usable form
3. Usable parts of food
4. Obtaining and processing food
7. Ingestion is the taking in of _____
8. Making complex materials from simple materials
10. Organisms that use oxygen
CHAPTER 3: QUIZ

A. FILL-IN QUESTIONS

DIRECTIONS: Complete each of the following statements by writing the correct word or phrase in the space provided.

1. Individual organisms _____ do not _____ need reproduction to stay alive.
2. The study of living things is called _____ biology _____.
3. The materials formed from synthesis become a part of the _____ structure _____ of an organism.
4. Living things are known as _____ organisms _____.
5. The characteristics that all living things have in common are referred to as _____ life _____ functions or activities.
6. _____ Nutrition _____ is the life activity by which organisms obtain and process food.
7. The endocrine and nervous systems are responsible for the life activity of _____ regulation _____.
8. Taking in food from the environment is called _____ ingestion _____.
9. Circulation and absorption are both parts of the life process called _____ transport _____.
10. All the life processes together are its _____ metabolism _____.
11. _____ Autotrophs _____ are organisms that can make their own food.
12. Respiration is the series of chemical reactions that releases _____ energy _____.
13. The removal of cellular wastes is _____ excretion _____.
14. Nutrients are the _____ usable _____ parts of food.
15. A stimulus is defined as _____ a change in the external or internal environment _____.
16. Living things produce complex substances from simple substances by _____ synthesis _____.
17. _____ Digestion _____ is the process that changes food into a form that can be used by the cell.
18. An increase in size and/or number of cells of an organism is _____ growth _____.
19. The life process that is not necessary for the life of a single organism is _____ reproduction _____.
20. Control and coordination of life activities is carried on by the _____ regulation _____ system.

B. MULTIPLE-CHOICE QUESTIONS

DIRECTIONS: Circle the number of the expression that best completes each of the following statements.

1. The process by which a cell gets rid of wastes is known as
   (1) synthesis    (3) growth    (4) digestion
   (2) excretion

2. By which life process does a plant produce energy?
   (1) respiration    (3) digestion    (4) photosynthesis
   (2) excretion

3. Which of the following processes changes complex molecules into simple molecules?
   (1) excretion    (3) digestion
   (2) ingestion    (4) egestion
4. The energy stored in food molecules is released during
   (1) digestion
   (2) excretion
   (3) circulation
   (4) respiration

DIRECTIONS (5-7): For each phrase in questions 5 through 7, select the life process, chosen from the list below, that is most closely associated with that phrase. Then write its number in the space next to the question.

   Life Processes
   (1) Digestion
   (2) Excretion
   (3) Reproduction
   (4) Respiration

5. The removal of metabolic wastes.  2

6. The release of energy from foods.  4

7. The production of new organisms that are essentially the same as their parents.  3

8. Before being transported in the body, food must be
   (1) digested by enzymes
   (2) absorbed by alveoli
   (3) moved by cilia
   (4) egested by the large intestine

9. The manufacture of insulin in the pancreas is an example of the life function called
   (1) excretion
   (2) respiration
   (3) synthesis
   (4) reproduction

10. Which process takes place during digestion?
    (1) Large molecules are broken into small molecules.
    (2) Small molecules join to form large molecules.
    (3) Large molecules are changed into different large molecules.
    (4) Small molecules are changed into different small molecules.

C. ESSAY QUESTION

DIRECTIONS: Use complete sentences to answer the question in this part.

1. State one difference between the processes of egestion and excretion.

   Answers vary.