شكراً لتحميلك هذا الملف من موقع المناهج الإماراتية

مراجعة وفق الهيكل الوزاري بريدج

تاريخ نشر الملف على موقع المناهج: 2023-11-10 05:16:14

التواصل الاجتماعي بحسب الصف الثاني عشر العام

روابط مواد الصف الثاني عشر العام على تلغرام

التربية الاسلامية	اللغة العربية	اللغة الانجليزية	الرياضيات

المزيد من الملفات بحسب الصف الثاني عشر العام والمادة علوم في الفصل الأول

1	نموذج الهيكل الوزاري الجديد بريدج
2	تلخيص كامل الكتاب
3	كتاب الطالب انسباير
4	حل أسئلة الامتحان النهائي
5	ملخص شرح درس جهاز الغدد الصماء

مؤسسة الإمارات للتعليم المدرسي
EMIRATES SCHOOLS ESTABLISHMENT

EoT1 Exam Coverage-12G Biology

AL ZAIDYA

United Arab Emirates

Academic Year العام الدراسي	2023/2024	Term الفصل	1
Subject المادة	Biology/Bridge الأحياء/بريدج	Grade الصف	12
Stream المسار	General العام	Mode of Implementation - طريقة التطبيق	SwiftAssess
		Exam Duration - مدة الامتحان	120 minutes

Marks of MCQ درجة الأسئلة الموضوعية	100	Maximum Overall Grade الدرجة القصوى الممكنة	100

Questions might appear in a different order in the actual exam, قد تظهر الأسئلة بترتيب مختلف في الامتحان الفعلي

As it appears in the textbook, LMS, and (Main_IP). كما وردت في كتاب الطالب وLMS والخطة الفصلية.

Section 2

Essential Questions

- What are the parts of a chemical reaction?
- How can energy changes be related to chemical reactions?
- What is the importance of enzymes in living organisms?

Review Vocabulary

process: a series of steps or actions that produce an end product

New Vocabulary

chemical reaction
reactant
product
activation energy
catalyst
enzyme
substrate
active site

Chemical Reactions

MAIN Idea **Chemical reactions allow living things to grow, develop, reproduce, and adapt.**

Real-World Reading Link When you lie down for the night, you might think that your body is completely at rest. In fact, you are still digesting the food that you ate that day, the scrape on your elbow is healing, and your muscles and bones are growing and developing. All the things that happen inside your body are the result of chemical reactions.

Reactants and Products

A new car with shining chrome and a clean appearance is appealing to many drivers. Over time, however, the car might get rusty and lose some of its appeal. Rust is a result of a chemical change called a chemical reaction. A **chemical reaction** is the process by which atoms or groups of atoms in substances are reorganized into different substances. Chemical bonds are broken and formed during chemical reactions. The rust on the chain in **Figure 13** is a compound called iron oxide (Fe_2O_3), and it was formed when oxygen (O_2) in the air reacted with iron (Fe).

It is important to know that substances can undergo changes that do not involve chemical reactions. For example, consider the water in **Figure 13.** The water is undergoing a physical change. A physical change alters a substance's appearance but not its composition. The water is water before and after the change.

How do you know when a chemical reaction has taken place? Although you might not be aware of all the reactions taking place inside your body, you know that the surface of the chain in **Figure 13** has changed. What was once silver and shiny is now dull and orange-brown. Other clues that a chemical reaction has taken place include the production of heat or light, and the formation of a new gas, liquid, or solid.

Figure 13 After a chemical change, such as rusting, a new substance is formed. During a physical change, such as ice melting or water boiling, the chemical makeup of the water is not altered.

Chemical change

Physical change

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
دراسة المعلومات الواردة في الصفحة- Study the information on the page	12

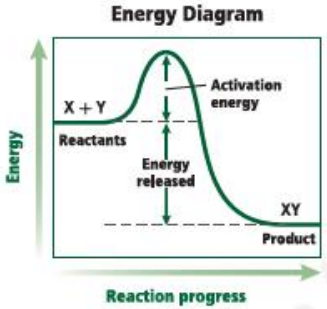
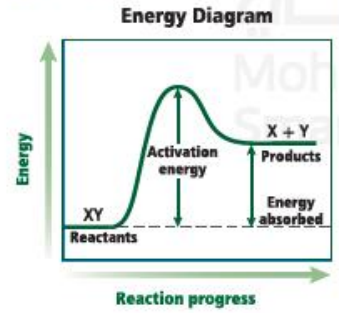


Figure 15 The flame of the match provides activation energy—the amount of energy needed to begin a reaction. The reaction gives off energy in the form of heat and light.

Activation energy The minimum amount of energy needed for reactants to form products in a chemical reaction is called the **activation energy.** For example, you know that a candle will not burn until you light its wick. The flame provides the activation energy for the reaction of the substances in the candle wick with oxygen. In this case, once the reaction begins, no further input of energy is needed and the candle continues to burn on its own. **Figure 15** shows that for the reactants X and Y to form product XY, energy is required to start the reaction. The peak in the graph represents the amount of energy that must be added to the system to make the reaction occur. Some reactions rarely happen because they have a very high activation energy.

Energy change in chemical reactions Compare how energy changes during the reaction in **Figure 15** to how energy changes during the reaction in **Figure 16.** Both reactions require activation energy to get started. However, the reaction in **Figure 15** has lower energy in the product than in the reactants. This reaction is exothermic–it released energy in the form of heat. The reaction in **Figure 16** is endothermic–it absorbed heat energy. The energy of the products is higher than the energy of the reactants. In every chemical reaction, there is a change in energy caused by the making and breaking of chemical bonds as reactants form products. Exothermic reactions keep your internal body temperature at about 37°C.

Figure 16 In an endothermic reaction, the energy of the products is higher than the energy of the reactant.



Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 15	14
Figure No. 15	

-دراسة المعلومات الواردة في الصفحة
-الشكل 15 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 15, its data, and the commentary accompanying the figure

Section 3

Water and Solutions

Essential Questions

- How does the structure of water make it a good solvent?
- What are the similarities and differences between solutions and suspensions?
- What are the differences between acids and bases?

Review Vocabulary

physical property: characteristic of matter, such as color or melting point, that can be observed or measured without changing the composition of the substance

New Vocabulary

polar molecule
hydrogen bond
mixture
solution
solvent
solute
acid
base
pH
buffer

MAIN Idea **The properties of water make it well suited to help maintain homeostasis in an organism.**

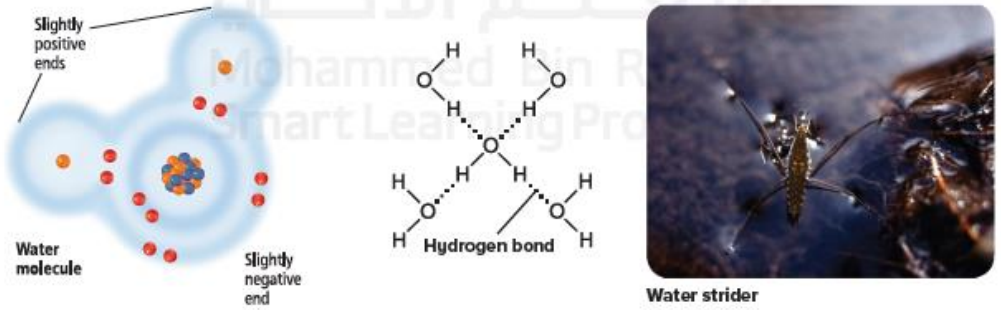
Real-World Reading Link You probably know that the main color on a globe is blue. That's because water covers about 70 percent of Earth's surface, giving it the blue color you see from a distance. Now imagine zooming in to a single cell of an organism on Earth. Water accounts for approximately 70 percent of that cell's mass. It is one of the most important molecules for life.

Water's Polarity

Earlier in this chapter, you discovered that water molecules are formed by covalent bonds that link two hydrogen (H) atoms to one oxygen (O) atom. Because electrons are more strongly attracted to the oxygen atom's nucleus, the electrons in the covalent bond with hydrogen are not shared equally. In water, the electrons spend more time near the oxygen atom's nucleus than they do near the hydrogen atoms' nuclei. **Figure 19** shows that there is an unequal distribution of electrons in a water molecule. This, along with the bent shape of water molecules, results in the oxygen end of the molecule having a slightly negative charge and the hydrogen ends of the molecule having a slightly positive charge. Molecules that have an unequal distribution of charges are called **polar molecules,** meaning that they have oppositely charged regions.

Polarity is the property of having two opposite poles, or ends. A magnet has polarity–there is a north pole and a south pole. When the two ends are brought close to each other, they attract each other. Similarly, when a charged region of a polar molecule comes close to the oppositely charged region of another polar molecule, a weak electrostatic attraction results. In water, the electrostatic attraction is called a hydrogen bond. A **hydrogen bond** is a weak interaction involving a hydrogen atom and a fluorine, oxygen, or nitrogen atom. Hydrogen bonding is a strong type of van der Waals force. **Figure 20** describes polarity and the other unique properties of water that make it important to living things.

Figure 19 Because water molecules have a bent shape and electrons are not shared equally between hydrogen and oxygen, hydrogen bonds form among the molecules. Due to the attraction among the atoms that make up water, the surface of water supports a water strider.



Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 19	17
Figure No. 19	

-دراسة المعلومات الواردة في الصفحة
-الشكل19 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 19, its data, and the commentary accompanying the figure

Mixtures with Water

You are probably familiar with powdered drink products that dissolve in water to form a flavored beverage. When you add a powdered substance to water, it does not react with water to form a new product. You create a mixture. A **mixture** is a combination of two or more substances in which each substance retains its individual characteristics and properties.

Homogeneous mixtures When a mixture has a uniform composition throughout, it is called a homogeneous (hoh muh JEE nee us) mixture. A **solution** is another name for a homogeneous mixture. For example, in the powdered drink mix solution shown in **Figure 21,** the drink mix is on top, in the middle, and at the bottom of the container. The water retains its properties and the drink mix retains its properties.

In a solution, there are two components: a solvent and a solute. A **solvent** is a substance in which another substance is dissolved. A **solute** is the substance that is dissolved in the solvent. In the case of the drink mix, water is the solvent and the powdered substance is the solute. A mixture of salt and water is another example of a solution because the solute (salt) dissolves completely in the solvent (water). Saliva moistens your mouth and begins the digestion of some of your food. Saliva is a solution that contains water, proteins, and salts. In addition, the air you breathe is a solution of gases.

Heterogeneous mixtures Think about the last time you ate a salad. Perhaps it contained lettuce and other vegetables, croutons, and salad dressing. Your salad was a heterogeneous mixture. In a heterogeneous mixture, the components remain distinct, that is, you can tell what they are individually. Compare the mixture of sand and water to the solution of salt and water next to it in **Figure 22.** Sand and water form a type of heterogeneous mixture called a suspension. Over time, the particles in a suspension settle to the bottom.

A colloid is a heterogeneous mixture in which the particles do not settle out like the sand settled from the water. You are probably familiar with many colloids, including fog, smoke, butter, mayonnaise, milk, paint, and ink. Blood is a colloid made up of plasma, cells, and other substances.

Reading Check **Distinguish** between solutions and suspensions.

Figure 21 The drink mix forms a homogeneous mixture in water. The particles of the solute (drink mix) are dissolved and spread throughout the solvent (water).

VOCABULARY

ACADEMIC VOCABULARY

Suspend
to keep from falling or sinking
A slender thread suspended the spider from the web.

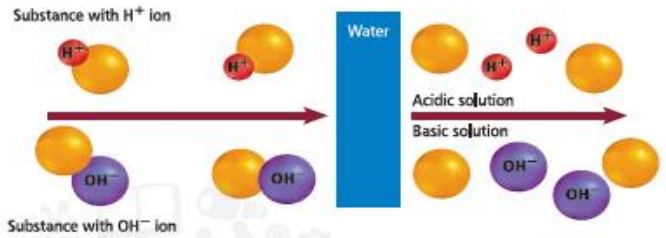
Figure 22
Left: Sand and water form a heterogeneous mixture; you can see both the liquid and the solid. The homogeneous mixture of salt and water is a liquid; you cannot see the salt.
Right: Blood is a heterogeneous mixture called a colloid.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
	19
الشكل رقم 21 و 22	19
Figure No. 21,22	

-دراسة المعلومات الواردة في الصفحة
-الشكل 21+22 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 21+22, its data, and the commentary accompanying the figure

Figure 23 Substances that release H^+ in water are acids. Substances that release OH^- in water are bases.



Acids and bases Many solutes readily dissolve in water because of water's polarity. This means that an organism, which might be as much as 70 percent water, can be a container for a variety of solutions. When a substance that contains hydrogen is dissolved in water, the substance might release a hydrogen ion (H^+) because it is attracted to the negatively charged oxygen atoms in water, as shown in **Figure 23.** Substances that release hydrogen ions when they are dissolved in water are called **acids.** The more hydrogen ions a substance releases, the more acidic the solution becomes.

Similarly, substances that release hydroxide ions (OH^-) when they are dissolved in water are called **bases.** Sodium hydroxide (NaOH) is a common base that breaks apart in water to release sodium ions (Na^+) and hydroxide ions (OH^-). The more hydroxide ions a substance releases, the more basic the solution becomes.

Acids and bases are key substances in biology. Many of the foods and beverages that we eat and drink are acidic, and the substances in the stomach that break down the food, called gastric juices, are highly acidic.

DATA ANALYSIS LAB 1

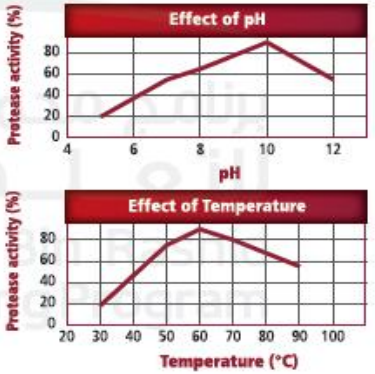
Based on Real Data*

Recognize Cause and Effect

How do pH and temperature affect protease activity? Proteases are enzymes that break down protein. Bacterial proteases often are used in detergents to help remove stains such as egg, grass, blood, and sweat from clothes.

Data and Observations

A protease from a newly isolated strain of bacteria was studied over a range of pH values and temperatures.



Think Critically

1. **Identify** the range of pH values and temperatures used in the experiment.
2. **Summarize** the results of the two graphs.
3. **Infer** If a laundry detergent is basic and requires hot water to be most effective, would this protease be useful? Explain.

*Data obtained from: Adinarayana, et al. 2003. Purification and partial characterization of thermostable serine alkaline protease from a newly isolated *Bacillus subtilis* PE-11. *AAPS PharmSciTech 4: article 56.*

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 23	20
Figure No. 23	

-دراسة المعلومات الواردة في الصفحة
-الشكل 23 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 23, its data, and the commentary accompanying the figure

Section 4

The Building Blocks of Life

Essential Questions

- What is the role of carbon in living organisms?
- What are the four major families of biological macromolecules?
- What are the functions of each group of biological macromolecules?

Review Vocabulary

organic compound: a carbon-based substance that is the basis of living matter

New Vocabulary

macromolecule
polymer
carbohydrate
lipid
protein
amino acid
nucleic acid
nucleotide

MAIN Idea **Organisms are made up of carbon-based molecules.**

Real-World Reading Link Children enjoy toy trains because they can link long lines of cars together and make patterns by joining cars of similar color or function. Similarly, in biology, there are large molecules made of many smaller units joined together.

Organic Chemistry

The element carbon is a component of almost all biological molecules. For this reason, life on Earth often is considered carbon-based. Because carbon is an essential element, scientists have devoted an entire branch of chemistry, called organic chemistry, to the study of organic compounds, which are those compounds containing carbon.

As shown in **Figure 25,** carbon has four electrons in its outermost energy level. Recall that the second energy level can hold eight electrons, so one carbon atom can form four covalent bonds with other atoms. These covalent bonds enable the carbon atoms to bond to each other, which results in a variety of important organic compounds. These compounds can be in the shape of straight chains, branched chains, and rings, such as those illustrated in **Figure 25.** Together, carbon compounds lead to the diversity of life on Earth.

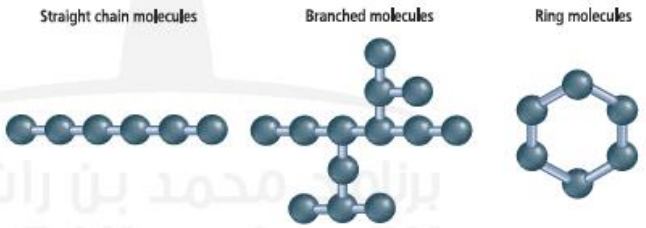
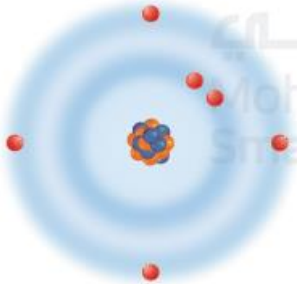


Figure 25 The amazing diversity of life is based on the variety of carbon compounds. The half-filled outer energy level of carbon allows for the formation of straight chain, branched, and ring molecules.



Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 25	22
Figure No. 25	

-دراسة المعلومات الواردة في الصفحة
-الشكل 25 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 25, its data, and the commentary accompanying the figure

Figure 29
Left: The general structure of an amino acid has four groups around a central carbon.
Right: The peptide bond in a protein happens as a result of a chemical reaction.
Interpret *which other molecule is a product when a peptide bond forms.*

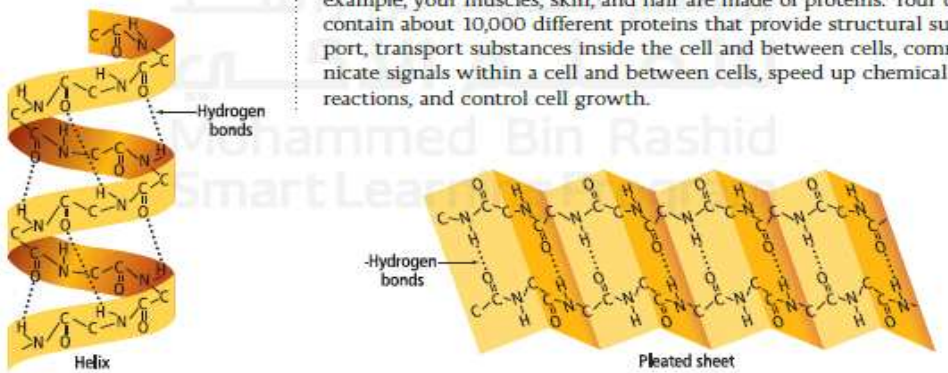
Proteins Another primary building block of living things is protein. A **protein** is a compound made of small carbon compounds called amino acids. **Amino acids** are small compounds that are made of carbon, nitrogen, oxygen, hydrogen, and sometimes sulfur. All amino acids share the same general structure.

Amino acid structure Amino acids have a central carbon atom like the one shown in **Figure 29.** Recall that carbon can form four covalent bonds. One of those bonds is with hydrogen. The other three bonds are with an amino group ($-NH_2$), a carboxyl group ($-COOH$), and a variable group ($-R$). The variable group makes each amino acid different. There are 20 different variable groups, and proteins are made of different combinations of all 20 different amino acids. Several covalent bonds called peptide bonds join amino acids together to form proteins, which is also shown in **Figure 29.** A peptide bond forms between the amino group of one amino acid and the carboxyl group of another.

Three-dimensional protein structure Based on the variable groups contained in the different amino acids, proteins can have up to four levels of structure. The number of amino acids in a chain and the order in which the amino acids are joined define the protein's primary structure. After an amino acid chain is formed, it folds into a unique three-dimensional shape, which is the protein's secondary structure. **Figure 30** shows two basic secondary structures: the helix and the pleat. A protein might contain many helices, pleats, and folds. The tertiary structure of many proteins is globular, such as the hemoglobin protein shown in **Table 1,** but some proteins form long fibers. Some proteins form a fourth level of structure by combining with other proteins.

Protein function Proteins make up about 15 percent of your total body mass and are involved in nearly every function of your body. For example, your muscles, skin, and hair are made of proteins. Your cells contain about 10,000 different proteins that provide structural support, transport substances inside the cell and between cells, communicate signals within a cell and between cells, speed up chemical reactions, and control cell growth.

Figure 30 The shape of a protein depends on the interactions among the amino acids. Hydrogen bonds help the protein hold its shape.



Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 29	26
Figure No. 29	

-دراسة المعلومات الواردة في الصفحة
-الشكل 29 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 29, its data, and the commentary accompanying the figure

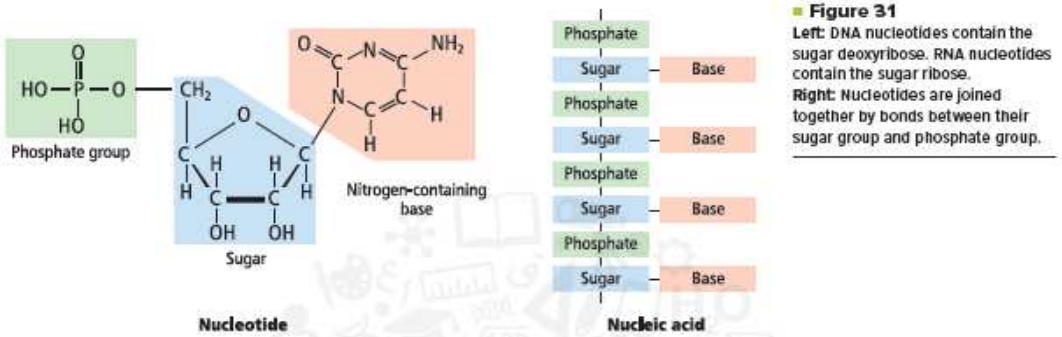


Figure 31
Left: DNA nucleotides contain the sugar deoxyribose. RNA nucleotides contain the sugar ribose.
Right: Nucleotides are joined together by bonds between their sugar group and phosphate group.

Nucleic acids The fourth group of biological macromolecules are nucleic acids. **Nucleic acids** are complex macromolecules that store and transmit genetic information. Nucleic acids are made of smaller repeating subunits composed of carbon, nitrogen, oxygen, phosphorus, and hydrogen atoms, called **nucleotides.** **Figure 31** shows the basic structure of a nucleotide and nucleic acid. There are five major nucleotides, all of which have three units–a phosphate, a nitrogenous base, and a ribose sugar.

There are two types of nucleic acids found in living organisms: deoxyribonucleic (dee AHK sih rib oh noo klay ihk) acid (DNA) and ribonucleic (rib oh noo KLAY ihk) acid (RNA). In nucleic acids such as DNA and RNA, the sugar of one nucleotide bonds to the phosphate of another nucleotide. The nitrogenous base that sticks out from the chain is available for hydrogen bonding with other bases in other nucleic acids.

A nucleotide with three phosphate groups is adenosine triphosphate (ATP). ATP is a storehouse of chemical energy that can be used by cells in a variety of reactions. It releases energy when the bond between the second and third phosphate group is broken. Less energy is released when the bond between the first and second phosphate group is broken.

Section 4 Review

Section Summary

- Carbon compounds are the basic building blocks of living organisms.
- Biological macromolecules are formed by joining small carbon compounds into polymers.
- There are four types of biological macromolecules.
- Peptide bonds join amino acids in proteins.
- Chains of nucleotides form nucleic acids.

Understand Main Ideas

1. MAIN Idea **Explain** If an unknown substance found on a meteorite is determined to contain no trace of carbon, can scientists conclude that there is life at the meteorite's origin?
2. **Compare** the types of biological macromolecules and their functions.
3. **Determine** the components of carbohydrates and proteins.
4. **Discuss** the importance of amino acid order to a protein's function.

Think Critically

5. **Summarize** Given the large number of proteins in the body, explain why the shape of an enzyme is important to its function.
6. **Draw** two structures (one straight chain and one ring) of a carbohydrate with the chemical formula $(CH_2O)_6$.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 31	27
Figure No.31	

-دراسة المعلومات الواردة في الصفحة
-الشكل 31 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 31, its data, and the commentary accompanying the figure

Hybridization Recall that crossing parent organisms with different forms of a trait to produce offspring with specific traits results in hybrids. Farmers, animal breeders, scientists, and gardeners often use the production of hybrids, also known as hybridization. They select traits that will give hybrid organisms a competitive edge. These hybrid organisms can be bred to be more disease-resistant, to produce more offspring, or to grow faster. For example, plant breeders might choose to cross two different varieties of tomato plants in order to produce a hybrid that has both the disease resistance of one parent and the fast growth rate of the other parent.

Care must be taken to identify organisms with desired traits and successfully cross them to yield the right combination of traits from both parents. A disadvantage of hybridization is that it is time consuming and expensive. For example, it took rice breeders three decades to produce hybrid rice varieties that can produce higher yields than non-hybrid varieties. Because hybrids can be bred to be more nutritious, to have the ability to adapt to a wide range of changes in the environment, and to produce greater numbers of offspring, the advantages of hybridization sometimes outweigh the disadvantages.

Inbreeding Once a breeder observes a desired trait in an organism, a process is needed to ensure that the trait is passed on to future generations. This process, in which two closely related organisms are bred to have the desired traits and to eliminate the undesired ones in future generations, is called **inbreeding.**

Pure breeds are maintained by inbreeding. Clydesdale horses and Angus cattle are examples of organisms produced by inbreeding. You might have seen Clydesdale horses at parades and petting zoos. Horse breeders first bred the Clydesdale horse in Scotland hundreds of years ago for use as a farm horse. Because of their strong build, agility, and obedient nature, Clydesdales originally were inbred and used extensively for pulling heavy loads.

A disadvantage of inbreeding is that harmful recessive traits also can be passed on to future generations. Inbreeding increases the chance of homozygous recessive offspring. If both parents carry the recessive allele, the harmful trait likely will not be eliminated.

Reading Check **Describe** the disadvantages associated with hybridization and inbreeding.

Mini Lab 1

Model Hybridization

How are hybrid lilies produced? In this lab, you will examine techniques used by both professional plant breeders and amateur gardeners to produce the wide variety of lilies you might see growing in landscaped areas.

Procedure

1. Identify the safety concerns of this lab before work begins.
2. Obtain a **labeled drawing of a lily flower** and a **fresh open lily flower.** Examine the flower with a **hand lens** and identify the male anthers and the female pistil.
3. Use a **cotton swab** to gently rub an anther to pick up pollen.
4. Trade flowers with another lab group and, using the cotton swab, gently apply the pollen from your flower to the stigma of the pistil of the new flower.

Analysis

1. **Infer** When breeders hybridize lilies, they transfer pollen to the stigma of an unopened lily flower and then cover the stigma with a foil cap. Why do you think this would be necessary?
2. **Think Critically** A breeder produces a hybrid lily which then is allowed to grow and produce seeds naturally. When these seeds are planted, the new lily plants do not have the same characteristics as the hybrid parent. Hypothesize why this would occur.

Review Based on what you have read about selective breeding, how would you now answer the analysis questions?

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
-دراسة المعلومات الواردة في الصفحة -Study the information contained on the page	39

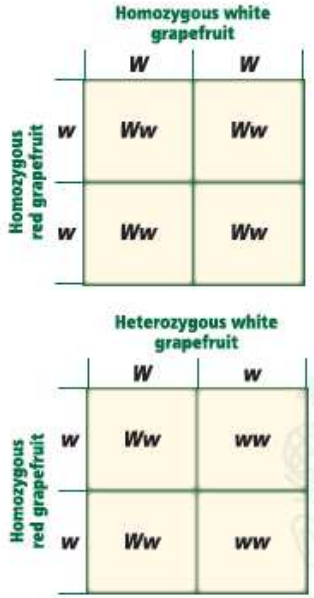


Figure 2 The genotype of a white grapefruit tree can be determined by the results of a test cross with a homozygous red grapefruit.

Test Cross

An important thing a breeder has to determine when producing a hybrid is the genotype of the hybrid. Once a breeder observes the desired trait, if the trait is dominant, then the genotype of the organism could be homozygous dominant or heterozygous. The exact genotype is determined by performing a test cross. A **test cross** involves breeding an organism that has the unknown genotype with one that is homozygous recessive for the desired trait. If the parent's genotype is homozygous dominant, all the offspring will have the dominant phenotype; if it is heterozygous, the offspring will show a 1:1 phenotypic ratio.

Performing a test cross Suppose a breeder wants to produce hybrid white grapefruits. In grapefruit trees, white fruit color is the dominant trait, while red is recessive. Therefore, the red grapefruit trees in the orchard must be homozygous recessive (*ww*). The genotype of the hybrid white grapefruit tree obtained by the breeder can be homozygous dominant (*WW*) or heterozygous (*Ww*) for the white color. Therefore, the breeder has to perform a test cross to determine the genotype of the white grapefruit tree. Remember when performing a cross, pollen from the flower of one plant is transferred to the female organ in a flower of another plant.

Results As shown in the top Punnett square in **Figure 2,** if the white grapefruit tree is homozygous dominant (*WW*) and is crossed with a red grapefruit tree (*ww*), then all the offspring will be heterozygous (*Ww*) and white in color. In this case, all of the offspring will have the dominant phenotype. However, as shown in the second Punnett square in **Figure 2,** if the white grapefruit tree is heterozygous (*Ww*), then half the number of offspring will be white and half will be red, and the phenotypic ratio will be 1:1. Review the results in the Punnett squares in **Figure 2.** If the white grapefruit tree is homozygous, all offspring will be heterozygous–white in color. If the tree is heterozygous, half of the test-cross offspring will be white and half will be red.

Section 1 Review

Section Summary

- Selective breeding is used to produce organisms with traits that are considered desirable.
- Hybridization produces organisms with desired traits from parent organisms with different traits.
- Inbreeding creates pure breeds.
- A test cross can be used to determine an organism's genotype.

Understand Main Ideas

1. MAIN Idea **Assess** the effect of selective breeding on food crops.
2. **Describe** three traits that might be desired in sheep. How can these traits be passed on to the next generation? Explain.
3. **Compare and contrast** inbreeding and hybridization.
4. **Predict** the phenotype of offspring from a test cross between a seedless orange (*ss*) and an orange with seeds (*Ss*).

Think Critically

5. **Evaluate** Should a cow and a bull that both carry recessive alleles for a mutation that causes decreased milk production be bred? Why or why not?

MATH in Biology

6. A breeder performs a test cross to determine the genotype of a black cat. He crosses the black cat (*BB* or *Bb*) with a white cat (*bb*). If 50 percent of the offspring are black, what is the genotype of the black cat?

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 2	40
Figure No.2	

-دراسة المعلومات الواردة في الصفحة
-الشكل 2 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 2, its data, and the commentary accompanying the figure

VOCABULARY

ACADEMIC VOCABULARY

Manipulate
to manage or utilize skillfully
Scientists use technology to manipulate genetic information in order to test scientific hypotheses.

DNA Tools

You have learned that selective breeding is used to produce plants and animals with desired traits. Genetic engineering can be used to increase or decrease the expression of specific genes in selected organisms. It has many applications from human health to agriculture.

An organism's **genome** is the total DNA present in the nucleus of each cell. As you will learn in the next section, genomes, such as the human genome, can contain millions and millions of nucleotides. In order to study a specific gene, DNA tools can be used to manipulate DNA and to isolate genes from the rest of the genome.

Restriction enzymes Some types of bacteria contain powerful defenses against viruses. These cells contain proteins called **restriction enzymes** that recognize and bind to specific DNA sequences and cleave the DNA within that sequence. A restriction enzyme, also called an endonuclease (en doh NEW klee ayz), cuts the viral DNA into fragments after it enters the bacteria. Since their discovery in the late 1960s, scientists have identified and isolated hundreds of restriction enzymes. Restriction enzymes are used as powerful tools for isolating specific genes or regions of the genome. When the restriction enzyme cleaves genomic DNA, it creates fragments of different sizes that are unique to every individual.

EcoRI One restriction enzyme that is used widely by scientists is known as *EcoR*I. As illustrated in **Figure 4,** *EcoR*I specifically cuts DNA containing the sequence GAATTC. The ends of the DNA fragments created by *EcoR*I are called sticky ends because they contain single-stranded DNA that is complementary. The ability of some restriction enzymes to create fragments with sticky ends is important because these sticky ends can be joined together with other DNA fragments that have complementary sticky ends.

Reading Check **Generalize** how restriction enzymes are used.

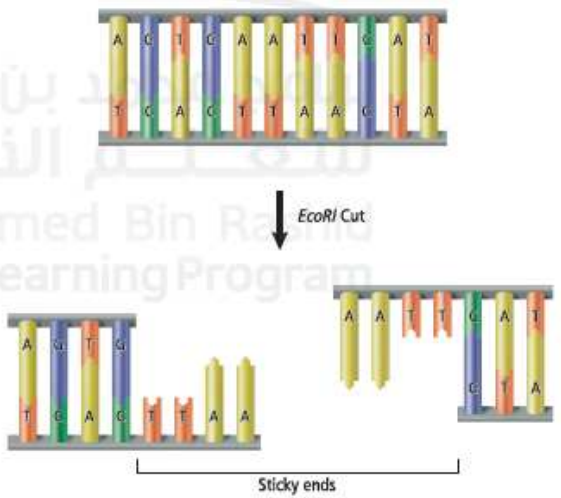
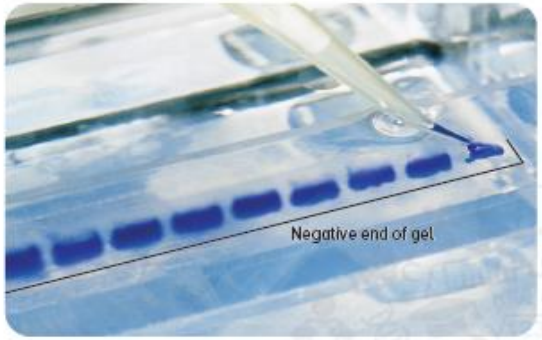


Figure 4 DNA containing the sequence GAATTC can be cut by the restriction enzyme *EcoR*I to produce sticky ends.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
-دراسة المعلومات الواردة في الصفحة -Study the information contained on the page	42

Loading the gel Solution containing DNA is dropped into holes at one end of the gel with a pipette.



Fragment pattern A staining solution binds to the separated DNA fragments in the gel, making them visible under ultraviolet light.

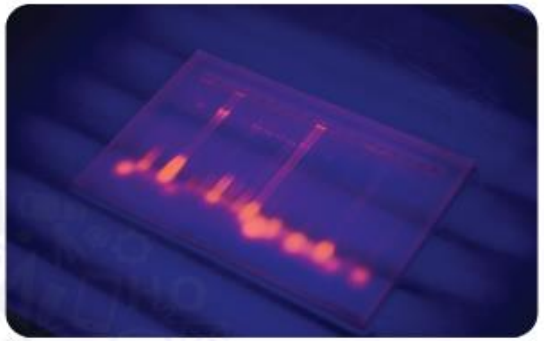


Figure 5 When the loaded gel is placed in an electrophoresis tank and the electric current is turned on, the DNA fragments separate.

However, not all restriction enzymes create sticky ends. Some enzymes produce fragments containing blunt ends–created when the restriction enzyme cuts straight across both strands. Blunt ends do not have regions of single-stranded DNA and can join to any other DNA fragment with blunt ends.

Connection to Physics **Gel electrophoresis** An electric current is used to separate DNA fragments according to the size of the fragments in a process called **gel electrophoresis.** **Figure 5** shows how the DNA fragments are loaded on the negatively charged end of a gel. When an electric current is applied, the DNA fragments move toward the positive end of the gel. The smaller fragments move farther faster than the larger ones. The unique pattern created based on the size of the DNA fragment can be compared to known DNA fragments for identification. Also, portions of the gel containing each band can be removed for further study.

MiniLab 2

Model Restriction Enzymes

How are sticky ends modeled? Use scissors and tape to produce paper DNA fragments with sticky ends and a recombinant DNA plasmid.

Procedure

1. Identify the safety concerns of this lab before work begins.
2. Obtain one **straight paper DNA sequence** from your teacher, which will represent genomic DNA, and one **circular paper DNA sequence,** which will represent a plasmid.
3. Find each GAATTC sequence recognized by the restriction enzyme *EcoRI* and cleave the genome and plasmid DNA using **scissors**.
4. Use **tape** to make a recombinant DNA plasmid.

Analysis

1. **Compare** your plasmid to those made by other lab groups. How many different recombinant plasmids could be made using this particular genomic sequence? Explain.
2. **Infer** what enzyme was represented by the scissors. Explain.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
دراسة المعلومات الواردة في الصفحة- -Study the information contained on the page	43

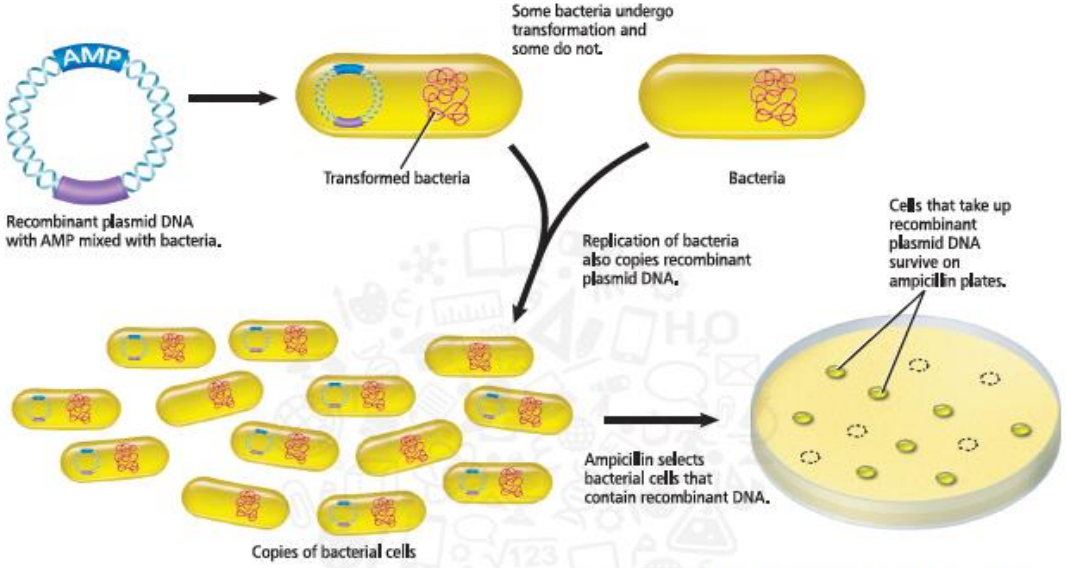


Figure 7 Clones containing copies of the recombinant DNA can be identified and used for further study when the bacterial cells that do not contain recombinant DNA die.

Gene cloning To make a large quantity of recombinant plasmid DNA, bacterial cells are mixed with recombinant plasmid DNA. Some of the bacterial cells take up the recombinant plasmid DNA through a process called **transformation,** as shown in **Figure 7.** Bacterial cells can be transformed using electric pulsation or heat. Recall that all cells, including bacterial cells, have plasma membranes. A short electric pulse or a brief rise in temperature temporarily creates openings in the plasma membrane of the bacteria. These temporary openings allow small molecules, such as the recombinant plasmid DNA, to enter the bacterial cell. The bacterial cells make copies of the recombinant plasmid DNA during cell replication. Large numbers of identical bacteria, each containing the inserted DNA molecules, can be produced through this process called **cloning.**

Recombinant plasmid DNA contains a gene that codes for resistance to an antibiotic such as ampicillin (AMP). Researchers use this gene to distinguish between bacterial cells that have taken up the recombinant plasmid DNA and those that have not. Notice in **Figure 7** that when the transformed bacterial cells are exposed to the specific antibiotic, only the bacterial cells that have the plasmid survive.

DNA sequencing The sequence of the DNA nucleotides of most organisms is unknown. Knowing the sequence of an organism's DNA or of a cloned DNA fragment provides scientists with valuable information for further study. The sequence of a gene can be used to predict the function of the gene, to compare genes with similar sequences from other organisms, and to identify mutations or errors in the DNA sequence. Because the genomes of most organisms are made up of millions of nucleotides, the DNA molecules used for sequencing reactions first must be cut into smaller fragments using restriction enzymes.

VOCABULARY

SCIENCE USAGE V. COMMON USAGE

Transformation

Science usage: process by which one type of bacterium takes up the DNA from another source *Transformation of bacteria involves the uptake of plasmid DNA.*

Common usage: the act of change *The transformation of the room was complete with the addition of new drapes.*

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 7	45
Figure No.7	
	45

-دراسة المعلومات الواردة في الصفحة
-الشكل 7 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 7, its data, and the commentary accompanying the figure

Recall that a codon is a group of three nucleotides that code for an amino acid. Researchers look for the start codon AUG and a stop codon such as UAA, UGA, or UAG. ORF analysis has been used to identify correctly over 90 percent of genes in yeast and bacteria. However, the identification of genes in more complex organisms such as humans requires more sophisticated computer programs called algorithms. These algorithms use information, such as the sequence of the genomes of other organisms, to identify human genes.

Bioinformatics

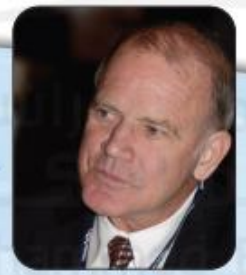
The completion of the HGP and the sequencing of the genomes of other organisms have resulted in large amounts of data. Not only has this enormous amount of data required careful storage, organization, and indexing of sequence information, but it also has created a new field of study. This field of study, called **bioinformatics,** involves creating and maintaining databases of biological information. The analysis of sequence information involves finding genes in DNA sequences of various organisms and developing methods to predict the structure and function of newly discovered proteins. Scientists also study the evolution of genes by grouping protein sequences into families of related sequences and comparing similar proteins from different organisms.

DNA Microarrays

Analyzing all the expressed genes from a given organism or a specific cell type can be useful. This analysis can be done using **DNA microarrays,** which are tiny microscope slides or silicon chips that are spotted with DNA fragments. DNA microarrays can contain a few genes, such as the genes that control the cell cycle, or all of the genes of the human genome. Therefore, a large amount of information can be stored in one small slide or chip. DNA microarrays help researchers determine whether the expression of certain genes is caused by genetic factors or environmental factors.

Study Tip

BioJournal As you read about the human genome, list several beneficial uses of this information.



1983 Kary Mullis invents the polymerase chain reaction, for which he will be awarded the Nobel Prize in 1993.

1980 1970 1960

1973 Herbert Boyer, Annie Chang, Stanley C., and Robert Helling discover that recombinant DNA reproduce if inserted into bacteria.

1972 Paul Berg creates the first recombinant DNA molecules.

1959 Down syndrome is the first chromosomal abnormality identified in humans.

Figure 14
Discoveries in Genetics
Many studies in genetics have led to advances in biotechnology.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
دراسة المعلومات الواردة في الصفحة - -Study the information contained on the page	53

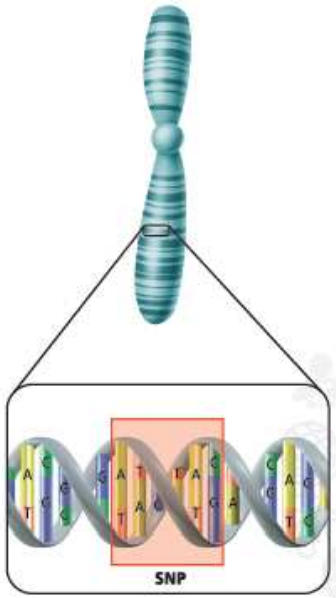
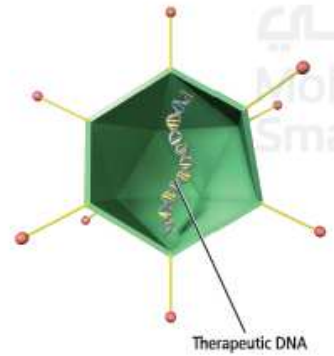


Figure 16 The HapMap project involves grouping all adjacent SNPs that are inherited together into haplotypes.

Figure 17 DNA can be encapsulated in a virus and delivered into a patient to replace a defective gene. Once the virus enters the cells, the genetic information is released into the nucleus and inserted into the genome.



The HapMap project An internationl group of scientists is creating a catalog of common genetic variations that occur in humans. Linked genes are inherited together and similarly, genetic variations located close together also tend to be inherited together. Therefore, regions of linked variations in the human genome, known as **haplotypes,** can be located. The project to create this catalog is called the haplotype map, or HapMap project. Assembling the HapMap involves identifying groups of SNPs in a specific region of DNA.

Figure 16 shows how the genome is divided into haplotypes. Once completed, the HapMap will describe what these variations are, where they occur in our DNA, and how they are distributed among people within populations and among populations in different parts of the world. This information will help researchers find genes that cause disease and affect an individual's response to drugs.

Pharmacogenomics Sequencing the human genome combines the knowledge of genes, proteins, and SNPs with other areas of science. The study of how genetic inheritance affects the body's response to drugs is called **pharmacogenomics** (far muh koh jeh NAW mihks). The benefits of pharmacogenomics include more accurate dosing of drugs that are safer and more specific. Researchers hope that pharmacogenomics will allow for drugs to be custom-made for individuals based on their genetic makeups. Prescribing drugs based on an individual's genetic makeup will increase safety, speed recovery, and reduce side effects. Perhaps one day when you are sick, your doctor will read your genetic code and prescribe medicine tailor-made for you.

Gene therapy A technique aimed at correcting mutated genes that cause human diseases is called **gene therapy.** Scientists insert a normal gene into a chromosome to replace a dysfunctional gene. In most gene therapy studies, inserting a normal gene into a viral vector, like the one in **Figure 17,** produces recombinant DNA. Target cells in the patient are infected with the virus and the recombinant DNA material is released into the affected cells. Once deposited into cells, the normal gene inserts itself into the genome and begins functioning.

Connection to Health In 1990, the first clinical gene therapy trial at the National Institutes of Health was conducted on a four year old child with severe combined immunodeficiency (SCID). The Food and Drug Administration (FDA) monitors new medical trials, including gene therapy. Gene therapy has seen its share of setbacks, but the possibilities are endless when it comes to new treatments. Recent gene therapy trials include work with diabetes, cancer, retinal disease, Parkinson's disease, and others.

Reading Check **Compare and contrast** pharmacogenomics to gene therapy.

Genomics and Proteomics

Sequencing the human genome began what researchers call "the genomic era." **Genomics** is the study of an organism's genome. Genomics has become one of the most powerful strategies for identifying human genes and interpreting their functions. In addition to the mass of data obtained from sequencing the genomes of multiple organisms, scientists also are investigating the proteins produced by these genes.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
-دراسة المعلومات الواردة في الصفحة -Study the information contained on the page	56

The Endocrine System

Essential Questions

- What are the functions of the glands that make up the endocrine system?
- What is the role of the endocrine system in maintaining homeostasis?
- What are the feedback mechanisms that regulate hormone levels in the body?

Review Vocabulary

homeostasis: the regulation of an organism's internal environment to maintain life

New Vocabulary

endocrine gland
hormone
pituitary gland
thyroxine
calcitonin
parathyroid hormone
insulin
glucagon
aldosterone
cortisol
antidiuretic hormone

MAIN Idea **Systems of the human body are regulated by hormonal feedback mechanisms.**

Real-World Reading Link When driving a car, everyone usually maintains a similar speed. When cars go faster or slower than the accepted speed, the chance of an accident increases. Similarly, hormones must stay in the proper balance to maintain homeostasis in the body.

Action of Hormones

The endocrine system is composed of glands and functions as a communication system. **Endocrine glands** produce hormones, which are released into the bloodstream and distributed to body cells. A **hormone** is a substance that acts on certain target cells and tissues to produce a specific response. Hormones are classified as steroid hormones and nonsteroid or amino acid hormones, based on their structure and mechanism of action.

Steroid hormones Estrogen and testosterone are two examples of steroid hormones. Both of these hormones affect the human reproductive system. All steroid hormones work by causing the target cells to initiate protein synthesis, as illustrated in **Figure 12.**

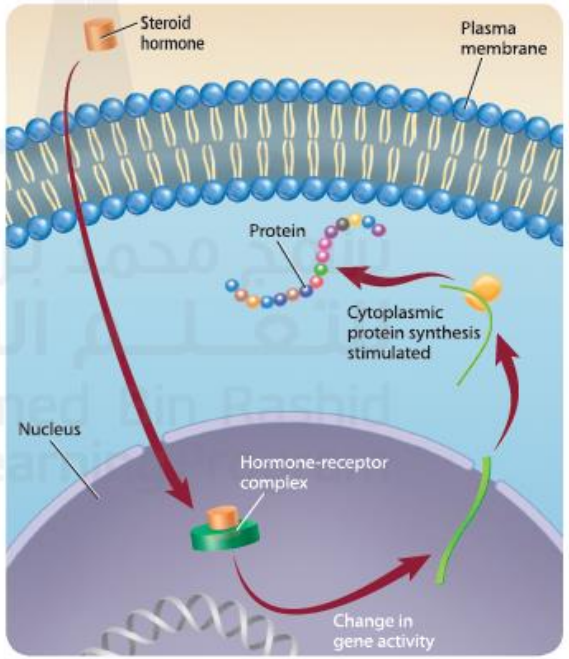


Figure 12 A steroid hormone passes through a cell membrane, binds to a receptor within the cell, and stimulates protein synthesis.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 12	79
Figure No.12	

-دراسة المعلومات الواردة في الصفحة
-الشكل 12 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 12, its data, and the commentary accompanying the figure

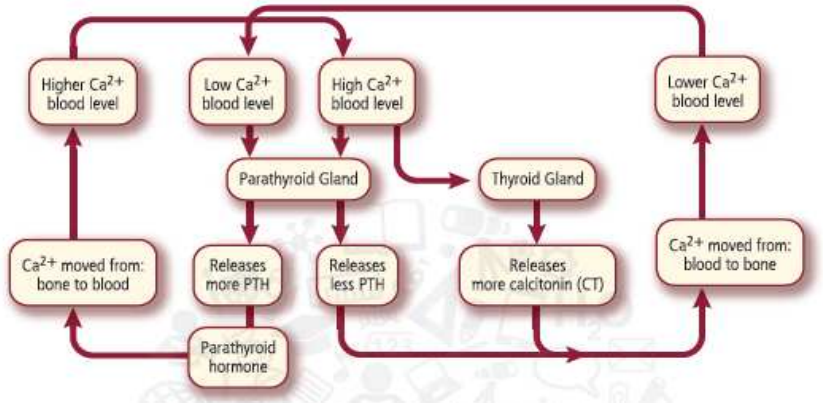


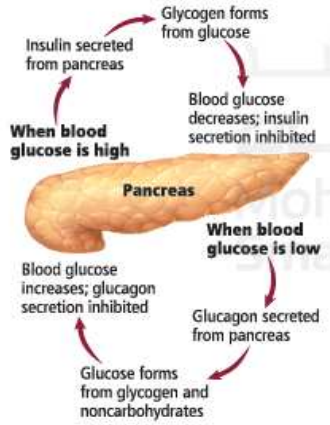
Figure 17 Parathyroid hormone (PTH) and calcitonin (CT) regulate the level of calcium in the blood.
Explain *how PTH and CT illustrate negative feedback.*

Thyroid and parathyroid glands Identify the thyroid and parathyroid glands in **Figure 17.** One hormone produced by the thyroid gland is thyroxine. Like hGH, **thyroxine** does not act on specific organs; rather, it causes cells of the body to have a higher rate of metabolism. The thyroid gland also produces calcitonin. **Calcitonin** is a hormone that is partly responsible for the regulation of calcium, an important mineral for bone formation, blood clotting, nerve function, and muscle contraction. Calcitonin lowers blood calcium levels by signaling bones to increase calcium absorption and also signaling the kidneys to excrete more calcium.

When blood calcium levels are too low, the parathyroid glands increase production of parathyroid hormone. **Parathyroid hormone** increases blood calcium levels by stimulating the bones to release calcium. The action of this hormone also causes the kidneys to reabsorb more calcium and the intestines to absorb more calcium from food. The thyroid and parathyroid glands have opposite effects on blood calcium levels. However, as they work together, they maintain homeostasis.

Reading Check **Explain** how negative feedback is important in maintaining homeostasis.

Figure 18 Glucagon and insulin work together to maintain the level of sugar in the blood.



Pancreas As discussed in Section 1, the pancreas has a crucial role in the production of enzymes that digest carbohydrates, proteins, and fats. The pancreas also secretes the hormones insulin and glucagon, which work together to maintain homeostasis, as illustrated in **Figure 18.** When blood glucose levels are high, the pancreas releases insulin. **Insulin** signals body cells, especially liver and muscle cells, to accelerate the conversion of glucose to glycogen, which is stored in the liver. When blood glucose levels are low, glucagon is released from the pancreas. **Glucagon** binds to liver cells, signaling them to convert glycogen to glucose and release the glucose into the blood.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
الشكل رقم 17	82
Figure No.17	

-دراسة المعلومات الواردة في الصفحة
-الشكل 17 وبياناته والتعليق المصاحب للشكل

-Study the information contained on the page
-Figure 17, its data, and the commentary accompanying the figure

Link to the Nervous System

The nervous and endocrine systems are similar in that they both are involved in regulating the activities of the body and maintaining homeostasis. Refer to **Figure 19** to study the role of the hypothalamus in homeostasis. Recall that this part of the brain is involved with many aspects of homeostasis. The hypothalamus produces two hormones, oxytocin and antidiuretic hormone (ADH). These hormones are transported through axons and stored in axon endings located in the pituitary gland.

The **antidiuretic hormone** functions in homeostasis by regulating water balance. ADH affects portions of the kidneys called the collecting tubules. Think back to the last time you were working outside on a hot summer day. You produced a lot of sweat to help keep you cool, and you might have become dehydrated. When this happens, cells in your hypothalamus detect that you are dehydrated–that the level of water in the blood is low–and respond by releasing ADH from axons in the pituitary gland that have been storing the hormone.

As illustrated in **Figure 20,** ADH travels in the blood to the kidneys, where it binds to receptors on certain kidney cells. This causes the kidneys to reabsorb more water and decrease the amount of water in the urine, increasing the water level in the blood. If there is too much water in a person's blood, the hypothalamus decreases the release of ADH, and the urine tends to be more dilute. ADH production is stimulated by nausea and vomiting, both of which cause dehydration. Blood loss of 15 or 20 percent by hemorrhage results in the release of ADH.

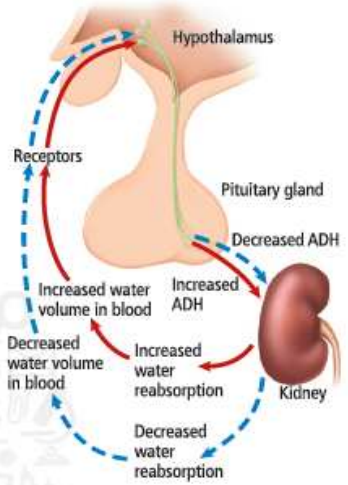


Figure 20 Antidiuretic hormone (ADH) helps to control the concentration of water in the blood.

Section 3 Review

Section Summary

- Endocrine glands produce substances called hormones.
- Hormones travel throughout the body in the bloodstream.
- Hormones are classified as steroid hormones or amino acid hormones.
- Hormone levels are influenced by feedback systems.
- The endocrine system helps to maintain homeostasis with signals from internal mechanisms called negative feedback.

Understand Main Ideas

1. MAIN Idea **Assess** the reasons why hormone feedback systems are referred to as "negative feedback."
2. **Predict** when you would expect to find high levels of insulin in a person's blood and when you would expect to find high levels of glucagon in a person's blood.
3. **Explain** how the endocrine and nervous systems work together to maintain homeostasis.
4. **Identify** and describe the functions of pituitary, thyroid, parathyroid, pancreas, and adrenal glands.

Think Critically

5. **Research** Iodine is essential for thyroid gland function. Fetal and childhood iodine deficiency is a major cause of mental retardation in the world, yet the deficiency is preventable. Predict how iodine deficiency might lead to mental retardation or other health issues. Research what has been and what is being done to alleviate this concern. Include information about sources of iodine in your response.
6. **Analyze** how a malfunction in a negative feedback mechanism can lead to the death of an organism.

Reference(s) in the Student Book (Arabic Version)	
المرجع في كتاب الطالب (النسخة العربية)	
Example/Exercise	Page
مثال/تمرين	الصفحة
-دراسة المعلومات الواردة في الصفحة -Study the information contained on the page	85