Senior High School

Department of Education
National Capital Region
SCHOOLS DIVISION OFFICE
MARIKINA CITY

Physical Science

First Quarter - Module 4

Biological Macromolecules

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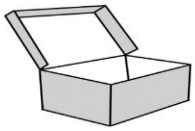


What I Need to Know

There are four major biological macromolecules, or biomolecules that are essential for living organisms. These are the carbohydrates, proteins, lipids, and nucleic acids. They are huge organic molecules.

On this module, the topic will explain how the structures of biological macromolecules such as carbons, proteins, lipids, and nucleic acids determine their properties and functions.

After reading and studying this lesson, you are expected to demonstrate the following skills to explain how the structures of biological macromolecules such as carbohydrates, lipids, nucleic acid, and proteins determine their properties and functions. (S11/12PS-IIId-e19)

The module is divided into 2 lessons, namely

- Lesson 1 – Carbohydrates and Lipids
- Lesson 2 – Proteins and Nucleic Acids

Moreover, in this lesson you will learn concepts and do practice activities that will help you to do the following prior to the main lesson

1. distinguish between carbohydrates, proteins, lipids, and nucleic acids;
2. summarize the general characteristics of each biomolecule; and
3. relate the structures of the biomolecules with their properties.

What I Know

Read the question carefully and encircle the letter of the correct answer.

1. Maltose, also known as malt sugar, is a disaccharide. Which of the following statements is **NOT TRUE** about maltose?
   A. Maltose is soluble in water.
   B. Maltose is difficult to digest.
   C. Maltose is linked by a glycosidic bond.
   D. Maltose has a higher molecular weight than fructose.

2. Which of the following statement/s is/are **TRUE**?
   A. Polysaccharides are generally insoluble in aqueous solutions.
   B. Polysaccharides have -OH groups that always form covalent bonds with water.
   C. Monosaccharides and disaccharides are generally soluble in aqueous solutions.
   D. All the statements are true

3. Glucose, galactose, and fructose have the same formula but differ in structure. What is their formula?
   A. $C_2H_6O_3$ B. $C_3H_4O_3$ C. $C_3H_4O_6$ D. $C_6H_{12}O_6$

4. Which of the following statement/s is/are **TRUE**?
   A. Carbohydrates function as energy storage.
   B. Carbohydrates function for structural component.
   C. Some polysaccharides are used to thicken aqueous solutions.
   D. All of the statements are true.

5. What type of lipid contains a property to transfer molecules into the bloodstream?
   A. Fatty Acids
   B. Phospholipids
   C. Triglycerides
   D. Wax

6. What is the solid form of triglyceride that can be found from animal sources?
   A. Fat
   B. Glycerol
   C. Oil
   D. Saturated Fats

7. What is the type of lipid that contains glycerol and three fatty acids?
   A. Hyperfatty Acid
   B. Phospholipid
   C. Triglyceride
   D. Wax

8. What type of lipid is insoluble water and contains double bonds?
   A. Fatty Acid
   B. Phospholipid
   C. Saturated Fat
   D. Unsaturated Fat

9. Hemoglobin and enzymes are examples of _____.
   A. Carbohydrates
   B. Lipids
   C. Nucleic Acids
   D. Protein

10. What is the protein that is usually found in hair, skin, and nails?
   A. Collagen
   B. Enzyme
   C. Keratin
   D. Myoglobin

11. What is a natural fiber that has good insulation and high resistance to deformation; and is known as the strongest example protein?
    A. Azlon
    B. Collagen
    C. Silk protein
    D. None of the above

12. What protein is a component of blood and carrier of essential oxygen throughout the body?
    A. Fibroin
    B. Haptoglobin
    C. Hemoglobin
    D. Myoglobin

13. RNA contains _____.
    A. ribose sugar and thymine
    B. ribose sugar and uracil
    C. deoxyribose sugar and uracil
    D. deoxyribose sugar and thymine

14. What is the type of sugar that makes up the ribonucleic acid?
    A. Deoxyribose
    B. Glucose
    C. Phosphate
    D. Ribose

15. What is the process in which translation and transcription occurs?
    A. DNA Replication
    B. Photosynthesis
    C. Protein Synthesis
    D. None of the above

Lesson 1 Carbohydrates and Lipids

What's In

Carbohydrates are an immediate source of energy. Some diets forbid carbohydrate consumption due to a claim that a low-carbohydrate diet helps people lose weight faster. However, eliminating carbohydrates is not the best way to lose weight. A low-calorie diet, together with plenty of exercise and plenty of water, is the more sensible way to lose weight.

Lipids also provides storage of energy for long-term use. Aside from this, it serves a range of functions within a cell. These includes hormonal roles (e.g. steroids such as estrogen and testosterone), thermal and electrical insulation, protection of internal organs, and structural components of cells.

What's New

Activity 1.1

Let us examine your prior knowledge of the topic by answering the questions below.

1. What does a "low-carb diet" mean?

2. Athletes often do a "carb-load" before an important competition, why is it so?

3. What is your prior knowledge of fats and oils?

4. Why fats are important to our body?

What Is It

Carbohydrates

- It is the most abundant biomolecule in nature.
- It provides energy to the body through glucose. Glucose is a simple sugar molecule and an ingredient in staple foods.
- It can be written as CH_2O. Thus, the ratio of its components: carbon to hydrogen to oxygen is 1:2:1 in carbohydrate molecules.

Another term for carbohydrate is saccharide. The term is derived from the Latin word *saccharum* referring to sugar- a common carbohydrate.

- Carbohydrates are classified either as simple or complex.
    - Simple sugars are monosaccharides and disaccharides.
    - Complex sugars are polysaccharides.
- The excess carbohydrates are converted to glycogen which is stored in the liver and in muscles. **Glycogen** is a slow-releasing carbohydrate.

Monosaccharides

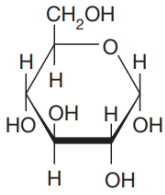
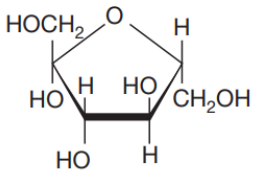
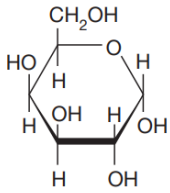
Monosaccharides are simple sugars. The most common example of which are glucose, galactose, and fructose.

Table 1.1. Types of Monosaccharides

Type	Description
Glucose	Used in dextrose, blood sugar; the form utilized by the human body
Galactose	Also known as brain sugar; found in milk and milk products
Fructose	Also known as fruit sugar; found in fruit juices and honey

Glucose, fructose, and galactose are structural isomers. They have the same molecular formula ($C_6H_{12}O_6$) but differ structurally and in the arrangement, resulting in differences in their properties.

Table 1.2. Structural Formulas of Glucose, Fructose, and Galactose

Types of Monosaccharide	Glucose	Fructose	Galactose
Haworth Structure			

Source: *Structural Formula of glucose, fructose, and galactose." Digital Image. Hogendoorn, Bob. 2010. Enhanced Chemistry II. Melbourne: Pearson Australia.*

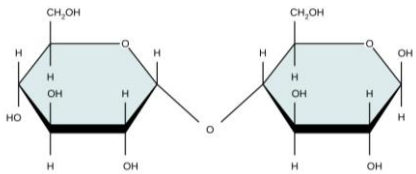
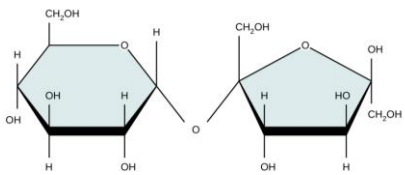
Disaccharides

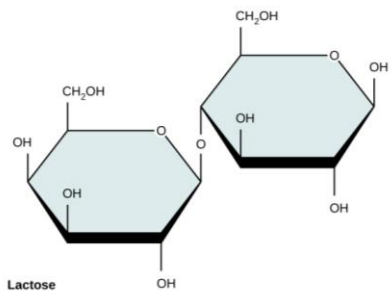
Disaccharides consist of two monosaccharides that is connected by a glycosidic bond.

Table 1.3. Types of Disaccharides

Type	Composition	Description
Maltose	Glucose + Glucose	Found in malt
Sucrose	Glucose + Fructose	Found in regular table sugar, sugarcane, and sugar beet
Lactose	Glucose + Galactose	Found in milk and milk products

Table 1.4. Structural Formulas of Maltose, Sucrose, and Lactose

Types of Disaccharide	Haworth Structure
Maltose	
Sucrose	

Lactose	

Source: *"Common Disaccharides." Digital Image. Lumen Learning. Accessed August 8, 2020. https://courses.lumenlearning.com/wm-biology1/chapter/reading-types-of-carbohydrates/*

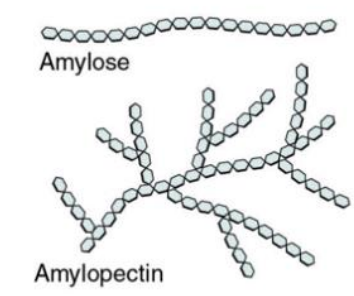
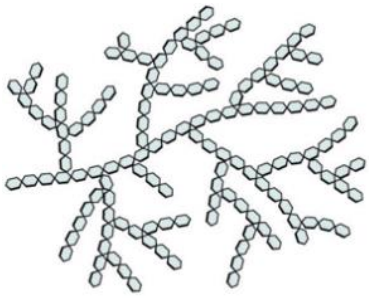
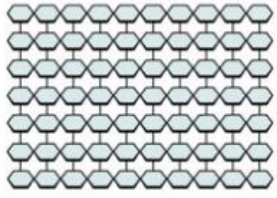
Polysaccharides

Polysaccharides are a chain of monosaccharides linked through glycosidic bonds. The chains are either branched or unbranched and may contain different types of monosaccharides. Polysaccharides are also called complex sugars.

Table 1.5. Types of Polysaccharides

Type	Description
Starch / Amylose	Storage form of glucose in plants through photosynthesis
Amylopectin	Storage form of glucose in plants
Glycogen	Storage form of glucose in animals, stored in the liver and muscles
Cellulose	Structural material in plants cell walls in wood, wood fiber Cannot be digested by humans

Table 1.6. Structures of Polysaccharides

Starch	Glycogen	Cellulose
		

Source: *"Three Important Polysaccharides." Digital Image. Lumen Learning. Accessed August 8, 2020. https://courses.lumenlearning.com/wm-biology1/chapter/reading-types-of-carbohydrates/*

Physical Properties of Carbohydrates

- Monosaccharides and disaccharides are generally soluble in water due to the hydroxyl groups that forms hydrogen bonds with water.
- Polysaccharides are generally insoluble in water and it due to its strong polymer linkage.
- Digestible carbohydrates are converted into monosaccharides such as fructose and glucose.

Lipids

The word lipid is derived from the Greek word *lipos* which means fat.

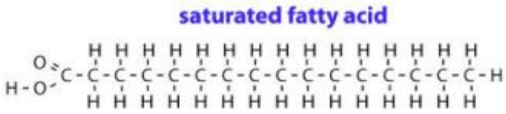
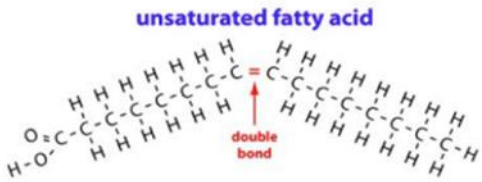
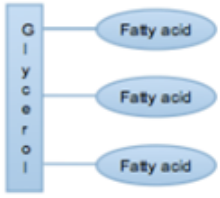
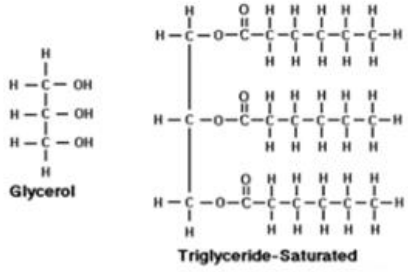
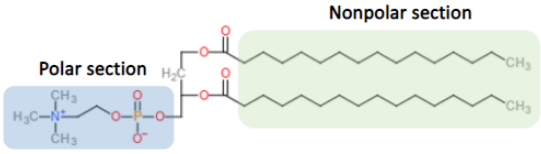
- Lipids are biomolecules with varied structures.
- Lipids are based mainly on carbon and hydrogen. They also contain small amounts of oxygen and, occasionally, other elements.
- Most lipids are essentially non-polar and so they are insoluble in water. This is a hydrophilic property (water-fearing).
- Lipids provide insulation from the environment for plants and animals. Example is that they help keep aquatic birds and mammals dry when forming a protective layer over fur or feathers because of their water-repellant hydrophobic nature
- Fats and oils are the best-known lipids.

Tables 1.7 and 1.8 shows the types of lipids, their functions, and respective structures.

Table 1.7. Types of Lipids

Lipids	Function
Fatty acids	Insoluble in water. Fatty acids can be saturated or unsaturated.
Triglycerides	Under triglycerides are fats and oil. • Fat refers to solid triglyceride usually from animal sources such as meat, milk, butter, margarine, eggs, and cheese. • Oil refers to liquid triglycerides from plant sources. Examples are olive oil, corn oil, sunflower oil, and soybean oil.
Phospholipids	Have a polar and non-polar section which enable them to form a bilipid layer in cell membranes.

Table 1.8. Structures of Lipids

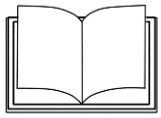
Lipids	Description	Structure
Fatty Acids	Saturated fatty acids contain single bonds in its hydro-carbon chain	
	Unsaturated fatty acids contain double bonds.	
Triglycerides	Composed of glycerol and three fatty acids. 	
Phospholipids	Contains glycerol, two fatty acids, and a phosphate group.	

Sources:

(1) *"Saturated and Unsaturated Fats." Digital Image. University of Washington. Accessed August 8, 2020. http://www.washington.edu*

(2) *"Triglycerides." Digital Image. University of Washington. Accessed August 8, 2020. http://www.washington.edu*

(3) *"Polar and non-polar section of phospholipids." Digital Image. Frontlearners. Accessed August 8, 2020. http://www.frontlearners.com*



What's More

Activity 1.2

Let us check your understanding of carbohydrates through a True or False Activity. Write **TRUE** if the statement is correct and **FALSE** if it is wrong.

1. Sucrose is a disaccharide.
2. Cellulose are form of glucose found in animals.
3. Monosaccharides are connected via glycosidic bonds.
4. Sucrose is a combination of glucose to another glucose.
5. Glucose, galactose, and fructose have the same chemical formula.

Activity 1.3

Match column A with the correct answer on column B.

Column A	Column B
1. A lipid composed of 2 fatty acids, a unit of glycerol, and a phosphorus containing acid.	a. Triglycerides
2. Lipids that are liquid at room temperature.	b. Lipids
3. Lipids that are solid at room temperature.	c. Phospholipids
4. A family of organic compounds soluble in organic solvents but not in water.	d. Fats
5. Lipids composed of 3 units of fatty acids and a unit of glycerol.	e. Oil

Activity 1.4

Let us examine your understanding of the topic by answering the questions below.

1. What are the elements found in the structure/ formula of carbohydrates?

2. Describe the chemical formula and structure of glucose. Compare it with the chemical formula of galactose and fructose.

3. What are the similarities in structures of monosaccharides? Of disaccharides?

4. What are the differences on the structure of a saturated fat to an unsaturated fat?

What I Have Learned

Activity 1.5

Summarize your understanding by completing the table below.

Description	Carbohydrates	Lipids
Function		
Elements seen on the biomolecule		
Sub-units of the biomolecule		
Examples of the biomolecule		

Activity 1.6

Examine the situation given and answer the question that follows.

When people are talking about ways to lose weight, cutting out carbohydrates is always on the equation. Thus, there has been a lot of misconceptions on carbs or "carb myths."

For this part, write some common misconceptions on carbs and the corresponding justification why people should stop believing in it.

Myth/Misconception	Why stop believing in it

Assessment

Read the question carefully and encircle the letter of the correct answer.

1. Carbohydrates provide energy by means of _____.
   A. fructose B. glucose C. lactose D. maltose

2. Which of the following statement/s is/are **TRUE**?
   A. Carbohydrates are generally stable molecules.
   B. Polysaccharides can form stable structures which is influenced by the presence of many hydrogen bonds.
   C. None of the statements is true.
   D. All the statements are true.

3. What carbohydrates are formed when two monosaccharides undergo a dehydration reaction and are connected via glycosidic bonds?
   A. disaccharides
   B. polysaccharides
   C. both A and B
   D. none of the above

4. What type of polysaccharide cannot be digested by humans?
   A. Amylose
   B. Cellulose
   C. Glycogen
   D. Lactose

5. Which of the following statement/s is/are **TRUE**?
   A. Glucose, a disaccharide is soluble in aqueous solutions.
   B. Starch, a monosaccharide, is soluble in aqueous solutions.
   C. Lactose, a monosaccharide, is insoluble in aqueous solutions.
   D. None of the statements are true.

6. Which of the following is a type of biomolecule that provides insulation from the environment for plants and animals?
   A. Amino Acids
   B. Lipids
   C. Protein
   D. Sugar

7. In what resources can oil be mostly found?
   A. Bloodstream
   B. Cheese
   C. Eggs
   D. Plant sources

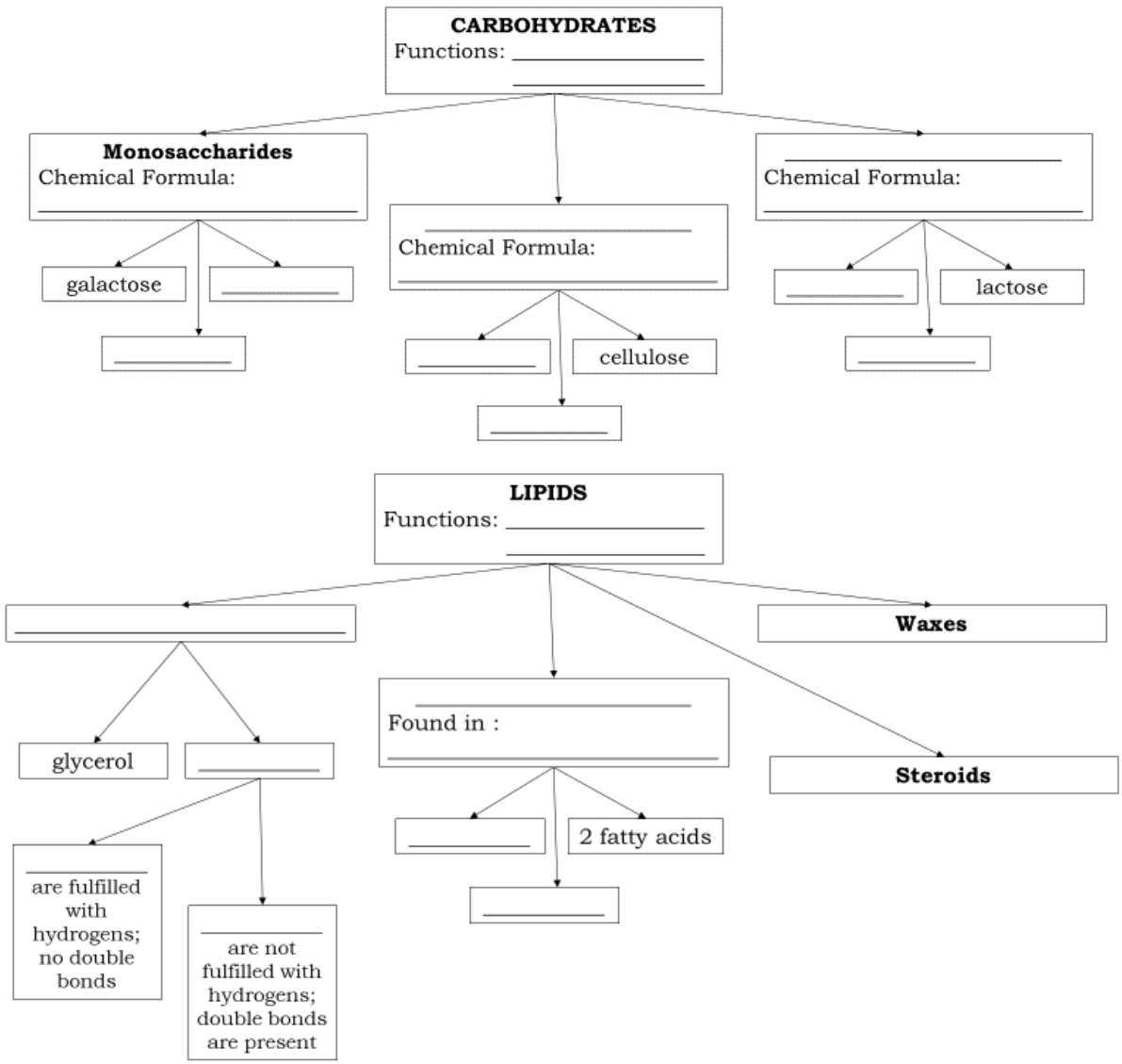
8. What is type of lipid that can be categorized as saturated or unsaturated?
   A. Fat
   B. Fatty Acid
   C. Oil
   D. Triglyceride

9. What part of phospholipids is also a phosphate group?
   A. Glycerol
   B. Hydrophilic Head
   C. Hydrophilic Tail
   D. Oil

10. Which of the following is an example of lipid?
   A. Collagen
   B. Glycogen
   C. Protein
   D. Steroid

Additional Activities

Complete the concept map of carbohydrates and lipids.



Lesson 2 Proteins and Nucleic Acids

What's In

Protein is crucial to good health. Proteins function mainly in the cell and do various tasks. To name some function of the protein in our bodies:

- Protein is responsible for the growth and maintenance of tissues.
- Protein takes charge of several of the body's hormones and transmits information between cells, tissues, and organs.
- Proteins help the body maintain proper pH values of the blood and other bodily fluids.
- A class of proteins known as fibrous proteins provides various parts of the body with structure, strength, and elasticity.
- Proteins in the blood maintain the fluid balance between the blood and the surrounding tissues.
- Proteins form antibodies to protect the body from disease-causing bacteria and viruses.
- Proteins transport nutrients throughout the entire body, while others store them.

Meanwhile, **nucleic acid** was discovered in 1868 by a Swiss physician named Friedrich Miescher. He was curious to an unknown substance in white blood cells that do not resemble the characteristics of a carbohydrate, protein, nor a lipid. He was able to isolate the substance from the nucleus and called it **nuclein.**

Sooner, he was able to break down this substance nuclein into protein and nucleic acids. He found out that nucleic acids contain carbon, hydrogen, oxygen, nitrogen, and phosphorus.

What's New

Activity 2.1

Let us examine your prior knowledge of the topic by answering the questions below.

1. What is the common knowledge of the sources of protein?

2. Is too much protein harmful? Justify.

3. Why was DNA originally called nuclein?

What Is It

Proteins

- Proteins are composed of four elements: carbon, hydrogen, oxygen, and nitrogen. Sulfur and other metals are sometimes found in proteins.
- Proteins are also called polypeptides.
- If carbohydrates are made up of saccharides, proteins, on the other hand, are made up or polymers of amino acids.
- Polypeptide or protein is a molecule made from monomers of amino acids.
- An amino acid is a molecule with a functional group amine, and a carboxyl group joined with a peptide bond. Figure 2.1 and Figure 2.2 below show the structure of an amino acid and the formation of peptide bonds.

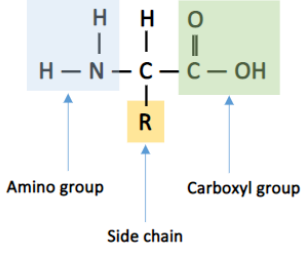


Figure 2.1. Structure of an Amino Acid

Source: *"Structure of an Amino Acid." Digital Image. Frontlearners. Accessed August 8, 2020. https://www.frontlearners.com*

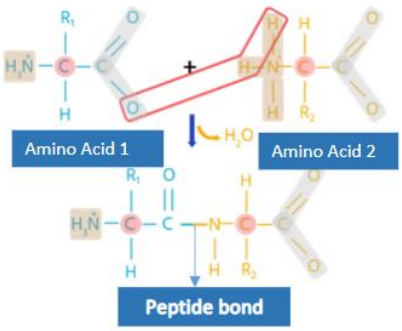


Figure 2.2. Formation of Peptide Bonds

Source: *"Formation of Peptide Bonds." Digital Image. Frontlearners. Accessed August 8, 2020. https://www.frontlearners.com*

- Water is released in the formation of peptide bonds, like the formation of complex saccharides. It is illustrated on Figure 2.3.
- Proteins can act both as an acid or base due to the presence of both positive NH_3^+ and negative COO^- charge; they are amphoteric.

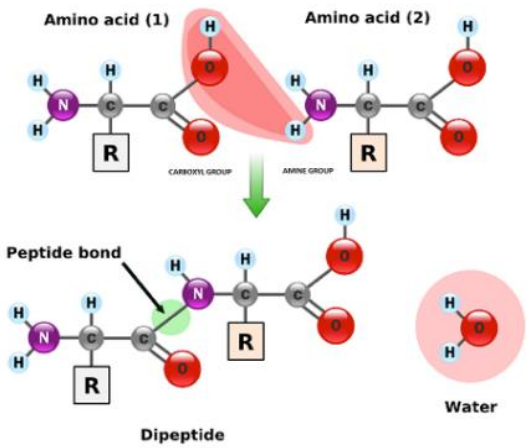


Figure 2.3. Release of water on a peptide bond

Source: *"Typical Structure of a Peptide Bond." Digital Image. The Research Gate. Accessed August 8, 2020. https://www.researchgate.net/figure/Typical-structure-of-an-amino-acid-and-peptide-bond-formation-This-figure-was-taken _fig1_45817828*

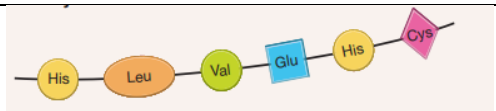
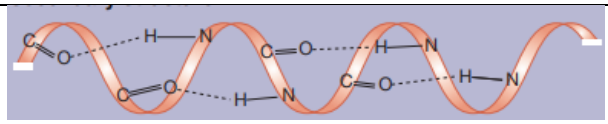
The amino acids make up proteins in the body. Table 2.1 shows some of the amino acids that are essential to our diet. Table 2.2 shows the structures of the essential amino acids.

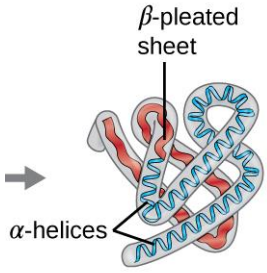
Table 2.1. Sources of Functions of Essential Amino Acids

Amino Acids (Essential)	Sources	Function
Isoleucine (ile) Leucine (leu) Valine (val)	Nuts and weeds, seaweeds, algae products	The rebuilding of muscles and wound healing
Lysine (lys)	Eggs, mung beans, peas, hazelnuts	The energy production in the muscles at a cellular lever The absorption of calcium for other foods
Methionine (met)	Sunflower seeds, avocado	Supporting the immune system in the prevention of allergies The production of serotonin to regulate mood
Phenylalanine (phe)	Eggs, organic soya products	Helping to regulate blood sugar, the structure of collagen and elastin in the skin
Threonine (thr)	Wheatgerm and oat-germ	Reducing and controlling inflammation
Tryptophan (trp)	Eggs, nuts, bananas	Maintaining mental function and clarity

Proteins differ from one another in the number, type, and sequence of their constituent amino acids. Each protein has a precise chemical composition, amino acid sequence, and three-dimensional shape. Table 2.2 illustrates the levels of protein structure. Some examples of protein are summarized in Table 2.3.

Table 2.2. Levels of Protein Structure

Levels	Description	Illustration
Primary Structure	A series of amino acids	
Secondary Structures	Parts of chain attracting each other Involves hydrogen bonding Local folding of the polypeptide chain into sheets or helices	

Tertiary Structures	Side chain interaction elsewhere on the protein chain. As a result, sections of the chains may be folded back on each other in intricate and unique shapes	
Quaternary Structures	Protein of more than one amino acid chain	

Source: *"Levels of Protein Structure." Digital Image. Enhanced Chemistry 2. Accessed August 8, 2020. Hogendoorn, Bob. 2010. Enhanced Chemistry II. Melbourne: Pearson Australia.*

Table 2.3. Examples of Protein

Examples	Description
Keratin	Major component of the protective covering of animals such as skin, fur, hair, wool, claws, nails, hooves, scales, feathers
Collagen	Helps hold the whole body together. Present in the muscle, skin, tendons
Enzymes	Biological proteins; catalyzes metabolic processes
Hemoglobin	Transport molecule: Hemoglobin, a component of blood is the carrier of essential element, oxygen, throughout the body

Nucleic Acid

- Nucleic acids play an essential role in the storage, transfer, and expression of genetic information.
- Nucleic acids contain carbon, hydrogen, oxygen, nitrogen, and phosphorus.
- Nucleic acids are also known as polynucleotides.
- If carbohydrates are composed of saccharide units, proteins of amino acids, and lipids of fatty acids, nucleic acids are composed of nucleotides.
    - Three Parts of Nucleotide (the structure is shown on Figure 2.4)
        1. Nitrogenous base
        2. Five-carbon carbohydrate or sugar
        3. Phosphate group

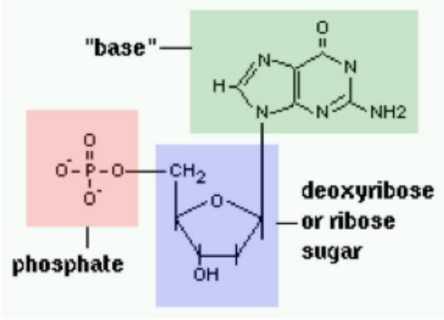


Figure 2.4 Parts of a Nucleotide
Source: *"Parts of a Nucleotide." Digital Image. Study.com. Accessed August 8, 2020. http://study.com/academy/lesson/nucleotides-structure-components-quiz.html*

The types of nucleic acids are the RNA and the DNA. Table 2.4 discusses some of their basic functions.

Table 2.4. Types of Nucleic Acids

Type	Description	Structure
Ribonucleic Acids (RNA)	carries the information from the DNA to the cellular factories for the protein synthesis	Single Stranded
Deoxyribonucleic Acids (DNA)	a nucleic acid that carries the genetic code or hereditary information of organisms	Double Helix

The nitrogenous bases of DNA and RNA are:

- DNA's : Adenine (A), Guanine (G), Cytosine (C), and Thymine (T)
- RNA's : Adenine (A), Guanine (G), Cytosine (C), and Uracil (U)

Watson and Crick's double helix model of the DNA molecule helped explain many phenomena in the field of genetics. The two-strand structure facilitates precise copying of genetic codes in preparation for cell division. The strands joined by multiple hydrogen bonds is a very stable configuration, thus, not prone to mutation, and makes the DNA an effective and efficient storage of genetic codes.

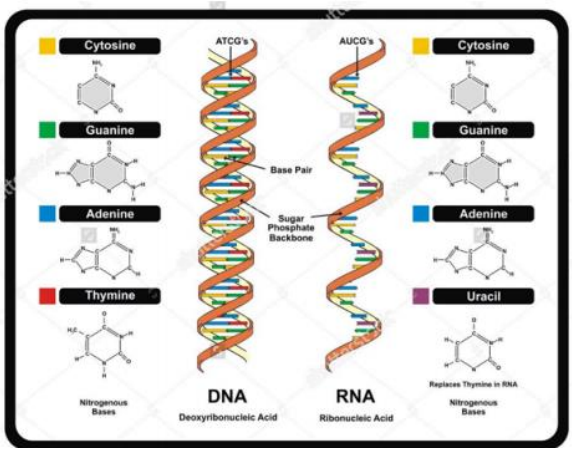


Figure 2.5. Structures of DNA and RNA

Source: *"Structures of DNA and RNA." Digital Image. Shutterstock. Accessed August 8, 2020. http://www.shutterstock.com/pic-108466967/stock-vector-vector-dna-and-rna.html*

Figure 2.5 shows that DNA is double stranded, and RNA is single stranded. The bases are paired up as can be seen in DNA. The bases C and G have three H-bonds between them, and A and T have two. Hydrogen bonding is greatly responsible for the shape of both RNA and DNA. The different nucleotides are connected in a chain via phosphodiester bonds.

What's More

Activity 2.2

Let us examine your understanding of the topic by answering the questions below.

1. What functional groups are present in amino acids?

2. Why should essential amino acids be included in a healthy diet?

3. What is meant by the primary, secondary, tertiary, and quaternary structures of a protein?

4. What are the three parts of a nucleotide?

5. How are DNA and RNA similar and different?

Activity 2.3

Summarize your understanding of this module by completing the table below.

Description	Protein	Nucleic Acids
Function		
Elements seen on the biomolecule		
Sub-units of the biomolecule		
Examples of the biomolecule		

Activity 2.5

Examine the given situation and answer the query that follows.

Amino acid deficiencies result in decreased immunity, digestive problems, fertility issues, lower mental alertness, and many other health issues. Each of the essential amino acids plays a different role in the body, and the symptoms of deficiency vary accordingly. For this part, list down an amino acid metabolism disorder and write down its respective causes and symptoms.

Amino Acid Metabolism Disorder	Causes	Symptoms

Assessment

Read the question carefully and encircle the letter of the correct answer.

1. A protein is made up of _____.
   A. amino acids
   B. glycerol
   C. nucleotide
   D. all of the above

2. What type of bond joins an amine and carboxyl group which makes up an amino acid?
   A. Hydrogen bond
   B. Ionic bond
   C. Peptide bond
   D. None of the above

3. What is the intermolecular force that dictates and maintains the shape of a protein?
   A. Covalent Bond
   B. Hydrogen Bonding
   C. Phosphodiester Bond
   D. Polypeptide

4. What is the protein that contains four sub-units that transports four oxygen molecules?
   A. Enzyme
   B. Fibroin
   C. Hemoglobin
   D. Keratin

5. What is the protein that has the function to catalyze chemical reactions?
   A. Collagen
   B. Enzymes
   C. Hemoglobin
   D. Myoglobin

6. What kind of bond links nucleotides?
   A. Hydrogen bond
   B. Ionic bond
   C. Phosphodiester bond
   D. None of the above

7. What type of bonding is present between the polar parts of DNA and RNA which maintains the structure of the nucleic acid?
   A. Covalent bonds
   B. Hydrogen bonds
   C. Ionic bonds
   D. Phosphate bonds

8. What is the process in which translation and transcription occurs?
   A. DNA Replication
   B. Photosynthesis
   C. Protein Synthesis
   D. None of the above

9. How many nucleotide bases are in a nucleic acid?
   A. 2 B. 3 C. 4 D. 5

10. Which of the following statement/s is/are **TRUE**?
    A. Ionic bonds in DNA is the main structural feature that explains why DNA is stable.
    B. Covalent bonds in DNA is the main structural feature that explains why DNA is stable.
    C. Hydrogen bonds in DNA is the main structural feature that explains why DNA is stable.
    D. All the statements are true

Additional Activities

Prepare a flyer that informs students about proteins. The brochure should include the following information on proteins:

- Function of proteins
- Importance of essential amino acids
- Staple food of where proteins/ amino acid can be obtained

The flyer should include an overall theme that emphasizes the importance of proteins on the overall function of the body.

Rubric:

Criteria	**Rating**		
The function of the protein is identified	The protein's function in the body is properly identified and discussed in detail. 5.0 pts	The protein's function in the body is properly identified. 3.0 pts	The protein is not discussed sufficiently. 0.0 pts
The structural makeup of the biomolecule summarized.	Structural makeup discussed/ illustrated in detail in connection to function in the body. 5.0 pts	Structural makeup summarized/ illustrated. 3.0 pts	No structural makeup incorporated 0.0 pts.
Proper referencing of obtained information	Properly cited references using APA. 5.0 pts	Cited sources and references used. 3.0 pts	No referencing/ citation has been made. 0.0 pts

Posttest

Read the question carefully and encircle the letter of the correct answer.

1. Maltose, also known as malt sugar, is a disaccharide. Which of the following statements is **NOT TRUE** about maltose?
   A. Maltose is soluble in water.
   B. Maltose is difficult to digest.
   C. Maltose is linked by a glycosidic bond.
   D. Maltose has a higher molecular weight than fructose.

2. Which of the following statement/s is/are **TRUE**?
   A. Carbohydrates function as energy storage.
   B. Carbohydrates function for structural component.
   C. Some polysaccharides are used to thicken aqueous solutions.
   D. All of the statements are true

3. Glucose, galactose, and fructose have the same formula but differ in structure. What is their formula?
   A. $C_2H_6O_3$ B. $C_3H_4O_3$ C. $C_3H_4O_6$ D. $C_6H_{12}O_6$

4. Which of the following statement/s is/are true?
   A. Polysaccharides are generally insoluble in aqueous solutions.
   B. Polysaccharides have -OH groups that always form covalent bonds with water.
   C. Monosaccharides and disaccharides are generally soluble in aqueous solutions.
   D. All the statements are true

5. What type of lipid contains a property to transfer molecules into the bloodstream?
   A. Fatty Acids
   B. Phospholipids
   C. Triglycerides
   D. Wax

6. What type of lipid is insoluble water and contains double bonds?
   A. Fatty Acid
   B. Phospholipid
   C. Saturated Fat
   D. Unsaturated Fat

7. What is the solid form of triglyceride that can be found from animal sources?
   A. Fat
   B. Glycerol
   C. Oil
   D. Saturated Fats

8. What is the type of lipid that contains glycerol and three fatty acids?
   A. Hyperfatty Acid
   B. Phospholipid
   C. Triglyceride
   D. Wax

9. What is the type of sugar that makes up the ribonucleic acid?
   A. Deoxyribose
   B. Glucose
   C. Phosphate
   D. Ribose

10. What is the process in which translation and transcription occurs?
   A. DNA Replication
   B. Photosynthesis
   C. Protein Synthesis
   D. None of the above

11. RNA contains _____.
   A. ribose sugar and uracil
   B. ribose sugar and thymine
   C. deoxyribose sugar and uracil
   D. deoxyribose sugar and thymine

12. What is a natural fiber that has good insulation and high resistance to deformation; and is known as the strongest example protein?
   A. Azlon
   B. Collagen
   C. Silk protein
   D. None of the above

13. What protein is a component of blood and carrier of essential oxygen throughout the body?
   A. Fibroin
   B. Haptoglobin
   C. Hemoglobin
   D. Myoglobin

14. Hemoglobin and enzymes are examples of _____.
   A. Carbohydrates
   B. Lipids
   C. Nucleic Acids
   D. Protein

15. What is the protein that is usually found in hair, skin, and nails?
   A. Collagen
   B. Enzyme
   C. Keratin
   D. Myoglobin

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