

Life and Earth Sciences

basic education

9th

مدرسة

SPECIMEN
مكتبة



National
Textbook

New Curricula

Center for Educational Research and Development

Republic of Lebanon
Ministry of Education and Higher Education

**LIFE AND
EARTH SCIENCES**

Basic Education
Grade Nine

Center for Educational Research and Development



National
Textbook

New Curricula

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LIFE AND EARTH SCIENCES

Basic Education
Grade Nine

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The National Textbook Project

By issuing the textbooks for the third year of each educational cycle, the Educational Center for Research and Development will have completed the third and last installment of books called for by the New Curricula. We are placing these books in the hands of students with the great hope that we are moving, step by step, toward the goal of acquiring sound learning, using sophisticated educational means and up-to-date methodology that encourage and reinforce individual thinking and research, acquisition of skills, development of ethical and national attitudes, the feeling of national belonging as well as the feeling of belonging to humanity at large.

The on-going revolution in information, communication and educational-aids technology has undoubtedly limited the role of the textbook and lowered the rank it used so recently to occupy. However, in our society and in many other societies, the textbook remains the basic means of education, and it is our duty to exert our utmost effort and care to come up with the best product as to form and content. Yet we should not lose sight of the fact that the textbook is not sufficient by itself but should rather be used as a stepping stone to access other sources of information. What is important is to keep a clear vision and maintain the right course toward our objective. The means should not turn into the end and the student should always remain the focus of the learning/teaching process.

No one ignores or denies the fact that textbook writing requires very high academic and educational qualifications and very wide field experience. The authors committees undeniably possess such qualities. Yet the textbooks of the last two years contained some negative aspects. Such is the nature of human work, no matter how good the intentions or how great the effort extended. Here constructive criticism constitutes a real contribution to raising the standard of authorship, minimizing errors and filling gaps. We say that, with all due appreciation and respect to all those who have contributed to the success of this project.

The Educational Center for Research and Development is embarking this year on a process of evaluating the New Curricula and related textbooks, teacher training courses and student achievement. This is a natural and necessary step now that the new system has been put into effect. This process aims at identifying the curricular objectives that have been achieved as well as those that have not been achieved, with a view to proceeding with the positive aspects and correcting the negative ones.

As part of this correction process, we plan to review the versions that have been issued in order to secure good textbooks for our students, who always deserve the best.

March 13, 2000

**President, Educational Center for
Research and Development**

Nemer FRAYHA



This book of Life and Earth Sciences is intended for Basic Education, grade nine students. It is designed to conform, in content and spirit, to the official program and the pedagogical instructions of the curriculum. It includes the following topics:

- Nutrition and Metabolism
- Nervous Communication and Human Behavior
- Reproduction and Genetics

It is intended to attain three fundamental goals:

- ◆ Provide students with scientific knowledge on the functioning of the human body.
- ◆ Help students acquire methodological and cognitive competencies such as the practice of scientific reasoning and the mastering of communication techniques and experimentation.
- ◆ Develop in students a responsible attitude towards their own health, their own family, and their own society.

In order to meet these goals, this book follows a pedagogical student -centered approach based on solving scientific problems within the activities of each chapter which rotates around a main focus problem.

Teaching relies on activities rich in documents that favor the development of observation, reflection and experimentation. The main objective is to provide students with autonomous learning situations.

The book contributes to developing the students' scientific spirit, capacities of oral and written expression as well as graphic analysis.

To facilitate its usage, the book is designed in a clear and simple presentation; it is divided into parts, each made up of a number of chapters, all organized in the same manner:

- A double front page states the main focus problem and the questions-problems to be solved.
- Activity pages include a selection of documents, used as studying aids (pictures, texts, diagrams, data tables, and charts). The studying aids are followed by questions that help students to use them and to find answers to the stated problems. A glossary of new terms, indicated by an asterisk, is added.
- "Summing Up" sections summarize the main ideas covered in the activities.
- "Concept Map" which visually illustrates these ideas.
- "Solved Exercises" teach the student how to write proper answers.
- "Exercises" help check and verify the acquired knowledge. The number of such exercises depends on the requirements of the program and satisfies the wishes of teachers to be provided with sufficient choices to support their teaching.
- Supplementary readings provide insight into current events.

We hope that this book will be a reliable support for the teacher, an attractive tool of work for the students and that it will stimulate and enhance their interest in Life and Earth Sciences.

The authors

I Discover my Book

Double front page of the chapter

Title of the chapter

Problems to solve


Presentation of the chapter

CHAPTER 1

Transformation of Food into Nutrients: Digestion

Body organs do not directly use the food that we consume. This food must be first transformed into nutrients before being absorbed and distributed by blood to the organs.

How and where does the transformation of food take place?

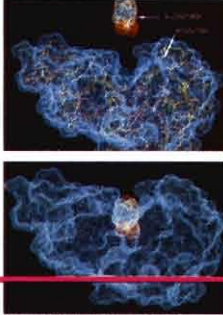


Digestion allows the body to use food.

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Problems to Solve


- What is the nature of the constituents of food?
- What does the transformation of food in the digestive tract consist of?
- What are the chemical agents of digestion? How do they act?
- What happens to the digested food?
- How does absorption of nutrients occur?



Computerized photomicrographs showing an enzyme with its substrate.

Activities to Understand

- Our Food
- Chemical Transformations of Food
- Enzymes, Agents of Digestion
- From Food to Nutrients
- The Route of Nutrients



Intestinal villi.

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Activities to understand

Activity pages to extract important notions

Title of the activity

Presentation of the activity

Documents to understand the topic

ACTIVITY 1

Our Food

Food, of all variety, is often considered as a mixture of substances that can be classified as organic matter: carbohydrates, lipids and proteins, and as mineral constituents, water and mineral salts.


What are the constituents of food and how are they identified?

1 Chemical Analysis of Bread

Substance to identify	Test	Result	
Carbohydrates	Starch	Iodine test (brown orange) performed without heating	Dark blue color
	Sugar (glucose)	Fehling solution test (blue) performed with heating	Brick-red precipitate
Proteins	Biuuret test	Copper sulfate (blue) and sodium hydroxide, performed without heating	Violet color
Lipids	Put or rub the food on a piece of paper		Translucent spot


Tests for the identification of organic matter

First experiment



Before → After

Second experiment



Before → After

Slice of bread + copper sulfate then sodium hydroxide

Simple experiments to verify the presence of certain constituents of bread.

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Glossary

Organic matter: matter made of carbon (plant or animal origin).

Fehling solution: reagent used to identify certain sugars called reducing sugars such as glucose and fructose.

Probing the activity

- Perform the experiments of ...
- Indicate the constituents of bread using the experimental results and the name of ...
- Name, by relating to ... the constituents of the substances tested.
- Using CuSO₄, find what are milk and poultry made of.
- Based on this whole activity, justify the following statement: "bread is a complex food".

2 Components of Some Foods

Food	Starch (I ₂)	Fehling test	Biuuret test
green		green juice	
banana		bracketed juice	
potatoes		bracketed juice	
eggs		bracketed juice	
fish		bracketed juice	

Experimental verification of the constituents of foods.

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Glossary

Probing the activity

Summing up and concept map

Summing Up

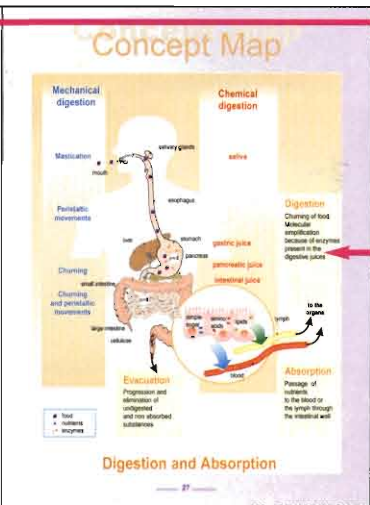
Food
Food is a mixture of organic substances (carbohydrates, fats and proteins) and mineral substances (salts and mineral salts). These substances are identified by chemical tests such as iodine test that checks for starch, Fehling test that indicates the presence of reducing sugars and biuret test that verifies the presence of proteins except for amino acids.

Digestion, a Chemical Transformation of Food
Digestion consists of the transformation of food because of the action of chemical substances called enzymes. This transformation is facilitated by mechanical action, such as mastication, chewing and rhythmic contractions of the wall of the digestive tract (peristaltic movements).

Enzymes, Agents of Digestion
Enzymes are biocatalysts contained in the digestive juices. They catalyze the hydrolysis of food. Each enzyme acts on a specific substrate at body temperature and with a convenient pH of the medium.

Digestion, a Molecular Simplification
Digestion allows the gradual breaking down of complex molecules into simple ones by the action of digestive enzymes. The digestion of carbohydrates leads to the formation of sugars such as glucose, that of proteins to amino acids and that of lipids to fatty acids and glycerol.

Intestinal Absorption
At the end of digestion, the small intestine contains:
- simple molecules that may or may not result from digestion. These are the nutrients (sugars, amino acids, fatty acids and glycerol, water, mineral salts and vitamins);
- complex molecules that are not digested such as the fibres of cellulose of plant origin.
Nutrients pass through the intestinal wall to the blood and to the lymph, this is a molecular absorption. The wall of the small intestine, with its numerous ridges covered with millions of villi, constitutes a large area of exchange. This large area and the thin lining of the intestinal wall favor the process of absorption. As nutrients leave the small intestine, some of them pass into the blood stream while others pass into the lymph. Then all nutrients join the blood circulation, and blood distributes them to the whole body. The undigested nutrients continue their way in the large intestine and form the faeces.



Summary to remember

A concept map visually illustrates the essential notions

Exercises pages to evaluate acquired knowledge

Solved exercise to help the student answer correctly

Solved Exercise

The experiment shown in the figure is performed in order to study the digestion of the egg white by a pancreatic enzyme, the trypsin. This enzyme is present in three tubes A, B, C placed under certain conditions.

a. Based on the setup, identify the given problem.
b. Formulate the hypothesis that is tested by the setup (1) and (2).
c. Indicate the results of the experiment, illustrated in (3) and (4).
d. Do the results of the experiment conform with the hypothesis formulated? Draw a conclusion.

To answer correctly

Observe carefully at the setup

Question a
Draw a relationship between the given problem and the setup used in order to formulate the tested hypothesis.

Question b
Observe carefully the setup in (3) and (4).

Question c
Draw a relationship between the results of the experiment and the formulated hypothesis.

Question d

Suggested answers

a. We aim at specifying the effect of the pH of the medium and the temperature on the activity of enzyme.

b. Hypothesis: trypsin is inactive in an acidic medium and at a temperature of 0°C.

c. The egg white has practically disappeared in A, while it remains unchanged in B and C.

d. The results confirm the hypothesis.

Conclusion: trypsin did not catalyze the digestion of the egg white in an acidic medium and at a temperature of 0°C.

Exercises

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Find the word or expression that does not belong.
a. Salivary amylase, albumin, starch, saliva
b. Stomach, niacin, villi, small intestine
c. Digestive enzyme, digestive juice, chewing, molecular amplification
d. Bile, lipase, glucose, fatty acids and glycerol
e. Glucose, amino acids, nutrients, starch

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Indicate the right expressions and correct the false ones.
a. Amino acids result from the digestion of lipids.
b. Nutrients are absorbed in the level of the small intestine.
c. All nutrients pass into the lymph at the level of intestinal villi.
d. Digestive juices are produced by digestive glands.
e. Fehling test verifies the presence of starch without heating.
f. The internal layer of the small intestine is called villi.

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In a simple stomach, mastication is a factor that favors absorption.
In bile, enough presence of enzymes, increases the digestion of lipids.
We can say that the action of enzymes is specific.

64
Construct a sentence using each of the following groups of words or expressions.
a. Digestion, molecular simplification, food, nutrients
b. Stomach, gastric juice, pepsin, proteins
c. Chemical digestion, mechanical action, digestive tract

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Fill in and give well the words corresponding to the following expressions.

- Salivary amylase
- Produced by the liver
- Mechanical action
- Organ of absorption
- Liquid secreted by a digestive gland
- The scale of absorption of lipids
- Present in the gastric juice
- End product of protein digestion
- Secretes the pancreatic juice

Evaluation exercises

Pages for an opening on current events

Info plus

Info plus

A Bacterium at the Origin of Stomach Ulcer

The stomach is the target of a painful disorder: ulcer. Ulcer is a hole in the lining of the stomach that does not heal. Excessive secretion of hydrochloric acid in the stomach damages its mucosal lining and consequently leads to ulcer. Various factors may also cause ulcer: smoking, stress, regular intake of anti-inflammatory drugs, certain types of food, smoking, caffeine, alcohol and also genetic predisposition.

In 1989, two Australian researchers discovered the presence of a bacterium, *Helicobacter pylori*, at the surface of the stomach lining. Nowadays, it is proven that this microorganism plays a role in the development of ulcer and even cancer of the stomach.

This bacterium has a spiral shape, and possesses a flagellum which allows it to move. It can develop in the stomach despite the strong acidity it survives in the mucosal lining by producing an enzyme that decreases the acidity in this area. The main route of contamination is saliva.

The discovery of this bacterium constitutes an achievement in the treatment of ulcer which can then be cured by antibiotics or prevented by vaccination.

Can we finally consider that the stomach ulcer is bacterial?

Helicobacter pylori is present in the stomach of 2/3 persons out of 10.

Lining of the stomach with an ulcer.

Chapter 1 Transformation of Food into Nutrients: Digestion

- Activities**
1. Our Food
 2. Chemical Transformations of Food
 3. Enzymes, Agents of Digestion
 4. From Food to Nutrients
 5. The Route of Nutrients

Summing Up Concept Map

Solved Exercise Exercises

Info-plus

Chapter 2 From Nutrients to Energy: Respiration

- Activities**
1. Organization of the Respiratory System
 2. Pulmonary Ventilation
 3. Respiratory Gas Exchange
 4. Transport of Respiratory Gases

Summing Up Concept Map

Solved Exercise Exercises

Info-plus

Chapter 3 Transport and Distribution of Nutrients and Oxygen Gas to Organs

- Activities**
1. Heart and Cardiac Activity
 2. Blood Vessels and the Dynamics of Circulation
 3. Cardiovascular Accidents
 4. Adaptation of the Body to a Physical Activity
 5. Usage of Nutrients and Oxygen Gas by the Cells

Summing Up Concept Map

Solved Exercise Exercises

Info-plus

Chapter 4 Regulation of the Internal Medium: Renal Function

- Activities**
1. The kidneys, Site of Urine Formation
 2. Renal Functions

Summing Up Concept Map

Solved Exercise Exercises

Chapter 5 Nutrition and Health

- Activities**
1. Variety of Food
 2. Food Ration
 3. A Balanced Diet

Summing Up Concept Map

Solved Exercise Exercises

Info-plus