LIFE SCIENCE

Secondary Education
Second year
Sciences Section

Center for Educational Research and Development
National Textbook
New Curricula

Republic of Lebanon

Ministry of Education and Higher Education

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The National Textbook Project

This is the second installment of textbooks completed by the Center as part of a three-stage effort to produce the 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 and modern learning, using sophisticated educational means and up-to-date methodology that encourage and reinforce individual thinking and research, the acquisition of skills, the 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 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 qualifications and qualities, yet last year's textbooks did contain some faults and gaps which were duly pointed out by researchers in many articles, and, indeed, we have benefited from some of them. Such is the nature of human work, no matter how good the intentions or how great the effort exerted.

Constructive criticism is a real contribution to raising the standard of authorship, minimizing errors and filling gaps. We only hope that criticism will always be objective and motivated by a desire to enhance educational reform in order to achieve better products.

A favorite adage handed down from our old scholars: "He who criticizes you is as helpful as a co-author". Let all criticism directed at the Center be of this caliber.

In closing, we hope that we all will have benefited from our experience and that the textbooks of the third and final stage be closer to realizing our hopes and more beneficial to our students. We are now preparing ourselves to assess the parts so far achieved of the new curricula and to assure that our educational movement is proceeding on the right track for achieving the best results.

June 2, 1999

President, National Center for Educational Research and Development

Nemer FRAYHA

Preface

The curriculum of the second year of the secondary cycle in Life Science, S series, focuses on three themes:

- functional characteristics of living things at the cellular level
- nutrition and health
- interdependence of living things and their relationships with the environment.

This textbook is conceived for science-oriented students. It favors discovery and reasoning. It presents varied didactic aids (graphics, photographs, documents, histograms) which lead the student from observation to conceptualisation. Guided by the teacher in the scientific procedure step, the student can acquire a critical thinking and an autonomy, which are the characteristics of a responsible citizen and a future researcher.

At the end of the second year of the secondary cycle, the student would have developed the following skills:

- to relate biological identity to genetic information
- to identify the functional characteristics of cells which allow the conversion of potential energy of organic matter into ATP which is used by the cells
- to identify the interdependence between living things within an environment
- to determine the responsibility of the human being in the control of ecosystems
- to relate good health to good eating habits

Each part of the book is divided into chapters which include:

- activities and their application to build up knowledge
- a "summing-up" that represents the main ideas
- a "concept-map" which summarizes the relationships between the main concepts of the chapters
- assessment exercises
- "supplementary information," which deals usually with current issues

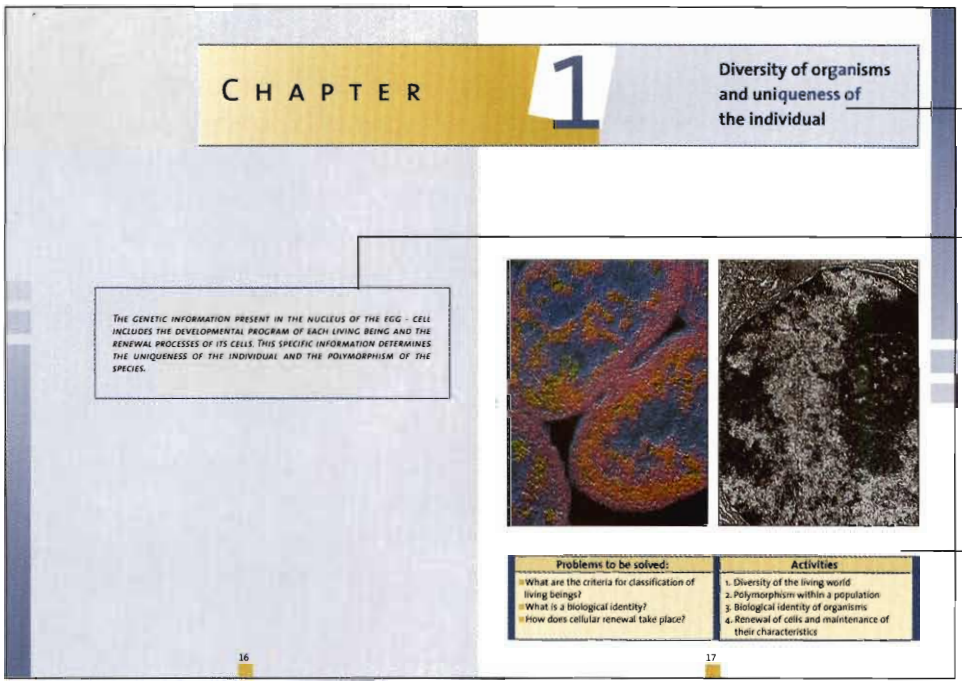
Supplementary files and a glossary complete the necessary information, which make this textbook a working tool and a reference. The authors hope that this textbook will be useful to the students and serve as a pedagogical aid for the teacher.

Sincere thanks and appreciation go to all those who helped us.

The Authors

USING THIS BOOK

The chapter opening page



Title of the chapter

Presentation of the chapte

Problems to be solved and activities to understand

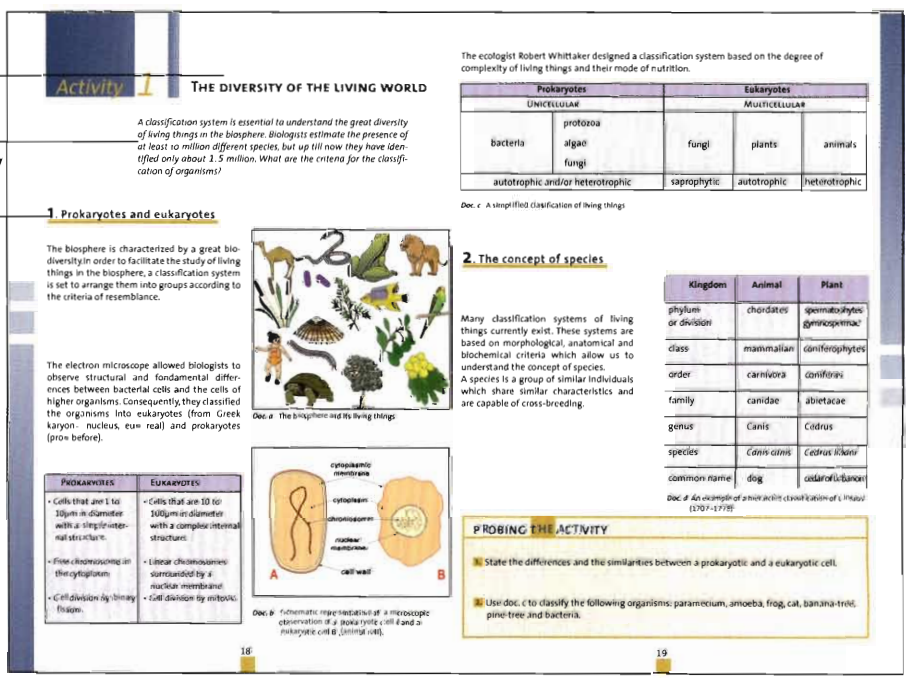
Activities to deduce the important notions

Title of the activity

Presentation of the activity

Documents to better understand

Probing the activity



Summing-up and concept map

Summing up to remember

SUMMING UP

The distinction between prokaryotes and eukaryotes is one of the multiple facets of the diversity of the living world. In addition to the polymorphism existing between populations, we observe differences between individuals of the same species.
The biological identity of living things depends on the genetic instructions localized in chromosomes. These instructions are responsible for the growth of the organism, the renewal of the cells and the maintenance of their characteristics.

I - Diversity of living things

The present nomenclature and classification system of living things into five kingdoms, reflects their great diversity. This does not exclude the distinction established earlier between prokaryotes and eukaryotes.

- **Prokaryotes** are **unicellular** living things whose cell lacks a nuclear membrane which separates their chromosome from the cytoplasm.
- **Eukaryotes** are **unicellular** or **multicellular** living things whose cells have a nuclear membrane surrounding their hereditary material, thus separating it from the cytoplasm.

On the other hand, the species is always considered the basic unit of any classification. It is defined as a group of living things possessing morphological, anatomical and physiological resemblances and whose individuals are capable of cross-breeding.

II - Population polymorphism

Individuals within a species have traits that distinguish each from the others. In humans, the descendants of a couple (with the exception of identical twins) are different from each other and from their parents. Nevertheless, they show "family traits."
This diversity could be extrapolated at the population level and even more at the species level.
At the **organism** level, the **uniqueness** of the individual is characterized by "**phenotypic markers**" such as skin pigmentation, hair color...
At the **cellular** level, **biochemical characteristics** allow to distinguish each of us from the others. This is the case for red **blood cell markers**, which are **glycoproteins** localized on their plasma membranes. These markers determine our **blood group** (A, B, AB and O).
Other markers provide additional particularities to the individual. That is why tissue and organ transplantations succeed in identical twins but are rejected in fraternal twins. All of these markers define the individual and allow the establishment of a "**molecular identity card**" for each of us. The **biological identity** of an organism is determined by the specific traits (of the species) and by individual, morphological and molecular traits.

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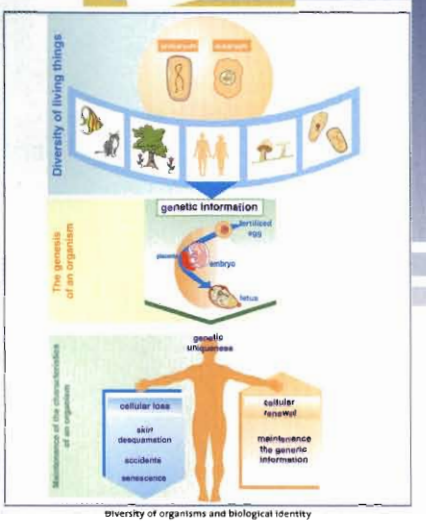
CONCEPT MAPPING



Diversity of organisms and biological identity

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The concept map illustrates by the image the essential notions.

Exercises to test acquired knowledge

EXERCISES

Exercise 1

Mark the true statements and correct the false ones.

1. There are not two human beings with the same genetic program.
2. Transplant rejection is caused by the similarity of markers between the donor and the recipient.
3. The identity markers exist in all our cells.
4. The bone marrow contains stem cells for red blood cells only.

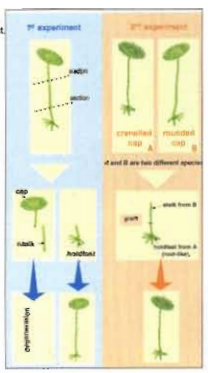
Exercise 2

Choose the correct answer(s)

1. Fetal and maternal blood
   a- mix at the placental level.
   b- mix at the umbilical cord level.
   c- do not mix.
   d- are not in direct contact.
2. The prokaryotic cell has
   a- a nuclear membrane
   b- many linear chromosomes.
   c- one free chromosome
   d- a cytoplasmic membrane.
3. The genetic information of eukaryotic cells is found in
   a- the cytoplasm.
   b- the chromosomes.
   c- the cytoplasmic membrane.
   d- the nucleus.

Exercise 3

The seaweed Acetabularia is an algae consisting of a single giant cell. Various sectioning and grafting experiments were performed on this algae.



1. Analyse the above experiments.
2. What can one deduce?

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Supplementary information

Species classification

Aristotle's system with two kingdoms

Plants	Animals
Terrestrial Plants Algae Fungi	Animals

Three kingdoms system depending on the distinction between prokaryotes and eukaryotes

Plants	Animals	Monera	
Terrestrial Plants Algae Fungi	Protozoa	Animals	Prokaryotes

Five-kingdom system

Mode of nutrition	Plants	Fungi	Animals	Protista	Procaryotes
Photosynthesis Absorption Ingestion	Terrestrial Plants and multicellular algae	Fungi	Animals	Unicellular algae Protozoa	Bacteria Bacteria

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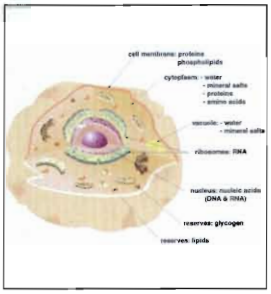
Supplementary information dealing with up to date issues

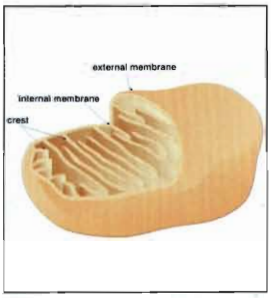
Assessment exercises

Part One:
Functional characteristics of living things at the cellular level

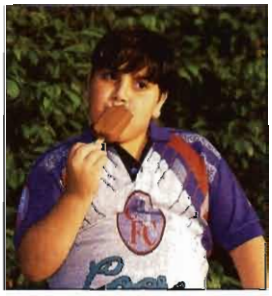
A-Biological identity and genetic information

B- Molecular renewal and energetic metabolism





Part Two:
Nutrition and Health



Part Three:
Interdependence of living things and their relationships with the environment