BIOLOGY

Living Systems

Oram • Hummer • Smoot

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A MERRILL SCIENCE PROGRAM

Biology: Living Systems, Pupil's Edition & Teacher's Annotated Edition
Biology: Living Systems, Teacher Resource Book
Laboratory Biology: Investigating Living Systems, Pupil's Edition & Teacher's Annotated Edition
Probing Levels of Life: A Laboratory Manual, Pupil's Edition & Teacher's Annotated Edition
Biology: Living Systems, Evaluation Program (Spirit Duplicating and Black Line Masters)

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PREFACE

BIOLOGY: Living Systems, Fifth Edition, maintains the high standards of the previous editions while adding new and current material of prime importance to high school students. As with previous editions, input from both teachers and students has played a key role in the updating and revision of the text. Emphasis is placed on broad concepts applicable to all living systems. Details concerning the diversity of processes, structures, and organisms are related to the unifying principles and features of all life. Basic concepts are repeated at different points and at varying degrees of depth. Thus, the student builds upon the foundation of previously mastered ideas.

Living systems are characterized by organization. Maintenance of this organization depends on the interrelationship of matter and energy. *BIOLOGY: Living Systems*, Fifth Edition, begins by introducing these important concepts. The relationship is then emphasized and repeated throughout the text as it applies to different levels of biological organization.

Uniqueness of science is then discussed. Whenever possible, important principles and concepts are presented and developed on the basis of the experimental evidence supporting them. Thus, the student gains an insight into, and an appreciation for, the way scientific knowledge is produced. The text stresses the interrelationships and differences among facts, observations, interpretations, and experimentation. It also stresses that scientific theories, though currently supported by extensive experimentation, are always subject to revision in the light of new evidence. Evolution, for example, is treated as a theory rather than as fact.

Chemical aspects of living systems are a basic part of today's biology. Only those principles of chemistry needed for an understanding of biochemical processes are presented. When these processes are presented with other concepts, the significance of the processes is emphasized. Chemical details are minimized. A chapter on energy ties the chemical aspects of living systems to the following chapter, which explores cell structure and function.

Following the introductory unit, reproduction is analyzed in terms of the cell, genetics, and biochemistry. The text then proceeds to a discussion of the evidence regarding change in organisms. Adaptations, speciation, and human origins are considered. Succeeding chapters deal with principles of taxonomy and a survey of the five kingdoms.

The next three units are devoted to the anatomy and physiology of simple organisms, plants, and animals respectively. Because these three groups of organisms are adapted to very different ways of life, they are presented separately. However, the sequence of topics in all three units is similar, and such organization provides teaching flexibility. This organization facilitates the emphasizing of life functions as being common to all organisms, and the teacher may draw examples from all forms of life in presenting each function.

The book concludes with a unit on environment. Chapters in this unit include an examination of behavior, population biology, and ecology. An analysis of the role of humans in causing, coping with, and solving contemporary problems of pollution, conservation, and overpopulation is incorporated.

The content is presented in a logical manner—from the simplest to the most complex level of biological organization. However, the presentation is flexible enough so that chapters may be studied in a variety of sequences.

Many aids to student learning are incorporated into the text. Each unit begins with a discussion and a photograph that provide a preview of the material to be covered. A chapter-opening photograph and an introductory paragraph are used to convey the theme of each chapter to the student. A goal statement identifies the major objectives of each chapter. Margin notes, section-end and chapter-end questions, vocabulary lists, and chapter summaries provide guides for self-assessment, review, and study. Reading lists, project ideas, appendices (including infor-

mation on biology related careers), a complete glossary, and an extensive index complete the many learning aids. Together, these features provide a guide by which students may efficiently approach their study of biology.

Biology, as a study of life, is a relevant and vital discipline. *BIOLOGY: Living Systems,* Fifth Edition, presents basic biological principles by using examples that best illustrate these principles. Concepts and theories are augmented by practical, applied, and familiar examples and illustrations. Thus, the text appeals to nonscience students as well as to those who will continue their study of science.

TO THE STUDENT

What common bond do you share with the more than two million other known kinds of organisms on Earth? You and the other organisms are living systems. What makes you and other life forms "alive"? What needs do you share? What activities do you all carry out? How are you all different? In what ways do you interact? How do you and other organisms affect the environment, and how does the environment affect you?

You are about to begin a course in biology, which will enable you to answer some of these questions. You may or may not consider yourself a young "scientist." You may or may not ever take another course in biology. However, what you learn in this course will be valuable to you always. Knowledge of biology will be useful and important to you now as you learn about what makes you and other organisms "tick." It will also be important later as an aid to making responsible decisions as an adult.

BIOLOGY: Living Systems, Fifth Edition, contains much interesting and up-to-date information. Understanding how to use your text will make your study of biology easier. Each unit begins with a photograph and a discussion that preview the material in the unit to follow. Each chapter begins with a photograph and introductory paragraph that convey the theme of the chapter. A goal statement explains the prime objective for your study of the chapter. Throughout the chapter, margin notes emphasize the major ideas. Use these notes as a self-check to evaluate your understanding of facts and major ideas. Major terms are highlighted in boldface type. Each term is defined in the text material where boldface type appears.

Review questions and/or problems have been placed throughout the chapter. These, too, provide a means for you to check your understanding. At the end of each chapter, a *Summary* provides a list of the major points and ideas presented. Some of you will find reading this section useful both *before* and *after* studying the chapter. A word list, *Language of Biology,* reminds you of the most important terms so you may easily review each definition.

Also at the end of each chapter are sets of questions and problems. *Checking Your Ideas* is a set of questions stressing your understanding of major facts and terms. *Evaluating Your Ideas* contains questions and problems that are useful as a review of the chapter's concepts. *Applying Your Ideas* includes questions and problems that require you to apply what you have learned to new but related ideas. In addition, a set of project ideas is presented in *Extending Your Ideas.* Included among the five Appendices are *A Classification of Living Systems* and *Biology-Related Careers.* The Glossary contains over 1300 complete definitions that will aid your study of biology. The complete Index will be valuable to you in locating particular topics.

With these thoughts in mind, it is time to begin. Our hope is that *BIOLOGY: Living Systems* is your key to a successful year of study that will result in an increased awareness and understanding of yourself and your relationship with other life forms. Also, we hope that this understanding brings on a sense of excitement and wonderment that stimulates your continued questioning of and learning about the world around you.

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CHARACTERISTICS

Biology, the study of life, is a vital and challenging field. Each year that field grows as old questions are answered and new questions are raised. What determines how an organism grows? What are the basic structures common to all living systems? Why do some life forms better resist disease than others? These and other questions and their answers affect you, for you are a part of the world of life.

Observe the characteristics of this great blue heron. What special features enabled it to capture the catfish? Notice that the structure of the heron's neck, beak, and legs distinguish it from other organisms. What features does it have in common with other organisms? Within the tremendous diversity of life, there is also unity. There are certain characteristics of life shared by all living systems.

Unit 1 focuses on the common characteristics of life. For example, all organisms require energy and interact with other life forms and the environment. You will learn about common features such as these as well as some of the methods by which organisms are studied. You will also be introduced to some ideas of chemistry needed for today's study of biology.

Great Blue Heron with Catfish

OF LIFE

Unit 1

Dr. Betty Linthicum

Carl W. Rettenmeyer

If you examine the world around you, you will find it full of living things. Most easy to observe may be plants and animals, but other types of life are also present. Although the life forms seem very different, they have some things in common. All living things need food. From the food they get energy. How do living things such as these ants obtain and use energy? What is the major source of energy to the living things on Earth?

Chapter 1

Life: Common Characteristics

GOAL: You will gain an understanding of the basic features of life common to all organisms.

You are about to begin a course in **biology,** the study of life. Naturally, you want to know what you will be learning. Your study will involve different kinds of organisms (living things). An **organism** is anything capable of carrying on life processes. Part of the course will examine the major groups of organisms that exist today. You will learn about the physical characteristics that set one type of organism apart from others.

Biology is the study of life.

Biology is more than just a study that describes the many differences among organisms. There are nearly two million known kinds of organisms. You could not possibly learn about all or even most of them. Therefore, your study of life will focus on the similarities among organisms. These similarities most often involve the life processes of organisms—their activities and functions. By studying these processes, you will see that certain features are common to all organisms. By the time you complete the course, you will have a good understanding of what is meant by the word "life."

Anything capable of carrying on life processes is called an organism.

Organisms are similar in their activities and functions.

THE COMMUNITY

1:1 Organisms

Have you ever had the chance to spend a day exploring the natural surroundings where you live? Perhaps you live in an area near a forest. Imagine that you are about to walk through the forest. As you near the edge of the forest, you see many things.