国外生命科学优秀教材

Concepts in Biology

Tenth Edition

生物学原理

影印版

Eldon D. Enger
Frederick C. Ross

内附彩色光盘

科学出版社
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内 容 简 介

本书是经典生物学教材，历经时间考验，已经出版至第十版。全书共26章，全面阐述了基础生物学的内容：生命的化学、细胞和酶、生化途径、遗传基础、细胞分化与分裂、经典遗传学、进化与生态、生物多样性、生理、营养与代谢、物质与能量交换、生命的起源与进化、微生物、动物、植物等等。结构严谨、基础知识丰富、系统性强；篇幅适中、语言生动，尤其适合中国人阅读英文。书中附有全书彩图光盘，方便师生使用。本书在线资源库更加丰富多彩。

本书适合作为高等院校低年级普通生物学双语教材，也可供对生物学感兴趣的一般读者阅读参考。

Eldon D. Enger, Frederick C. Ross.
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Preface

Purpose

The origin of this book is deeply rooted in our concern for the education of college students in the field of biology. We believe that large, thick books intimidate introductory-level students who are already anxious about taking science courses. We have worked hard to write a book that is useful, interesting, and user-friendly.

Organization

Concepts in Biology is arranged in a traditional manner, progressing from the basic to the complex. It begins with a discussion of the meaning, purpose, and future of biology as a scientific endeavor. It then covers biological concepts as an expanding spiral of knowledge. Thus, chemistry is followed by cell biology, cell division, genetics, ecology, evolution, anatomy and physiology, and the diversity and classification of living things.

The Tenth Edition

As with all previous editions, we have updated the entire text. We have carefully considered all comments by reviewers and have made many changes and additions that will make the text more readable, current, and accurate.

Since the last edition, the concept that there are three major categories of life known as domains has become generally accepted by the scientific community. This concept is introduced in Chapter 4 on cells and has been incorporated throughout the text whenever appropriate.

The material on the scientific method has been rewritten to better describe how the process of science really works and includes new discussions of dependent and independent variables, deductive and inductive reasoning, and the nature of laws and theories.

Sections of the text that deal with evolution, classification, and taxonomy have been changed substantially. New sections deal with common misconceptions about natural selection, the difference between the biological and morphological species concepts, evidence for evolution, evolutionary time lines, and cladistics. Cladograms have been included in several places in the text where they are appropriate. The section on human evolution has been rewritten to include recent changes in thinking about human origins.

The section on photosynthesis has been rewritten to present photosynthesis as including three distinct stages: light-capturing processes, chemical reactions that are dependent on light, and chemical reactions that are light independent. As with the section on respiration, the section on photosynthesis is divided into basic, intermediate, and detailed presentations that can be tailored to the needs of the instructor and students.

A new section on the phosphorus cycle has been added to the part on ecology. In addition, Chapter 17 on behavioral ecology has been substantially reorganized. There is new material on the adaptive nature of behavior, including human behavior.

Several new tables have been added, including (1) tables on the sources and functions of vitamins and minerals; (2) summary tables of the nature of mitosis and meiosis; (3) a table that describes different levels of organization from atoms to ecosystems; (4) one that shows the biological and evolutionary significance of different kinds of behaviors; and (5) a summary table that compares the structure of plant and animal cells.

A *Concepts in Biology* Online Learning Center at www.mhhe.com/enger10 accompanies the tenth edition. This online resource offers an extensive array of online content to fortify the learning and teaching experience, including chapter quizzes, concept maps, animations, web links, and access to premium McGraw-Hill assets such as the Essential Study Partner and BioCourse.com. In addition, For Your Information, Check This Out!, and Experience This features from the ninth edition text are available on this site.

Features

Each chapter in this text contains a number of features that actively involve students in the learning process:

Chapter Outline
As part of the chapter opening, the outline lists the major headings in the chapter as well as the boxed readings.

Key Concepts and Applications Table
This table is also part of the chapter opening and identifies the key topics of the chapter as well as the significance of mastering each topic.

Topical Headings
Throughout the chapter, headings subdivide the material into meaningful sections that help the reader recognize and organize information.

Full-Color Graphics
The line drawings and photographs illustrate concepts or associate new concepts with previously mastered information. Every illustration emphasizes a point or helps teach a concept.

How Science Works and Outlooks
Each of these boxed readings was designed to catch the interest of the reader by providing alternative views, historical perspectives, or interesting snippets of information related to the content of the chapter.

Chapter Summary
The summary at the end of each chapter clearly reviews the concepts presented.

Thinking Critically
This feature gives students an opportunity to think through problems logically and arrive at conclusions based on the concepts presented in the chapters.

Concept Maps
Constructing these maps provides the students with an opportunity to strengthen their understanding of the chapter by organizing terms or ideas from the chapter into a logical relationship with each other. Concept maps for each chapter are found on the Online Learning Center.

Key Terms
The list of key terms used in the chapter helps students identify concepts and ideas necessary for comprehending the material presented in the chapter. Definitions are found in the glossary at the end of the text.

e-Learning Connections
Each chapter ends with an e-Learning Connections page, which organizes relevant online study materials and review questions by major sections of the chapter. This page is repeated and expanded on the Online Learning Center at www.mhhe.com/enger10.

Support Materials

The following materials have been developed to accompany *Concepts in Biology*, tenth edition:

The **Instructor's Manual** provides a brief statement outlining the purpose of each chapter and is online in the Instructor Center of the Online Learning Center at www.mhhe.com/enger10.

A **Computerized Text Bank** that utilizes Brownstone Diploma® testing software is available on CD-ROM in both Windows and Mac platforms. A Microsoft Word file of the text bank is also included on this CD-ROM.

A set of 150 full-color **transparencies** are available free to adopters of the tenth edition of *Concepts in Biology*. This set includes tables and figures from the text.

Every piece of line art as well as many of the photographs from the text are available on CD-ROM as the **Digital Content Manager.**

The **Laboratory Manual** features 29 carefully designed, class-tested exploratory investigations.

The **Laboratory Resource Guide** provides information on acquiring, organizing, and preparing laboratory equipment and supplies. Estimates of the time required for students to complete individual laboratory experiences are provided as well as answers to questions in the laboratory manual.

A revised **Student Study Guide** features an overview of the chapter as well as multiple-choice, short answer, and label/diagram/explain questions. Answers to these questions are provided in an appendix to allow for immediate feedback.

The *Concepts in Biology* **Online Learning Center** is found at www.mhhe.com/enger10. This website contains a wealth of information for both students and instructors, including chapter reviews, art quizzes, labeling exercises, web links, animations, and much more. The **Essential Study Partner**, a collection of interactive study modules, can be accessed through the Online Learning Center, as can **BioCourse.com**, which provides a vast array of up-to-date resources pertaining to the life sciences.

Acknowledgments

A large number of people have helped us write this text. Our families continued to give understanding and support as we worked on this revision. We acknowledge the thousands of students in our classes who have given us feedback over the years concerning the material and its relevancy. They were the best possible sources of criticism.

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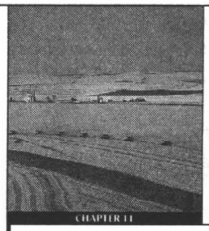
Guided Tour

Chapter Outline Appears at the beginning of each chapter as a quick guide to the chapter's organization.

Key Concepts and Applications Identifies the key topics of the chapter and the significance of mastering each topic.

Summary Reviews key concepts at the end of each chapter.

Thinking Critically Questions that challenge students to think through problems logically and arrive at conclusions based on chapter concepts.



CHAPTER 11

Diversity Within Species 11

PART FOUR Evolution and Ecology

Chapter Outline

Key Concepts	Applications
Understand the difference in meaning between the terms species and population.	• Understand the criteria for distinguishing one species from another. • Understand that the definition for species allows for species designations to be changed.
Describe the occurrence of a gene in a population in terms of gene frequency.	• Describe the difference between the biological species concept and the morphological species concept. • Describe why all organisms of a species are not the same. • Understand the meaning of the term *gene pool*. • Appreciate the significance of genetic diversity.
Relate the concepts of cloning and hybridization to asexual and sexual reproduction.	• Describe how hybrid plants are produced. • Recognize how different breeds of animals are produced. • Recognize the importance and potential danger of the practice of monoculture.
Recognize the factors that can change gene frequencies.	• Describe how differences in gene frequency are produced through mutation, sexual reproduction, population size, and migration. • Describe why different populations of the same species often have different gene frequencies.
Recognize that population genetics principles apply to human populations.	• Describe why certain diseases are more common in some groups of people than in others. • Understand what meaning "race" has in the human species. • Describe the role of a genetic counselor. • Understand how misunderstanding of population genetics resulted in eugenics movements.

SUMMARY

All matter is composed of atoms, which contain a nucleus of neutrons and protons. The nucleus is surrounded by moving electrons. There are many kinds of atoms, called elements. These differ from one another by the number of protons and electrons they contain. Each is given an atomic number, based on the number of protons in the nucleus, and an atomic weight, determined by the total number of protons and neutrons. Atoms of an element that have the same atomic number but differ in their atomic weight are called isotopes. Some isotopes are radioactive, which means that they fall apart, releasing energy and smaller, more stable particles. Atoms may be combined into larger units called molecules. Two kinds of chemical bonds allow molecules to form—ionic bonds and covalent bonds. A third bond, the hydrogen bond, is a weaker bond that holds molecules together and may also help large molecules maintain a specific shape.

Energy can neither be created nor destroyed, but it can be converted from one form to another. Potential energy and kinetic energy can be interconverted. When energy is converted from one form to another, some of the useful energy is lost. The amount of kinetic energy that the molecules of various substances contain determines whether they are solids, liquids, or gases. The random motion of molecules, which is due to their kinetic energy, results in their distribution throughout available space.

An ion is an atom that is electrically unbalanced. Ions interact to form ionic compounds, such as acids, bases, and salts. Compounds that release hydrogen ions when mixed in water are called acids; those that release hydroxide ions are called bases. A measure of the hydrogen ions present in a solution is known as the pH of the solution. Molecules that interact and exchange parts are said to undergo chemical reactions. The changing of chemical bonds in a reaction may release energy or require the input of additional energy.

THINKING CRITICALLY

Sodium bicarbonate ($NaHCO_3$) is a common household chemical known as baking soda, bicarbonate of soda, or bicarb. It has many home: place a pinch of sodium bicarbonate ($NaHCO_3$) on a plate. Add a couple of drops of vinegar. Observe the reaction. Based on the reaction above, can you explain chemically what has happened?

CONCEPT MAP TERMINOLOGY

Construct a concept map to show relationships among the following concepts.

anion
cation
electron
ion
ionic bond
molecule
neutron
proton
salt

Concept Maps Students organize terms or ideas from the chapter into a logical relationship with each other.

KEY TERMS

acid
anion
atom
atomic mass unit (AMU)
atomic nucleus
atomic number
atomic weight (mass number)
base
cation
chemical bonds
chemical formula
chemical reaction
chemical symbol
colloid
compound
covalent bond
density
electrons
elements
empirical formula
energy level
first law of thermodynamics

Key Terms Helps students identify concepts and ideas presented in the chapter.

e—LEARNING CONNECTIONS *www.mhhe.com/enger10*

Topics	Questions	Media Resources
4.1 The Cell Theory	1. Describe how the concept of the cell has changed over the past 200 years. 2. Define cytoplasm.	**Quick Overview** • The simplest unit of life **Key Points** • The cell theory
4.2 Cell Membranes	3. What are the differences between the cell and the cell membrane?	**Quick Overview** • Chemical boundaries **Key Points** • Cell membranes
4.3 Getting Through Membranes	4. What three methods allow the exchange of molecules between cells and their surroundings? 5. How do diffusion, facilitated diffusion, osmosis, and active transport differ? 6. Why does putting salt on meat preserve it from spoilage by bacteria?	**Quick Overview** • Boundaries create new problems **Key Points** • Getting through membranes **Animations and Review** • Osmosis • Facilitated diffusion • Active transport **Experience This!** • Diffusion, osmosis, or active transport?
4.4 Cell Size	7. On the basis of surface area-to-volume ratio, why do cells tend to remain small?	**Quick Overview** • Why are cells small? **Key Points** • Cell size
4.5 Organelles Composed of Membranes	8. Make a list of the membranous organelles of a eukaryotic cell and describe the function of each. 9. Define the following terms: stroma, grana, and cristae.	**Quick Overview** • Partitioning the cell **Key Points** • Organelles composed of membranes **Interactive Concept Maps** • Text concept map

e-Learning Connections
Organizes relevant online study materials and review questions by major sections of the text. This page, found at the end of each chapter, is repeated and expanded on the Online Learning Center at www.mhhe.com/enger10, where a click of the mouse takes you to a specific study aid.

Online Learning Center
This online resource, found at www.mhhe.com/enger10, offers an extensive array of interactive learning tools, such as art labeling exercises, vocabulary flashcards, concept maps, chapter review quizzes, and other activities designed to reinforce learning.

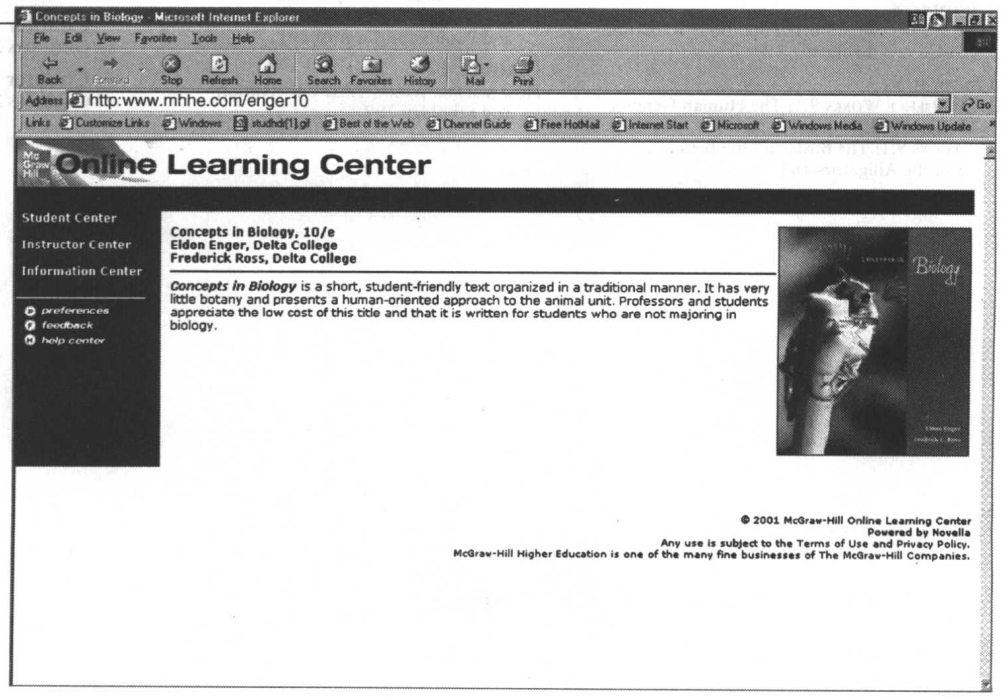


Table of Boxes

Brief Contents

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*These elements appear in every chapter.

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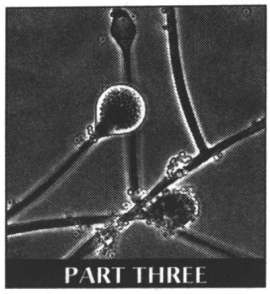

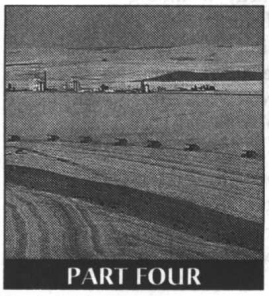

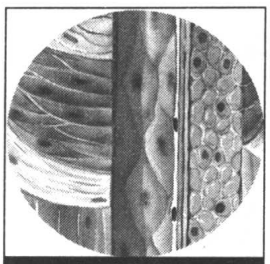

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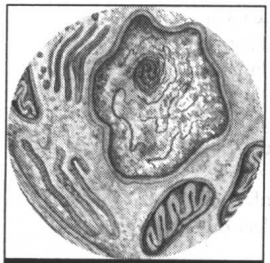

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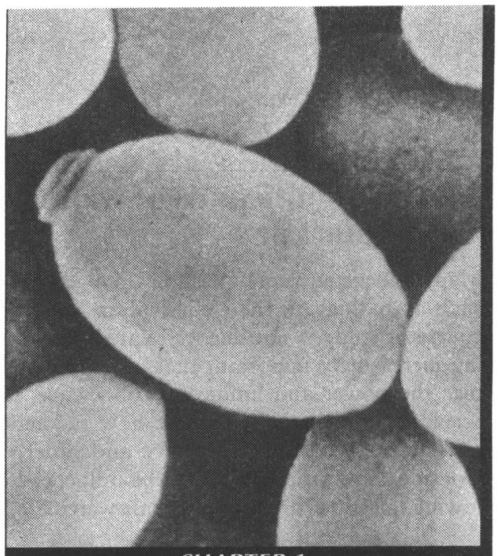
What Is Biology?

1



CHAPTER 1

Chapter Outline

It is often helpful when learning new material to have the goals clearly stated before that material is presented. It is also helpful to have some idea why the material will be relevant. This information can provide a framework for organization as well as serve as a guide to identify the most important facts. The following table will help you identify the key topics of this chapter as well as the significance of mastering those topics.

Key Concepts	Applications
Understand the process of science as well as differentiate between science and nonscience.	• Know if information is the result of scientific investigation. • Explain when "scientific claims" are really scientific. • Recognize that some claims are pseudoscientific and are designed to mislead.
Understand that many advances in the quality of life are the result of biological discoveries.	• Give examples of how biological discoveries have improved your life. • Recognize how science is relevant for you.
Differentiate between applied and theoretical science.	• Describe the kinds of problems biologists have to deal with now and in the future.
Recognize that science has limitations.	• Give examples of problems caused by unwise use of biological information. • Identify questions that science is not able to answer.
Know the characteristics used to differentiate between living and nonliving things.	• Correctly distinguish between living and nonliving things.

1.1 The Significance of Biology in Your Life

Many college students question the need for science courses such as biology in their curriculum, especially when their course of study is not science related. However, it is becoming increasingly important that all citizens be able to recognize the power and limitations of science, understand how scientists think, and appreciate how the actions of societies change the world in which we and other organisms live. Consider how your future will be influenced by how the following questions are ultimately answered:

- Does electromagnetic radiation from electric power lines, computer monitors, cell phones, or microwave ovens affect living things?
- Is DNA testing reliable enough to be admitted as evidence in court cases?
- Is there a pill that can be used to control a person's weight?
- Can physicians and scientists manipulate our genes in order to control certain disease conditions we have inherited?
- Will the thinning of the ozone layer of the upper atmosphere result in increased incidence of skin cancer?
- Will a vaccine for AIDS be developed in the next 10 years?
- Will new, inexpensive, socially acceptable methods of birth control be developed that can slow world population growth?
- Are human activities really causing the world to get warmer?
- How does extinction of a species change the ecological situation where it once lived?

As an informed citizen in a democracy, you can have a great deal to say about how these problems are analyzed and what actions provide appropriate solutions. In a democracy it is assumed that the public has gathered enough information to make intelligent decisions (figure 1.1). This is why an understanding of the nature of science and fundamental biological concepts is so important for any person, regardless of his or her vocation. *Concepts in Biology* was written with this philosophy in mind. The concepts covered in this book are core concepts selected to help you become more aware of how biology influences nearly every aspect of your life.

Most of the important questions of today can be considered from philosophical, social, and scientific standpoints. None of these approaches individually presents a solution to most problems. For example, it is a fact that the human population of the world is growing very rapidly. Philosophically, we may all agree that the rate of population growth should be slowed. Science can provide information about why populations grow and which actions will be the most effective in slowing population growth. Science can also develop methods of conception control that would limit a person's ability to reproduce. Killing infants and forced sterilization are both methods that have been tried in some parts of the world within the past century. However, most would contend that these "solutions" are philosophically or socially unacceptable. Science can provide information about the reproductive process and how it can be controlled, but society must answer the more fundamental social and philosophical questions about reproductive rights and the morality of controls. It is important to recognize that science has a role to play but that it does not have the answers to all our problems.

Figure 1.1

Biology in Everyday Life
These news headlines reflect a few of the biologically based issues that face us every day. Although articles such as these seldom propose solutions, they do inform the general public so that people can begin to explore possibilities and make intelligent decisions leading to solutions.

1.2 Science and the Scientific Method

You already know that biology is a scientific discipline and that it has something to do with living things such as microorganisms, plants, and animals. Most textbooks define **biology** as the science that deals with life. This basic definition seems clear until you begin to think about what the words *science* and *life* mean.

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