Preface

The origin of this book remains 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. With each edition, we have worked hard to provide a book that is useful, interesting, and engaging to students while introducing them to the core concepts and current state of the science.

The Twelfth Edition

There are several things about the twelfth edition of *Concepts in Biology* that we find exciting. This revision, as with previous editions, is very much a collaborative effort. When we approach a revision, we carefully consider comments and criticisms of reviewers and discuss how to address their suggestions and concerns. As we proceed through the revision process, we solicit input from one another and we critique each other's work.

Overview of Changes to *Concepts in Biology*, Twelfth Edition

Opening Chapter Vignette

A new opening chapter vignette sets the scene for the student by demonstrating the relevance of that chapter's content to their daily lives.

Enhanced Visuals and Page Layout

The art program has been a prime focus for this edition. We have added and updated a large percentage of line drawings and photographs. Page design has been updated to provide students with a more open, inviting, and useable text.

Increased Student Accessibility

The readability of the text has been improved by the use of additional subheadings and a more direct writing style.

See the list of topical additions and updates made to the twelfth edition.

Biochemical Pathways

In previous editions, biochemical pathways were presented in one chapter (chapter 6). We decided to split this chapter into two chapters: Biochemical Pathways—Cellular Respiration and Biochemical Pathways—Photosynthesis. The complexity of these metabolic pathways has long been difficult for students to grasp. To help with this problem, and with the encouragement of reviewers, we moved the material on ATP, electron transport, and proton pumps to the previous chapter—Enzymes, Coenzymes, and Energy. These changes should allow students to more easily sort out the details of each pathway and understand the information.

New Chapter—Applications of Biotechnology

In previous editions, biotechnology was addressed in the same chapter as DNA replication and protein synthesis. This new chapter presents biotechnology as the processes of making comparisons of DNA or transferring DNA from one cell to another. This chapter also provides students with fundamental information on current topics, such as why biotechnology works, gene sequencing, the Human Genome Project, biotechnology ethics, DNA comparisons, stem cells, the polymerase chain reaction, and gene cloning.

Cell Division Chapter

The mitosis and meiosis chapters have been combined to stress comparisons between these two cellular processes and their implications. Treating both topics as one chapter will encourage students to find similarities in the names for the different stages. At the same time, students will also be more likely to explore the significant differences between these two types of cell division.

New End-of-Chapter Basic Review Questions

New end-of-chapter basic review questions have been added. These questions will provide students with more help in mastering chapter concepts.

Part I—Introduction

Chapter 1—What Is Biology?
The major changes to this chapter involve updating the figures and adding subheadings to help the reader recognize the organization of the material in the chapter. There are nine new illustrations and several of the original figures have been modified.

Part II—Cornerstones: Chemistry, Cells, and Metabolism

Chapter 2—The Basics of Life: Chemistry
This chapter has been restructured to make an otherwise challenging topic more manageable. Many figures have been changed in order to enhance learning. There is also a new Outlooks box on how buffers work.

Chapter 3—Organic Molecules—the Molecules of Life
Additional subheadings, examples, and figures allow students to more easily follow the flow of ideas. New information is presented on reducing LDL levels and controlling cholesterol. There is a new Thinking Critically box that focuses on the use of alcoholic beverages and societal issues concerning its use.

Chapter 4—Cell Structure and Function
This chapter was reorganized with extensive revision of the sections on cell size, cellular membranes, and diffusion and osmosis. There is a new How Science Works box on the development of the fluid-mosaic model. Most of the illustrations are new or revised.

Chapter 5—Enzymes, Coenzymes, and Energy
New material on Gaucher disease has been added, along with many new illustrations. In addition, the reorganization of the chapter dealing with biochemistry resulted in the addition of a new section on enzymatic reactions used in processing energy and matter. This section presents information on biochemical pathways, generating ATP, electron transport, and proton pumps.

Chapter 6—Biochemical Pathways—Cellular Respiration
The original chapter on biochemical pathways has been divided into two chapters. This chapter focuses on the process of cellular respiration. The first section presents material on how organisms handle energy to meet their needs. There are two new Outlooks boxes: one on the processes of spoiling and souring and one on lipid metabolism and ketoacidosis. The new Thinking Critically feature challenges students to trace the biochemical pathways they would follow if they were a hydrogen atom as they moved through the process of aerobic cellular respiration.

Chapter 7—Biochemical Pathways—Photosynthesis
Photosynthesis is now in its own chapter, with many new illustrations.

Part III—Molecular Biology, Cell Division, and Genetics

Chapters in this part have been updated to reflect recent advances in fields of molecular biology, cellular biology, and biotechnology. These four chapters are revised to emphasize the genetic implications of cell division, Mendelian genetics, and biotechnology for the cell's protein synthesis activities.

Chapter 8—DNA and RNA: The Molecular Basis of Heredity
This chapter presents the traditional sequence of DNA replication, followed by protein synthesis and the effects of mutation on protein synthesis. The illustration updates for this edition more clearly present transcription, translation, and DNA replication. New illustrations address gene structure, splicing, and the effects of mutations.

Chapter 9—Cell Division—Replication and Reproduction
Chapter 9 presents both mitosis and meiosis in one chapter to stress their common cellular processes and contrast their differences. Cancer is used to provide the student with insight into the regulatory mechanisms used to control cell division and how cancer treatments frequently attempt to use cellular processes to the advantage of the patient.

Chapter 10—Patterns of Inheritance
Two new tools for teaching genetics problems are presented. The Gene Key helps students organize allele interactions by directing the students to identify and examine phenotype and genotype information for each gene. The Solution Pathway helps students identify and organize the information in a genetics problem by placing the information from each problem into a single, generalized process that stresses key concepts, such as gamete formation, independent assortment, segregation, and allelic interactions.

Chapter 11—Applications of Biotechnology
This is a new chapter for *Concepts in Biology*. In previous editions, biotechnology was addressed in the same chapter as DNA replication and protein synthesis. This chapter presents biotechnology as a process of making comparisions of DNA or transferring DNA from one cell to another. This chapter emphasizes the end results of biotechnology by examining its applications. This will help the student more easily identify the timeliness and relevancy of this topic. Techniques common to biotechnology, such as gel electrophoresis, DNA sequencing, and PCR, are treated in boxes separate from the chapter's conceptual development. This allows the instructor the choice to focus on the uses and implications of biotechnology or to include a deeper discussion of how biotechnology is actually accomplished in a laboratory setting.

Part IV—Evolution and Ecology

Chapter 12—Diversity Within Species and Population Genetics
The sequence of presentation within this chapter has been changed. Many figures are either modified or new.

Chapter 13—Evolution and Natural Selection
Information on the development of evolutionary thought has been updated and moved from a later chapter. There are many new figures.

Chapter 14—The Formation of Species and Evolutionary Change
New examples have been included throughout, along with many new illustrations. Two new How Science Works boxes have been added: one on evolution and the domesticated dog and one on the taxonomic status of Neandertals. There is also a new section on homologous and analogous structures, and material on human evolution has been updated.

Chapter 15—Ecosystem Dynamics: The Flow of Energy and Matter

Chapter 16—Community Interactions
Chapters 15 and 16 have been completely reorganized and over 80% of the figures are new or revised. Chapter 15 now focuses on ecosystem-level concepts, such as energy flow, trophic relationships, and nutrient cycles. Chapter 16 deals with concepts related to interactions among organisms within communities. The concepts of niche, habitat, kinds of organism interactions, biomes, and succession are some of the topics covered in chapter 16. It also has a new Outlooks box on biodiversity hotspots.

Chapter 17—Population Ecology
There is a new section on population distribution and a new Outlooks box on the lesser snow goose population problem. Two-thirds of the figures are new or revised.

Chapter 18—Evolutionary and Ecological Aspects of Behavior
There has been extensive reorganization of the material in the chapter, and the sections on anthropomorphism, territorial behavior, and social behavior were extensively revised. A new section on communication was added and many of the figures are new or revised.

Part V—The Origin and Classification of Life

Chapter 19—The Origin of Life and the Evolution of Cells
This chapter was structurally reorganized and many new heads were added to help the reader make sense of this complex topic. The section on the origin of eukaryotic cells was rewritten. About half of the figures are new or revised.

Chapter 20—The Classification and Evolution of Organisms
Most of the changes to this chapter are organizational. The How Science Works box on cladistics was greatly modified and the table on human classification was greatly simplified. Over half of the figures are new or revised.

Chapter 21—The Nature of Microorganisms

Chapter 22—The Plant Kingdom

Chapter 23—The Animal Kingdom
Chapters 21–23 have been completely rewritten. Each chapter is now clearly organized on a phylogenetic basis and discusses the major structural and functional features of each taxon. In addition, the ecological significance of each kind of organism is discussed. Most of the figures in these chapters are new or revised. Several new boxed readings discuss the microbial ecology of a cow, fairy rings, the terminology used in classifying plants, the major food crops of the world, and the discovery of coelacanths.

Part VI—Physiological Processes

Chapter 24—Materials Exchange in the Body
New material has been added on white blood cells, the nature of plasma, and blood proteins. A new section has been added that presents the lymphatic system, including material on lymph organs and the role this system plays.

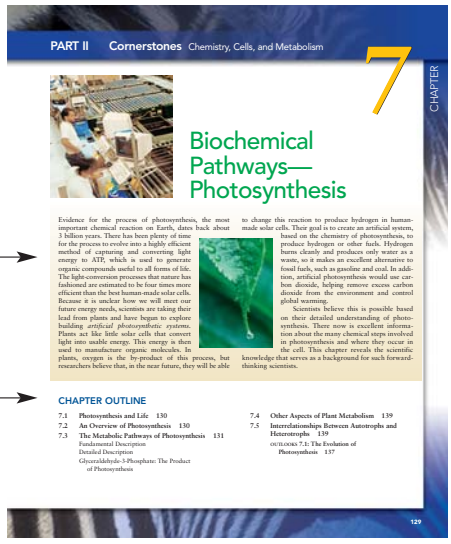
Chapter 25—Nutrition: Food and Diet
New to this chapter is a How Science Works box on estimating basal metabolic rate. There is a new section on Dietary Reference Intakes. There is updated material on the Food Guide Pyramid, diet and weight control, and osteoporosis. The concept of fitness is also introduced.

Chapter 26—The Body's Control Mechanisms and Immunity
A section covering the body's defense mechanisms has been added, along with many new illustrations. This section presents the topics of nonspecific defenses, specific defenses, allergic reactions, and autoimmune and immunodeficiency diseases. Also new are materials on homeostasis, negative and positive feedback, and somatic and autonomic nervous systems, as well as an Outlooks box on organ transplants.

Chapter 27—Human Reproduction, Sex, and Sexuality
There is a new section presenting the spectrum of human sexuality. Updated information is included on Klinefelter's syndrome, Barr bodies, the SRY gene, and erectile dysfunction. There is a new Outlooks box on menstruation and endometriosis and two new How Science Works boxes: one on assisted reproductive technology and one on the history of pregnancy testing. A new table presents the common causes of infertility.

Features

Opening Vignette The vignette is designed to pique students' interest and help them recognize the application and relevance of the topics presented in each chapter.


PART II Cornerstones Chemistry, Cells, and Metabolism

CHAPTER 7

Biochemical Pathways—Photosynthesis

Evidence for the process of photosynthesis, the most important chemical reaction on Earth, dates back about 3 billion years. There has been plenty of time for the process to evolve into a highly efficient method of capturing and converting light energy to ATP, which is used to generate organic compounds useful to all forms of life. The light-conversion processes that nature has fashioned are estimated to be four times more efficient than the best human-made solar cells. Because it is unclear how we will meet our future energy needs, scientists are taking their lead from plants and have begun to explore building *artificial photosynthetic systems*. Plants act like little solar cells that convert light into usable energy. This energy is then used to manufacture organic molecules. In plants, oxygen is the by-product of this process, but researchers believe that, in the near future, they will be able to change this reaction to produce hydrogen in human-made solar cells. Their goal is to create an artificial system, based on the chemistry of photosynthesis, to produce hydrogen or other fuels. Hydrogen burns cleanly and produces only water as a waste, so it makes an excellent alternative to fossil fuels, such as gasoline and coal. In addition, artificial photosynthesis would use carbon dioxide, helping remove excess carbon dioxide from the environment and control global warming.

Scientists believe this is possible based on their detailed understanding of photosynthesis. There now is excellent information about the many chemical steps involved in photosynthesis and where they occur in the cell. This chapter reveals the scientific knowledge that serves as a background for such forward-thinking scientists.

CHAPTER OUTLINE

7.1 Photosynthesis and Life 130
7.2 An Overview of Photosynthesis 130
7.3 The Metabolic Pathways of Photosynthesis 131
Fundamental Description
Detailed Description
Glyceraldehyde-3-Phosphate: The Product of Photosynthesis
7.4 Other Aspects of Plant Metabolism 139
7.5 Interrelationships Between Autotrophs and Heterotrophs 139
OUTLOOKS 7.1: The Evolution of Photosynthesis 157

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

Quality Visuals 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.

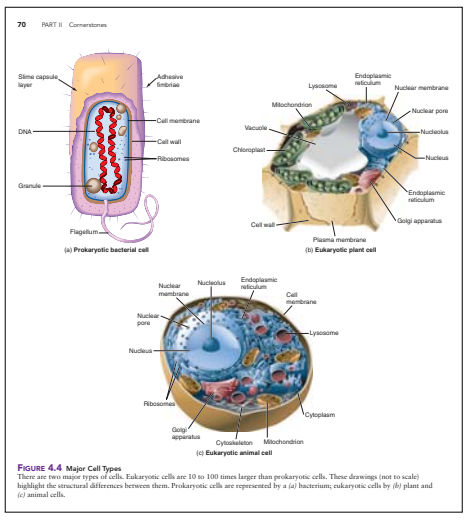


FIGURE 4.4 Major Cell Types
There are two major types of cells. Eukaryotic cells are 10 to 100 times larger than prokaryotic cells. These drawings (not to scale) highlight the structural differences between them. Prokaryotic cells are represented by a *(a)* bacterium; eukaryotic cells by *(b)* plant and *(c)* animal cells.

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


24 PART II Cornerstones

2.1 Matter, Energy, and Life

All forms of life are composed of different forms of *matter* and carry out processes that involve the use of *energy*. Recall from chapter 1 that **matter** is anything that has mass[1] and takes up space. **Energy** is the ability to do work or cause things to move. This means that, when life processes occur, part of an organism or its environment is moved. This movement might be the opening of a flower bud or the blinking of your eyelid as you read this sentence. The structure of all matter involves chemicals, substances used or produced in processes that involve changes in matter. **Chemistry** is the science concerned with the study of the composition, structure, and properties of matter and the changes it undergoes. Living matter has the same basic building blocks and undergoes the same kinds of changes as nonliving matter. Therefore, a basic understanding of chemistry will help you understand living things (figure 2.1). muscle contraction, p. 582

Where do living things get their energy to make these changes? Most people would answer that many organisms get their energy from food or nutrients, whereas other organisms receive theirs from sunlight. However, the answer is more complex. There are two general types of energy: *kinetic* and *potential*. **Kinetic energy** is energy of motion. For example, a fish swimming through a pond displays kinetic energy. Energy that is not yet doing work is **potential energy.** You might also think of potential energy as stored energy. When we talk about the energy in chemicals, we are talking about the potential energy in matter. This energy has the potential to be converted to kinetic energy to do work, such as causing an organism to move faster, digest food, or build muscle.

The Law of Conservation of Energy

One of the important scientific laws, the **law of conservation of energy,** or the *first law of thermodynamics*, states that energy is never created or destroyed. Energy can be converted from one form to another, but the *total* energy remains constant. All living things obey this law. One kind of energy change is between kinetic energy and potential energy.

An object that appears to be motionless does not necessarily lack energy. An object on top of a mountain may be motionless but still may contain significant amounts of potential energy, or "energy of position." It can be released as kinetic energy if the object rolls down the mountain. Keep in mind that potential energy also increases whenever things experiencing a repelling force are pushed together. You experience this every time you use kinetic energy to "click" your ballpoint pen, which compresses the spring inside. This gives the spring more potential energy, which is converted back into kinetic energy when the spring expands as the ink cartridge is retracted into the case. The kinetic energy for compressing the spring comes from your biological ability to harvest energy from food molecules. Potential energy also increases whenever things that attract each other are pulled apart. An example of this occurs when you stretch a rubber band. That increased potential energy is converted to the snapping back of the band when you let go. Again, the kinetic energy needed to stretch the rubber band comes from you. It is important to understand that energy is not used up in these processes. The same amount of energy is released when the rubber band is snapped back as was stored when you stretched the band. cell metabolism, p. 82

Forms of Energy

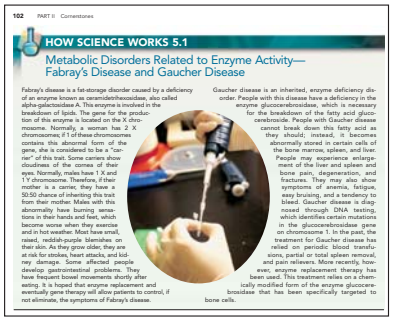
There are five forms of energy, and each can be either kinetic or potential: (1) *mechanical*, (2) *nuclear*, (3) *electrical*, (4) *radiant*, and (5) *chemical*. All organisms interact in some way with these forms of energy. *Mechanical energy* is the energy most people associate with machines or things in motion. A track athlete displays potential mechanical energy at the start line; the energy becomes kinetic mechanical energy when the athlete is running (figure 2.2). *Nuclear energy* is the form of energy from reactions involving the innermost part of matter, the atomic nucleus. In a nuclear

[1]Don't confuse the concepts of mass and weight. *Mass* refers to an amount of matter, whereas *weight* refers to the amount of force with which an object is attracted by gravity. Because gravity determines weight, your weight would be different on the Moon than it is on Earth, but your mass would be the same.

FIGURE 2.1 Biology and Chemistry Working Together
In order to understand living things, researchers must investigate both their structure and their function. At the core of modern biology is an understanding of our molecular structure, including such molecules as DNA, the molecule of which genes are composed.

Cross-References Highlighted cross-references call attention to related or background material located elsewhere in the text. These guide students to review basic coverage as they study new topics and to see connections between concepts.

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


102 PART II Cornerstones

HOW SCIENCE WORKS 5.1

Metabolic Disorders Related to Enzyme Activity—Fabray's Disease and Gaucher Disease

Fabray's disease is a fat-storage disorder caused by a deficiency of an enzyme known as ceramidetrihexosidase, also called alpha-galactosidase A. This enzyme is involved in the breakdown of lipids. The gene for the production of this enzyme is located on the X chromosome. Normally, a woman has 2 X chromosomes; if 1 of these chromosomes contains this abnormal form of the gene, she is considered to be a "carrier" of this trait. Some carriers show cloudiness of the cornea of their eyes. Normally, males have 1 X and 1 Y chromosome. Therefore, if their mother is a carrier, they have a 50:50 chance of inheriting this trait from their mother. Males with this abnormality have burning sensations in their hands and feet, which become worse when they exercise and in hot weather. Most have small, raised, reddish-purple blemishes on their skin. As they grow older, they are at risk for strokes, heart attacks, and kidney damage. Some affected people develop gastrointestinal problems. They have frequent bowel movements shortly after eating. It is hoped that enzyme replacement and eventually gene therapy will allow patients to control, if not eliminate, the symptoms of Fabray's disease.

Gaucher disease is an inherited, enzyme deficiency disorder. People with this disease have a deficiency in the enzyme glucocerebrosidase, which is necessary for the breakdown of the fatty acid glucocerebroside. People with Gaucher disease cannot break down this fatty acid as they should; instead, it becomes abnormally stored in certain cells of the bone marrow, spleen, and liver. People may experience enlargement of the liver and spleen and bone pain, degeneration, and fractures. They may also show symptoms of anemia, fatigue, easy bruising, and a tendency to bleed. Gaucher disease is diagnosed through DNA testing, which identifies certain mutations in the glucocerebrosidase gene on chromosome 1. In the past, the treatment for Gaucher disease has relied on periodic blood transfusions, partial or total spleen removal, and pain relievers. More recently, however, enzyme replacement therapy has been used. This treatment relies on a chemically modified form of the enzyme glucocerebrosidase that has been specifically targeted to bone cells.

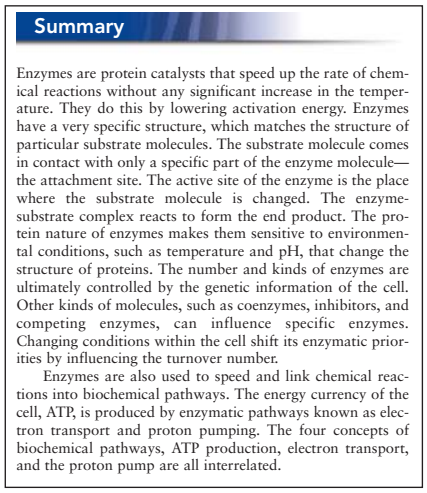

98 PART II Cornerstones

OUTLOOKS 5.1

Enzymes and Stonewashed "Genes"

The popularity of stonewashed jeans grew dramatically in the late 1960s. To get the stonewashed effect, the denim was washed with stones; the stones rubbed against the denim, wearing the blue dye off the surface of the material. But the stones also damaged the cotton fibers, which shortened the life of the fabric, a feature that many consumers found unacceptable. Now, to create the stonewashed look and still maintain strong cotton fibers, enzymes are used to "digest," or hydrolyze, the blue dye on the surface of the fabric. Because the enzyme is substrate or dye specific, the cotton fibers are not harmed.

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

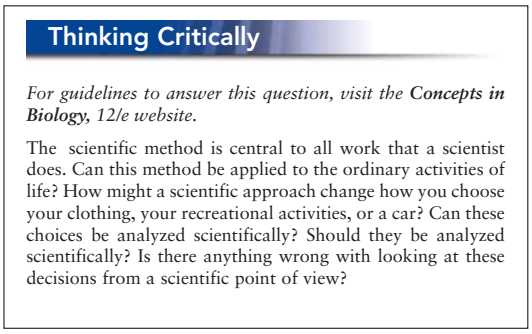


Summary

Enzymes are protein catalysts that speed up the rate of chemical reactions without any significant increase in the temperature. They do this by lowering activation energy. Enzymes have a very specific structure, which matches the structure of particular substrate molecules. The substrate molecule comes in contact with only a specific part of the enzyme molecule—the attachment site. The active site of the enzyme is the place where the substrate molecule is changed. The enzyme-substrate complex reacts to form the end product. The protein nature of enzymes makes them sensitive to environmental conditions, such as temperature and pH, that change the structure of proteins. The number and kinds of enzymes are ultimately controlled by the genetic information of the cell. Other kinds of molecules, such as coenzymes, inhibitors, and competing enzymes, can influence specific enzymes. Changing conditions within the cell shift its enzymatic priorities by influencing the turnover number.

Enzymes are also used to speed and link chemical reactions into biochemical pathways. The energy currency of the cell, ATP, is produced by enzymatic pathways known as electron transport and proton pumping. The four concepts of biochemical pathways, ATP production, electron transport, and the proton pump are all interrelated.

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. Guidelines to assist students in thinking about these questions are found on the Assessment Review Instruction System (ARIS) site.

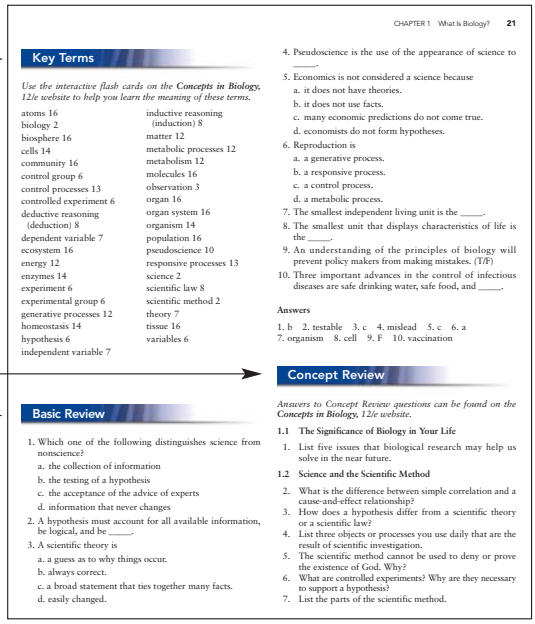


Thinking Critically

For guidelines to answer this question, visit the ***Concepts in Biology,*** *12/e website.*

The scientific method is central to all work that a scientist does. Can this method be applied to the ordinary activities of life? How might a scientific approach change how you choose your clothing, your recreational activities, or a car? Can these choices be analyzed scientifically? Should they be analyzed scientifically? Is there anything wrong with looking at these decisions from a scientific point of view?

Page-Referenced Key Terms A list of page-referenced key terms in each chapter helps students identify the vocabulary they need to understand the concepts and ideas presented in the chapter. Definitions are found in the glossary at the end of the text. Students can practice learning key terms with interactive flash cards on the Assessment Review Instruction System (ARIS) site.



CHAPTER 1 What Is Biology? 21

Key Terms

Use the interactive flash cards on the ***Concepts in Biology,*** *12/e website to help you learn the meaning of these terms.*

atoms 16
biology 2
biosphere 16
cells 14
community 16
control group 6
control processes 13
controlled experiment 6
deductive reasoning (deduction) 8
dependent variable 7
ecosystem 16
energy 12
enzymes 14
experiment 6
experimental group 6
generative processes 12
homeostasis 14
hypothesis 6
independent variable 7
inductive reasoning (induction) 8
matter 12
metabolic processes 12
metabolism 12
molecules 16
observation 3
organ 16
organ system 16
organism 14
population 16
pseudoscience 10
responsive processes 13
science 2
scientific law 8
scientific method 2
theory 7
tissue 16
variables 6

Basic Review

1. Which one of the following distinguishes science from nonscience?
   a. the collection of information
   b. the testing of a hypothesis
   c. the acceptance of the advice of experts
   d. information that never changes
2. A hypothesis must account for all available information, be logical, and be _____.
3. A scientific theory is
   a. a guess as to why things occur.
   b. always correct.
   c. a broad statement that ties together many facts.
   d. easily changed.
4. Pseudoscience is the use of the appearance of science to _____.
5. Economics is not considered a science because
   a. it does not have theories.
   b. it does not use facts.
   c. many economic predictions do not come true.
   d. economists do not form hypotheses.
6. Reproduction is
   a. a generative process.
   b. a responsive process.
   c. a control process.
   d. a metabolic process.
7. The smallest independent living unit is the _____.
8. The smallest unit that displays characteristics of life is the _____.
9. An understanding of the principles of biology will prevent policy makers from making mistakes. (T/F)
10. Three important advances in the control of infectious diseases are safe drinking water, safe food, and _____.

Answers

1. b 2. testable 3. c 4. mislead 5. c 6. a 7. organism 8. cell 9. F 10. vaccination

Concept Review

Answers to Concept Review questions can be found on the ***Concepts in Biology,*** *12/e website.*

1.1 The Significance of Biology in Your Life

1. List five issues that biological research may help us solve in the near future.

1.2 Science and the Scientific Method

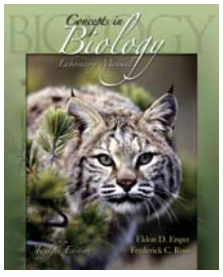
2. What is the difference between simple correlation and a cause-and-effect relationship?
3. How does a hypothesis differ from a scientific theory or a scientific law?
4. List three objects or processes you use daily that are the result of scientific investigation.
5. The scientific method cannot be used to deny or prove the existence of God. Why?
6. What are controlled experiments? Why are they necessary to support a hypothesis?
7. List the parts of the scientific method.

Basic Review and Concept Review Questions Students can assess their knowledge by answering the basic review questions. The answers to the basic review questions are given at the end of the question set, so students can get immediate feedback. The concept review questions are designed as a "writing-to-learn" experience. Students are asked to address the concept questions by writing a few sentences, making a list, or composing a paragraph. Concept review questions are answered on the student site of the Assessment Review Instruction System (ARIS).

Teaching Supplements for the Instructor

McGraw-Hill offers a variety of tools and technology products to support the twelfth edition of *Concepts in Biology.*

Laboratory Manual The laboratory manual features 30 carefully designed, class-tested learning activities. Each exercise contains an introduction to the material, step-by-step procedures, ample space to record and graph data, and review questions. The activities give students an opportunity to go beyond reading and studying to actually participate in the process of science.



Digital Content Manager This collection of multimedia resources provides tools for rich visual support of your lectures. You can utilize artwork from the text in multiple formats to create customized classroom presentations, visually based tests and quizzes, dynamic course website content, or attractive printed support materials. The following assets are grouped by chapter on a cross-platform CD-ROM or DVD:

- Art—Full-color digital files of all illustrations in the book, plus the same art saved in an unlabeled version, can be readily incorporated into lecture presentations, exams, or custom-made classroom materials.
- Photos—All photos from the text are available in color. A separate folder contains hundreds of additional photos relative to the study of biology.
- Tables—Every table that appears in the text is provided in electronic format.
- Animations—Full-color presentations of key biological processes have been brought to life via animation. These animations offer flexibility for instructors and were designed to be used in lecture.
- PowerPoint Lecture Outlines—A ready-made presentation that combines lecture notes and art is written for each chapter. The outlines can be used as they are, or you can customize them to preferred lecture topics and sequences.
- Active Art—Illustrations depicting key processes have been converted to a format that allows the artwork to be edited inside PowerPoint. Each piece can be broken down to its core elements, grouped or ungrouped, and edited to create customized illustrations.

Instructor's Testing and Resource CD This cross-platform CD-ROM provides a wealth of resources. Among the supplements featured on this CD-ROM is a computerized test bank that uses testing software to quickly create customized exams. Word files of the test bank questions are provided for those instructors who prefer to work outside of the test-generator software.

Other assets on the Instructor's Testing and Resource CD include an instructor's manual and the Laboratory Resource Guide. Both of these assets can also be accessed via the Assessment Review Instruction System (ARIS) site at *www.mhhe.com/enger12*.

For each chapter, the instructor's manual contains a brief narrative summarizing the chapter and goals/objectives.

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.

Overhead Transparencies A set of 250 full-color transparencies is available free to adopters of the twelfth edition of *Concepts in Biology.* This set includes figures and some tables from the text.

Assessment Review Instruction System (ARIS)

www.mhhe.com/enger12

McGraw-Hill's ARIS for *Concepts in Biology* is a complete electronic homework and course management system, designed for greater ease of use than any other system available. Free upon adoption of *Concepts in Biology,* you can create and share course materials and assignments with colleagues with a few clicks of the mouse. You can edit questions, import your own content, and create announcements and due dates for assignments. ARIS has automatic grading and reporting of homework, quizzing, and testing. Once a student is registered in the course, all student activity within McGraw-Hill's ARIS is automatically recorded and available to you through a fully integrated grade book, which can be downloaded to Excel.

eInstruction Classroom Performance System (CPS) Wireless technology brings interactivity into the classroom or lecture hall. The Classroom Performance System (CPS) is an interactive system that allows you to administer questions electronically during class. Instructors and students receive immediate feedback through wireless response pads, which are easy to use and engage students. eInstruction can be used to

- Take attendance
- Administer quizzes and tests
- Create a lecture with intermittent questions
- Manage lectures and student comprehension through use of the CPS grade book
- Integrate interactivity into PowerPoint presentations

Course Delivery Systems With help from our partners, WebCT, Blackboard, eCollege, and other course management systems, you can take complete control over your course content. These course cartridges also provide online testing and powerful student tracking features.

McGraw-Hill: *Biology Digitized Video Clips* on DVD McGraw-Hill is pleased to offer adopting instructors a new presentation tool—digitized biology video clips on DVD. Licensed from some of the highest-quality science video producers in the world, these brief segments range from about 5 seconds to just under 3 minutes in length and cover all areas of general biology from cells to ecosystems. Engaging and informative, McGraw-Hill's digi-

tized biology videos will help capture students' interest while illustrating key biological concepts and processes such as mitosis, how cilia and flagella work, and how some plants have evolved into carnivores.

Learning Supplements for the Student

Student Study Guide

This student study guide provides an overview for each chapter along with several learning activities. There is a focus on vocabulary terms in a section entitled "What do you mean by that?". There are several activities that help students master the material. These include: questions with short answers, label/diagram/explain activities, and multiple choice questions. A new section entitled "Asking the right question" provides open-ended questions and an opportunity for students to develop questions that they can ask their instructors. Answers to all of the questions are provided in the study guide.

Assessment Review Instruction System (ARIS)

The ARIS site at *www.mhhe.com/enger12* offers a vast array of online content to fortify the learning experience. This site features quizzes, interactive activities, and study tools tailored to coincide with each chapter of the text.

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