

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 Fourteenth Edition

There are several things about the fourteenth 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. This edition has several significant changes.

Opening Chapter Vignette

Nearly all of the chapter-opening vignettes are new. Each vignette is intended to draw the students into the chapter by showing how the material is relevant to their lives. To help meet this goal the vignettes have been redesigned to resemble a magazine layout to draw the attention of the reader.

Concept Review

In this edition, each major numbered heading ends with a Concept Review feature, which consists of a series of questions that probe the reader's level of understanding of the material in the section. The purpose of this feature is to encourage the reader to review the material in the section if he or she cannot answer the questions.

Enhanced Visuals and Page Layout

The visual elements of a text are extremely important to the learning process. Over 150 figures are new or have been modified. The purpose of these changes is to more clearly illustrate a concept or show examples of material discussed in the text.

Major Content Changes

Chapter 1 What Is Biology?

- Section 1.1, “Why the Study of Biology Is Important,” and material in Section 1.2, “Cause-and-Effect Relationships,” and “The Scientific Method” have been rewritten to better communicate these concepts.
- The material in Section 1.4 entitled “What Makes Something Alive?” has been reordered to present a more logical progression of ideas. Also in Section 1.4, “The Levels of Biological Organization and Emerging Properties” section has been rewritten and now includes the concept of emerging properties. In addition, “The Consequences of Not Understanding Biological Principles” has a new introduction designed to present the concept of selective acceptance of scientific evidence.

Chapter 2 The Basics of Life: Chemistry

- Section 2.1 “Matter, Energy, and Life” was rewritten to consolidate the introductory material on basic chemistry.

Chapter 3 Organic Molecules—The Molecules of Life

- New material in the section on proteins presents the concept of chaperone proteins.

Chapter 4 Cell Structure and Function

- There is a new section, “Basic Cell Types,” that introduces the characteristics that are unique to eukaryotic and noneukaryotic cells. It also presents the most current thoughts on the evolution and relationships among the Bacteria, Archaea, and Eucarya.
- There is a new section on the two groups of membrane proteins involved in facilitated diffusion: (a) carrier proteins and (b) ion channels.
- A new diagram illustrates how all living things are classified.

Chapter 6 Biochemical Pathways—Cellular Respiration

- There are new summary presentations for each portion of cellular respiration, as suggested by reviewers' comments.

- There are several new figures and flow charts to enhance student understanding of these very complex pathways.

Chapter 7 Biochemical Pathways—Photosynthesis

- There are new summary presentations for each portion of photosynthesis suggested by reviewers' comments.
- There are several new figures and flow charts to enhance student understanding of these very complex pathways.

Chapter 8 DNA and RNA: The Molecular Basis of Heredity

- Sections 8.1, “DNA and the Importance of Proteins,” and 8.2, “DNA Structure and Function,” have been rewritten.
- There is a new section on epigenetics.
- Section 8.4, “Protein Synthesis,” has been rewritten.
- There are new presentations on sickle cell anemia and other genetic abnormalities.

Chapter 9 Cell Division—Proliferation and Reproduction

- A new section on epigenetics and cancer was added.

Chapter 11 Applications of Biotechnology

- Information on genetically modified organisms has been extensively revised.

Chapter 14 The Formation of Species and Evolutionary Change

- New information is presented on Ida, *Darwinius masillae*, and her probable place in human evolution.
- Information on the proposed new species (hobbit) from Indonesia has been made current.
- A new table on primate classification has been added.
- There is a new section that discusses the recently published information about *Ardipithecus*.

Chapter 16 Community Interactions

- The material on the nature of biomes has been enhanced with additional photos and climographs to better illustrate the nature of each biome.
- A new section entitled “Modern Concepts of Succession and Climax” was added.

Chapter 17 Population Ecology

- The section on gene flow and gene frequency was reorganized.
- New material on the random and clumped distribution in populations was added to the text.

Chapter 19 The Origin of Life and the Evolution of Cells

- Section 19.3, “The ‘Big Bang’ and the Origin of the Earth,” has new subheadings to help the reader follow the discussion.
- Section 19.4, “The Chemical Evolution of Life on Earth,” was substantially reorganized and rewritten.
- Section 19.5, “Major Evolutionary Changes in Early Cellular Life,” has had major sections rewritten.
- Table 19.1, “Summary of Characteristics of the Three Domains of Life,” was rewritten and placed later in the chapter.
- Section 19.6, “The Geologic Timeline and the Evolution of Life,” was rewritten to include new information, better sequencing of information, and more subheadings to aid the reader in following the discussion.

Chapter 20 The Classification and Evolution of Organisms

- The section on Archaea was substantially rewritten to include the latest information on the variety of kinds of Archaea found in oceans and soil.

Chapter 21 The Nature of Microorganisms

- Section 21.1, “What Are Microorganisms?” was substantially rewritten.
- The section on control of bacterial population now includes discussion of methicillin resistant *Staphylococcus*.
- The section on Archaea was substantially rewritten to include recent understanding of the nature of Archaea diversity.
- The section on Fungi has additional information on the classification of fungi and clarification on the meaning of yeast, mold, and mildew.

Chapter 23 The Animal Kingdom

- The section on body cavities was substantially rewritten.
- Section 23.6, “Primitive Marine Animals,” was substantially rewritten.
- Section 23.10, “Mollusca,” was substantially rewritten.
- The section on terrestrial arthropods was substantially rewritten.

Chapter 24 Materials Exchange in the Body

- The sections on white blood cells, platelets, and plasma were rewritten.

Chapter 25 Nutrition: Food and Diet

- Throughout the chapter when food calories are being discussed the term *Calorie* is used rather than *kilocalorie*.

- There has been a major reorganization of the material.
- The old section 25.7, “Deficiency Diseases,” has been eliminated and much of the material in the section has been moved to parts of the chapter dealing with protein metabolism, vitamins, and minerals.
- Section 25.2, “Kinds of Nutrients and Their Function,” has been reorganized with subheadings that highlight the nature and function of nutrients, how the body manages the nutrients, and other factors that are important to nutrition. Much new material was added.
- Tables 25.1, “Sources of Essential Amino Acids,” 25.2, “Sources and Functions of Vitamins,” and 25.3, “Sources and Functions of Minerals,” have been updated and reorganized to help the reader see the significance of the nutrients.
- Material on discretionary Calories was added to the exercise portion of the Food Guide Pyramid discussion.
- The sections on body mass index and weight control were integrated into the section on obesity.
- Section 25.6, “Eating Disorders,” has been completely rewritten.
- Section 25.8, “Nutrition for Sports and Fitness,” has been substantially rewritten.

Chapter 26 The Body’s Control Mechanisms and Immunity

- The section on negative and positive feedback was rewritten.
- Table 26.2 on inflammation was reorganized.
- Table 26.3 on classes of antibodies was reorganized.
- A new heading, “Immune System Diseases,” now includes discussion of allergies, autoimmune diseases, and immunodeficiency diseases, which were previously discussed in different sections.

Chapter 27 Human Reproduction, Sex, and Sexuality

- A new section 27.2, “The Sexuality Spectrum,” includes a reorganized discussion of intersexual anatomy, transsexual behavior, and homosexuality.
- A new section 27.3, “Components of Sexual Behavior,” now discusses sexual attraction, foreplay, and intercourse.
- The section on contraception was significantly reorganized and rewritten.

Other Significant Changes

Thirty-seven new boxed readings have been added or substituted for boxed readings that had become dated:

HOW SCIENCE WORKS 2.2: Greenhouse Gases and Their Relationship to Global Warming

HOW SCIENCE WORKS 3.1: Organic Compounds: Poisons to Your Pets!

OUTLOOKS 3.2: So You Don’t Eat Meat! How to Stay Healthy

OUTLOOKS 3.3: What Happens When You Deep-Fry Food?

HOW SCIENCE WORKS 4.2: Cell Membrane Structure and Tissue Transplants

HOW SCIENCE WORKS 5.1: Don’t Be Inhibited—Keep Your Memory Alive

HOW SCIENCE WORKS 7.1: Solution to Global Energy Crisis Found in Photosynthesis?

HOW SCIENCE WORKS 8.1: Scientists Unraveling the Mystery of DNA

OUTLOOKS 8.1: Life in Reverse—Retroviruses

OUTLOOKS 8.3: One Small Change—One Big Difference!

HOW SCIENCE WORKS 9.1: The Concepts of Homeostasis and Mitosis Applied

OUTLOOKS 11.1: The First DNA Fingerprint in a Criminal Case

OUTLOOKS 12.1: Your Skin Color, Gene Frequency Changes, and Natural Selection

OUTLOOKS 13.2: Genetic Diversity and Health Care

OUTLOOKS 14.1: Evolution and Domesticated Cats

OUTLOOKS 15.1: Changes in the Food Chain of the Great Lakes

OUTLOOKS 15.2: Dead Zones

HOW SCIENCE WORKS 15.1: Scientists Accumulate Knowledge About Climate Change

HOW SCIENCE WORKS 16.1: Whole Ecosystem Experiments

OUTLOOKS 16.1: Varzea Forests—Seasonally Flooded Amazon Tropical Forests

OUTLOOKS 17.1: Marine Turtle Population Declines

HOW SCIENCE WORKS 18.1: Males Raised the Young in Some Species of Dinosaurs

HOW SCIENCE WORKS 19.1: The Oldest Rocks on Earth

HOW SCIENCE WORKS 20.1: New Information Causes Changes in Taxonomy and Phylogeny

OUTLOOKS 20.1: A Bacterium That Controls Animal Reproduction

HOW SCIENCE WORKS 21.1: How Many Microbes Are There?

OUTLOOKS 21.1: Food Poisoning/Foodborne Illness/Stomach Flu

OUTLOOKS 21.3: The Marine Microbial Food Web

HOW SCIENCE WORKS 22.1: Using Information from Tree Rings

OUTLOOKS 23.1: The Problem of Image

HOW SCIENCE WORKS 23.1: Genes, Development, and Evolution

OUTLOOKS 24.1: Blood Doping

OUTLOOKS 24.2: Newborn Jaundice

OUTLOOKS 25.3: Muscle Dysmorphia

OUTLOOKS 25.5: Nutritional Health Products and Health Claims

OUTLOOKS 26.1: The Immune System and Transplants

OUTLOOKS 27.2: Causes of Infertility