

Preface

Essentials of Genetics is written for courses requiring a text that is shorter and more basic than its more comprehensive companion, *Concepts of Genetics*. While coverage is thorough and modern, *Essentials* is written to be more accessible to biology majors early in their undergraduate careers, as well as to students majoring in a number of other disciplines, including agriculture, animal husbandry, chemistry, engineering, forestry, psychology, and wildlife management. Because the text is shorter than many other books, *Essentials of Genetics* is also more manageable in one-quarter and one-semester courses.

Goals

In this edition of *Essentials of Genetics*, one of the most important goals has been to make the text more affordable to students by reducing its length by about 30 pages. We subsequently expect the text to be priced 25% lower than its predecessor. Our other overarching goals remain the same as for previous editions. Specifically, we seek to

- Emphasize concepts rather than excessive detail.
- Write clearly and directly to students in order to provide understandable explanations of complex analytical topics.
- Maintain careful organization within and between chapters.
- Propagate the rich history of genetics that so beautifully elucidates how information is acquired as the discipline develops and grows.
- Emphasize problem solving, thereby guiding students to think analytically and to apply and extend their knowledge of genetics.
- Provide the most modern and up-to-date coverage of this exciting field.
- Create inviting, engaging, and pedagogically useful full-color figures enhanced by meaningful photographs to support concept development.
- Provide outstanding Online Media Tutorials to guide students in understanding important concepts through animations, tutorial exercises, and self-assessment tools.

These goals serve as the cornerstone of *Essentials of Genetics*. This pedagogic foundation allows the book to accommodate courses with many different approaches and lecture formats. While the book presents a coherent table of contents that represents one approach to offering a course in genetics, chapters are nevertheless written to be independent of one another, allowing instructors to utilize them in various sequences.

New to This Edition

The Seventh Edition has several new and enhanced features as well as updated content, making this edition even more pedagogically useful for students of genetics. Collectively, these improvements create a platform that seeks to challenge students to think more deeply about, and thus understand more comprehensively, the information he or she has just finished studying.

- **Exploring Genomics** New to this edition, *Exploring Genomics* appears in 12 chapters. Its presence is in keeping with the impact of genomics on most aspects of genetics. Each entry asks students to access one or more genomics-related Web sites that collectively are among the best publicly available resources and databases. Students work through interactive exercises that ensure their familiarity with the type of genomic or proteomic information available. Exercises instruct students on how to explore specific topics and how to access significant data. Questions guide student exploration and challenge them to further explore the sites on their own. Importantly, *Exploring Genomics* integrates genomics information throughout the text, as this emerging field is linked to chapter content. This feature provides the basis for individual or group assignments in or out of the classroom.
- **Case Study** A new feature called *Case Study* appears in each chapter and provides the basis for enhanced classroom interactions. In each entry, a short scenario related to one of the chapter topics is presented, followed by several questions. These ask students to apply their newly acquired knowledge to real-life issues that may be explored in small-group discussions or serve as individual assignments.
- **Essential Points** Within each chapter, at the conclusion of the coverage of all major topics, we have created a new feature called *Essential Points*. Found numerous times throughout each chapter, these provide important summaries that succinctly review the central focus of the previous coverage. By integrating these within the text of each chapter, they serve as “signposts” for students as they read or review each chapter.
- **Genetics, Technology, and Society Essays** We continue to offer these highly relevant essays, but in a new “interactive” format. After each essay, a new section entitled “Your Turn” appears in which questions are posed to students along with various resources to help answer them. This innovation provides yet another format to enhance classroom interactions. While all previous topics have been revised and updated, two new essays have been added:

"Down Syndrome, Prenatal Testing, and the New Eugenics" (Chapter 6) and "Personalized Genome Projects and the Race for the \$1000 Genome" (Chapter 19).

- **Modernization of Topics** As with every new edition, our major efforts have been directed toward updating coverage of all aspects of the text. Special attention was paid to genomics and proteomics (Chapter 18), as well as to all areas of molecular genetics, including gene regulation (Chapter 15) and cancer genetics (Chapter 16). Sarah Ward again invigorated our coverage of conservation genetics (Chapter 24).
- **New Chapter** In keeping with our intent to present in an accessible fashion highly relevant, emerging areas of genetics, we have created a new chapter "Genetics and Behavior" (Chapter 21). The chapter reflects our growing knowledge of the role genes play in all aspects of the behavior of organisms. This topic will be as interesting to students because the findings surrounding it intersect our knowledge of our own species.
- **Updated Instructor and Student Media** The instructor and student media have been updated to reflect the changes made in this new edition. Support for lecture presentations and other teaching responsibilities includes electronic access to text photos and tables and a great variety of PowerPoint offerings on the book's Instructor Resource DVD. Media found on the revamped Companion Website reflect the growing awareness that today's students must use their limited study time as wisely as possible. Also available on the student Web site will be questions that direct students to research articles to summarize, compare, or evaluate.

Emphasis on Concepts and Problem Solving

Essentials of Genetics focuses on conceptual issues in genetics and uses problem solving to develop a deep understanding of them. Our experience shows that students whose primary focus is on concepts more easily comprehend and take with them to succeeding courses the most important ideas in genetics. Most importantly, linking conceptual issues to problem solving provides an enhanced analytic view of biology. To aid students in identifying conceptual aspects of a major topic, each chapter begins with a section called "Chapter Concepts," which outlines the most important ideas about to be presented.

Another valued pedagogic feature, first introduced in the Sixth Edition, appears in each chapter: *How Do We Know?* Entries ask the student to identify the experimental basis of the most important concepts presented in the chapter. As an extension of the learning approach in biology called "Science as a Way of Knowing," the use of this feature enhances students' understanding of many key topics covered in each chapter.

The feature called *Now Solve This*, found numerous times throughout each chapter, asks students to link conceptual understanding in a more immediate way to problem-solving. Each one directs the student to a problem found at the end of the chapter that is closely related to the current text discussion. Pedagogic hints are provided to aid in solving the problem. This feature more closely links text discussions to the problems.

Beyond the above features, all chapters conclude with what has become a popular and successful section called "Insights and Solutions." This section provides sample problems and solutions that demonstrate approaches useful in genetic analysis. These help students develop analytical thinking and experimental reasoning skills. Digesting the information in "Insights and Solutions" primes students as they move on to the lengthier "Problems and Discussion Questions" section that concludes each chapter. Here, we present questions that review topics in the chapter and problems that ask students to think in an analytical and applied way about genetic concepts. Problems are of graduated difficulty, with the most demanding near the end of each section.

Acknowledgments

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For the Student

Companion Website—www.geneticsplace.com

The Companion Website, designed to enable users of the Seventh Edition to focus on those chapter sections and topics where they need review or further explanation, contains numerous in-depth tutorials that allow students to interactively comprehend genetic concepts. The Chapter Guide pages provide students with a focused, section-by-section access to the e-book, and questions that offer hints and answer feedback. Interactive Chapter Quizzes give students a way to test their comprehension of chapter topics before exams. The grading function offers precise feedback and allows instructors to track their students' scores. The Website also contains RSS feeds to breaking news in genetics and links to related websites. The site also provides access via Pearson's **Research Navigator™** database to EBSCO, the world's leading online journal library, containing scholarly articles from over 79,000 publications. Online writing-focused **Research Navigator™** assignments allow students to evaluate and synthesize information from selected readings, then submit their work online directly to their instructor. Finally, *Exploring Genomics* sections from the text have been excerpted and placed on the Companion Website.

Online Web Tutorials

The most sophisticated learning and tutorial package available for students of genetics, these online tutorials address the concepts that students find most difficult. Each of the tutorials comprises animations and interactive exercises, along with a post-tutorial quiz of self-grading questions to reinforce important concepts. Found on the student Companion Website, the tutorials offer timely support for students. Look for this icon in the margin of this page to identify media tutorials that support concepts presented in the textbook.

Study Guide and Solutions Manual

Harry Nickla, Creighton University (0-32-161870-X)

This valuable handbook provides a detailed step-by-step solution or discussion for every problem in the text. It also features additional study aids, including extra study problems, chapter outlines, vocabulary exercises, and an overview of how to study genetics.

For the Instructor

Instructor Resource DVD (0-32-161874-2)



The Instructor Resource DVD for the Seventh Edition offers adopters convenient access to a comprehensive and innovative set of teaching tools. Developed to meet the needs of veteran and newer instructors alike, these resources include:

- The JPEG files of all text line drawings with labels enhanced for optimal projection results (as well as unlabeled versions)
- Pedagogically important textbook photos and all textbook tables as JPEG files
- The JPEG files of line drawings, photos, and tables preloaded into comprehensive PowerPoint® presentations for each chapter
- PowerPoint® presentations containing a comprehensive set of in-class Classroom Response System (CRS) questions for each chapter.

- Over 100 Instructor Animations dynamically illustrating the most important concepts in the course preloaded into PowerPoint® presentations (PC and Macintosh versions).

Instructor Manual and Test Bank

Harry Nickla, Creighton University (0-32-161872-6)

This manual and testbank contains over 1000 questions and problems for use in preparing exams. The manual also provides optional course sequences, a guide to audiovisual supplements, and a section on searching the Web. The testbank portion of the manual is also available in electronic format.

TestGen EQ Computerized Testing Software (0-32-161873-4)

In addition to the printed volume, the test questions are also available as part of the TestGen EQ Testing Software, a text-specific testing program that is networkable for administering tests. It also allows instructors to view and edit questions, export the questions as tests, and print them out in a variety of formats.

Transparency Acetates (0-32-161871-8)

Electronic versions of transparencies, in JPEG format, are available on the Instructor Resource DVD and instructors can copy them onto their desktop.

Introduction to Genetics

1. Mendelian inheritance is the general principle by which traits are controlled by factors (genes) and transmitted through parents from generation to generation. It is fundamental principles were first put forward by Gregor Mendel in the mid-nineteenth century. Later work by others showed that genes are on chromosomes and that genetic strains can be used to map genes on chromosomes.
2. The recognition that DNA encodes genetic information, the discovery of DNA's structure, and elucidation of the mechanism of gene expression form the foundation of molecular genetics.
3. Recombinant DNA technology, which allows scientists to synthesize large quantities of specific DNA molecules, has revolutionized genetics, laying the foundation for new techniques for analyzing such as the Human Genome Project that combine genetic with information technology.
4. Biotechnology includes the use of genetically modified organisms and their products in a wide range of activities including agriculture, medicine, and industry.
5. Some of the most exciting and A research results from the early part of the twentieth century are now used in combination with sophisticated DNA technology and computers to study human diseases.
6. Genetic engineering is a discipline that combines the principles of genetics with modern DNA technology and computers to study human diseases.