

Preface

At times it is useful for textbook authors to step back and look with fresh eyes at their work, how it represents the body of information in its field, and how the material is structured, both scientifically and pedagogically. The publication of the 8th edition of *Concepts of Genetics*, now in its third decade of providing support to students, presents an occasion for a fresh look. The field of genetics has grown tremendously since the book was first published, both in what we know and what we want beginning students to comprehend. In creating this edition, we sought not only to familiarize students with the most important discoveries of the past 150 years, but also to help them relate this information to the underlying genetic mechanisms that explain cellular processes, biological diversity, and evolution. Further, we have also emphasized connections that link transmission genetics, molecular genetics, genomics, and proteomics.

In the early years of this new millennium, discoveries in genetics continue to be numerous and profound. As students of genetics, the thrill of being part of this era must be balanced by a strong sense of responsibility and careful attention to the many scientific, social, and ethical issues that have already arisen, and others that will undoubtedly arise in the future. Policy makers, legislators, and an informed public will increasingly depend upon knowledge of the details of genetics in order to address these issues. As a result, there has never been a greater need for a genetics textbook that clearly explains the principles of genetics.

Goals

In the 8th edition of *Concepts of Genetics*, as with all past efforts, we have six major goals. Specifically, we seek to:

- Emphasize the basic concepts of genetics;
- Write clearly and directly to students in order to provide understandable explanations of complex, analytical topics;
- Establish a careful organization within and between chapters;
- Maintain constant emphasis on science as a way of illustrating how we know what we know;
- Propagate the rich history of genetics that so beautifully elucidates how information is acquired within the discipline as it develops and grows;

- Create inviting, engaging, and pedagogically useful full-color figures enhanced by equally helpful photographs to support concept development.

These goals collectively serve as the cornerstone of *Concepts of Genetics*. This pedagogic foundation allows the book to be used in 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. We believe that the varied approaches embodied in these goals together provide students with optimal support for their study of genetics.

Writing a textbook that achieves these goals and having the opportunity to continually improve on each new edition has been a labor of love for us. The creation of each of the eight editions is a reflection of not only our passion for teaching genetics, but also the constructive feedback and encouragement provided by adopters, reviewers, and our students over the past three decades.

Features of This Edition

- **Organization**—A new organization better reflects how genetics is taught in the era of genomics. A new introductory chapter (Chapter 1) gives an overview of molecular biology as a way to connect the early transmission genetics chapters to molecular topics. Enhanced coverage of model organisms is woven throughout the chapters, but is especially prominent in the new chapter on dissection of gene function using mutational analysis (Chapter 21).
- **Pedagogy**—Two new features appear several times in each chapter. The first, “How Do We Know?,” asks the student to reflect on the experimental basis of an important finding to more fully understand rather than memorize the conclusion drawn from the body of research. The second feature, “Now Solve This,” directs the student to a problem found at the end of the chapter that is related to the previous text discussion. In each case, a pedagogic hint has been provided. Each feature displays an appropriate icon for ease of identification. It is our hope that the use of these features throughout each chapter will challenge the student to think more deeply about the information he or she has just finished studying.

- **New/Revised Chapters**—In keeping with our intent to increase the coverage of model organisms utilized in genetic study and to elaborate on the use of mutations to study gene function, we have created a new chapter entitled “Dissection of Gene Function: Mutational Analysis in Model Organisms” (Chapter 21). This chapter gathers together information previously spread throughout many chapters of the text and extends it considerably. The assembled information reflects the sophisticated, modern approaches used to study gene function and provides insights into the role of “model organisms” in genetic study. In addition, we have given particular attention to our coverage of quantitative genetics, population genetics, and evolutionary genetics (Chapters 24, 25, and 26). Coverage in these chapters has been extensively reviewed, and their revision reflects the best thinking of many colleagues whose specialized training is in these fields.
- **Modernization of Topics**—While we have updated each chapter to reflect the most current and significant findings in genetics, we have paid particular attention to the cutting edge topics of comparative genomics, bioinformatics, and proteomics (Chapter 20) because of their impact on future studies and on society. Also clearly evident are the discussions of the current applications of DNA biotechnology and the ethical issues arising from them (Chapter 22). Additionally, we have further updated and extended our presentation of the rapidly advancing field of cancer genetics (Chapter 18). An in depth consideration of conservation genetics (Chapter 27) remains as another hallmark of our modern genetic coverage. This field, which attempts to assess and maintain genetic diversity in endangered species, remains at the forefront of genetic studies.
- **New Illustrations Throughout**—The 8th edition features a whole new color palette as well as the redrafting of almost all figures to enhance their pedagogic value and artistic quality. Many figures feature “flow diagrams” that visually guide a student through experimental protocols and techniques.
- **New Photographs**—An even greater number of photographs illustrate and enhance this edition.
- **Section Numbers**—All major sections are numbered, making it easier to assign and locate topics within chapters.
- **New/Revised “Genetics, Technology, and Society” Essays**—As with every new edition, we have revised many of these essays and added new ones that reflect recent findings in genetics and their impact on society. Among the new essays are those that consider Tay–Sachs disease (Chapter 3), Fragile Chromosome Sites and Cancer (Chapter 8), Quorum Sensing (Chapter 16), and Gene Deregulation and Human Disease (Chapter 17). These new additions supplement essays from past editions, including those that discuss edible vaccines, human sex selection, genetically modified foods, gene therapy, and endangered species such as the Florida panther, among many other topics.
- **Emphasis on Problem Solving**—Over 200 new problems have been added to the section “Problems and Discussion Questions” at the ends of chapters. Most are “high end” problems found in the subsection that we call “Extra-Spicy Problems.” Many of these are based on data derived from the primary literature of genetics. The “Insights and Solutions” sections found at the ends of chapters continue to guide students in learning to think analytically about problems.
- **Instructor and Student Media Address Real Needs**—Support for lecture presentations and other teaching responsibilities has been increased, including electronic access to more text photos and tables and a greater variety of PowerPoint offerings on the book’s Instructor Resource Center on CD/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.

Emphasis on Concepts

Concepts of Genetics, as its title implies, emphasizes the conceptual framework of genetics. Our experience with this book, reinforced by the many adopters with whom we have been in contact over the years, demonstrates quite conclusively that students whose primary focus is on concepts more easily comprehend and take with them to succeeding courses the most important ideas in genetics as well as an analytic view of biological problem solving.

To aid students in identifying conceptual aspects of a major topic, each chapter begins with a new section called “Chapter Concepts,” which outlines the most important ideas about to be presented. Within each chapter, as noted above, the “How Do We Know?” feature asks the student to connect concepts to experiments. Then, the “Now Solve This” feature asks students to link conceptual understanding in a more immediate way to problem solving. Additionally, each chapter ends with a “Chapter Summary,” which enumerates the five to ten key points that have been covered. Collectively, these features help to ensure that students focus on and understand concepts as they confront the extensive vocabulary and the many important details of genetics. Carefully designed figures also support this approach throughout the book.

Problem Solving and Insights and Solutions

To optimize the opportunities for student growth in the important areas of problem solving and analytical thinking, each chapter integrates “Now Solve This” questions with accompanying pedagogic hints and concludes with an extensive collection of “Problems and Discussion Questions.” These are designed with several levels of difficulty, with the most challenging (those called Extra-Spicy Problems) located at the end of each section. Brief answers to half the problems are in Appendix B. The *Student Handbook* answers every problem and is available to students when faculty decide that it is appropriate. As the reader familiar with previous editions will see, over 200 new problems appear at chapter ends.

As an aid to the student in learning to solve problems, the “Problems and Discussion Questions” section of each chapter

is preceded by what has become an extremely popular and successful section called "Insights and Solutions." In this expanded section we stress:

Problem solving
Quantitative analysis
Analytical thinking
Experimental rationale

Problems or questions are posed and detailed solutions or answers are provided. This feature primes students for moving on to the "Problems and Discussion Questions" section that concludes each chapter.

The Genetics MediaLab section is available on the Companion Website. Each MediaLab contains several Web-linked problems designed to enhance and extend the topics presented in the chapter. To complete these problems students must actively participate in the exercises and virtual experiments. For reference, the estimated time required to solve the problem is noted at the beginning of the exercise.

Alternative Edition

To accommodate instructors who wish to organize their course to emphasize molecular genetics before transmission genetics there exists an alternative version of this book entitled *Genetics: A Molecular Perspective*. It begins with DNA and establishes the basis of genetic function at the molecular level before returning to the consideration of the historically important discoveries that fall under the descriptor of "transmission genetics."

Acknowledgments

Contributors

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We are grateful to all of the above contributors not only for sharing their genetic expertise, but for their dedication to this project as well as the pleasant interactions they provided.

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Reviewers

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George Bates, Florida State University
Sidney L. Beck, DePaul University
Andrew Bohonak, San Diego State
Peta Bonham-Smith, University of Saskatchewan
Paul J. Bottino, University of Maryland
Nicole Bournias, California State University, San Bernardino
Philip Busey, University of Florida
Alan H. Christensen, George Mason University
Michael Christoffers, North Dakota State University
Jim Clark, University of Kentucky
Mary Anne Clark, Texas Wesleyan University
Gregory Copenhagen, University of North Carolina
Jason Curtis, Purdue University
Naomi D'Alessio, Nova Southeastern University
Diane Dalo, The College of New Jersey
Garry Davis, University of Alaska, Anchorage
Robert S. Dotson, Tulane University
Bob Durino, UNC Chapel Hill
Johnny El-Rady, University of South Florida
Bert Ely, University of South Carolina
Lloyd M. Epstein, Florida State University
Asim Esen, Virginia Tech
Dale Fast, Saint Xavier University
Rebecca Ferrell, Metropolitan State College
David Fotlz, Louisiana State University

Gail Frazier, Kent University
 Donald Gailey, California State University, Hayward
 Anne Galbraith, University of Wisconsin, LaCrosse
 George W. Gilchrist, Clarkson University
 Sandra Gilchrist, University of South Florida
 Thomas J. Glover, Hobart & William Smith Colleges
 James Godde, Monmouth College
 Elliott S. Goldstein, Arizona State University
 Ernie Hannig, University of Texas-Dallas
 Douglas Harrison, University of Kentucky
 Don Hauber, Loyola University
 Vincent Henrich, University of North Carolina, Greensboro
 Philip L. Hertzler, Central Michigan University
 Karen Hicks, Kenyon College
 Allison Hill, Duke University
 Margaret Hollingsworth, SUNY Buffalo
 Rebecca Jann, Queens College
 Mitrick A. Johns, Northern Illinois University
 Cheryl Jorcyk, Boise State University
 David Kass, Eastern Michigan University
 M.A. Lachance, University of Western Ontario
 Paul F. Lurquin, Washington State University
 Terrence Lyttle, University of Hawaii
 Clint Magill, Texas A&M University
 John McDonald, University of Delaware
 Peter Mirabito, University of Kentucky
 Janet Morrison, The College of New Jersey
 Harry Nickla, Creighton University
 Amanda Norvell, The College of New Jersey
 Berl R. Oakley, Ohio State University
 Marcia O'Connell, The College of New Jersey
 John C. Osterman, University of Nebraska-Lincoln
 Danial Panaccione, West Virginia University
 Dennis T. Ray, University of Arizona
 Joseph Reese, Pennsylvania State University
 Todd Rimkus, Marymount University
 Janice Rumph, Montana State University
 Thomas F. Savage, Oregon State University
 Cathy Schaeff, American University
 Rodney Scott, Wheaton College
 William Seddon, Frostburg University
 Thomas P. Snyder, Michigan Technological University
 Theresa Spradling, University of Northern Iowa
 Paul Spruell, University of Montana
 Christine Tachibana, University of Washington
 Marty Tracy, International University
 Arthur Trese, Ohio University
 Albrecht von Arnim, University of Tennessee
 Laurence von Kalm, University of Central Florida

Yunqiu Wang, University of Miami, FL
 Michael Wooten, Auburn University
 Tracy Whitford, East Stroudsburg University
 John Zamora, Middle Tennessee State University

Media reviewers include:

Peggy Brickman, University of Georgia
 Carol Chihara, University of San Francisco
 Karen Hughes, University of Tennessee
 Cheryl Ingram-Smith, Clemson University
 David Kass, Eastern Michigan University
 John Kemner, University of Washington
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As the above acknowledgments make clear, a text such as this is a collective enterprise. All of the above individuals deserve to share in any success this text enjoys. We want them to know that our gratitude is equaled only by the extreme dedication evident in their efforts. Many, many thanks to them all.

Editorial and Production Input

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For the Student

Companion Website—www.prenhall.com/klug

Respect for the students' increasingly valuable study time is reflected by the features of the Companion Website, which have been designed to enable users of the Eighth Edition to focus on those chapter sections and topics where they need review or further explanation. The Online Study Guide provides students with a focused, section-by-section review of topic coverage that features concise summary points accompanied by key illustrations and probing review questions that offer hints and feedback. The Web Tutorials offer today's learners the opportunity to quickly and conveniently visualize complex topics and dynamic processes—or to simply refamiliarize themselves with concepts they may have learned earlier but are encountering for the first time in the context of a genetics course. Several new Web Tutorials have been added to the Eighth Edition to keep the media current with the book. The media's strict adherence to both the principles and specific lessons of the textbook means that students and instructors can be assured that study time isn't being squandered on media that confuses students and emphasizes extraneous topics. The media tab on the outside margin of this page appears throughout the book to let you know when there is a Web Tutorial on a topic related to the coverage in the book.

In addition, a Media Lab for each chapter is offered on the Companion Website for those who want to explore genetics beyond the boundaries of a book through the vast array of genetics-related resources available through the Web.

Student Handbook and Solutions Manual

Harry Nickla, Creighton University (0-13-149008-7)

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

New York Times Themes of the Times: Genetics and Molecular Biology

Compiled by Harry Nickla, Creighton University
(0-13-186604-4)

This exciting supplement brings together recent genetics and molecular biology articles from the pages of the *New York Times*. This free supplement, available through your local representative, encourages students to make the connections between genetic concepts and the latest research and breakthroughs that are making headlines in the field. This resource is updated regularly.

"Research Navigator" www.researchnavigator.com

Prentice Hall's Research Navigator™ gives your students access to the most current information available for a wide array of subjects via EBSCO's Content Select™ Academic Journal Database, The New York Times Search by Subject Archive, "Best of the Web" Link Library, and information on the latest news and current events. This valuable tool helps students find the most useful articles and journals, cite sources, and write effective papers for research assignments.

For the Instructor**Instructor Resource Center on CD/DVD**

(0-13-149011-7)

The Instructor Resource Center on CD/DVD for the Eighth Edition offers adopters convenient access to the most comprehensive and innovative set of lecture presentation and teaching tools offered by any genetics textbook. Developed to meet the needs of veteran and newer instructors alike, these resources include:

- The JPEG files of all text line drawings with labels individually enhanced for optimal projection results (as well as unlabeled versions) and all text tables
- Most of the text photos, including all photos with pedagogical significance, as JPEG files
- The JPEG files of line drawings, photos, and tables preloaded into comprehensive PowerPoint® presentations for each chapter
- A second set of PowerPoint® presentations consisting of a thorough lecture outline for each chapter augmented by key text illustrations
- An impressive series of concise instructor animations adding depth and visual clarity to the most important topics and dynamic processes described in the text
- The instructor animations preloaded into PowerPoint® presentation files for each chapter
- PowerPoint® presentations containing a comprehensive set of in-class Classroom Response System (CRS) questions for each chapter
- In Word files, a complete set of the assessment materials and study questions and answers from the Testbank, the text's in-chapter text questions, and the student media practice questions.
- Finally, to help instructors keep track of all that is available in this media package, a printable Media Integration Guide in PDF format that lists each chapter's media offerings

Instructor's Resource Manual with Testbank

(0-13-149007-9)

This manual and test bank 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

(0-13-149010-9)

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.

Transparencies

(0-13-149019-2)

Two hundred seventy-five figures from the text are included in the transparency package: 200 four-color transparencies from the text plus 75 transparency masters. The font size of the labels has been increased and boldfaced for easy viewing from the back of the classroom.