

生命科学名著

LEWIN'S ESSENTIAL SECOND EDITION

GENES

LEWIN 基因精要

(第二版)

JOCELYN E. KREBS
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科学出版社

www.sciencep.com

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Second Edition

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JONES AND BARTLETT PUBLISHERS

Sudbury, Massachusetts

BOSTON TORONTO LONDON SINGAPORE

World Headquarters

Jones and Bartlett Publishers
40 Tall Pine Drive
Sudbury, MA 01776
978-443-5000
info@jbpub.com
www.jbpub.com

Jones and Bartlett Publishers Canada
6339 Ormindale Way
Mississauga, Ontario L5V 1J2
Canada

Jones and Bartlett Publishers International
Barb House, Barb Mews
London W6 7PA
United Kingdom

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Composition: Shepherd, Inc.
Printing and Binding: Courier Kendallville
Cover Printing: Courier Kendallville
Cover Image: © Carin L. Cain, The Art of Science:
Medical and Scientific Visualization
(www.carincain.com)

About the cover: In this picture, eukaryotic gene expression is depicted as a video game. mRNA (purple) is transcribed from chromosomes (blue), processed (scissors), and transported from the nucleus (green circle) where it is translated by ribosomes in the cytoplasm to polypeptides. Antisense RNAs (pink) aid in the regulation of mRNA stability.

Library of Congress Cataloging-in-Publication Data

Lewin's essential genes / by Jocelyn E. Krebs, Elliott S. Goldstein, and Stephen T. Kilpatrick. — 2nd ed.
p. ; cm.

Rev. ed. of: *Essential genes* / Benjamin Lewin. c2006.

Condensed and updated ed. of: *Genes IX* / Benjamin Lewin. c2008.

Includes index.

ISBN 978-0-7637-5915-5 (alk. paper)

1. Genetics. 2. Genes. I. Krebs, Jocelyn E. II. Goldstein, Elliott S. III. Kilpatrick, Stephen T. IV. Lewin Benjamin. Essential genes. V. Lewin, Benjamin. Genes IX. VI. Title. Essential genes.

[DNLM: 1. Genes. 2. DNA Replication. 3. Eukaryotic Cells—physiology. 4. Gene Expression. 5. Proteins—genetics. 6. Recombination, Genetic. QU 470 E78 2009]

QH430.L4 2009

576.5—dc22

2008047274

6048

Printed in the United States of America

13 12 11 10 09 10 9 8 7 6 5 4 3 2 1

Preface

Of the diverse ways to study the living world, molecular biology has been most remarkable in the speed and breadth of its expansion. New data are acquired daily, and new insights into well-studied processes come on a scale measured in weeks or months rather than years. It's difficult to believe that the first complete organismal genome sequence was obtained less than 15 years ago. The structure and function of genes and genomes and their associated cellular processes are sometimes elegantly and deceptively simple but frequently amazingly complex, and no single book can do justice to the realities and diversities of natural genetic systems. The purpose of this book is to provide a clear and concise overview of the field for the undergraduate student; it may also be appropriate for some medical school courses in the subject. Compared to the full edition, there is a redirected focus on essential topics and (in some areas) more background and introductory material.

This edition is generally updated and reorganized for a more logical flow of topics. In particular, discussion of chromatin organization and nucleosome structure now precedes the discussion of eukaryotic transcription, because chromosome organization is critical to all DNA transactions in the cell, and current research in the field of transcriptional regulation is heavily biased toward the study of the role of chromatin in this process. The discussion of transcriptional activation and chromatin remodeling has accordingly been combined into one chapter (Chapter 26). Two chapters on transposons and retrotransposons have been combined into one (Chapter 21). Chapter 30, "Genetic Engineering," has been expanded. Throughout the book, there is additional background material and some expanded coverage of evolutionary genetic concepts. Many new figures are included in this book, some reflecting new developments in the field.

This book is organized into five parts. **Part I (Genes)** comprises Chapters 1 through 6. Chapters 1 and 2 serve as an introduction to the structure and function of DNA and contain basic coverage of DNA

replication and gene expression. Chapter 3 introduces the interrupted structures of eukaryotic genes, and Chapters 4 through 6 discuss genome structure and evolution.

Part II (Proteins) comprises Chapters 7 through 10. Chapters 7 to 9 provide general introductions to gene expression: transcription, translation, and the genetic code. Chapter 10 covers the transport of proteins within cells.

Part III (Prokaryotic Gene Expression) includes Chapters 11 through 14. Chapter 11 provides more in-depth coverage of bacterial transcription. In Chapters 12 and 13, the regulation of bacterial gene expression via operons and regulatory RNAs, including RNAi, are discussed. Chapter 14 covers the regulation of expression of genes during phage development as they infect bacterial cells.

Part IV (DNA Replication and Recombination) comprises Chapters 15 through 23. Chapters 15 to 18 provide detailed discussions of DNA replication in plasmids, viruses, and prokaryotic and eukaryotic cells. Chapters 19 through 22 cover recombination and its roles in DNA repair and the human immune system, with Chapter 21 focusing on different types of transposable elements. Chapter 23 discusses the structure of eukaryotic chromosomes.

Part V (Eukaryotic Gene Expression) includes Chapters 24 through 30. In Chapter 24, the structure of nucleosomes and chromatin is discussed; chromatin remodeling and other chromosomal alterations are covered in Chapters 26 and 27. Chapters 25 and 26 describe eukaryotic transcription and its regulation, with Chapter 28 detailing posttranscriptional RNA processing. Chapter 29 provides a discussion of ribozymes. Chapter 30 introduces basic molecular techniques for the study of genes and gene expression.

Although the chapter on genetic engineering has been placed at the end of the book, instructors may choose to use the information from this chapter at any point appropriate for their courses, such as following the introductory chapters, 1 and 2.

For instructors who prefer to order topics with the essentials of DNA replication and gene expression followed by more advanced topics, the following chapter sequence is suggested:

Introduction: Chapters 1–2

Gene and Genome Structure: Chapters 3–6

DNA Replication: Chapters 15–18

Transcription: Chapters 7, 11, 25, and 28

Translation: Chapters 8–9

Regulation of Gene Expression: Chapters 12–14, 22–23, and 26

Other chapters can be covered at the instructor's discretion.

To the Instructor

This edition contains many new pedagogical components to help the instructor engage students in the topic. The text has been revised to be more accessible for students at introductory levels. Each chapter section concludes with *Concept and Reasoning Checks*: one or two questions for review, conceptual synthesis, hypothesizing, or application of learning. Each chapter includes a set of *End of Chapter Questions* with answers to half of the questions provided to the students; the other questions could be used as homework assignments or quizzes. There are additional instructional tools available on the Instructor's ToolKit CD-ROM and accompanying Web site (see below).

To the Student

There are a number of features in the book to help you learn as you read. Each section is summarized with a bulleted list of *Key Concepts*. *Key Terms* are highlighted in boldface in the text and defined in the margin for easy reference as well as compiled into the *Glossary* at the end of the book. Each chapter includes a set of *End of Chapter Questions* intended for self-assessment. Most chapters contain at least one feature box with additional background material or more in-depth details on an issue relevant to the chapter's focus. Boxes fall into one of four categories: *Essential Ideas*, *Historical Perspectives*, *Methods and Techniques*, and *Medical Applications*. In many cases these represent areas of ongoing research in the field. Finally, each chapter concludes with suggested *Further Reading*, a brief list of current reviews and pivotal papers to supplement and reinforce the chapter content.

Ancillaries

Jones and Bartlett Publishers offers an impressive variety of traditional and interactive multimedia supplements to assist instructors and aid students in mas-

tering molecular biology. Additional information and review copies of any of the following items are available through your Jones and Bartlett sales representative or by going to <http://www.jbpub.com/biology>.

Online Student Study Guide

Jones and Bartlett Publishers and Brent Nielsen of Brigham Young University have developed an interactive, electronic study guide dedicated exclusively to this title. Students will find a variety of study aids and resources at <http://biology.jbpub.com/lewin/essentialgenes>, all designed to explore the concepts of molecular biology in more depth and to help students master the material in the book. A variety of activities are available to help students review class material, such as an interactive summary, Web-based learning exercises, study quizzes, a searchable glossary, and links to animations, videos, and podcasts, all to help students master important terms and concepts.

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The *Instructor's ToolKit CD-ROM* contains a suite of files to help professors teach their courses. The materials are cross-platform for Windows and Macintosh systems. All the files on the CD are ready for online courses using the **WebCT** or **Blackboard** formats.

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- The **PowerPoint Lecture Outline Slides** presentation package provides images and lecture notes, created by Hao Nguyen, of California State University, Sacramento, for each chapter of *Lewin's Essential Genes, Second Edition*. A PowerPoint viewer is provided on the CD. Instructors with the Microsoft PowerPoint software can customize the outlines, figures, and order of presentation.
- The **Test Bank**, also created by Hao Nguyen, is provided as a text file with over 700 questions in a variety of formats.

Acknowledgments

The authors would like to thank the following individuals for their assistance in the preparation of this book:

The editorial, production, marketing, and sales teams at Jones & Bartlett have been exemplary in

all aspects of this project. Cathy Sether, Molly Steinbach, and Lou Bruno deserve special mention. Cathy brought us together on this project and in doing so launched an efficient and amiable partnership. She has provided able leadership and has been an excellent resource as we ventured into new territories. Molly and Lou have handled the daily responsibilities of the writing and production phases with friendly professionalism, helpful guidance, and appropriate doses of humor.

Thanks for the creation of many of the End of Chapter Questions go to Brent Nielsen. We also thank the authors of the special topics boxes found throughout the text:

Loree Burns
Jamie Kass, New York Academy of Sciences
Brent Nielsen, Brigham Young University
Teri Shors, University of Wisconsin, Oshkosh
Esther Siegfried, University of Pittsburgh at
Johnstown

We thank Hao Nguyen of California State University, Sacramento, for writing the test bank and lecture outlines. Finally, we would like express our gratitude to the reviewers of this edition, whose feedback helped to shape the text in many ways:

Salem Al-Maloul, Hashemite University
James Botsford, New Mexico State University

David Bourgaize, Whittier College
John Boyle, University of Mississippi
Mary Connell, Appalachian State University
Robert Dotson, Tulane University
Julia Frugoli, Clemson University
Daniel Herman, University of Wisconsin,
Eau Claire
Stan Ivey, Delaware State University
Christi Magrath, Troy University
Mitch McVey, Tufts University
Hao Nguyen, California State University,
Sacramento
Stacy Darling Novak, University of La Verne
Eva Sapi, University of New Haven
Ben Stark, Illinois Institute of Technology
Takashi Ueda, Florida Gulf Coast University
Ramakrishna Wusirika, Michigan Technological
University
Anastasia Zimmerman, College of Charleston

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cation. He has participated in the development and authoring of ancillary materials for several introductory biology, genetics, and molecular genetics texts as well as writing articles for educational reference publications. For his classes at UPJ, Dr. Kilpatrick has developed many active learning exercises in introductory biology, genetics, and evolution. Dr. Kilpatrick resides in Johnstown, PA, with his wife and three children. Outside of scientific interests, he enjoys music, literature, and theater and occasionally performs in local community theater groups.

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