

GENES

BENJAMIN
• LEWIN •

III



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GENES

THIRD EDITION

BENJAMIN LEWIN

Editor, *Cell*

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PREFACE

GENES is intended to provide a coherent view of genetics from the perspective of the gene. A summary of current knowledge in molecular biology, *GENES* reflects a rethinking of the way we view genetics as a whole in the light of recent discoveries and techniques. In my view, the study of genetics now essentially means dealing with DNA.

The underlying theme of *GENES*, continuing through each edition, is that the gene has at its disposal a vast repertoire of strategies for survival, different examples of which are displayed in various systems. An extreme view would be that the organism (any organism) is merely the survival kit for the package of genes that it carries.

This book, like the earlier editions, recognizes what amounts to a new field, whose extraordinary progress has all but overwhelmed the traditional discipline of genetics. By bringing together in a concise format the enormous mass of information that has accumulated, it is possible to address the crucial questions: what is a gene, how is it reproduced, how is it expressed, what controls its expression?

The starting point for *GENES* is the issue of how a gene is represented in protein; and from the protein, we work backward at the molecular level, as it were, to the DNA itself. Reflecting the perspective of current research, prokaryotic and eukaryotic molecular biology are given equal weight. Both are now part of the same story. In some cases, it is appropriate to treat both types of system together; in other cases, separate chapters are devoted to prokaryotic or eukaryotic systems.

The appearance of another edition at this time reflects the pace of advance in the field. Reading individual research articles, as they have been submitted to *Cell* or published in other journals, since *GENES II* was published, I have been aware that molecular biology continues to advance at a rapid pace. Just how

rapid, however, became apparent only as I was writing this third edition. Observations conveying fundamental insights continue to accumulate and it is only in attempting to put them all together that the full force of the advances becomes evident. *GENES III* therefore includes considerable new material and displays significant changes of perspective, even though it is only two years since the publication of *GENES II*.

Further changes in organization since the first edition reflect my view that the topics discussed in this book have become the central focus for research in modern biology. In order to make this *tour d'horizon* intelligible to a wider audience, the introductory material has been extended further, and other explanatory material is included in the text where appropriate.

GENES starts by considering the biochemical basis for heredity, as seen through the structure of DNA. Following this recapitulation of basic information, it should be possible for readers lacking advanced knowledge of biochemistry or genetics to use this book as a text. This approach recognizes the fact that this book is increasingly treated as part of an introduction to genetics. Indeed, the major part of most introductory books on genetics now usually focuses on direct analysis of the genome, the ground covered in *GENES*.

Within the main body of the book, the discussion of transcription and its regulation—now even more clearly the major target for gene regulation—have been integrated into a single section. More can be said about processing of RNA in eukaryotes; we are gaining a much keener impression of the flux of DNA in the genetic material; manipulation of DNA in the genome is acquiring more power; and a new final section takes the topics under discussion into the further realm of normal development during embryogenesis and abnormal development of cancer cells.

Aside from the attempt to focus more sharply on major insights by eliminating or abbreviating matters of peripheral interest, *GENES III* retains the same approach and style as earlier editions. All important points are illustrated diagrammatically, and where appropriate the illustrations attempt to give some feeling for the scale and relationship of the elements involved. As before, each chapter concludes with a brief bibliography that suggests recent useful reviews and some critical research articles that lead more deeply into the subject.

It is again a pleasure to thank colleagues who were generous enough to review chapters: Welcome Bender, Michael Bishop, Arg Efstratiadis, Howard Green, Ira Herskowitz, Paula Kiberstis, Nancy Kleckner, Marilyn Kozak, James Lake, David Livingston, Ken Marcu, Howard Nash, and Harold Varmus suggested many improvements in the present edition. And it is of course pleasing to acknowledge the assistance of John Balbalis, whose artistic efforts are responsible for the clarity that the illustrations have brought to the text.

Cambridge, Massachusetts
January 1987

BENJAMIN LEWIN

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