

The last quarter of the 20th century saw major scientific revolutions in genetics and computer technology. Indeed, handling the vast amounts of genetic information generated nowadays depends on advanced computer technology. This book reflects this massive surge in our understanding of the molecular foundations of genetics. Today, we now know that genes are much more than the abstract entities proposed over a century ago by Mendel. Genes are segments of DNA molecules, carrying encoded information. Indeed, genes have now become chemical reagents to be manipulated in the test tube in ever more complex ways. Over the next half century our understanding of how living organisms function at the molecular level, together with our ability to intervene, will expand in ways we are only just beginning to perceive.

A full understanding of how living organisms function includes an appreciation of how cells operate at the molecular level. This is of vital importance to all of us as it becomes ever more clear that molecular factors underlie many health problems and diseases. While cancer is the “classic” case of a disease that only became understandable when its genetic basis was revealed, it is not the only one by any means. Today, the molecular aspects of medicine are expanding rapidly and it is becoming possible to tailor clinical treatment personally by taking into account the genetic make-up of individual patients, an area known as personal genomics.

This book is intended as a survey-oriented textbook for upper-division students in a variety of biological subdisciplines. In particular, it is aimed at final-year undergraduates and beginning graduate students. This book does not attempt to be exhaustive in its coverage, even as a textbook. There is a second book in this series, entitled “Biotechnology,” which emphasizes the more practical applications of modern genetics. We hope that both books together effectively survey the foundations and applications of modern molecular genetics.

Some of the students using this book will be well-versed in the basics of modern molecular biology, having taken courses in genetics, biochemistry, and cell biology. However, others will not be so well-prepared, in part due to the continuing influx of students into molecular biology from biology programs that are not oriented in a molecular direction. For them we have tried to create a book whose early chapters cover the basics before launching out into the depths. The first unit of five chapters covers basic cell structure and genetics. This is followed by a survey of DNA, RNA, and proteins and how they interact to provide the cell with genetic information.

Because of the continuing interest in applying molecular biology to an ever-widening array of topics, we have tried to avoid overdoing detail (depth) in favor of breadth. Molecular biology is applicable to more than just human medicine and health. The genetic revolution has also greatly impacted other important areas such as agriculture, veterinary medicine, animal behavior, evolution, and microbiology. Students of these, and related disciplines, will all benefit from an improved understanding of molecular biology.

Changes in the Second Edition

This edition includes significant changes in comparison to the first edition of *Molecular Biology*.

The flood of new sequence information has necessitated updates to many areas of the book, especially Genomics and Systems Biology (Ch. 9), Proteomics (Ch. 15) Bacterial Genetics (Ch. 25), and Molecular Evolution (Ch. 26). Perhaps the most rapidly-changing area of molecular biology at present is the ever-expanding role of RNA. Although scattered items occur throughout the book, particularly in Unit 4, most of the major novel RNA topics, such as CRISPR and long-non-coding RNA, are grouped together in Chapter 18, Regulation at the RNA level.