

Preface

Our goal is to explain the molecular basis of life at the cellular level. We use evolution and molecular structures to provide the context for understanding the dynamic mechanisms that support life. As research in cell biology advances quickly, the field may appear to grow more complex, but we aim to show that understanding cells actually becomes simpler as new general principles emerge and more precise molecular mechanisms replace vague concepts about biological processes.

For this edition, we revised the entire book, taking the reader to the frontiers of knowledge with exciting new information on every topic. We start with new insights about the evolution of eukaryotes, followed by macromolecules and research methods, including recent breakthroughs in light and electron microscopy. We begin the main part of the book with a section on basic molecular biology before sections on membranes, organelles, membrane traffic, signaling, adhesion and extracellular matrix, and cytoskeleton and cellular motility. As in the first two editions, we conclude with a comprehensive section on the cell cycle, which integrates all of the other topics.

Our coverage of most topics begins with an introduction to the molecular hardware and finishes with an account of how the various molecules function together in physiological systems. This organization allows for a clearer exposition of the general principles of each class of molecules, since they are treated as a group rather than isolated examples for each biological system. This approach allows us to present the operation of complex processes, such as signaling pathways, as an integrated whole, without diversions to introduce the various components as they appear along the pathway. For example, the section on signaling mechanisms begins with chapters on receptors, cytoplasmic signal transduction proteins, and second messengers, so the reader is prepared to appreciate the dynamics of 10 critical signaling systems in the chapter that concludes the section. Teachers of shorter courses may concentrate on a subset of the examples in these systems chapters, or they may use parts of the "hardware" chapters as reference material.

We use molecular structures as one starting point for explaining how each cellular system operates. This edition includes more than 50 of the most important and revealing new molecular structures derived from electron cryomicroscopy and x-ray crystallography. We explain the evolutionary history and molecular diversity

of each class of molecules, so the reader learns where the many varieties of each type of molecule came from. Our goal is for readers to understand the big picture rather than just a mass of details. For example, Chapter 16 opens with an original figure showing the evolution of all types of ion channels to provide context for each family of channels in the following text. Given that these molecular systems operate on time scales ranging from milliseconds to hours, we note (where it is relevant) the concentrations of the molecules and the rates of their reactions to help readers appreciate the dynamics of life processes.

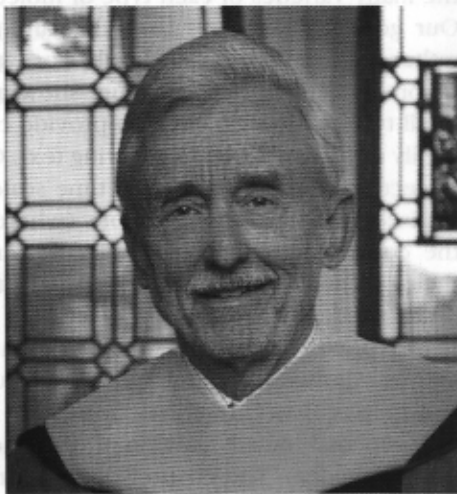
We present a wealth of experimental evidence in figures showing micrographs, molecular structures, and graphs that emphasize the results rather than the experimental details. Many of the methods will be new to readers. The chapter on experimental methods introduces how and why scientists use particularly important approaches (such as microscopy, classical genetics, genomics and reverse genetics, and biochemical methods) to identify new molecules, map molecular pathways, or verify physiological functions.

The book emphasizes molecular mechanisms because they reveal the general principles of cellular function. As a further demonstration of this generality, we use a wide range of experimental organisms and specialized cells and tissues of vertebrate animals to illustrate these general principles. We also use medical "experiments of nature" to illustrate physiological functions throughout the book, since connections have now been made between most cellular systems and disease. The chapters on cellular functions integrate material on specialized cells and tissues. Epithelia, for example, are covered under membrane physiology and junctions; excitable membranes of neurons and muscle under membrane physiology; connective tissues under the extracellular matrix; the immune system under connective tissue cells, apoptosis, and signal transduction; muscle under the cytoskeleton and cell motility; and stem cells and cancer under the cell cycle and signal transduction.

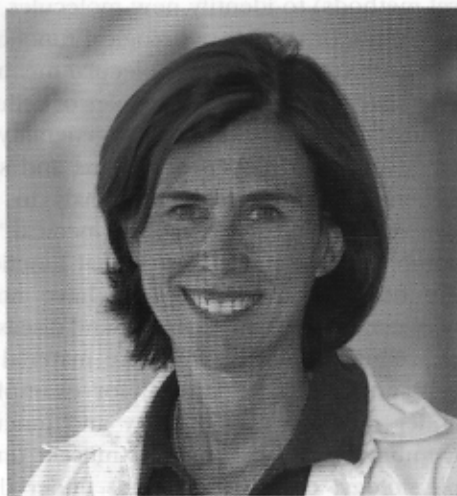
The Guide to Figures Featuring Specific Organisms and Specialized Cells that follows the Contents lists figures by organism and cell. The relevant text accompanies these figures. Readers who wish to assemble a unit on cellular and molecular mechanisms in the immune system, for example, will find the relevant material associated with the figures that cover lymphocytes/immune system.

Our Student Consult site provides links to the Protein Data Bank (PDB), so readers can use the PDB accession numbers in the figure legends to review original data, display an animated molecule, or search links to the original literature simply by clicking on the PDB number in the online version of the text.

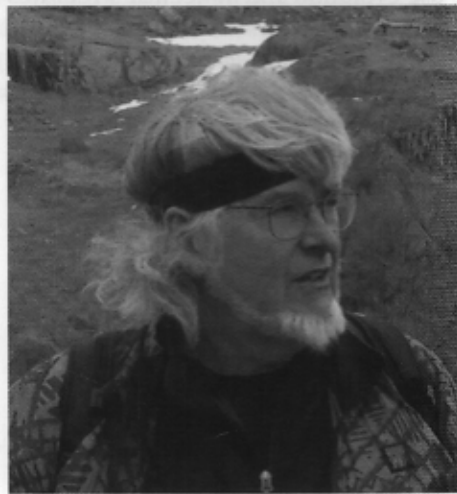
Throughout, we have attempted to create a view of Cell Biology that is more than just a list of parts and reactions. Our book will be a success if readers finish each section with the feeling that they understand better how some aspect of cellular behavior actually works at a mechanistic level and in our bodies.



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