

Preface

In our world there is no form of matter more astonishing than the living cell: tiny, fragile, marvelously intricate, continually made afresh, yet preserving in its DNA a record of information dating back more than three billion years, to a time when our planet had barely cooled from the hot materials of the nascent solar system. Ceaselessly re-engineered and diversified by evolution, extraordinarily versatile and adaptable, the cell still retains a core of complex self-replicating chemical machinery that is shared and endlessly repeated by every living organism on the face of the Earth, in every animal, every leaf, every bacterium in a piece of cheese, every yeast in a vat of wine.

Curiosity, if nothing else, should drive us to study cell biology; but there are practical reasons, too, why cell biology should be a part of everyone's education. We are made of cells, we feed on cells, and our world is made habitable by cells. We need to understand cell biology to understand ourselves; to look after our health; to take care of our food supplies; and to protect our endangered ecosystems. The challenge for scientists is to deepen knowledge and find new ways to apply it. But all of us, as citizens, need to know something of the subject to grapple with the modern world, from our own health affairs to the great public issues of environmental change, biomedical technologies, agriculture, and epidemic disease.

Cell biology is a big subject, and it has links with almost every other branch of science. The study of cell biology therefore provides a great scientific education. However, it is easy to become lost in the detail and distracted by an overload of information and technical terminology. In this book we therefore focus on providing a digestible, straightforward, and engaging account of only the essential principles. We seek to explain, in a way that can be understood even by a reader approaching modern biology for the first time, how the living cell works: to show how the molecules of the cell—especially the protein, DNA, and RNA molecules—cooperate to create this remarkable system that feeds, responds to stimuli, moves, grows, divides, and duplicates itself.

The need for a clear account of the essentials of cell biology became apparent to us while we were writing *Molecular Biology of the Cell* (MBoC), now in its fifth edition. MBoC is a large book aimed at advanced undergraduates and graduate students specializing in the life sciences or medicine. Many students and educated lay people who require an introductory account of cell biology would find MBoC too detailed for their needs. *Essential Cell Biology* (ECB), in contrast, is designed to provide the fundamentals of cell biology that are required by anyone to understand both the biomedical and the broader biological issues that affect our lives.

In this third edition, we have brought every part of the book up to date, with new material on chromosome structure and epigenetics, microRNAs

and RNAi, protein quality control, cell-cell recognition, genetic variation, stem cells and their medical potential, rational cancer treatments, genome evolution, and many other topics. We have improved our discussion of energetics and thermodynamics, integrated the cell cycle and cell division into a single chapter, and updated the "How We Know" sections, describing experiments that illustrate how biologists tackle important questions and how their experimental results shape future ideas.

As before, the diagrams in *ECB* emphasize central concepts and are stripped of unnecessary details. The key terms introduced in each chapter are highlighted when they first appear and are collected together at the end of the book in a large, illustrated glossary. We have not listed references for further reading: those wishing to explore a subject in greater depth are encouraged to consult the reading lists in *MBoC5* or look for recent reviews in the current literature through one of the powerful search engines, such as Pubmed (<http://www.ncbi.nlm.nih.gov>) or Google Scholar (<http://scholar.google.com>).

A central feature of the book is the many questions that are presented in the text margins and at the end of each chapter. These are designed to provoke students to think about what they have read and to encourage them to pause and test their understanding. Many questions challenge the student to place the newly acquired information in a broader biological context, and some have more than one valid answer. Others invite speculation. Answers to all the questions are given at the end of the book; in many cases these provide a commentary or an alternative perspective on material presented in the main text.

For those who want to develop their active grasp of cell biology further and to get a deeper understanding of how cell biologists extract conclusions from experiments, we recommend *Molecular Biology of the Cell, Fifth Edition: A Problems Approach*, by John Wilson and Tim Hunt. Though written as a companion to *MBoC*, this contains questions at all levels of difficulty and is a goldmine of thought-provoking problems for teachers and students. We have drawn upon it for some of the questions in *ECB*, and we are very grateful to its authors.

The explosion of new imaging and computer technologies continues to give fresh and spectacular views of the inner workings of living cells. We have tried to capture some of the excitement of these advances in a revised and enlarged version of the *Essential Cell Biology Interactive* media player on the DVD-ROM included with each copy of the book. It contains over 130 video clips, animations, molecular structures, and high-resolution micrographs—all designed to complement the material in individual book chapters. One cannot watch cells crawling, dividing, segregating their chromosomes, or rearranging their surface without a sense of wonder at the molecular mechanisms that underlie these processes. For a vivid sense of the marvel that science reveals beneath the surface of everyday things, it is hard to match the movie of DNA replication included on the DVD. We hope that *ECB Interactive* will motivate and intrigue students while reinforcing basic concepts covered in the text, and thereby will make the learning of cell biology both easier and more rewarding.

As with *MBoC*, each chapter of *ECB* is the product of communal effort, with individual drafts circulating from one author to another. In addition, many people have helped us, and these are credited in the Acknowledgments that follow. Despite our best efforts, it is inevitable that there will be errors in the book. We encourage readers who find them to let us know at science@garland.com, so that we can correct these errors in the next printing.