

Preface

Since the first edition of this book appeared, cell biology has undergone a revolution in information and concepts, particularly in the areas of cell motility, the structure and function of membranes, and the cell nucleus. This second edition reflects these changes and as a consequence is essentially a new book. However, the aim of the first edition, to present a balanced view of cell biology through an integration of structure and function, has been retained.

As in the first edition, an effort has been made to analyze the most important hypotheses and concepts of cell biology and to present them in language that is as simple and direct as possible. After an introduction to cell biology, biological molecules, and enzymology, the discussion moves to membrane structure and the role of membranes in transport and the provision of energy for the cell. The use of energy in cellular activity is then described, first in cell motility, and then in cell synthesis, with particular attention to the activities of the nucleus and cytoplasm in the synthesis of proteins. The discussion then turns to the primary result of cell synthesis and activity, cellular reproduction. The book closes with a description of the current hypotheses of the origin of cellular life. As in the first edition, the information provided in support of the hypotheses and concepts presented in these topics ranges from classical to contemporary, and includes evidence from experiments conducted with animals, plants, and microorganisms.

Material new to the second edition includes a more extensive discussion of enzymes and enzymatic catalysis. The chapter on membrane structure has been completely updated, and new chapters have been written on transport and the specializations of the cell surface. The transport chapter includes a section on nerve conduction; the cell surface chapter includes descriptions of cell-to-cell recognition, reception, and adhesion, and extracellular structures such as collagen in animals and cell walls in plants and prokaryotes. In addition, there are new chapters on cell motility, including one on microtubules and one on microfilaments. The microfilament chapter contains a discussion of striated muscle cell structure and function as well as microfilament-based motility in nonmuscle cells.

The chapters on respiration, photosynthesis, nuclear structure, RNA transcription, protein synthesis, DNA replication and the cell cycle, mitosis and meiosis have also been completely updated. The chapter on protein synthesis contains an extensive treatment of the regulation of cellular synthesis, and the cell cycle chapter discusses the controls regulating cell division in detail. The new information on nucleosomes, described in the chapter on nuclear structure is integrated with the chapters on RNA transcription, protein synthesis, and DNA replication and related to the functions of the chromosomes in these activities. The structure and function of the hereditary material of chloroplasts and mitochondria are now integrated with the chapters on RNA transcription, protein synthesis, and DNA replication as chapter supplements rather than as a separate chapter as in the first edition. Gametogenesis, which was presented in a lengthy chapter in the first edition, has been condensed and integrated with the chapter on meiosis. Major techniques used in the experiments discussed in the text are outlined in an appendix.

More specialized topics, such as unusual contractile systems in protozoa that are not based on microfilament or microtubule activity, the histone-protamine shift in sperm development, the structure and function of polytene chromosomes, and recombinant DNA and cloning are presented as chapter supplements. The supplements, a format new to this edition, can be used or omitted to provide flexibility and tailor the text to the information presented in different cell biology courses.

This book could not have been written without the help of friends and colleagues who reviewed the text and offered suggestions for improving the accuracy and content of the chapters. I am also deeply indebted to the many cell biologists throughout the world who generously supplied micrographs, diagrams, and tables, and to Darwen and Vally Hennings, Catherine Brandel, and Victor Royer, who provided the original artwork, and, for the sake of uniformity, redrew many of the diagrams sent by other authors.

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