

CELL BIOLOGY

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CELL BIOLOGY

FOURTH EDITION
OF
GENERAL CYTOLOGY

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W. B. SAUNDERS COMPANY
Philadelphia and London 1965

1st Spanish Edition	1946
2nd Spanish Edition	1952
3rd Spanish Edition	1955
1st Japanese Edition	1956
2nd Japanese Edition	1958
4th Spanish Edition	1960
1st Russian Edition	1962
5th Spanish Edition	1963
6th Spanish Edition	1965

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PREFACE TO THE FOURTH EDITION

In the preface to the first Spanish edition of this book—then entitled *General Cytology*—published in 1946 by El Ateneo of Buenos Aires, we stated:

“This book originally arose from the need for a synthesis in the Spanish language of the most important aspects of modern cytology.

“In recent years this branch of biology has shown rapid progress and has become fundamental to the study of the structure and function of living organisms. The cell can be regarded as the vital unit of organisms and the anatomic and physiologic substrate of biologic phenomena. In its morphologic aspect, modern cytology has gone beyond simple description of structures visible to the light microscope; by the application of new methods, an analysis has been begun of submicroscopic organization—the architectural arrangement of the molecules and micelles composing living matter. In this functional aspect, it has transcended the stage of pure description of physiologic changes, and seeks an explanation of them in the intimate physicochemical and metabolic processes of protoplasm. Finally, modern cytology, based on the nuclear structures, has tried to interpret and explain the phenomena of heredity, sex, variation, mutation and evolution of living organisms.”

Through the two decades that have elapsed, these postulates have been valid, but progress has been so rapid and revolutionary that we revised each edition extensively and now, in this fourth edition, have revised the book entirely. We have adopted the new title *Cell Biology* not only to stress the profound changes that have been introduced, but to emphasize the cell as a fundamental unit in biology.

While in recent years we have been spectators of the extraordinary development of molecular biology, which stresses the fundamental role of macromolecules such as the proteins and nucleic acids, it is again evident that these advances should be integrated within the framework of the cell as the true structural and functional organization of living matter.

In this book, the cell is analyzed at all levels of organization using the various optical instruments (e.g., light and electron microscopes, x-ray diffraction) that are able to reveal its subcellular, macromolecular and molecular architecture. At the same time the chemical composition and metabolism of the cell are studied cytochemically and functionally by analyzing the most important manifestations of cellular activity, such as contractility, excitability, permeability, nutrition and secretion. This integration is further stressed in the study of the macromolecules that carry biologic information, of the chromosomes, cell division and the cytologic and molecular bases of genetics.

This book is intended primarily for college courses in cytology, cell biology, general biology, general physiology, general zoology, general botany and cytogenetics, and for students who, for purposes of teaching or investigation in other fields of biology such as medicine, genetics, physiology, agronomy or veterinary medicine, wish to gain a general view of modern cytology.

The content of the book has been organized in a manner that is most useful to the student, going from simple to more complex matters. Thus chapters that review the chemistry of the cell, the enzymes and metabolism are at the beginning of the book, and the study of elementary macromolecular structures and membrane models introduces the study of the structural aspects of the cell. To keep the book within reasonable limits, we have incorporated the new material at the expense of older, less essential material. Most figures are new, and numerous tables and diagrams serving as teaching aids have been added.

The material is now divided into 23 chapters instead of 17 as in the last edition. Following two introductory chapters, the other 21 are organized into seven parts entitled: Molecular Components of the Cell, Methods for the Study of the Cell, Structural Bases of the Cell, The Cytoplasm and Cytoplasmic Organoids, Cellular Bases of Cytogenetics, Molecular Bases of Cytogenetics, and Cell Physiology. The entirely new chapters are concerned with the elementary structures, human cytogenetics, molecular genetics, membrane permeability, nerve conduction and synaptic transmission.

Because of the nature of the present book, only a few references are given at the end of each chapter and these are divided into two groups. Under General References is a list of books or general review articles that can be used for supplementary reading or as a guide to more specific literature. No attempt has been made to cover the literature extensively, and the few Cited References mentioned by number in the text should also be considered as keys to recent information in cell biology.

We are indebted to numerous of our colleagues for their help in the improvement of this edition. We would like to mention particularly Dr. Amanda Pellegrino de Iraldi for helping with the electron micrograph illustrations; Prof. José L. Reissig, Prof. Hersch M. Gerschenfeld and Dr. Carlos Tandler, for critically reading the chapters on molecular genetics, synaptic transmission and cytochemistry of the nucleus, respectively; and Drs. José A. Zadunaisky and Arnaldo Lasansky for their contributions to the chapters dealing with the cell membrane and cell permeability.

We would like to thank the many colleagues who have contributed tables and figures to enrich the value of this book.

In the preparation of the manuscript Misses Alicia Fernández Cowper, Julia Elena Connaughton, and Susana Mansfield and Mr. Walter Ludwig were most

helpful. We are very much indebted to the W. B. Saunders Company for the excellent editorial work and presentation of this new edition.

We were stimulated in our task by the good reception¹ this book has received in its several English, Spanish and Japanese editions and also the recent Russian edition. We have received numerous suggestions and criticisms from our colleagues and students of many countries. We cannot enumerate these here, but all of them have contributed to the improvement of this edition. We want to thank particularly Professors George E. Palade, Elof Carlson, Donald R. Ritchie and Miriam Schurin for critically reading the former edition and for numerous valuable suggestions. We are especially grateful to Prof. Warren Andrew, whose excellent translation of the first English edition became a starting point for the success of our book in the English speaking countries.

A book that tries to interpret and translate into didactic terms the extraordinary advances made by modern cytology is possible only with the unselfish collaboration of all who contribute to the permanent progress of this field of biologic knowledge.

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