

VOLUME TWO

# MEDICAL PHYSIOLOGY

FOURTEENTH EDITION

Edited by

VERNON B. MOUNTCASTLE, M.D.



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# MEDICAL PHYSIOLOGY

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**VERNON B. MOUNTCASTLE, M.D.**

Professor and Director, Department of Physiology  
The Johns Hopkins University  
Baltimore, Maryland

**FOURTEENTH EDITION**

with 1668 illustrations

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**FOURTEENTH EDITION**

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# Contributors

## **G. D. AURBACH**

National Institutes of Health  
Bethesda, Maryland

## **LLOYD M. BEIDLER**

Florida State University  
Tallahassee, Florida

## **JOHN D. BIGGERS**

Harvard University  
Boston, Massachusetts

## **F. J. BRINLEY, Jr.**

National Institutes of Health  
Bethesda, Maryland

## **JOHN R. BROBECK**

University of Pennsylvania  
Philadelphia, Pennsylvania

## **CHANDLER M. BROOKS**

State University of New York  
Brooklyn, New York

## **KENNETH T. BROWN**

University of California  
San Francisco, California

## **C. LOCKARD CONLEY**

The Johns Hopkins University  
Baltimore, Maryland

## **ROBERT D. DeVOE**

The Johns Hopkins University  
Baltimore, Maryland

## **ROBERT M. DOWBEN**

The University of Texas  
Dallas, Texas

## **ARTHUR B. DuBOIS**

Yale University  
New Haven, Connecticut

## **NORMAN GESCHWIND**

Harvard University  
Boston, Massachusetts

## **MOÏSE H. GOLDSTEIN, Jr.**

The Johns Hopkins University  
Baltimore, Maryland

## **H. MAURICE GOODMAN**

University of Massachusetts  
Worcester, Massachusetts

## **CARL W. GOTTSCHALK**

University of North Carolina at Chapel Hill  
Chapel Hill, North Carolina

## **JAMES D. HARDY**

Yale University  
New Haven, Connecticut

## **DALE A. HARRIS**

Harvard University  
Boston, Massachusetts

## **THOMAS R. HENDRIX**

The Johns Hopkins University  
Baltimore, Maryland

## **ELWOOD HENNEMAN**

Harvard University  
Boston, Massachusetts

## **JAMES C. HOUK**

Northwestern University  
Chicago, Illinois

**vi Contributors**

**KIYOMI KOIZUMI**

State University of New York  
Brooklyn, New York

**CHRISTIAN J. LAMBERTSEN**

University of Pennsylvania  
Philadelphia, Pennsylvania

**WILLIAM E. LASSITER**

University of North Carolina at Chapel Hill  
Chapel Hill, North Carolina

**PETER C. MALONEY**

The Johns Hopkins University  
Baltimore, Maryland

**JANICE W. MARAN**

McNeil Laboratories  
Fort Washington, Pennsylvania

**THOMAS H. MAREN**

University of Florida  
Gainesville, Florida

**DONALD J. MARSH**

University of Southern California  
Los Angeles, California

**JEAN M. MARSHALL**

Brown University  
Providence, Rhode Island

**LORNE M. MENDELL**

Duke University  
Durham, North Carolina

**WILLIAM R. MILNOR**

The Johns Hopkins University  
Baltimore, Maryland

**VERNON B. MOUNTCASTLE**

The Johns Hopkins University  
Baltimore, Maryland

**WILLIAM L. NASTUK**

Columbia University  
New York, New York

**BARRY W. PETERSON**

Rockefeller University  
New York, New York

**JAMES M. PHANG**

National Institutes of Health  
Bethesda, Maryland

**GIAN F. POGGIO**

The Johns Hopkins University  
Baltimore, Maryland

**SID ROBINSON**

Indiana University  
Bloomington, Indiana

**ANTONIO SASTRE**

The Johns Hopkins University  
Baltimore, Maryland

**W. T. THACH, Jr.**

Washington University  
St. Louis, Missouri

**PAOLA S. TIMIRAS**

University of California at Berkeley  
Berkeley, California

**LESTER VAN MIDDLESWORTH**

The University of Tennessee  
Memphis, Tennessee

**GERHARD WERNER**

University of Pittsburgh  
Pittsburgh, Pennsylvania

**GERALD WESTHEIMER**

University of California at Berkeley  
Berkeley, California

**VICTOR J. WILSON**

Rockefeller University  
New York, New York

**F. EUGENE YATES**

University of Southern California  
Los Angeles, California

# Preface

## TO FOURTEENTH EDITION

The general principles by which this textbook is organized remain those described in the preface to its twelfth edition, namely, to present mammalian physiology as an independent biologic discipline as well as a basic medical science. Two new sections appear in this edition, the first on the principles of system theory as applied to physiology and the second on the physiology of development and aging. Sixty-five chapters of the present edition either are wholly new (ten) or have been extensively revised (fifty-five); twelve chapters remain essentially as they appeared in the thirteenth edition.

This edition has been written by forty-five authors, of whom twelve have joined this effort

for the first time. Forty-one of these writers are continually engaged in research and teaching in physiology. Each has taken time from that dedicated life to summarize here the present state of knowledge in a particular field of interest. Whatever value this book possesses is wholly due to the contributors' depth of understanding, skill of exposition, and devotion to the task. For this I am indebted to each.

For them and for myself I wish to thank those authors and publishers who have allowed us to reproduce illustrations previously published elsewhere.

**Vernon B. Mountcastle**

# Preface

## TO TWELFTH EDITION

The twelfth edition of *Medical Physiology* presents a cross section of knowledge of the physiologic sciences, as viewed by a group of thirty-one individuals, twenty-three of whom are actively engaged in physiologic research and teaching. Each section of the book provides statements of the central core of information in a particular field of physiology, reflecting, by virtue of the daily occupations of its authors, the questioning and explorative attitude of the investigator and indeed some of the excitement of the search. These statements vary along a continuum from those with a high probability for continuing certainty to those that are speculative but, it is hoped, of heuristic value. An attempt has been made to maintain a balanced point of view. I hope this book will convey to the student who reads it the fact that physiology is a living and changing science, continuously perfecting its basic propositions and laws in the light of new discoveries that permit new conceptual advances. The student should retain for himself a questioning attitude toward all, for commonly the most important advances are made when young investigators doubt those statements others have come to regard as absolutely true. This is not a book that sets forth in stately order a series of facts which, if learned, will be considered adequate for success in a course in physiology. Many such "facts" are likely to be obsolete before the student of physiology reaches the research laboratory, or the student of medicine the bedside. Nor is it a book that provides ready-made correlations and integrations of the various fields of physiology necessary for a comprehensive understanding of bodily function. Those integrations are an essential part of scholarly endeavor not readily gained from books alone. It is my hope, however, that study of this book, combined with laboratory experience and scholarly reflection, will

provide the student with a method and an attitude that will serve him long after the concepts presented here are replaced by new and more cogent ones.

The title *Medical Physiology* has been retained, for one of the purposes of this edition, in common with earlier ones, is "to present that part of physiology which is of special concern to the medical student, the practitioner of medicine, and the medical scientist in terms of the experimental inquiries that have led to our present state of knowledge." The scope of the book was and is still broader, however, and attempts to present mammalian physiology as an independent biologic discipline as well as a basic medical science. Mammalian physiology has its base in cellular physiology and biophysics, and it is from this point of view that many of the subjects treated here are approached. Above all, mammalian physiology must deal with problems of the interactions between large populations of cells, organs, and organ systems and, finally, the integrated function of an entire animal. Physiology thus must bridge the distance from cellular biology on the one hand to systems analysis and control theory on the other: each is important and any one is incomplete without the others. This approach to the problems of internal homeostasis, of reaction to the environment, and of action upon the environment is evidenced in several sections of this book.

Of the eighty chapters composing this book, twenty-nine are wholly new in this edition; forty-five from the last edition have been extensively revised either by their original authors or by new ones. Six have been allowed to stand substantially as previously written, for these seemed to comprise as balanced and modern a survey as any presently possible. The names and affiliations of my colleagues in this effort have been

**x** *Preface to twelfth edition*

listed. They have taken time from busy lives to survey their fields of interest; for this I am greatly indebted to each. If this book possesses any worth it is in large part due to their continuing devotion to the task of its preparation.

For them and for myself I wish to thank those authors and publishers who have allowed us to reproduce illustrations previously published elsewhere.

**Vernon B. Mountcastle**



# Contents

## VOLUME ONE

### Part I

#### Cellular physiology

- 1 Principles of cell homeostasis, 3  
Robert D. DeVoe and Peter C. Maloney
- 2 Excitation and conduction in nerve fibers, 46  
F. J. Brinley, Jr.
- 3 Contractility, with special reference to skeletal muscle, 82  
Robert M. Dowben
- 4 Vertebrate smooth muscle, 120  
Jean M. Marshall

### Part II

#### The biology of nerve cells

- 5 Neuromuscular transmission, 151  
William L. Nastuk
- 6 Synaptic transmission, 184  
Vernon B. Mountcastle and Antonio Sastre

### Part III

#### Principles of system theory as applied to physiology

- 7 Systems and models, 227  
James C. Houk
- 8 Homeostasis and control principles, 246  
James C. Houk

### Part IV

#### General physiology of the forebrain

- 9 Functional organization of thalamus and cortex, 271  
Glan F. Poggio and Vernon B. Mountcastle

- 10 Sleep, wakefulness, and the conscious state: intrinsic regulatory mechanisms of the brain, 299  
Vernon B. Mountcastle

### Part V

#### Central nervous mechanisms in sensation

- 11 Sensory receptors and neural encoding: introduction to sensory processes, 327  
Vernon B. Mountcastle
- 12 Neural mechanisms in somesthesia, 348  
Vernon B. Mountcastle
- 13 Pain and temperature sensibilities, 391  
Vernon B. Mountcastle
- 14 The auditory periphery, 428  
Moise H. Goldstein, Jr.
- 15 Central nervous mechanisms in hearing, 457  
Vernon B. Mountcastle
- 16 The eye, including central nervous system control of eye movements, 481  
Gerald Westheimer
- 17 Physiology of the retina, 504  
Kenneth T. Brown
- 18 Central neural mechanisms in vision, 544  
Glan F. Poggio
- 19 The chemical senses: gustation and olfaction, 586  
Lloyd M. Beidler

**Part VI**

**Some aspects of higher nervous function**

- 20 The study of sensation in physiology: psychophysical and neurophysiologic correlations, 605  
Gerhard Werner
- 21 Higher functions of the nervous system, 629  
Gerhard Werner
- 22 Some special functions of the human brain: dominance, language, apraxia, memory, and attention, 647  
Norman Geschwind

**Part VII**

**Neural control of posture and movement**

- 23 Organization of the motor systems: a preview, 669  
Elwood Henneman
- 24 Skeletal muscle: the servant of the nervous system, 674  
Elwood Henneman
- 25 Feedback signals from muscle and their efferent control, 703  
Dale A. Harris and Elwood Henneman
- 26 Organization of the motoneuron pool: the size principle, 718  
Elwood Henneman
- 27 Input to motoneuron pools and its effects, 742  
Lorne M. Mendell and Elwood Henneman
- 28 Organization of the spinal cord and its reflexes, 762  
Elwood Henneman
- 29 Motor functions of the brain stem and basal ganglia, 787  
Elwood Henneman
- 30 The role of the vestibular system in posture and movement, 813  
Victor J. Wilson and Barry W. Peterson
- 31 The cerebellum, 837  
W. T. Thach, Jr.

- 32 Motor functions of the cerebral cortex, 859  
Elwood Henneman

**Part VIII**

**The autonomic nervous system, hypothalamus, and integration of body functions**

- 33 The autonomic system and its role in controlling body functions, 893  
Kiyomi Koizumi and Chandler M. Brooks
- 34 The hypothalamus and control of integrative processes, 923  
Chandler M. Brooks and Kiyomi Koizumi

**VOLUME TWO**

**Part IX**

**The circulation**

- 35 Cardiovascular system, 951  
William R. Milnor
- 36 Properties of cardiac tissues, 961  
William R. Milnor
- 37 The heart as a pump, 986  
William R. Milnor
- 38 The electrocardiogram, 1007  
William R. Milnor
- 39 Principles of hemodynamics, 1017  
William R. Milnor
- 40 Normal circulatory function, 1033  
William R. Milnor
- 41 Autonomic and peripheral control mechanisms, 1047  
William R. Milnor
- 42 The cardiovascular control system, 1061  
William R. Milnor
- 43 Capillaries and lymphatic vessels, 1085  
William R. Milnor
- 44 Regional circulations, 1094  
William R. Milnor
- 45 Pulmonary circulation, 1108  
William R. Milnor

**46 Blood volume, 1118**

William R. Milnor

**47 The blood, 1126**

C. Lockard Conley

**48 Hemostasis, 1137**

C. Lockard Conley

**Part X****The kidney and body fluids****49 Volume and composition of the body fluids, 1149**

William E. Lassiter and Carl W. Gottschalk

**50 Mechanisms of urine formation, 1165**

Carl W. Gottschalk and William E. Lassiter

**51 Urine formation in the diseased kidney, 1206**

William E. Lassiter and Carl W. Gottschalk

**52 Cerebrospinal fluid, aqueous humor, and endolymph, 1218**

Thomas H. Maren

**Part XI****Physiology of the digestive system****53 The absorptive function of the alimentary canal, 1255**

Thomas R. Hendrix

**54 The secretory function of the alimentary canal, 1289**

Thomas R. Hendrix

**55 The motility of the alimentary canal, 1320**

Thomas R. Hendrix

**Part XII****Metabolism****56 Energy exchange, 1351**

John R. Brobeck and Arthur B. DuBois

**57 Energy balance and food intake, 1366**

John R. Brobeck

**58 Physiology of muscular exercise, 1387**

Sid Robinson

**59 Body temperature regulation, 1417**

James D. Hardy

**Part XIII****Endocrine glands****60 Introduction to endocrinology, 1459**

H. Maurice Goodman

**61 The pituitary gland, 1468**

H. Maurice Goodman

**62 The thyroid gland, 1495**H. Maurice Goodman and  
Lester Van Middlesworth**63 Vitamin D, parathyroid hormone, and calcitonin, 1519**

G. D. Aurbach and James M. Phang

**64 The adrenal cortex, 1558**F. Eugene Yates, Donald J. Marsh,  
and Janice W. Maran**65 Reproduction, 1602**

H. Maurice Goodman

**66 The pancreas and regulation of metabolism, 1638**

H. Maurice Goodman

**Part XIV****Respiration****67 The lung: physical aspects of respiration, 1677**

Christian J. Lambertsen

**68 Gas exchanges of the atmosphere with the lungs and blood, 1691**

Christian J. Lambertsen

**69 Transport of oxygen, carbon dioxide, and inert gases by the blood, 1721**

Christian J. Lambertsen

**70 Neural control of respiration, 1749**

Christian J. Lambertsen

**71 Chemical control of respiration at rest, 1774**

Christian J. Lambertsen

**72 Dyspnea and abnormal types of respiration, 1828**

Christian J. Lambertsen

**73 Hypoxia, altitude, and acclimatization, 1843**

Christian J. Lambertsen

**xlv** *Contents*

- 74** Physical, chemical, and nervous interactions in respiratory control, 1873  
**Christian J. Lambertsen**
- 75** Effects of excessive pressures of oxygen, nitrogen, helium, carbon dioxide, and carbon monoxide: implications in aerospace, undersea, and industrial environments, 1901  
**Christian J. Lambertsen**

**Part XV**

**The physiology of development and aging**

- 76** Fetal and neonatal physiology, 1947  
**John D. Biggers**
- 77** Physiology of aging, 1986  
**Paola S. Timiras**











