Tenth Edition

Davis — Christopher

TEXTBOOK OF SURGERY

THE BIOLOGICAL BASIS OF MODERN SURGICAL PRACTICE

Edited by

DAVID C. SABISTON, Jr., M.D.

James B. Duke Professor and Chairman, Department of Surgery, Duke University Medical Center Durham, North Carolina W. B. Saunders Company: West Washington Square Philadelphia, Pa. 19105

> 12 Dyott Street London, WC1A 1DB 833 Oxford Street Toronto 18, Ontario

Listed here is the latest translated edition of this book together with the language of the translation and the publisher.

Portuguese (9th Edition) – Editora Guanabara Koogan, Rio de Janeiro, Brazil Spanish (9th Edition) – Editorial Interamericana, Mexico

Davis-Christopher TEXTBOOK OF SURGERY

ISBN 0-7216-7865-3

© 1972 by W. B. Saunders Company. Copyright 1936, 1939, 1942, 1945, 1949, 1956, 1960 and 1968 by W. B. Saunders Company. Copyright under the International Copyright Union. All rights reserved. This book is protected by copyright. No part of it may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without written permission from the publisher. Made in the United States of America. Press of W. B. Saunders Company. Library of Congress catalog card number 76-173341.

Print No.: 9 8 7 6 5 4 3 2

DEDICATION

To medical students and residents,
who through their concern, inquisitiveness, and impressive abilities
continuously stimulate improvements in the diagnosis and management of the sick.

PREFACE

It is astonishing with how little reading a doctor can practice medicine, but it is not astonishing how badly he may do it.

-SIR WILLIAM OSLER

In the tenth edition of this text, primary emphasis is placed upon those biological principles and derangements which form the basis of disease. This concept is appropriately stressed in the added subtitle, "The Biological Basis of Modern Surgical Practice." The fundamental roles of physiology, biochemistry, immunology, pharmacology, and pathology form the basis for discussions of the pathogenesis, clinical manifestations, diagnosis, and management of each disorder. While this approach has obvious merits, it is perhaps of even more importance that the modern student justifiably insists that these fundamental biological features form the foundation of an acceptable text.

In keeping with the recent and unprecedented strides in surgical science, contributors of recognized authority have been chosen for each section. Thus, the subject and author may be clearly identified, in recognition of the fact that most readers prefer the views of respected authorities.

In this edition an annotated bibliography is introduced for each section, with concise descriptions of the most important references in the literature. This is designed to provide the reader with a summary of the references in order to permit more selective reading. Additional references to substantiate the points of view expressed in the body of the text are listed at the end of each chapter.

Particular emphasis is placed upon *illustrations* in this edition, with selection of those which represent the best available in the literature. These are reproduced by permission of the original authors and were selectively chosen because they were the most graphic available. New drawings and photographs were used when suitable illustrations could not be found.

Several entirely new subjects are added, including a chapter on "homeostasis" in which Dr. Francis D. Moore has assembled a remarkable amount of basic physiologic data in a highly relevant and readable manner. A chapter called "Fever: Etiology, Physiologic, and Metabolic Effects, and Management in Surgical Patients" by Drs. John M. Kinney and Fred T. Caldwell, Jr., is also added. The emerging field of computer science is considered in a new chapter by Dr. John H. Siegel entitled "Computers and Mathematical Techniques in Surgery." The increasing application of nuclear medicine to surgical diagnosis is emphasized in Dr. Robert H. Jones' section, "Radioisotope Techniques for Diagnosis of Surgical Disorders." The chapter on transplantation is initiated with a basic section by a distinguished immunologist, Dr. D. Bernard Amos, with specific clinical contributions by Drs. Griepp, Kountz, Najarian, Reemtsma, Seigler, Shumway, Simmons, Starzl, and Stickel, each of whom has been an original contributor in the field. The impressive advances in the field of cancer immunology are presented in a new chapter entitled "Immunobiology of Neoplastic Disease" by Drs. Morton and Wells. "Lung Function" by

٧

Drs. Austen and Laver, "Cardiac Catheterization" by Drs. Robin, Ganguly, and Bing, and "Surgical Pharmacology of the Cardiovascular System" by Drs. Powell and Daggett are all new additions of special significance.

Finally, the objective of this edition has been the creation of a surgical text of sufficient scope to meet the needs of medical students, residents, practicing surgeons, and teachers of surgery.

DAVID C. SABISTON, JR.

CONTRIBUTORS

PAUL C. ADKINS, A.B., M.D.

Professor and Chairman, Department of Surgery, George Washington University; George Washington University Hospital, Washington, D.C.

J. WESLEY ALEXANDER, M.D., Sc.D.

Associate Professor of Surgery, University of Cincinnati College of Medicine; Director, Transplantation Division, Cincinnati General Hospital; University of Cincinnati Medical Center and Affiliated Hospitals, Cincinnati, Ohio.

WILLIAM A. ALTEMEIER, M.D.

Christian R. Holmes Professor of Surgery and Chairman of the Department, University of Cincinnati College of Medicine; Director, Surgical Services, Cincinnati General Hospital; Surgeon-in-Chief, Children's Hospital and Holmes Hospital, Cincinnati, Ohio.

D. BERNARD AMOS, M.D.

James B. Duke Professor of Immunology and Experimental Surgery, Duke University Medical Center, Durham, North Carolina.

ROBERT W. ANDERSON, M.D.

Assistant Professor of Surgery, Duke University Medical Center, Durham, North Carolina.

WILLIAM G. ANLYAN, M.D.

Professor of Surgery and Vice President for Health Affairs, Duke University Medical Center, Durham, North Carolina.

CURTIS P. ARTZ, M.D.

Professor of Surgery and Chairman of the Department, Medical University of South Carolina, Charleston, South Carolina.

W. GERALD AUSTEN, M.D.

Professor of Surgery, Harvard Medical School; Chief of Surgery, Massachusetts General Hospital, Boston, Massachusetts.

HENRY T. BAHNSON, M.D.

George Vance Foster Professor of Surgery and Chairman of the Department, University of Pittsburgh School of Medicine, Pittsburgh, Pennsylvania.

WALTER F. BALLINGER, M.D.

Bixby Professor of Surgery and Head of the Department, Washington University School of Medicine; Surgeon-in-Chief, Washington University Medical School and Allied Hospitals, St. Louis, Missouri.

HENDRICK B. BARNER, M.D.

Associate Professor of Surgery, St. Louis University School of Medicine; Associate Professor of St. Louis University Hospital; Firmin Desloge Hospital, St. Louis, Missouri.

JOHN M. BEAL, M.D.

Professor and Chairman, Department of Surgery, Northwestern University Medical School; Chief, Division of Surgery, Passavant Memorial Hospital; Attending Surgeon, Chicago Wesley Memorial Hospital; Senior Consultant, Veterans Administration Research Hospital, Chicago, Illinois.

RICHARD J. BING, M.D.

Professor of Medicine, University of Southern California; Director of Cardiology and Intramural Medicine, Huntington Memorial Hospital, Pasadena, California.

C. THOMAS BOMBECK, M.D.

Assistant Professor of Surgery, University of Illinois College of Medicine; University of Illinois Hospital, Chicago, Illinois.

GERT H. BRIEGER, M.D., Ph.D.

Associate Professor of the History of Medicine, Duke University, Durham, North Carolina.

EDWARD A. BRUNNER, M.D., Ph.D.

Professor and Chairman, Department of Anesthesia, Northwestern University Medical School; Director of Anesthesia, Chicago Wesley Memorial Hospital, Passavant Memorial Hospital, and Veterans Administration Research Hospital, Chicago, Illinois.

JAMES P. BYRNE, M.D.

Resident in Thoracic and Cardiovascular Surgery, University of Utah Affiliated Hospitals, Salt Lake City, Utah.

FRED T. CALDWELL, JR., M.D.

Professor of Surgery, University of Arkansas Medical Center, Little Rock, Arkansas.

GILBERT S. CAMPBELL, M.D., Ph.D.

Professor and Head, Department of Surgery, University of Arkansas School of Medicine, Little Rock, Arkansas.

WILLIAM M. CHARDACK, M.D.

Associate Professor of Surgery, State University of New York at Buffalo School of Medicine; Chief, Thoracic Surgical Service, Veterans Administration Hospital, Buffalo, New York.

ISIDORE COHN, JR., B.S., M.D., M.Sc. (Med), D.Sc. (Med)

Professor and Chairman, Department of Surgery, Louisiana State University School of Medicine; Senior Visiting Surgeon, Surgeon-in-Chief, L.S.U. Surgical Service, Charity Hospital of Louisiana at New Orleans, New Orleans, Louisiana.

JACK W. COLE, M.D.

Ensign Professor and Chairman, Department of Surgery, Yale University School of Medicine; Surgeon-in-Chief, Yale New Haven Hospital, New Haven; Consultant, West Haven Veterans Hospital, West Haven, Connecticut.

ROBERT E. CONDON, M.D., M.S.

Professor of Surgery, University of Iowa College of Medicine; Attending Surgeon, University of Iowa Hospitals, Iowa City, Iowa.

REX B. CONN, M.D.

Professor and Director, Sub-Department of Laboratory Medicine, The Johns Hopkins University School of Medicine; Director, Department of Laboratory Medicine, The Johns Hopkins Hospital, Baltimore, Maryland.

JOHN E. CONNOLLY, M.D.

Professor and Chairman, Department of Surgery, University of California at Irvine, Irvine; Chief of Surgery, Orange County Medical Center, Orange; Consultant, Long Beach Veterans Administration Hospital, Camp Pendleton and Long Beach Naval Hospitals, San Diego, California.

WILLARD M. DAGGETT, M.D.

Assistant Surgeon, Department of Surgery, Massachusetts General Hospital, Assistant Professor of Surgery, Harvard Medical School, Boston, Massachusetts.

LOYAL DAVIS, M.D., Ph.D.

Honorary F.R.C.S. (Eng. and Edin.)

Professor of Surgery, Emeritus, Northwestern University Medical School; Passavant Memorial Hospital, Chicago, Illinois.

JEROME J. DECOSSE, M.D., Ph.D.

Professor and Chairman, Division of Surgery, Medical College of Wisconsin, Milwaukee; Chief of Surgery, Milwaukee County General Hospital; Consultant in Surgery, Veterans Administration Hospital, Wood, Wisconsin.

DAVID A. DEPP, B.A., M.D.

Chief Resident in General Surgery, University of Utah Affiliated Hospitals, Salt Lake City, Utah.

MARCUS L. DILLON, Jr., M.D.

Associate Professor, University of Kentucky Department of Surgery; Chief, Thoracic Cardiovascular Surgery Veterans Administration, Hospital, Lexington, Kentucky.

THEODORE DRAPANAS, M.D.

Henderson Professor and Chairman, Department of Surgery, Tulane University School of Medicine; Surgeon-in-Chief, Tulane Division, Charity Hospital of Louisiana at New Orleans, New Orleans, Louisiana.

WILLIAM R. DRUCKER, M.D., F.R.C.S.(C)

Professor and Chairman, Department of Surgery, University of Toronto; Surgeon-in-Chief, Toronto General Hospital, Toronto, Ontario, Canada.

STANLEY J. DUDRICK, M.D.

Professor and Chairman, Department of Surgery, University of Texas Medical School, Houston, Texas.

PAUL A. EBERT, M.D.

Professor and Chairman, Department of Surgery, Cornell University; Surgeon-in-Chief, New York Hospital, New York, New York.

JAMES E. ECKENHOFF, M.D.

Professor of Anesthesia and Dean, Northwestern University Medical School; Senior Attending Anesthesiologist, Chicago Wesley Memorial Hospital, Passavant Memorial Hospital, Veterans Administration Research Hospital, Chicago, Illinois.

MILTON T. EDGERTON, Jr., M.D.

Professor and Chairman, Department of Plastic Surgery, The University of Virginia School of Medicine; Plastic Surgeon-in-Chief, University of Virginia Medical Center, Charlottesville, Virginia.

F. HENRY ELLIS, Jr., M.D., Ph.D.

Lecturer in Surgery, Harvard Medical School; Chief, Cardiovascular Surgery, Lahey Clinic Foundation, Boston, Massachusetts.

THOMAS J. FOGARTY, M.D.

Assistant Clinical Professor of Surgery, Stanford University Medical Center, Stanford, California.

JOHN E. FOKER, Ph.D.

Instructor of Surgery, Department of Surgery, University of Minnesota Health Sciences Center, Minneapolis, Minnesota.

HARRY FRIEDMAN, B.S., M.D.

Instructor, University of Tennessee Medical Units; Division of Neurosurgery, Baptist Memorial Hospital and The LeBonheur Children's Hospital, Memphis, Tennessee.

SUNILENDU N. GANGULY, M.D.

Instructor of Medicine, Wayne State University School of Medicine; Attending Cardiologist, Hutzel Hospital Medical Unit, Detroit, Michigan.

JAMES F. GLENN, M.D.

Professor of Urology and Chief of the Division, Duke University Medical Center, Durham, North Carolina.

HARRY S. GOLDSMITH, M.D.

Samuel D. Gross Professor of Surgery and Chairman, Department of Surgery, Jefferson Medical College; Surgeon-in-Chief, Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.

JOHN T. GRAYHACK, M.D.

Professor and Chairman, Department of Urology, Northwestern University Medical School; Attending Physician, Passavant Memorial Hospital; Consultant, Chicago Wesley Memorial Hospital; Consultant, Veterans Administration Research Hospital, Chicago, Illinois.

RANDALL B. GRIEPP, M.D.

Chief Resident, Cardiovascular Surgery, Stanford University School of Medicine, Stanford, California.

WARD O. GRIFFEN, Jr., M.D., Ph.D.

Professor and Chairman, Department of Surgery, University of Kentucky College of Medicine; Chief of Surgery, University of Kentucky Medical Center; Consultant, Veterans Administration Hospital; Medical Education Staff, St. Joseph's Hospital, Central Baptist Hospital, and Good Samaritan Hospital, Lexington, Kentucky.

HERMES C. GRILLO, M.D.

Associate Clinical Professor of Surgery, Harvard Medical School; Visiting Surgeon and Chief of General Thoracic Surgery, Massachusetts General Hospital, Boston, Massachusetts.

J. CAULIE GUNNELLS, Jr., M.D.

Associate Professor of Medicine, Duke University Medical Center, Durham, North Carolina.

CHARLES B. HAMMOND, M.D.

Assistant Professor of Obstetrics and Gynecology, Duke University Medical Center; Director, Endocrinology Division, and Director, Regional Trophoblastic Disease Center, Department of Obstetrics and Gynecology, Duke University Medical Center, Durham, North Carolina.

JAMES D. HARDY, M.D.

Professor and Chairman, Department of Surgery, The University of Mississippi Medical Center; Surgeon-in-Chief, University Hospital, Jackson, Mississippi.

TIMOTHY S. HARRISON, M.D.

Professor of Surgery, University of Michigan Medical School, Ann Arbor, Michigan.

BRACK G. HATTLER, Jr., M.D., Ph.D.

Assistant Professor of Surgery, University of Arizona Medical Center; Attending Surgeon, University of Arizona Medical Center, Division of Thoracic Surgery, Tucson, Arizona.

THOMAS M. HOLDER, M.D.

Clinical Professor of Surgery, University of Missouri at Kansas City; Chief, Section of Thoracic and Cardiovascular Surgery, Children's Mercy Hospital; Attending Pediatric Surgeon, St. Luke's and Research Hospitals, Kansas City, Missouri.

ADOLPH M. HUTTER, Jr., M.D.

Assistant Professor of Medicine, Harvard Medical School; Assistant in Medicine, Massachusetts General Hospital, Boston, Massachusetts.

R. SCOTT JONES, M.D.

Associate Professor, Department of Surgery, Duke University Medical Center; Chief of General Surgery, Durham Veterans Administration Hospital Durham, North Carolina.

ROBERT H. JONES, M.D.

Scholar in Academic Surgery, Duke University Medical Center, Durham, North Carolina.

JAMES R. JUDE, M.D.

Clinical Professor of Surgery, University of Miami School of Medicine; Chief of Thoracic and Cardiovascular Surgery; St. Francis Hospital; Attending Surgeon, Jackson Memorial Hospital and Mercy Hospital, Miami, Florida.

JOHN M. KINNEY, M.D.

Professor of Surgery, College of Physicians and Surgeons of Columbia University; Attending Surgeon, Department of Surgery, Presbyterian Hospital, New York, New York.

JOHN W. KIRKLIN, M.D.

Charles and Fay Kerner Professor of Surgery And Chairman of the Department, School of Medicine and the Medical Center, University of Alabama in Birmingham; Surgeon-in-Chief, University of Alabama Hospitals and Clinics, Birmingham, Alabama.

NICHOLAS T. KOUCHOUKOS, M.D.

Associate Professor of Surgery, School of Medicine and the Medical Center, University of Alabama in Birmingham; Attending Surgeon, University of Alabama Hospitals and Clinics, Birmingham, Alabama.

SAMUEL L. KOUNTZ, M.D.

Associate Professor of Surgery, University of California School of Medicine, San Francisco; Co-Director, Transplant Service, University of California, San Francisco, California.

WILLIAM W. KRIPPAEHNE, M.D.

Professor and Chairman, Department of Surgery, University of Oregon Medical School; Consultant in General Surgery, Veterans Administration Hospital, Portland, Oregon.

HIRAM T. LANGSTON, A.B., M.D., M.S.

Professor of Surgery, Abraham Lincoln College of Medicine, University of Illinois; Thoracic Surgeon, St. Joseph Hospital and Grant Hospital; Consultant, Hines Veterans Administration Hospital, Chicago, Illinois.

ALLAN M. LANSING, M.D., Ph.D.

Professor of Surgery and Chief of Cardiovascular Surgery, University of Louisville School of Medicine; Cardiovascular Surgeon, Children's Hospital, Jewish Hospital, Louisville General Hospital; Consultant, Methodist Evangelical Hospital, Veterans Administration Hospital, Louisville, Kentucky.

WILLIAM A. LARMON, M.D.

Associate Professor of Orthopaedic Surgery, Northwestern University Medical School; Attending Orthopaedic Surgeon, Passavant Memorial Hospital and Hines Veterans Administration Hospital, Chicago, Illinois.

MYRON B. LAVER. M.D.

Professor of Anesthesia, Harvard Medical School, Boston, Massachusetts.

LUCIAN L. LEAPE, M.D.

Associate Professor of Surgery, University of Kansas School of Medicine; Head, Section of Pediatric Surgery, University of Kansas Medical Center, Kansas City, Kansas.

MARTIN S. LITWIN, M.D.

Associate Professor of Surgery, Tulane University School of Medicine; Visiting Surgeon, Tulane Division, Charity Hospital of Louisiana at New Orleans, New Orleans, Louisiana.

WILLIAM P. LONGMIRE, Jr., M.D.

Professor of Surgery, UCLA School of Medicine; Surgeon-in-Chief, UCLA Hospital, Los Angeles, California.

JOHN LUDBROOK, Ch.M., F.R.C.S., F.R.A.C.S.

Professor of Surgery, University of Adelaide Medical School; Visiting Surgeon, Royal Adelaide Hospital; Consultant Surgeon, Queen Elizabeth Hospital, Queen Victoria Hospital, and Adelaide Children's Hospital, Adelaide, South Australia.

ROBERT A. MACBETH, B.A., M.D., M.Sc.

Professor and Chairman, Department of Surgery, University of Alberta; Chairman, Department of Surgery, University of Alberta Hospital, Edmonton, Alberta, Canada.

WALTER C. MACKENZIE, M.D., M.S.

Professor of Surgery and Dean of Medicine, University of Alberta; Active Staff, University of Alberta Hospital, Edmonton, Alberta, Canada.

LLOYD D. MACLEAN, M.D., F.R.C.S.(C)

Professor and Chairman, Department of Surgery, McGill · University; Surgeon-in-Chief, Royal Victoria Hospital, Montreal, Canada.

JOHN W. MADDEN, M.D.

Associate Professor of Surgery, University of Arizona, College of Medicine; Director, Section of Surgical Biology; Chief, Hand Rehabilitation Services; Attending Surgeon, University Hospital, Tucson, Arizona.

M. STEPHEN MAHALEY, Jr., M.D., Ph.D.

Assistant Professor of Neurosurgery and Anatomy, Duke University Medical Center; Associate Director for Graduate Medical Education, Duke University Medical Center; Neurosurgery Consultant, Durham Veterans Administration Hospital and Watts Hospital, Durham, North Carolina.

DEV R. MANHAS, M.D., M.S.

Instructor of Surgery, University of Washington, School of Medicine; Chief Resident Cardiothoracic Surgery, University of Washington Affiliated Hospitals, Seattle, Washington.

K. ALVIN MERENDINO, M.D., Ph.D.

Professor and Chairman, Department of Surgery, University of Washington School of Medicine; Surgeon-in-Chief, University Hospital; Active Medical Staff, General, Thoracic and Cardiovascular Surgery, King County Hospital; Consultant in Surgery, Veterans Administration Hospital and Children's Orthopedic Hospital, Seattle, Washington.

GORDON F. MOOR, M.D.

Watson Clinic (private practice); Chief of Thoracic and Cardiovascular Section, Lakeland General Hospital, Lakeland, Florida.

FRANCIS D. MOORE, M.D.

Moseley Professor of Surgery, Harvard Medical School; Surgeon-in-Chief, Peter Bent Brigham Hospital, Boston, Massachusetts.

DONALD L. MORTON, M.D.

Professor of Surgery and Chief, Division of Oncology, University of California, Los Angeles; Attending Surgeon in General and Thoracic Surgery, University of California Hospital, Los Angeles; Chief of Surgery, Sepulveda Veterans Administration Hospital, Sepulveda, California.

C. BARBER MUELLER, M.D.

Professor of Surgery and Department Chairman, McMaster University; Chief, Section of Surgery, McMaster University Medical Center; Active Staff, Hamilton Civic Hospitals; Affiliate Staff, St. Joseph's Hospital, Hamilton, Ontario, Canada.

WILLIAM H. MULLER, Jr., M.D.

Stephan H. Watts Professor of Surgery and Chairman, Department of Surgery, University of Virginia Medical School, Charlottesville; Surgeon-in-Chief, University of Virginia Medical Center; Consultant, Veterans Administration Hospital, Salem, Virginia.

JOHN S. NAJARIAN, M.D.

Professor and Chairman, Department of Surgery, University of Minnesota Health Sciences Center, Minneapolis, Minnesota.

FRANCIS C. NANCE, M.S. (Physiology), M.D.

Associate Professor of Surgery and Associate Professor of Physiology, Louisiana State University School of Medicine; Visiting Surgeon, Charity Hospital of Louisiana at New Orleans; Attending Physician, Veterans Administration Hospital; Attending Physician, Touro Infirmary, New Orleans, Louisiana.

BLAINE S. NASHOLD, Jr., M.D.

Professor and Chairman, Division of Neurosurgery, Emory University School of Medicine, Atlanta, Georgia.

STANTON P. NOLAN, M.D., M.S. in Surgery

Associate Professor of Surgery, University of Virginia School of Medicine, Charlottesville; Surgeon-in-Charge, Division of Thoracic and Cardiovascular Surgery, Department of Surgery, University of Virginia; Consultant, Veterans Administration Hospital, Salem, Virginia.

LLOYD M. NYHUS, M.D.

Warren H. Cole Professor and Head, Department of Surgery, The Abraham Lincoln School of Medicine, University of Illinois at the Medical Center; Surgeon-in-Chief, University of Illinois Hospital, Chicago, Illinois.

GUY L. ODOM, M.D.

Professor of Neurosurgery and Chief of the Division, Duke University Medical Center, Durham, North Carolina.

H. NEWLAND OLDHAM, Jr., M.D.

Associate Professor of Surgery, Duke University Medical Center, Durham, North Carolina

MARSHALL J. ORLOFF, B.S., M.S., M.D.

Professor and Chairman, Department of Surgery, School of Medicine, University of California at San Diego; Surgeon in Chief, University Hospitals, UCSD; Consultant in Surgery, San Diego Veterans Administration Hospital; U.S. Naval Hospital, San Diego; U.S. Naval Hospital, Camp Pendelton, California.

ALAN G. PARKS, M.D., M.Ch., F.R.C.S.

Teacher in Surgery, The London Hospital Medical College; Consultant Surgeon, The London Hospital and St. Mark's Hospital, London.

ERLE E. PEACOCK, Jr., M.D.

Professor and Chairman, Department of Surgery, University of Arizona College of Medicine; Chief of Surgical Services, University of Arizona Medical Center, Tucson, Arizona.

WILLIAM P. J. PEETE, M.D.

Professor of Surgery, Duke University Medical Center, Durham, North Carolina.

GORDON W. PHILPOTT, M.D.

Assistant Professor of Surgery, Washington University School of Medicine; Attending Surgeon, Washington University Medical School and Allied Hospitals, St. Louis, Missouri.

KENNETH L. PICKRELL, M.D.

Professor of Plastic and Maxillofacial Surgery and Chief of the Division, Duke University Medical Center, Durham, North Carolina.

MARVIN POMERANTZ, M.D.

Associate Professor of Surgery, University of Colorado Medical School; Associate Director of Surgery, Denver General Hospital; Chief, Cardiovascular-Thoracic Division, Denver General Hospital, Denver, Colorado.

RAYMOND W. POSTLETHWAIT, M.D.

Professor of Surgery, Duke University Medical Center; Chief of Surgery, Durham Veterans Administration Hospital, Durham, North Carolina.

W. JOHN POWELL, Jr., M.D.

Assistant Professor of Medicine, Harvard Medical School; Assistant in Medicine, Massachusetts General Hospital, Boston, Massachusetts.

CHARLES W. PUTNAM, M.D.

Resident in Surgery, University of Colorado School of Medicine, Denver, Colorado.

KENNETH P. RAMMING, M.D.

Senior Assistant Resident, General and Thoracic Surgery, Duke University Medical Center, Durham, North Carolina.

MARK M. RAVITCH, M.D.

Professor of Surgery, University of Pittsburgh; Surgeon in Chief, Montefiore Hospital, Pittsburgh, Pennsylvania.

KEITH REEMTSMA, M.D., Med.Sc.D.

Professor and Chairman, Department of Surgery, Columbia University College of Physicians and Surgeons, and Director of The Surgical Service, Presbyterian Hospital in the City of New York, New York.

ROBERT K. RHAMY, M.D.

Professor of Urology, Vanderbilt University School of Medicine; Chairman, Division of Urology, Vanderbilt University Hospital; Nashville General Hospital, Veterans Administration Hospital, Nashville, Tennessee.

JONATHAN E. RHOADS, M.D., D.Sc.(Med)

John Rhea Barton Professor of Surgery and Director of the Harrison Department of Surgical Research, University of Pennsylvania School of Medicine; Chief of Surgery, Hospital of the University of Pennsylvania, Philadelphia, Pennsylvania.

RALPH R. ROAN, M.D.

Chief Resident in Surgery, University of California at San Francisco, San Francisco, California

ERWIN ROBIN, M.D.

Assistant Professor of Medicine, Wayne State University School of Medicine; Chief, Section of Cardiology, Hutzel Hospital Medical Unit, Wayne State University, Detroit, Michigan.

BRADLEY M. RODGERS, M.D.

Senior Resident, Department of Surgery, Duke Medical Center, Durham, North Carolina.

DAVID C. SABISTON, Jr., M.D.

James B. Duke Professor of Surgery and Chairman of the Department of Surgery, Duke University Medical Center, Durham, North Carolina.

GORDON F. SCHWARTZ, A.B., M.D.

Associate Professor of Surgery, Jefferson Medical College; Assistant Attending Surgeon, Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.

H. WILLIAM SCOTT, Jr., M.D.

Professor of Surgery and Chairman of the Department, Vanderbilt University School of Medicine; Professor of Clinical Surgery, McNarry Medical School; Surgeon in Chief, Vanderbilt University Hospital; Consultant in Surgery, Veterans Administration Hospital, Nashville General Hospital, and St. Thomas Hospital, Nashville, Tennessee.

WILL C. SEALY, M.D.

Professor of Thoracic Surgery, Duke University Medical Center; Chief, Division of Thoracic Surgery, Duke University Medical Center, Durham, North Carolina.

HILLIARD F. SEIGLER, M.D.

Associate Professor of Surgery and Associate Professor of Immunology, Duke University Medical Center, Durham, North Carolina.

WILLIAM W. SHINGLETON, M.D.

Professor and Chief, Division of General Surgery, Duke University Medical Center; Attending Surgeon, Watts Hospital, and Lincoln Hospital; Consultant in Surgery, Veterans Administration Hospital, Durham, North Carolina.

NORMAN E. SHUMWAY, M.D., Ph.D.

Professor of Surgery, Stanford University School of Medicine; Chief, Cardiovascular Surgery Division, Stanford University Hospital, Stanford, California.

JOHN H. SIEGEL, M.D.

Associate Professor of Surgery, Albert Einstein College of Medicine; Attending Surgeon, Bronx Municipal Hospital Center; Attending Surgeon, The Hospital of the Albert Einstein College of Medicine; Associate Director, Clinical Research Center - Acute, Albert Einstein College of Medicine, New York, New York.

DONALD SILVER, M.D.

Professor of Surgery, Duke University Medical Center; Attending Physician, General and Thoracic Surgery, Veterans Administration Hospital; Consultant (Surgery), Watts Hospital, Durham, North Carolina.

FIORINDO A. SIMEONE, Sc.M.,

M.D., Sc.D.(Hon)

Professor of Medical Science, Brown University; Surgeon-in-Chief, The Miriam Hospital, Providence, Rhode Island.

RICHARD L. SIMMONS, M.D.

Associate Professor of Surgery and Microbiology, Department of Surgery, University of Minnesota Health Sciences Center, Minneapolis, Minnesota.

JAMES B. SNOW, Jr., M.D.

Chairman, Department of Otolaryngology, University of Pennsyfvania, Philadelphia, Pennsylvania.

THOMAS E. STARZL, M.D., Ph.D.

Professor and Chairman, Department of Surgery, University of Colorado School of Medicine; Chief, Surgical Service, Veterans Administration Hospital, Denver, Colorado.

DELFORD L. STICKEL, M.D.

Professor of Surgery, Duke University Medical Center; Chief of Staff, Durham Veterans Administration Hospital, Durham, North Carolina.

TIMOTHY TAKARO, M.D., M.S.(Surg)

Associate Clinical Professor of Surgery, Duke University Medical Center; Chief, Surgical Service, Veterans Administration Hospital, Oteen, North Carolina.

JAMES L. TALBERT, M.D.

Professor of Surgery and Pediatrics, University of Florida College of Medicine; Chief of Children's Surgery and Medical Director of Emergency Services; W. A. Shands Teaching Hospital and Clinics, University of Florida, Gainesville, Florida.

COLIN G. THOMAS, Jr., M.D.

Professor and Chairman, Department of Surgery, University of North Carolina, School of Medicine; Chief of Surgery, North Carolina Memorial Hospital, Chapel Hill, North Carolina.

JAMES C. THOMPSON, M.D., M.A.

Professor of Surgery and Chairman, Department of Surgery, The University of Texas Medical Branch; Chief of Surgery, University of Texas Medical Branch Hospitals, Galveston, Texas.

G. FRANK O. TYERS, M.D., F.R.C.S.(C)

Assistant Professor of Surgery, Department of Surgery, The Pennsylvania State University College of Medicine, The Milton S. Hershey Medical Center; Thoracic and Cardiovascular Surgeon, The Milton S. Hershey Medical Center, Hershey, Pennsylvania.

JOHN A. WALDHAUSEN, M.D.

Professor and Chairman, Department of Surgery, The Pennsylvania State University College of Medicine, The Milton S. Hershey Medical Center; Surgeon-in-Chief, The Milton S. Hershey Medical Center, Hershey, Pennsylvania.

W. DEAN WARREN, M.D.

Joseph B. Whitehead Professor and Chairman, Department of Surgery, Emory University School of Medicine; Attending Surgeon, Grady Memorial Hospital, Emory University Hospital, Atlanta Veterans Administration Hospital, and Henrietta Egleston Hospital for Children, Atlanta, Georgia.

SAMUEL A. WELLS, Jr., M.D.

Associate Professor of Surgery, Duke University Medical Center, Durham, North Carolina.

MYRON W. WHEAT, Jr., M.D.

Professor of Surgery and Director of Activities in Thoracic and Cardiovascular Surgery, University of Louisville School of Medicine, Louisville, Kentucky.

ROBERT H. WILKINS, M.D.

Chairman, Department of Neurosurgery, Scott and White Clinic, Temple, Texas.

GAYLORD S. WILLIAMS, M.D.

Assistant Professor of Plastic Surgery, University of Virginia Medical School; Plastic Surgeon, University of Virginia Medical Center, Charlottesville, Virginia.

G. RAINEY WILLIAMS, M.D.

Professor of Surgery and Vice Chairman of the Department of Surgery, University of Oklahoma School of Medicine; Chief, Division of Thoracic and Cardiovascular Surgery; Attending Surgeon, University of Oklahoma Hospitals, Oklahoma City, Oklahoma.

VALLEE L. WILLMAN, M.D.

Chairman and Professor of Surgery, St. Louis University School of Medicine; Chairman and Professor, St. Louis University Hospital, Firmin Desloge Hospital, St. Louis, Missouri.

RICHARD E. WILSON, M.D.

Associate Professor of Surgery, Harvard Medical School; Surgeon, Peter Bent Brigham Hospital, Boston, Massachusetts.

WALTER G. WOLFE, M.D.

Assistant Professor of Surgery, Duke University Medical Center, Durham, North Carolina.

BARNES WOODHALL, M.D.

Professor of Neurosurgery, Duke University Medical Center, Durham, North Carolina.

EDWARD R. WOODWARD, M.D.

Professor and Chairman, Department of Surgery, University of Florida College of Medicine; Attending General Surgeon, W. A. Shands Teaching Hospital and Clinics; Consultant, Lake City Veterans Administration Hospital

and Gainesville Veterans Administration Hospital, Florida.

D'ABNEY R. YARBROUGH, III, M.D.

Assistant Professor of Surgery, Medical University of South Carolina, Charleston, South Carolina.

W. GLENN YOUNG, Jr., M.D.

Professor of Surgery, Duke University Medical Center; Consulting Thoracic Surgeon, North Carolina Tuberculosis Sanatoria, Wilson and McCain, North Carolina.

ROBERT ZEPPA, M.D.

Professor and Chairman, Department of Surgery, University of Miami School of Medicine; Chief of Surgery, Jackson Memorial Hospital; Chief of Surgery, University of Miami Hospital and Clinics, Miami, Florida.

BERNARD ZIMMERMANN, M.D., Ph.D.

Professor and Chairman, Department of Surgery, West Virginia University, Morgantown; Surgeon-in-Chief, West Virginia University Hospital, Morgantown; Senior Consultant, Veterans Administration Hospital, Clarksburg, West Virginia.

ACKNOWLEDGMENTS

First, a note of deep personal gratitude is expressed to Loyal Davis. He has been most gracious in help and support after transferring the direction of a great textbook which he had steered through four successful editions.

The present edition is made possible by a number of previous authors and many new contributors. Each has worked diligently to produce a section firmly based upon fundamental biological principles. The attention to detail that the authors have given in the preparation of each chapter, including the annotated references and bibliography, merits special acknowledgment.

Particular thanks are due Mr. Robert B. Rowan for his advice, encouragement, and constant help in all phases of the extensive revisions in this edition. He has exerted a major influence in the creation of this text, and this is gratefully recognized.

The editorial assistance of Miss Elizabeth J. Taylor of the Saunders staff has been invaluable. Her broad knowledge of editorial style combined with a policy of attention to every detail in editing both the manuscript and illustrations has far exceeded expectations. Moreover, she has demonstrated a distinct personal interest in this text which is most appreciated.

Albert Beringer and his associates in the Production Department of the Saunders Company are congratulated for having brought this large volume into existence in a spectacularly brief period of time — while maintaining the highest standards of accuracy and typographic beauty.

Finally, to Mrs. Kathryn Slaughter is due much personal appreciation for her tireless efforts in the preparation of the manuscripts and for the painstaking care with which each contribution has been checked. Her many suggestions during the past several years have been most helpful. The special interest she has taken in this book, her loyalty, and her enthusiasm for the entire undertaking are gratefully acknowledged.

CONTENTS

1	
THE DEVELOPMENT OF SURGERY: Historical Aspects Important in the Origin and Development of Modern Surgical Science	1
2	
HOMEOSTASIS: BODILY CHANGES IN TRAUMA AND SURGERY: The Responses to Injury in Man as the Basis for Clinical Management Francis D. Moore, M.D.	26
3	
SHOCK: CAUSES AND MANAGEMENT OF CIRCULATORY COLLAPSE	65
Lloyd D. MacLean, M.D.	00
4	
FLUID AND ELECTROLYTE BALANCE IN SURGICAL PATIENTS Bernard Zimmermann, M.D.	94
5 .	
PRINCIPLES OF PREOPERATIVE PREPARATION OF THE SURGICAL PATIENT	112
6	
BLOOD TRANSFUSIONS AND DISORDERS OF SURGICAL BLEEDING	131
7	
METABOLISM IN SURGICAL PATIENTS: PROTEIN, CARBOHYDRATE, AND FAT UTILIZATION BY ORAL AND PARENTERAL ROUTES	147

1	

FEVER: ETIOLOGY, PHYSIOLOGIC AND METABOLIC EFFECTS, AND MANAGEMENT IN SURGICAL PATIENTS	175
9	
ANESTHESIA	189
10	
COMPUTERS AND MATHEMATICAL TECHNIQUES IN SURGERY John H. Siegel, M.D.	213
11	
RADIOISOTOPE TECHNIQUES FOR DIAGNOSIS OF SURGICAL DISORDERS	234
12	
WOUND HEALING: BIOLOGIC AND CLINICAL FEATURES	249
13	
BURNS: Including Cold, Chemical, and Electrical Injuries	272
14	
PRINCIPLES OF OPERATIVE SURGERY: ANTISEPSIS, TECHNIQUE, SUTURES AND DRAINS	300
15	
SURGICAL INFECTIONS AND CHOICE OF ANTIBIOTICS	319
16	
BITES AND STINGS	342
17	
TRAUMA: MANAGEMENT OF THE ACUTELY INJURED PATIENT Theodore Drapanas, M.D., and Martin S. Litwin, M.D.	351
18	
SURGICAL COMPLICATIONS	398