Fourth edition

VOLUME TWO

CAMPBELL'S OPERATIVE ORTHOPAEDICS

Editor **A. H. CRENSHAW, M.D.**
Memphis, Tenn.

Chapter on hand surgery **LEE MILFORD, M.D.**
Memphis, Tenn.

With 1535 illustrations, including 9 in color

THE C. V. MOSBY COMPANY
Saint Louis 1963

Fourth edition

Printed in the United States of America
Library of Congress Catalog Card Number 63-18842
Distributed in Great Britain by Henry Kimpton, London

Contributors

L. D. ANDERSON, M.D. (Chapters 12 and 19)

Assistant Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, City of Memphis Hospitals, and Hospital for Crippled Adults; Consultant Staff, St. Jude Hospital; Associate Staff, Baptist Memorial Hospital; Courtesy Staff, Le Bonheur Children's Hospital, Methodist Hospital, and St. Joseph Hospital.

OTTO E. AUFRANC, M.D. (section on Smith-Petersen mold arthroplasty in Chapter 16)

Assistant Clinical Professor in Orthopaedic Surgery, Harvard Medical School, Boston, Mass.; Chief of Fracture Clinic, Massachusetts General Hospital.

JAMES E. BATEMAN, M.D. (section on denervation of joints in Chapter 12)

Surgeon-in-Chief, Orthopaedic and Arthritic Hospital, Toronto, Ontario, Canada; Consultant, Sunnybrook Hospital (Department of Veterans Affairs), Scarborough General Hospital, Northwestern General Hospital, Peel Memorial Hospital, and Belleville General Hospital.

H. B. BOYD, M.D. (Chapters 3 and 8)

Professor of Orthopaedic Surgery and Head of the Division of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Hospital for Crippled Adults, Baptist Memorial Hospital, Le Bonheur Children's Hospital, and City of Memphis Hospitals; Consultant Staff, Methodist Hospital, St. Joseph Hospital, and United States Public Health Service Hospital.

R. A. CALANDRUCCIO, M.D. (Chapter 17 and sections on reconstructions in Chapter 23)

Instructor in Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Hospital for Crippled Adults, Baptist Memorial Hospital, Le Bonheur Children's Hospital, and City of Memphis Hospitals; Consultant Staff, United States Public Health Service Hospital; Courtesy Staff, Methodist Hospital and St. Joseph Hospital.

P. T. CRAWFORD, M.D. (Chapter 1)

Assistant Professor of Medicine, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Hospital for Crippled Adults, Baptist Memorial Hospital, and City of Memphis Hospitals; Courtesy Staff, Methodist Hospital and St. Joseph Hospital.

A. H. CRENSHAW, M.D. (Chapters 13 and 14)

Assistant Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Hospital for Crippled Adults, Baptist Memorial Hospital, and Methodist Hospital; Consultant Staff, United States Public Health Service Hospital; Associate Staff, Le Bonheur Children's Hospital and City of Memphis Hospitals.

A. S. EDMONSON, M.D. (Chapter 24)

Assistant in Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Hospital for Crippled Adults, and City of Memphis Hospitals; Associate Staff, Baptist Memorial Hospital and St. Joseph Hospital; Courtesy Staff, Le Bonheur Children's Hospital and Methodist Hospital.

W. S. GILMER, JR., M.D. (Chapter 18)

Visiting Lecturer in Pathology, University of North Carolina, Chapel Hill, N. C.; Pathologist to the Cape Fear Valley Hospital, Fayetteville, N. C.; formerly Associate Professor of Pathology, University of Tennessee College of Medicine, and Pathologist to Campbell Clinic and Hospital, Memphis, Tenn.

J. F. HAMILTON, M.D. (Chapter 1)

Associate Professor of Medicine, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, and Hospital for Crippled Adults; Courtesy Staff, Baptist Memorial Hospital, Methodist Hospital, and St. Joseph Hospital.

A. J. INGRAM, M.D. (Chapters 21 and 22)

Associate Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Chief of Staff, Crippled Children's Hospital; Active Staff, Campbell Clinic and Hospital, Hospital for Crippled Adults, Baptist Memorial Hospital, Le Bonheur Children's Hospital, and City of Memphis Hospitals; Consultant Staff, Methodist Hospital and St. Joseph Hospital.

LEE MILFORD, M.D. (Chapter 4)

Instructor in Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Hospital for Crippled Adults, Crippled Children's Hospital, and Baptist Memorial Hospital; Consultant in Hand Surgery, United States Public Health Service Hospital; Associate Staff, Le Bonheur Children's Hospital and City of Memphis Hospitals; Courtesy Staff, Methodist Hospital and St. Joseph Hospital.

FRANCIS MURPHEY, M.D. (Chapter 23 and section on neurosurgery in Chapter 12)

Professor of Neurosurgery and Head of the Division of Neurosurgery, University of Tennessee College of Medicine, Memphis, Tenn.; Chief of Neurosurgery, City of Memphis Hospitals; Chief of Neurosurgery, Baptist Memorial Hospital.

F. P. SAGE, M.D. (Chapter 25)

Instructor in Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Medical Director, Crippled Children's Hospital; Active Staff, Campbell Clinic and Hospital, Baptist Hospital, and Hospital for Crippled Adults; Attending Staff, Le Bonheur Children's Hospital, Methodist Hospital, and City of Memphis Hospitals; Courtesy Staff, St. Joseph Hospital.

D. B. SLOCUM, M.D. (Chapter 9)

Chief of Orthopaedic Surgery, Sacred Heart Hospital, Eugene, Ore.; Clinical Instructor in Orthopaedic Surgery, University of Oregon Medical School, Portland, Ore.; Visiting Lecturer, School of Health and Physical Education, University of Oregon, Eugene, Ore.

HUGH SMITH, M.D. (Chapters 2, 6, and 7)

Associate Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Hospital for Crippled Adults, and Crippled Children's Hospital; Consultant Staff, Baptist Memorial Hospital, Methodist Hospital, and St. Joseph Hospital; Attending Staff, City of Memphis Hospitals and Le Bonheur Children's Hospital.

J. S. SPEED, M.D. (Chapters 15 and 20)

Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, and Hospital for Crippled Adults; Consultant Staff, Baptist Memorial Hospital, Le Bonheur Children's Hospital, Kennedy Veterans Administration Hospital, Methodist Hospital, and St. Joseph Hospital.

MARCUS STEWART, M.D. (Chapters 5 and 10)

Associate Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Hospital for Crippled Adults, Baptist Memorial Hospital, City of Memphis Hospitals, Le Bonheur Children's Hospital, and Methodist Hospital; Consultant Staff, St. Joseph Hospital.

T. L. WARING, M.D. (Chapters 11 and 16)

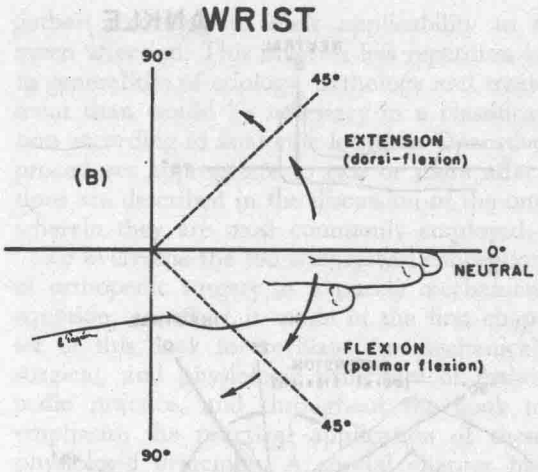
Associate Professor of Orthopaedic Surgery, University of Tennessee College of Medicine, Memphis, Tenn.; Chief of Staff, Hospital for Crippled Adults; Active Staff, Campbell Clinic and Hospital, Crippled Children's Hospital, Baptist Memorial Hospital, City of Memphis Hospitals, and Le Bonheur Children's Hospital; Courtesy Staff, Methodist Hospital and St. Joseph Hospital; Area Medical Director, Veterans Administration, Atlanta, Ga.; Consultant Staff, United States Public Health Service Hospital, Memphis, Tenn.

Preface to fourth edition

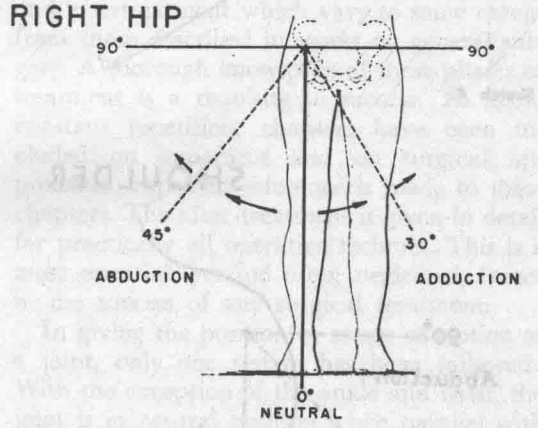
In this edition, as in previous revisions, many older operations and the indications for their use have been deleted, but an even larger number of newer ones has been added. Also added is a new and comprehensive chapter on hand surgery. To make space for this new material, the chapters on surgical physiology and on apparatus have been omitted. Good discussions of these topics can be found in works not primarily concerned with operations.

With the exception of the chapter on amputations, which has been revised, and the section on Smith-Petersen mold arthroplasty in Chapter 16, which has been retained with minor revisions, this edition has been completely rewritten and in many places has been reorganized to clarify all introductory material and especially to give more specific indications for operations. Of the total of 1535 illustrations included in this edition, 510 are new. For simplicity and speed in reading, the operative techniques are presented in the active voice.

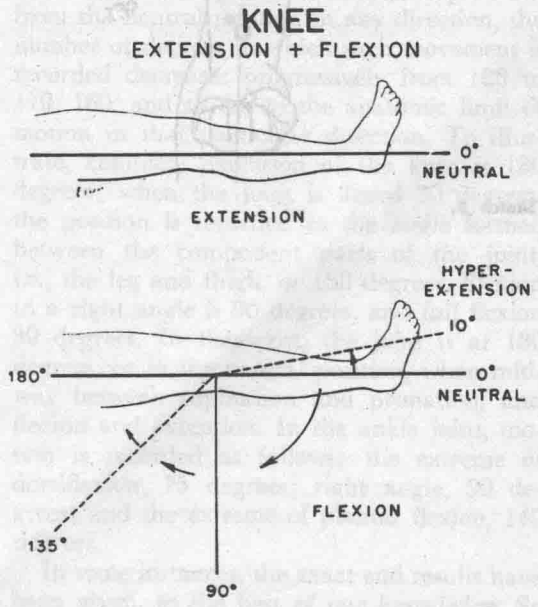
We have adopted almost entirely the method of measuring joint motion that has recently been advocated by the American Academy of Orthopaedic Surgeons. The neutral position is 0° instead of 180° as in previous editions (see accompanying sketches 1 through 4*). For the shoulder, however, the method of the Academy seemed too complicated for immediate adoption here. Although the neutral position is 0° as for other joints, the direction of movement in adduction, abduction, flexion, and extension is the same as previously used (see sketches 5 and 6).



Sketch 1.

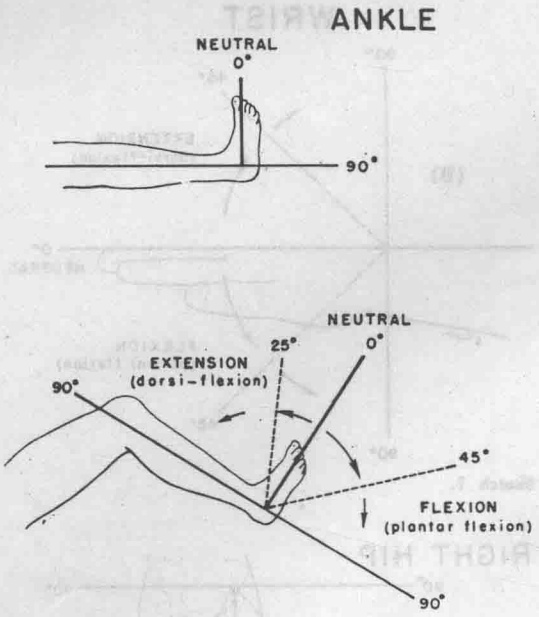


Sketch 2.

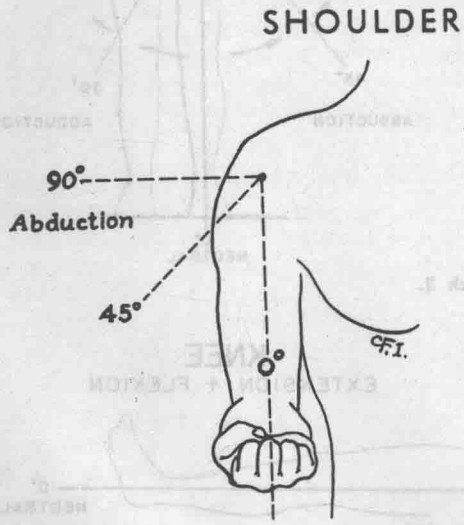


Sketch 3.

*Reproduced by courtesy of the American Academy of Orthopaedic Surgeons.



Sketch 4.



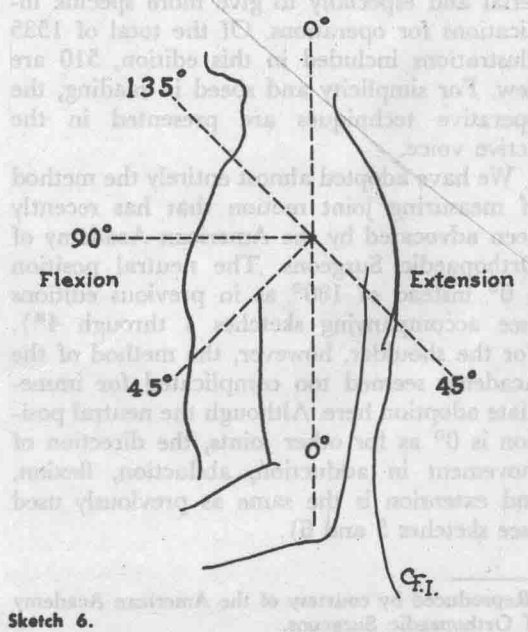
Sketch 5.

Because barriers of language remain almost insurmountable, little material not available in English has been included.

The editor and the other members of the staff of the Campbell Clinic are especially indebted to those authors who are not members of the staff: Dr. Otto E. Aufranc, Dr. James E. Bateman, Dr. W. S. Gilmer, Jr., Dr. Francis Murphey, and Dr. D. B. Slocum. We are also indebted to Dr. Joseph S. Barr, Dr. Walter P. Blount, Dr. David M. Bosworth, and Dr. Herbert Knodt, and to Prof. A. R. Hodgson, who have offered special suggestions, comments, and corrections or have proofread material. To all of these and to the many surgeons who have so kindly permitted us to reproduce their illustrative material, we extend our thanks. We also thank Mr. William B. McNett and Miss Betty Oliver, who prepared many of the new illustrations for the chapter on the hand.

I wish specially to express my appreciation to Marcia L. Anderson, Ph.D., our librarian and medical editor, for her skillful assistance with the manuscript and references. Without her help the task would have been many times more difficult. Again I wish to thank Mr. C. F. Ingram, our medical artist; Mrs. Allene Jefferson, who prepared the indices; and Miss M. Irene Jones, the librarian of the University of Tennessee College of Medicine.

A. H. Crenshaw, M.D.



Sketch 6.

Preface to first edition

The title of this book, *Operative Orthopedics,* is not intended to convey the impression that the chief or most important method of treatment of orthopedic affections is open surgery. Although many orthopedic affections are best treated by operative measures alone, the majority are successfully treated by more conservative means. Further, such measures are often essential adjuncts either before or after operation.

This volume has been written to meet the current need for a comprehensive work on operative orthopedics, not only for the specialist, but also for many industrial and general surgeons who are doing excellent work in some branches of orthopedic surgery, and are making valuable contributions to this field.

The evolution of orthopedic surgery has been exceedingly slow as compared to that of surgery in general. Not until aseptic technic had been materially refined was surgery of the bones and joints feasible. The statement is often made that the World War afforded the experience which made possible the rapid development of orthopedic surgery during the past two decades. The surgery of the war, however, was chiefly the surgery of sepsis; there was little of the refined asepsis which is required in reconstruction surgery. Undoubtedly, the demonstration during the war of the necessity and importance of this field led many able men to specialize in orthopedics, and to them considerable credit is due for its subsequent progress.

No classification of orthopedic affections is entirely satisfactory; consequently, any arrangement of operative procedures is subject to similar criticism. With the exception of the chapters on Arthroplasty and Arthrodesis, operations described in this text are grouped together according to their applicability to a given affection. This involves less repetition as to generalities of etiology, pathology and treatment than would be necessary in a classification according to anatomic location. Operative procedures appropriate to two or more affections are described in the discussion of the one wherein they are most commonly employed.

To overcome the too widespread conception of orthopedic surgery as a purely mechanical equation, an effort is made in the first chapter of this book to correlate the mechanical, surgical, and physiologic principles of orthopedic practice, and throughout the book to emphasize the practical application of these physiologic principles. A special chapter has been written on surgical technic, for the purpose of stressing certain details in preparation and aftertreatment which vary to some extent from those described in works on general surgery. A thorough knowledge of these phases of treatment is a requisite to success. To avoid constant repetition, chapters have been included on apparatus and on surgical approaches; repeated reference is made to these chapters. The after-treatment is given in detail for practically all operative technics. This is a most essential, yet too often neglected, factor in the success of any surgical treatment.

In giving the position or range of motion of a joint, only one system has been followed: With the exception of the ankle and wrist, the joint is in neutral position when parallel with the long axis of the body in the anteroposterior and lateral planes. As the joint proceeds from the neutral position in any direction, the number of degrees in which such movement is recorded decreases progressively from 180 to 170, 160, and so on, to the anatomic limit of motion in that particular direction. To illustrate, complete extension of the knee is 180 degrees; when the joint is flexed 30 degrees, the position is recorded as the angle formed between the component parts of the joint, i.e., the leg and thigh, or 150 degrees. Flexion to a right angle is 90 degrees, and full flexion 30 degrees. In the wrist, the joint is at 180 degrees, or in the neutral position, when midway between supination and pronation, and flexion and extension. In the ankle joint, motion is recorded as follows: the extreme of dorsiflexion, 75 degrees; right angle, 90 degrees; and the extreme of plantar flexion, 140 degrees.

In some instances, the exact end results have been given, to the best of our knowledge. So many factors are involved in any one condi-

tion, that a survey of end results can be of only questionable value unless the minute details of each case are considered. Following arthroplasty of the knee, for example, one must consider the etiology, pathology, position of the ankylosed joint, the structure of the bones comprising the joint, the distribution of the ankylosis, and the age of the patient, in estimating the end result in each case. Further, a true survey should include the results of *all* patients treated over a period of *many* years, and should be made by the surgeon himself, rather than by a group of assistants, or by correspondence.

In our private clinic and the hospitals with which we are associated, a sufficient amount of material on every phase of orthopedic surgery has been accumulated during the past twenty years or more to justify an evaluation of the various procedures. From this personal experience, we also feel that definite conclusions may be drawn in regard to the indications, contraindications, complications, and other considerations entering into orthopedic treatment. In all surgical cases, mature judgment is required for the selection of the most appropriate procedure. With this in mind, the technics which have proved most efficient in the author's experience have been given preference in the text. In addition, after a comprehensive search of the literature, operative measures have been selected which in the judgment of the author are most practicable.

Although no attempt has been made to produce an atlas of orthopedic surgery, an effort has been made to describe those procedures which conform to mechanical and physiologic principles and will meet all individual requirements. In any work of this nature, there are sins of omission; also, many surgeons in the same field may arrive independently at the same conclusions and devise identical procedures. We have endeavored, however, to give credit where credit was due. If there are errors, correction will gladly be made. In some of the chapters we have drawn heavily from authoritative articles on special subjects; the author gratefully acknowledges his indebtedness for this material. He also wishes to thank those authors who have so graciously granted permission for the reproduction of original drawings.

In conclusion, I cannot too deeply express my sincere appreciation and gratitude to my associate, Dr. Hugh Smith, who has untiringly and most efficiently devoted practically all of his time during the past two years to collaboration with me in the compilation and preparation of material, which alone has made this work possible. I also desire to express appreciation to Dr. J. S. Speed for his collaboration on the sections on Spastic Cerebral Paralysis and Peripheral Nerve Injuries; to Dr. Harold Boyd for anatomic dissections verifying all surgical approaches described, and for his assistance in preparing the chapter on this subject; to Dr. Don Slocum for his aid in the preparation of the chapter on Physiology and Pathology; to Mrs. Allene Jefferson for her efficient editorial services, and to Mr. Ivan Summers and Mr. Charles Ingram for their excellent illustrations.

1939 *Willis C. Campbell*

Contents

VOLUME ONE

VOLUME TWO