

THE CIBA
COLLECTION OF
MEDICAL
ILLUSTRATIONS

VOLUME 8

MUSCULOSKELETAL SYSTEM

PART II

DEVELOPMENTAL DISORDERS,
TUMORS, RHEUMATIC DISEASES,
AND JOINT REPLACEMENT

FRANK H. NETTER, M.D.

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VOLUME 8

MUSCULOSKELETAL SYSTEM

PART II

Developmental Disorders,
Tumors, Rheumatic Diseases,
and Joint Replacement

A compilation of paintings prepared

by FRANK H. NETTER, M.D.

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Prepared by
Frank H. Netter, M.D.

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Endocrine System and Selected Metabolic Diseases
Heart
Kidneys, Ureters, and Urinary Bladder
Respiratory System
Musculoskeletal System, Part I: Anatomy, Physiology, and Metabolic Disorders

See page 276 for additional information

Foreword

In 1953, as an intern at the University of Chicago, I obtained a copy of the very first of the now world-famous CIBA COLLECTION masterpieces by Frank Netter, M.D. The subject was the *Nervous System* that, after an amazing thirteen printings, is now in its second printing of a revised edition. My colleagues and I at that time and all subsequent generations of physicians over the last 35 years marveled at the artistry and extraordinary clarity of those illustrations; and how remarkably, when coupled with the short but well-written text, they provided such a clear definition of complex three-dimensional structures and confusing relationships that we had struggled sometimes in vain to comprehend. There was little doubt in our minds that we were looking at the works of a genius—not only because he saw so much and so clearly, but because he could make us see it with equal clarity. We waited, as did the world, for subsequent volumes and were not disappointed with any of the next six. The *Reproductive System*, published in 1954, the *Digestive System* in 1957, the *Endocrine System* in 1965, the *Heart* in 1969, the *Kidney, Ureters, and Urinary Bladder* in 1973, and the *Respiratory System* in 1979 all showed the same remarkable ability to portray the anatomy and embryology, physiology, pathology, and clinical states with such extraordinary clarity and in sufficient detail as to become, for each of these disciplines, major teaching and reference texts. I wonder how many times in these past 35 years a Netter illustration has been used for a lecture or demonstration in a medical school or residency classroom, and how many copies have been made of the figures to subsequently reside in teaching collections throughout the world? Surely the number must be exceeded only by the number of physicians who hold the volumes as cherished possessions and have read them over and over in a quest for knowledge or as part of a scholarly pursuit.

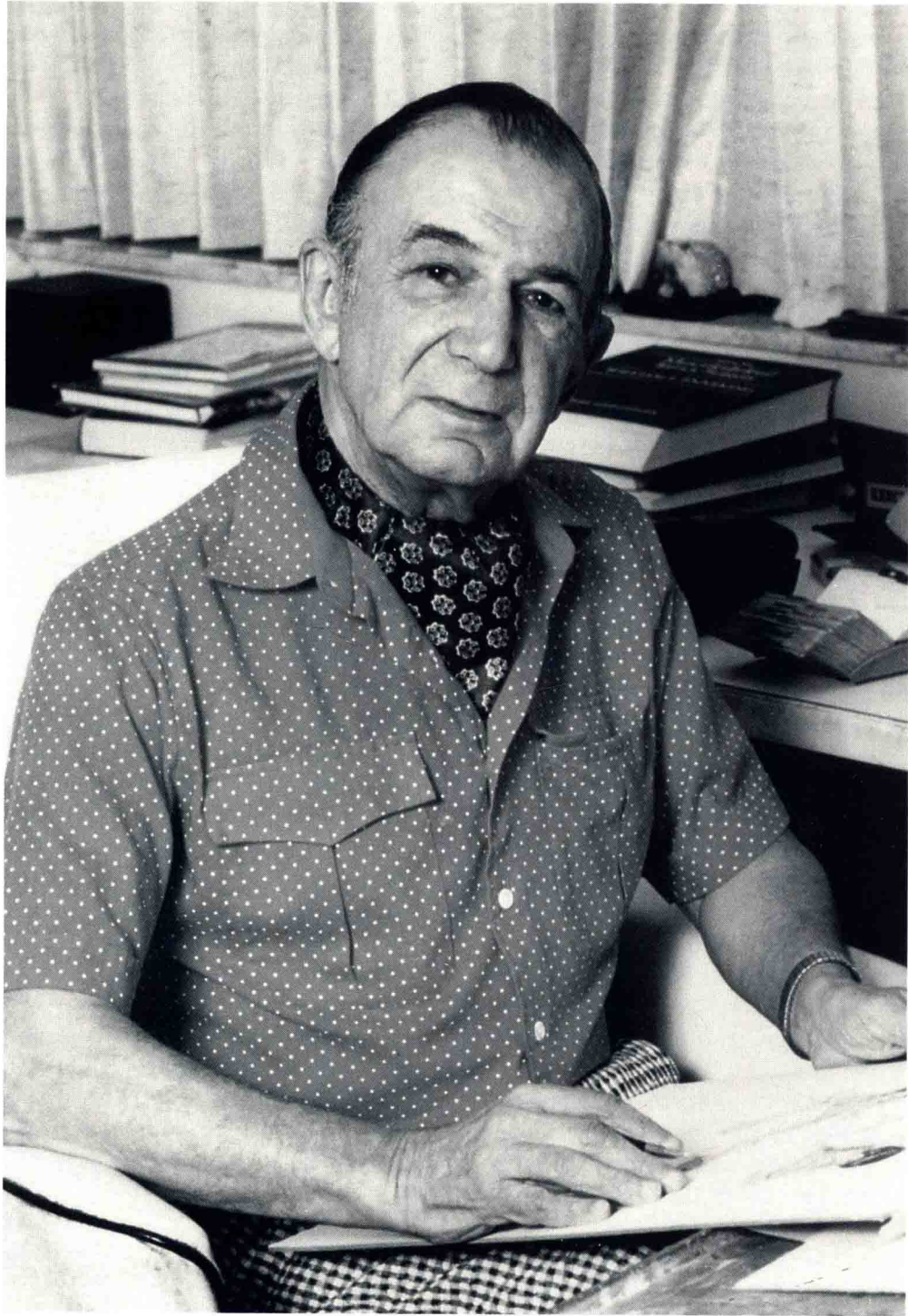
Having said that, I must express a degree of disappointment on behalf of my colleagues in Orthopaedics, Rheumatology, Physiatry, and the sciences associated with connective tissue diseases, with the evident fact that with the exception of some of the plates in Volumes 1 and 4 there were few of these teaching atlases that had any relevance to our rather sizable corner of the world of medicine. It is therefore with great enthusiasm and unbridled pleasure that our specialties now greet *Volume 8: The Musculoskeletal System*. Furthermore, after consideration of the contents and study of the magnificent plates and text, I conclude that not only was the product worth waiting for but in my opinion the three parts comprising this latest work are the author's finest! Frank Netter, M.D., has not only "done it again" but he's done it better than he ever did it before!

The *Musculoskeletal System* is one of Dr. Netter's most ambitious projects. Any of the subjects covered would seem to require a separate volume, and perhaps one of the major aspects of the genius of the artist is deciding what to include. Realizing that each plate contains several main themes and multiple facts (all nicely tied together by the artistry of the author), it is not surprising that anatomy and physiology (including metabolic disorders) are included in the 214 plates that comprise Part I; and that congenital and developmental disorders can be depicted in 111 plates, neoplasms in 34, rheumatic disorders in 73, and joint replacement surgery in another 28, all in Part II. Part III on injuries (182 plates), infections (20 plates), vascular disturbances (30 plates), and rehabilitation (20 plates) completes the set. If one totals these plates, the number exceeds 700 (what a fantastic effort even for Dr. Netter!), and with the text supplied by the numerous contributors, the three parts of Volume 8 should rapidly become classic teaching texts for our specialties.

One may wonder why Volume 8 required so many plates and so much text as compared with the other disciplines, and upon consideration, I believe the answer is self-evident. The musculoskeletal system comprises most of the body's supportive and protective elements and provides movement and prehension. The tissues included vary from the undifferentiated fibrous supporting membranes to the remarkably complex organ systems of the bones and joints, and the anatomic structures are as different as the big toe and the first cervical vertebra. While trauma is almost exclusively related to the bones and joints, metabolic bone disease involves the endocrine and renal systems; genetic disorders, other multiple organ systems; arthritis, the sciences of immunology and internal metabolism; and neoplasms, the entire field of oncology. What brings these fields together in this remarkable volume and in the scientific world is the anatomic structures and, perhaps more relevantly, the entire background framework of connective tissue chemistry, mechanical engineering, and materials science, which Dr. Netter has woven so beautifully and understandably into every section.

The students, scholars, and practitioners who deal with the musculoskeletal system have been waiting along with me since 1953 for Frank Netter's Volume 8. I don't think they will be disappointed.

HENRY J. MANKIN, M.D.
Boston, July 1987



FRANK H. NETTER, M.D.

Introduction

In my introduction to Part I of this atlas, I wrote of how awesome albeit fascinating I had found the task of pictorializing the fundamentals of the musculoskeletal system, both its normal structure as well as its multitudinous disorders and diseases. As compactly, simply, and succinctly as I tried to present the subject matter, it still required three full books (Parts I, II, and III of Volume 8 of THE CIBA COLLECTION OF MEDICAL ILLUSTRATIONS). Part I of this trilogy covered the normal anatomy, embryology, and physiology of the musculoskeletal system as well as its diverse metabolic diseases, including the various types of rickets. This book, Part II, portrays its congenital and developmental disorders, neoplasms—both benign and malignant—of bone and soft tissue, and rheumatic and other arthritic diseases, as well as joint replacement. Part III, on which I am still at work, will cover trauma, including fractures and dislocations of all the bones and joints, soft-tissue injuries, sports injuries, burns, infections including osteomyelitis and hand infections, compartment syndromes, amputations, both traumatic and surgical, replantation of limbs and digits, prostheses, and rehabilitation, as well as a number of related subjects.

As I stated in my above-mentioned previous introduction, some disorders, however, do not fit exactly into a precise classification and are therefore covered piecemeal herein under several headings. Furthermore, a considerable number of orthopedic ailments involve also the fields of neurology and neurosurgery, so that readers may find it helpful to refer in those instances to my atlases on the anatomy and pathology of the nervous system (Volume 1, Parts I and II of THE CIBA COLLECTION OF MEDICAL ILLUSTRATIONS).

Most meaningfully, however, I herewith express my sincere appreciation of the many great physicians, surgeons, orthopedists, and scientists who so graciously shared with me their knowledge and supplied me with so much material on which to base my illustrations. Without their help I could not have created this atlas. Most of these wonderful people are credited elsewhere in this book under the heading of "Acknowledgments" but I must nevertheless specifically mention a few who were not only collaborators and consultants in this undertaking but who have become my dear and esteemed friends. These are Dr. Bob Hensinger, my consulting editor, who guided me through many puzzling aspects of the organization and subject matter of this atlas; Drs. Alfred and Genevieve Swanson, pioneers in the correction of rheumatically deformed hands with silastic implants, as well as in the classification and study of congenital limb deficits; Dr. William Enneking, who has made such great advances in the diagnosis and management of bone tumors; Dr. Ernest ("Chappy") Conrad III; the late Dr. Charley Frantz, who first set me on course for this project, and Dr. Richard Freyberg, who became the consultant on the rheumatic diseases plates; Dr. George Hammond; Dr. Hugo Keim; Dr. Mack Clayton; Dr. Philip Wilson; Dr. Stuart Kozinn; and Dr. Russell Windsor.

Finally, I also sincerely thank Mr. Philip Flagler, Ms. Regina Dingle, and others of the CIBA-GEIGY organization who helped in more ways than I can describe in producing this atlas.

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Acknowledgments

Work on Volume 8, *Musculoskeletal System* began more than a decade ago, and over the years it became evident that the original plan to publish one book was unworkable. Thus, *Musculoskeletal System* evolved from a single book of 270 illustrations into a three-part volume of more than 700.

Though Part II deals with some of the musculoskeletal system's most painful and debilitating pathology, no paintings are more touchingly presented than those of children with congenital anomalies. Dr. Netter has captured in their faces and in the way they approach their individual deficits the optimism of the human spirit they so clearly epitomize. This has helped transform an arduous task into an uplifting experience for all of us involved—an unexpected bonus to help carry us through the many years of preparation.

As in previous CIBA COLLECTION volumes, we have adopted the terminology commonly used in standard American medical texts. For consistency of presentation, our primary resource has been *Blakiston's Gould Medical Dictionary*, fourth edition. The 1977 revision of the International Nomenclature of Constitutional Diseases of Bone, published in 1979 by the March of Dimes Birth Defects Foundation, is the classification used for the plates on dwarfism. For the plates on congenital limb malformations, we have used the 1964 Swanson modification of the Frantz-O'Rahilly classification.

We express our sincere thanks to all the authors who contributed their time and expertise to the development of this book. During the long period of its preparation, we had to ask them to review and rewrite their texts to reflect the advances in the current knowledge of the various disorders and their treatment. This they did with patience and understanding.

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In Section I, Dr. Steven E. Kopits supplied information on the correction of bowleg deformity in achondroplasia, shown in Plate 3, and Dr. John A. Ogden provided

the description and demonstration of the points of blood compromise, shown in Plate 56. Dr. Robert E. Eilert collaborated on the development of Plates 68–74.

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Finally, no acknowledgment would be complete without profound thanks to Dr. Netter, whose grasp of the complexities of the subject, uncanny abilities to condense and organize the details, and long-recognized conceptual and artistic talents are the very source of this book and of all its predecessors. That this has been an uplifting and heartwarming experience as well is further tribute to his greatness.

PHILIP B. FLAGLER
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Contents

SECTION I	Page
Congenital and Developmental Disorders	
<i>Dysplasias of Bone and Soft Tissue</i>	
Achondroplasia	
Plates 1–3	3–5
Hypochondroplasia	
Plate 4	6
Diastrophic Dwarfism	
Plate 5	7
Pseudoachondroplasia	
Plate 6	8
Metaphyseal Chondrodysplasias	
Plate 7	9
Chondrodysplasia Punctata	
Plate 8	10
Chondroectodermal, Grebe, and Acromesomelic Dysplasias	
Plate 9	11
Multiple Epiphyseal Dysplasia	
Plate 10	12
Pycnodysostosis	
Plate 11	13
Campomelic Dysplasia	
Plate 12	14
Spondyloepiphyseal Dysplasia Tarda and Congenita	
Plate 13	15
Spondylocostal Dysostosis; Dyggve-Melchior-Clausen Dysplasia	
Plate 14	16
Kniest Dysplasia	
Plate 15	17
Mucopolysaccharidoses	
Plate 16	18
Cutaneous Lesions in Neurofibromatosis	
Plate 17	19
Spinal Deformities in Neurofibromatosis	
Plate 18	20
Bone Overgrowth and Erosion in Neurofibromatosis	
Plate 19	21
Arthrogryposis Multiplex Congenita	
Plate 20	22
Myositis Ossificans Progressiva; Progressive Diaphyseal Dysplasia	
Plate 21	23
Osteopetrosis; Osteopoikilosis	
Plate 22	24
Melorheostosis	
Plate 23	25

SECTION I (continued)	Page
<i>Deformities of Spine</i>	
Congenital Anomalies of Occipitocervical Junction	
Plates 24–25	26–27
Synostosis of Cervical Spine	
Plate 26	28
Congenital Muscular Torticollis	
Plate 27	29
Nonmuscular Causes of Torticollis	
Plate 28	30
Pathologic Anatomy of Scoliosis	
Plate 29	31
Scoliosis Curve Patterns	
Plate 30	32
Congenital Scoliosis	
Plate 31	33
Clinical Evaluation of Scoliosis	
Plate 32	34
Determination of Skeletal Maturation; Measurements of Curvature and Rotation	
Plate 33	35
Braces for Scoliosis	
Plate 34	36
Scheuermann's Disease	
Plate 35	37
Congenital Kyphosis	
Plate 36	38
Spondylolysis and Spondylolisthesis	
Plate 37	39
Myelodysplasia	
Plate 38	40
Lumbosacral Agenesis	
Plate 39	41
<i>Deformities of Upper Limb</i>	
Congenital Elevation of Scapula, Absence of Clavicle, and Pseudarthrosis of Clavicle	
Plate 40	42
Kienböck's Disease	
Plate 41	43
Panner's Disease	
Plate 42	44
Madelung's Deformity	
Plate 43	45
Congenital Radioulnar Synostosis	
Plate 44	46
Congenital Dislocation of Radial Head	
Plate 45	47
<i>Deformities of Hip and Proximal Femur</i>	
Radiographic Classification of Proximal Femoral Focal Deficiency	
Plate 46	48
Proximal Femoral Focal Deficiency	
Plates 47–48	49–50

SECTION I (continued)	Page
Congenital Short Femur With Coxa Vara	
Plate 49	51
Recognition of Congenital Dislocation of Hip	
Plate 50	52
Clinical Findings in Congenital Dislocation of Hip	
Plate 51	53
Radiographic Evaluation of Congenital Dislocation of Hip	
Plate 52	54
Adaptive Changes in Dislocated Hip That Interfere With Reduction	
Plate 53	55
Positioning Devices Used in Treatment of Congenital Dislocation of Hip	
Plate 54	56
Device for Treatment of Clinically Reducible Dislocation of Hip	
Plate 55	57
Blood Supply to Femoral Head in Infancy	
Plate 56	58
Pathogenesis of Legg-Calvé-Perthes Disease	
Plate 57	59
Physical Examination in Legg-Calvé-Perthes Disease	
Plates 58–59	60–61
Catterall and Salter-Thompson Classifications of Legg-Calvé-Perthes Disease and Corresponding Radiographs	
Plates 60–61	62–65
Conservative Management in Legg-Calvé-Perthes Disease	
Plates 62–63	66–67
Femoral Varus Derotational Osteotomy	
Plate 64	68
Innominate Osteotomy	
Plate 65	69
Slipped Capital Femoral Epiphysis	
Plate 66	70
Pin Fixation in Slipped Capital Femoral Epiphysis	
Plate 67	71
 <i>Deformities of Knee</i>	
Disorders of Patella	
Plates 68–70	72–74
Congenital Meniscal Variations; Meniscal Tears	
Plate 71	75
Synovial Plica	
Plate 72	76
Osteochondritis Dissecans	
Plates 73–74	77–78
Osgood-Schlatter Lesion	
Plate 75	79
 <i>Deformities of Lower Limb</i>	
Congenital Bowing of Tibia	
Plate 76	80

SECTION I (continued)	Page
Congenital Pseudarthrosis of Tibia and Dislocation of Knee	
Plate 77	81
Bowleg and Knock-knee	
Plate 78	82
Blount's Disease	
Plate 79	83
Rotational Deformities of Lower Limb: Toeing In and Toeing Out	
Plates 80–81	85–86
Limb-Length Discrepancy	
Plate 82	87
Enchondromatosis	
Plate 83	88
Charts for Timing Growth Arrest and Determining Amount of Limb Lengthening to Achieve Limb-Length Equality at Maturity	
Plate 84	89
Growth Arrest; Growth Retardation	
Plate 85	90
Wagner Technique for Limb Lengthening	
Plate 86	91
Ilizarov and De Bastiani Techniques for Limb Lengthening	
Plate 87	92
 <i>Deformities of Foot</i>	
Congenital Clubfoot	
Plate 88	93
Corrective Manipulation for Congenital Clubfoot	
Plate 89	94
Congenital Vertical Talus	
Plate 90	95
Cavovarus	
Plate 91	96
Calcaneovalgus and Planovalgus	
Plate 92	97
Tarsal Coalition	
Plates 93–94	98–99
Accessory Navicular	
Plate 95	100
Congenital Toe Deformities	
Plate 96	101
Freiberg's Disease	
Plate 97	102
Köhler's Disease I	
Plate 98	103
 <i>Congenital Limb Malformation</i>	
Foot Prehensility in Amelia	
Plate 99	104
Transverse Arrest: Transmetacarpal and Transtarsal Amputation Type	
Plate 100	105

SECTION I (continued)	Page
Transverse Arrest: Wrist Disarticulation Type Plate 101	106
Transverse Arrest: Forearm Amputation Type Plate 102	107
Transverse Arrest: Above-Elbow Amputation Type Plate 103	108
Transverse Arrest: Shoulder Disarticulation Type Plate 104	109
Transverse Arrest: Below-Knee and Above-Knee Amputation Type Plate 105	110
Transverse Arrest: Hip Disarticulation Type Plate 106	111
Longitudinal Arrest: Radial Deficiency Plate 107	112
Longitudinal Arrest: Ulnar Deficiency Plate 108	113
Longitudinal Arrest: Central Deficiency Plate 109	114
Longitudinal Arrest: Intersegmental Deficiency Plate 110	115
Syndactyly; Polydactyly; Macrodactyly; Constriction Band Syndrome Plate 111	116

SECTION II

Tumors of Musculoskeletal System

Staging of Musculoskeletal Tumors Plate 1	119
--	-----

Benign Tumors of Bone

Osteoid Osteoma Plate 2	120
Osteoma Plate 3	121
Osteoblastoma Plate 4	122
Enchondroma Plate 5	123
Periosteal Chondroma Plate 6	124
Osteocartilaginous Exostosis Plate 7	125
Chondroblastoma; Chondromyxoid Fibroma Plate 8	126
Fibrous Dysplasia Plate 9	127
Nonossifying and Desmoplastic Fibromas Plate 10	128
Eosinophilic Granuloma Plate 11	129

SECTION II (continued)	Page
Aneurysmal Bone Cyst Plate 12	130
Simple Bone Cyst Plate 13	131
Giant-Cell Tumor of Bone Plate 14	132

Malignant Tumors of Bone

Osteosarcoma Plates 15–16	133–134
Parosteal and Periosteal Osteosarcomas Plate 17	135
Chondrosarcoma Plate 18	136
Malignant Fibrous Histiocytoma and Fibrosarcoma of Bone Plate 19	137
Ewing's Sarcoma Plate 20	139
Myeloma; Reticulum-Cell Sarcoma Plate 21	140
Adamantinoma; Giant-Cell Sarcoma Plate 22	141
Tumors Metastatic to Bone Plate 23	142

Benign Tumors of Soft Tissue

Fibroma; Fibromatosis; Hemangioma Plate 24	143
Lipoma; Neurofibroma; Myositis Ossificans Plate 25	144

Malignant Tumors of Soft Tissue

Malignant Fibrous Histiocytoma and Fibrosarcoma of Soft Tissue Plate 26	145
Synovial Sarcoma; Liposarcoma Plate 27	146
Neurosarcoma; Myosarcoma; Angiosarcoma Plate 28	147

Evaluation and Treatment

Tumor Biopsy Plate 29	148
Surgical Margins for Musculoskeletal Tumors Plate 30	149
Reconstruction or Stabilization After Partial Excision or Curettage Plate 31	150
Limb-Salvage Procedures for Reconstruction of Joint After Resection for Tumor Plate 32	151

SECTION II (continued)	Page
Limb-Salvage Procedures for Reconstruction of Diaphysis After Resection for Tumor <i>Plate 33</i>	152
Tikhoff-Linberg Procedure for Tumors of Scapula and Proximal Humerus; Rotationplasty for Sarcoma of Distal Femur <i>Plate 34</i>	153

SECTION III

Rheumatic Diseases

Joint Pathology in Rheumatoid Arthritis <i>Plate 1</i>	157
Early and Moderate Hand Involvement in Rheumatoid Arthritis <i>Plate 2</i>	158
Advanced Hand Involvement in Rheumatoid Arthritis <i>Plate 3</i>	159
Foot Involvement in Rheumatoid Arthritis <i>Plate 4</i>	160
Knee, Shoulder, and Hip Joint Involvement in Rheumatoid Arthritis <i>Plate 5</i>	161
Extraarticular Manifestations in Rheumatoid Arthritis <i>Plates 6–7</i>	162–163
Immunologic Features in Rheumatoid Arthritis <i>Plate 8</i>	164
Variable Clinical Course of Adult Rheumatoid Arthritis <i>Plate 9</i>	165
Physical Therapy for Arthritis <i>Plate 10</i>	166
Exercises for Upper Limbs <i>Plate 11</i>	167
Exercises for Shoulders and Lower Limbs <i>Plate 12</i>	168
Devices Used to Rest Inflamed Joints and Prevent Deformities <i>Plate 13</i>	169
Techniques for Aspiration of Joint Fluid <i>Plate 14</i>	170
Synovial Fluid Examination <i>Plates 15–16</i>	171–172
Systemic Juvenile Arthritis <i>Plate 17</i>	173
Joint Involvement in Juvenile Arthritis <i>Plate 18</i>	175
Ocular Manifestations in Juvenile Arthritis <i>Plate 19</i>	176
Sequelae of Juvenile Arthritis <i>Plate 20</i>	177
Joint Pathology in Osteoarthritis <i>Plate 21</i>	178

SECTION III (continued)	Page
Hand Involvement in Osteoarthritis <i>Plate 22</i>	179
Hip Joint Involvement in Osteoarthritis <i>Plate 23</i>	180
Spine Involvement in Osteoarthritis <i>Plate 24</i>	181
Ankylosing Spondylitis <i>Plates 25–26</i>	182–183
Psoriatic Arthritis <i>Plate 27</i>	184
Reiter's Syndrome <i>Plate 28</i>	185
Infectious Arthritis <i>Plate 29</i>	186
Tuberculous Arthritis <i>Plate 30</i>	187
Hemophilic Arthritis <i>Plate 31</i>	188
Neuropathic Joint Disease <i>Plate 32</i>	189
Gouty Arthritis <i>Plates 33–34</i>	190–191
Articular Chondrocalcinosis <i>Plate 35</i>	192
Nonarticular Rheumatism <i>Plate 36</i>	193
Polymyalgia Rheumatica; Giant-Cell Arteritis <i>Plate 37</i>	194
Tendonitis and Bursitis of Shoulder <i>Plate 38</i>	195
Surgery for Acute and Chronic Calcific Tendonitis and Bursitis of Shoulder <i>Plate 39</i>	196
Open Acromioplasty <i>Plate 40</i>	197
Arthroscopic Acromioplasty <i>Plate 41</i>	198
Adhesive Capsulitis of Shoulder <i>Plate 42</i>	199
Exercises for Adhesive Capsulitis of Shoulder <i>Plate 43</i>	200
Tears and Ruptures of Rotator Cuff <i>Plate 44</i>	201
Rupture of Biceps Brachii Muscle <i>Plate 45</i>	202
De Quervain's Disease <i>Plate 46</i>	203
Trigger Finger; Ganglion of Wrist <i>Plate 47</i>	204
Dupuytren's Contracture <i>Plate 48</i>	205
Pigmented Villonodular Synovitis; Meniscal Cysts <i>Plate 49</i>	206
Forefoot Deformities in Rheumatoid Arthritis <i>Plate 50</i>	207

SECTION III (continued)	Page
Conservative Management of Rheumatoid Foot Deformities	
<i>Plate 51</i>	208
Surgical Reconstruction of Severe Rheumatoid Forefoot Deformity	
<i>Plate 52</i>	209
Plantar Ligament Interpositional Arthroplasty for Lesser Toes; Capsular Interpositional Arthroplasty for Great Toe	
<i>Plate 53</i>	210
Silicone Implant Resection Arthroplasty for Rheumatoid Forefoot Deformity	
<i>Plate 54</i>	211
Postoperative Care After Forefoot Reconstruction	
<i>Plate 55</i>	212
Results of Forefoot Reconstruction	
<i>Plate 56</i>	213
Hindfoot Deformities in Rheumatoid Arthritis	
<i>Plate 57</i>	214
Surgical Procedures for Hindfoot Deformities	
<i>Plate 58</i>	215
Surgical Procedures for Toe Deformities	
<i>Plate 59</i>	216
Bunion, Hallux Valgus, and Metatarsus Primus Varus	
<i>Plate 60</i>	217
McBride Operation for Bunion; Mitchell Osteotomy-Bunionectomy; McKeever Operation for Hallux Valgus	
<i>Plate 61</i>	218
Deformities of Metacarpophalangeal Joint	
<i>Plate 62</i>	219
Implant Resection Arthroplasty for Metacarpophalangeal Joints	
<i>Plates 63–64</i>	220–221
Implant Resection Arthroplasty for Proximal Interphalangeal Joint	
<i>Plate 65</i>	222
Reconstruction of Swan-neck and Boutonniere Deformities	
<i>Plate 66</i>	223
Metacarpophalangeal Deformities of Thumb	
<i>Plate 67</i>	224
Implant Resection Arthroplasty for Trapezium	
<i>Plate 68</i>	225
Implant Resection Arthroplasty for Scaphoid	
<i>Plate 69</i>	226
Implant Resection Arthroplasty for Lunate	
<i>Plate 70</i>	227
Implant Resection Arthroplasty for Radiocarpal Joint	
<i>Plates 71–72</i>	228–229
Implant Resection Arthroplasty for Distal Radioulnar Joint	
<i>Plate 73</i>	230

SECTION IV	Page
Joint Replacement	
<i>Total Hip Replacement</i>	
Prostheses for Total Hip Replacement	
<i>Plate 1</i>	235
Technique for Total Hip Replacement	
<i>Plates 2–6</i>	236–240
Dysplastic Acetabulum	
<i>Plate 7</i>	241
Protrusio Acetabuli	
<i>Plate 8</i>	242
Loosening of Femoral Component	
<i>Plate 9</i>	243
Fractures of Femur and Femoral Component	
<i>Plate 10</i>	244
Loosening of Acetabular Component; Dislocation of Total Hip Prosthesis	
<i>Plate 11</i>	245
Infection	
<i>Plate 12</i>	246
Bipolar Prosthesis for Hemiarthroplasty of Hip	
<i>Plate 13</i>	247
Intertrochanteric Osteotomy	
<i>Plate 14</i>	248
<i>Total Knee Replacement</i>	
Total Condylar Knee Prosthesis	
<i>Plate 15</i>	249
Posterior Stabilized Knee Prosthesis	
<i>Plate 16</i>	250
Technique for Total Knee Replacement	
<i>Plates 17–21</i>	251–255
Medial Release for Varus Deformity of Knee	
<i>Plate 22</i>	256
Lateral Release for Valgus Deformity of Knee	
<i>Plate 23</i>	257
High Tibial Osteotomy for Varus Deformity of Knee	
<i>Plate 24</i>	258
<i>Total Shoulder Replacement</i>	
Total Shoulder Replacement	
<i>Plate 25</i>	259
Exercises Following Total Shoulder Replacement	
<i>Plate 26</i>	260
<i>Elbow Reconstruction</i>	
Radial Head Implant Arthroplasty; Total Elbow Replacement	
<i>Plates 27–28</i>	261–262
Selected References	263–269
Subject Index	270–275