Primer on the Rheumatic Diseases

THIRTEENTH EDITION

Primer on the Rheumatic Diseases

THIRTEENTH EDITION

Edited by

JOHN H. KLIPPEL, MD

John H. Stone, MD, MPH

Leslie J. Crofford, MD

Patience H. White, MD, MA

John H. Klippel, MD
President and CEO
Arthritis Foundation
Atlanta, GA, USA

Leslie J. Crofford, MD
Gloria W. Singletary Professor of
Internal Medicine
Chief, Division of Rheumatology &
Women's Health
University of Kentucky
Lexington, KY, USA

John H. Stone, MD, MPH
Associate Physician
Massachusetts General Hospital
Deputy Editor for Rheumatology
UpToDate
Boston, MA, USA

Patience H. White, MD, MA
Chief Public Health Officer
Arthritis Foundation
Atlanta, GA, USA

Library of Congress Control Number: 2007925709

ISBN: 978-0-387-35664-8 e-ISBN: 978-0-387-68566-3

Printed on acid-free paper

© Springer Science+Business Media, LLC. 2008

All rights reserved. This work may not be translated or copied in whole or in part without the written permission of the publisher (Springer Science+Business Media, LLC, 233 Spring Street, New York, NY 10013, USA), except for brief excerpts in connection with reviews or scholarly analysis. Use in connection with form of information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed is forbidden.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of going to press, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

9 8 7 6 5 4 3 2 1

springer.com

The 13th edition of the *Primer on the Rheumatic Diseases* is an extraordinary handbook for clinical care. The *Primer* will educate trainees, update established clinicians, and help health care providers from all walks of the profession provide better care for patients with arthritis and rheumatic diseases.

In achieving these purposes, the *Primer* continues a tradition of excellence dating back more than 70 years. The *Primer* and its precursors have served as a major learning tool for medical students, house officers, fellows, and allied health professionals since 1934, when the early publications of the American Committee for the Control of Rheumatism included the *Primer on Rheumatism: Chronic Arthritis* in 1934. Since that work, which consisted of a 52-page brochure, the *Primer* has evolved into a reference guide of nearly 90 chapters and 4 appendices.

The *Primer* is designed to provide up-to-date information about the major clinical syndromes seen by primary care physicians, rheumatologists, orthopedic surgeons, as well as physician assistants, nurse practitioners, physical and occupational therapists, and allied health professionals whose expertise contributes to patient care. Emphasis on the evaluation of the patient, the physical examination including musculoskeletal signs and symptoms, laboratory and imaging evaluations, and current and novel therapeutic approaches are essential for all who work in this field. Arthritis and other rheumatic diseases, which affect more than 46 million Americans (including 300,000 children), remain a leading cause of disability and the most common chronic illness in the United States.

I congratulate the editors on their superb work. In addition, the multiple contributors—many of whom are members of the American College of Rheumatology—should be thanked for their scholarly contributions to the *Primer*. Rheumatology has never been more exciting than it is today, and there is no doubt that the 13th edition of the *Primer* reflects this. I join clinicians and patients alike in thanking the Arthritis Foundation for the continuing achievements of this book.

MICHAEL E. WEINBLATT, MD
Professor of Medicine
Harvard Medical School
Brigham and Women's Hospital
Boston, MA, USA

Students, residents, and fellows interested in learning about the rheumatic diseases are faced with the daunting challenge of trying to integrate learning about a multitude of fascinating and diverse clinical disorders with an ever-expanding and complex body of basic science.

This need encapsulates the principal rationale for the major changes in the 13th edition of *The Primer on the Rheumatic Diseases*. Although the first part of all recent editions of *The Primer* have summarized succinctly the physiology of tissues and cells that mediate inflammation and musculoskeletal disease, preparation of the new edition resulted in the identification of two major problems with this “tried-and-true” formula. First, for readers who really wished to understand the molecular basis of rheumatic disease to the depth that would facilitate laboratory research and improve patient care, the initial chapters no longer provided sufficient detail. Second, for readers seeking an introduction or update within the clinical realm of rheumatic disorders, the first part of *The Primer* bore virtually no relation to the diseases described so engagingly in the rest of the book. In short, in this era of increasing integration between the basic and clinical sciences, the preliminary *Primer* chapters were at risk for becoming simply the pages thumbed through quickly to get to the good stuff.

Therefore, in the 13th edition, the clinical descriptions that *The Primer* has always done best have been augmented by including the clinically relevant basic science components in the same sections. Thus, for each major rheumatic disease—for example, rheumatoid arthritis, osteoarthritis, systemic lupus erythematosus, and idiopathic inflammatory myopathies—the chapter describing the clinical and epidemiological features is accompanied by another chapter devoted to “Pathology and Pathogenesis.” This second chapter incorporates the appropriate (and updated) elements from previous *Primer* chapters entitled “Synovium,” “Articular Cartilage,” “The Complement System,” and “Muscle” that are essential to understanding a particular disease today.

Moreover, this fundamental change in the contents is only the beginning of the improvements to the 13th edition. Other changes include:

- New chapters on “Clinical Immunology” and “Applied Genetics” designed to heighten the translational nature of the book.
- Color figures that are particularly important for depicting cutaneous findings and histopathology.
- An expanded chapter on the cutaneous manifestations of disease, emphasizing the types of disorders rheumatologists often see in consultation.
- A section devoted entirely to juvenile inflammatory arthritis, with individual chapters on “Clinical Features,” “Pathology and Pathogenesis,” “Treatment and Assessment,” and “Special Considerations.”
- Separate chapters on ankylosing spondylitis and the reactive and enteropathic arthropathies, once lumped together (with psoriatic arthritis) as “seronegative spondyloarthropathies.”

- A tripling of the text devoted to psoriatic arthritis, an acknowledgement of the substantial treatment advances in that disorder.
- Individual chapters (and more than doubling of the text) to the metabolic and inflammatory myopathies, once included in the same chapter.
- Reorganization of the vasculitis section along more rational and all-inclusive lines, with a chapter entitled “ANCA-Associated Vasculitis” that addresses together Wegener’s granulomatosis, microscopic polyangiitis, and the Churg-Strauss syndrome, disorders with striking similarities but important contrasts.
- Now entering its eighth decade, *The Primer* has rejected strongly the notion that “If it ain’t broke, don’t fix it.” In view of the recent remarkable strides in understanding and treating rheumatic disease, students, trainees, and practicing clinicians all need a standard textbook that can change with the times and reflect these advances. *The Primer* continues to fill that need. Read, learn, and enjoy.

John H. Klippel, MD

John H. Stone, MD, MPH

Leslie J. Crofford, MD

Patience H. White, MD, MA

Foreword by Michael E. Weinblatt	v
Preface	vii
Contributors	xv
1. Public Health and Arthritis: A Growing Imperative	1
PATIENCE H. WHITE AND ROWLAND W. CHANG	
2. Evaluation of the Patient	6
A. History and Physical Examination	6
DAVID B. ROBINSON AND HANI S. EL-GABALAWY	
B. Laboratory Assessment	15
KERSTIN MOREHEAD	
C. Arthrocentesis, Synovial Fluid Analysis, and Synovial Biopsy	21
KENNETH H. FYE	
D. Imaging of Rheumatologic Diseases	28
WILLIAM W. SCOTT, JR., WILLIAM J. DIDIE, AND LAURA M. FAYAD	
3. Musculoskeletal Signs and Symptoms	42
A. Monarticular Joint Disease	42
H. RALPH SCHUMACHER AND LAN X. CHEN	
B. Polyarticular Joint Disease	47
STERLING WEST	
C. Neck and Back Pain	58
DAVID BORENSTEIN	
D. Regional Rheumatic Pain Syndromes	68
JOSEPH J. BIUNDO, JR.	
E. The Fibromyalgia Syndrome	87
DINA DADABHOY AND DANIEL J. CLAUW	
4. Molecular and Cellular Basis of Immunity and Immunological Diseases	94
KEVIN ELIAS, RICHARD SIEGEL, AND JOHN J. O'SHEA	
5. Genetics and Disease	108
JAMES KELLEY AND ROBERT P. KIMBERLY	
6. Rheumatoid Arthritis	114
A. Clinical and Laboratory Manifestations	114
CHRISTOPHER V. TEHLIRIAN AND JOAN M. BATHON	

B. Epidemiology, Pathology, and Pathogenesis	122
JEAN-MARC WALDBURGER AND GARY S. FIRESTEIN	
C. Treatment and Assessment	133
ALYCE M. OLIVER AND E. WILLIAM ST. CLAIR	
7. Juvenile Idiopathic Arthritis	142
A. Clinical Features	142
DANIEL J. LOVELL	
B. Pathology and Pathogenesis	149
PATRICIA WOO	
C. Treatment and Assessment	154
PHILIP J. HASHKES AND RONALD M. LAXER	
D. Special Considerations	163
CAROL B. LINDSLEY	
8. Psoriatic Arthritis	170
A. Clinical Features	170
DAFNA D. GLADMAN	
B. Pathology and Pathogenesis	178
CHRISTOPHER RITCHLIN	
C. Treatment and Assessment	185
PHILIP J. MEASE	
9. Ankylosing Spondylitis	193
A. Clinical Features	193
DÉSIRÉE VAN DER HEIJDE	
B. Pathology and Pathogenesis	200
JUERGEN BRAUN	
C. Treatment and Assessment	209
JOHN C. DAVIS, JR.	
10. Reactive and Enteropathic Arthritis	217
ROBERT D. INMAN	
11. Osteoarthritis	224
A. Clinical Features	224
PAUL DIEPPE	
B. Pathology and Pathogenesis	229
FRANCIS BERENBAUM	
C. Treatment	235
LEENA SHARMA	
12. Gout	241
A. Clinical Features	241
N. LAWRENCE EDWARDS	

B. Epidemiology, Pathology, and Pathogenesis	250
HYON K. CHOI	
C. Treatment	258
ROBERT A. TERKELTAUB	
13. Calcium Pyrophosphate Dihydrate, Hydroxyapatite, and Miscellaneous Crystals	263
GERALDINE MCCARTHY	
14. Infectious Disorders	271
A. Septic Arthritis	271
GEORGE HO, JR.	
B. Viral Arthritis	277
LEONARD H. CALABRESE	
C. Lyme Disease	282
LINDA K. BOCKENSTEDT	
D. Mycobacterial, Fungal, and Parasitic Arthritis	290
STEVEN R. Ytterberg	
E. Rheumatic Fever	297
STANFORD SHULMAN AND PREETI JAGGI	
15. Systemic Lupus Erythematosus	303
A. Clinical and Laboratory Features	303
JILL P. BUYON	
B. Epidemiology, Pathology, and Pathogenesis	319
DAVID S. PISETSKY	
C. Treatment and Assessment	327
SUSAN MANZI AND AMY H. KAO	
16. Antiphospholipid Syndrome	339
MICHELLE PETRI	
17. Systemic Sclerosis	343
A. Clinical Features	343
MAUREEN D. MAYES	
B. Epidemiology, Pathology, and Pathogenesis	351
JOHN VARGA	
C. Treatment and Assessment	359
MAYA H. BUCH AND JAMES R. SEIBOLD	
18. Idiopathic Inflammatory Myopathies	363
A. Clinical Features	363
ROBERT L. WORTMANN	

B. Pathology and Pathogenesis	368
LISA G. RIDER AND FREDERICK W. MILLER	
C. Treatment and Assessment	375
CHESTER V. ODDIS	
19. Metabolic Myopathies	381
ALAN N. BAER	
20. Sjögren's Syndrome	389
TROY DANIELS	
21. Vasculitides	398
A. Giant Cell Arteritis, Polymyalgia Rheumatica, and Takayasu's Arteritis	398
CORNELIA M. WEYAND AND JÖRG J. GORONZY	
B. Polyarteritis Nodosa	410
KEITH T. ROTT	
C. The Antineutrophil Cytoplasmic Antibody–Associated Vasculitides: Wegener's Granulomatosis, Microscopic Polyangiitis, and the Churg–Strauss Syndrome	416
JOHN H. STONE	
D. Immune Complex–Mediated Vasculitis	427
PHILIP SEO	
E. Miscellaneous Vasculitis (Behçet's Disease, Primary Angiitis of the Central Nervous System, Cogan's Syndrome, and Erythema Elevatum Diutinum)	435
KENNETH T. CALAMIA AND CARLO SALVARANI	
F. Kawasaki's Disease	444
BARRY L. MYONES	
22. Relapsing Polychondritis	451
HARVINDER S. LUTHRA	
23. Adult-Onset Still's Disease	455
JOHN M. ESDAILE	
24. Periodic Syndromes	460
JOHN G. RYAN AND DANIEL L. KASTNER	
25. Less Common Arthropathies	470
A. Hematologic and Malignant Disorders	470
ADEL G. FAM	
B. Rheumatic Disease and Endocrinopathies	479
PETER A. MERKEL	
C. Hyperlipoproteinemia and Arthritis	484
ROBERT F. SPIERA	

D. Neuropathic Arthropathy	488
ANN K. ROSENTHAL	
E. Dermatologic Disorders	492
JEFFREY P. CALLEN	
F. Hypertrophic Osteoarthropathy	504
MANUEL MARTINEZ-LAVIN	
26. Complex Regional Pain Syndrome	509
GEOFFREY LITTLEJOHN	
27. Sarcoidosis	514
EDWARD S. CHEN	
28. Storage and Deposition Diseases	523
DUNCAN A. GORDON	
29. The Amyloidoses	533
PASHA SARRAF AND JONATHAN KAY	
30. Neoplasms of the Joint	543
ANDREW J. COOPER, JAMES D. REEVES, AND SEAN P. SCULLY	
31. Heritable Disorders of Connective Tissue	549
REED EDWIN PYERITZ	
32. Bone and Joint Dysplasias	559
WILLIAM A. HORTON	
33. Osteonecrosis	565
THORSTEN M. SEYLER, DAVID MARKER, AND MICHAEL A. MONT	
34. Paget's Disease of Bone	573
ROY D. ALTMAN	
35. Osteoporosis	576
A. Epidemiology and Clinical Assessment	576
KENNETH G. SAAG	
B. Pathology and Pathophysiology	584
PHILIP SAMBROOK	
C. Treatment of Postmenopausal Osteoporosis	592
NELSON B. WATTS	
36. Rehabilitation of Patients with Rheumatic Diseases	599
THOMAS D. BEARDMORE	
37. Psychosocial Factors in Arthritis	609
ALEX ZAUTRA AND DENISE KRUSZEWSKI	
38. Self-Management Strategies	614
TERESA J. BRADY	
39. Pain Management	620
JOHN B. WINFIELD	

40. Therapeutic Injections of Joints and Soft Tissues	628
JUAN J. CANOSO	
41. Nonsteroidal Anti-Inflammatory Drugs	634
LESLIE J. CROFFORD	
42. Glucocorticoids	644
FRANK BUTTGEREIT AND GERD-RÜDIGER BURMESTER	
43. Operative Treatment of Arthritis	651
JOSEPH A. BUCKWALTER AND W. TIMOTHY BALLARD	
44. Complementary and Alternative Therapies	664
ERIN L. ARNOLD AND WILLIAM J. ARNOLD	
Appendix I. Criteria for the Classification and Diagnosis of the Rheumatic Diseases	669
Appendix II. Guidelines for the Management of Rheumatic Diseases	683
Appendix III. Supplement and Vitamin and Mineral Guide	691
Index	703

Roy D. Altman, MD

Professor, Department of Medicine/Rheumatology and Immunology, University of California, Los Angeles, Los Angeles, CA, USA

Erin L. Arnold, MD

Partner/Rheumatologist, Illinois Bone and Joint Institute, The Center for Arthritis and Osteoporosis, Morton Grove, IL, USA

William J. Arnold, MD

Partner/Rheumatologist, Illinois Bone and Joint Institute, The Center for Arthritis and Osteoporosis, Morton Grove, IL, USA

Alan N. Baer, MD

Associate Professor, Department of Medicine, Chief, Section of Rheumatology, University at Buffalo, State University of New York, Buffalo, NY, USA

W. Timothy Ballard, MD

Director, Joint Replacement Center, Department of Orthopaedics, Memorial Hospital, Chattanooga, TN, USA

Joan M. Bathon, MD

Professor, Department of Medicine, Director, Johns Hopkins Arthritis Center, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Thomas D. Beardmore, MD, FACP, FACR

Chief, Department of Rheumatology, Rancho Los Amigos National Rehabilitation Center, Downey, CA; Professor, Department of Medicine, Keck School of Medicine, The University of Southern California, Los Angeles, CA, USA

Francis Berenbaum, MD, PhD

Professor, Department of Rheumatology, Saint-Antoine Hospital; University Pierre & Marie Curie, Paris, France

Joseph J. Biundo, Jr., MD

Clinical Professor, Department of Medicine, Tulane University School of Medicine, Kenner, LA, USA

Linda K. Bockenstedt, MD

Professor, Department of Internal Medicine, Yale University School of Medicine, New Haven, CT, USA

David Borenstein, MD

Clinical Professor of Medicine, The George Washington University Medical Center; Arthritis and Rheumatism Associates, Washington, DC, USA

Teresa J. Brady, PhD

Senior Behavioral Scientist, Arthritis Program, Centers for Disease Control and Prevention, Atlanta, GA, USA

Juergen Braun, MD

Professor, Department of Rheumatology, Rheumazentrum Ruhrgebiet, Herne, Germany

Maya H. Buch, MBChB, MRCP

Clinical Lecturer and Research Fellow, University of Michigan Scleroderma Program, University of Michigan Health System, Ann Arbor, MI, USA; Academic Unit of Musculoskeletal Disease, University of Leeds, UK

Joseph A. Buckwalter, MS, MD

Professor and Head, Orthopedic Surgery, Department of Orthopaedics and Rehabilitation, University of Iowa, Iowa City, IA, USA

Gerd-Rüdiger Burmester, MD

Professor, Department of Rheumatology and Clinical Immunology, Charité University Hospital, Berlin, Germany

Frank Buttgerit, MD

Professor, Department of Rheumatology and Clinical Immunology, Charité University Hospital, Berlin, Germany

Jill P. Buyon, MD

Professor, Department of Medicine, Division of Rheumatology, New York University School of Medicine, New York, NY; Director, Lupus Clinic, New York University Hospital for Joint Diseases, New York, NY, USA

Leonard H. Calabrese, DO

Professor, Department of Rheumatic and Immunologic Diseases, Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland Clinic Foundation, Cleveland, OH, USA

Kenneth T. Calamia, MD

Associate Professor, Department of Medicine, Division of Rheumatology, Mayo Clinic College of Medicine, Jacksonville, FL, USA

Jeffrey P. Callen, MD

Professor, Department of Medicine (Dermatology); Chief, Division of Dermatology, University of Louisville School of Medicine, Louisville, KY, USA

Juan J. Canoso, MD, FACP, MACR
Attending, American British Cowdray Medical Center,
Mexico City, Mexico

Rowland W. Chang, MD, MPH
Professor of Preventive Medicine, Medicine, and Physical
Medicine and Rehabilitation; Director, Program in Public
Health, Northwestern University, Feinberg School of
Medicine, Chicago, IL, USA

Edward S. Chen, MD
Assistant Professor, Department of Medicine, Division of
Pulmonary and Critical Care Medicine, Johns Hopkins
University School of Medicine, Baltimore, MD, USA

Lan X. Chen, MD, PhD
Clinical Assistant Professor, Department of Medicine/
Rheumatology, University of Pennsylvania, Philadelphia, PA,
USA

Hyon K. Choi, MD, MPH, DrPH, FRCPC
Associate Professor of Medicine and Mary Pack Arthritis
Society Chair in Rheumatology, Department of Medicine,
Division of Rheumatology, The University of British
Columbia, Vancouver, British Columbia, Canada

Daniel J. Clauw, MD
Professor, Department of Internal Medicine, Division of
Rheumatology, University of Michigan, Ann Arbor, MI,
USA

Andrew J. Cooper, MD
Resident, Department of Orthopaedic Surgery, University of
Miami, Miami, FL, USA

Leslie J. Crofford, MD
Gloria W. Singletary Professor of Internal Medicine, Chief,
Division of Rheumatology & Women's Health, University of
Kentucky, Lexington, KY, USA

Dina Dadabhoy, MD
Clinical Lecturer, Department of Internal Medicine, Division
of Rheumatology, University of Michigan, Ann Arbor, MI,
USA

Troy Daniels, DDS, MS
Professor, Schools of Dentistry and Medicine, University of
California, San Francisco, San Francisco, CA, USA

John C. Davis, Jr., MD, MPH
Associate Professor, Department of Medicine, Division of
Rheumatology, University of California San Francisco, San
Francisco, CA, USA

William J. Didie, MD
Fellow, Musculoskeletal Imaging, Department of Radiology,
Johns Hopkins University, Baltimore, MD, USA

Paul Dieppe, MD
Professor, Department of Social Medicine, University of
Bristol, Bristol, UK

N. Lawrence Edwards, MD
Professor and Vice Chairman, Department of Medicine,
University of Florida, Gainesville, FL, USA

Hani S. El-Gabalawy, MD, FRCPC
Professor, Department of Medicine, Arthritis Centre, Univer-
sity of Manitoba, Winnipeg, Manitoba, Canada

Kevin Elias, MD
Howard Hughes Medical Institute-National Institute of
Health Research Scholar, Lymphocyte Cell Biology Section,
National Institute of Arthritis, Musculoskeletal, and Skin
Diseases, Bethesda, MD, USA

John M. Esdaile, MD, MPH
Scientific Director, Arthritis Research Centre of Canada;
Professor, University of British Columbia, Vancouver, British
Columbia, Canada

Adel G. Fam, MD, FRCP(C), FACP
Emeritus Professor of Medicine, Department of Medicine,
Division of Rheumatology, Sunnybrook & Women's College
Health Sciences Centre, University of Toronto, Toronto,
Ontario, Canada

Laura M. Fayad, MD
Assistant Professor, The Russell H. Morgan Department
of Radiology and Radiological Science, Johns Hopkins
University School of Medicine, Baltimore, MD, USA

Gary S. Firestein, MD
Professor, Department of Medicine, Chief, Division of
Rheumatology, Allergy and Immunology, University of
California San Diego, School of Medicine, La Jolla, CA, USA

Kenneth H. Fye, MD
Clinical Professor, Department of Medicine, University of
California, San Francisco, San Francisco, CA, USA

Dafna D. Gladman, MD, FRCPC
Professor, Department of Medicine/Rheumatology, University
of Toronto; Senior Scientist, Toronto Western Research
Institute; Director, Psoriatic Arthritis Program, University
Health Network, Toronto, Canada

Duncan A. Gordon, MD, FRCPC, MACR
Professor, Department of Medicine, University of Toronto;
Rheumatologist, University Health Network, Toronto
Western Hospital, Toronto, Ontario, Canada

Jörg J. Goronzy, MD
Co-Director, Department of Medicine, Kathleen B. and
Mason I. Lowance Center for Human Immunology, Emory
University School of Medicine, Atlanta, GA, USA

Philip J. Hashkes, MD, MSc
Head, Section of Pediatric Rheumatology, Department of
Rheumatic Diseases, Cleveland Clinic Foundation, Cleveland,
OH, USA

George Ho, Jr., MD

Professor, Department of Internal Medicine, Division of Rheumatology, Brody School of Medicine at East Carolina University, Greenville, NC, USA

William A. Horton, MD

Director, Research Center/Molecular and Medical Genetics, Shriners Hospital for Children; Professor, Oregon Health and Science University, Portland, OR, USA

Robert D. Inman, MD

Professor, Department of Medicine, Division of Rheumatology, University of Toronto, Toronto Western Hospital, Toronto, Ontario, Canada

Preeti Jaggi, MD

Assistant Professor, Department of Infectious Diseases, Department of Pediatrics, Ohio State University, Columbus, OH, USA

Amy H. Kao, MD, MPH

Assistant Professor, Department of Medicine, Division of Rheumatology and Clinical Immunology, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Daniel L. Kastner, MD, PhD

Chief, Genetics and Genomics Branch; Clinical Director and Director of Translational Research, National Institute of Arthritis and Musculoskeletal and Skin Diseases, Bethesda, MD, USA

Jonathan Kay, MD

Associate Clinical Professor, Department of Medicine, Harvard Medical School; Director of Clinical Trials, Rheumatology Unit, Massachusetts General Hospital, Boston, MA, USA

James Kelley, PhD

Postdoctoral Fellow, Department of Medicine, Division of Clinical Immunology and Rheumatology, University of Alabama at Birmingham, Birmingham, AL, USA

Robert P. Kimberly, MD

Howard L. Holley Professor of Medicine and Director, Division of Clinical Immunology and Rheumatology, Senior Associate Dean for Research, Department of Medicine, University of Alabama at Birmingham, Birmingham, AL, USA

John H. Klippel, MD

President and CEO, Arthritis Foundation, Atlanta, GA, USA

Denise Kruszewski, MS

Graduate Student/Research Assistant, Department of Psychology, Arizona State University, Tempe, AZ, USA

Ronald M. Laxer, MD, FRCPC

Vice President, Education and Quality, The Hospital for Sick Children; Professor, Department of Pediatrics and Medicine, The University of Toronto, Toronto, Ontario, Canada

Carol B. Lindsley, MD

Professor, Department of Pediatrics, Director of Pediatric Rheumatology, University of Kansas Medical Center, Kansas City, KS, USA

Geoffrey Littlejohn, MD, MPH, MBBS[Hon], FRACP, FRCP(Edin)

Director of Rheumatology and Associate Professor of Medicine, Department of Medicine, Monash University at Monash Medical Centre, Melbourne, Australia

Daniel J. Lovell, MD, MPH

Joseph Levinson Professor of Pediatrics, Division of Rheumatology, Cincinnati Children's Hospital Medical Center, Cincinnati, OH, USA

Harvinder S. Luthra, MD

John Finn Professor of Medicine, Department of Rheumatology, Mayo Clinic College of Medicine, Rochester, MN, USA

Susan Manzi, MD, MPH

Associate Professor, Department of Medicine, Division of Rheumatology and Clinical Immunology, University of Pittsburgh School of Medicine, University of Pittsburgh Graduate School of Public Health, Pittsburgh, PA, USA

David Marker, BS

Medical Student, Rubin Institute for Advanced Orthopedics, Sinai Hospital of Baltimore, Baltimore, MD, USA

Manuel Martinez-Lavin, MD

Chief, Department of Rheumatology, National Institute of Cardiology, Mexico, DF, Mexico

Maureen D. Mayes, MD, MPH

Professor, Department of Internal Medicine, Division of Rheumatology and Immunogenetics, University of Texas-Houston Medical School, Houston, TX, USA

Geraldine McCarthy, MD, FRCPI

Associate Professor/Consultant Rheumatologist, Division of Rheumatology, Department of Medicine, University College Dublin, Dublin/Mater Misericordiae University Hospital, Dublin, Ireland

Philip J. Mease, MD

Head, Seattle Rheumatology Associates; Chief, Division of Rheumatology Research, Swedish Medical Center; Clinical Professor, University of Washington School of Medicine, Seattle, WA, USA

Peter A. Merkel, MD, MPH

Associate Professor, Department of Medicine, Section of Rheumatology, Boston University School of Medicine, Boston, MA, USA

Frederick W. Miller, MD, PhD

Chief, Environmental Autoimmunity Group, Office of Clinical Research, National Institute of Environmental Health Sciences, National Institutes of Health, Bethesda, MD, USA

Michael A. Mont, MD

Director, Rubin Institute for Advanced Orthopedics, Sinai Hospital of Baltimore, Baltimore, MD, USA

Kerstin Morehead, MD

Assistant Clinical Professor, Department of Medicine, Division of Rheumatology, University of California, San Francisco, San Francisco, CA, USA

Barry L. Myones, MD

Associate Professor, Pediatric Rheumatology Center, Baylor College of Medicine/Texas Children's Hospital, Houston, TX, USA

Chester V. Oddis, MD

Professor, Department of Medicine, Division of Rheumatology and Clinical Immunology, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA

Alyce M. Oliver, MD, PhD

Fellow in Rheumatology, Department of Medicine, Division of Rheumatology and Immunology, Duke University Medical Center, Durham, NC, USA

John J. O'Shea, MD

Scientific Director, National Institute of Arthritis and Musculoskeletal and Skin Diseases; Chief, Molecular Immunology and Inflammation Branch; Chief, Lymphocyte Cell Biology Section, National Institutes of Health, Bethesda, MD, USA

Michelle Petri, MD, MPH

Professor, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, MD, USA

David S. Pisetsky, MD, PhD

Chief, Department of Medicine, Division of Rheumatology and Immunology, Duke University School of Medicine, Durham, NC, USA

Reed Edwin Pyeritz, MD, PhD

Professor, Department of Medicine and Genetics, Hospital of the University of Pennsylvania, Philadelphia, PA, USA

James D. Reeves, MD

Resident, Department of Orthopaedic Surgery, University of Miami, Miami, FL, USA

Lisa G. Rider, MD

Deputy Chief, Environmental Autoimmunity Group, Office of Clinical Research, National Institute of Environmental Health Sciences, National Institutes of Health, Clinical Research Center, Bethesda, MD, USA

Christopher Ritchlin, MD

Associate Professor, Department of Medicine, Division of Allergy, Immunology and Rheumatology, University of Rochester Medical Center, Rochester, NY, USA

David B. Robinson, MD, MSc, FRCPC

Associate Professor, Department of Medicine, Arthritis Centre, University of Manitoba, Winnipeg, Manitoba, Canada

Ann K. Rosenthal, MD

Professor, Department of Medicine, Division of Rheumatology, Medical College of Wisconsin/Zablocki VA Medical Center, Milwaukee, WI, USA

Keith T. Rott, MD, PhD

Assistant Professor, Department of Medicine, Division of Rheumatology, Emory University School of Medicine, Atlanta, GA, USA

John G. Ryan, MB, MRCPI

Clinical Fellow, Genetics and Genomics Branch, National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Bethesda, MD, USA

Kenneth G. Saag, MD, MSc

Associate Professor, Director, Center for Education and Research on Therapeutics of Musculoskeletal Disorders, Division of Clinical Immunology and Rheumatology, University of Alabama at Birmingham, Birmingham, AL, USA

Carlo Salvarani, MD

Director, Division of Rheumatology, Hospital S. Maria Nuova, Reggio Emilia, Italy

Philip Sambrook, MD, FRACP

Professor, Department of Rheumatology, University of Sydney, Sydney, NSW Australia

Pasha Sarraf, MD, PhD

Fellow, Department of Medicine, Division of Rheumatology, Allergy and Immunology, Massachusetts General Hospital, Boston, MA, USA

H. Ralph Schumacher, MD

Professor, Department of Medicine/Rheumatology, University of Pennsylvania; VA Medical Center, Philadelphia, PA, USA

William W. Scott, Jr., MD

Associate Professor, The Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Sean P. Scully, MD, PhD

Professor, Department of Orthopaedics, Miller School of Medicine, University of Miami, Miami, FL, USA

James R. Seibold, MD

Professor, Department of Internal Medicine/Rheumatology, Director, University of Michigan Scleroderma Program, University of Michigan Health System, Ann Arbor, MI, USA

Philip Seo, MD, MHS

Co-Director, Johns Hopkins Vasculitis Center, Division of Rheumatology, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Thorsten M. Seyler, MD

Center for Joint Preservation and Reconstruction, Rubin Institute for Advanced Orthopedics, Sinai Hospital of Baltimore, Baltimore, MD, USA

Leena Sharma, MD

Professor, Department of Internal Medicine, Division of Rheumatology, Feinberg School of Medicine at Northwestern University, Chicago, IL, USA

Stanford Shulman, MD

Chief, Department of Infectious Diseases; Professor, Department of Pediatrics, Northwestern University Feinberg School of Medicine/The Children's Memorial Hospital, Chicago, IL, USA

Richard Siegel, MD, PhD

Principal Investigator, Immunoregulation Group, National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Bethesda, MD, USA

Robert F. Spiera, MD

Adjunct Clinical Instructor, Department of Medicine/Rheumatology, Mount Sinai School of Medicine, New York, NY, USA

E. William St. Clair, MD

Professor, Department of Medicine, Division of Rheumatology and Immunology, Duke University Medical Center, Durham, NC, USA

John H. Stone, MD, MPH

Associate Physician, Massachusetts General Hospital; Deputy Editor for Rheumatology, UpToDate, Boston, MA, USA

Christopher V. Tehlirian, MD

Post-Doctoral Fellow, Department of Medicine, Division of Clinical and Molecular Rheumatology, Johns Hopkins University School of Medicine, Baltimore, MD, USA

Robert A. Terkeltaub, MD

Chief, Rheumatology Section, Department of Medicine, Veterans Affairs Medical Center San Diego; Professor, Department of Medicine, University of California San Diego School of Medicine, San Diego, CA, USA

Désirée Van der Heijde, MD, PhD

Professor, Department of Rheumatology, University Hospital Maastricht, The Netherlands

John Varga, MD

Gallagher Professor of Medicine, Department of Medicine, Division of Rheumatology, Northwestern University Feinberg School of Medicine, Chicago, IL, USA

Jean-Marc Waldburger, MD, PhD

Post-Doctoral Scholar, Department of Medicine, Division of Rheumatology, Allergy, and Immunology, University of California San Diego School of Medicine, La Jolla, CA, USA

Nelson B. Watts, MD

Professor, Department of Internal Medicine, University of Cincinnati College of Medicine, Cincinnati, OH, USA

Sterling West, MD

Professor, Department of Rheumatology, University of Colorado Health Sciences Center, Denver, CO, USA

Cornelia M. Weyand, MD

Co-Director, Kathleen B. and Mason I. Lowance Center for Human Immunology, Department of Medicine, Emory University School of Medicine, Atlanta, GA, USA

Patience H. White, MD, MA

Chief Public Health Officer, Arthritis Foundation, Atlanta, GA, USA

John B. Winfield, MD

Smith Distinguished Professor of Medicine Emeritus, Department of Medicine, University of North Carolina, Chapel Hill, NC, USA

Patricia Woo, BSc, MBBS, PhD, MRCP, FRCP, CBE

Professor, Department of Immunology and Molecular Pathology, University College London, London, UK

Robert L. Wortmann, MD, FACP, FACR

Professor and C. S. Lewis, Jr., MD Chair of Medicine, Department of Internal Medicine, The University of Oklahoma College of Medicine, Tulsa, OK, USA

Steven R. Ytterberg, MD

Associate Professor, Department of Medicine, Division of Rheumatology, Mayo Clinic College of Medicine, Rochester, MN, USA

Alex Zautra, PhD

Foundation Professor, Department of Psychology, Arizona State University, Tempe, AZ, USA