

# JOURNAL OF CLINICAL ONCOLOGY

Official Journal of the American Society of Clinical Oncology

## EDITOR ROSTER

### *Publisher*

Theresa Van Schaik  
Administrative Assistant  
Gwen Montalvo

### *Managing Editor*

Ken G. Kornfield  
Assistant Managing Editor

Glenn Landis  
Publications Specialist  
Sarah Michaud

### *Editorial Assistants*

Christopher Bohn, Emilie Gunn,  
Daniel Nelson, Erin Roberts  
Senior Editorial Coordinator  
Dana Howe

Production Assistant  
Alissa Perlman

### *Deputy Publisher*

Victoria Vaughn  
Production Manager

Doug Parker  
Production Coordinators  
Justin Edwards, Alicia Richardson  
Online Project Coordinator

James Kim  
Production Editing Administrator

Juana Llorens  
Copy Editors  
Julie Blum, Betsy Garman

Proofreader  
Valencia Person  
Administrative Assistant  
Destiny Porter

### *Director of Licensing, Rights, and Permissions*

Robin Bodishbaugh  
Licensing and Rights Coordinator  
Jennifer Hubbard

### *Business Operations Manager*

Christine Wacker  
Senior Program Assistant  
Shoni Carver  
Program Assistant  
Arkat Tahir

### *Executive Editor*

F. Hill Slowinski, JD

### *Editorial & Publications Offices*

330 John Carlyle Street  
Suite 300  
Alexandria, VA 22314

### **Editorial Office**

**Phone: 703-797-1900**

**Fax: 703-684-8720**

**E-mail: [jco@asco.org](mailto:jco@asco.org)**

Publications Office

Phone: 703-519-1430

Fax: 703-518-8155

E-mail: [jcoservice@asco.org](mailto:jcoservice@asco.org)

### **EDITOR-IN-CHIEF**

Daniel G. Haller, MD, *Philadelphia, PA*

### **Deputy Editor: Translational Oncology**

Mary L. Disis, MD, *Seattle, WA*

### **Deputy Editor: International Editions**

David M. Khayat, MD, PhD, *Paris, France*

### **Associate Editors**

Judith Abrams, PhD, *Detroit, MI*

George J. Bosl, MD, *New York, NY*

Stephen A. Cannistra, MD, *Boston, MA*

Bruce D. Cheson, MD, *Washington, DC*

Arlene A. Forastiere, MD, *Baltimore, MD*

Patricia A. Ganz, MD, *Los Angeles, CA*

Bruce G. Haffty, MD, *New Brunswick, NJ*

Mark N. Levine, MD, *Hamilton, Canada*

Michael P. Link, MD, *Stanford, CA*

Eleftherios P. Mamounas, MD, *Canton, OH*

Nicholas J. Petrelli, MD, *Newark, DE*

Mark J. Ratain, MD, *Chicago, IL*

Joan H. Schiller, MD, *Dallas, TX*

Jaap Verweij, MD, PhD, *Rotterdam, the Netherlands*

### **Consultant Editors**

Marc Buyse, ScD—Biostatistics

Stephen A. Cannistra, MD—Translational Oncology

Charles L. Loprinzi, MD—The Art of Oncology

Daniel Normolle, PhD—Biostatistics

Arthur T. Skarin, MD—Diagnosis in Oncology

### **JCO Hungarian Edition**

Editor, József Timár, MD, PhD, DSc, *Budapest, Hungary*

### **JCO Polish Edition**

Editor, Maciej Krzakowski, MD, *Warsaw, Poland*

### **JCO Spanish Edition**

Editor, Franco M. Muggia, MD, *New York, NY*

Associate Editor, Roman Pérez-Soler, MD, *Bronx, NY*

### **Editors Emeriti**

Joseph R. Bertino, MD, *New Brunswick, NJ*

George P. Canellos, MD, *Boston, MA*

# JOURNAL OF CLINICAL ONCOLOGY

Official Journal of the American Society of Clinical Oncology

## EDITORIAL BOARD

### Biostatistics

Todd A. Alonzo, PhD *Arcadia, CA*  
Karla V. Ballman, PhD *Rochester, MN*  
Mark F. Brady, PhD *Buffalo, NY*  
Doug Case, PhD *Winston-Salem, NC*  
Richard J. Chappell, PhD *Madison, WI*  
Tyson H. Holmes, PhD *Stanford, CA*  
Terry Hyslop, PhD *Philadelphia, PA*  
Gina Petroni, PhD *Charlottesville, VA*  
Richard M. Simon, DSc *Bethesda, MD*  
Harm Van Tinteren, PhD *Amsterdam, the Netherlands*

### Breast Cancer

Matti S. Aapro, MD *Genolier, Switzerland*  
Harry Bartelink, MD, PhD *Amsterdam, the Netherlands*  
Harold J. Burstein, MD, PhD *Boston, MA*  
PierFranco Conte, MD *Modena, Italy*  
Nancy E. Davidson, MD *Ann Arbor, MI*  
Veronique Dieras, MD *Paris, France*  
Kevin R. Fox, MD *Philadelphia, PA*  
Richard D. Gelber, PhD *Boston, MA*  
Daniel F. Hayes, MD *Ann Arbor, MI*  
Dawn Hershman, MD *New York, NY*  
Kathy D. Miller, MD *Indianapolis, IN*  
Lisa A. Newman, MD, MPH, FACS *Ann Arbor, MI*  
Martine J. Piccart, MD, PhD *Brussels, Belgium*  
Joseph Ragaz, MD, FRCPC *Montréal, Canada*  
Abram Recht, MD *Boston, MA*  
Michael S. Sabel, MD *Ann Arbor, MI*  
Ian E. Smith, MD *London, United Kingdom*  
Lawrence J. Solin, MD *Philadelphia, PA*  
Eva Thomas, MD *Houston, TX*  
Maureen E. Trudeau, MD *Toronto, Canada*  
Tim Whelan, BM, BCH, MSc *Hamilton, Canada*  
Eric P. Winer, MD *Boston, MA*

### Cancer Prevention

Dean E. Brenner, MD *Ann Arbor, MI*  
Powel H. Brown, MD, PhD *Houston, TX*  
Margie L. Clapper, PhD *Philadelphia, PA*  
Andrew J. Dannenberg, MD *New York, NY*  
Andrea Decensi, MD *Milan, Italy*  
Raymond N. Dubois, MD, PhD *Nashville, TN*  
Carol J. Fabian, MD *Kansas City, KS*  
Andy Gescher, PhD *Leicester, United Kingdom*  
Generosa Grana, MD *Camden, NJ*  
Fadlo R. Khuri, MD *Atlanta, GA*  
Peter Lance, MD *Tucson, AZ*  
Patrick M. Lynch, JD, MD *Houston, TX*  
Jeanne Mandelblatt, MD, MPH *Washington, DC*  
Worta McCaskill-Stevens, MD *Rockville, MD*  
Arthur M. Michalek, PhD *Buffalo, NY*  
Brad H. Pollock, MPH, PhD *San Antonio, TX*  
Victor G. Vogel, MD, MHS *Pittsburgh, PA*  
Jeffrey N. Weitzel, MD *Duarte, CA*

### Central Nervous System Tumors

Jan C. Buckner, MD *Rochester, NY*  
Mark R. Gilbert, MD *Houston, TX*  
Steven Grunberg, MD *Burlington, VT*  
Mitchell Machtay, MD *Philadelphia, PA*  
Gregory E. Plautz, MD *Cleveland, OH*  
Roger Stupp, MD *Lausanne, Switzerland*

Eric T. Wong, MD *Boston, MA*

### Clinical Trials and Ethics

Steve Joffe, MD *Boston, MA*  
Lowell E. Schnipper, MD *Boston, MA*  
Thomas J. Smith, MD *Richmond, VA*

### Community Practice

Edward P. Balaban, DO *Wexford, PA*  
John V. Cox, DO, FACP *Dallas, TX*  
Judy L. Schmidt, MD *Missoula, MT*  
Frederick M. Schnell, MD, FACP *Macon, GA*  
Keith Thompson, MD *Montgomery, AL*  
Peter M. Townley, MD *Omaha, NE*

### Gastrointestinal Cancer

H. Richard Alexander Jr, MD, FACS *Baltimore, MD*  
Jordan D. Berlin, MD *Nashville, TN*  
Charles Blanke, MD, FACP *Portland, OR*  
Bruce Boman, MD, PhD *Philadelphia, PA*  
Roland Bugat, MD *Toulouse, France*  
Michael Goodyear, MD *Halifax, Canada*  
Leonard L. Gunderson, MD, MS *Scottsdale, AZ*  
David H. Ilson, MD, PhD *New York, NY*  
J. Philip Kuebler, MD, PhD *Columbus, OH*  
Heinz-Josef Lenz, MD *Los Angeles, CA*  
T. S. Maughan, MD *Cardiff, United Kingdom*  
Mark Roh, MD *Pittsburgh, PA*  
Elin R. Sigurdson, MD *Philadelphia, PA*  
Josep Taberner, MD *Barcelona, Spain*  
Charles R. Thomas Jr, MD *San Antonio, TX*  
Christophe Tournigand, MD *Paris, France*  
Robert S. Warren, MD *San Francisco, CA*

### Genitourinary Cancer

Richard J. Cote, MD, FRCPath *Los Angeles, CA*  
Theodore L. DeWeese, MD *Baltimore, MD*  
Robert S. DiPaola, MD *New Brunswick, NJ*  
Ralph W. de Vere White, MD *Davis, CA*  
Robert Dreicer, MD, FACP *Cleveland, OH*  
Karim Fizazi, MD, PhD *Villejuif, France*  
Alan Horwich, PhD, FRCR, MBBS *Sutton, United Kingdom*  
Maha Hussain, MD, FACP *Ann Arbor, MI*  
William Kevin Kelly, DO *New York, NY*  
Lawrence Klotz, MD *Toronto, Canada*  
Douglas G. McNeel, MD, PhD *Madison, WI*  
David M. Nanus, MD *New York, NY*  
Peter S. Nelson, MD *Seattle, WA*  
David F. Penson, MD, MPH *Los Angeles, CA*  
Roberto Pili, MD *Baltimore, MD*  
Joseph C. Presti Jr, MD *Stanford, CA*  
Derek Raghavan, MD, PhD *Cleveland, OH*  
Olivier Rixe, MD *Paris, France*  
Mack Roach III, MD *San Francisco, CA*  
Bruce J. Roth, MD *Nashville, TN*  
Joel Sheinfeld, MD *New York, NY*  
Christopher J. Sweeney, MBBS *Indianapolis, IN*  
Ian M. Thompson, MD *San Antonio, TX*  
Anotheny Zietman, MD *Boston, MA*

### Gynecologic Cancer

Carol Aghajanian, MD *New York, NY*  
Andres Cervantes-Ruiperez, MD *Valencia, Spain*  
Nicoletta Colombo, MD *Milan, Italy*  
Serban Costa, MD, PhD *Magdeburg, Germany*

George Coukos, MD *Philadelphia, PA*  
Susan A. Davidson, MD *Denver, CO*  
Elizabeth A. Eisenhauer, MD *Kingston, Canada*  
Barbara A. Goff, MD *Seattle, WA*  
Jonathan L. Hecht, MD *Boston, MA*  
Beth Y. Karlan, MD *Los Angeles, CA*  
Noah D. Kauff, MD *New York, NY*  
David H. Moore, MD *Indianapolis, IN*  
Peter G. Rose, MD *Cleveland, OH*  
Gordon J.S. Rustin, MD *Middlesex, United Kingdom*  
Paul Sabbatini, MD *New York, NY*  
Michael V. Seiden, MD, PhD *Philadelphia, PA*  
Claes G. Tropé, MD, PhD *Oslo, Norway*  
Ignace B. Vergote, MD, PhD *Leuven, Belgium*  
Jan B. Vermorken, MD, PhD *Edegem, Belgium*

### Head and Neck Cancer

David J. Adelstein, MD *Cleveland, OH*  
Jacques Bernier, MD, PhD *Genolier, Switzerland*  
Bruce Brockstein, MD *Evanston, IL*  
Christine H. Chung, MD *Nashville, TN*  
Ezra E.W. Cohen, MD *Chicago, IL*  
Avraham Eisbruch, MD *Ann Arbor, MI*  
Paul M. Harari, MD *Madison, WI*  
Wayne Koch, MD *Baltimore, MD*  
Nancy Y. Lee, MD *New York, NY*  
Lisa Licitra, MD *Milan, Italy*  
Jens Overgaard, MD *Aarhus, Denmark*  
Vassiliki A. Papadimitrakopoulou, MD *Houston, TX*  
David G. Pfister, MD *New York, NY*  
David Raben, MD *Aurora, CO*  
Danny Rischin, MD *Melbourne, Australia*  
David I. Rosenthal, MD *Houston, TX*  
Ashok R. Shaha, MD *New York, NY*  
Randal S. Weber, MD *Houston, TX*  
Stuart J. Wong, MD *Milwaukee, WI*

### Health Services Research

John Z. Ayanian, MD, MPP *Boston, MA*  
Charles L. Bennett, MD, PhD *Chicago, IL*  
Craig C. Earle, MD, MSc *Boston, MA*  
Susan Gross Fisher, PhD *Rochester, NY*  
Patrick A. Grusenmeyer, ScD *Newark, DE*  
Susan L. Kahn, MD *Los Angeles, CA*  
Nancy L. Keating, MD, MPH *Boston, MA*  
Scott D. Ramsey, MD *Seattle, WA*  
Christopher S. Saigal, MD *Los Angeles, CA*  
Deborah Schrag, MD *New York, NY*  
May L. Tao, MD *Santa Monica, CA*  
Rosalie C. Viney, MEd, PhD *Sydney, Australia*

### Hematologic Malignancies

Stephen M. Ansell, MD, PhD *Rochester, MN*  
Joan Bladé, MD *Barcelona, Spain*  
John C. Byrd, MD *Columbus, OH*  
Patrice Carde, MD, PhD *Villejuif, France*  
Franco Cavalli, MD *Bellinzona, Switzerland*  
Jorge E. Cortes, MD *Houston, TX*  
Myron S. Czuczman, MD *Buffalo, NY*  
Meletios A. Dimopoulos, MD *Athens, Greece*  
Andreas Engert, MD *Köln, Germany*  
Jonathan W. Friedberg, MD *Rochester, NY*  
Randy D. Gascoyne, MD *Vancouver, Canada*  
Michele Ghilmini, MD *Bellinzona, Switzerland*  
Christian Gisselbrecht, MD *Paris, France*

# JOURNAL OF CLINICAL ONCOLOGY

Official Journal of the American Society of Clinical Oncology

## EDITORIAL BOARD

Leo I. Gordon, MD *Chicago, IL*

Larry W. Kwak, MD, PhD *Houston, TX*

Bob Löwenberg, MD, PhD *Rotterdam, the Netherlands*

Heinz Ludwig, MD *Vienna, Austria*

Ralph M. Meyer, MD *Hamilton, Canada*

Craig H. Moskowitz, MD *New York, NY*

Susan O'Brien, MD *Houston, TX*

Owen A. O'Connor, MD, PhD *New York, NY*

Paul G. Richardson, MD *Boston, MA*

John W. Sweetenham, MD *Cleveland, OH*

Kensei Tobinai, MD, PhD *Tokyo, Japan*

Donald E. Tsai, MD, PhD *Philadelphia, PA*

Georgia B. Vogelsang, MD *Baltimore, MD*

Edus H. Warren, MD, PhD *Seattle, WA*

Jane N. Winter, MD *Chicago, IL*

George J. Weiner, MD *Iowa City, IA*

### Melanoma

Michael B. Atkins, MD *Boston, MA*

Natale Cascinelli, MD *Milan, Italy*

Paul B. Chapman, MD *New York, NY*

Ulrich Keilholz, MD *Berlin, Germany*

Howard L. Kaufman, MD *New York, NY*

John M. Kirkwood, MD *Pittsburgh, PA*

Kelly M. McMasters, MD, PhD *Louisville, KY*

Jean-Phillipe Spano, MD, PhD *Paris, France*

Lynn Mara Schuchter, MD *Philadelphia, PA*

### Patient Management

Janet L. Abraham, MD *Boston, MA*

Tim A. Ahles, PhD *Lebanon, NH*

Michael J. Fisch, MD, MPH *Houston, TX*

Carolyn C. Gotay, PhD *Honolulu, HI*

Irene J. Higginson, BMedSci, BM BS, FFPHM, PhD *London, United Kingdom*

Paul B. Jacobsen, PhD *Tampa, FL*

Ann M. O'Mara, PhD, RN *Bethesda, MD*

Linda Sarna, RN, DNSc *Los Angeles, CA*

Marc D. Schwartz, PhD *Washington, DC*

Lari B. Wenzel, MD *Irvine, CA*

### Pediatric Oncology

Peter C. Adamson, MD *Philadelphia, PA*

Robert J. Arceci, MD, PhD *Baltimore, MD*

Smita Bhatia, MD, MPH *Duarte, CA*

Stefan S. Bielack, MD *Münster, Germany*

Susan M. Blaney, MD *Houston, TX*

Gary V. Dahl, MD *Stanford, CA*

Stella M. Davies, MBBS, PhD, MRCP *Cincinnati, OH*

James Feusner, MD *Oakland, CA*

Paul G. Fisher, MD *Stanford, CA*

Wayne L. Furman, MD *Memphis, TN*

Amar Gajjar, MD *Memphis, TN*

Joanne M. Hilden, MD, FAAP *Cleveland, OH*

Larry E. Kun, MD *Memphis, TN*

Beverly J. Lange, MD *Philadelphia, PA*

John M. Maris, MD *Philadelphia, PA*

William H. Meyer, MD *Oklahoma City, OK*

Kevin C. Oeffinger, MD *New York, NY*

Leslie L. Robison, PhD *Memphis, TN*

Martin Schrappe, MD *Hanover, Germany*

Lewis B. Silverman, MD *Boston, MA*

Paul M. Sondel, MD, PhD *Madison, WI*

Joanne Wolfe, MD, MPH *Boston, MA*

### Phase I and Clinical Pharmacology

J. Jean-Pierre Armand, MD *Villejuif, France*

Frank M. Balis, MD *Bethesda, MD*

Jose Baselga, MD *Barcelona, Spain*

Carolyn D. Britten, MD *Vancouver, Canada*

Alan Hilary Calvert, MD *Newcastle-Upon-Tyne, United Kingdom*

Jerry Collins, PhD *Rockville, MD*

Robert B. Diasio, MD *Birmingham, AL*

Ross C. Donehower, MD *Baltimore, MD*

Boon-Cher Goh, MD *Singapore, Singapore*

Vassilis Georgoulas, MD *Crete, Greece*

Roy S. Herbst, MD, PhD *Houston, TX*

Ian Judson, MA, MD, FRCP *Sutton, United Kingdom*

Howard L. McLeod, PhD *St Louis, MO*

Stefan Madajewicz, MD *Stonybrook, NY*

Peter J. O'Dwyer, MD *Philadelphia, PA*

Amita Patnaik, MD *San Antonio, TX*

Eric Raymond, MD, PhD *Clichy, France*

Mace L. Rothenberg, MD *Nashville, TN*

Gary K. Schwartz, MD *New York, NY*

Cristiana Sessa, MD *Bellinzona, Switzerland*

Lillian L. Siu, MD *Toronto, Canada*

Alex Sparreboom, PhD *Bethesda, MD*

Anthony W. Tolcher, MD *San Antonio, TX*

### Sarcoma

Laurence H. Baker, DO *Ann Arbor, MI*

Murray F. Brennan, MD *New York, NY*

George D. Demetri, MD *Boston, MA*

Alexander M.M. Eggermont, MD, PhD

*Rotterdam, the Netherlands*

Christopher D.M. Fletcher, MD, FRCPath

*Boston, MA*

Holcombe E. Grier, MD *Boston, MA*

John M. Kane III, MD *Buffalo, NY*

Axel Le Cesne, MD *Villejuif, France*

Robert Maki, MD, PhD *New York, NY*

Peter W.T. Pisters, MD *Houston, TX*

Sam Singer, MD *New York, NY*

Vernon K. Sondak, MD *Tampa, FL*

Alan van Oosterom, MD, PhD *Leuven, Belgium*

### Surgical Oncology

Rene Adam, MD *Villejuif, France*

Thomas Anthony, MD *Dallas, TX*

Harry D. Bear, MD, PhD *Richmond, VA*

Henri Bismuth, MD *Paris, France*

Bjorn Cedermark, MD, PhD *Stockholm, Sweden*

Kevin C.P. Conlon, MA, MCh, MBA, FRCSI, FACS

*Dublin, Ireland*

Jeffrey A. Drebin, MD, PhD, FACS *Philadelphia, PA*

Stephen B. Edge, MD *Buffalo, NY*

Morton S. Kahlenberg, MD *San Antonio, TX*

Henry M. Kuerer, MD, PhD, FACS *Houston, TX*

Andrew M. Lowy, MD *San Diego, CA*

Mark McKee, MD *Chicago, IL*

Frederick L. Moffat Jr, MD *Miami, FL*

Yoshihiro Moriya, MD, PhD *Tokyo, Japan*

Lisa Newman, MD, MPH, FACS *Ann Arbor, MI*

Bernard Nordlinger, MD *Boulogne, France*

David M. Ota, MD *Durham, NC*

Peter M. Schlag, MD, PhD *Berlin, Germany*

Robert S. Warren, MD *San Francisco, CA*

### Thoracic Oncology

A. William Blackstock, MD *Winston-Salem, NC*

Jeffrey A. Bogart, MD *Syracuse, NY*

Hak Choy, MD *Dallas, TX*

Gerald Clamon, MD *Iowa City, IA*

Philip A. Dennis, MD, PhD *Bethesda, MD*

Giuseppe Giaccone, MD, PhD *Amsterdam, the Netherlands*

Peter Goldstraw, MD *London, United Kingdom*

Stephen L. Graziano, MD *Syracuse, NY*

Fred R. Hirsch, MD *Denver, CO*

Tien Hoang, MD *Madison, WI*

Bruce E. Johnson, MD *Boston, MA*

Kemp H. Kernstine, MD, PhD *Los Angeles, CA*

Deepak Khuntia, MD *Madison, WI*

Quynh-Thu Le, MD *Stanford, CA*

Rogero C. Lilenbaum, MD *Miami Beach, FL*

Minesh P. Mehta, MD *Madison, WI*

Francoise Mornex, MD *Benite, France*

William Pao, MD, PhD *New York, NY*

Edward F. Patz Jr, MD *Durham, NC*

Michael C. Perry, MD *Columbia, MO*

Rafael Rosell, MD *Barcelona, Spain*

Charles M. Rudin, MD *Baltimore, MD*

Ann G. Schwartz, PhD, MPH *Detroit, MI*

Jill M. Siegfried, PhD *Pittsburgh, PA*

Mark A. Socinski, MD *Chapel Hill, NC*

William D. Travis, MD *New York, NY*

Johan Vansteenkiste, MD, PhD *Leuven, Belgium*

Henry Wagner Jr, MD *Hershey, PA*

Heather A. Wakelee, MD *Stanford, CA*

### Translational Oncology

Garth R. Anderson, PhD *Buffalo, NY*

Gerold Bepler, MD, PhD *Tampa, FL*

Andrew Berchuck, MD *Durham, NC*

Jeffrey Boyd, PhD *New York, NY*

Albert de la Chapelle, MD, PhD *Columbus, OH*

Lee M. Ellis, MD *Houston, TX*

Leif W. Ellisen, MD, PhD *Boston, MA*

Soldano Ferrone, MD, PhD *Buffalo, NY*

Lawrence Fong, MD *San Francisco, CA*

Jennifer R. Grandis, MD, FACS *Pittsburgh, PA*

Stephen M. Hahn, MD *Philadelphia, PA*

Elizabeth M. Jaffee, MD *Baltimore, MD*

Keith L. Knutson, PhD *Rochester, MN*

Edmund C. Lattime, PhD *New Brunswick, NJ*

H. Kim Lyerly, MD *Durham, NC*

David A. Mankoff, MD, PhD *Seattle, WA*

Howard L. McLeod, MD *St Louis, MO*

Donna Neuberg, ScD *Boston, MA*

Charles M. Perou, PhD *Chapel Hill, NC*

Joyce Seldon, MS, CGC *Los Angeles, CA*

David Sidransky, MD *Baltimore, MD*

Robert H. Vonderheide, MD, DPhil *Philadelphia, PA*

Timothy J. Yeatman, MD *Tampa, FL*

### Transplantation

Michael R. Bishop, MD *Bethesda, MD*

Stephen J. Forman, MD *Duarte, CA*

Sergio A. Giralt, MD *Houston, TX*

Koen van Besien, MD *Chicago, IL*

Georgia B. Vogelsang, MD *Baltimore, MD*

Edmund K. Waller, MD *Atlanta, GA*