

CLINICAL CANCER RESEARCH

The Journal of Clinical and Translational Research

AN OFFICIAL JOURNAL OF THE **AACR** American Association
for Cancer Research



Editor-in-Chief

Keith T. Flaherty

Executive Editor

Marlowe S. Tessmer

Scientific Editor

Jacqueline Brosnan-Cashman

Deputy Editors

Omar Abdel-Wahab

Jennifer R. Grandis

Susan G. Hilsenbeck

Pasi A. Jänne

Jean-Charles Soria

Josep Tabernero

Jedd D. Wolchok

Senior Editors

Julie E. Bauman

Andrew S. Chi

Ezra E.W. Cohen

Ryan B. Corcoran

Matthew S. Davids

Robert C. Doebele

Michael A. Dyer

Richard S. Finn

Daniel J. George

Theodore S. Hong

David M. Hyman

Scott Kopetz

Josep M. Llovet

Jason J. Luke

Michael L. Maitland

Ignacio J. Melero

Constantine S. Mitsiades

Amit M. Oza

Daniel A. Pryma

John H. Sampson

Sabina Signoretti

Alex Sparreboom

Ulrich G. Steidl

Brian A. Van Tine

Amit Verma

Eduardo Vilar

Colin D. Weekes

Douglas Yee

Evan Y. Yu

Statistical Reviewers

Cong Chen

Susan Groshen

Katherine A. Guthrie

Byung-Ho Nam

Megan Othus

Katherine S. Panageas

Yu Shyr

Satoshi Teramukai

Michael C. Wu

Editorial Staff

Managing Editor

Kim Mackey

Assistant Managing Editor

William J. Siegmann

Special Content Manager

Chris Vesce

Assistant Director, Production

David Livewell

Editorial Staff

Nina Lispi

Cara E. Vandy

Editorial Office: *Clinical Cancer Research* [ISSN: 1078-0432 (Print); 1557-3265 (Online)] is published twice a month, one volume per year, by the American Association for Cancer Research, Inc.; 615 Chestnut Street, 17th Floor, Philadelphia, PA 19106-4404. Periodicals postage paid at Philadelphia, PA, and additional mailing offices. POSTMASTER: Send address changes to *Clinical Cancer Research*, Member Services, AACR, 615 Chestnut Street, 17th Floor, Philadelphia, PA 19106-4404 or E-mail: membership@aacr.org. Copyright 2021 by the American Association for Cancer Research, Inc. © The paper used in this publication meets the requirements of ANSI/NISO Z39.48-1992 (Permanence of Paper).

CLINICAL CANCER RESEARCH

Editorial Board

James L. Abbruzzese
Joseph A. Aisner
Jaffer Ajani
Kenneth D. Aldape
Francis Ali-Osman
Jennifer Amengual
Carey Anders
David E. Avigan
Rebecca G. Bagley
Surinder Batra
James Berenson
Ray Bergan
Joseph R. Bertino
Kapil N. Bhalla
Ronald G. Blasberg
Renier J. Brentjens
Ronald M. Bukowski
Daniel P. Cahill
George A. Calin
Kevin Camphausen
Michael A. Carducci
William Carroll
William E. Carson
Paul B. Chapman
Dharminder Chauhan
Cong Chen
Zhen Cheng
Paul Chiao
Fortunato Ciardiello
Robert Clarke
Barbara A. Conley
Roisin M. Connolly
Joseph Contessa
Rajvir Dahiya
William L. Dahut
Michael A. Davies
Johann S. de Bono
Sandra Demaria
Adam P. Dicker
Catherine Diefenbach
Federica Di Nicolantonio
Colin P. Dinney
Ronny Drapkin
Raymond N. DuBois
Steven DuBois
Robert P. Edwards
Adel K. El-Naggar
Wael El-Rifai
Jeffrey Engelman
Alan L. Epstein
Francisco J. Esteva
Robert L. Ferris
Soldano Ferrone
William D. Figg
Barbara Fingleton
Michelangelo Fiorentino
David A. Frank
Paul Frankel
Simone Fulda
Varsha V. Gandhi
Stanton L. Gerson
Michele Ghilmini

Irene Ghobrial
Giuseppe Giaccone
Francis Giles
Bonnie S. Glisson
Lucy Godley
Ajay Goel
William E. Gooding
Steven D. Gore
James S. Goydos
Steven Grant
Tim F. Greten
William E. Grizzle
Susan Groshen
Katherine A. Guthrie
Stephen M. Hahn
Roy S. Herbst
James G. Herman
Fred R. Hirsch
Walter N. Hittelman
Robert M. Hoffman
Patrick Hwu
Rakesh K. Jain
Jin Jen
John M. Jessup
Faye M. Johnson
Dejan Juric
Pawel Kalinski
Michael Kalos
Judith E. Karp
Scott H. Kaufmann
Edward Kim
John M. Kirkwood
E. Anders Kolb
Murray Korc
Jason A. Koutcher
Rakesh Kumar
Marc Ladanyi
Heinz-Josef D. Lenz
Ross L. Levine
Min Li
Jonathan D. Licht
Sagar Lonial
Patricia LoRusso
Nupam Mahajan
Robert G. Maki
Sami Malek
Sridhar Mani
David A. Mankoff
H. Charles Manning
Maurie Markman
Katherine K. Matthay
Andrew P. Mazar
David J. McConkey
Janice Mehnert
Alan A. Melcher
Todd W. Miller
John D. Minna
Tetsuya Mitsudomi
Gareth J. Morgan
Hasan Mukhtar
Byung-Ho Nam
William G. Nelson
Shuji Ogino

Frank G. Ondrey
Ruth M. O'Regan
Eileen O'Reilly
Robert Orłowski
Megan Othus
Katherine S. Panageas
Klaus Pantel
William Pao
George Peoples
Roman Perez-Soler
Leonidas Platanius
Christine A. Pratilas
Pingping Qu
Jerry Radich
Noopur Raje
Ramesh K. Ramanathan
Mark J. Ratain
C. Patrick Reynolds
Jeremy N. Rich
Andrea Richardson
Rafael Rosell
Eric K. Rowinsky
Lawrence V. Rubinstein
David P. Ryan
Stefania Scala
Maurizio Scaltriti
Gary K. Schwartz
Michael V. Seiden
Violeta Serra
Geoffrey Shapiro
Dong M. Shin
Yu Shyr
Susan F. Slovin
Keiran S.M. Smalley
David Solit
Paul Sondel
Joseph Sparano
Vered Stearns
Patricia S. Steeg
Barry Storer
Walter J. Storkus
Mario Sznol
Yu-Tzu Tai
Chris H. Takimoto
James Talmadge
Beverly A. Teicher
Joel E. Tepper
Satoshi Teramukai
Lawrence D. True
Jeffrey W. Tyner
Carter Van Waes
Augusto Villanueva
Emile Voest
Robert H. Vonderheide
Jeffrey S. Weber
Wolfgang A. Weber
Patrick Y. Wen
Theresa L. Whiteside
Ignacio I. Wistuba
Michael C. Wu
Keping Xie
Yun Yen
Bin Zheng

CLINICAL CANCER RESEARCH

Publishing Information

AN OFFICIAL JOURNAL OF THE **AACR** American Association for Cancer Research

AACR Officers

David A. Tuveson, President
 Lisa M. Coussens, President-Elect
 Antoni Ribas, Past President
 William N. Hait, Treasurer
 Margaret Foti,
 Chief Executive Officer

Publications Committee

Victor E. Velculescu, Chairperson
 Adriana Albini
 Laura Fejerman
 Masanori Hatakeyama
 Catriona H.M. Jamieson
 Jos Jonkers
 Virginia G. Kaklamani
 Andrew Kung
 Jonathan D. Licht
 Ira Mellman
 Gordon B. Mills
 Kunle Odunsi
 Kenneth J. Pienta
 Joshua D. Rabinowitz
 Timothy R. Rebbeck
 David L. Rimm
 Mack Roach, III
 Sheila K. Singh
 Sheila A. Stewart
 Miguel A. Villalona-Calero
 Michael B. Yaffe

Publishing Staff

Publisher

Christine Battle

Director, Journal Operations and Systems

Daniel S. Evanko

Director, Journal Sales and Marketing

Nicola L. Hill

Director, Digital Publishing

Mark Jacobson

Director, Editorial

Robert Kruger

Associate Director, Production

Charlene Squibb

Assistant Director, Production

David Livewell

Assistant Director, Journal Marketing

Joanna Arnold

Assistant Director, Institutional Sales & Outreach

Karola Rac

Marketing and Creative Services

Senior Director

Paul Driscoll

Design Staff

Susan Moore

Scope

Clinical Cancer Research publishes innovative clinical and translational cancer research studies that bridge the laboratory and the clinic. The Journal is especially interested in clinical trials evaluating new treatments, accompanied by research on pharmacology, and molecular alterations or biomarkers that predict response or resistance to treatment. The Journal also prioritizes laboratory and animal studies of new drugs and molecule-targeted agents with the potential to lead to clinical trials, and studies of targetable mechanisms of oncogenesis, progression of the malignant phenotype, and metastatic disease.

Clinical Cancer Research is abstracted and/or indexed in Current Contents/Clinical Medicine, MEDLINE, Science Citation Index, Scopus, and Web of Science.

Submission of Manuscripts

Online manuscript submission is welcomed at <https://ccr.msubmit.net>. Before submitting a manuscript, please read the Instructions for Authors, which are available from the Journal's home page at <https://clincancerres.aacrjournals.org>.

Publication Charges

Articles will be published with the understanding that the author(s) will pay both a publication fee plus a color figure handling fee. Please see the Publication Fees and Reprints page which is available at <https://aacrjournals.org/content/authors/publication-fees-and-reprints>.

Subscription Information

Nonmember Individuals

Subscriptions include online access only. Contacts listed below are for nonmember individual subscriptions.

USA and Rest of World (excluding Japan)
 American Association for Cancer Research, 615 Chestnut Street, Philadelphia, PA 19106; 1-855-744-4667; pubsales@aacr.org

Japan

e-support@maruzen.co.jp;
journal@kinokuniya.co.jp; usaco@usaco.co.jp

International print subscriptions include cost of surface mail. Expedited mailing is available. Contact the American Association for Cancer Research for rates.

Site Licenses

For information about institutional site licenses, contact pubsales@aacr.org.

AACR Members

AACR members may opt to receive either a print subscription with online access to content or an online-only subscription. Contact membership@aacr.org or visit the membership page at <https://aacr.org> for more information.

Single Issue Sales/Claims

Due to the impact of COVID-19, the AACR has discontinued single issue orders and fulfillment of claims through December 31, 2021.

Claims

One-time claims for missing issues made within 120 days of the issue's publication will be honored, subject to availability. No credit or refund will be given if an issue is out of print at the time of claim.

AACR Members

membership@aacr.org

Nonmembers and Institutions

pubsales@aacr.org

Advertising Information

For information about advertising in AACR journals, contact The Walchli Tauber Group, Inc., 2225 Old Emmorton Road, Suite 201, Bel Air, MD 21015; 443-512-8899; maura.paoletti@wt-group.com.

Copyright and Permissions

Content printed in or disseminated by *Clinical Cancer Research* is protected by copyright. Authors who wish to publish material in *Clinical Cancer Research* must formally transfer copyright to the AACR. All authors must sign copyright transfer forms before the AACR can proceed with publication.

To read the complete AACR Copyright and Permissions Policy, visit <https://aacrjournals.org/content/authors/copyright-permissions-and-access>.