

# CANCER PREVENTION RESEARCH

The Forefront of Prevention Science

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



## Editor-in-Chief

Raymond N. DuBois



## Editor-in-Chief

Michael N. Pollak

## Special Advisors to the Editors-in-Chief

Elizabeth H. Blackburn  
Ronald M. Evans  
William N. Hait

## Deputy Editors

Marcia R. Cruz-Correa  
Ernest T. Hawk  
Avrum Spira  
Eva Szabo  
Timothy C. Wang

## Senior Editors

Adriana Albin  
Powel H. Brown  
Jack Cuzick  
Andrew J. Dannenberg  
Zigang Dong  
Marc Gunter  
Mark Hull  
Daehee Kang  
Thomas W. Kensler  
Lawrence J. Marnett  
David Sidransky  
Ignacio I. Wistuba

## Statistical Editor

J. Jack Lee

## Editorial Staff

### Associate Editor

Jing Peng

### Associate Managing Editor

Jen Zimmerman

### Special Content Manager

Chris Vesci

### Editorial Associate

Brittany Rubio

**Editorial Office:** *Cancer Prevention Research* [ISSN: 1940-6207 (Print); ISSN: 1940-6215 (Online)] is published monthly one volume per year, by the American Association for Cancer Research, Inc.; 615 Chestnut Street, 17th Floor, Philadelphia, PA 19106-4404. Postage paid at Philadelphia, PA, and additional mailing offices. Send address changes to *Cancer Prevention Research*, Member Services, AACR, 615 Chestnut Street, 17th Floor, Philadelphia, PA 19106-4404 or E-mail: [membership@aacr.org](mailto:membership@aacr.org). Copyright 2020 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).

# CANCER PREVENTION RESEARCH

## Editorial Board

James L. Abbruzzese  
Lucile L. Adams-Campbell  
Rajesh Agarwal  
David S. Alberts  
Garnet L. Anderson  
Karen Anderson  
Michael A. Andrykowski  
Leonard H. Augenlicht  
Mariano Barbacid  
John A. Baron  
Steven A. Belinsky  
Raymond C. Bergan  
Diane F. Birt  
Maarten Bosland  
G. Timothy Bowden  
Deborah J. Bowen  
Norman F. Boyd  
Douglas E. Brash  
Otis W. Brawley  
Dean E. Brenner  
John Burn  
Joseph A. Califano  
Ya Cao  
Philip E. Castle  
Andrew T. Chan  
Rowan T. Chlebowski  
Margie L. Clapper  
James A. Crowell  
Mary B. Daly  
Roderick H. Dashwood  
Nancy E. Davidson  
Andrea De Censi  
Silvio De Flora  
Angelo M. De Marzo  
Wendy Demark-Wahnefried  
Phillip A. Dennis  
John DiGiovanni  
Ethan Dmitrovsky  
Mitchell Dowsett  
Steven M. Dubinett  
Adel El-Naggar  
Craig A. Elmets  
Isam-Eldin Eltoun  
Carol J. Fabian  
Olivera J. Finn  
Leslie G. Ford  
Wilbur A. Franklin  
Stephen J. Freedland

Patricia A. Ganz  
Judy E. Garber  
Andreas J. Gescher  
Maura L. Gillison  
Karen Glanz  
Jeffrey E. Green  
Peter Greenwald  
Clinton J. Grubbs  
Lorraine J. Gudas  
J. Silvio Gutkind  
Heather Hampel  
Samir M. Hanash  
Lynn C. Hartmann  
Stephen S. Hecht  
James G. Herman  
Fred R. Hirsch  
Anthony Howell  
Chanita Hughes-Halbert  
Stephen D. Hursting  
Peter A. Jones  
V. Craig Jordan  
Humam N. Kadara  
Robert L. Keith  
Fadlo R. Khuri  
Eric A. Klein  
Ah-ng Tony Kong  
Ernst Kuipers  
Stephen Lam  
Ho-Young Lee  
Scott J. Leischow  
Christopher I. Li  
Karen T. Liby  
Paul J. Limburg  
Mark W. Lingen  
Steven M. Lipkin  
Karen H. Lu  
Carlo C. Maley  
Sharon L. Manne  
Li Mao  
Sanford D. Markowitz  
James R. Marshall  
Rajendra G. Mehta  
Frank L. Meyskens  
Stefan Michiels  
John D. Minna  
James L. Mulshine  
Kenneth Offit  
Olufunmilayo Olopade

Frank G. Ondrey  
Vali Papadimitrakou-poulou  
Howard L. Parnes  
Electra D. Paskett  
Richard Peek  
John Pepper  
Gloria M. Petersen  
Chinthalapally Rao  
Rebecca R. Richards-Kortum  
Daniel W. Rosenberg  
Miriam P. Rosin  
Charles M. Rudin  
Carmen Sapienza  
Dong Moon Shin  
Imad Shureiqi  
Yu Shyr  
Shivendra V. Singh  
Michael B. Sporn  
Sudhir Srivastava  
Silvia D. Stan  
William P. Steward  
Gary D. Stoner  
Kotha Subbaramaiah  
Nanjoo Suh  
Saraswati Sukumar  
Shi-Yong Sun  
Young-Joon Surh  
Catherine M. Tangen  
Craig B. Thompson  
Henry J. Thompson  
Ian Thompson  
David Threadgill  
Thea D. Tlsty  
Asad Umar  
Toshikazu Ushijima  
Jaye L. Viner  
Kala Visvanathan  
Victor G. Vogel  
Cheryl Lyn Walker  
Thomas Wang  
Robyn Ward  
Dennis A. Wigle  
Benjamin C.Y. Wong  
Kwok-Kin Wong  
Chung S. Yang  
Ming You  
Harald zur Hausen

## CANCER PREVENTION RESEARCH

# Publishing Information

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

### AACR Officers

Elaine R. Mardis, President  
Antoni Ribas, President-Elect  
Elizabeth M. Jaffee, Past President  
William N. Hait, Treasurer  
Margaret Foti, Chief Executive Officer

### Publications Committee

Victor E. Velculescu, Chairperson  
Mary Helen Barcellos-Hoff  
Alberto Bardelli  
Dafna Bar-Sagi  
Michael E. Berens  
René Bernards  
John D. Carpten  
Frederic J. de Sauvage  
Sanjiv Sam Gambhir  
Maura L. Gillison  
Rakesh K. Jain  
Pasi A. Jänne  
Gerrit A. Meijer  
Gordon B. Mills  
Steffi Oesterreich  
William Pao  
Gloria M. Petersen  
Helen M. Piwnica-Worms  
Charles W.M. Roberts  
Alice T. Shaw  
Lillian L. Siu  
David B. Solit  
Saraswati V. Sukumar  
Toshikazu Ushijima

### 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

#### Associate Director, Production

Charlene Squibb

#### Assistant Director, Journal Marketing

Joanna Arnold

#### Assistant Director, Institutional Sales & Outreach

Karola Rac

#### Senior Director, Marketing and Creative Services

Paul Driscoll

#### Design Staff

Susan Moore

### Scope

*Cancer Prevention Research* publishes original studies, reviews, and perspectives in the field of cancer prevention. Its scope includes the molecular and cellular biology of premalignancy and early lesions; genetic and environmental risk factors; risk assessment and reduction; early detection research (cancer screening and diagnosis); and preventive interventions (chemoprevention, immunoprevention, and others) to intercept cancer development at early stages prior to initiation, promotion, or progression. The journal comprises preclinical, clinical, and translational research, with special attention given to molecular discoveries and an emphasis on building a translational bridge between the basic and clinical sciences.

*Cancer Prevention 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 <http://capr.msubmit.net>. Before submitting a manuscript, please read the Instructions for Authors, which is available from the Journal's home page at <http://cancerpreventionresearch.aacrjournals.org>.

### Publication Charges

Beginning with manuscripts submitted January 1, 2016 or after, 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 Instructions for Authors, which are available from the Journal's home page at <http://cancerpreventionresearch.aacrjournals.org>.

### Subscription Information

#### Nonmember Individuals

Subscriptions include print version with online access. 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](mailto:pubsales@aacr.org)

#### Japan

[e-support@maruzen.co.jp](mailto:e-support@maruzen.co.jp);  
[journal@kinokuniya.co.jp](mailto:journal@kinokuniya.co.jp); [usaco@usaco.co.jp](mailto: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](mailto: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](mailto:membership@aacr.org) or visit the membership page at [www.aacr.org](http://www.aacr.org) for more information.

#### Single Issue Sales

Subject to their availability, single or back issues may be purchased for \$60 (U.S.) or \$65 (outside the U.S.) each. The cost must be prepaid. Contact [pubsales@aacr.org](mailto:pubsales@aacr.org).

#### 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](mailto:membership@aacr.org)

#### Nonmembers and Institutions

[pubsales@aacr.org](mailto:pubsales@aacr.org)

### Advertising Information

For information about advertising in AACR journals, contact Pharmaceutical Media Inc., 30 East 33rd St., 4th Floor, New York, NY 10016; 212-904-0360; [Dsimone@pminy.com](mailto:Dsimone@pminy.com).

### Copyright and Permissions

Content printed in or disseminated by *Cancer Prevention Research* is protected by copyright. Authors who wish to publish material in *Cancer Prevention 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 <http://aacrjournals.org/content/authors/copyright-permissions-and-access>.