



Cancer Research

OFFICIAL JOURNAL OF THE AMERICAN ASSOCIATION FOR CANCER RESEARCH

Editor

Peter N. Magee

Managing Editor
Margaret Foti

Assistant Managing Editor
Mary Anne Mennite

Senior Staff Editor
Heide M. Puszta

Staff Editors
Ellen M. McDonald
Mark G. Hall

Editorial Assistants
Martha Michael
Joseph Heim

Administrative Secretary
Margaret A. Pickels

Editorial Secretaries
Theresa A. Griffith
Mary Ellen Pirring

*American Association for
Cancer Research, Inc.*

Executive Director
Margaret Foti

Senior Administrator
Adam D. Blistein

Senior Accountant
Anthony P. Biengio

Financial Assistant
George L. Moore

**Meetings and Development
Coordinator**
Jeffrey M. Ruben

Executive Secretaries
Ruth E. Fortson
Elizabeth A. Moore

**Secretary for
Member Services**
Robin E. Felder

Associate Editors

Stuart A. Aaronson
Samuel Abraham
David S. Alberts
William M. Baird
Charles M. Balch
Allan Balmain
Mariano Barbacid
J. Carl Barrett
Stephen B. Baylin
William T. Beck
John M. Bennett
Michael Bennett
Bijoy K. Bhuyan
June L. Biedler
Peter M. Blumberg
G. Tim Bowden
A. R. Bradwell
Luther W. Brady
Murray F. Brennan
Norman Breslow
Edward Bresnick
Garrett M. Brodeur
Sam C. Brooks
Ronald N. Buick
C. Patrick Burns
Ed Cadman
Robert L. Capizzi
Stephen K. Carter
Judith K. Christman
Samuel M. Cohen
Nancy H. Colburn
David Colcher
Allan H. Conney
Geoffrey M. Cooper
Joseph G. Cory
Eugene R. DeSombre

T. Michael Dexter
Ralph E. Durand
Harold F. Dvorak
Alan Eastman
Gertrude B. Elion
Lois B. Epstein
M. Essex
Nelson Fausto
Isaiah J. Fidler
Robert A. Floyd
Kenneth A. Foon
Joseph F. Fraumeni, Jr.
Errol C. Friedberg
Philip Frost
Eugene W. Gerner
Leo E. Gerweck
David W. Golde
David M. Goldenberg
Joel S. Greenberger
J. W. Grisham
Daniel P. Griswold
F. Peter Guengerich
Sen-itiroh Hakomori
Uli Hammerling
Philip C. Hanawalt
Nabil Hanna
Curtis C. Harris
John C. Harshbarger
Stephen S. Hecht
Ingegerd Hellstrom
Brian E. Henderson
Gloria H. Heppner
Ronald B. Herberman
Russell Hilf
Daniel C. Ihde
John T. Isaacs

Mark A. Israel
Rakesh K. Jain
Peter A. Jones
V. Craig Jordan
R. L. Juliano
Robert F. Kallman
David G. Kaufman
Ann R. Kennedy
Robert S. Kerbel
Young S. Kim
John M. Kirkwood
Alfred G. Knudson, Jr.
Kurt W. Kohn
Laurence N. Kolonel
Hilary Koprowski
Donald W. Kufe
John S. Lazo
Brigid G. Leventhal
Jay A. Levy
Shutsung Liao
Michael W. Lieberman
Victor Ling
Martin Lipkin
Marc E. Lippman
Gerald Litwack
Leroy F. Liu
Kenneth O. Lloyd
Lawrence A. Loeb
Dan L. Longo
Diana M. Lopez
Reuben Lotan
James W. Lown
David B. Ludlum
Tak W. Mak
Laurence J. Marton
Michael J. Mastrangelo

Kenneth B. McCredie
Myron R. Melamed
John Mendelsohn
Thomas C. Merigan
Christopher J. Michejda
John D. Minna
Malcolm S. Mitchell
Richard R. Monson
John A. Montgomery
Harold L. Moses
Franco M. Muggia
Sharon B. Murphy
Paul Nettesheim
Garth L. Nicolson
Thomas G. O'Brien
Peter J. O'Dwyer
Gilbert S. Omenn
C. Kent Osborne
Robert F. Ozols
Lester Packer
Michael A. Palladino, Jr.
Peter L. Pedersen
Anthony E. Pegg
Angel Pellicer
Sidney Pestka
W. J. Pledger
George K. Radda
Janardan K. Reddy
Donald J. Reed
Ralph A. Reisfeld
Richard A. Rifkind
Joseph L. Roti Roti
Berish Y. Rubin
Avery A. Sandberg
Jeffrey Schlom
Beatrice Singer

Francis M. Sirotnak
Michael A. Sirover
Helene S. Smith
Arthur A. Spector
Robert A. Squire
Martha R. Stampfer
Eric J. Stanbridge
Gary S. Stein
Bernard S. Strauss
James A. Swenberg
Paul Talalay
James E. Talmadge
David Tarin
Armen H. Tashjian
Douglas D. Taylor
Snorri S. Thorgierson
Douglass C. Tormey
Jeffrey M. Trent
Teresa J. Vietti
Ellen S. Vitetta
Bert Vogelstein
Barbara K. Vonderhaar
Daniel D. Von Hoff
Peter A. Ward
Michael D. Waterfield
Lee W. Wattenberg
George Weber
I. Bernard Weinstein
Clifford W. Welsch
Gerald N. Wogan
Sheldon Wolff
Sandra R. Wolman
Charles W. Young
Stuart H. Yuspa
Harald zur Hausen

Cover Editorial Board

Sidney Weinhouse,
Cover Editor

Joseph H. Burchenal
Nancy H. Colburn

Hugh J. Creech
George H. Hitchings

Edwin A. Mirand
John H. Weisburger

Cancer Research is sponsored by the American Association for Cancer Research, Inc. and receives major support from the American Cancer Society, Inc. Publication costs are also met by a grant from the Elsa U. Pardee Foundation.

Subscription Information

Cancer Research is published twice a month, one volume per year, by the American Association for Cancer Research, Inc. Subscriptions include the *Proceedings of the American Association for Cancer Research*, issued in March of each year. Except for members of the American Association for Cancer Research, all subscriptions are payable in advance to Waverly Press, Inc., 428 E. Preston Street, Baltimore, Maryland 21202, to which all business communications, remittances (in United States currency or its equivalent), and subscription orders should be sent. In Japan, send orders and inquiries to (sole agent): USACO Corporation, Tsutsumi Bldg., 13-12, 1-chome, Shimbashi, Minato-ku, Tokyo 105, Japan; Tel. (03) 502-6471. Nonmembers of the American Association for Cancer Research within the United States may subscribe to the journal *Cancer Research* at the rate of \$250.00 (individual nonmembers) or \$280.00 (institutional nonmembers) per annual volume, including postage. Institutional and individual nonmembers outside of the United States should add \$55.00 to their respective rates to offset second-class postage costs. Air mail and other means of delivery are available at extra charge; contact Waverly Press for information. Waverly Press should be notified of changes of address 60 days in advance; subscribers should give both their old and new addresses. Copies of the journal which are undeliverable because of address changes will be destroyed.

Notice to Members of the American Association for Cancer Research

Officers for 1989-1990

President: Harris Busch, Baylor College of Medicine, Houston, TX 77030

President-Elect: I. Bernard Weinstein, Columbia University College of Physicians & Surgeons, New York, NY 10032

Treasurer: Thomas J. King, Georgetown University Medical Center, Washington, DC 20007

Executive Director: Margaret Foti, AACR, 330 Market Street, 2nd Floor, Philadelphia, PA 19106.

Annual Dues

The annual dues of active members of the American Association for Cancer Research are \$100.00 and they include a subscription to the journal *Cancer Research*. The regular subscription price of *Cancer Research* for members of the Association is \$65.00 per annual volume. Corresponding members of the Association should add \$55.00 to this rate to offset postage costs. Payment of dues and changes of address of members of the Association should be sent promptly to Margaret Foti, Executive Director, American Association for Cancer Research, 330 Market Street, 2nd Floor, Philadelphia, PA 19106 (215) 440-9300.

Back Issues and Single Copy Sales of the Journal

Copies of back stock of the journal *Cancer Research* may be ordered from Waverly Press, Inc. As long as supplies permit, single copies of *Cancer Research* will be sold by this company at \$22.00 per copy for regular issues and \$22.00 per copy for Supplement issues which contain material from conferences on topics related to cancer. The annual *Proceedings of the American Association for Cancer Research* is available at \$20.00 per copy. Orders outside the U. S. and Canada add \$2.00/copy to offset postage costs.

Advertisements in *Cancer Research*

Advertisement insertion orders and copy must be received 60 days prior to the date of issue in which the advertisement is to be published. The journal is mailed approximately 7 days preceding the date of issue. Inquiries about advertising should be directed to: Gary A. Walchli, Williams and Wilkins, 428 E. Preston Street, Baltimore, Maryland 21202. Telephone: 301-528-4280.

Historical Cover Themes

Readers are invited to submit themes (events, persons, institutions) for consideration for the illustrated covers of *Cancer Research*. Correspondence regarding suggested cover themes, or other matters regarding covers, should be addressed to the Cover Editor, *Cancer Research* Editorial Office.

Submission of Manuscripts

Manuscripts should be sent to the attention of: Dr. Peter N. Magee, Editor, *Cancer Research* Editorial Office, American Association for Cancer Research, 330 Market Street, 2nd Floor, Philadelphia, PA 19106 (215) 440-9300. If accepted, they will be listed under one of ten categories in the Table of Contents. Please specify in a covering letter which category applies to your submission: Basic Sciences section—biochemistry and biophysics, carcinogenesis, endocrinology, immunology, molecular biology and genetics, preclinical pharmacology and experimental therapeutics, tumor biology, virology; Clinical Investigations section—clinical studies, epidemiological studies. (Final categorization in the Table of Contents is at the discretion of the Editor.) Consult the "Instructions for Authors" printed in the January issue of the journal for other submission requirements. Reprints of the "Instructions" are available upon request.

Manuscript Processing Fee

Journal policy requires that a manuscript processing fee of \$75.00 be assessed for each paper to defray the expenses incurred in the editorial review process. Each manuscript submitted for publication should be accompanied by a check (drawn on a U.S. bank) or purchase order for \$75.00 in U. S. currency, payable to *Cancer Research* at the above address. Note: If an author resubmits a manuscript that our Editors previously found unacceptable for publication, it is journal policy to consider it a new submission, assign it a new manuscript number, and charge the author another \$75.00 handling fee to cover the cost of review.

Page Charges

Accepted manuscripts will be published with the understanding that the author(s) will pay a charge of \$55.00 per printed page. Under exceptional circumstances, when no source of grant or other support exists, the author(s) may apply to Dr. Peter N. Magee, Editor, at the time of submission, for a waiver of the page charges. All such applications must be countersigned by an appropriate institutional official stating that no funds are available for the payment of page charges.

Copyright and Copyright Clearance Center

The Copyright Revision Act (PL 94-553), which became effective January 1, 1978, states that the copyright of a work is vested in the author from the moment of creation. Therefore, all authors who wish to publish in *Cancer Research* must formally transfer copyright to the proprietor of the journal, the American Association for Cancer Research, Inc. It is understood by this transfer that the authors relinquish all exclusive rights of copyright ownership, including the rights of reproduction, derivation, distribution, sale, and display.

Authors who prepared their articles as part of their official duties as employees of the U. S. Federal Government are not required to transfer copyright to the American Association for Cancer Research, Inc., since these articles are considered to be in the public domain. However, it is necessary for these authors to sign the appropriate section of the transfer form. In the case of articles supported by federal grants or contracts, copyright transfer to the American Association for Cancer Research, Inc., is required. The federal government may retain a nonexclusive license to publish or republish such material.

The duly authorized agent of a commercial firm or commissioning organization must sign the transfer form if the author prepared the article as part of his or her official duties as an employee.

Appropriate forms for transfer of copyright will be sent routinely with acknowledgment of receipt of manuscripts for review. They may also be requested from the *Cancer Research* Editorial Office. The journal will not publish a paper unless the form is properly completed and signed.

Copies of articles for which the American Association for Cancer Research, Inc. owns the copyright may be made for personal or internal use, provided that the copier pay the per-copy fee of \$2.00 through the Copyright Clearance Center, Inc. This Center is a nonprofit organization through which individuals and institutions may reimburse a copyright owner for photocopying journal articles beyond what is defined as "fair use" in Sections 107 and 108 of the Copyright Revision Act of 1978.

Those who wish to photocopy *Cancer Research* articles may report the number of copies they have made, together with the fee code 0008-5472/89 \$02.00, to: Copyright Clearance Center, Inc., 27 Congress St., Salem, Mass. 01970. Remittances may be sent to the Center at the time of reporting or the Center will bill the user on a monthly basis. Deposit accounts and prepayment plans may also be arranged.

Between June 1978 and August 1983, a fee code appeared on the first page of all articles for which *Cancer Research* owned the copyright. For those issues, it is understood that any articles which did not carry this code are in the public domain.

Cancer Research is abstracted or indexed in *Biological Abstracts*, *Chemical Abstracts*, *Index Medicus*, *Science Citation Index*, and by the *International Cancer Research Data Bank*.

No responsibility is accepted by the Editors, by the American Association for Cancer Research, Inc., or by Waverly Press, Inc. for the opinions expressed by contributors or for the content of the advertisements.

Cancer Research (ISSN 0008-5472) is published twice a month for \$65 per year (for members of the American Association for Cancer Research) or \$250 and \$280 per year (for nonmembers) by the American Association for Cancer Research, Inc. Second-class postage paid at Baltimore, Md. and additional mailing offices. POSTMASTER: Send address changes to *Cancer Research*, c/o Waverly Press, Inc., 428 E. Preston Street, Baltimore, Md. 21202.

Copyright 1989 by the American Association for Cancer Research, Inc.