



Cancer Research

**American Association for
Cancer Research, Inc.**

Publications Staff
Managing Editor
Margaret Foti

Assistant Managing Editor
Mary Anne Mennite

Production Manager
Heide M. Pusztay

Staff Editor
Martha Michael

Editorial Assistants
Angela Barry
Linda Pote Musumeci
James D. Tang

**Supervisor, Manuscript
Processing**
Margaret A. Pickels

**Assistant Supervisor,
Manuscript Processing**
Theresa A. Griffith

Editorial Secretaries
Mary Ellen Perring
June A. Holloway
Valerie L. Taylor
Luz M. Torres

Administrative Staff
Executive Director
Margaret Foti

**Associate Director of
Administration**
Adam D. Blistein

Senior Accountant
Anthony P. Blengino

Financial Assistant
George L. Moore

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

**Executive Assistant for
Programs**
Ruth E. Fortson

Administrative Assistant
Elizabeth A. Moore

**Staff Assistant for Member
Services**
Robin E. Felder

Editorial Secretary
Diana F. Certo

Editor-in-Chief
Carlo M. Croce

Associate Editors

Stuart A. Aaronson
Jerry M. Adams
David S. Alberts
William M. Baird
Charles M. Balch
Allan Balmain
J. Carl Barrett
Renato Baserga
William T. Beck
Thomas L. Benjamin
June L. Biedler
Clara D. Bloomfield
Peter M. Blumberg
Gianni Bonadonna
G. Tim Bowden
Luther W. Brady
Norman Breslow
Edward Bresnick
Samuel Broder
Sam C. Brooks
Ronald N. Buick
C. Patrick Burns
Bruno Calabretta
Eli Canaani
Robert L. Capizzi
Bruce A. Chabner
Yung-chi Cheng
David Colcher
Allan H. Conney
Neal G. Copeland
Joseph G. Cory
Jeffrey Cossman
Frank Costantini
Benoit de Crombrughe
Riicardo Dalla-Favera

Richard L. Davidson
Mark M. Davis
Eugene R. DeSombre
T. Michael Dexter
Ralph E. Durand
Alan Eastman
Gertrude B. Elion
Lois B. Epstein
Leonard C. Erickson
M. Essex
Emmanuel Farber
Nelson Fausto
Isaiah J. Fidler
Robert A. Floyd
Judah Folkman
Kenneth A. Foon
Joseph F. Fraumeni, Jr.
Errol C. Friedberg
Minoru Fukuda
Philip Furmanski
Eugene W. Gerner
Leo E. Gerweck
Eli Glatstein
David W. Golde
Michael M. Gottesman
J. W. Grisham
Sen-itiroh Hakomori
Philip C. Hanawalt
Curtis C. Harris
Jules E. Harris
John C. Harshbarger
Stephen S. Hecht
Ingegerd Hellstrom
Brian E. Henderson
Gloria H. Heppner

Russell Hilf
Richard B. Hochberg
Tasuku Honjo
Kay Huebner
James N. Ihle
John T. Isaacs
Mark A. Israel
Rakesh K. Jain
Peter A. Jones
V. Craig Jordan
Robert S. Kerbel
Young S. Kim
Tadamitsu Kishimoto
Alfred G. Knudson, Jr.
Kurt W. Kohn
Laurence N. Kolonel
Donald W. Kufe
John S. Lazo
Brigid G. Leventhal
Jay A. Levy
Frederick P. Li
Michael W. Lieberman
Victor Ling
Lance A. Liotta
Martin Lipkin
Marc E. Lippman
Gerald Litwack
Leroy F. Liu
Lawrence A. Loebl
Dan L. Longo
Diana M. Lopez
Reuben Lotan
James W. Lown
David B. Ludlum
Tak W. Mak

Michael J. Mastrangelo
W. Gillies McKenna
Anna T. Meadows
Myron R. Melamed
John Mendelsohn
Christopher J. Michejda
John D. Minna
Malcolm S. Mitchell
Richard R. Monson
Harold L. Moses
Sharon B. Murphy
Garth L. Nicolson
Kenneth Nilsson
Jeffrey A. Norton
Peter C. Nowell
Kenneth Olden
Gilbert S. Omenn
Robert F. Ozols
Michael A. Palladino, Jr.
Peter L. Pedersen
Anthony E. Pegg
Angel Pellicer
Bice Perussia
Sidney Pestka
Cecil B. Pickett
W. J. Pledger
Frank J. Rauscher III
Donald J. Reed
Ralph A. Reisfeld
Richard A. Rifkind
Robert T. Schimke
J. Schlessinger
Manfred Schwab
Joseph V. Simone
Beatrice Singer

Francis M. Sirotnak
Michael A. Sirover
Arthur A. Spector
Martha R. Stampfer
Eric J. Stanbridge
Gary S. Stein
Bernard S. Straus
Takashi Sugimura
Saraswati Sukumar
James A. Swenberg
Paul Talalay
James E. Talmadge
Masaaki Terada
Snorri S. Thorgeirsson
Donald J. Tindall
George J. Todaro
Jeffrey M. Trent
Giorgio Trinchieri
Axel Ullrich
Peter Vaupel
Ellen S. Vitetta
Daniel D. Von Hoff
Peter A. Ward
Michael D. Waterfield
Lee W. Wattenberg
I. Bernard Weinstein
Bengt Westermark
Raymond L. White
Walter Willett
Sheldon Wolff
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

Takashi Sugimura

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 April 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, MD 21202-3993, 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, Shimbashi-chome, Minato-ku, Tokyo 105, Japan; Tel. (03) 502-6471. Nonmembers of the American Association for Cancer Research within the United States may subscribe to Volume 52 (1992) of *Cancer Research* at the rate of \$350.00 (individual and institutional nonmembers), including postage. Institutional and individual nonmembers outside of the United States should add \$60.00 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. Changes of address notification should be sent 60 days in advance and include both old and new addresses. Member subscribers should send address changes to: Member Services, American Association for Cancer Research, Inc., Public Ledger Building, 620 Chestnut St., Suite 816, Philadelphia, PA 19106-3483. Nonmember subscribers should notify Waverly Press of changes of address. 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 1991-1992

President: Harold L. Moses, Vanderbilt University School of Medicine, Nashville, TN 37232

President-Elect: Lee W. Wattenberg, University of Minnesota, Minneapolis, MN 55455

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

Executive Director: Margaret Foti, AACR, Public Ledger Building, 620 Chestnut St., Suite 816, Philadelphia, PA 19106-3483

Annual Dues

The annual dues of active members of the American Association for Cancer Research are \$125.00 and they include a subscription to one AACR journal. The member rate for each additional journal is \$45.00. Corresponding members of the Association will be charged an appropriate fee to offset postage costs. Payment of dues and changes of address of members of the Association should be sent promptly to: Member Services, American Association for Cancer Research, Inc., Public Ledger Building, 620 Chestnut St., Suite 816, Philadelphia, PA 19106-3483. Telephone: (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 \$30.00 per copy for regular issues and \$30.00 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 \$25.00 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: Elizabeth Mosko, Williams and Wilkins, 428 E. Preston Street, Baltimore, MD 21202-3993. Telephone: (410) 528-4005.

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, AACR Publications Department.

Submission of Manuscripts

Manuscripts should be sent to the attention of: Dr. Carlo M. Croce, Editor-in-Chief, AACR Publications Department, American Association for Cancer Research, Public Ledger Building, 620 Chestnut St., Suite 816, Philadelphia, PA 19106-3483. Telephone: (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-in-Chief.) Consult the "Instructions for Authors" printed in the January 1 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 \$65.00 per printed page. Under exceptional circumstances, when no source of grant or other support exists, the author(s) may apply to Dr. Carlo M. Croce, Editor-in-Chief, 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.

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 0008-5472/92 \$02.00, to: Copyright Clearance Center, Inc., 27 Congress St., Salem, MA 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*. This journal is printed on acid-free paper.

No responsibility is accepted by the Editors, by the American Association for Cancer Research, Inc., or by Waverly, 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 \$80 per year (for members of the American Association for Cancer Research) or \$350 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 21202-3993.

Copyright 1992 by the American Association for Cancer Research, Inc.