

Cancer Research

OFFICIAL JOURNAL OF THE AMERICAN ASSOCIATION FOR CANGER RESEARCH AND ASSOCIATION FOR CANGER RESEARCH

Editor

Peter N. Magee

Managing Editor Margaret Foti

Assistant Managing Editor Mary Anne Mennite

Senior Staff Editor Heide M. Pusztay

Staff Editors
Ellen M. McDonald
Mark G. Hall

Editorial Assistants Martha Michael Joseph Heim

Administrative Secretary Margaret A. Pickels

Editorial Secretaries Sandra E. Pettie 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. Blengino

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 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 Nancy H. Colburn Samuel M. Cohen **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 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 Saxon Graham 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 Jav A. Levv **Shutsung Liao** Michael W. Lieberman Victor Ling Martin Lipkin Marc E. Lippman Gerald Litwack Leroy F. Liu Kenneth O. Lloyd 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 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 Eric J. Stanbridge Gary S. Stein Bernard S. Strauss James A. Swenberg Douglas D. Taylor Paul Talalay James E. Talmadge David Tarin Armen H. Tashjian Snorri S. Thorgiersson Douglass C. Tormey Jeffrev 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, remittaness (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 ad \$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 1988-1989

President: Lawrence A. Loeb, University of Washington, Seattle, WA 98195
President-Elect: Harris Busch, Baylor College of Medicine, Houston, TX 77030
Treasurer: Thomas J. King, Georgetown University Medical Center, Washington, DC 20007
Executive Director: Margaret Foti, AACR, 530 Walnut Street, 10th 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, 530 Walnut Street, 10th 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, 530 Walnut Street, 10th 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.