



Cancer Research

The Official Organ of the American Association for Cancer Research, Inc.

PETER N. MAGEE, *Editor*

MARGARET FOTI, *Managing Editor*

MARY ANNE MENNITE, *Assistant Managing Editor*

HEIDE M. PUSZTAY, *Staff Editor*

MICHAEL B. SHIMKIN, *Cover Editor*

Editorial Assistants

DONNA SHAWN CAMPBELL

DONNA D. GIACOBELLO

ELLEN M. McDONALD

ELIZABETH A. MOORE, *Executive Secretary*

MARGARET A. CRAWFORD, *Administrative Secretary*

CHRISTINE PYREAR, *Editorial Secretary*

SANDRA E. PETTIE, *Editorial Secretary*

RITA IAQUINTO, *Editorial Secretary*

DANISE E. GRANT, *Editorial Secretary*

ROSEMARY GRIFFIN, *Editorial Secretary*

KIMBERLY A. COLLINS, *Editorial Secretary*

DIANE E. NOLTE, *Editorial Secretary*

American Association for Cancer Research, Inc.

MARGARET FOTI, *Executive Director*

RUTH E. FORTSON, *Executive Secretary*

JAN M. SANDS, *Secretary*

Sponsors

Cancer Research is sponsored by the American Association for Cancer Research, Inc.; the National Cancer Institute, United States Public Health Service; the American Cancer Society, Inc.; the Elsa U. Pardee Foundation; Society for the Promotion of Cancer Research, Japan; Hoffmann-LaRoche Inc.; American Cyanamid Company; and E. I. DuPont De Nemours & Company, Inc.; publication costs are met in part by grants from these agencies.

Associate Editors

Stuart A. Aaronson
Samuel Abraham
Richard H. Adamson
Vincent G. Alfrey
Claudio Basílico
Stephen B. Baylin
James A. Belli
L. Lee Bennett, Jr.
Alexander Bloch
Clara D. Bloomfield
Peter M. Blumberg
Gerard P. Bodey
Dani P. Bolognesi
Carmia Borek
Edward Bresnick
R. Wallace Brockman
Sam C. Brooks
Ronald N. Buick
Ed Cadman
George P. Canellos
Paul P. Carbone
Stephen K. Carter
Bruce A. Chabner
Judith K. Christman
Samuel M. Cohen
Philip Cole
Allan H. Conney
Thomas L. Dao
Etienne de Harven
Friedrich Deinhardt
Eugene R. DeSombre
Lyle A. Dethlefsen
Vincent T. DeVita, Jr.
Leila Diamond
Benjamin Drewinko
Howard J. Eisen
Gertrude B. Eilon
Mortimer M. Elkind
Rose Ruth Ellison
Ronald W. Estabrook
Isaiah J. Fidler
Bernard Fisher
Jorgen Fogh
Joseph F. Fraumeni, Jr.
Emil J. Freireich
Charlotte Friend
John J. Furth
Harry V. Gelboin
Leo E. Gerweck
Raymond V. Gilden

Mary Catherine Glick
David M. Goldenberg
Stanley Goldfarb
James H. Goldie
Joel S. Greenberger
J. W. Grisham
Arthur P. Grollman
Lawrence Grossman
DuPont Guerry, IV
Pietro M. Gullino
George M. Hahn
Uli Hammerling
Robert E. Handschumacher
M. G. Hanna, Jr.
Richard W. Hanson
Gordon C. Hard
Curtis C. Harris
Stephen S. Hecht
Ingegerd Hellström
Brian E. Henderson
Gloria Heppner
Russell Hill
Vincent P. Hollander
Eliezer Huberman
Frank M. Huennekens
Robert B. Hurbert
Mary Ellen Jones
R. L. Juliano
Takeo Kakunaga
David G. Kaufman
Charles M. King
Eva Klein
Kurt W. Kohn
Hilary Koprowski
Margaret L. Kripke
Lloyd W. Law
Shutsung Liao
Michael W. Lieberman
William Lijinsky
Martin Lipkin
John B. Little
Gerald Litwack
Kenneth O. Lloyd
Lawrence A. Loeb
David B. Ludlum
Veronica M. Maher
Clement L. Markert
Michael J. Mastrangelo
Alvin M. Mauer
Charles F. McKhann

Daniel Medina
Mortimer L. Mendelsohn
Barbara R. Migeon
Enrico Milich
John D. Minna
Malcolm S. Mitchell
Charles G. Moertel
Malcolm A. S. Moore
Harold L. Moses
Paul Nettesheim
A. Munro Neville
Paul M. Newberne
Garth L. Nicolson
Peter C. Nowell
Albert H. Owens, Jr.
Anthony E. Pegg
Carl Peraino
G. Barry Pierce
Morton D. Prager
David M. Prescott
Ralph A. Reisfeld
Janet D. Rowley
Dante G. Scarpelli
Philip S. Schein
Jeffrey Schlom
James K. Selkirk
Robert Silber
Beatrice Singer
Francis M. Sirotnak
Thomas J. Slaga
Arthur A. Spector
Michael B. Sporn
Bernard S. Strauss
Louise C. Strong
Ian F. Tannock
Armen H. Tashjian, Jr.
E. Brad Thompson
George J. Todaro
Yale J. Topper
Frederick Urbach
Lee W. Wattenberg
George Weber
Sidney Weinhouse
Arthur Weissbach
Sherman M. Weissman
Clifford W. Welsch
Charles E. Wenner
Sheldon Wolff
John M. Yuhas
Stuart H. Yuspa

Subscription Information

Cancer Research is published monthly, one volume per year, for Cancer Research, Inc. by Waverly Press, Inc., 428 E. Preston Street, Baltimore, Maryland 21202. 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 the publisher of the journal, Waverly Press, Inc., to which all business communications, remittances (in United States currency or its equivalent), and subscription orders should be sent. Nonmembers of the American Association for Cancer Research within the United States and Canada may subscribe to the journal *Cancer Research* at the rate of \$80.00 (individual nonmembers) or \$140.00 (institutional nonmembers) per annual volume, including postage. Institutional and individual nonmembers outside of the United States and Canada should add \$30.00 to their respective rates to offset postage costs. The publisher should be notified of changes of address 60 days in advance; subscribers should give both their old and new addresses. Members of the American Association for Cancer Research should also inform the Executive Director, Margaret Foti, Temple University School of Medicine, West Building, Room 301, Philadelphia, Pa., 19140, of their change 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 1983-1984

President: Gertrude B. Elion, Wellcome Research Laboratories, 3030 Cornwallis Road, Research Triangle Park, North Carolina 27709
Vice President: Frederick S. Philips, Memorial Sloan-Kettering Cancer Center, 1275 York Avenue, New York, New York 10021
Secretary-Treasurer: Robert E. Handschumacher, Yale University School of Medicine, 333 Cedar Street, New Haven, Connecticut 06510
Executive Director: Margaret Foti, Temple University School of Medicine, West Building, Room 301, Philadelphia, Pa. 19140

Annual Dues

The annual dues of active members of the American Association for Cancer Research are \$55.00 and they include a subscription to the journal *Cancer Research*. The regular subscription price of *Cancer Research* for members of the Association is \$40.00 per annual volume. Corresponding members of the Association should add \$30.00 to this rate to offset postage costs. Payment of dues and changes of address of members of the Association should be sent promptly to the office of the American Association for Cancer Research, c/o Margaret Foti, Executive Director, American Association for Cancer Research, Temple University School of Medicine, West Building, Room 301, Philadelphia, Pa. 19140 (215-221-4565).

Back Issues and Single Copy Sales of the Journal

Copies of back stock of the journal *Cancer Research* for the two years preceding the current year may be ordered from Waverly Press, Inc. As long as supplies permit, single copies of *Cancer Research* will be sold by this company at \$20.00 per copy for regular issues and \$20.00 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. When available, earlier issues may be obtained from Walter J. Johnson, Inc., 355 Chestnut Street, Norwood, New Jersey 07648.

Advertisements in Cancer Research

Advertisement insertion orders and copy must be received 60 days prior to the month of issue in which the advertisement is to be published. The journal is mailed on or about the 20th of the month preceding the month of issue. Inquiries about advertising should be directed to: Donald H. Nichols, Vice President, Journal Sales, Waverly Press, Inc., 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

Papers submitted for publication in *Cancer Research* and all other communications for the attention of the Editor should be sent to: Dr. Peter N. Magee, Editor, *Cancer Research*, Fels Research Institute, Temple University School of Medicine, Philadelphia, Pennsylvania 19140. Telephone: 215/221-4720. *Cancer Research* publishes original studies in all the subfields of cancer research, including: biochemistry and physiology; chemical and physical carcinogenesis and mutagenesis; clinical investigations; endocrinology; epidemiology and biostatistics; immunology; molecular and cell biology; preclinical pharmacology and experimental therapeutics; radiobiology; and virology. Clinical investigations and epidemiological studies are published in a separate section from papers in the basic sciences. Authors should consult the detailed "Instructions for Authors" printed in the January issue of the journal, copies of which are available upon request.

Manuscript Processing Fee

Journal policy requires that a single manuscript processing fee of \$60.00 be assessed for all papers to defray the expenses incurred in the editorial review process. An invoice is sent to the author upon receipt of the manuscript. Review to determine acceptability will not be delayed pending payment of this fee.

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, *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 *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 *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.

As the copyright owner, *Cancer Research* has consented that copies of an article 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 0008-5472/83 \$02.00, to: Copyright Clearance Center, Inc., 21 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.

Articles from any issue of *Cancer Research* dating from 1973 may be photocopied under the same conditions and at the same fee. If there is no fee code, as in issues prior to June 1978, the user should report the title of the journal, the month of the issue, and the initial page number of the article, together with a statement of the number of copies made. If an article published after June 1978 does not carry a fee code, it is understood to be in the public domain and may be copied without restriction or payment of a fee.

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 *Cancer Research*, Inc., by the American Association for Cancer Research, Inc., or by the publisher of the journal *Cancer Research* for the opinions expressed by contributors or for the content of the advertisements.

Cancer Research (ISSN 0008-5472) is published monthly for \$40 per year (for members of the American Association for Cancer Research) or \$80 and \$140 per year (for nonmembers) by Waverly Press, Inc., 428 E. Preston Street, Baltimore, Md. 21202. 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 1983 by *Cancer Research*, Inc.