



# 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*

ELEANOR W. HUNNEMANN  
DONNA SHAWN CAMPBELL  
DONNA D. GIACOBELLO

ELIZABETH A. MOORE, *Executive Secretary*  
MARGARET A. CRAWFORD, *Administrative Secretary*  
JAN M. SANDS, *Editorial Secretary*  
CHRISTINE PYREAR, *Editorial Secretary*  
SANDRA E. PETTIE, *Editorial Secretary*  
RITA IAQUINTO, *Editorial Secretary*  
DANISE E. GRANT, *Editorial Secretary*  
ROSEMARY GRIFFIN, *Editorial Secretary*

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

MARGARET FOTI, *Executive Director*  
RUTH E. FORTSON, *Executive 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.; and American Cyanamid Company; publication costs are met in part by grants from these agencies.

#### *Associate Editors*

Stuart A. Aaronson	Raymond V. Gilden	Daniel Medina
Richard H. Adamson	Mary Catherine Glick	Mortimer L. Mendelsohn
Vincent G. Alfrey	David M. Goldenberg	Barbara R. Migeon
Claudio Basilico	Stanley Goldfarb	Enrico Mihich
Stephen B. Baylin	Joel S. Greenberger	Malcolm S. Mitchell
James A. Belli	J. W. Grisham	Charles G. Moertel
L. Lee Bennett, Jr.	Arthur P. Grollman	Malcolm A. S. Moore
Alexander Bloch	Lawrence Grossman	Paul Nettesheim
Clara D. Bloomfield	DuPont Guerry, IV	A. Munro Neville
Peter M. Blumberg	Pietro M. Gullino	Paul M. Newberne
Gerald P. Bodey	George M. Hahn	Garth L. Nicolson
Dani P. Bolognesi	Robert E. Handschumacher	Peter C. Nowell
Carmia Borek	M. G. Hanna, Jr.	Albert H. Owens, Jr.
Edward Bresnick	Richard W. Hanson	Anthony E. Pegg
R. Wallace Brockman	Gordon C. Hard	Carl Peraino
Sam C. Brooks	Curtis C. Harris	G. Barry Pierce
Ronald N. Buick	Stephen S. Hecht	Morton D. Prager
Ed Cadman	Ingegerd Hellström	David M. Prescott
George P. Canellos	Brian E. Henderson	Ralph A. Reisfeld
Paul P. Carbone	Gloria Heppner	Saul A. Rosenberg
Stephen K. Carter	Russell Hill	Janet D. Rowley
Bruce A. Chabner	Vincent P. Hollander	Dante G. Scarpelli
Judith K. Christman	Eliezer Huberman	Philip S. Schein
Donald S. Coffey	Frank M. Huennekens	Jeffrey Schlom
Samuel M. Cohen	Robert B. Hurlbert	James K. Selkirk
Philip Cole	Mary Ellen Jones	Robert Silber
Allan H. Conney	R. L. Juliano	Beatrice Singer
Thomas L. Dao	Takeo Kakunaga	Francis M. Sirotnak
Etienne de Harven	David G. Kaufman	Thomas J. Slaga
Friedrich Deinhardt	Charles M. King	Arthur A. Spector
Lyle A. Dethlefsen	Eva Klein	Michael B. Sporn
Vincent T. DeVita, Jr.	Kurt W. Kohn	Bernard S. Strauss
Leita Diamond	Hilary Koprowski	Armen H. Tashjian, Jr.
Benjamin Drewinko	Margaret L. Kripke	E. Brad Thompson
Howard J. Eisen	Lloyd W. Law	George J. Todaro
Gertrude B. Elion	Shutsung Liao	Yale J. Topper
Mortimer M. Elkind	Michael W. Lieberman	Frederick Urbach
Rose Ruth Ellison	William Ljinsky	Lee W. Wattenberg
Ronald W. Estabrook	Martin Lipkin	George Weber
Isaiah J. Fidler	Gerald Litwack	Sidney Weinhouse
Bernard Fisher	Lawrence A. Loeb	Arthur Weissbach
Jørgen Fogh	David B. Ludlum	Sherman M. Weissman
Joseph F. Fraumeni, Jr.	Veronica M. Maher	Clifford W. Welsch
Emil J. Freireich	Clement L. Markert	Charles E. Wenner
Charlotte Friend	Michael J. Mastrangelo	John M. Yuhas
John J. Furth	Alvin M. Mauer	Stuart H. Yuspa
Leo E. Gerweck	Charles F. McKhann	

#### **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 1982-1983

**President:** Gerald C. Mueller, McArdle Laboratory for Cancer Research, 450 North Randall Avenue, Madison, Wisconsin 53706  
**Vice President:** Gertrude B. Elion, Burroughs Wellcome Co., 3030 Cornwallis Road, Research Triangle Park, North Carolina 27709  
**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.

The appearance of the code 0008-5472/83/0043-0000\$02.00 at the top of the first page of an article in *Cancer Research* indicates that the copyright owner has consented that copies of the article may be made for personal or internal use, provided that the copier pay the stated 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 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.