

**PRESIDENT OF THE ACADEMY**

Ralph J. Cicerone

**EDITOR-IN-CHIEF**

Randy Schekman

**ASSOCIATE EDITORS**

William C. Clark  
Alan Fersht  
Jack Halpern  
Jeremy A. Sabloff  
Solomon H. Snyder  
Peter K. Vogt  
Susan R. Wessler

**EDITORIAL BOARD**

**Animal, Nutritional, and Applied Microbial Sciences**

David L. Denlinger  
R. Michael Roberts  
Linda J. Saif  
Ryuzo Yanagimachi

**Anthropology**

Richard G. Klein  
Dolores R. Piperno  
Alan Walker

**Applied Mathematical Sciences**

Peter J. Bickel

**Applied Physical Sciences**

David Chandler  
Noel A. Clark  
Francisco de la Cruz

**Astronomy**

Geoffrey W. Marcy

**Biochemistry**

Edward D. Korn  
John Kuriyan  
Alan M. Lambowitz  
Michael A. Marletta  
Kiyoshi Mizuuchi  
Paul L. Modrich  
Charles M. Radding  
Venkatraman Ramakrishnan  
Tom A. Rapoport  
Peter Walter  
James A. Wells  
William T. Wickner

**Biophysics and Computational Biology**

David Baker  
Adriaan Bax  
Charles R. Cantor  
William A. Eaton  
Barry H. Honig  
Robert Langer  
Michael Levitt  
Gregory A. Petsko

**Cellular and Developmental Biology**

Eric H. Davidson  
John B. Gurdon  
Eric N. Olson  
Michael Rosbash  
David D. Sabatini  
Gertrud M. Schüpbach  
Robert Tjian

**Cellular and Molecular Neuroscience**

Pietro V. De Camilli  
Richard L. Huganir  
L. L. Iversen  
Yuh Nung Jan  
Jeremy Nathans  
Charles F. Stevens  
Thomas C. Südhof  
Joseph S. Takahashi  
Hans Thoenen  
Charles S. Zuker

**Chemistry**

Stephen J. Benkovic  
Harry B. Gray  
Raphael D. Levine  
Jerrold Meinwald  
Mark A. Ratner  
Nicholas J. Turro

**Computer and Information Sciences**

William H. Press

**Economic Sciences**

Avinash K. Dixit

**Engineering Sciences**

Anthony G. Evans

**Environmental Sciences and Ecology**

James H. Brown  
Christopher B. Field  
David M. Karl  
Robert May  
David W. Schindler

**Evolutionary Biology**

Francisco J. Ayala  
May R. Berenbaum  
W. Ford Doolittle  
Douglas J. Futuyma  
Daniel L. Hartl  
Masatoshi Nei  
Tomoko Ohta

**Genetics**

Kathryn V. Anderson  
Thomas W. Cline  
Stanley N. Cohen  
Stanley Fields  
Jeffrey C. Hall  
Philip C. Hanawalt  
Rudolf Jaenisch

Jasper Rine  
Reed B. Wickner

**Geology**

W. G. Ernst  
James P. Kennett

**Geophysics**

Mark H. Thiemens

**Human Environmental Sciences**

Ruth S. DeFries  
Susan Hanson

**Immunology**

Peter Cresswell  
Douglas T. Fearon  
Tak Wah Mak  
Philippa Marrack  
William E. Paul  
Ralph M. Steinman  
Tadatsugu Taniguchi  
Arthur Weiss

**Mathematics**

Richard V. Kadison  
Robion C. Kirby

**Medical Genetics, Hematology, and Oncology**

Joseph L. Goldstein  
Mark T. Groudine  
Tony Hunter  
Philip W. Majerus  
David C. Page  
Stanley B. Prusiner  
Craig B. Thompson  
Inder M. Verma  
Robert H. Waterston

**Medical Physiology and Metabolism**

Michael S. Brown  
Charles A. Dinarello  
Robert J. Lefkowitz  
Salvador Moncada

**Microbial Biology**

John M. Coffin  
R. John Collier  
Emil C. Gotschlich  
E. Peter Greenberg  
Diane E. Griffin

Peter M. Howley  
Elliott D. Kieff  
Robert A. Lamb  
Peter Palese  
Thomas E. Shenk  
Thomas J. Silhavy  
Thomas E. Wellems

**Physics**

Anthony Leggett  
Paul C. Martin  
José N. Onuchic

**Physiology and Pharmacology**

Susan G. Amara  
David Julius  
Ramon Latorre

**Plant Biology**

Anthony R. Cashmore  
Maarten J. Chrispeels  
Enrico Coen  
Jeffery L. Dangl  
Joseph R. Ecker  
Robert Haselkorn

**Plant, Soil, and Microbial Sciences**

Roger N. Beachy  
Brian J. Staskawicz  
M. S. Swaminathan

**Psychology**

Dale Purves  
Edward E. Smith

**Social and Political Sciences**

Alejandro Portes  
Brian Skyrms

**Sustainability Science**

Barry R. Bloom  
Partha Sarathi Dasgupta  
Robert W. Kates  
Pamela A. Matson  
Elinor Ostrom  
Hans Joachim Schellnhuber  
B. L. Turner II

**Systems Neuroscience**

Robert Desimone  
Fred H. Gage  
Charles D. Gilbert  
Marcus E. Raichle  
Leslie G. Ungerleider

**Submission to PNAS**

Authors (members and nonmembers) may submit their manuscripts directly to PNAS at [www.pnascentral.org](http://www.pnascentral.org). In a cover letter or in the online submission form, authors must recommend 3 appropriate Editorial Board members, 3 NAS members who are expert in the paper's scientific area, and 5 qualified referees. **Submission is open to all authors** and no Academy member sponsor is required.

**PNAS** (ISSN-0027-8424) is published weekly in print by the National Academy of Sciences.

**Correspondence:** PNAS, 500 Fifth Street, NW, NAS 340, Washington, DC 20001 USA or 2101 Constitution Avenue, NW, NAS 340, Washington, DC 20418 USA (for courier or express mail). E-mail: PNAS@nas.edu.

**Copyright:** Volumes 90–105, copyright © 1993–2008 by the National Academy of Sciences of the United States of America, all rights reserved. Volumes 1–89, copyright as a collective work only; author(s) retains copyright to individual articles. **Requests for Permission:** See [www.pnas.org/misc/rightperm.shtml](http://www.pnas.org/misc/rightperm.shtml) for details. Address requests to reproduce material published in Volumes 1–89 to the original author(s); e-mail other requests to PNASpermissions@nas.edu, fax 1-202-334-2739, or PNAS Permissions Editor, 500 Fifth Street, NW, NAS 340, Washington, DC 20001 USA. Please cite the exact material to be reprinted and state specifically where it will be used. **Photocopies:** PNAS is registered with the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923 USA, fax 1-978-750-4470, or [www.copyright.com](http://www.copyright.com). Authorization to photocopy items for the internal or personal use of specific clients is granted by the National Academy of Sciences provided that the proper fee is paid directly to CCC. **Microforms:** Contact UMI at [www.umi.com](http://www.umi.com) or P.O. Box 1346, Ann Arbor, MI 48106-1346 USA.

**Advertising:** Mark Chesnek, 500 Fifth Street, NW, NAS 340, Washington, DC 20001 USA. Phone 1-202-334-2696, fax 1-202-334-1346, e-mail [mchesnek@nas.edu](mailto:mchesnek@nas.edu).

**Subscriptions:** Send payments to PNAS, c/o AIP, P.O. Box 503284, St. Louis, MO 63150-3284 USA. For subscription help, e-mail [subs@aip.org](mailto:subs@aip.org), phone 1-516-576-2270, or visit [www.pnas.org/subscriptions](http://www.pnas.org/subscriptions). **2008 Rates:** U.S., individual–\$320 (first class delivery available at a surcharge of \$160); U.S., institutional–\$1,825; non-U.S., individual–\$505; non-U.S., institutional–\$2,180. Subscriptions are entered on a calendar-year basis.

**Exclusive Agent for Subscribers in Japan:** USACO Corporation, 17-12 Higashi-Azabu, 2-Chome, Minato-ku, Tokyo 106-0044, Japan. Phone 81 3 3505 3256, fax 81 3 3505 6282, e-mail [tokyo-sales@usaco.co.jp](mailto:tokyo-sales@usaco.co.jp). **Change of Address:** PNAS, c/o AIP, Suite 1N01, 2 Huntington Quadrangle, Melville, NY 11747 USA. Phone 1-800-344-6902, fax 1-516-349-9704, e-mail [subs@aip.org](mailto:subs@aip.org). Please send notification 6 weeks in advance and list the old and new addresses. **Claims:** Requests for replacement copies will not be honored more than 60 days after the issue date for domestic subscribers and not more than 90 days after the issue date for foreign subscribers. Claims will not be honored for more than 2 issues per calendar year for the same subscriber. To make a claim, e-mail [subs@aip.org](mailto:subs@aip.org) or call 1-800-344-6902. **Single Copies:** \$40 per issue in the U.S., \$50 non-U.S. To order, e-mail [subs@aip.org](mailto:subs@aip.org) or call 1-800-344-6902. **Canadian GST:** Registration Number R-133130880.

**Postmaster:** Send address changes to PNAS, c/o AIP, Suite 1N01, 2 Huntington Quadrangle, Melville, NY 11747 USA. Periodicals postage paid at Washington, DC, and additional mailing offices.

**PNAS is available online at [www.pnas.org](http://www.pnas.org).**  
PRINTED IN THE USA



Printed on acid-free paper effective Volume 84, Issue 1, and on 10% post-consumer recycled paper effective Volume 105, Issue 1.

## PNAS STAFF

**Publisher**  
Kenneth R. Fulton

**Executive Editor**  
Diane M. Sullenberger

**Managing Editor**  
Daniel H. Salsbury

**Editorial Staff**  
James B. Allison  
Josiah W. Armour  
Maya Ellis Brown  
Tom J. Colihan  
Julia M. Diez d'Aux  
Kathleen E. Dugan  
Jim L. Feasel  
Moses M. Jackson  
Meredith C. Jones  
Etta Kavanagh  
Jacob Kendall-Taylor  
Amanda Kennell  
Sarah Leamy  
Tom Myers  
Jennifer Nelson  
N. T. Ngo  
May B. Piotrowski  
Allison Ross  
Benjamin Snow  
David Stopak

**Production Manager**  
Dana M. Compton

**Production Staff**  
Barbara A. Bacon  
Tiffany A. Millerd  
Ariana B. Raveica

**Marketing Manager**  
Mark Chesnek

**Marketing Staff**  
Jennifer Bradley

**Media Staff**  
Thoko Kachipande  
Jonathan Lifland  
Kaspar Mossman

**Finance Manager**  
Simone Marshall-Campbell

**Business Staff**  
Juanita Culler  
Julia A. Little  
Sara Spizzirri

## Authorship

Authorship should be limited to those who have contributed substantially to the work. Authors must indicate their specific contributions to the published work; this information will be published as a footnote to the paper. The corresponding author must have obtained permission from all authors for the submission of each version of the paper and for any change in authorship.

## Conflict of Interest

All authors, members, referees, and editors must disclose any association that poses a conflict of interest in connection with the manuscript. Authors must acknowledge all funding sources supporting the work. See [www.pnas.org/misc/coi.shtml](http://www.pnas.org/misc/coi.shtml) for details.

## Supporting Information

Authors may use Supporting Information to enhance their papers in PNAS by providing additional substantive material for online posting, but the print version of the paper must stand on its own merits.

## Cover Images

Authors are encouraged to submit scientifically interesting and visually arresting images for the cover.

## Information for Authors

Please see the complete Information for Authors, available online at [www.pnas.org](http://www.pnas.org).

## PNAS Online

PNAS articles are published daily online before print at [www.pnas.org](http://www.pnas.org) in PNAS Early Edition.

The articles in PNAS report original research by independent authors and do not necessarily represent the views of the National Academies.