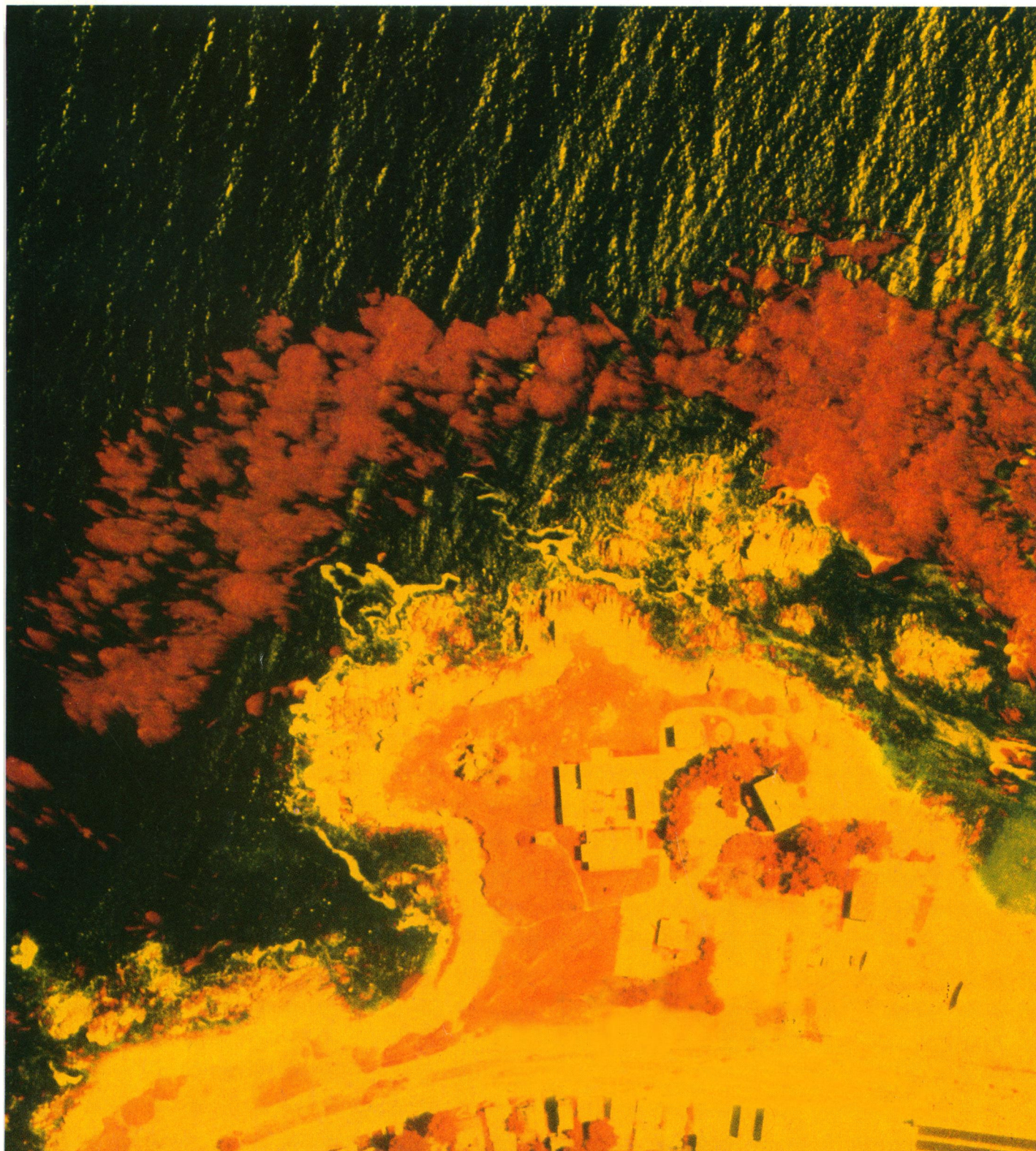


AMERICAN  
ASSOCIATION FOR THE  
ADVANCEMENT OF  
SCIENCE

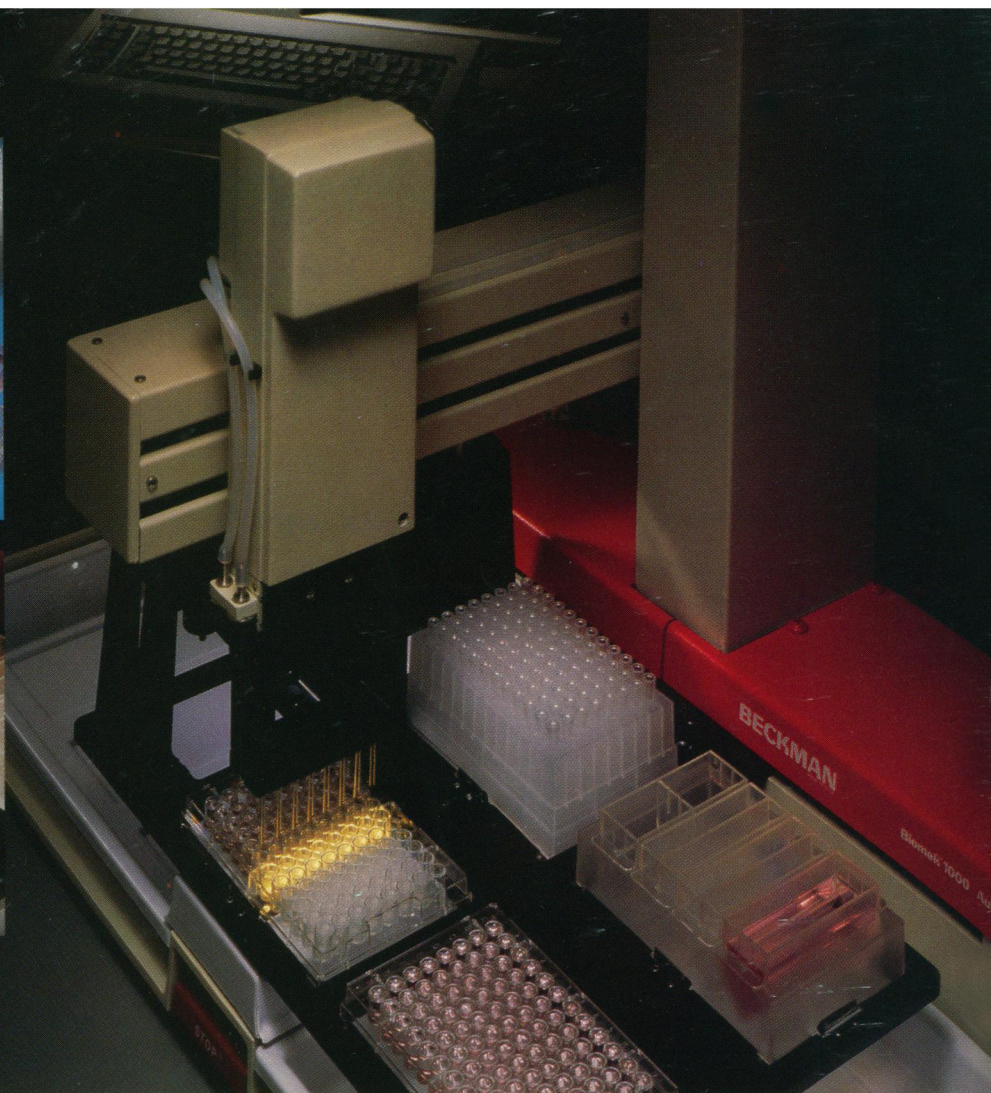
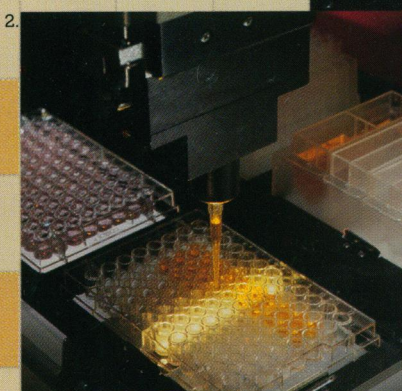
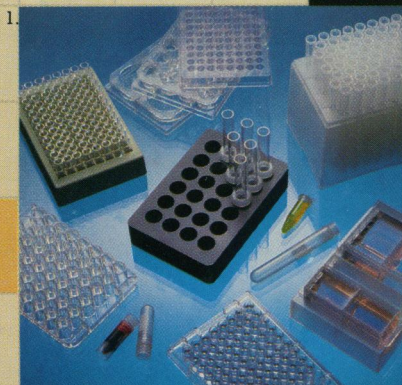
# SCIENCE

23 JANUARY 1987  
VOL. 235 ■ PAGES 397-512

\$2.50







New from Beckman

## The Most Advanced Robot To Enter The Laboratory

The Biomek™ 1000 Automated Laboratory Workstation. It's a new concept in laboratory automation, and it's changing the way researchers spend their time.

Ideal for immunoassays such as ELISA, hybridoma screening and selection, or other bioassays, Biomek takes over all liquid handling steps. Pipetting, diluting, dispensing, plate washing, even photometry can be completed at this single workstation.

### Fast

With Biomek™ 1000, plate-

based enzyme immunoassays, from sample transfer to OD measurement, can take just 12 minutes, excluding incubations. And a tenfold, 96-tube serial dilution and transfer, with tip changes, can be completed in just over 3 minutes.

### Flexible

With Biomek™ 1000, you're not restricted to a manufacturer-supplied program. Biomek does your work the way you want it done. A proprietary assay language lets you easily program methods from simple to complex. And you can use labware you're accustomed to: multiwell plates,

cryovials, tubes, or our new modular reservoirs.

As cost and labor savings become more critical to the research lab, the demand grows for instruments that speed research and stretch research dollars. Biomek 1000 does both.

To find out more, call toll-free (800) 742-2345, or write to Beckman Instruments, Inc., Spinco Division, 1050 Page Mill Rd., Palo Alto, CA 94304. Offices in major cities worldwide.

1. With the Biomek™ 1000 Automated Laboratory Workstation, you can use the labware you're accustomed to.
2. Complex procedures, from pipetting through photometry, can be performed at this single workstation.

# BECKMAN

Circle No. 92 on Readers' Service Card



## **A 6,000 V Constant Power Supply with Unequalled Versatility for Electrophoresis Work**

The new E-C Quantum 650 delivers so many constant power options you may never need to buy another power supply. High voltage range (6,000 V) for DNA sequencing, HV isoelectric focusing, other advanced work. Low voltage range (2,000 V) for multiple SDS gels, general electrophoresis, electroblotting, immunoassays. Constant power to 200 W. Constant voltage to 6,000 V. Constant current to 350 mA.

Four power outlets let you run up to four procedures simultaneously. Digital LED readout. Automatic 3-mode crossover. Full E-C safety features. Adaptability to any E-C or similar cell. Only \$2,495 f.o.b. St. Petersburg, FL.

To place an order or obtain more information, call Technical Service collect at 800-624-2232 (in Florida 800-282-7932). Or write E-C Apparatus Corporation, 3831 Tyrone Boulevard N., St. Petersburg, FL 33709. Telex: 51-4376 HALA.



403 This Week in *Science*

## Editorial

- 405 Techniques and Strategies of Verification

## Policy Forum

- 406 Verification and Arms Control: M. EIMER AND S. DRELL

## Letters

- 415 Earth's Early Atmosphere: K. M. TOWE; J. F. KASTING AND T. P. ACKERMAN ■ Novelty of "Supply-Side Ecology"; C. M. YOUNG ■ U.S. Management and Productivity: T. P. VOGL; F. BLOCK; M. N. BAILY

## News & Comment

- 422 Integrity of Research Papers Questioned  
423 EPA Finds Western Lakes Free of Acid Pollution, But Vulnerable  
424 Academy Panel Blasts U.S. Export Controls  
425 Shuttle Plan Faulted  
426 A Crisis in Space Research  
429 Science Sections in U.S. Newspapers Increase Dramatically in Past 2 Years

## Research News

- 430 Biological Issues in Schizophrenia  
431 A Top Priority at NIMH  
433 A Geophysics Potpourri in San Francisco: Getting a Full View of the Earth's Innards ■ U.S.-Soviet Seismic Monitoring Advances ■ Ocean Hot Springs Similar Around Globe ■ How Much Drying from a Greenhouse Warming?  
436 Dietary Fat-Breast Cancer Link Questioned

## Articles

- 437 Weather Regimes: The Challenge in Extended-Range Forecasting: B. REINHOLD  
442 Angiogenic Factors: J. FOLKMAN AND M. KLAGSBRUN

## Research Articles

- 448 Atomic Structure of Thymidylate Synthase: Target for Rational Drug Design: L. W. HARDY, J. S. FINER-MOORE, W. R. MONTFORT, M. O. JONES, D. V. SANTI, R. M. STROUD

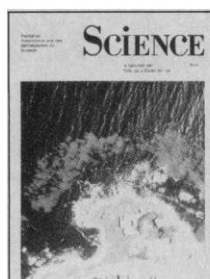
## Reports

- 456 In Situ Detection of  $\beta$ -Galactosidase in Lenses of Transgenic Mice with a  $\gamma$ -Crystallin/*lacZ* Gene: D. R. GORING, J. ROSSANT, S. CLAPOFF, M. L. BREITMAN, L.-C. TSUI  
458 Crystallographic R Factor Refinement by Molecular Dynamics: A. T. BRÜNGER, J. KURIYAN, M. KARPLUS

■ **SCIENCE** is published weekly on Friday, except the last week in December, and with an extra issue in February by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Second-class postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Now combined with **The Scientific Monthly**® Copyright © 1987 by the American Association for the Advancement of Science. The title **SCIENCE** is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$65. Domestic institutional subscription (51 issues): \$98. Foreign postage extra: Canada \$32, other (surface mail) \$27, air-surface via Amsterdam \$65. First class, airmail, school-year, and student rates on request. Single copies \$2.50 (\$3 by mail); back issues \$4 (\$4.50 by mail); Biotechnology issue, \$5.50 (\$6 by mail); classroom rates on request; Guide to Biotechnology Products and Instruments \$16 (\$17 by mail). **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$1 per copy plus \$0.10 per page is paid directly to CCC, 21 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, DC 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.





**COVER** Aerial photograph of the kelp forest fringing the rocky intertidal zone at Hopkins Marine Station on Monterey Bay, California. Infrared film renders the kelps red. Fish, living in this kelp forest, affect recruitment to the adjacent intertidal barnacle population showing that the dynamics of the two communities are coupled. See page 479. [Slide courtesy of the California Department of Fish and Game; print by R. Gilbert]

- 
- 460 Thunderstorms: An Important Mechanism in the Transport of Air Pollutants: R. R. DICKERSON, G. J. HUFFMAN, W. T. LUKE, L. J. NUNNEMACKER, K. E. PICKERING, A. C. D. LESLIE, C. G. LINDSEY, W. G. N. SLINN *et al.*
- 465 Validity Tests of the Mixing-Length Theory of Deep Convection: K. L. CHAN AND S. SOFIA
- 467 The Glucocorticoid Receptor Protein Binds to Transfer RNA: M. ALI AND W. V. VEDECKIS
- 470 Brain Barrier Tissues: End Organs for Atriopeptins: L. STEARDO AND J. A. NATHANSON
- 473 Macrophage Cytotoxicity: Role for L-Arginine Deiminase and Imino Nitrogen Oxidation to Nitrite: J. B. HIBBS, JR., R. R. TAINTOR, Z. VAVRIN
- 476 The Cytoskeletal Protein Vinculin Contains Transformation-Sensitive, Covalently Bound Lipid: P. BURN AND M. M. BURGER
- 479 Fish in Offshore Kelp Forests Affect Recruitment to Intertidal Barnacle Populations: S. D. GAINES AND J. ROUGHGARDEN
- 481 Mapping Human Brain Monoamine Oxidase A and B with <sup>11</sup>C-Labeled Suicide Inactivators and PET: J. S. FOWLER, R. R. MACGREGOR, A. P. WOLF, C. D. ARNETT, S. L. DEWEY, D. SCHLYER, D. CHRISTMAN, J. LOGAN, *et al.*
- 

## AAAS Meetings

- 486 Call for Symposium Proposals, 1988 AAAS Annual Meeting
- 

## Book Reviews

- 490 Controversy in Victorian Geology, *reviewed by* W. MONTGOMERY ■ Misunderstanding Media, G. WISE ■ Blueschists and Eclogites, W. G. ERNST ■ Synapses, Circuits, and the Beginnings of Memory, T. J. TEYLER ■ Ecology and Natural History of Desert Lizards, J. TRAVIS ■ Reprints of Books Previously Reviewed ■ Books Received
- 

## Products & Materials

- 495 Sample Preparation Systems ■ Analog-to-Digital Converter ■ Electrochemical Detector ■ Bench-Scale Fermenter ■ Automated 2-D Gel Analysis System ■ Laptop Computer ■ Literature
- 

### Board of Directors

Gerard Piel  
*Retiring President,  
Chairman*

Lawrence Bogorad  
*President*

Sheila E. Widnall  
*President-elect*

Robert McC. Adams  
Robert W. Berliner  
Floyd E. Bloom  
Mary E. Clutter  
Mildred S. Dresselhaus  
Donald N. Langenberg  
Dorothy Nelkin  
Linda S. Wilson

William T. Golden  
*Treasurer*

William D. Carey  
*Executive Officer*

### Editorial Board

Elizabeth E. Bailey  
David Baltimore  
William F. Brinkman  
Philip E. Converse  
Joseph L. Goldstein  
James D. Idol, Jr.  
Leon Knopoff  
Seymour Lipset  
Walter Massey  
Oliver E. Nelson  
David V. Ragone  
David M. Raup  
Vera C. Rubin  
Larry L. Smarr  
Solomon H. Snyder  
Robert M. Solow  
James D. Watson

### Board of Reviewing Editors

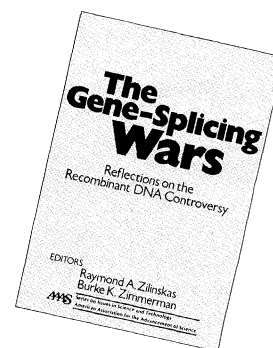
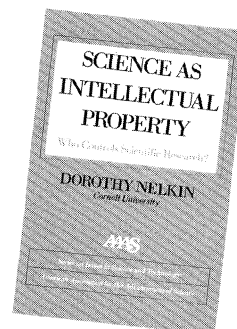
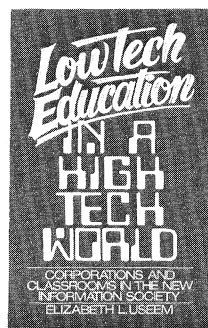
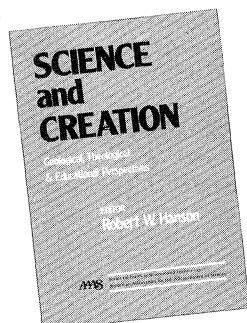
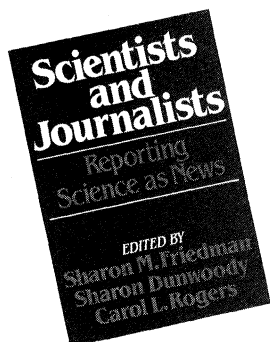
John Abelson  
Qais Al-Awqati  
James P. Allison  
Don L. Anderson  
Elizabeth H. Blackburn  
Floyd E. Bloom  
Charles R. Cantor  
James H. Clark  
Bruce F. Eldridge  
Stanley Falkow  
Theodore H. Geballe  
Roger I. M. Glass  
Stephen P. Goff  
Robert B. Goldberg

Corey S. Goodman  
Richard M. Held  
Gloria Heppner  
Eric F. Johnson  
Konrad B. Krauskopf  
I. Robert Lehman  
Karl L. Magleby  
Joseph B. Martin  
John C. McGiff  
Alton Meister  
Mortimer Mishkin  
Peter Olson  
Gordon H. Orians  
John S. Pearce

Yeshayau Pocker  
Jean Paul Revel  
James E. Rothman  
Thomas C. Schelling  
Ronald H. Schwartz  
Stephen M. Schwartz  
Otto T. Solbrig  
Robert T. N. Tjian  
Virginia Trimble  
Geerat J. Vermeij  
Martin G. Weigert  
Harold Weintraub  
Irving L. Weissman  
George M. Whitesides  
Owen N. Witte  
William B. Wood



# New Titles Available from AAAS



## **Scientists and Journalists: Reporting Science as News**

*Edited by Sharon M. Friedman,  
Sharon Dunwoody, and Carol L. Rogers*

The public is interested in science and depends largely on the mass media for the latest information. But how well do scientists and journalists connect to communicate to the public? This book examines the human aspect of the links between scientists and journalists through the eyes of both.

1985, 352 pp., hardcover; \$24.95, AAAS members \$19.95

## **Science and Creation: Geological, Theological, and Educational Perspectives**

*Edited by Robert W. Hanson*

The creation/evolution controversy is examined by scientists, theologians, educators, and historians. These authors view the controversy as a false dichotomy and as an attempt to force a choice between two ideas that are not mutually exclusive. Includes case studies from several states.

1986, 240 pp., hardcover; \$24.95, AAAS members \$19.95

## **Low Tech Education in a High Tech World: Corporations and Classrooms in the New Information Society**

*Elizabeth L. Useem*

Are students in the U.S. developing the skills necessary for a high technology society, or will it be technological boom, educational gloom? Useem examines education in California's "Silicon Valley" and Boston's Route 128, two of the country's leading high tech centers, and suggests ways for education and industry to forge a stronger partnership for the future.

1985, 256 pp., hardcover; \$19.95, AAAS members \$15.95

## **Science as Intellectual Property: Who Controls Scientific Research?**

*Dorothy Nelkin*

Who controls research? A growing number of legal and administrative disputes raise critical issues of professional sovereignty, scientific secrecy, and proprietary rights. Nelkin offers cases illustrating the dilemmas that arise as the interests of scientists, the rights of citizens, and the security needs of government and industry come into increasing conflict.

1984, 130 pp., softcover; \$10.00, AAAS members \$8.00

## **The Gene-Splicing Wars: Reflections on the Recombinant DNA Controversy**

*Edited by Raymond A. Zilinskas and  
Burke K. Zimmerman*

Questions of safety and ethics about recombinant DNA techniques continue to surface. This book takes a look at historical, political, industrial, scientific, and international aspects of these issues. The authors show how lessons learned from the experience can be used to cope with similar issues in the future.

1986, 256 pp., hardcover; \$24.95, AAAS members \$19.95



All orders must be prepaid. VISA, MasterCard, and Choice accepted; include account number, expiration date, and signature.

Send orders to: AAAS Marketing, 1333 H Street, NW, Dept. M, Washington, DC 20005. Please add \$1.50 postage and handling per order. Allow 4-6 weeks for delivery.

*Published by Macmillan, Inc., for the American  
Association for the Advancement of Science*



---

## This Week in SCIENCE

---

### Angiogenesis

FORMATION of new capillary blood vessels or angiogenesis accompanies many normal and pathologic processes in the body—ovulation, wound healing, tumor growth, chronic inflammation, immune reactions, diabetic retinopathy, neovascular glaucoma, rheumatoid arthritis, and others (page 442). Sometimes a disease, called an angiogenic disease, appears to be the direct consequence of angiogenesis. The growth of blood vessels requires both cell proliferation and locomotion; it is promoted by angiogenic factors that either directly stimulate these processes or stimulate other factors that then induce vessel growth. Folkman and Klagsbrun discuss the history of angiogenesis research, the angiogenic factors that have been characterized (some have been cloned and sequenced, others are less well defined), and the methods that have been developed for analyzing this crucial physiologic process. Since angiogenic factors have been isolated from many tissues, the interesting question is raised as to how the process is, in the healthy body, kept under control so that rampant vessel growth does not occur at the wrong times but can be initiated rapidly when needed.

### Crystallin gene expression

CRYSTALLIN proteins are stable structural components distributed nonuniformly in the vertebrate lens (page 456). Goring *et al.* used a “reporter” gene—the *lacZ* gene that produces a detectable enzyme,  $\beta$ -galactosidase—to study when the gene for the  $\gamma$ -crystallin protein had been active during development. A piece of DNA was constructed with the *lacZ* gene so situated that its regulation was controlled by the regulators of the  $\gamma$ -crystallin gene. The engineered DNA was inserted into fertilized eggs; several transgenic mice resulted whose DNA contained the integrated hybrid gene. Single cells expressing the  $\beta$ -galacto-

sidase gene were detected; only cells in the nucleus of the lens, not the cortex and not epithelial cells at its anterior, had the reporter gene. Since growth of the lens involves migration of cells toward the center, centrally located cells are those that were active at the earliest time in development. This strategy can be used to study gene activation of other genes—of particular interest are those in the nervous system—to which the *lacZ* gene can be fused.

### Local pollution: Gone with the wind

SCIENTISTS are often accused of having their heads in the clouds; some are actually doing experiments there (page 460). In 1985, Dickerson *et al.* flew several research aircraft in and out of a severe thunderstorm over Oklahoma, sampling trace gases (such as reactive nitrogen compounds) and recording other meteorologic parameters to investigate how the storm affected the dispersal of pollutants. The findings were supplemented with radar, satellite, and balloon sounding data. Generally, most anthropogenic pollutants (photochemicals, acids) remain in the lower part of the troposphere (below 1 kilometer) for brief periods, contributing to smoggy air and eventually being deposited as acid rain or snow. Movement of atmospheric gases and particles upward occurs slowly (in a matter of months), but computer simulations had suggested that, in a storm, upward movement by convection could be accelerated enormously (to a matter of hours); and, once transported to the upper troposphere, pollutants would then be dispersed more widely as a result of the higher wind speeds in that layer and because the lifetimes of gases are longer in the low temperatures and in the absence of rain. The experiments confirmed the prediction of rapid transport of atmospheric pollutants to the stratosphere. A role for the turbulent actions of thunderstorms must, therefore, be considered in models of how local pollution affects global pollution.

### Validity of mixing-length theory

THE mixing-length theory of convection is used for calculating stellar and solar structures (page 465). The assumption is made that heat transfer occurs by the motion of packets of fluid that travel a distance—the mixing length—before they blend into the surroundings. The theory has been used for three decades, but experimental verification is not yet feasible, and the theory has not previously been tested mathematically. Chan and Sofia performed three-dimensional numerical simulations in situations where convection is deep and efficient. Although simplifying features of convective flow in stratified compressible media, the mixing-length approximation was found to have basic physical validity and to be adequate for roughly computing flux in such systems.

### Coastal ecology

A good season for a central California coastal kelp and rockfish community signals a bad season for an onshore barnacle community (page 479). Large forests of kelp stretch offshore down the American Pacific coast (cover); forest size (sometimes as long as 8 kilometers) depends on local storm effects, currents (such as those caused by El Niño), and the presence of otters and other predators in the area. Living within the kelp forests are rockfish, with sometimes as many as 100 juveniles crowding into an area of 1 cubic meter. Inshore, barnacles cling to the rocky intertidal zone. Adult barnacles release larvae, the larvae are carried offshore, and new larval recruits to the rocks are those that successfully navigate from the offshore region through the kelp forest to the inshore rocks. Gaines and Roughgarden found that the larger the kelp and rockfish populations, the fewer larvae arrived at the rocks; larvae were found in the stomachs of the rockfish. The well-being of the onshore community is thus closely connected to that of the community offshore.



# THE SIXTH ANNUAL CONGRESS FOR **HYBRIDOMA RESEARCH**

**MARCH 1 – 4, 1987**  
**MOSCONE CENTER, SAN FRANCISCO, CALIFORNIA**

Organized by Scherago Associates, Inc. and Mary Ann Liebert, Inc., publishers

## *Co-Chairmen:*

Zenon Steplewski, The Wistar Institute, Philadelphia, PA  
Hilary Koprowski, The Wistar Institute, Philadelphia, PA  
Joseph Davie, Washington University, St. Louis, MO

## **SESSIONS**

### **KEYNOTE ADDRESS** (Sunday P.M.)

Genetics and Biochemistry of Retroviral Replication  
Stephen Goff, Columbia University, College of Physicians and Surgeons  
Left-Handed and Right-Handed DNA in Genetic Recombination  
Alexander Rich, Massachusetts Institute of Technology

### **ACQUIRED IMMUNE DEFICIENCY SYNDROME (AIDS)**

(Monday A.M. - P.M.)

**Chairman:** Erling Norrby, Karolinska Institutet, Stockholm, Sweden

**Speakers:** Luc Montagnier, Paris William Haseltine, Boston  
Robert C. Gallo, Bethesda Myron Essex, Boston  
Jay A. Levy, San Francisco Robin Weiss, London  
Simon Wain-Hobson, Paris Dani P. Bolognesi, Durham  
Flossie Wong-Staal, Bethesda Bernard Moss, Bethesda

### **TRANSGENIC MICE AS TOOL IN IMMUNOLOGY** (Tuesday A.M.)

**Chairman:** Davor Solter, The Wistar Institute

**Speakers:** Rudolf Grosschedl, U.C.S.F.  
Ken-Ichi Yamamura, Kumamoto Univ. Medical School  
Jean-Claude Weill, Institute Jacques-Monod  
Barbara A. Knowles, The Wistar Institute

### **WORKING GROUP MEETINGS**

This year we are planning two Working Groups:

- A. IMMUNOTHERAPY** – Chairman, Michael Mastrangelo  
Thomas Jefferson University Hospital  
**B. IMMUNODIAGNOSIS** – Chairman, Edgar Haber  
Massachusetts General Hospital

*Working groups will meet in closed sessions. It is our intent to select participants actively involved in the above listed research for in-depth discussion of progress made recently. The consensus reached by working groups will be presented to the whole Congress and results of these discussions will be published in Hybridoma.*

*Investigators interested in participating in these Group Meetings should send a short summary to Dr. Zenon Steplewski, The Wistar Institute, Thirty Sixth Street At Spruce, Philadelphia, PA 19104. (215) 898-3924 by January 10, 1987.*

### **ANTI-IDIOTYPE VACCINES** (Tuesday P.M.)

**Chairman:** J. Donald Capra, University of Texas

**Speakers:** Katheryn Meek, Univ. of Texas Health Science Center  
At Dallas  
Ronald C. Kennedy, Southwestern Foundation for  
Biomedical Research  
Dorothee Herlyn, The Wistar Institute  
Karl Erik Hellström, Oncogen Inc.  
David Sacks, N.I.H.

### **THE USE OF HYBRIDOMAS IN DETERMINING CYTOKINE STRUCTURES AND FUNCTIONS** (Wednesday A.M.)

**Chairman:** Robert Schreiber, Washington University

**Speakers:** Robert Coffman, DNAX Research Institute  
Frank Fitch, Pritzler School of Medicine  
Carl Pierce, Washington University School of Medicine  
Robert Schreiber, Washington University

### **ANTI-CARBOHYDRATE MAB'S IN THE STUDY OF GLYCOLI- PID-MEDIATED CELLULAR EFFECTS** (Wednesday a.m.)

**Chairman:** Jan Thurin, The Wistar Institute

**Speakers:** David A. Cheresch, Scripps Clinic & Research Foundation  
Tomas Brodin, The Wallenberg Laboratory  
Bruce Fenderson, Fred Hutchinson Cancer Research Center  
Nobuo Hanai, Fred Hutchinson Cancer Research Center

### **SUMMARY** (Wednesday P.M.)

**Chairman:** Joseph Davie, Washington University School of Medicine

## **POSTER SESSION AND EXHIBITS**

### **REGISTRATION FEES:**

\$450 On-site registration

\$400 ADVANCE REGISTRATION – (Received by Jan. 15) \$150 STUDENT REGISTRATION – Undergraduate, graduate students only. Conf. in writing.

4-7 registrations received together from same organization \$300 each. 8-10 registrations received together from same organization \$200 each.

Larger group rates available upon request. Cancellations must be received in writing by February 1, 1987.

Attendance will be limited. Make checks payable to: **Scherago Associates, Inc., DNA / HYBRIDOMA**

**S-1-23**

☐ Please reserve \_\_\_\_\_ space(s): Registration Fee of \$ \_\_\_\_\_ enclosed.

☐ Please send abstract form.

Name \_\_\_\_\_

Dept. \_\_\_\_\_ Organization \_\_\_\_\_

Street \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone: ( ) \_\_\_\_\_

Return to: **Hybridoma: c/o Scherago Associates, Inc.**, 1515 Broadway, Dept. S-1-23 New York, NY 10036 • (212) 730-1050



**American Association for the Advancement of Science**  
*Science* serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

**Publisher:** William D. Carey

**Editor:** Daniel E. Koshland, Jr.

**Deputy Editors:** Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*)

## EDITORIAL STAFF

**Managing Editor:** Patricia A. Morgan

**Assistant Managing Editors:** Nancy J. Hartnagel, John E. Ringle

**Senior Editors:** Eleanore Butz, Ruth Kulstad

**Associate Editors:** Martha Collins, Barbara Jasny, Katrina L. Kelner, Edith Meyers, Phillip D. Szurromi, David F. Voss

**Letters Editor:** Christine Gilbert

**Book Reviews:** Katherine Livingston, *editor*; Deborah F. Washburn

**This Week in Science:** Ruth Levy Guyer

**Chief Production Editor:** Ellen E. Murphy

**Editing Department:** Lois Schmitt, *head*; Caitilin Gordon, Mary McDaniel, Barbara E. Patterson

**Copy Desk:** Lyle L. Green, Sharon Ryan, Beverly Shields, Anna Victoreen

**Production Manager:** Karen Schools

**Graphics and Production:** John Baker, *assistant manager*; Holly Bishop, Kathleen Cosimano, Eleanor Warner

**Covers Editor:** Grayce Finger

**Manuscript Systems Analyst:** William Carter

## NEWS STAFF

**News Editor:** Barbara J. Culliton

**News and Comment:** Colin Norman, *deputy editor*; Mark H. Crawford, Constance Holden, Eliot Marshall, Marjorie Sun, John Walsh

**Research News:** Roger Lewin, *deputy editor*; Deborah M. Barnes, Richard A. Kerr, Gina Kolata, Jean L. Marx, Arthur L. Robinson, M. Mitchell Waldrop

**European Correspondent:** David Dickson

## BUSINESS STAFF

**Associate Publisher:** William M. Miller, III

**Business Staff Manager:** Deborah Rivera-Wienhold

**Classified Advertising:** Leo Lewis

**Membership Recruitment:** Gwendolyn Huddle

**Member and Subscription Records:** Ann Ragland

**Guide to Biotechnology Products and Instruments:** Shauna S. Roberts

## ADVERTISING REPRESENTATIVES

**Director:** Earl J. Scherago

**Production Manager:** Donna Rivera

**Advertising Sales Manager:** Richard L. Charles

**Marketing Manager:** Herbert L. Burklund

**Sales:** New York, NY 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); Scotch Plains, NJ 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); Chicago, IL 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); San Jose, CA 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 24808 Shrubbery Hill Ct. (301-972-9270).

Instructions for contributors appears on page xi of the 19 December 1986 issue. Editorial correspondence, including requests for permission to reprint and reprint orders, should be sent to 1333 H Street, NW, Washington, DC 20005. Telephone: 202-326-6500.

Advertising correspondence should be sent to Tenth Floor, 1515 Broadway, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO.

## Techniques and Strategies of Verification

In this issue of *Science* we publish a Policy Forum on one of the most important controversies of our time: the verification of arms control agreements. The format differs from that of previous Policy Forums in that the two participants were asked to answer specific questions rather than to present broad arguments. In the nomenclature of "hawks, doves, and owls," Sidney Drell would generally be identified as a dove, and Manfred Eimer would appear on the side of the hawks; both would qualify as owls because of their wisdom and extensive experience with arms control.

Not only is this Policy Forum likely to be informative to those who have an interest in, but little knowledge of, the techniques of verification, but it also illustrates an important principle of most public debates between experts—that there are basic areas of agreement as well as disagreement. Thus, both Drell and Eimer agree that construction of the Russian radar station at Krasnoyarsk violates the Antiballistic Missile Treaty; that the trustworthiness of treaty signatories is crucial, regardless of the military significance of a violation; that the asymmetry between the closed society of the Soviet Union and the largely open society of the United States puts special burdens on arms control verification; that the United States should not be involved in a disinformation strategy; that the Standing Consultative Commission can effectively resolve ambiguities but not deliberate violations; and that a proportionate response is the appropriate strategy for a confirmed treaty violation. This consensus is significant because it indicates a measure of stability and professionalism within this important area of national policy. Most negotiations that surface with great public clamor during the tenure of one president are actually the result of years of preparation involving several presidents and quite different public political images.

That there are areas of agreement does not imply that the disagreements are unimportant or minor. For example, Eimer states that the encryption of missile tests and the new Soviet SS-25 missile are clear violations of the Strategic Arms Limitation Talks II, whereas Drell considers them possible violations in view of allegedly imprecise data and the ambiguity of the treaty wording. Eimer concludes that the Soviets have a bad record on compliance and Drell argues that they have a satisfactory record. The disagreement here depends on how each interprets the seriousness of the deviations. Ultimately arms control will rely to some extent on deductions of the intentions and behavior of human beings as well as on differing interpretations of the evidence.

The analyses by these two experts points up the difficulties that will be faced in the future. Control of nuclear weapons has two main goals: the promotion of peace by removing the temptation to use nuclear weapons, and the limitation of the cost of an armament program. The advent of a mobile missile, which the Soviet Union and the United States are both developing and which many say may be a more cost-effective and feasible alternative than the Strategic Defense Initiative for preserving second strike capability, will certainly make arms control and verification of compliance more difficult. As both experts state, cooperation between the superpowers will be helpful as we enter this era of new weapons and new strategies. For example, on-site inspection may involve important political changes in two superpowers who eye each other with deep suspicion; it is the modern equivalent of an exchange of ambassadors in the era of large infantries and cavalries.

If we must choose between saving money and preventing war, it is clear that we must choose the latter. But there are scenarios in which preventing war and lowering costs can both be achieved if tough political decisions on verification can be made. There is hope that world leaders will recognize the mutual advantages of imaginative departures from past practices. If that hope becomes a reality, then the techniques of verification and a citizenry enlightened in its application will be an important first step toward a safer world.

—DANIEL E. KOSHLAND, JR.



# THE TENDER TRAP.



Membrane 'trap'  
containing eluted Coomassie  
blue-stained sample.

## The new Elutrap™ chamber— for the highest possible recovery of purified macromolecules.

Great advances often come in small packages—obviously the case with the new Elutrap chamber from S&S. This unique device represents a major step forward in the use of filtration for rapid elution, isolation and purification of nucleic acids and proteins from gels and for the concentration of biologicals from solutions.

**Unique** because, unlike other methods, it requires no membrane pre-treatment and minimal sample pre- and post-treatment.

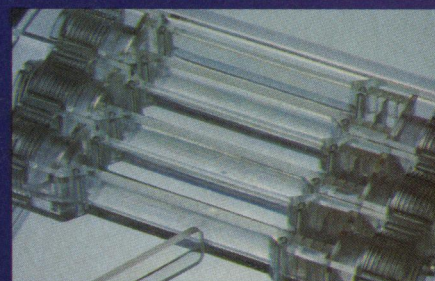
**Unique** in its efficiency—because it delivers high concentrations of charged molecules, at high purity levels, with recovery rates greater than 90%.

**Unique** in its simplicity—operating in any standard horizontal electrophoresis chamber; no need to purchase a separate power supply.

Operation is simple. Sample molecules migrate through the device's elution chamber into a small "trap" formed by two inert exclusion membranes which allow current to pass through the device. Large particulates and contaminants are excluded by the first membrane: molecules larger than 5000 D are retained by the second one. Both membranes allow passage of buffer when an electric field is present, yet prevent buffer flow when there is no current. When elution or concen-

tration is complete, the sample is simply removed from the trap with a standard pipet.

Call or write for more information on how to put the Elutrap chamber to work for your application.



Simultaneous use  
of multiple Elutrap chambers.

Sold under 'Biotrap' trademark outside the U.S. and Canada. Patent pending.

## Schleicher & Schuell

Schleicher & Schuell, Inc., Keene, NH 03431 • 800-245-4024 • 603-352-3810

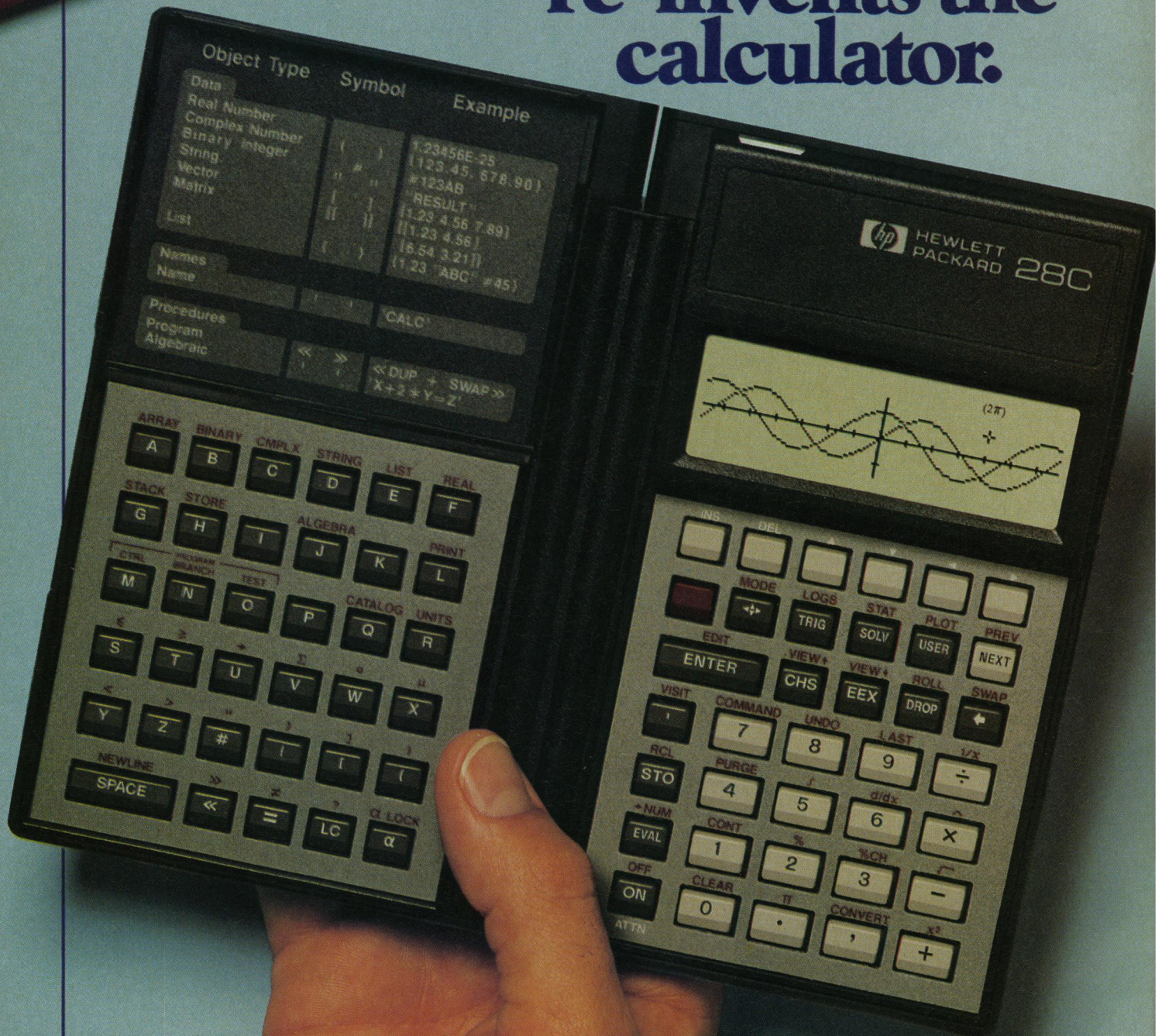
Schleicher & Schuell GmbH, D-3354 Dassel, West Germany • Schleicher & Schuell AG, CH-8714 Feldbach ZH, Switzerland

• Schleicher & Schuell Nederland BV, 5201 AH 's-Hertogenbosch, The Netherlands

Circle No. 60 on Readers' Service Card



# Hewlett-Packard re-invents the calculator.

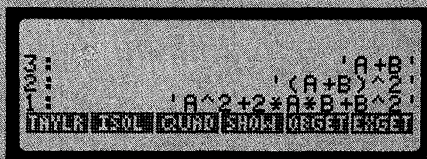




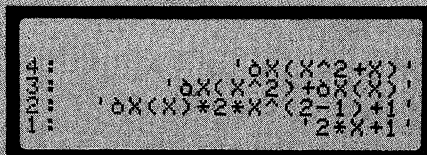
SYM	REVISIONS	APPROVED	DATE
A	AS ISSUED	DRE	9/8/86

## THE NEW HP-28C DOES THINGS NO OTHER CALCULATOR CAN. AND IT DOES MORE

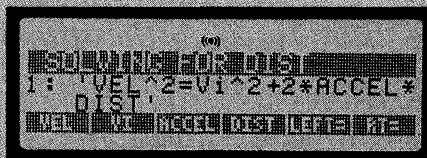
THE FIRST  
CALCULATOR THAT  
DOES SYMBOLIC  
ALGEBRA



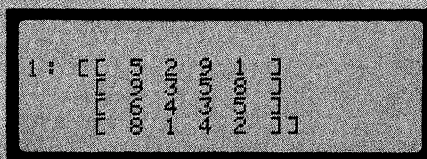
THE FIRST  
CALCULATOR THAT  
DOES SYMBOLIC  
CALCULUS



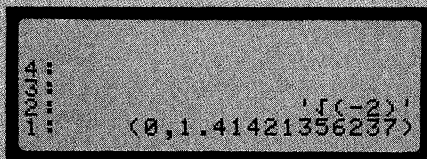
THE FIRST  
SCIENTIFIC CALCULATOR  
THAT ACCEPTS YOUR OWN  
FORMULAS, THEN SOLVES  
FOR ANY UNKNOWN



THE FIRST  
CALCULATOR THAT  
PERFORMS MATRIX  
OPERATIONS AS EASILY  
AS FOUR-FUNCTION MATH



THE FIRST  
CALCULATOR THAT  
DOES COMPLEX NUMBER  
ARITHMETIC AS EASILY AS  
FOUR-FUNCTION MATH



THINGS THAN ANY  
OTHER CALCULATOR  
CAN, MORE THAN  
THE UNIQUE  
FUNCTIONS  
DISPLAYED ON THE  
LEFT, THE HP-28C  
ALSO BRINGS  
TOGETHER SUCH  
FEATURES AS  
KEYSTROKE  
PROGRAMMABILITY;  
RPN LOGIC WITH  
ALGEBRAIC  
EXPRESSION ENTRY;  
120 UNIT CONVERSION  
FACTORS; HEX,  
OCTAL AND BINARY  
MATH--AND  
CONVERSIONS;  
ADVANCED STATISTICS;  
AND THE ABILITY TO  
USE AN OPTIONAL  
PRINTER VIA  
INFRARED BEAM.  
FOR A  
DEMONSTRATION,

CALL 1-800-307-4772, EXT. 189A  
AND ASK FOR THE NAME OF YOUR  
NEAREST HP DEALER. THEN SEE  
QUOD ERAT DEMONSTRANDUM.

# Q.E.D.

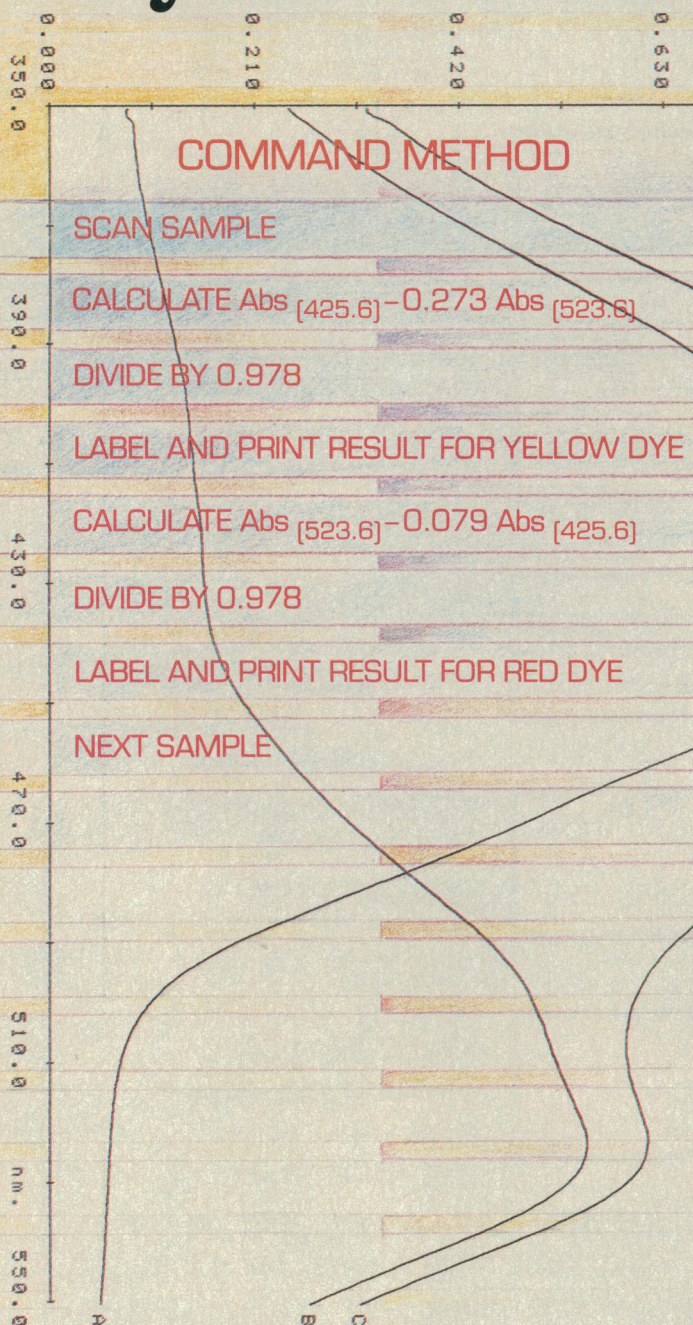


HEWLETT  
PACKARD

DO NOT SCALE THIS DRAWING			©1987 Hewlett-Packard Company	PG12611		SEE NOTE
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES.	ITEM	QTY.	PART/MATERIAL-DESCRIPTION	MAT'L-PART NO.	MAT'L-DWG. NO.	MAT'L-SPEC.
TOLERANCES .XX+.02 .XXX+.005	JERRY STEIGER		4/20/86	TOPCASE- NUMERIC		00028-40001 PART NUMBER
	DRAWN BY		DATE			
	JERRY STEIGER		4/20/86	TITLE		2X SCALE
	ENGINEER/CHECKER					
	RELEASE TO PROD.			SHEET 1 OF 1		D-00028-40001-1
SEE CORP. STD. 608	SUPERSEDES DWG.					



# How to take command of your UV-Vis Assays



DETERMINATION OF TWO COMPONENTS IN A MIXTURE

YELLOW DYE CONCENTRATION 0.843  
RED DYE CONCENTRATION 0.591

## 1. RECALL METHOD

## 2. START

If your analytical work involves the determination of

- purity of samples
- perturbation and dilution effects
- concentration of single or multicomponents
- decomposition studies
- comparison with reference materials

or other assays requiring advanced scanning capabilities, take command with the Varian DMS 200 UV-Vis Spectrophotometer. Combine its advanced calculator functions with its powerful COMMAND function and automate spectral data calculations. Calculated results are printed on-line, along with selected spectral data.

IBM PC/XT software enhances DMS 200 capabilities by extending method storage, storing spectral data and allowing application of user-developed spectral manipulations.

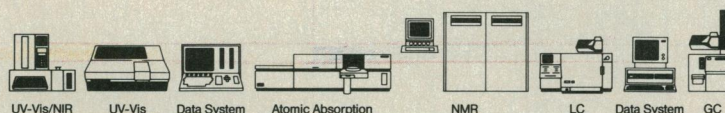


Call 800-231-5772

(in Canada 416-457-4130)

for more information on the DMS 200, one of Varian's family of high-performing UV-Vis-NIR spectrophotometers.

IBM and PC/XT are trademarks of International Business Machines Corporation



VERY INTELLIGENT SOLUTIONS FOR YOU



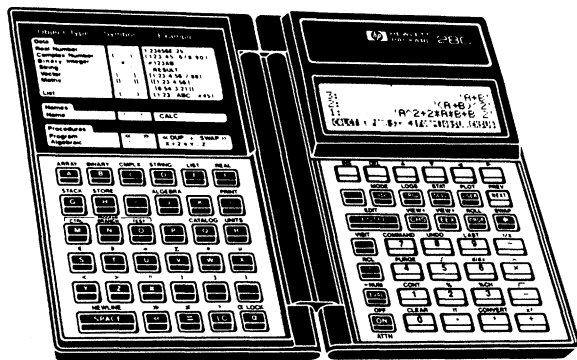


# The UnExpected HP-28C— is this your next calculator?



## A first report:

If you're at all like me, this is what you've been holding your breath for (in the calculator direction, of course). Just a few years back, calculators were exciting. Maybe once a year there was a new model that could do startlingly more. Not recently, though.



For a color picture, see HP ad in this issue, p.418.

## The HP-28C is first in a new generation.

I haven't got room here to do it justice, there are so many interesting features and specs for it. I'll sketch it for you, though...

**You'll have ON-SCREEN MENUS and SOFTKEYS, just like a PC**—sensible access to hundreds of functions (128K ROM!) and high-level problem solving. Gamma function, random numbers,...

Complex numbers, matrices, vectors, lists, and algebraic expressions can be viewed, edited, and then used in calculations just as easily as ordinary numbers. Dot and cross products, determinant,...

**You can choose RPN LOGIC for calculations OR use the built-in ALGEBRAIC LOGIC**—with RPN its 4-line display shows your stack OR you'll see your equation displayed just as you would write it. You choose.

You'll do no programming to get solutions, either—it will solve for any unknown variable anywhere in your equation.

It will convert between different unit systems, too. The values of 120 units are built-in, and you can add your own. Are you ready for all this right now? (I have them in stock).

**You'll use SEPARATE KEYBOARDS, the right hand one for NUMBERS and the left for LETTERS.** Later, you can fold it to pop into your shirt pocket.

You can plot graphs of your functions, even two at a time. Then place the cursor near where the graphs cross and press a key to calculate the x-value of the crossing, correct to 12 digits. I was amazed.

Scatter plots of your statistical data are easy too. Imagine showing all this to your colleagues!

**Plotting.** Plot mathematical functions and statistical data; set plot scales, axes, and center; display graphics.

**Statistics.** Single- or multi-variable statistics: summation, deletion, mean, standard deviation, total, maximum, minimum, variance, covariance, correlation. Linear regression and predicted value. Normal, Students t, F, and Chi-square distributions.

A major leap in technology—you'll do **SYMBOLIC ALGEBRA**, even **SYMBOLIC CALCULUS**. You'll manipulate unknowns and letters as well as numbers, even differentiate functions to get their derivative functions. This is the first small machine capable of doing symbolic mathematics, like MACSYMA on a mainframe, and it can be yours right now.

**Symbolic Algebra.** All real and complex number functions; expand, collect terms; expression editor; subexpression recall and substitution, symbolic solve; quadratic equations.

**Calculus.** Symbolic differentiation of arbitrary expressions; symbolic integration of polynomials; numerical integration of arbitrary expressions; Taylor series.

**Programmability is enormous**—You can use all of the built-in functions with your own menus and softkeys, plus sophisticated utilities.

**Binary Integer Operations.** Decimal, octal, hexadecimal, and binary bases; arithmetic; variable wordsize; bit shift and rotate, byte shift and rotate, arithmetic shift; logical operators; floating-point/integer conversion.

**Programming Features.** User-defined functions, local variables, indefinite nesting and recursion, IF... THEN... ELSE, FOR... NEXT, DO... UNTIL, WHILE... REPEAT; halt, continue, abort, single-step, pause, read key, beep, display, error message, error number; set/clear/test 64 user flags; conditionals, logical operators; object type.

**But you can't see the best part**—Your HP-28C comes with a built-in InfraRed Printer Interface.

This means no wires or cables to your portable thermal printer—just point your 28C at it and press a key for an instant record. Have your printer now, or get it later—your choice.



**The HP-28C lists for \$235.**

**It will be the world's standard for years to come. You're sure to get one sooner or later. Why not now? I have them in stock, and I'll give you a discount savings of \$45 now.**

Hewlett-Packard has been the choice of engineers and scientists for the past 15 years. HP is simply the best. Yours will last you for years to come.

EduCALC is the World's Premier HP-Calculator Store. You can trust our years of experience and straightforward service.

Order by mail: each HP-28C is **\$189.95**; save **\$29** on each InfraRed Printer at **\$105.95** (Calif. residents add 6% tax). Add \$4 for UPS delivery (no extra charge for multiple items). Allow 12 days for personal checks to clear, or send your MC/Visa number and card address.

For fastest service, call during west-coast business hours at **(714)582-2637**. Or, for all days/all hours call toll-free **(800)633-2252**, ext. 348, with your MC or VISA card. Of course, if you live in Southern California, drop by in person and pick up your new HP-28C.

**I guarantee you'll be delighted with the HP-28C—or your money back within 15 days, no questions asked.**

*Jim Carter, Mgr.*

EduCALC Mail Store  
27953-8 Cabot Road  
Laguna Niguel, CA 92677



---

# Call for Symposium Proposals

## 1988 AAAS Annual Meeting ♦ Boston ♦ 11 – 16 February

---

Please return this form no later than 1 April 1987 to:  
AAAS Meetings Program; 1333 H Street, NW, Washington, DC 20005 • Telephone: (202) 326-6448

---

**Principal Organizer** (primary contact for correspondence):

Name \_\_\_\_\_

Affiliation \_\_\_\_\_

Mailing Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone \_\_\_\_\_  
(Area Code) (Number)

**Co-Organizer** (if applicable):

Name \_\_\_\_\_

Affiliation \_\_\_\_\_

Mailing Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone \_\_\_\_\_  
(Area Code) (Number)

---

**Title of Proposed Symposium** \_\_\_\_\_

---

Proposed Sponsor(s) (AAAS Section, Office, or Affiliate <b>only</b> ) _____	No. of 3-hr. Sessions Requested _____
--	--

---

1. Speaker \_\_\_\_\_

Affiliation \_\_\_\_\_

Topic \_\_\_\_\_

2. Speaker \_\_\_\_\_

Affiliation \_\_\_\_\_

Topic \_\_\_\_\_

3. Speaker \_\_\_\_\_

Affiliation \_\_\_\_\_

Topic \_\_\_\_\_

4. Speaker \_\_\_\_\_

Affiliation \_\_\_\_\_

Topic \_\_\_\_\_

5. Speaker \_\_\_\_\_

Affiliation \_\_\_\_\_

Topic \_\_\_\_\_

**Please attach synopsis of  
objectives of proposed symposium  
(approximately 200 words).**

---

**Instructions:** AAAS members are invited to submit symposium proposals for the next Annual Meeting in Boston, 11–16 February 1988. Please complete the form above, attach a “Synopsis of Objectives” (about 200 words), and send it to us **no later than 1 April 1987**.

We are particularly interested in symposia dealing with the latest developments in science and technology, and the implications of these developments for society. Coordinated contributed paper sessions are also welcome; inquire for details with this submission.

All symposium proposals are subject to review. If the information submitted is inadequate for reviewing, the proposal will be returned. Endorsement (sponsorship) by a AAAS Section Committee expedites the review process. It is therefore in the interest of the proposer to

**send a copy** of the proposal to the appropriate Section Secretary (see “AAAS News” section in *Science*, first issue of each month, for names) for endorsement at the same time the original is sent to the AAAS Meetings Office.

Speakers should *not* be confirmed at this time; however, sufficient information about probable speakers and their topics should be provided to allow for evaluation of the proposal. Please note that AAAS does not pay honoraria to speakers.

**Some Deadlines: June**—You will be notified about the acceptability of your proposal. **July**—Preliminary programs with confirmed speakers are due. **September**—Final program copy, suitable for publication, is due.

# DON'T LET YOUR WORK GO UP IN SMOKE.

## ***Baker High Velocity Return Air Slots maximize product protection.***

The smoke test proves it: without proper precautions, particulates can enter your work area and contaminate sensitive biological materials.

The best way to reduce the risk? Baker Biological Safety Cabinets. With the best materials. The best workmanship. The best performance.

Outside contaminants don't have a chance with Baker's *exclusive airflow designs*: High Velocity Return Air Slots at the crucial cabinet sidewall areas; Zoned Airflow for a more

impenetrable barrier at the front of the cabinet; and negative pressure surrounding the entire work area.

At The Baker Company, we never compromise on product or personnel protection. Should you?

Call toll free for complete data. Or write to The Baker Company, P.O. Drawer E, Sanford, ME 04073.

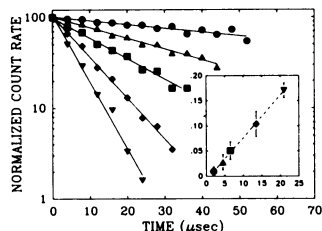
## **1-800-992-2537**



Circle No. 24 on Readers' Service Card

## **PUBLICATION QUALITY CHARTS AND GRAPHS**

from your IBM PC, XT, AT  
and HP or compatible plotter.



### **SIGMA PLOT™ software — \$350.**

- Error bars
- Smooth Lines
- Clean diagonals
- Movable labels
- Log/semi-log scales
- **And Now!**
- **Multiple graphs per page**
- **Curve fitting**
- **Laser printer support**

Load data from keyboard, ASCII or DIF files (including LOTUS 123). Call or write for more information.

**JANDEL SCIENTIFIC**  
MICROCOMPUTER TOOLS FOR THE SCIENTIST  
2656 Bridgeway, Sausalito, CA 94965  
800-874-1888 (outside CA)  
415-331-3022 (inside CA)

Circle No. 105 on Readers' Service Card

## **Do you want to know about**

- toxicity of new artificial sweeteners?
- diet and Alzheimer's disease?
- disposal of hazardous waste?

## **BIOLOGICAL QUESTIONS**

like these  
need answers  
from CAS ONLINE!

CAS ONLINE. The database of chemistry...and a good place to go if your research concerns biology, pharmacology, biotechnology, and more!

## **CAS ONLINE...over 1/3 of our database is related to life sciences!**

Send to:  
Chemical Abstracts Service  
Dept. 32786  
P.O. Box 3012  
Columbus, OH 43210

I'd like to find out about  
CAS ONLINE and its coverage of  
biological information.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company \_\_\_\_\_

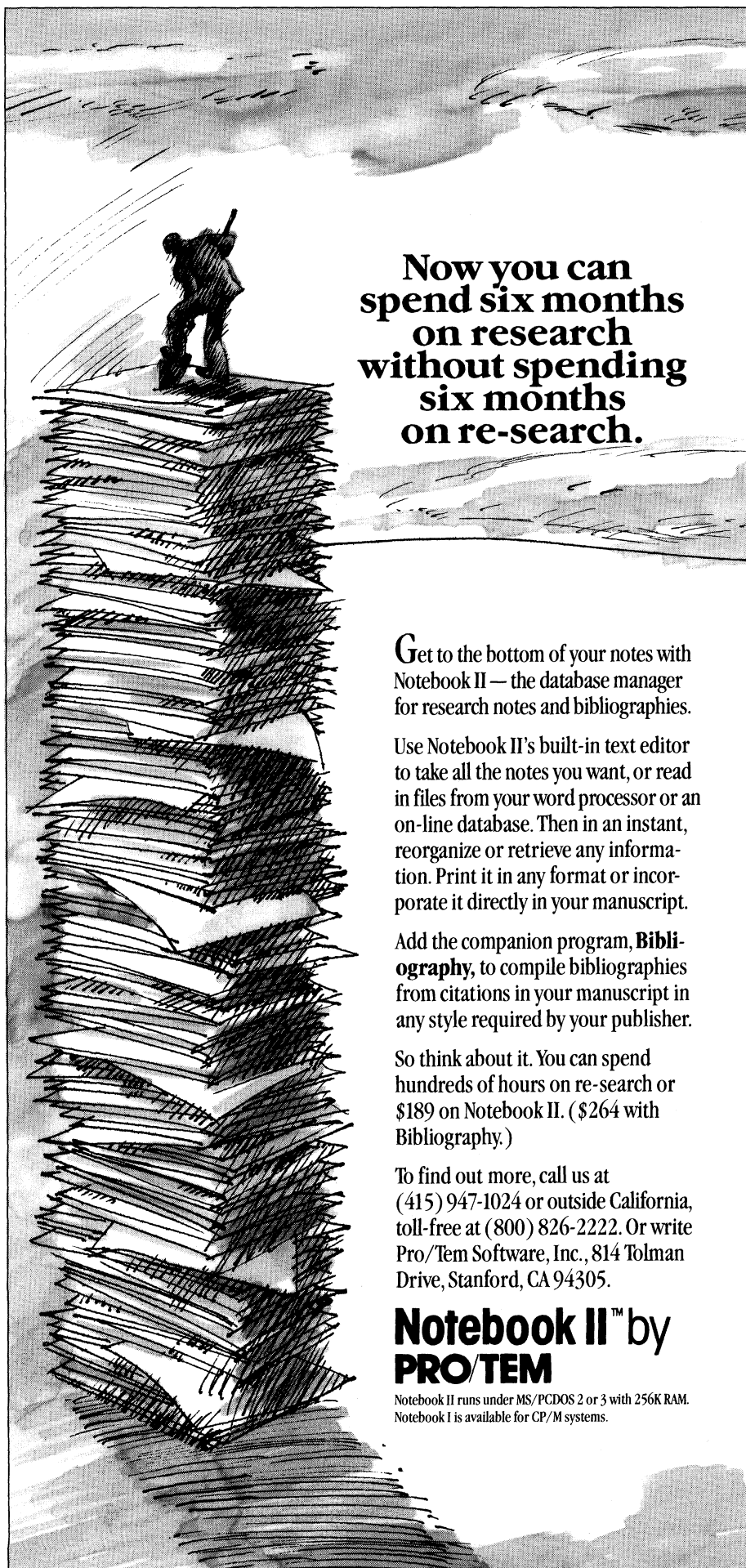
Address \_\_\_\_\_

**CAS ONLINE®**  
Available on STN International®  
The Scientific & Technical Information Network

CAS is a division of the American  
Chemical Society

Circle No. 66 on Readers' Service Card





**Now you can  
spend six months  
on research  
without spending  
six months  
on re-search.**

Get to the bottom of your notes with Notebook II — the database manager for research notes and bibliographies.

Use Notebook II's built-in text editor to take all the notes you want, or read in files from your word processor or an on-line database. Then in an instant, reorganize or retrieve any information. Print it in any format or incorporate it directly in your manuscript.

Add the companion program, **Bibliography**, to compile bibliographies from citations in your manuscript in any style required by your publisher.

So think about it. You can spend hundreds of hours on re-search or \$189 on Notebook II. (\$264 with Bibliography.)

To find out more, call us at (415) 947-1024 or outside California, toll-free at (800) 826-2222. Or write Pro/Tem Software, Inc., 814 Tolman Drive, Stanford, CA 94305.

**Notebook II™ by  
PRO/TEM**

Notebook II runs under MS/PCDOS 2 or 3 with 256K RAM.  
Notebook I is available for CP/M systems.

## **A MUST for your science collection**

### *Books from Science*

**AIDS**; R. Kulstad, ed. Research papers and reports on acquired immune deficiency syndrome (AIDS) published between August 1982 and September 1985 show how far AIDS research has come and provide an indication of the directions in which it might go.  
1986; case \$32.95; paper \$19.95; 653pp

**Astronomy & Astrophysics**; M.S. Roberts, ed. From the solar system to the pulsars at the very edge of the observable universe, this volume reveals a broad, coherent, and contemporary picture of our astronomical universe.  
1985; case \$29.95; paper \$17.95; 383pp

**Neuroscience**; P.H. Abelson, E. Butz, S.H. Snyder, eds. Neuroscience research ranging from genetic engineering to clinical therapy is presented. Provides an integrative treatment of brain anatomy, physiology, and chemistry and addresses fundamental questions concerning nervous system functioning.  
1985; case \$29.95; paper \$14.95; 453 pp

**Biotechnology & Biological Frontiers**; P.H. Abelson, ed. Covers the most important topics at the forefront of biological R&D and deals with both fundamental research techniques and practical applications. For researchers and students in all fields of biology, agriculture, and the health sciences.  
1984; case \$29.95; paper \$14.95; 550pp

**Biotechnology: The Renewable Frontier** D.E. Koshland, Jr., ed. Like its predecessor, this new volume covers the latest and most important topics in biological R&D.  
1986; case \$29.95; paper \$17.95; 384 pp

**Frontiers in the Chemical Sciences**; W. Spindel, R.M. Simon, eds. Details progress in all areas of chemistry, including new work in ultrafast reactions, catalysis, conduction organics, enzyme mechanisms, and materials and analysis.  
1986; case \$29.95; paper \$17.95; 624pp

Order from AAAS Sales Dept C, 1333 H St. NW, Washington, DC 20005. Add \$1.50 postage & handling per order; allow 4-6 weeks for delivery.

**American Association for  
the Advancement of Science**

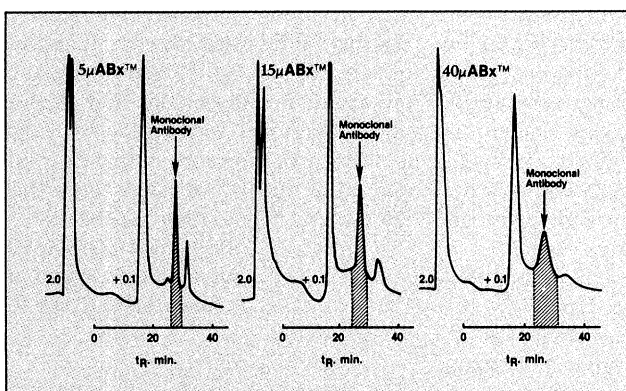
“In order to easily scale up from analytical separations, there is a need for families of packings in different particle sizes, but with the same surface chemistry. Manufacturers should work on this problem.”

—Klaus Unger to the 1986  
Pittsburgh Conference

## Baker has done it!

Introducing the BAKERBOND™ Universal Matrix.

Identical Surface Chemistries on 5 $\mu$ , 15 $\mu$ , and 40 $\mu$  BAKERBOND™ ABx Facilitate Rapid Method Development for Scale-up



+ Please note scale changes. The void volume peaks of non-retained proteins represent 90-95% of all non-immunoglobulin proteins. Detector sensitivity for all other peaks has been increased twenty-fold to better visualize retained proteins and monoclonal antibodies.

### ANALYTICAL CONDITIONS:

**Column:** 7.75 x 100 mm BAKERBOND ABx™, 5 micron, 15 micron, 40 micron  
**Mobile Phase:** Buffer A = 10mM MES, pH 5.6  
 Buffer B = 1M NaOAc, pH 7.0  
**Gradient:** 0% B to 100% B; 60 min.  
**Flow Rate:** 1.0 ml/min.  
**Detection:** UV at 280 nm: 2.0, 0.1 AUFS  
**Peaks:** Void Volume: albumins, transferrins, proteases, phenol red  
 Arrow: monoclonal antibody  
**Sample:** 0.5 ml 10x concentrated cell culture supernatant

**Bonded phases with uniform surface chemistry in a full range of particle sizes.**

BAKERBOND™ Universal Matrix bonded phases offer uniform surface chemistry in particle sizes of 5, 15, and 40 microns...to aid in the purification of any biological fluid...from characterization, through analysis, to small-scale or large-scale purification...quickly, and with high resolution.

The family of BAKERBOND silica-based bonded phases includes PEI (anion exchanger), CBX (cation exchanger), HI-Propyl (hydrophobic interaction), C<sub>4</sub> (reversed phase), and MAb™ and ABx™ (antibody purification). They are offered in prepacked HPLC columns (5 and 15 micron) and in bulk (40 micron) and provide superior performance for HPLC, traditional low pressure LC, and batch purification.

For technical assistance or ordering information on the entire BAKERBOND Universal Matrix family of bonded phases, call toll free 1-800-JTBAKER. (In New Jersey, 201-859-2151). Or write J.T. Baker Chemical Company, 222 Red School Lane, Phillipsburg, NJ 08865.



**J.T. Baker Chemical Co.**  
 222 Red School Lane  
 Phillipsburg, NJ 08865

BAKERBOND, BAKERBOND ABx, and BAKERBOND MAb are trademarks of J.T. Baker Chemical Co.