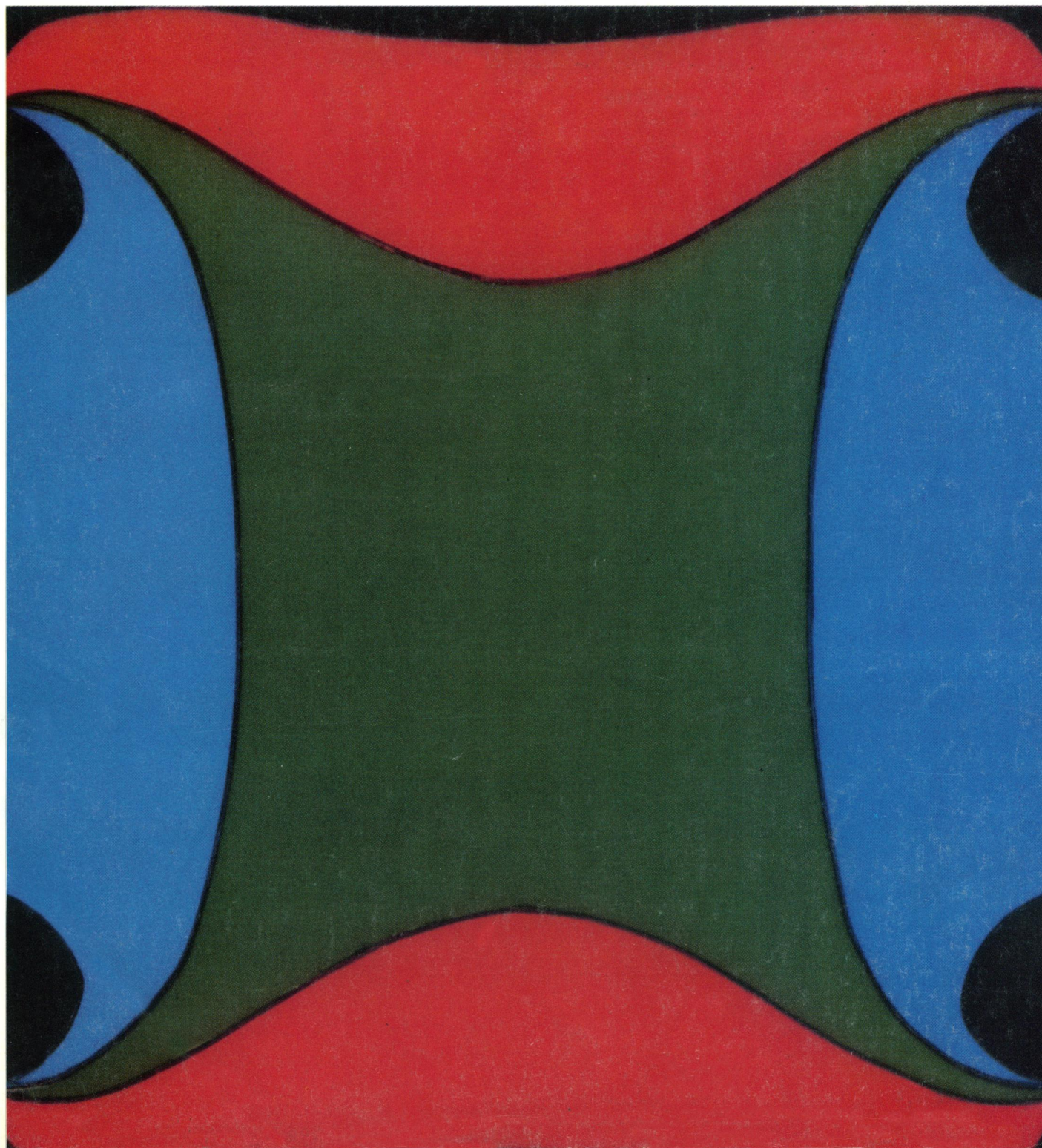


AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

Science

2 OCTOBER 1987
VOL. 238 ■ PAGES 1-132

\$2.50



Powerful Yet Affordable

IBI/Pustell Sequence Analysis Software

User friendly and competitively priced IBI/Pustell software puts all of the most widely used programs for molecular biology research at your finger tips. These features are not available elsewhere at such an affordable price.

POWERFUL

Searching for a sequence? By using a keyword search, you can access a DNA sequence from the GENBANK™ database in under 10 seconds.

Doing a global search? It takes less than 5 minutes to search the entire NBRF Protein database with a query sequence.

These speeds are routinely achieved on a standard IBM AT. Why waste your grant money on expensive CD players or tape drive systems when they're really unnecessary?

COMPATIBLE

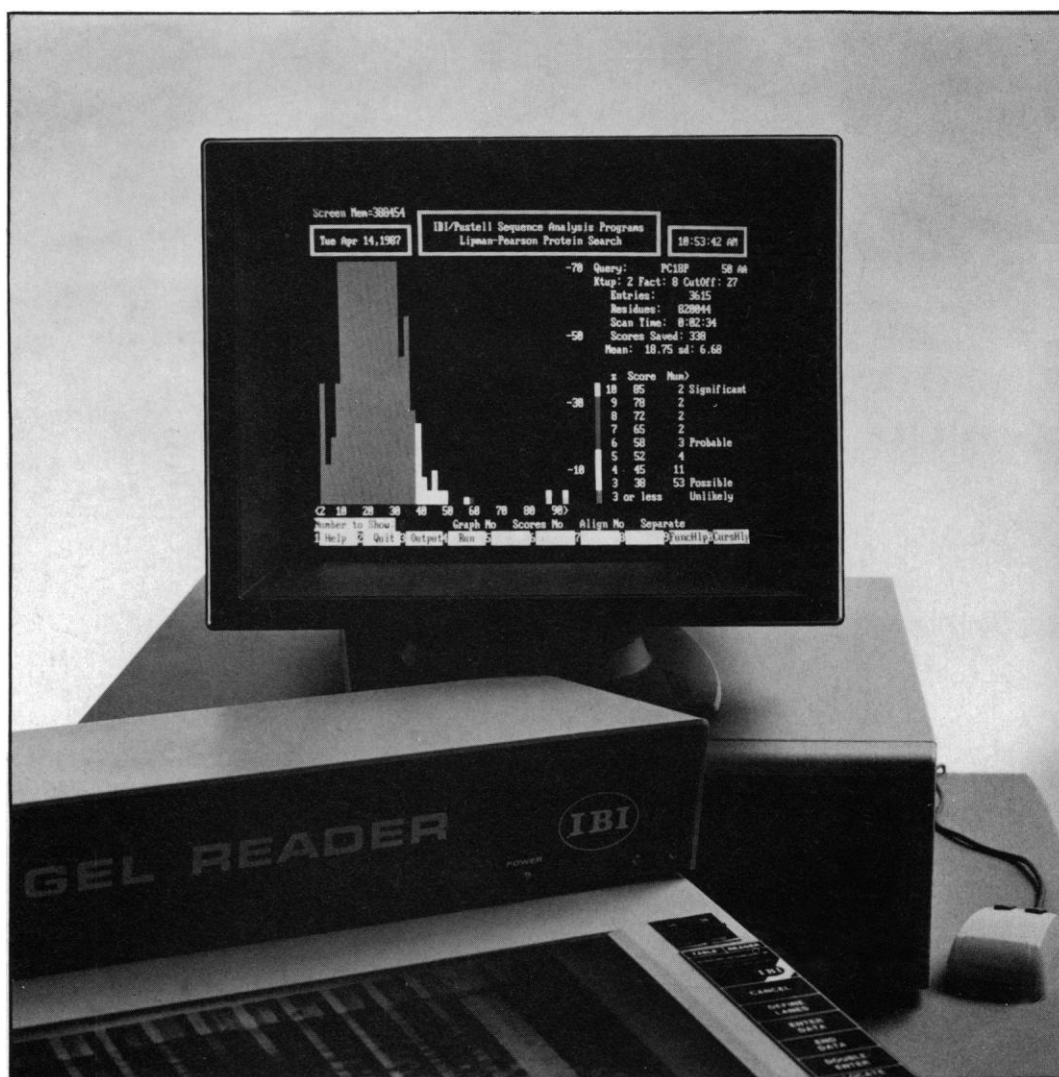
IBI's unique Cyborg Database Manager allows you to use sequence data in the following four different file formats: GENBANK™, BIONET™, STADEN and Line. Time is no longer wasted on reformatting data. For example, BIONET users can use our programs to analyze their sequence data without logging onto the BIONET mainframe.

ACCESS TO DATABASES

Users of our software can buy the GENBANK nucleic acid database directly from GENBANK, % BBN Laboratories at their nonprofit price. Updated several times a year, this database now contains over 13,000 sequences and comes complete with all sequence annotation. Why should you spend more, receive less and wait longer for a different version of GENBANK?

IBI GEL READER

Designed to save time and improve the accuracy of your sequence data, the IBI Gel Reader enters your data directly in the analytical programs from a autoradiogram. Protein and DNA fragment sizes can also be calculated directly from a photograph of your gel. Only IBI's Gel Reader has a menu strip with twenty different functions which enables you to edit your sequence data directly on the digitizer.



For more information about the IBI/Pustell Sequence Analysis Software [IBI #81521/22] or Gel Reader [IBI #81450], call TOLL-FREE 800-243-2555

GENBANK™ is a registered trademark of NIH.

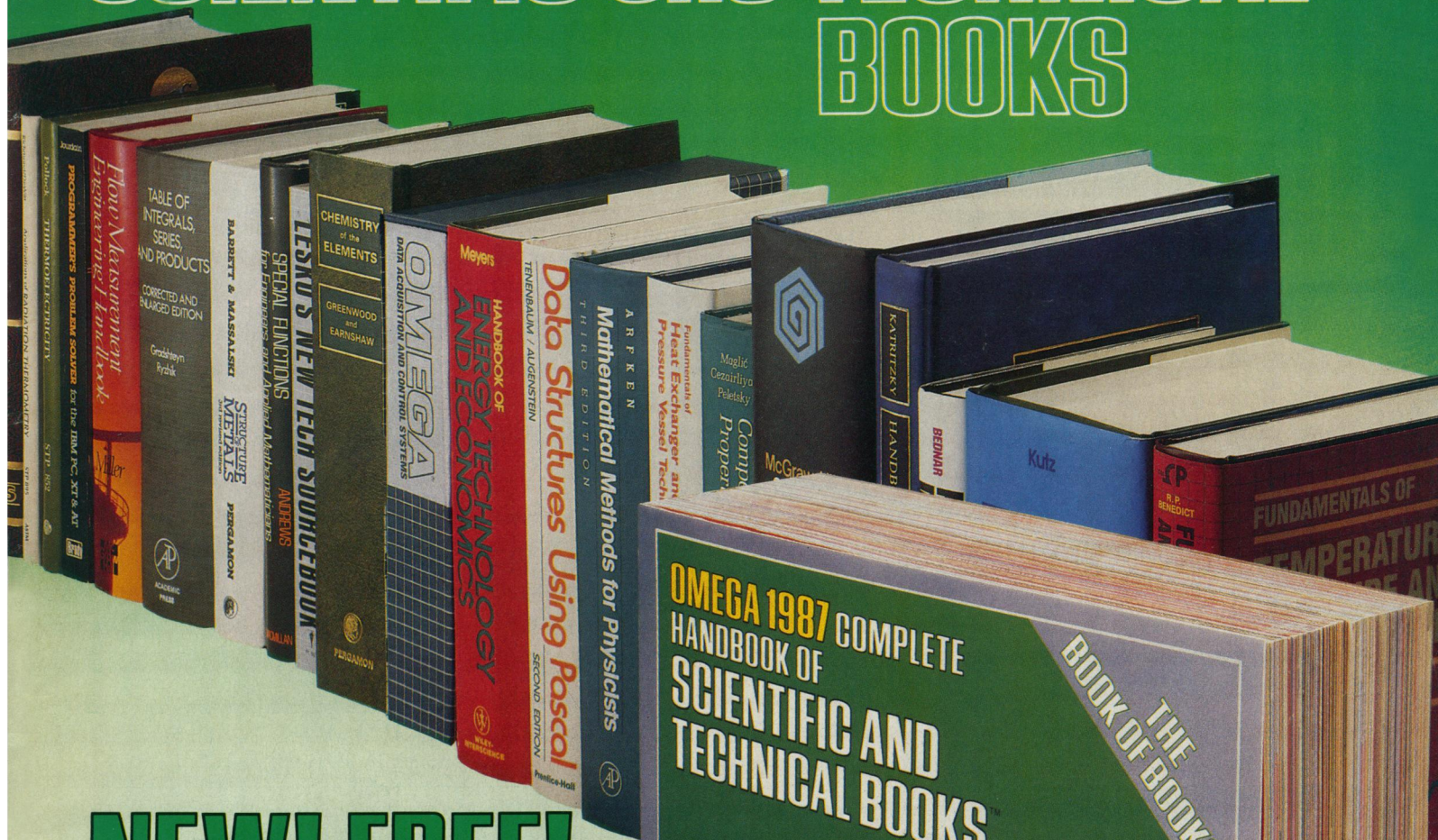
BIONET™ is a registered trademark of Intelligenetics.

The Cutting Edge of Molecular Biology

IBI

Circle No. 223 on Readers' Service Card

THE SOURCE FOR ALL YOUR SCIENTIFIC and TECHNICAL BOOKS



NEW! FREE! 1987 HANDBOOK OF SCIENTIFIC AND TECHNICAL BOOKS™

- ✓ One-Stop Ordering Source For All Your Books
- ✓ Full Descriptions and Prices
- ✓ Complete Listing From 14 of the World's Leading Publishers
- ✓ Over 10,000 Books in 16 Subject Areas

*The Easy Way to Order
All Your Scientific and Technical Books.*

IN A RUSH FOR YOUR HANDBOOK? DIAL . . .

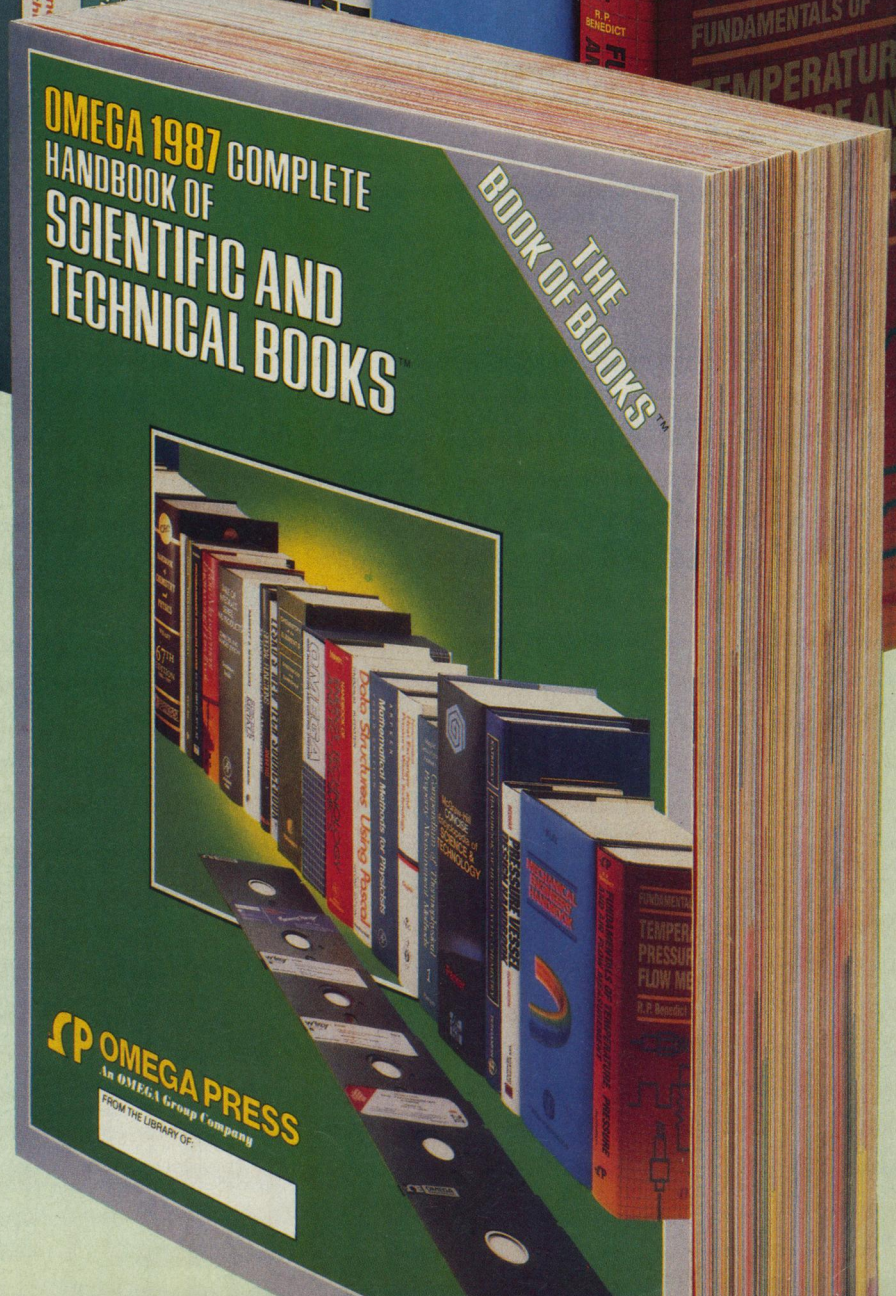
SP OMEGA PRESS
An OMEGA Group Company
(203) 359-RUSH

One Omega Drive, Box 4047, Stamford, CT 06907
Telex 996404 Cable OMEGA FAX (203) 359-7700

Circle Reader Service Number or Send Business Card
to Receive Qualification Form.

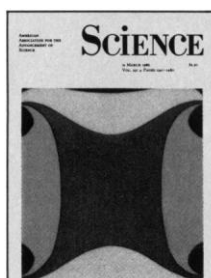
©COPYRIGHT 1987 OMEGA ENGINEERING, INC. PRINTED IN U.S.A.

Circle No. 9 on Readers' Service Card



	7	This Week in <i>Science</i>
Editorial	9	Arms and the Men
Letters	10	Man on Mars: A Turnabout: N. H. HOROWITZ ■ Chernobyl Public Health Effects: G. F. LAWLESS; R. WILSON ■ Arresting Vocabulary: R. W. WRIGHT
News & Comment	16	Soviets Plan Huge Linear Collider
	17	Big Brother Is Counting Your Keystrokes
	18	Europe Splits Over Gene Regulation
	19	Indo-U.S. Vaccine Pact Disputed
	20	EPA's Predicament Over Regulating Pesticides
	22	Japan's Inscrutable Research Budget
	23	GM Wants to Use Soviet Launchers <i>Briefing:</i> Morrison Makes TV Debut ■ Busy Signal at NSF
Research News	24	The Unmasking of Mitochondrial Eve
	27	Chemical Coat Helps Semiconductor Prospects
	30	A Better Fit for the Plate Tectonic Puzzle
Articles	31	Injury Litigation and Liability Insurance Dynamics: P. HUBER
	36	The Use of a Charge-Coupled Device for Quantitative Optical Microscopy of Biological Structures: Y. HIRAOKA, J. W. SEDAT, D. A. AGARD
	42	Multidimensional Analysis of an Evolving Lineage: D. B. WAKE AND A. LARSON
Research Articles	48	A Portable Signal Causing Faithful DNA Methylation de Novo in <i>Neurospora crassa</i> : E. U. SELKER, B. C. JENSEN, G. A. RICHARDSON
Reports	55	Eclipse Measurements of Io's Sodium Atmosphere: N. M. SCHNEIDER, D. M. HUNTEN, W. K. WELLS, L. M. TRAFTON
	58	Electromagnetic Stabilization of Weakly Conducting Fluids: C. F. IVORY, W. A. GOBIE, J. B. BECKWITH, R. HERGENROTHER, M. MALEC
	61	X-ray Photographs of a Solar Active Region with a Multilayer Telescope at Normal Incidence: J. H. UNDERWOOD, M. E. BRUNER, B. M. HAISCH, W. A. BROWN, L. W. ACTON

- 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 Electric power dissipation levels in a vertical slit with finite electrodes. Joule heating is greatest near the electrode tips (black semicircles) and decreases by roughly half with each color change, from blue to green to red. Temperature gradients produced by Joule heating drive unstable nature convection. The picture was generated numerically using Laplace's equation for the potential. See page 58. [William A. Gobie, Department of Chemical Engineering, Washington State University, Pullman, WA 99164]

AAAS News

AAAS Meeting

Book Reviews

Software Reviews

Products & Materials

- 64 Bat Predation and Its Influence on Calling Behavior in Neotropical Katydid: J. J. BELWOOD AND G. K. MORRIS
- 67 Glycolysis Preferentially Inhibits ATP-Sensitive K⁺ Channels in Isolated Guinea Pig Cardiac Myocytes: J. N. WEISS AND S. T. LAMP
- 70 Climate and Chlorophyll a: Long-Term Trends in the Central North Pacific Ocean: E. L. VENRICK, J. A. MCGOWAN, D. R. CAYAN, T. L. HAYWARD
- 72 Trophic Stimulation of Cultured Neurons from Neonatal Rat Brain by Epidermal Growth Factor: R. S. MORRISON, H. I. KORNBLUM, F. M. LESLIE, R. A. BRADSHAW
- 75 The IL-2 Receptor β Chain (p70): Role in Mediating Signals for LAK, NK, and Proliferative Activities: J. P. SIEGEL, M. SHARON, P. L. SMITH, W. J. LEONARD
- 78 Thyroid Hormone Regulates TRH Biosynthesis in the Paraventricular Nucleus of the Rat Hypothalamus: T. P. SEGERSON, J. KAUSER, H. C. WOLFE, H. MOBTAKER, P. WU, I. M. D. JACKSON, R. M. LECHAN
- 81 A Glycan-Phosphatidylinositol-Specific Phospholipase D in Human Serum: M. A. DAVITZ, D. HERELD, S. SHAK, J. KRAKOW, P. T. ENGLUND, V. NUSSENZWEIG

- 86 Women in Science and Engineering Is Focus of Conferences ■ PREP Prepares Volume on Theories in Population/Resources/Environment ■ Proposals and Resolutions Invited for 1988 Council Meeting ■ AAAS Travellers to India . . . ■ 1987 Forum to Look at Students and Learning Reminder for Members ■ Reminder to Members—AAAS Elections Are Under Way
- 89 *Forum '87: Students and Science Learning* Advance Registration and Housing Form
- 92 Technology and Global Industry, *reviewed by* R. E. LITAN ■ General Circulation of the Ocean, P. RHINES ■ Predation, J. D. ALLAN ■ Superstring Theory, D. Z. FREEDMAN ■ Reprints of Books Previously Reviewed ■ Books Received
- 97 Sequence Analysis on Microcomputers: G. C. CANNON
- 104 Mac Software Recognizes Handwriting ■ Word Processor with Document Management ■ Gradient Former for HPLC ■ Protein Sequence Analysis Software ■ Thermal Stages ■ Viscometry Software ■ Literature

Board of Directors

Lawrence Bogorad
*Retiring President,
Chairman*

Sheila E. Widnall
President

Walter E. Massey
President-elect

Robert McC. Adams
Floyd E. Bloom
Mary E. Clutter
Mildred S. Dresselhaus
Beatrice A. Hamburg
Donald N. Langenberg
Frank von Hippel
Linda S. Wilson
William T. Golden
Treasurer
Alvin W. Trivelpiece
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
Oliver E. Nelson
David V. Ragone
David M. Raup
Vera C. Rubin
Larry L. Smarr
Solomon H. Snyder
Robert M. Solow
James D. Watson

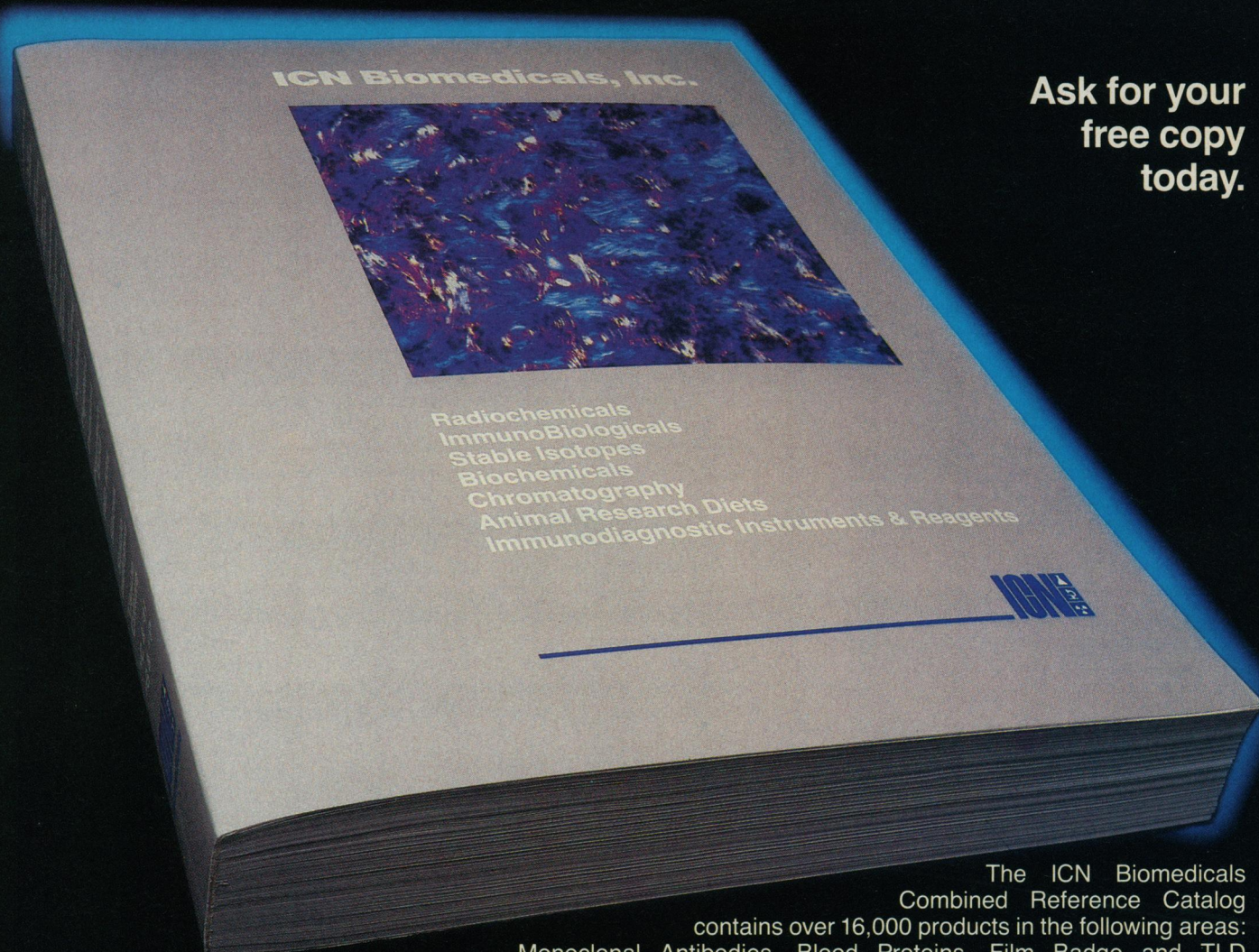
Board of Reviewing Editors

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

Corey S. Goodman
Stephen J. Gould
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
Carl O. Pabo
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

**Your Personal Copy
of the New
ICN Biomedicals Combined
Reference Catalog
Is Waiting.**



**Ask for your
free copy
today.**

The ICN Biomedicals Combined Reference Catalog contains over 16,000 products in the following areas:
Monoclonal Antibodies, Blood Proteins, Film Badge and TLD Services, Enzymes, Human IgG Subclass Kits, Growth Factors and other Tissue Culture Reagents, Laboratory Accessories, NMR Solvents, Electrophoresis Reagents, Ultra Pures, Aluminas, Silicas, Animal Research Diets & Components, Pipetting Instruments, Gamma Counters, Immunodiagnostic Reagents, Automated RIA, Immunochemicals, Iodinated Products, Standards/Sources, Nuclides, Liquid Scintillation Cocktails, ^{35}S -, ^{32}P -, ^{14}C -, and ^3H Labeled Compounds.

ICN Biomedicals, Inc.

(800) 854-0530

P.O. Box 19536, Irvine, CA 92713



Circle No. 70 on Readers' Service Card

This Week in SCIENCE

DNA methylation in fungi

BEFORE a piece of DNA becomes functional in eukaryotes, certain of its cytosine residues are methylated; the methylation alters the DNA's physical properties and affects its interactions with proteins (page 48). Although methylation is considered important for gene expression, the exact biologic sequelae of methylation and of the process by which methylation occurs are undefined. In a piece of DNA called the zeta-eta region from the fungus *Neurospora crassa*, methylation is unusually heavy; this region formed from an imperfect duplication of a segment of DNA. Methyl groups were stripped from ζ - η by propagation in bacteria; when ζ - η was later reintroduced into *N. crassa*, cytosines were faithfully remethylated no matter where the ζ - η region integrated into the host genome. Methylation rarely extended beyond the insert to DNA sequences from the host; the ζ - η region thus appears to be equipped with its own methylation signal. According to the model proposed by Selker *et al.*, the signal is most likely to be contained in a structural feature of the region, probably a feature related to the rearrangement that occurred when the region was originally duplicated.

Advance in x-ray astronomy

AN x-ray image of the sun's corona has been recorded with a new type of telescope, the normal-incidence multilayer reflector telescope (page 61). The multilayer materials efficiently reflect x-ray wavelengths at normal incidence; x-rays have in the past been difficult to focus onto film plates when more complicated—grazing incidence—optical systems were used. The equipment described by Underwood *et al.* flew as part of a solar-experiment rocket payload; the rocket was launched hours after a solar flare in October 1985 and ascended 290 kilometers above the earth. Images at 44.16 angstroms were recorded; this radiation is emitted by ionized silicon in the sun's high tem-

perature (between 1×10^6 and 10×10^6 kelvin) plasma. Computer-enhanced images and x-ray spectra taken by another instrument on board the rocket indicated that plasma in the active regions of the corona was contained in large and small loops outlining the magnetic fields emanating from the sun. The loop pattern was confirmed with an ultraviolet imager on the rocket and by instruments on the Solar Maximum Mission satellite. Further improvements in the optical system of the multilayer telescope should provide even higher resolution than is possible with other existing optical systems.

Bats strike out

KATYDIDS are generally among the most acoustically active of insects; the males typically sing to attract females of their species, but their songs also can attract predatory bats (page 64). In forests in Panama where such bats are common, Belwood and Morris observed that katyids have substituted tremulation—vigorous shaking of their bodies—for much of their singing. When male katyids tremulate on plants, female katyids feeding elsewhere on the plant feel the shaking and respond; the bats do not detect the shaking. Although tremulation probably involves greater output of energy than does loud singing, it is an apparently successful adaptive response by the katyids in the presence of acoustically orienting—and not the usual echolocating—bat predators. The katyids are thus like a variety of other insects—moths, green lacewings, crickets, and mantids—that have adapted their behavior to counter the threat of bat predators.

Climate and chlorophyll a in the ocean

CHLOROPHYLL a, which is produced by phytoplankton in the ocean, has doubled in abundance during summertime; this change has occurred in the last 20 years in a 15-million-square-kilometer area—the cen-

tral North Pacific Ocean (page 70). Venrick *et al.* attribute the increase to a long-term change in the climate that is most prominently expressed in winter. Chlorophyll a is considered to be an indicator of the amount of phytoplankton in the ocean; changes in its abundance reflect changes in the abundances of the carbon and nitrogen that are contained in the phytoplankton. The stronger winter winds and colder temperatures over the ocean have stressed and cooled the sea surface; this, in turn, could enhance the vertical mixing in the water column such that nutrients would be transported more fully to upper regions where the phytoplankton grow. This sizable increase in chlorophyll a could have effects not only on the local ecosystem but also on the global carbon cycle.

Enzyme for the anchor

SURFACE proteins of a variety of eukaryotic cells are anchored into cell membranes by phosphatidylinositol (PI), a glycolipid (page 81). Among the proteins that have such anchors are the decay-accelerating factor found on blood and endothelial cells (and involved in the complement cascade) and the variant surface glycoprotein of African trypanosomes, which are the agents of sleeping sickness. The membrane anchor appears to facilitate the lateral movement of the protein attached to it, and it may serve as a recognition site for enzymes that cleave glycoproteins from cell surfaces. Davitz *et al.* found that one such enzyme, phospholipase D, is a component of human serum; it cleaves the decay-accelerating factor and the variant surface glycoprotein but does not react with a number of similar related substrates; it also differs from several other previously described phospholipases, all of which have been cell-associated, by a number of criteria. Because this enzyme generates phosphatidic acid (which has growth factor-like effects) from PI on the surface of a cell, it may be crucial for the proper transduction of signals into cells bearing certain types of (cleavable) receptors.

THE LIGHT OF DISCOVERY

MICROPHOT



Now the most advanced, integrated and versatile instrument for research light microscopy... The Nikon Microphot. So advanced it will enhance the very process of discovery itself.

Available in two models, the Microphot FX has a built-in camera, while the Microphot may be equipped with any camera from Nikon's FX system.

The Microphot FX microscope uses a microprocessor and software program to provide flawless, automatic photography. Features include binocular focusing for photography with *moveable* 1% spot metering or 30% averaging. FX direct-projection provides fast shutter speeds, maximum metering sensitivity, and reduced glare and flare.

Both the Microphot FX and Microphot allow you to perform *all* viewing and analytical techniques in transmitted and reflected light... with a single instrument. You have the option of multiple functions simultaneously—photomicrography, image analysis, CCTV, microspectrophotometry.

Discover the Microphot FX and Microphot for yourself. Contact Nikon Inc., Instrument Group, 623 Stewart Avenue, Garden City, New York 11530. (516) 222-0200.

Nikon
Extending Man's Vision

For information circle reader service number 177
For a demonstration circle reader service number 178

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: Alvin W. Trivelpiece

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 Editor: Nancy J. Hartnagel

Senior Editors: Eleanor Butz, Ruth Kulstad

Associate Editors: Martha Collins, Barbara Jasny, Katrina L. Kelner, Edith Meyers, Phillip D. Szuroni, Kim D. Vandegriff, David F. Voss

Letters Editor: Christine Gilbert

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

This Week in Science: Ruth Levy Guyer

Contributing Editor: Lawrence I. Grossman

Chief Production Editor: Ellen E. Murphy

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

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

Production Manager: Karen Schools

Assistant Production Manager: James Landry

Graphics and Production: Holly Bishop, James J. Olivari, 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*; William Booth, Mark H. Crawford, Constance Holden, Eliot Marshall, Marjorie Sun, John Walsh

Research News: Roger Lewin, *deputy editor*; Deborah M. Barnes, Richard A. Kerr, Jean L. Marx, Leslie Roberts, M. Mitchell Waldrop

European Correspondent: David Dickson

BUSINESS STAFF

Associate Publisher: William M. Miller, III

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising Supervisor: Karen Morgenstern

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

Traffic Manager: Donna Rivera

Traffic Manager (Recruitment): Gwen Canter

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); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0392) 31645.

Information for contributors appears on page XI of the 25 September 1987 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.

Arms and the Men

The news of the arms control agreement shone like the proverbial candle in the night. It was not the end of the arms race—only a few thousand missiles removed in a sea of many thousands more—but the symbolism was enormous. At least the direction was down, not up; and the manner in which the agreement was concluded had a degree of professionalism as well as an absence of the political grandstanding that had marred previous attempts. Each of the two national leaders could rightfully claim substantial credit and, at the same time, each was pushed by historical forces to adjust to positions that were a long way from what he had initially demanded.

No one will claim that this first step will by itself bring permanent peace, but it is reassuring that the two leaders are not talking just about this agreement but also about the next steps needed to exploit the positive atmosphere. In this development, however, some realism in regard to the limitations of arms control and the true causes of wars had better be introduced.

One horror in the nuclear age, improbable but realistic enough to cause millions of dollars to be spent and to require eternal vigilance, is the preemptive strike. A plethora of arms widely dispersed decreases the likelihood of success for a first strike; therefore, one could argue that reducing arms increases the temptation for such an act. However, there are still so many arms so widely deployed that the surgical strike is likely to fail. Even the most hardened military professional could not expect his glistening hardware to operate perfectly when a German youth flies into Red Square or the U.S.S. *Stark* fails to defend itself against a routine attack.

The second and more probable scenario is a step-by-step escalation to Armageddon. The Falklands war was a model and warning of this danger: Country A grabs a little real estate, reasoning that Country B could not possibly care about some acres of farmland and a few sheep; Country B replies with diplomatic thunder, "Get out or else!" reasoning that tiny Country A will buckle under to threatening words from a larger military power. From that point on, the rhetoric becomes louder and fleets mobilize until both sides discover to their horror that they must act out their words or lose all credibility at home and with allies. Such an escalation could easily occur in the Middle East, Europe, or Central America. The fact that it has not happened so far between major powers may be because of the prospect of a nuclear holocaust, which has kept the peace among such powers for the longest period of modern times. Those living on a precipice become more cautious about a misstep. Ironically, arms control may enhance the chance of war if nations conclude that they can be more reckless now that we have returned to what might be called the comfortable old world of conventional warfare.

Arms control, therefore, offers a step back from the precipice that we cannot afford to waste. It will be valuable only if we seek to understand and defuse the causes of war. One of the problems of our times is the fact that designing military hardware presents such intriguing intellectual challenges: cruise missiles, satellite photography, submarine detection—marvelous scientific challenges with elegant solutions. Understanding aggressive behavior, global economic pressure, and nationalistic pride is far more difficult and less likely to lead to clean, brilliant solutions. Yet studies on those topics must be attempted if we are to maintain and enlarge our fragile peace.

A penetrating economic analysis might well show that mutual reduction in the number of troops together with a guarantee of open markets gives a far better bottom-line return than any conquest of territories. In-depth psychological studies could possibly tell us that proper education can direct national pride from jingoistic competition to constructive cooperation. A treaty of the future, therefore, might require the exchange of information between peoples, perhaps through television programs, just as the countries of the world now exchange ambassadors.

Utopian? Yes. But no more fantastic than sending photographs back from Mars, synthesizing cholesterol in the laboratory, or diagramming genes. We might even learn to understand ourselves, once it becomes clear that it is the only way that we are going to survive.—DANIEL E. KOSHLAND, JR.

For nearly 70 years we've been helping educators like you plan comfortable retirements. But it's our SRAs that give you the extra income to really get the most out of life.

Available to the education community only, Supplemental Retirement Annuities reduce your reportable income, so you get immediate tax savings. Contributions and earnings are fully tax-deferred until you receive them when you retire.

You can choose an SRA from TIAA, or one from CREF.* Or you can have both, in any combination you like.

Whichever combination you choose you'll have the option at retirement to receive part or all of your funds in a lump sum, fixed-period payments, or lifetime income.

SRAs from TIAA-CREF. They'll help you get the most out of school. And the most out of life.



Ensuring the future
for those who shape it.™

*TIAA's rate of return on new net premiums is 8.5%, guaranteed through 2/29/88. Dividends are declared for one year at a time. For 1986, CREF's net total investment return was 22.0%. CREF's return is based on common stock performance. Past performance is not indicative of future results. For information, call 1 800 223-1200.

Leaving school can really pay off.



The care to meet to know, to understand.

Ares-Serono Symposia is an independent foundation, created in 1971, to promote scientific research in all disciplines which contribute towards improving human health. This aim is pursued by means of congresses, courses, seminars and specialized studies.

Some of the international meetings scheduled for 1988 are:

5th European Workshop on the Molecular and Cellular Endocrinology of the Testis
Brighton, UK / April 13-16
Scientific Organization: B.A. Cooke (UK)

Endocrinology Under 35
Florence, Italy / May 23-25
Scientific Organization: M. Maggi (I) and C.J. Johnston (USA)

Platelets and Vascular Occlusion
Rome, Italy / June 1-3
Scientific Organization: G.A. FitzGerald (USA) and C. Patrono (I)

Advances in Biotechnology of Membrane Ion Transport
L'Aquila, Italy / September 19-20
Scientific Organization: R. Vernä (I), P.L. Jørgensen (DK) and R.P. Garay (F)

Third Conference on Differentiation Therapy
Villasimius (CA), Sardinia / September 6-9
Scientific Organization: G.B. Rossi (I), F. Takaku (J) and S. Waxman (USA)

The Adrenal and Hypertension: From Cloning to Clinic
Tokyo, Japan / July 25-26
Scientific Organization: E.G. Biglieri (USA), J. Funder (AUS), F. Mantero (I) and R. Takeda (J)

No form of advertising or promotional activity by any pharmaceutical company is allowed at Ares-Serono Symposia Congresses.



ARES
SERONO
SYMPOSIA

Do you know all the advantages that the Ares-Serono Symposia Congress Card offers?
Please fill in this form and mail to Ares-Serono Symposia for information.

CONGRESS
CARD
1988



ARES
SERONO
SYMPOSIA

swissair  Official Carrier

I would like to receive information about:

- ☐ Ares-Serono Symposia Congress Card
☐ All the above Congresses
☐ In particular the Congress on

☐ Ares-Serono Symposia Publications

Name

Address

Institution

Please send to Ares-Serono Symposia,
Via Ravenna 8 - 00161 Rome - Italy

sintesi informazione - roma

1987

AAAS-WESTINGHOUSE

SCIENCE JOURNALISM

AWARDS

For 36 years the AAAS-Westinghouse Science Journalism Awards have recognized outstanding reporting on the sciences and their engineering and technological applications (excluding medicine). Awards honor science reporting in newspapers and general circulation magazines and on radio and television.

Entries are judged on the basis of their initiative, originality, scientific accuracy, clarity of interpretation, and value in promoting a better understanding of science by the public.

Five awards of \$1,000 each are made in the categories of: over 100,000 daily circulation newspapers; under 100,000 circulation newspapers; general circulation magazines; radio; and television.

The 1987 Contest Year is 1 November 1986 — 31 October 1987. All entries must be postmarked before midnight, 13 November 1987.

The 1987 Awards will be presented at the National Association of Science Writers' banquet during the Annual Meeting of the American Association for the Advancement of Science in Boston in February 1988.

The Awards are administered by the American Association for the Advancement of Science under a grant from the Westinghouse Educational Foundation.

For further information and entry forms, contact the AAAS Office of Communications, 1333 H Street, N.W., Washington, D.C. 20005 or call (202) 326-6440.

SCIENCE

Posters

The following posters of Science covers are available:

9 February 1979, Locomotive in China;

27 July 1979, Lightning over St. Louis;

29 July 1983, Cheetah and cub;
2 December 1983, Snowshoe hare;

23 December 1983, Cathedral window/DNA molecule;

26 September 1986, Neurons in motor cortex;

28 November 1986, Byrd Glacier, Antarctica

Combination of space covers in scroll format: 1 June 1979, 23 November 1979, 10 April 1981.

Price is \$5.50 each (prepaid)

Write to AAAS Department POST,
1333 H Street, NW, Washington,
D.C. 20005.

SigmaScan™
*measures areas, lengths
coordinates, angles,
slopes, and more —*

IBM PC and Compatibles

NEW
VERSION 3.0

Quickly and accurately
digitize, measure and analyze
photomicrographs, strip charts,
X-rays, maps, and more — using
your own PC.

- Areas, lengths, angles, and slopes
- X,Y digitizing
- User-defined units
- Standard ASCII data output
(use in Lotus, dBase, etc.)
- Keyboard macros
- User-defined data transforms

Save hundreds of hours annually over
manual measurement techniques.
Automate complex analyses. Comes
complete with software, choice of
digitizing tablet, money-back guarantee
and full year hardware warranty.

Sigma-Scan™ software is also
available separately.

Free brochure **800-874-1888**
In CA **415-924-8640**
FAX: 415-924-2850 / Telex: 4931977
In Europe: R.J.A. Handers, Germany
Ph #02101/666268

Jandel
SCIENTIFIC

"Microcomputer Tools
for the Scientist"

65 Koch Road ■ Corte Madera, CA 94925

Circle No. 217 on Readers' Service Card

New NESLAB Bath/Circulators

More features than any other
bath on the market! New pro-
gramming, digital or analog
controllers tilt, turn, or can be
removed from bath for remote
operation. All units available
with basic controller. Temp
range -30°C to $+130^{\circ}\text{C}$.
Four sizes of bath work areas.
Adjustable high temp/low liquid
safety. Industrial grade, heavy
duty pump motors. Compact.



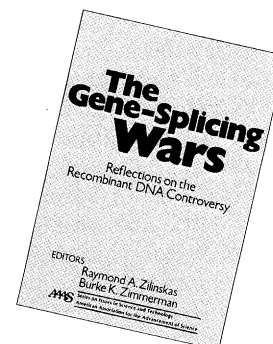
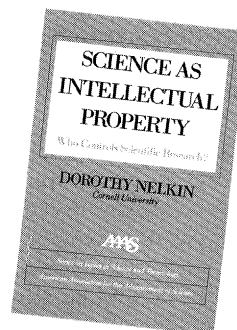
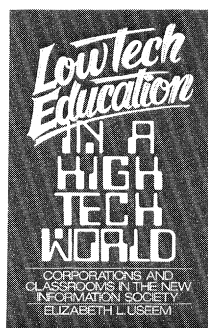
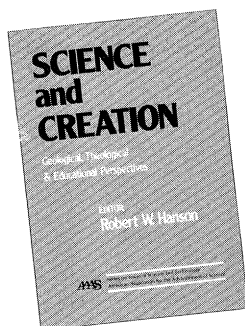
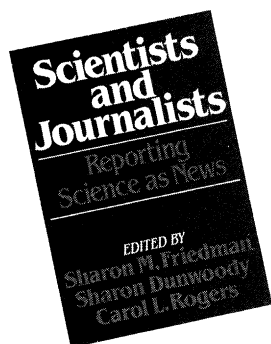
Call or write for
free catalog.
1-800-258-0830

NESLAB

Headquarters: NESLAB Instruments, Inc. P.O. Box 1178, Portsmouth, New Hampshire 03801 U.S.A. TELEX 940830

Circle No. 201 on Readers' Service Card

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*

DRUGS OF THE FUTURE

Yours may be?
You are an independent investigator.
You have discovered a new biological or chemical compound.
We are a Swiss financial institution and have the know-how and the means to develop your compound into a new drug.
Please send preliminary information to:

DEBIOPHARM S.A.
Rue du Petit-Chêne 38
1003 LAUSANNE, SWITZERLAND

Circle No. 85 on Readers' Service Card

BURN YOUR REFERENCE CARDS!

REF-11™

Computerizes your REFERENCES
and prepares your BIBLIOGRAPHIES

- ☐ Maintains a data base of references
- ☐ Searches for any combination of authors, years of publication, reference title, publication title, keywords or abstract
- ☐ Formats bibliographies exactly as you want them
- ☐ Reads your paper, inserts citations into the paper, and prepares a bibliography of the references cited (optional)
- ☐ Downloads references from MedLine data bases such as NLM, BRS and DIALOG (optional)

IBM PC/XT/AT, MS-DOS, CP/M 80 ... **\$195⁰⁰**

RT-11, TSX-Plus, RSX-11, P/OS **\$250⁰⁰**

VAX/VMS (native mode) **\$350⁰⁰**



ANY MANUAL **\$15⁰⁰**

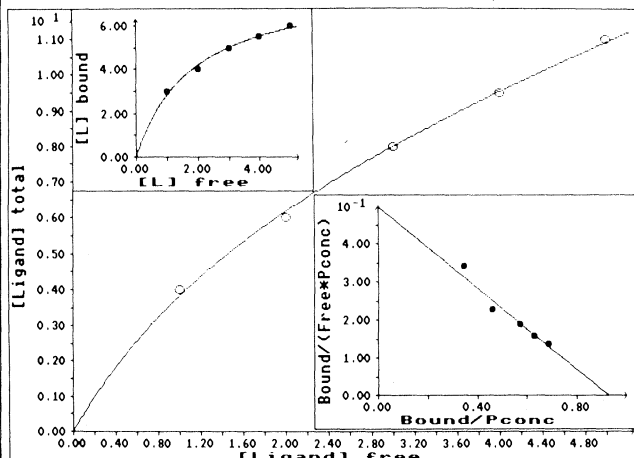
ANY MANUAL & DEMO **\$20⁰⁰**

322 Prospect Ave., Hartford, CT 06106
(203) 247-8500

Connecticut residents add 7½% sales tax.

Circle No. 15 on Readers' Service Card

THE ULTIMATE CURVE— FITTING PACKAGE FOR IBM PC



ENZFITTER

by R J Leatherbarrow

ENZFITTER fits sets of experimental data by non-linear regression (Marquart algorithm) to one of several different equations provided. If the equation or transformation you require is not on the list below, you can add your own with the integrated equation editor and store it on disk.

The results are presented in tabular and graphic form, with a presentation quality screen-dump facility available for Epson-compatible printers and the Hewlett Packard Laserjet. Extra sets of data and transformed/derivative plots of the same data can be shown on screen at the same time. You can draw one graph next to another for comparison. To distinguish data sets, you can select a variety of symbols, semi-continuous lines and add your own labels (including some Greek alphabet characters).

ENZFITTER can be set up to perform robust weighting (removal of outlying data) and to run in batch mode (performing several analyses automatically, without user intervention). All results can be sent to a printer or to disk.

ENZFITTER provides sophisticated entry and editing facilities for data and it will also read ASCII files including LOTUS 1-2-3 PRN.

ENZFITTER is presented in menu form, with windows and context-sensitive help. It supports Hercules, Color and Enhanced graphic cards.

Equations fitted:

Linear regression
pKa determination
Michaelis-Menten kinetics
Ligand binding (1 or 2 sites)
Single, double or triple exponential decay
1st order rate equation
Hill equation

Transformed/derivative plots fitted:

Residuals
Scatchard
Eadie
Lineweaver-Burk
Semi-logarithmic
Linearise pKa

Package includes comprehensive manual + 5.25" floppy disk for IBM PC (384K RAM min; DOS 2.0 or later). **US \$199; UK £99**

Full refund if not satisfied and program returned within 14 days.

Orders from individuals must be accompanied by payment as follows:-

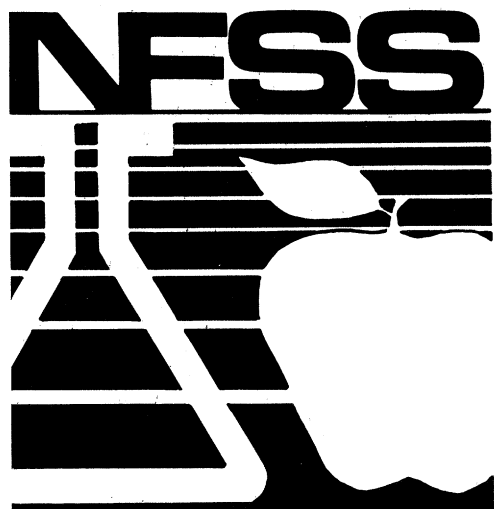
1. Cheque: made out to 'Elsevier' in US dollars.
2. Credit card: we accept AmEx, Visa and Access/Master/Eurocard. Please give card number, expiry date, issuing bank (if appropriate), the cardholder's name and signature.

Recognised institutions will be invoiced: terms strictly 7 days net.

Elsevier - BIOSOFT

Elsevier-BIOSOFT (JIC), 52 Vanderbilt Avenue,
New York, NY 10017, U.S.A.

Circle No. 169 on Readers' Service Card



Forum '87: Students and Science Learning

20-21 November 1987

Hyatt Regency Crystal City

(Adjacent to National Airport, Washington, DC)

The **National Forum for School Science** provides an annual opportunity for teachers, scientists, science educators, and other individuals to analyze and discuss key issues, and to focus attention on the most enduring concerns and most promising new directions in science education.

Forum '87 Program

Friday, 20 November:

7:30 a.m. REGISTRATION

8:30 a.m. WELCOME AND INTRODUCTION TO FORUM '87

8:45 a.m. OPENING ADDRESS: **What Do We Want Students To Learn?** — (Speaker to be Announced)

9:15 a.m. PANEL: **Perspectives on Science Learners**

The speakers in this session will present some of the different ways of thinking about learners: as constructors of knowledge, as processors of information, and as products of social and cultural influences. How these different perspectives affect science education policy and practice will be the topic of the ensuing discussion.

A. Constructivist View — **Rosalind Driver**, Center for Studies in Science and Mathematics Education, University of Leeds.

B. Perspectives from Cognitive Science — **Terry Winograd**, Computer Science Department, Stanford University.

C. Social Influences — **Jacquelynne Eccles**, Department of Psychology, University of Michigan.

D. Discussion

12:15 p.m. LUNCHEON AND ADDRESS: **Facing Our Fears: The New Diversity in Our Classrooms** — **Arturo Madrid**, Tomás Rivera Center, Claremont, CA.

(continued on next page)

Forum '87: Students and Science Learning

(continued from previous page)

2:30 p.m. PANEL: **What Information is Needed for Practice and Policy?**

Following a brief analysis by educators and policymakers, Forum participants will break into groups to discuss the types of information they need about students and learning. The focus will be on identifying research (such as demographic data, science aptitude, etc.) that will enable them to make informed policy and practice decisions.

A. Analysis — **Forbis Jordan**, *Division of Educational Leadership and Policy Studies, Arizona State University*; **Jim Minstrell**, *Mercer Island (WA) High School*; **Ramsay Selden**, *Council of Chief State School Officers*.

B. Discussion in Small Groups.

5:30 p.m. RECEPTION

Saturday, 21 November:

9:00 a.m. PANEL: **Environments and Strategies for Effective Science Learning**

The environments and strategies for science learning can be based on our conceptions of science, or on our knowledge about how people learn. This panel will explore the differences and similarities between these designs, and ask if there are optimal systems. Particular attention will be paid to the practical considerations imposed by school structures.

A. Classroom Practice Based on Conceptions of Science — **Kathryn Olesko**, *Department of History, Georgetown University*.

B. Classroom Practice Based on Learning Research — **Roger Johnson**, *Cooperative Learning Center, University of Minnesota*.

C. Real-World Perspective: Working Within Established School Structures — **Sally Crissman**, *Shady Hill School, Cambridge, MA*.

D. Discussion

12:00 noon LUNCHEON AND SUMMARY DISCUSSION: **Developing Practice and Policy That Adapt to Goals for Science Learning**

2:30 p.m. ADJOURNMENT

Register today by completing and returning the form on the next page. For more information, contact the AAAS Office of Science and Technology Education, 1333 H Street, NW, Washington, DC 20005; (202) 326-6620.

American Association for the Advancement of Science

Advance Registration Form

NS2

AAAS Forum '87: Students and Science Learning

20 – 21 November 1987 ♦ Hyatt Regency Crystal City, Arlington, VA
(Adjacent to National Airport, Washington, DC)

Please Print or Type

Name _____
(last) (first and initial)

Affiliation _____

Mailing Address _____
(street and number)

(city) (state & zip) (telephone number)

☐ Check enclosed or charge to my ☐ VISA or ☐ MasterCard
(no other credit cards accepted)

Card No. _____ Expiration Date _____

Cardholder's signature _____

☐ Check here if you need special services due to a handicap. We will contact you before the meeting.

Registration Fees

\$125 Full (meals included) \$ _____

\$90 Partial (without meals) _____

\$ 45 Student (without meals) _____

Separate Meal Tickets

\$ 20 Lunch, Friday (20 Nov.) _____

\$ 20 Lunch, Saturday
(21 Nov.) _____

TOTAL AMOUNT: \$ _____

All registrants will receive a program, registration badge, and *This Year in School Science 1987: Students and Science Learning*. Registration is limited; preregistration form and payment **must be received by 30 October** to ensure receipt of advance materials. Registrations received after 30 October will be held at the AAAS registration desk in the Hyatt Regency. **Refund Policy:** If cancellations are received by 30 October, advance registration and meal ticket fees will be refunded after the Forum. **No refunds will be made on cancellations received after 30 October.**

Mail top half (registration form) to: AAAS, Forum '87 Registration, Room 830
1333 H Street, NW, Washington, DC 20005

Hotel Reservation ♦ Hyatt Regency Crystal City

AAAS Forum '87 ♦ 20 – 21 November 1987

Reservations received after 30 October cannot be guaranteed.

Send confirmation to:

Name _____ Street _____

City _____ State _____ Zip _____ Telephone No. _____

Other occupants of room: Name _____ Name _____

Special housing needs due to handicap: _____

Room: ☐ Single (\$75)* ☐ Double (\$85)* *Add 4.5% VA sales tax and 5% occupancy tax.

Arrival: Date _____ Time _____ **Departure:** Date _____ Time _____

Please list definite arrival and departure dates and times. Check-in time is 3:00 p.m.; check-out time is 12 noon. Reservations will be held until 6 p.m. only unless guaranteed by one of the credit cards below or one night's deposit is received. Failure to cancel 24 hrs. prior will result in one night's charges.

☐ American Express ☐ Diner's Club Number _____ Expiration Date _____

☐ Carte Blanche ☐ MasterCard Cardholder's signature _____

☐ Deposit (check) for \$ _____ enclosed. Make check payable to Hyatt Regency Crystal City.

Mail bottom half (reservation form) to: Reservations, Hyatt Regency Crystal City
2799 Jefferson Davis Hwy., Arlington, VA 22202