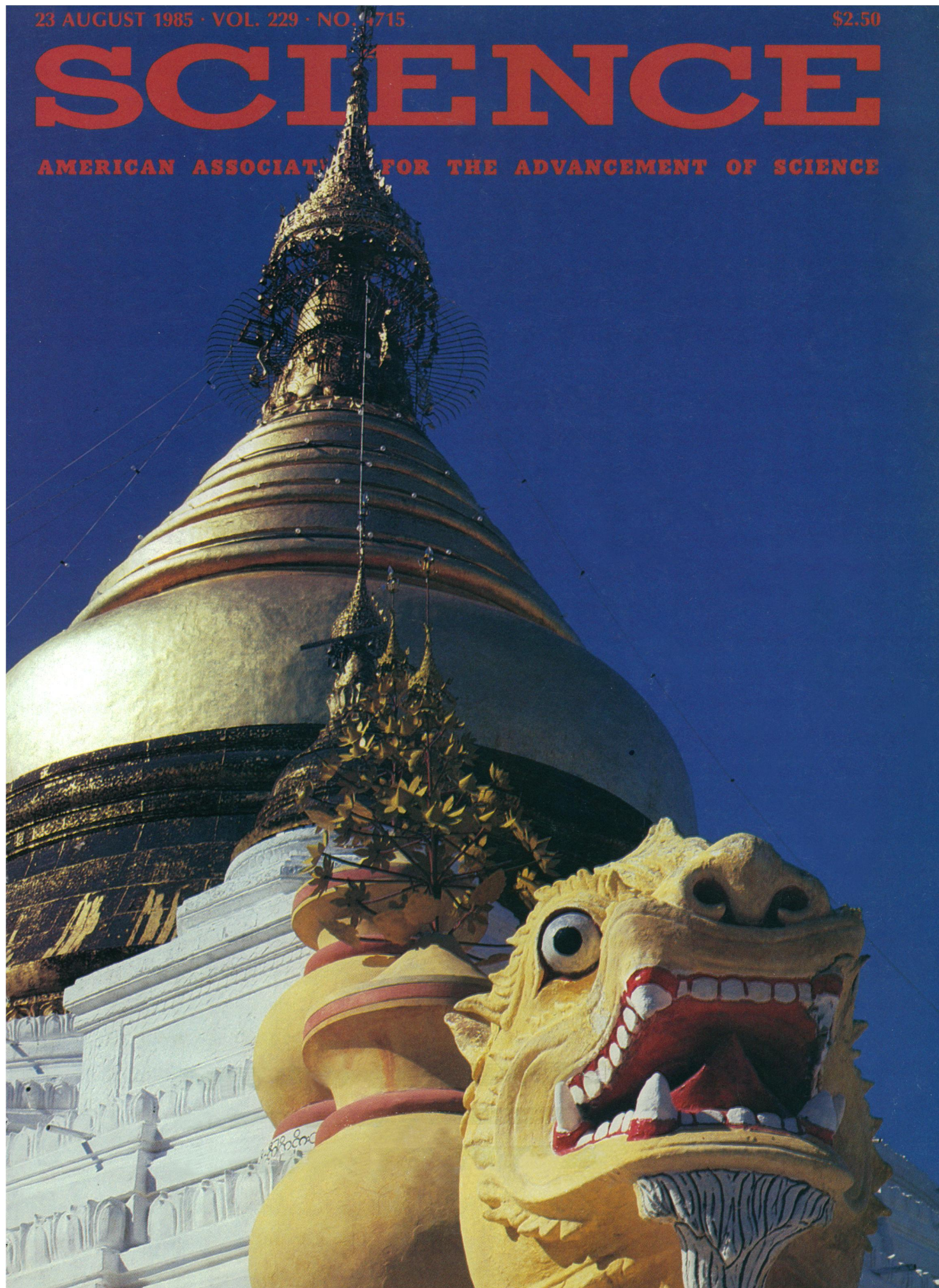


23 AUGUST 1985 • VOL. 229 • NO. 4715

\$2.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





Something Special

Imagine the world's simplest operating ultracentrifuge. Add the most reliable drive ever designed — the Ultra-Smooth vacuum-encased induction system. Include automatic "Soft-Start," built-in diagnostics and the ability to run every Beckman high performance rotor. Top it off with a most attractive purchase price. And you have the new Model L7-55 — the one you have been asking for.

With speeds to 55,000 rpm, forces to 408,000 *g*, integrated circuit logic and remarkably

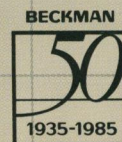
simple controls, the L7 is ideal for everyday applications. It's the perfect addition to the Beckman family of induction drive ultracentrifuges, joining the premier L8M models — the ultimate in centrifugal research tools — and the Benchtop TL-100 for rapid microvolume separations.

Use the L7 for the routine jobs. Save your L8M for investigations where microprocessor control and memory are an advantage, where delicate gradients call for acceleration/deceleration versatility, where computer

interfacing is needed for remote control or record keeping. When you want to cut run times for these jobs by more than half, use the TL-100.

The workaday Model L7-55: it's something special — especially for you!

To get better acquainted, ask for Brochure SB-667. Beckman Instruments, Inc., Spinco Division, 1050 Page Mill Road, Palo Alto, CA 94304.



BECKMAN

Circle No. 184 on Readers' Service Card

PROBLEM:



SOLUTION!



The Sci-Mate® solution: text management software designed to handle every form of text you need to organize . . . from address files to reprints.

You can create up to 64 data bases on your own terms—with the Sci-Mate Personal Text Manager's *variable field and record length*, and *free-text searching*.

Our *customer support program* completes the Sci-Mate solution to your text management problems. Our toll-free customer service hotline, newsletter, and significant discounts on updated versions of the software will help you take full advantage of Sci-Mate.

For more information, call toll-free (800) 523-4092. In Pennsylvania, call collect (215) 386-0100, ext. 1418.

From the people who bring you **Current Contents®**

isi®

Institute for Scientific Information®

Sci-Mate Customer Services, 3501 Market Street, Philadelphia, PA 19104 U.S.A.

Telephone: (215) 386-0100, ext. 1418, Cable: SCINFO, Telex: 84-5305

European Office: 132 High Street, Uxbridge, Middlesex UB8 1DP, United Kingdom

Telephone: 44-895-70016, Telex: 933693 UKISI

Circle No. 222 on Readers' Service Card

©1985 ISI
29-3895

SCIENCE

This Week in *Science* 703

LETTERS High Priority Scores: *P. Schimmel*; Antimalarial Etymology: *C. L. Herzenberg*; *D. L. Klayman*; Photoreceptor Alignment: *J. M. Enoch, D. G. Birch, E. E. Birch*; Neogene Congo Basin Rain Forest: *E. M. van Zinderen Bakker* 706

EDITORIAL Associations and Democracy 711

ARTICLES Hydrothermal Vent Animals: Distribution and Biology: *J. F. Grassle* 713

Geomicrobiology of Deep-Sea Hydrothermal Vents: *H. W. Jannasch* and *M. J. Mottl* 717

Nucleotide Sequence of Yellow Fever Virus: Implications for Flavivirus Gene Expression and Evolution: *C. M. Rice et al.* 726

Perspective: Glad Tidings from Yellow Fever Research: *T. P. Monath* 734

NEWS AND COMMENT New Biotech Review Board Planned 736

Congress to Review Chinese Nuclear Trade 737

Food Dyes Fuel Debate Over Delaney 739
Skirmishing Over the Dyes 740

The Neglected Disease in Medical Education 741

RESEARCH NEWS Molecules vs. Morphology: Of Mice and Men 743

Atomic Physics Tests Lorentz Invariance 745

NATIONAL FORUM FOR SCHOOL SCIENCE Announcement of the National Forum for School Science; Letter; Advance Registration Form 748

BOARD OF DIRECTORS

DAVID A. HAMBURG
Retiring President, Chairman

GERARD PIEL
President

LAWRENCE BOGORAD
President-Elect

ROBERT McC. ADAMS
ROBERT W. BERLINER

MILDRED DRESSELHAUS
DONALD N. LANGENBERG

CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
Daniel Zelinsky
Lynn Arthur Steen

PHYSICS (B)
Ralph O. Simmons
Rolf M. Sinclair

CHEMISTRY (C)
Rustum Roy
Jeanne M. Shreeve

ASTRONOMY (D)
David Morrison
John E. Gaustad

PSYCHOLOGY (J)
John I. Lacey
William N. Dember

SOCIAL, ECONOMIC, AND POLITICAL SCIENCES (K)
David Mechanic
David L. Sills

HISTORY AND PHILOSOPHY OF SCIENCE (L)
Edward Grant
Arthur L. Norberg

ENGINEERING (M)
Henry McGee
W. Edward Lear

EDUCATION (Q)
John F. Schafl
Joseph D. Novak

DENTISTRY (R)
Gordon H. Rowelstad
Harold M. Fullmer

PHARMACEUTICAL SCIENCES (S)
Edward G. Rippie
Betty-ann Hoener

INFORMATION, COMPUTING, AND COMMUNICATION (T)
Karen B. Levitan
Elliot R. Siegel

DIVISIONS

ARCTIC DIVISION

Robert White
President

Gunter E. Weller
Executive Secretary

CARIBBEAN DIVISION

Juan A. Bonnet, Jr.
President

Lucy Gaspar
Secretary-Treasurer

PACIFIC DIVISION

Walter Gardner
President

Alan E. Leviton
Executive Director

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with *The Scientific Monthly*. Copyright © 1985 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$60. Domestic institutional subscription (51 issues): \$98. Foreign postage extra: Canada \$24, 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 \$3 (\$3.50 by mail); Biotechnology issue, \$5 (\$5.50 by mail); classroom rates on request. **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 0036-8075/85 \$1 + .10. **Postmaster:** Send Form 3579 to *Science*, 1333 H Street, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

BOOK REVIEWS	Lavoisier and the Chemistry of Life, reviewed by T. H. Levere; The Young Einstein, D. Cahan; Hand Function and the Neocortex, H. Burton; Some Other Books of Interest; Books Received.....	751
REPORTS	A Local Time-Dependent Sverdrup Balance in the Eastern North Pacific Ocean: P. P. Niiler and C. J. Koblinsky	754
	Anthropoid Origins in Asia? New Discovery of <i>Amphipithecus</i> from the Eocene of Burma: R. L. Ciochon, D. E. Savage, T. Tint, B. Maw.....	756
	Genomic Diversity of Human T-Lymphotropic Virus Type III (HTLV-III): F. Wong-Staal et al.	759
	Gram-Positive Bacteria: Possible Photosynthetic Ancestry: C. R. Woese et al. ...	762
	Antibody-Directed Urokinase: A Specific Fibrinolytic Agent: C. Bode, G. R. Matsueda, K. Y. Hui, E. Haber.....	765
	The Role of <i>c-mos</i> Gene in the 8;21 Translocation in Human Acute Myeloblastic Leukemia: M. O. Diaz, M. M. Le Beau, J. D. Rowley, H. A. Drabkin, D. Patterson	767
	Noninvasive Study of High-Energy Phosphate Metabolism in Human Heart by Depth-Resolved ³¹ P NMR Spectroscopy: P. A. Bottomley	769
	Ethanol Withdrawal in Mice Precipitated and Exacerbated by Hyperbaric Exposure: R. L. Alkana, D. A. Finn, G. G. Galleisky, P. J. Syapin, R. D. Malcolm	772
	Regeneration of Functional Synapses Between Individual Recognizable Neurons in the Lamprey Spinal Cord: S. A. Mackler and M. E. Selzer	774
	Huntington's Disease: Two Families with Differing Clinical Features Show Linkage to the G8 Probe: S. E. Folstein et al.	776
	Diversity of Circumsporozoite Antigen Genes from Two Strains of the Malarial Parasite <i>Plasmodium knowlesi</i> : S. Sharma, P. Svec, G. H. Mitchell, G. N. Godson	779
	Selective Attention Gates Visual Processing in the Extrastriate Cortex: J. Moran and R. Desimone	782
	Locus of the α -Chain of the T-Cell Receptor Is Split by Chromosome Translocation in T-Cell Leukemias: J. Erikson, D. L. Williams, J. Finan, P. C. Nowell, C. M. Croce.....	784
PRODUCTS AND MATERIALS	Supercomputer; Laboratory Software; Ophthalmic Laser; Vessel Wall Model; Bone Embedding Kit; Chemistry Analyzer; Laboratory Animal Protection; Literature	788

DOROTHY NELKIN
JOHN E. SAWYER

SHEILA E. WIDNALL
LINDA S. WILSON

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
William H. Matthews III
Helen M. McCammon

BIOLOGICAL SCIENCES (G)
Betty M. Twarog
Judith P. Grassle

ANTHROPOLOGY (H)
Albert C. Spaulding
Priscilla Reining

MEDICAL SCIENCES (N)
Alfred P. Fishman
Jonathan E. Rhoads

AGRICULTURE (O)
Roy G. Creech
Ralph J. McCracken

INDUSTRIAL SCIENCE (P)
Robert H. Pry
Robert L. Stern

STATISTICS (U)
J. Stuart Hunter
Edward J. Wegman

ATMOSPHERIC AND HYDROSPHERIC (W)
F. Kenneth Hare
Bernice Ackerman

GENERAL (X)
Harold P. Green
Rodney W. Nichols

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Donald J. Nash
President

M. Michelle Balcomb
Executive Director

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

Mythical chinthe standing guard at the entrance to a pagoda, along the road from Mandalay to the remote Pondaung Hills of western Burma. Near the village of Mogaung in 40-million-year-old sediments of the Pondaung Formation a new fossil jaw of the earliest known higher primate, *Amphipithecus*, was discovered recently. This fossil substantiates the view that southeast Asia was the center of anthropoid origins. See page 756. [R. L. Ciochon, Department of Anatomical Sciences, State University of New York, Stony Brook 11794]

LABTECH NOTEBOOK™: IBM PC™ data acquisition without programming.

LABTECH NOTEBOOK™ is the remarkable new program that collects data directly from your laboratory instruments, analyzes it, and produces charts, graphs and printouts—all without programming!

It's even compatible with Lotus 1-2-3™ and Symphony™ so you can perform enhanced data manipulation, modeling, graphics and even word processing. Imagine going from raw data to a printed final report in minutes.

LABTECH NOTEBOOK supports Acrosystems, Burr-Brown, Cyborg, Data Translation, IBM, Keithley DAS, Metrabyte, National Instruments, Taurus and Tecmar hardware.

Call or write today for a **free 30-day trial**, or to **get more information**.



IBM PC is a trademark of International Business Machines Corporation. Lotus 1-2-3 and Symphony are trademarks of Lotus Development Corporation.



LABORATORY TECHNOLOGIES CORPORATION
255 Ballardvale St., Wilmington, MA 01887 • (617) 657-5400

Circle No. 145 on Readers' Service Card

IBM PC OWNERS*

A DIGITIZER WITH INTEGRATED MEASUREMENT AND GRAPHICS FOR ONLY \$495

A versatile digitizing pen; accurate, reliable and rugged.

A Scientific Measurement System.

Linear • perimeter • area • X, Y coordinates • angles • statistics: standard deviations, correlations, regression lines, transforms.

A Pocket Drafting System. Multiple CAD-like aids: auto lines, boxes, ellipses, multi-point curve fitting, enlarge, shrink, invert • color lift-off • symbol libraries • many type fonts.

Quick Lecture-Slides. Bar-graphs, line graphs • with auto-edit • sizing • conversion • labeling • coloring • programmed for Polaroid Palette.

Display and Printout on dot matrix or color printers • choice of size, shape.

The **Digital Paintbrush System** from Jandel Scientific carries a 15-day money-back guarantee. **Call toll-free 1-800-874-1888 or in California 415-331-3022.**

Jandel Scientific

2656 Bridgeway, Sausalito, CA 94965.

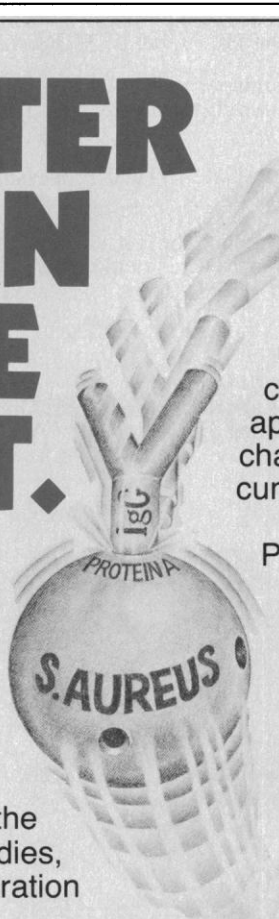
*Apple version \$299.

Circle No. 153 on Readers' Service Card

FASTER THAN ALL THE REST.

IgG^{sorb}® is the IgG adsorbing agent that won't keep you waiting. It removes antibody and antibody-complexed antigen from solution in a mere 15 minutes!

Highly specific for binding the FC portion of IgG antibodies, IgG^{sorb} is a lyophilized preparation



of Protein A fixed to the cell walls of inactivated *Staphylococcus aureus*.

IgG^{sorb} has more than speed too. It has long storage life. Its homogeneity can be assured. And it serves a variety of applications, in some cases replacing charcoal, double antibody, and other cumbersome methods of separation.

Plus, it's available in both liquid and dry form.

Try IgG^{sorb} yourself and see how fast it really is. Because two hour waits you really don't need!

TOLL-FREE 1-800-343-2170



THE ENZYME CENTER, INC.

36 Franklin Street, Malden MA 02148
(617) 322-4885

© The Enzyme Center, Inc., 1985 IgG^{sorb} is a Registered Trademark of The Enzyme Center, Inc.

Ecosystems at deep-sea vents

On the ocean floor, several thousand meters below the surface, exotic marine communities are alive and well, thriving near deep-sea geothermal springs (pages 713 and 717). The seawater at these springs percolates down through the earth's crust and is heated by contact with hot rock. The water is then vented at the sea floor through warm (5° to 23°C) or hot (270° to 380°C) springs, carrying with it inorganic compounds from the earth's interior. Because bacteria are extremely versatile and can grow at many temperatures with the use of different energy sources, it was expected that they would be found at vent openings; but the emergence of a diversified population of marine animals and the development of an unusual food chain around the vents was not expected. Jannasch and Mottl and Grassle describe in two articles how the mixing of vent fluids with oxygen-rich seawater permits chemosynthetic bacteria to use reduced sulfur compounds and other inorganics as energy sources for synthesizing organic compounds, just as their photosynthetic counterparts on land use the sun's energy for organic syntheses. Mats of microorganisms at the vents then support the growth of clams, mussels, tube worms, and other invertebrates in which ingestive and digestive organs have actually been replaced by symbiotic microbes. Crabs and other scavengers near the vents eat mussels and tube worms as well as microorganisms that they scrape off the tubes. The vent animals produce larvae luxuriantly and disperse them widely in the sea, ensuring the perpetuation of the species at newly opened vents great distances away. Individual vents remain geologically active for years or decades, as do the communities that develop around them, and evidence indicates that such communities were extant as far back as the Paleozoic, more than 200 million years ago.

Higher primate ancestor in Asia

A 40- to 44-million-year-old jaw fragment found in Burma has features that link it to those characterizing higher primates; this new specimen may help define evolutionary steps in the lineage leading to monkeys, apes, and man (anthropoids) (page 756). The depth of the jaw and size and shape of the molars (such as the square second molar) are anthropoid features. The fragment predates by 5 million years the earliest known fossil of a higher primate from the African continent, indicating that diversification among anthropoids was also occurring in Southeast Asia. Ciochon *et al.* were able to reconstruct a left mandible for this primate by using details and measurements from the new specimen and from the original specimen of its type found at a nearby site in Burma in 1923. The animal appears to have had a mosaic of higher and lower primate features and may represent a transitional form in early primate evolution.

Dissolving blood clots

Thrombolytic agents degrade fibrin, the structural component of blood clots; the value of these agents has been limited because they also degrade fibrinogen, the precursor of fibrin, and severe bleeding may ensue (page 765). Bode *et al.* have prepared a new agent; it is a conjugate of (i) an antibody that specifically binds to fibrin but not to fibrinogen and (ii) urokinase, an activator of the enzyme that initiates clot dissolution. The antibody's affinity for fibrin brings the conjugate to the clot, increasing the likelihood that fibrin and not fibrinogen will be degraded. In laboratory tests, the conjugate was 100 times more effective than urokinase alone at destroying fibrin. If effective in the body, this conjugate could be important in treating coronary thrombosis.

Nervous system regeneration

Spinal cord injuries that sever axons—conductors of electrochemical impulses between nerve cells—produce permanent neurologic disability. Axon regeneration studies in primitive vertebrate nervous systems suggest that someday such damage may be reversible (page 774). Mackler and Selzer measured conductivity between pairs of nerve cells in larvae of sea lamprey during recovery from experimental spinal transection. Nerve cells were impaled with microelectrodes and the potential measured between pairs. Fifty percent of pairs in normal larvae had measurable electrochemical potentials compared with four of 30 pairs sampled in experimental larvae. Functional connections between uncoupled nerve cells can thus be reestablished along with anatomic regeneration.

Testing for Huntington's disease

Presymptomatic diagnosis of Huntington's disease (HD)—a fatal neuropsychiatric condition characterized by chorea (rapid jerky involuntary movements), depression, dementia, and other symptoms—would distinguish among at-risk individuals those who will and will not develop the disease (page 776). Offspring of affected individuals have a 50 percent chance of developing HD; reassurance for those who have not inherited disease could allay years of anxiety since symptoms typically do not develop until mid-adult life. Folstein *et al.* evaluated 140 people in two large affected families for linkage of HD traits with a chromosomal probe, G8, to which disease had earlier been associated. Close but not absolute linkage was found: in each family, a number of affected individuals had the G8 pattern expected for unaffected individuals. Four HD families evaluated to date differ in ethnic background, age at onset of disease, and symptomatology. The shared G8 linkage enhances the likelihood that all HD families have mutations at the same chromosomal site and that a chromosomal marker near this site will become a useful diagnostic tool.

Mass ion

The new force in bio

ZetaPrep® Technology. Engineered for mass ion exchange. Powered with a unique solid matrix. Thrusting you in to a new age of upstream purification. Boosting mass flow and volume flow with results that outdate every other known separation method. Giving you quantum savings in time and money.

Unique solid matrix!

Designed for highly efficient, ultra-fast extraction of proteins, peptides and enzymes, the ZetaPrep solid matrix comes in a cartridge that's completely self-contained. With its unique, multi-directional radial flow, this patented rigid format offers optimal surface area for rapid bulk binding, plus the strength to withstand high flow rates.

All ZetaPrep housings and cartridges are completely sterilizable and compatible with standard equipment. Shown here is the ZetaPrep 100 for laboratory separations.

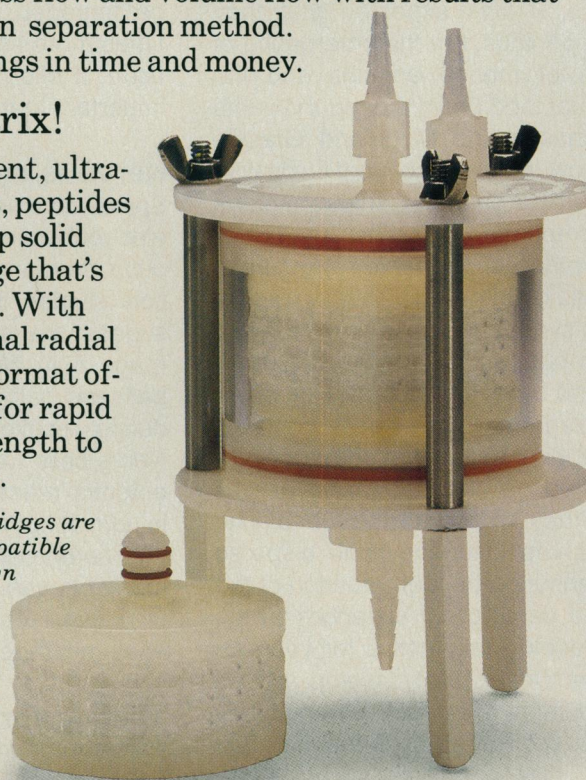
Economics you just can't ignore!

Capable of one-step purification and concentration with up to 80% purity or more, ZetaPrep will slash your production costs to a fraction of what they are today. Because ZetaPrep is so easy to operate, simple to automate and efficient in use, you'll cut expensive man hours to a minimum.

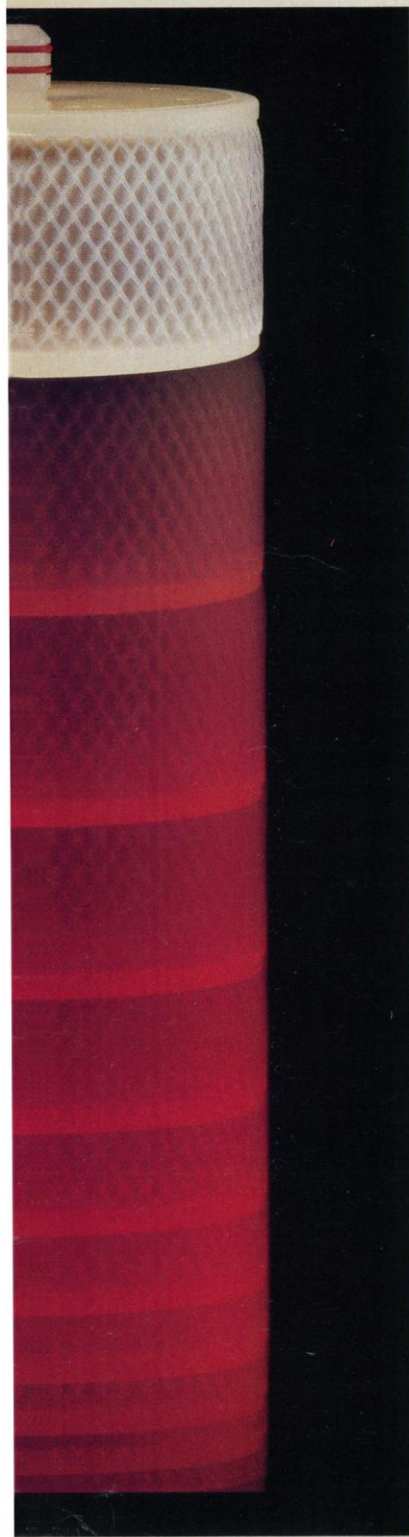
ZetaPrep's incredible flow lets you radically reduce total processing time. Gets you fast binding, wash and elution flow rates. And at least 10 times higher throughput. With no more packing problems. No more fines removal. Just all the benefits of a totally enclosed system—and yields that are truly astounding.

Amazing scale-up potential

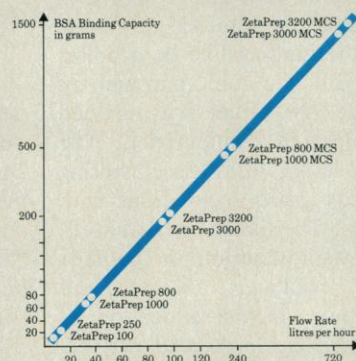
LKB's comprehensive range of ZetaPrep cartridges and Multi-Cartridge Systems lets you select different sizes, extend in series or even couple in parallel for virtually unlimited flow rate and process capacity. With DEAE, QAE and SP functional groups, you can now exploit this amazing scale-up potential from lab, through pilot to fullscale industrial production. In biotechnology, pharmaceuticals or any other process that needs cost-effective purification of proteins and biopolymer products.



exchangeTM process engineering!

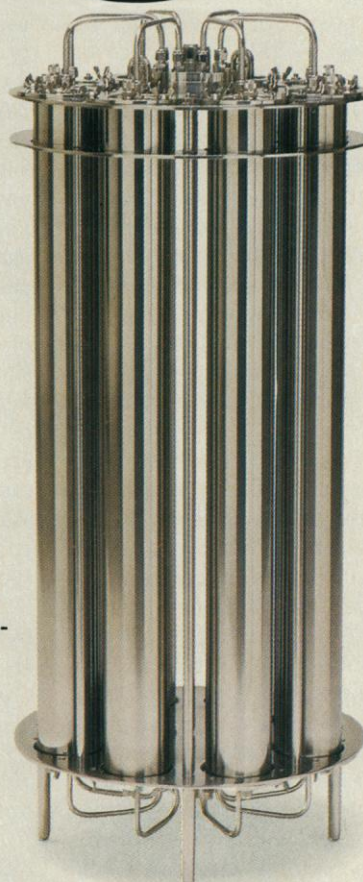


Scale up to 720 liters per hour



Seeing is believing!

Find out how much you can win. That'll convince you just why ZetaPrep Technology has been so successful in such a short time. Why many of the world's leading biotech and drug companies have gone from initial trials to routine industrial processing in just a few months. Why you should try ZetaPrep yourself. Post this coupon today, and we'll send you technical information, full details on test kits available and all prices. Your nearest LKB office delivers fast.



Available also in plastic housing, this ZetaPrep 3000 Multi-Cartridge System, is used for full-scale industrial bioprocessing.



LKB-Produkter AB, Box 305, S-161 26 Bromma, Sweden. Tel. +46(8)98 00 40, telex 10492
 Antwerp (03) 218 93 35 · Athens-Middle East +30 (1) 894 73 96 · Copenhagen (01) 29 50 44 · Hongkong (852) 5-555555
 London (01) 657 88 22 · Lucerne (041) 57 44 57 · Madras (044) 45 28 74 · Moscow (095) 256-9002 · Munich (089) 85 830
 Paris (06) 928 65 07 · Rome (06) 39 90 33 · Stockholm (08) 98 00 40 · Tokyo (03) 293-5141 · Turku (021) 678 111
 Vienna +43 (222) 92 16 07 · Washington (301) 963 3200 · Zoetermeer (079) 31 92 01
 Over 60 qualified representatives throughout the world.

Get more facts fast!

- ☐ Please send me more information ☐ I'd like to try ZetaPrep in my lab
☐ Have your technical representative contact me

Name _____

Title/Dept _____

Organization _____

Address _____

Tel. No _____

ZetaPrep is manufactured for LKB by AMF Molecular Separations Division **AMF**

Circle No. 137 on Readers' Service Card

The Case of the Tax-Perplexed Professor

It is the eve of April 15th. As midnight strikes, Professor Gregg G. Burnett is poring over a pile of papers. "Taxes, taxes, taxes," he groans, "Why do I have to pay all this money in taxes? How does everyone else manage? And still put a little extra aside for retirement?" Gregg sighs. "It's all a mystery to me."

Taking the sting out of taxes needn't be a mystery. There is a simple solution. Supplemental Retirement Annuities from TIAA-CREF. Or, very simply, SRAs. The flexible tax-deferred annuity plan that can reduce your federal taxes and increase your personal retirement savings *without* shrinking your take-home pay.

Under current law, contributions to SRAs are conveniently made through your institution's payroll system *before* that money shows up as taxable income. So you don't pay taxes on it. Or on the interest and dividends it earns. You only pay ordinary income taxes when you receive your income benefits or withdraw cash from your SRAs.

Best of all, you don't have to wait until retirement to take your money out. So if you want to use part of your money *before* you retire—to build or buy your retirement house or send your children to college, you can. *Without* paying any federal penalty tax.



You can also begin receiving your income benefits at any age—again, without a federal penalty tax. And you can choose from a number of *lifetime* income options for you and your spouse.

This flexibility plus TIAA's current effective annual interest rate of 11.75%* and CREF's broadly diversified common stock portfolio make SRAs more attractive than many other tax-deferred accounts. And with assets of over \$35 billion and 65 years of experience in retirement plan investing for people in education, TIAA-CREF helps provide financial security in these uncertain times.

So if *you* feel overtaxed like our perplexed professor, investigate the advantages of Supplemental Retirement Annuities. Simply mail the coupon to TIAA-CREF (Teachers Insurance and Annuity Association—College Retirement Equities Fund). Or call toll-free 800-223-1200 (in N.Y., call collect [212] 490-9000) and ask to speak to an Individual Counselor.

SRAs—Simple. Reliable. Accessible. Tax-deferred annuities. From TIAA-CREF.

*Effective March 1, 1985 through February 28, 1986 for funds credited January 1, 1985 or later. This interest rate is not guaranteed after February 28, 1986. A 1.5% expense charge is deducted from SRA premiums.

TIAA-CREF products and services are available only to staff members of colleges, universities, independent schools and certain other related educational organizations.



TIAA-CREF
730 Third Avenue
New York, NY 10017
Offices in Atlanta, Boston,
Dallas and San Francisco

Yes! I'd like to reduce my taxes and increase my retirement savings. Please send me your free brochure on solving this and other mysteries of my financial future.

Name _____
Name of Institution _____
Address _____
City _____
State _____ Zip _____

SCI 8-23-85

**To commemorate our
commitment to medical research and development,
we are pleased to announce:**

THE BOEHRINGER INGELHEIM FONDS RESEARCH AWARDS

The research:

Scientific studies on muscarinic receptors and their molecular mechanisms in the autonomic nervous system and peripheral organs.

The awards:

1st prize: 30,000 German Marks (approximately \$10,000)
2nd prize: 20,000 German Marks (approximately \$6,500)
3rd prize: 10,000 German Marks (approximately \$3,250)

Eligibility:

All scientists, except those employed by Boehringer Ingelheim Worldwide and members of the award jury.

Deadline:

March 15, 1986. Winners to be announced May 30, 1986.

Award ceremony:

VIII World Congress of Gastroenterology, São Paulo, Brazil, September 7-12, 1986. Prizes will be awarded upon the decision of an international jury.

Nigel J. M. Birdsall, London
Neil M. Nathanson, Seattle
Rudolf Hammer, Ingelheim

Restrictions:

No study will be considered unless submitted in German or English. It must be unpublished prior to February 15, 1984 and produced without the financial support of Boehringer Ingelheim Worldwide.

Other conditions:

- A curriculum vitae must accompany each paper.
- All studies will be treated as confidential. No use will be made of them as long as they remain unpublished.
- The decision of the international award jury will be final.
- In case of ties, awards may be divided.
- Your submission indicates your agreement to abide by all the above rules and conditions.

Mail all studies and any questions you may have to:

BOEHRINGER INGELHEIM FONDS

Stiftung für medizinische Grundlagenforschung
Löffelstrasse 3 D-7000 Stuttgart 70, West Germany



“a company is known by the people it keeps.”

We've taken the liberty of reversing a well-known axiom to make a point about our toxicology laboratory. People make it work. And we've got a greater percentage of the best of them than anyone else. Nearly every one of our toxicology study directors is certified by the American Board of Toxicology, and is a member of the Society of Toxicology. Our studies (acute, subchronic or chronic) are directed by toxicologists experienced in interpreting the normal findings as well as unusual treatment-related effects. In addition, our pathologists are all board-certified or board-eligible, each having over a decade of experience. The majority of our technicians are also AALAS-certified, hold college degrees and have passed a vigorous in-house training program.

Turning the saying back to its original form, “people are known by the company they keep,” there's another point to be made. That is, we not only encourage our people to gain certifications, but we keep them after they do.

People. A key ingredient to our success. And yours!

For information contact Dr. Gary Benke, (201) 873-2550, P.O. Box 43, Mettlers Road, East Millstone, New Jersey 08873.

**Toxicology testing...
we do it right the
first time. On time.**



Bio/dynamics, Inc.

Results you can trust.

TOXICOLOGY • INHALATION TOXICOLOGY • PATHOLOGY • METABOLIC AND ANALYTICAL CHEMISTRY • QUALITY ASSURANCE • FACILITIES MANAGEMENT

Circle No. 113 on Readers' Service Card

DB-248

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*), GARDNER LINDZEY (*Social Sciences*)

Editorial Board

PHILIP W. ANDERSON, DAVID BALTIMORE, ANSLEY J. COALE, JOSEPH L. GOLDSTEIN, LEON KNOPOFF, SEYMOUR LIPSET, WALTER MASSEY, OLIVER E. NELSON, ALLEN NEWELL, RUTH PATRICK, VERA C. RUBIN, HOWARD E. SIMMONS, SOLOMON H. SNYDER, ROBERT M. SOLOW

Board of Reviewing Editors

JAMES P. ALLISON, QAIS AL-AWQATI, LUIS W. ALVAREZ, DON L. ANDERSON, KENNETH J. ARROW, C. PAUL BIANCHI, ELIZABETH H. BLACKBURN, FLOYD E. BLOOM, MICHAEL S. BROWN, JAMES H. CLARK, STANLEY FALKOW, NINA V. FEDOROFF, GARY FELSENFELD, DOUGLAS J. FUTUYMA, THEODORE H. GEBALLE, STEPHEN P. GOFF, PATRICIA S. GOLDMAN-RAKIC, RICHARD M. HELD, GLORIA HEPPNER, JOHN IMBRIE, ERIC F. JOHNSON, KONRAD B. KRAUSKOPF, PAUL E. LACY, JOSEPH B. MARTIN, JOHN C. MCGIFF, MORTIMER MISHKIN, JOHN S. PEARSE, YESHAYAU POCKER, FREDERIC M. RICHARDS, JAMES E. ROTHMAN, RONALD H. SCHWARTZ, OTTO T. SOLBRIG, ROBERT T. N. THIAN, VIRGINIA TRIMBLE, GEERAT J. VERMEIJ, MARTIN G. WEIGERT, GEORGE M. WHITESIDES, WILLIAM B. WOOD, HARRIET ZUCKERMAN

Editorial Staff

Managing Editor: PATRICIA A. MORGAN
Assistant Managing Editors: NANCY J. HARTNAGEL, JOHN E. RINGLE
Production Editor: ELLEN E. MURPHY
News Editor: BARBARA J. CULLITON
News and Comment: COLIN NORMAN (deputy editor), MARK H. CRAWFORD, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, JOHN WALSH
European Correspondent: DAVID DICKSON
Research News: ROGER LEWIN (deputy editor), RICHARD A. KERR, GINA KOLATA, JEAN L. MARX, ARTHUR L. ROBINSON, M. MITCHELL WALDROP
Administrative Assistant, News: SCHERRAINE MACK; **Editorial Assistant, News:** FANNIE GROOM
Senior Editors: ELEANORE BUTZ, RUTH KULSTAD
Associate Editors: MARTHA COLLINS, SYLVIA EBERHART, CATILIN GORDON, WILLIAM GREAVES, BARBARA JASNY, STEPHEN KEPPEL, EDITA MEYERS, LOIS SCHMITT
Assistant Editor: LISA MCCULLOUGH
Book Reviews: KATHERINE LIVINGSTON, **Editor:** LINDA HEISERMAN, JANET KEGG
Letters Editor: CHRISTINE GILBERT
Contributing Editor: RUTH L. GUYER
Production: JOHN BAKER, HOLLY BISHOP, KATHLEEN COSIMANO, ELEANOR WARNER, ISABELLA BOULDIN, SHARON RYAN, BEVERLY SHIELDS
Covers, Reprints, and Permissions: GRAYCE FINGER, **Editor:** GERALDINE CRUMP, CORINNE HARRIS
Guide to Scientific Instruments: RICHARD G. SOMMER
Manuscript System Analyst: WILLIAM CARTER
EDITORIAL CORRESPONDENCE: 1333 H Street, NW, Washington, D.C. 20005. Telephone: 202-326-6500. For "Information for Contributors" see page xi, *Science*, 28 June 1985.

Business Staff

Chief Business Officer: WILLIAM M. MILLER III
Business Manager: HANS NUSSBAUM
Assistant to Chief Business Officer: ROSE LOWERY
Business Staff Supervisor: DEBORAH JEAN RIVERA
Membership Recruitment: GWENDOLYN HUDDLE
Member and Subscription Records: ANN RAGLAND

Advertising Representatives

Director: EARL J. SCHERAGO
Production Manager: DONNA RIVERA
Advertising Sales Manager: RICHARD L. CHARLES
Marketing Manager: HERBERT L. BURKLUND
Sales: NEW YORK, N.Y. 10036: J. Kevin Henebry, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); SAN JOSE, CALIF. 95112: Bob Brindley, 310 S. 16 St. (408-998-4690); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).
ADVERTISING CORRESPONDENCE: Tenth floor, 1515 Broadway, New York 10036 (212-730-1050).

Associations and Democracy

"Americans of all ages, all conditions, and all dispositions constantly form associations. They have not only commercial and manufacturing companies, in which all take part, but associations of a thousand other kinds, religious, moral, serious, futile, general or restricted, enormous or diminutive. The Americans make associations to give entertainments, to found seminaries, to build inns, to construct churches, to diffuse books, to send missionaries to the antipodes. If it is proposed to inculcate some truth or to foster some feeling by the encouragement of a great example, they form a society. Wherever at the head of some new undertaking you see the government in France, or a man of rank in England, in the United States you will be sure to find an association.

"The first time I heard in the United States that a hundred thousand men had bound themselves publicly to abstain from spirituous liquors, it appeared to me more like a joke than a serious engagement, and I did not at once perceive why these temperate citizens could not content themselves with drinking water by their own firesides. I at last understood that these hundred thousand Americans, alarmed by the progress of drunkenness around them, had made up their minds to patronize temperance. . . .

"[I]f these hundred thousand men had lived in France, each of them would singly have memorialized the government. . . . In aristocratic societies men do not need to combine in order to act, because . . . every wealthy and powerful citizen constitutes the head of a permanent and compulsory association, composed of all those who are dependent upon him or whom he makes subservient to the execution of his designs. . . . Among democratic nations, on the contrary, all the citizens are independent and feeble; they can do hardly anything by themselves, and none of them can oblige his fellow men to lend him their assistance. They all, therefore, become powerless if they do not learn voluntarily to help one another. Governments, therefore, should not be the only active powers; associations ought, in democratic nations, to stand in lieu of those powerful private individuals whom the equality of conditions has swept away."*

De Tocqueville in his prescient way predicted the vital role of associations in a pluralistic and increasingly specialized society. Associations of scientists have proliferated, from subspecialties such as clinical chemists to umbrella organizations such as the AAAS and the National Academy of Sciences. They compete for attention with associations of lawyers, nurses, and librarians. How can Congress and the Executive Branch respond to messages from all these associations? On the basis of the numbers? Ideally no, but practically somewhat. On the significance and wisdom of the message? Ideally yes, but practically, not entirely. If the content of the message were all important, would not that of a farsighted individual contribute more than the blandly worded compromise of an association? It is often said that "a camel is a horse designed by a committee." A message from an association involves a filtering process. Politicians are comforted that crackpot ideas are eliminated. The price may be elimination of the most brilliant ones also.

Are, in fact, our associations doing their jobs well? In certain respects—publishing journals, providing communication, and running meetings—they have proved most adept. In others—evaluating the future of their professions, identifying employment prospects for students, explaining their needs to Washington—their performance is episodic. Some do well; others poorly. If science is to play an increasingly important role in modern society, then the associations that de Tocqueville predicted would be so important to a democracy must constantly prove their effectiveness. We scientists should both contribute to and demand performance from our professional societies.—DANIEL E. KOSHLAND, JR.

*A. de Tocqueville, *Democracy in America*, first U.S. edition 1840, quoted from Knopf edition (New York, 1946), vol. 2, chap. 5.

The Amino Acid Story

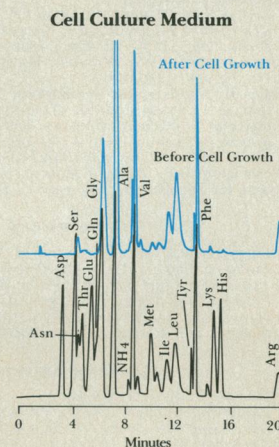


"I needed the specificity of ion exchange with the speed of prederivatization HPLC methods."

"Ion exchange is really specific for analyzing amino acids in complex samples like cell culture media. The problem is that it's just too slow. So I investigated prederivatization HPLC. It was faster, but now I had interferences to contend with. Not to mention all the time I ended up spending on sample preparation.

"The other day I finally discovered the best of both worlds. It's called Dionex. Now I get fast analysis, excellent specificity and reproducibility, with precious little sample prep. Most of the time I just dilute, filter, and inject.

"Also, with column switching I can use my Dionex to analyze organic acids, carbohydrates, organic amines, and inorganic ions."



P.O. Box 3603, Sunnyvale, CA 94088-3603 (408) 737-0700

DIONEX
THE ION EXPERTS



AAAS announces the
**National Forum
for School Science**

10–11 October 1985

Forum '85, **Science Teaching**, is designed to meet the challenge of improving the quality of science instruction in our nation's schools. The participants in Forum '85 will develop a plan of action to restructure science teaching to meet the increasing demands of our technological society.

What are the topics?

- Setting and Maintaining Standards of Quality for Science Teachers
- Changing the Social, Economic, and Professional Environment of Teaching
- What Rational Policy Is Possible?

Who should attend?

- Scientists
- School educators and administrators
- Business leaders
- State and local political leaders
- All who care about the quality of school science instruction

Who are the speakers?

- Paul Peterson, *Brookings Institution*
- Donald N. Langenberg, *University of Illinois at Chicago*
- Edward Harvey, *Ontario Institute for Studies in Education*
- Patricia A. Graham, *Harvard Graduate School of Education*
- Newt Gingrich (R-GA), *Member of Congress*
- Other speakers to be announced.

To register, please use the form on the following page.

If you need further information, please write or call: National Forum for School Science, AAAS, 1333 H Street, NW, Washington, DC 20005.
Telephone: (202) 326-6620.

Jointly funded by AAAS and the Carnegie Corporation of New York
American Association for the Advancement of Science

American
Association
for the Advancement of
Science

1333 H STREET, NW., WASHINGTON, D.C., 20005 (202)326-6400

CABLE ADDRESS: ADVANESCI

August 1985

Dear Colleague:

I invite you to attend the National Forum for School Science, 10-11 October, in Washington, D.C.

The Forum has been established to do two things:

1. Bring scientists, educators, and policymakers together to explore the issues that determine the quality of science education in the nation's schools, and
2. Set a course of action to improve science education and technological literacy, thereby providing the essential foundation for our nation's continued growth and development.

Attainment of the Forum's goals requires input of scientific professionals. For example, what is taught in school science must reflect science and technology as it is actually practiced. You can bring this important perspective to the Forum and make it an integral part of the evolving plan for the future of school science. Additionally, the Forum will enhance your effectiveness as an informed advocate for school science by alerting you to the complex social, economic, and political issues that attend educational reform.

The topic of Forum '85 is science teaching; the details are on the opposite page. If you feel a responsibility for the future of science education in this country, register today for Forum '85.

I look forward to meeting you at Forum '85 in Washington this fall.

Sincerely yours,

Audrey Champagne

Audrey B. Champagne
Project Director
National Forum for School Science



National Forum for School Science
10–11 October 1985
The Shoreham Hotel, Washington, D.C.

**Advance
Registration
Form**

Registrant's Name _____
(last name) (first name and initial)

Affiliation _____

Mailing Address _____
(street address)

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

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

Enclosed is a check, purchase order, or credit card information (see below) for:

- ☐ \$100 Full registration (registration materials, sessions, and two luncheons)
☐ \$ 75 Partial registration (registration materials and sessions only)
☐ \$ 35 Student registration—full-time graduate and undergrad. only (registration materials and sessions only)

Separate Meal Tickets: ☐ Lunch, Thursday, 10 October (\$18) ☐ Lunch, Friday, 11 October (\$18)

All registrants will receive program, registration badge, and copies of background papers. Preregistration and payment must be received by 16 September to ensure receipt of preliminary materials; registrations received after this date will be held at the AAAS Registration Desk in The Shoreham. **Refund policy:** Advance registration fees and meal tickets will be refunded for cancellations received by 7 October; no refunds will be made after this date.

Charge to my ☐ VISA or ☐ MASTERCARD. Number _____ Expiration Date _____

Cardholder's signature _____

Mail registration form to: AAAS, Forum '85 Registration, Dept. FR
1333 H Street, N.W., Washington, D.C. 20005

Shoreham Hotel Reservation

AAAS Forum '85 • 10–11 October 1985

(Reservations received after 9 September cannot be guaranteed)

Send confirmation to:

Name _____ Street _____

City _____ State _____ Zip _____ Telephone No. _____

Other occupants of room: Name _____ Name _____

Room: ☐ Single (\$105)* ☐ Double (\$125)* ☐ Twin (\$125)* *Add 10% D.C. sales tax and \$1 occupancy tax.

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

Be sure to list definite arrival and departure date and time. Check-in time is 3:00 p.m.; check-out time is 12 noon.

Special housing needs due to handicap _____

Enclose separate check, made out to The Shoreham, for first night's room deposit **or** indicate major credit card number:

Credit Card Name _____ Number _____ Expiration Date _____

Cardholder's signature _____

Mail hotel reservation form to: Reservations, The Shoreham, 2500 Calvert Street, N.W., Washington, D.C. 20008