

AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

12 MAY 1989

\$3.50

VOL. 244 ■ PAGES 621-744

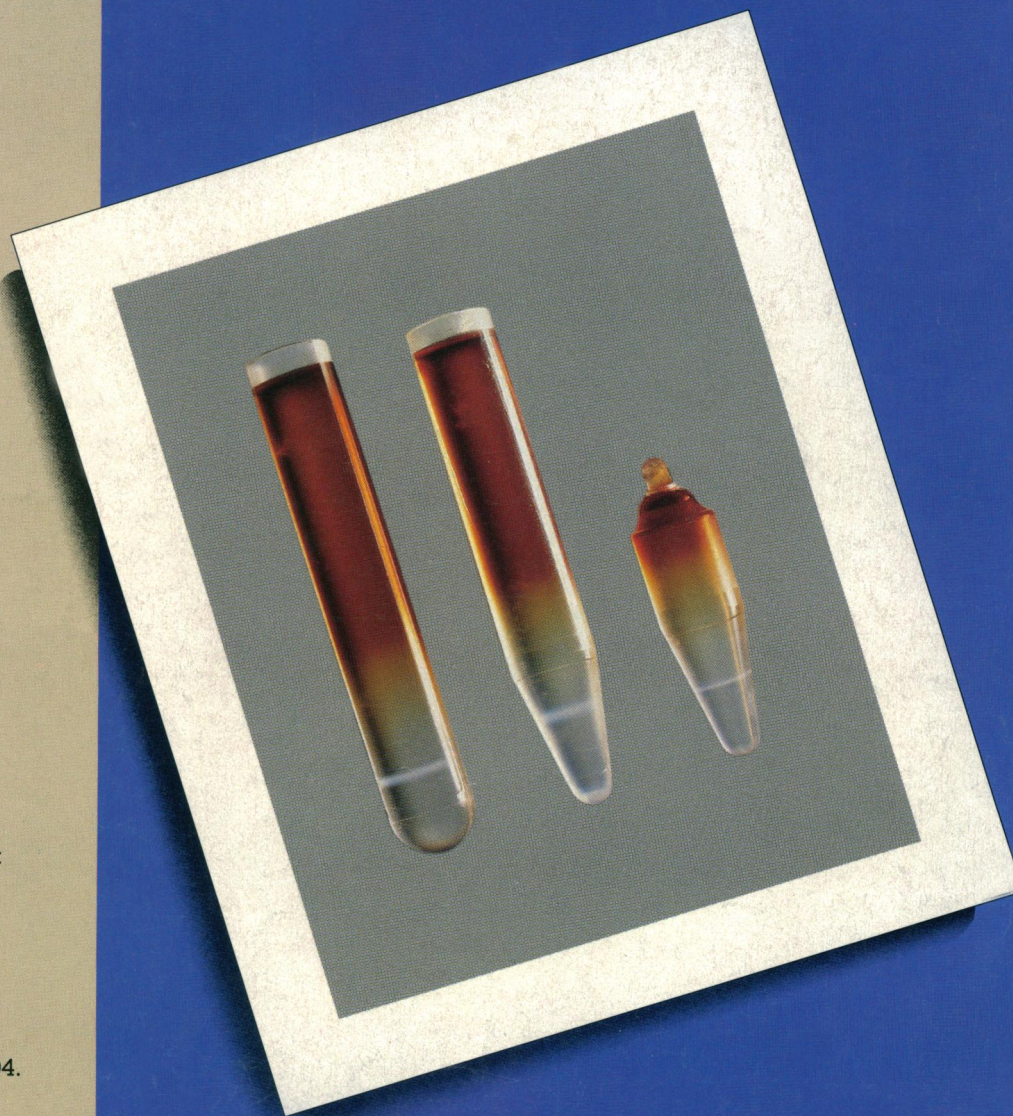


Pelleting RNA?

RNA separations in traditional and new konical™ tubes

Now get equivalent yields in shorter run times using the Beckman g-MAX™ System with either round bottom or konical™ tubes.

What takes 14 hours in the SW-41 rotor with full size tubes can be achieved in just 4 hours using the g-MAX System. Shown here are separations in 13.2-mL open-top, 10-mL konical, and 4-mL g-MAX konical tubes. Send for protocol. Beckman Instruments, Inc., 1050 Page Mill Road, Palo Alto, CA 94304. (800) 742-2345. Offices worldwide.



BECKMAN

A SMITHKLINE BECKMAN COMPANY

© 1989 Beckman Instruments, Inc.

Circle No. 96 on Readers' Service Card

Fantastic Plastics



New A Vage™ Gel Apparatus - CAT# 400060 - The VAGE™ (vertical agarose/acrylamide gel electrophoresis) apparatus allows the preparation of very thin agarose gels (1.5 mm or 3.0 mm) or acrylamide gels (1.0 mm - 1.5 mm) of uniform thickness. Running a thin agarose gel facilitates rapid electrophoresis with superior resolution of DNA bands. The apparatus is supplied with spacer, a 16 lane well comb for each thickness, two gel plates and 4 clamps.

New B Vage™ Casting Stand - CAT# 400066 - The Vage™ Casting Stand simplifies the preparation of vertical agarose gels through the use of a clamping system. This eliminates the need for tapping or plugging the glass gel plates.

New C Radioactivity Waste Container - CAT# 400014 - The radioactivity waste container is a heavy duty, 9.3 mm thick, clear acrylic closed cylinder for disposing of radioactive materials. Dimensions are 18 cm H x 15.25 cm diameter.

New D Beta Block - CAT# 400026 - The Betablock shield is a handy rack constructed of shatter resistant, acrylic which protects one from radiation. The dimensions of the Betablock are 10 cm H x 15 cm L x 3.8 cm W.

New E Push Column Beta Shield Device - CAT# 400700 - This 3 piece acrylic device protects one from radiation while operating the Stratagene push column. The dimensions are 12 cm L x 12 cm W x 23 cm H. The device supports the syringe for easier manipulation of the plunger. Please inquire regarding Stratagene's time saving push columns (CAT# 400701).

New F Stratavac™ Vacuum Blotter - CAT# 400080, 400082 - Available in both large and small sizes. Both Strata Vacs™ are designed for rapid blotting of both DNA and RNA. The sturdy stainless steel clamps are adjustable to provide air tight seals.

G Stratacooler™ II - CAT# 400002 - The durable acrylic Benchtop Freezer and lid contain a special plastic freezing material that freezes and melts at -15°C. The interior microfuge tube rack will hold twenty-four 1.5 ml tubes and eight 0.5 ml tubes. The exterior dimensions of the box are 22.9 cm L x 15.9 cm H x 14 cm W.

H Mini Horizontal Electrophoresis Apparatus - CAT# 400043 - The mini agarose electrophoresis apparatus has a bed constructed of UV transparent acrylic to allow easy viewing of ethidium stained nucleic acids. Exterior dimensions are 170 mm L x 87 mm W x 48 mm H. The gel bed is 88mm L x 75 mm W. Power supply leads and a safety top are included as well as 2 gel combs and a support bridge.

Also available Double Wide Horizontal Electrophoresis Apparatus - CAT# 400048 (not shown). Exterior dimensions are 170 mm x 170 mm W x 48 mm H. The gel bed is 160 mm W x 88 mm L.

I Parafilm™ Dispenser - Available in 2" and 4" sizes, CAT# 400031, 400032 - These dispensers will hold a full 250 ft. roll of Parafilm. The Parafilm™ can be dispensed and cut with one hand, eliminating the need for scissors.

J Sequencing Tray - CAT# 420001 - The sequencing tray replaces microfuge tubes for performing multiple sequencing reactions. Each tray contains 16 annealing tubes conveniently located adjacent to the sequencing reaction wells.

K Radioactivity Transport Capsule - CAT# 400010 - The radioactivity transport capsule is a heavy duty, one-half inch thick, closed cylinder for transporting ³²P and ³⁵S labeled substances. Interior dimensions are 90 mm H x 64 mm D. Each capsule comes with a rack that will hold 7 microfuge tubes.

New L Two-Sided Radioactivity Shield - CAT# 400025 - The two-sided radioactivity shield is constructed from 9.3 mm thick, shatter resistant acrylic. It has a sloped top for viewing experiments while shielding both you and others from radiation. The unique design maximizes bench space and gives protection to persons working on the opposite side of the bench.



STRATAGENE

11099 North Torrey Pines Road
La Jolla, CA 92037
Ordering: 800-424-5444
Technical Services: 800-548-1113
FAX: 619-535-5430
TELEX: 9103809841

In Europe: Stratagene GmbH
Postfach 105466
D-6900 Heidelberg
(Federal Republic of Germany)
Telefon: (06221) 40 06 34
Telefax: (06221) 40 06 39

Circle No. 131 on Readers' Service Card

For orders outside the USA or Germany please contact Stratagene for the distributor nearest you.

627 This Week in *Science*

Editorial

629 Oil Spills

Letters

631 Budget Cuts at NIH: M. J. PEAK ■ Climate and Forests: R. A. SEDJO ■ Retraction: K. M. MILAM, S. HORN, P. J. TOFILON, D. F. DEEN, L. J. MARTON ■ Educational Reform: D. ELKIND ■ Yanomami Indians and Anthropological Ethics: B. ALBERT AND A. R. RAMOS ■ Notification to Readers: J. F. FERRER AND P. GUPTA

News & Comment

643 The Dingell Probe Finally Goes Public ■ Credit for Whistle-Blower Vanishes ■ Secret Service Probes Lab Notebooks ■ "I Am Not a Neat Person" ■ A Question of Intent ■ NIH to Use Forensics
647 Electrochemists Fail to Heat Up Cold Fusion
648 Germany Sets Up New Space Agency
Researchers Irked by Changes to Testimony
649 Frazier Honored by Psychiatrists
Koop Resigns in a Huff
Science Artifacts on the Block
650 Skeleton Alleged in the Stealth Bomber's Closet

Research News

652 Two Cultures Find Common Ground
654 Gene Signals Relapse of Breast, Ovarian Cancers
655 New Chip May Speed Genome Analysis

Articles

659 The Economic Status of the Elderly: M. D. HURD
664 Observations in Particle Physics from Two Neutrinos to the Standard Model: L. M. LEDERMAN
673 How Old Is the Genetic Code? Statistical Geometry of tRNA Provides an Answer: M. EIGEN, B. F. LINDEMANN, M. TIETZE, R. WINKLER-OSWATTSCH, A. DRESS, A. VON HAESELER

Research Articles

679 Stereochemistry of RNA Cleavage by the *Tetrahymena* Ribozyme and Evidence That the Chemical Step Is Not Rate-Limiting: J. A. MCSWIGGEN AND T. R. CECHE

Reports

684 Model Simulation of the Cretaceous Ocean Circulation: E. J. BARRON AND W. H. PETERSON

- **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 © 1989 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): \$75. Domestic institutional subscription (51 issues): \$120. Foreign postage extra: Canada \$46, other (surface mail) \$46, air mail via Amsterdam \$85. First class, airmail, school-year, and student rates on request. **Single copy sales:** Current issue, \$3.50; back issues, \$5.00; Biotechnology issue, \$6.00 (for postage and handling, add per copy \$0.50 U.S., \$1.00 all foreign); Guide to Biotechnology Products and Instruments, \$18 (for postage and handling add per copy \$1.00 U.S., \$1.50 Canada, \$2.00 other foreign). Bulk rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and 11-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 0036-8075/89 \$1 + .10. **Postmaster:** Send Form 3579 to *Science*, P.O. Box 1722, Riverton, NJ 08077. *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 Color-enhanced tissue section from a human ovarian epithelial carcinoma. The tumor cells contain >fivefold amplification of the HER-2/*neu* proto-oncogene. The section is immunostained with antibody to the HER-2/*neu* protein. The typical cystic nature of the tumor can be seen, and there is intense membrane staining (brown color) of the tumor cells lining the cystic structures. Stromal cells and nonmalignant elements are unstained, indicating the absence of the protein ($\times 100$). See page 707. [Photograph by D. J. Slamon, Department of Medicine, UCLA School of Medicine, Los Angeles, CA 90024, and M. F. Press, Department of Pathology, University of Southern California School of Medicine, Los Angeles, CA 90033]

- 686 Hearing in Honey Bees: Detection of Air-Particle Oscillations: W. F. TOWNE AND W. H. KIRCHNER
- 688 Fibroblast Growth Factor in the Extracellular Matrix of Dystrophic (mdx) Mouse Muscle: J. DiMARIO, N. BUFFINGER, S. YAMADA, R. C. STROHMAN
- 690 Corn and Culture in Central Andean Prehistory: S. JOHANNESSEN AND C. A. HASTORF
- 692 Stereochemical Course of Catalysis by the *Tetrahymena* Ribozyme: J. RAJAGOPAL, J. A. DOUDNA, J. W. SZOSTAK
- 694 Identification of the Fusion Peptide of Primate Immunodeficiency Viruses: M. L. BOSCH, P. L. EARL, K. FARGNOLI, S. PICCIAFUOCO, F. GIOMBINI, F. WONG-STAAAL, G. FRANCHINI
- 697 Calicheamicin γ_1^1 and DNA: Molecular Recognition Process Responsible for Site-Specificity: N. ZEIN, M. PONCIN, R. NILAKANTAN, G. A. ELLESTAD
- 700 Complementary DNA Coding Click Beetle Luciferases Can Elicit Bioluminescence of Different Colors: K. V. WOOD, Y. A. LAM, H. H. SELIGER, W. D. McELROY
- 702 Reexamination of the Three-Dimensional Structure of the Small Subunit of RuBisCo from Higher Plants: S. KNIGHT, I. ANDERSSON, C.-I. BRÄNDÉN
- 705 Receptor-Mediated Drug Delivery to Macrophages in Chemotherapy of Leishmaniasis: A. MUKHOPADHYAY, G. CHAUDHURI, S. K. ARORA, S. SEHGAL, S. K. BASU
- 707 Studies of the HER-2/*neu* Proto-oncogene in Human Breast and Ovarian Cancer: D. J. SLAMON, W. GODOLPHIN, L. A. JONES, J. A. HOLT, S. G. WONG, D. E. KEITH, W. J. LEVIN, S. G. STUART, J. UDOVE, A. ULLRICH, M. F. PRESS
- 713 Activation of $\gamma\delta$ T Cells in the Primary Immune Response to *Mycobacterium tuberculosis*: E. M. JANIS, S. H. E. KAUFMANN, R. H. SCHWARTZ, D. M. PARDOLL
- 716 Neural Integration of Information Specifying Structure from Stereopsis and Motion: M. NAWROT AND R. BLAKE

Book Reviews

- 719 Otto Folin, reviewed by J. T. EDSALL ■ Nuts and Bolts of the Past, C. PURSELL ■ Evaporite Sedimentology and Evaporities and Hydrocarbons, P. SONNENFELD ■ Continental Flood Basalts, S. A. MORSE ■ Books Received

Products & Materials

- 724 Magnetic Cell Sorter ■ Statistical Experimental Design Software ■ In Vivo Electrochemistry System ■ Cell and Tissue Adhesive ■ Population Dynamics Software ■ Multivariate Data Analysis Software ■ Literature

Board of Directors

Walter E. Massey
*Retiring President,
Chairman*

Richard C. Atkinson
President

Donald N. Langenberg
President-elect

Mary Ellen Avery
Francisco J. Ayala
Floyd E. Bloom
Mary E. Clutter
Eugene H. Cota-Robles
Joseph G. Gavin, Jr.
John H. Gibbons
Beatrice A. Hamburg

William T. Golden
Treasurer

Richard S. Nicholson
Executive Officer

Editorial Board

Elizabeth E. Bailey
David Baltimore
William F. Brinkman
E. Margaret Burbidge
Philip E. Converse
Joseph L. Goldstein
Mary L. Good
F. Clark Howell
James D. Idol, Jr.
Leon Knopoff
Oliver E. Nelson
Helen M. Ranney
David M. Raup
Howard A. Schneiderman
Larry L. Smarr
Robert M. Solow
James D. Watson

Board of Reviewing Editors

John Abelson
Qais Al-Awqati
Don L. Anderson
Stephen J. Benkovic
Floyd E. Bloom
Henry R. Bourne
James J. Bull
Kathryn Calame
Charles R. Cantor
Ralph J. Cicerone
John M. Coffin
Robert Dorfman
Bruce F. Eldridge
Paul T. Englund
Fredric S. Fay
Theodore H. Geballe

Roger I. M. Glass
Stephen P. Goff
Robert B. Goldberg
Corey S. Goodman
Jack Gorski
Stephen J. Gould
Richard M. Held
Gloria Heppner
Eric F. Johnson
Konrad B. Krauskopf
Charles S. Levings III
Richard Losick
Karl L. Magleby
Philippa Marrack
Joseph B. Martin
John C. McGiff
Mortimer Mishkin
Carl O. Pabo

Yeshayau Pocker
Michael I. Posner
Dennis A. Powers
Russell Ross
James E. Rothman
Erkki Ruoslahti
Ronald H. Schwartz
Vernon L. Smith
Robert T. N. Tjian
Virginia Trimble
Emil R. Unanue
Geerat J. Vermeij
Bert Vogelstein
Harold Weintraub
Irving L. Weissman
George M. Whitesides
Owen N. Witte
William B. Wood

TWENTY NEW WAYS WE'RE WORKING TO FIGHT HEART DISEASE.

This year Glaxo launched a \$10 million Cardiovascular Discovery Grants Program. The Discovery Program is designed to forge research partnerships with scientists whose ideas may point the way to discovery of innovative cardiovascular therapeutic agents. We are pleased to announce the Advisory Board's recommendations for the 1989 funding recipients.

Dr. Joseph A. Beavo
University of Washington

Dr. David E. Clapham and Dr. Ernest Peralta
Mayo Clinic Harvard University

Dr. Jackie D. Corbin
Vanderbilt University School of Medicine

Dr. Wolfgang H. Dillmann
University of California, San Diego Medical Center

Dr. William John Elliott
University of Chicago

Dr. Fredric S. Fay and Dr. Mitsuo Ikebe
University of Massachusetts Medical School Case-Western Reserve University

Dr. Heidi Elizabeth Hamm
University of Illinois at Chicago College of Medicine

Dr. Edwin K. Jackson
Vanderbilt University School of Medicine

Dr. Michael Kahn and Dr. Michael E. Johnson
University of Illinois at Chicago

Dr. Alan J. Kinniburgh
Roswell Park Memorial Institute

Dr. Joe M. McCord
University of South Alabama College of Medicine

Dr. Anthony R. Means
Baylor College of Medicine

Dr. Walter L. Miller
University of California at San Francisco

Dr. L. Bruce Pearce
Boston University School of Medicine

Dr. Bruce R. Pitt and Dr. Paul Davies
University of Pittsburgh School of Medicine

Dr. David J. Riley
UMDNJ - Robert Wood Johnson Medical School

Dr. Michael R. Rosen
Columbia University College of Physicians and Surgeons

Dr. John Sutko, Dr. Luc Ruest, and Dr. Koert Gerzon
University of Nevada School of Medicine University of Sherbrooke Indiana University School of Medicine

Dr. Ian L. Taylor
Duke University Medical Center

Dr. Carl L. Tipton
Iowa State University

Glaxo

Health Care Through Discovery and Innovation

This Week in SCIENCE

Cretaceous currents

WHAT were ocean circulation patterns like during the mid-Cretaceous (100 million years ago)? The tropical Pacific was flowing westward. The Tethys Ocean (the seaway that separated North America and Eurasia in the north from Africa, South America, and India in the south) was also thought—based on laboratory experiments and biogeographic studies—to have a dominant west-flowing surface current. However, recent numerical simulations of the mid-Cretaceous Tethys Ocean circulation favor eastward flow along the northern margin of the ocean (page 684). The simulations took into account Cretaceous atmospheric conditions at the sea surface, the shape and size of Tethys, the positions and shapes of the continents, sea level, and other factors. Barron and Peterson discuss how differences in these parameters may be at the root of the discrepancies between the simulations and the earlier reconstructions. The results of the simulations bear directly on interpretations of marine organism dispersal by Tethys currents after the breakup of the supercontinent Pangea some 200 million years ago.

Honey bee sounds

A worker honey bee performs a dance to communicate to her nestmates where food is located; which of the dancer's signals are processed by the nestmates is now becoming clear. The dancer produces sounds by vibrating her wings, and the vibrations cause air particles near her abdomen to oscillate; other honey bees detect the oscillating air particles and respond by lowering their wings and raising their antennae (page 686). The responding bees do not react to the weak pressure oscillations that are also components of the traveling sound waves. Bees could learn to detect artificial airborne sounds and could distinguish between sounds at different frequencies. Towne and Kirchner speculate that the Johnston's organs on flagella of the bees' antennae detect the

air-particle oscillations. These organs are most sensitive to sounds at the frequency (265 Hz) of the sounds that accompany the dance; these organs may process information about where the dancer is and where the food she has found is located.

Corn and culture

MAIZE played an important part in prehistoric Peruvian cultures. Charred kernels of maize recovered from settlements dating from A.D. 450 to 1500 in the upper Mantaro Valley of the Andes provide a record of sequential steps in regional maize evolution and give some insights into local cultural and political developments (page 690). Johannessen and Hastorf studied kernels from six contiguous time periods and noted several trends—a general increase in kernel size, several changes in kernel shape, changes in the number of rows to an ear (inferred from the physical characteristics of the kernels), and an increase in the number of maize varieties. The gradual evolution of the maize has cultural significance. For example, the large-kernelled variety that was common by A.D. 1000 resembles maize that had suddenly come into use in coastal regions centuries earlier; the coastal maize had been attributed to the influence of the Waris (whose expansion occurred from A.D. 550 to 850), and it therefore appears unlikely that the Waris were influential in the upper Mantaro Valley. The large-kernelled maize was a local and not an Inca innovation: it and tools for growing, processing, and eating it were well established in this valley long before Inca time.

Prognostic tool for breast and ovarian cancers

DURING 1989, there are likely to be close to 162,000 new cases of breast and ovarian cancer; these two types of cancer account for about one-third of all the cancers in women. Of the several prognosticators for long-term survival in breast cancer,

the best are whether there has been amplification of the *HER-2/neu* proto-oncogene (a normal gene that is amplified in some tumors and may be associated with tumor development) and whether lymph nodes are involved; amplification of *HER-2/neu* also has now been shown to be an indicator of clinical outcome in ovarian cancer (page 707). Slamon *et al.* found in a large study that in 25 to 30% of breast and ovarian cancers there are multiple copies of this proto-oncogene. The consequences of amplification are overexpression of RNA and protein (cover); each of these indicators was assessed. Because follow-up studies show that the amount of amplification is predictive of the patient's long-term survival, *HER-2/neu* is an obvious target both for diagnostic tests and for therapies for both of these malignancies.

$\gamma\delta$ T cells

A function has been found for a subpopulation of cells of the immune system for which no function was previously known. The $\gamma\delta$ T cells appear to provide a rapid first-line defense in the immune response against the bacteria that cause tuberculosis (page 713). Studies by Janis *et al.* show that $\gamma\delta$ T cells are responsive to mycobacteria both in vivo and in vitro. After mice had been immunized with mycobacteria, the number of $\gamma\delta$ -bearing cells in lymph nodes expanded 20- to 25-fold. The $\gamma\delta$ cells participated in the primary immune response but were less active than other T cells ($\alpha\beta$ T cells) in the secondary responses that ensued after subsequent immunizations. These differences in responsiveness suggest that after $\gamma\delta$ T cells participate in the primary response to mycobacterial antigens (perhaps specifically to those antigens that are shared by many microorganisms) a switch may occur to turn on $\alpha\beta$ cells, which then mediate secondary responses to the same antigens. The $\gamma\delta$ T cells and the corresponding $\alpha\beta$ T cells recognize mycobacterial antigens in association with different cell surface structures. The two subpopulations appear to represent distinct T cell lineages.

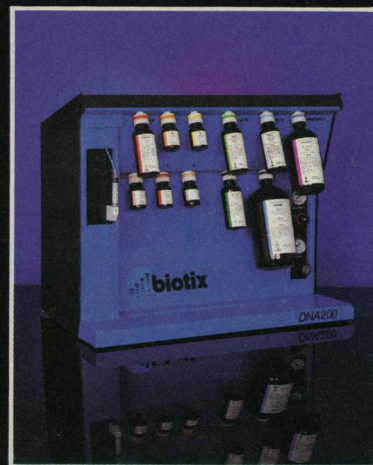
For economy, speed and purity, Biotix wins again. Hands down.

For primers, for thermocyclers and sequencing, nothing beats the low cost and high performance of the new Biotix DNA 200 synthesizer.

3 minute cycle time. 98-99% efficiency from phosphoramidite *or* newly perfected phosphonate chemistry. Guaranteed biologically active DNA. And backed by the Biotix Zero Downtime Warranty.

To find out more, call 1-800-288-2468, or write Biotix, Inc., Commerce Park, Corporate Drive, Danbury, CT 06810-4130.

The new
Biotix 200
DNA Synthesizer . . .



Speed, purity and

\$11,950.*

(*including computer!)



 **biotix**
Systems For Molecular Biology

Instruments for Scientists. By Scientists.

Reverse Phase HPLC of an unpurified 25 mer synthesized via the phosphoramidite chemistry.
VYDAC, C-4 column, 2.5mm \times 7.5cm, Gradient: 0%-30% B in 30 minutes, Solvent A: 0.1M TEA, Solvent B: acetonitrile

Circle No. 34 on Readers' Service Card

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: Richard S. Nicholson

Editor: Daniel E. Koshland, Jr.

News Editor: Ellis Rubinstein

Managing Editor: Patricia A. Morgan

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

EDITORIAL STAFF

Assistant Managing Editor: Nancy J. Hartnagel

Senior Editor: Eleanor Butz

Associate Editors: Keith W. Brocklehurst, Martha Coleman, R. Brooks Hanson, Barbara Jasny, Katrina L. Kelner, Edith Meyers, Linda J. Miller, Phillip D. Szuroni, David F. Voss

Letters Editor: Christine Gilbert

Book Reviews: Katherine Livingston, *editor*; Susan Milius

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, Patricia L. Moe, Barbara E. Patterson

Copy Desk: Joi S. Granger, Jane Hurd, MaryBeth Shartle, Beverly Shields

Production Manager: Karen Schools Colson

Assistant Production Manager: James Landry

Art Director: Yolanda M. Rook

Graphics and Production: Holly Bishop, Catherine S. Siskos

Covers Editor: Grayce Finger

Manuscript Systems Analyst: William Carter

NEWS STAFF

Correspondent-at-Large: Barbara J. Culliton

Deputy News Editors: Roger Lewin, Colin Norman

News and Comment/Research News: William Booth, Gregory Byrne, Mark H. Crawford, Constance Holden, Richard A. Kerr, Eliot Marshall, Jean L. Marx, Robert Pool, Leslie Roberts, Marjorie Sun, M. Mitchell Waldrop

European Correspondent: David Dickson

Contributing Writer: John Walsh

BUSINESS STAFF

Circulation Director: John G. Colson

Fulfillment Manager: Ann Ragland

Business Staff Manager: Deborah Rivera-Wienhold

Classified Advertising Supervisor: Karen Morgenstern

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

Employment Sales Manager: Edward C. Keller

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 60914: Jack Ryan, 525 W. Higgins Rd. (312-885-8675); San Jose, CA 95112: Bob Brindley, 310 S. 16th St. (408-998-4690); Dorset, VT 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581); Damascus, MD 20872: Rick Sommer, 11318 Kings Valley Dr. (301-972-9270); U.K., Europe: Nick Jones, +44(0647)52918; Telex 42513; FAX (0647) 52053.

Information for contributors appears on page XI of the 31 March 1989 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, New York, NY 10036. Telephone 212-730-1050 or WU Telex 968082 SCHERAGO, or FAX 212-382-3725.

Oil Spills

The Alaskan oil spill has become the most studied and managed event of its kind. Some 30 teams from various state and federal agencies have, as their goal, assessment of damage accruing from it. Each morning at Valdez there have been briefing sessions attended by 60 to 70 scientists. The cleanup is being managed by a committee that includes representatives from about 12 state and federal agencies.

Thus far the sequence of events following the spill has been governed by local factors such as wind, temperature, ocean currents, geology, and the composition of the Prudhoe Bay crude oil. Nevertheless events have been following a pattern similar to those observed in spills of crude oil elsewhere.

Crude oils differ, but in general they contain hundreds, even thousands, of different compounds. Some are straight-chain hydrocarbons with carbon numbers ranging from 4 or 5 to 35 or more. Other hydrocarbons have branched chains with a wide range of carbon numbers. Aromatic compounds such as benzene, toluene, and polynuclear hydrocarbons are substantially present. Other constituents include waxes and complex, high molecular weight asphaltenes. All of these substances and more are present in Prudhoe Bay crude oil. When ingested, most of the compounds are nontoxic. Notable exceptions are some of the aromatic compounds, including benzene and toluene.

After a crude oil is spilled in a marine environment, many processes follow. A typical crude has a density of about 0.85, more or less, and this factor combined with winds, wave action, and currents leads to spreading, which is particularly rapid during the first 24 hours. During that period most of the components having boiling points below 200°C volatilize. As a result some of the toxic chemicals such as benzene are removed. The composition of the floating mixture is further changed immediately and later by photooxidation, biodegradation, dispersion, and dissolution. About a day after the spill, depending on temperature and wave action, an emulsification of oil and sea water occurs, leading to formation of a highly viscous material that contains about 70% water. This material is very sticky, and it adheres to almost all objects that it encounters, including birds and sea otters. There has been one report of a minor fish kill in Prince William Sound. Observations at other oil spills indicate that dispersed oil is not toxic to zooplankton when ingested. It is eliminated in the feces. In general, oil chemicals are not concentrated in the food chain.

In Prince William Sound local factors have affected the movement and behavior of the spill. Part of the time, the sea is relatively calm, but often it is roiled by winds that create waves 20 feet high and more. The amplitude of the tide is about 15 feet. The Alaska Current enters the Sound on the east and exits on the west. This flow has protected some of the Sound from major contamination and has carried part of the spill out of the Sound. As a result of various physical, biological, and chemical processes, the inventory of oil in Prince William Sound (originally 10 million gallons) dropped about 70% during the first 4 weeks after the spill. The U.S. Forest Service, one agency active at the site, quotes an Exxon estimate as follows: evaporated, 35%; recovered, 17%; burned, 8%; biodegraded, 5%; dispersed, 5%. The total in the form of oil slicks on Prince William Sound amounted to 10% of the original spill; that on the shoreline, 18%. A large fleet of vessels was mopping up the slicks, and in good weather was capturing about 120,000 gallons a day. Previous experience has shown that once the slicks become thin (some micrometers) they are fairly rapidly destroyed by photooxidation and microbial action. However, the tarry oil on 300 miles of shoreline will only slowly be removed by wave action and by a workforce of about 4000.

Insofar as part of the oil leaves Prince William Sound and affects other portions of the Alaska coastline, Exxon will have additional problems. However, due to the cleanup, the flushing action of the Alaska Current, and the fact that some of Prince William Sound has escaped major contamination, it is likely that in a few years or less, the fauna of the Sound will be substantially restored. But television viewers will not soon forget heartrending scenes of oiled birds and sick otters.—PHILIP H. ABELSON

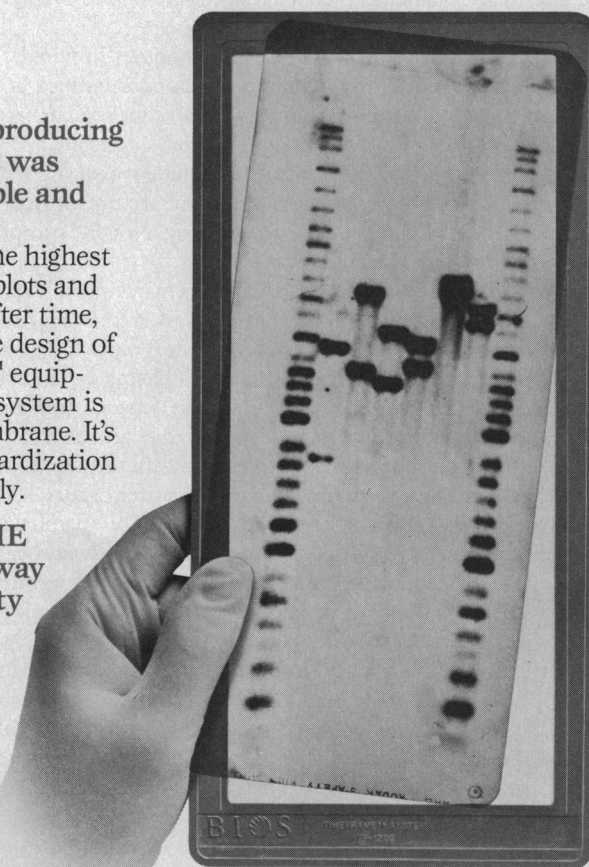
GOOD, BETTER, BIOS

Isn't it about time producing high quality autorads was uncomplicated, reliable and consistent?

Now you can produce the highest quality DNA and RNA blots and autoradiographs, time after time, thanks to the innovative design of BIOS™ TIMEFRAME™ equipment. The heart of the system is our unique, framed membrane. It's what enables true standardization of blot production. Finally.

BIOS TIMEFRAME equipment: A better way to prepare high quality autorads of Southern and Northern blots.

Rapid handling, accuracy and ease of use. That's what our unique instrumentation offers. The complete BIOS System consists of the TIMEFRAME Membrane, designed for multiple reprobing and easy handling; the Gel Casting Assembly and Electrophoresis Unit, that produce straight running lanes every time; the Blotting Unit that enables 100% two-hour capillary transfer; the novel Hybridization Cassette that eliminates plastic bags; and the Imaging Cassette that provides high quality autoradiographs with no chance of double exposure.



BIOS Population Blot prepared using BIOS TIMEFRAME™ equipment showing DNA variability among unrelated humans as detected by hybridization to a VNTR probe, pYNH24. Samples were electrophoresed (0.8% agarose gel, 640 Vhr) and prepared according to BIOS protocols. The blot was probed and strip-washed twice prior to this hybridization. Autoradiography: 2 days, -70°C.

Outside lanes contain DNA sizing markers with fragment sizes between 0.4 and 12 kb. Remaining 6 lanes contain 4 µg of TaqI digested human DNA from six unrelated individuals. Note unique hybridization patterns. The pYNH24 probe detects at least 30 alleles with fragment sizes ranging between 1.5 kb and 7.0 kb (Nakamura et al., 1987, *Science* 235:1616).

Because BIOS TIMEFRAME equipment is so flexible, it can fit your existing lab protocol as either a system or as individual instruments.

BIOS DNA Blots: A new option for genetic researchers.

BIOS Blots, as illustrated here, are available in three formats to meet your research needs: Chromosome Blots, Population Blots and Family Blots. The human DNA-containing blots are used to determine the chromosomal location of the homologous DNA region defined by a given probe, identification of RFLP types and frequencies in the human population and the heritability of these RFLPs. BIOS Blots are custom-prepared from permanent cell lines that are restricted with one of a set of nine enzymes, which detect 95% of known polymorphisms. Call our scientific staff to discuss how BIOS Blots can help your research.

The convenience, accuracy and reliability of a complete system for Southern and Northern blotting. At last.

Find out why BIOS TIMEFRAME equipment is right for you, whether you're an experienced researcher or just getting started with Southern and Northern blotting.

Call BIOS at (203) 773-0017 or (800) 678-9487.

BIOS

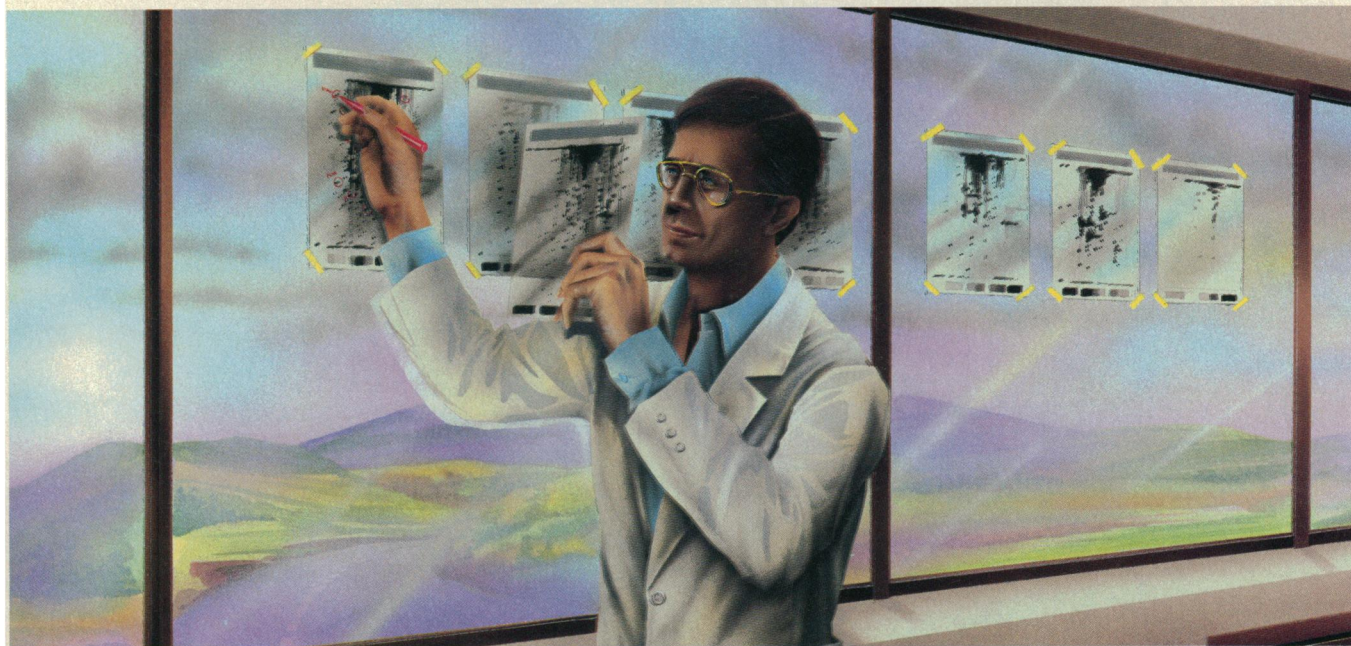
BIOS Corporation 291 Whitney Avenue New Haven, CT 06511
(203) 773-0017 (800) 678-9487 FAX (203) 562-9377

© 1989

For information on TimeFrame Equipment, circle #146 on reader service card.

For information on BIOS Blots, circle #147 on readers service card.

How in the world can you discover subtle changes in genetic expression?...



...With PDI—That's How!

We can give you the answer.

If you work with 2-D gels in the life sciences, then you need to know which proteins are being induced, repressed, phosphorylated and glycosylated. And you need to know when they are changing. PDI can help. We've taken the empirical art of 2-D electrophoresis and made it a more precise science by creating the only total system of analytical gel services, software, and instruments to reduce biological information to useful, manageable data.

We can quantify the changes in your cells and tissues.

Whether you run 2-D or not, we can give you the answers you need to make discoveries. With PDI, you get the benefit of years of gel running experience linked to software development devoted to quantifying and reducing biological data to answers you can use.

The marriage of 2-D Electrophoresis and computer-assisted analysis.

Our instrument system, the Discovery

Series™, does the tedious work and frees you for the creative and intuitive processes that lead to breakthroughs. That's the power of PDI; the power to illuminate, amplify. You no longer need to reinvent the wheel every time you run an experiment with hormones, growth factors, neurotransmitters, drugs.

Proven in top labs and by over 90 publications.

Don't take our word for it. Over 90 publications world-wide testify to the value of PDI's partnerships

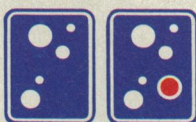
In applications such as:

- Growth & development
- Hormonal regulation
- Genetic expression
- Effects of toxins & drugs
- Genomic sequencing

with world's leading scientists. Clients from Cal Tech, Columbia University, The Pasteur Institute, The University of Penn., UCSF, Harvard, and leading pharmaceutical companies have used gel services and/or

The Discovery Series™ from PDI.

protein
databases
inc.



Use the Power of The Discovery Series™

Our latest version of The Discovery Series™ is the most powerful, the most user-friendly and the most customer-proven system available anywhere for



the systematic analysis of global changes occurring in biological systems. And it's more affordable than you think! As with all our services, you can buy or lease the entire system—or you may send your samples to us and use our system on a low-cost service basis. Either way, we give you the answers. You make the discoveries.

Call or write for our latest "Product & Services Guide" shown here and for more information.



(1) 800-777-6834

405 Oakwood Road, Huntington Station, NY 11746 (516) 673-3939, Fax: (516) 673-4502

Circle No. 122 on Readers' Service Card

The Thrill of Discovery

THERMOmax™ and SOFTmax®

The system approach to thermoregulated assays.

Accurate, rapid temperature regulation with precise well-to-well thermal and optical uniformity. Linear and non-linear, positive and negative kinetics. Only the THERMOmax Microplate Reader with SOFTmax 2.00 software addresses the unique requirements of your most challenging microassays.

Enzyme Studies. Analyze up to 96 samples simultaneously—especially useful with unstable samples. Data quality is equivalent to that of spectrophotometers.

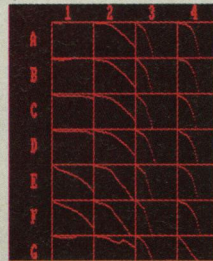
Kinetic Turbidimetric Assays. For endotoxin determination, clotting and clot lysis reactions, only THERMOmax prevents undesirable disruption of clots. SOFTmax determines log onset time versus log EU/ml.

Superoxide Studies with Living Cells. THERMOmax eliminates cross talk from scattered light. Readings are accurate even with highly turbid samples. And only THERMOmax and SOFTmax combine a narrow band-pass 550 nm filter, computation of maximum rates and dual wavelength kinetics.

Microbiology. For turbidimetric measurement of growth or kinetic measurement of pH changes, THERMOmax with SOFTmax allows you to calculate the maximum rate and

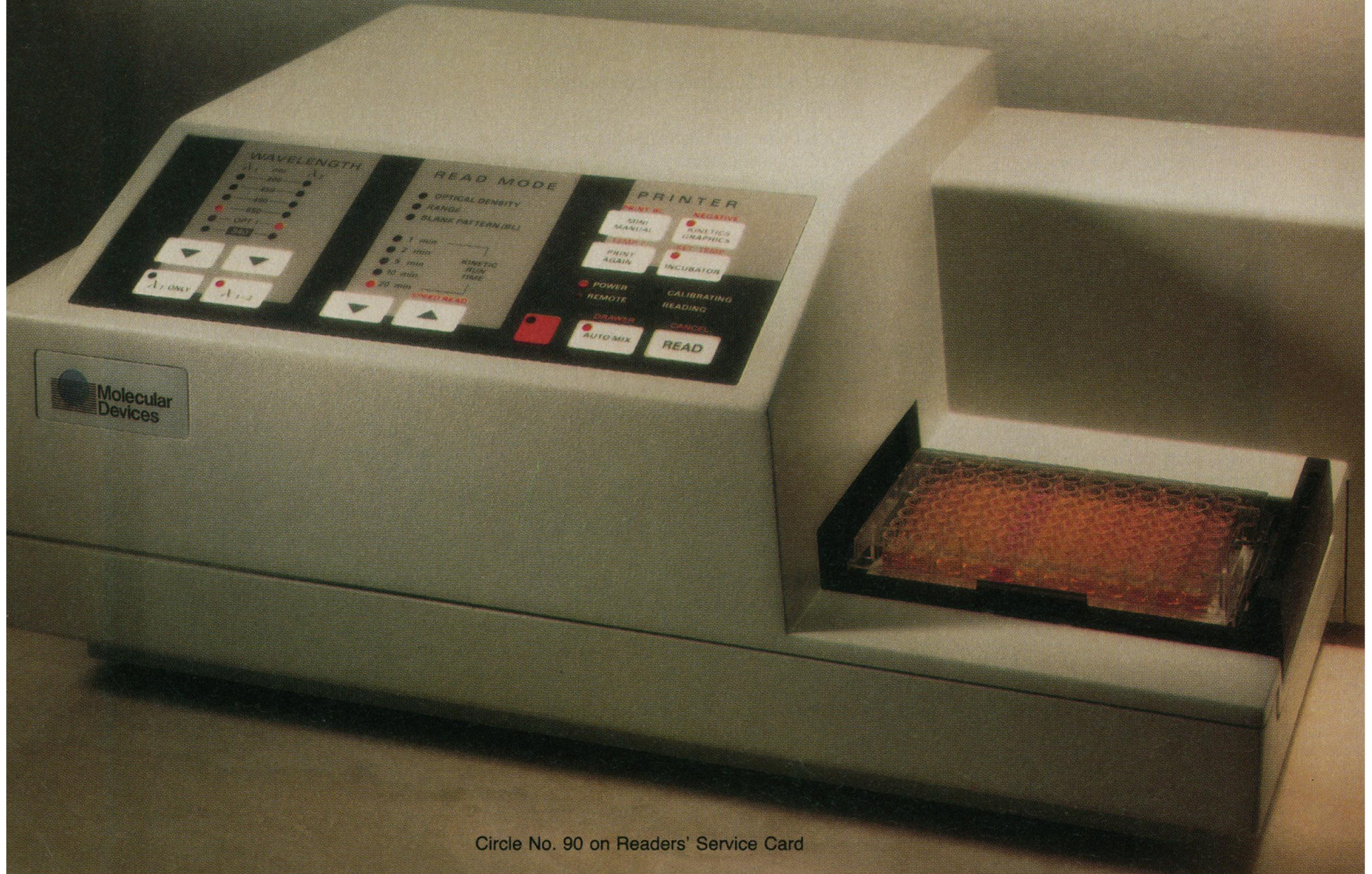
the time to the maximum rate.

THERMOmax and SOFTmax. The complete system for thermoregulated analysis. Contact Molecular Devices today.

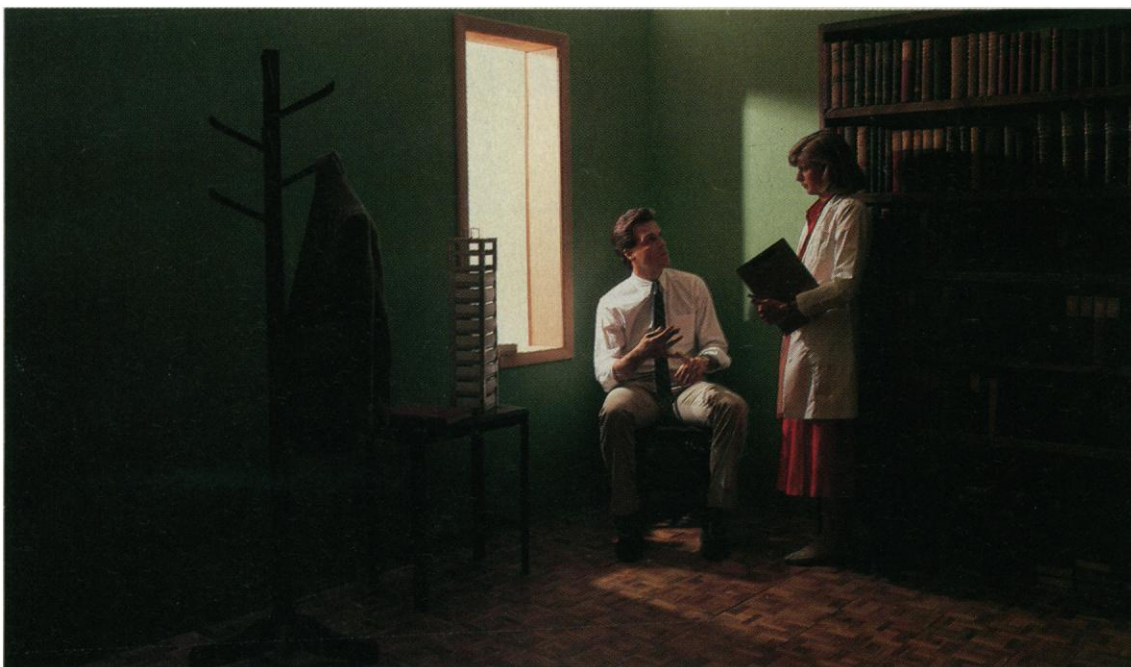


Molecular Devices Corporation
Menlo Oaks Corporate Center
4700 Bohannon Drive
Menlo Park, CA 94025
(800) 635-5577
(415) 322-4700
(415) 322-2069 (Telefax)
6716637 MOLEUW (Telex)

SOFTmax is a registered trademark, and THERMOmax is a trademark of Molecular Devices Corporation.



T H E D E C I S I O N



**Before you trust your life's work
to an ultra-low temperature freezer,
talk to someone who puts his trust in Harris,
and his reputation on the line.**

Talk to your independent Harris Sales Representative.

Because he operates his own company, it's his business to sell the best. He stakes his reputation on the quality and performance of each ultra-low temperature freezer he sells.

Which is why he sells Harris. A complete line of *Classic*™ and *Custom*™ chest and upright freezers. A variety of models to suit every lab budget, every application. Each freezer built tough, backed by the best warranty in the industry and supported by more than 200 factory trained service technicians located throughout North America.

Before you make your decision, talk to someone who deals from experience and shares the risk, hands-on.
Your local Harris Sales Representative.



Call us toll-free
and we'll put you in touch.
1-800-221-4201

Harris

Harris Manufacturing Company
P.O. Box 38, North Billerica, MA 01862
Phone 1-800-221-4201 Telex 577449

Circle No. 111 on Readers' Service Card

New by BACHEM. Lymphokines and Cytokines.

Human and mouse lymphokines are now available from BACHEM. We can deliver from stock the following new, highly pure products made by recombinant DNA technology:

Colony stimulating factors
Interleukins
Interferons

We cloned, expressed, purified and assayed these proteins in our molecular biology laboratories. These new lymphokines are another example of BACHEM's commitment to new product development, high quality and favorable prices. Call your nearest BACHEM office for complete product information and prices. Your satisfaction with our products is guaranteed.



THE BACHEM GROUP – FOR BETTER SERVICE, WORLDWIDE

BACHEM 
Feinchemikalien AG

serving you worldwide
except areas mentioned
Hauptstrasse 144
CH-4416 **Bubendorf**
Phone: 061/931 23 33
Fax: 061/931 25 49
Telex: 966 081

BACHEM 
Bioscience Inc

subsidiary of BACHEM Switzerland
serving the American continents
3700 Market Street
Philadelphia, PA 19104
Phone: 215/387 0011
Fax: 215/387 1170
Telex: 910 250 2352

BACHEM 
Biochemica GmbH

subsidiary of BACHEM Switzerland
serving FRG, GDR and CCCP
Lessingstrasse 26
D-6900 **Heidelberg**
Phone: 0 62 21/16 30 91
Fax: 0 62 21/214 42
Telex: 461 352

Circle No. 153 on Readers' Service Card

Whatever will be, will be wonderful—if you start planning for your future now.

And a good place to start is with TIAA and CREF Supplemental Retirement Annuities. SRAs are tax-deferred annuities that supplement your pension plan and can help you save the “extra” you’ll need to really enjoy your retirement.

Since contributions and earnings are tax-deferred until you retire, SRAs not only help you save for the future, they help you save today—by paying less taxes on your current income.

What’s more, with SRAs you can choose to diversify between TIAA, a fixed-dollar annuity, and CREF, a variable annuity. With CREF’s variable annuity, you have two investment options—CREF’s common stock and money market accounts. At retirement you can even choose to receive your payments in a lump sum, for a fixed period, or as lifetime income.

So consider SRAs now. To help your retirement be whatever you want it to be.

TIAA-CREF. Pension planning expertise for the education and research communities.



Ensuring the future
for those who shape it.™

For more complete information, including charges and expenses, call 1 800 842-2733 for a prospectus. Read the prospectus carefully before you invest or send money.

Qué SRA, SRA.

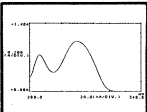
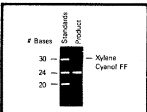


© 1988 TIAA-CREF

PCR

... Demands consistently pure DNA the first time, every time

CUSTOM SYNTHESIS SERVICE

| Type of Service | Reagent Grade | Research Grade |
|---|--|--|
| <ul style="list-style-type: none"> Purification method | <ul style="list-style-type: none"> Reverse phase chromatography | <ul style="list-style-type: none"> Polyacrylamide gel electrophoresis |
| Quality Control <ul style="list-style-type: none"> Monitoring method Documentation provided All oligos fully deblocked and detritylated | <ul style="list-style-type: none"> Trityl fractions monitored Spectrophotometric scan of product  | <ul style="list-style-type: none"> Visualization of single-band purity on ethidium-stained polyacrylamide gel  |
| Application | <ul style="list-style-type: none"> Routine running of experiments | <ul style="list-style-type: none"> Establishing experimental protocol |

LARGE SCALE SYNTHESIS AVAILABLE • RAPID TURN AROUND TIME • TECHNICAL SUPPORT

FOR INFORMATION ON OUR OTHER CUSTOM OLIGONUCLEOTIDE PRODUCTS, PLEASE CALL

1-800-336-7455

SYNTHECCELL
SYNTHECCELL
SYNTHECCELL
SYNTHECCELL
SYNTHECCELL
CORP

2096 Gaither Road, Rockville, MD 20850 USA

Circle No. 14 on Readers' Service Card

University of Maryland
Instructional Television
System Presents

Biotechnology: Patents, Regulations and Public Issues

Live by
Nationwide Satellite Broadcast

Critical Issues Facing Biotechnology Industries

June 14 and 15, 1989
11-5 Eastern Time



For information call
(301) 454-8955

AAAS Announces a Report on:

Science Policy Careers

Graduate Education and Career Directions in Science, Engineering and Public Policy, by *Albert H. Teich, Barry D. Gold, and June M. Wiaz*

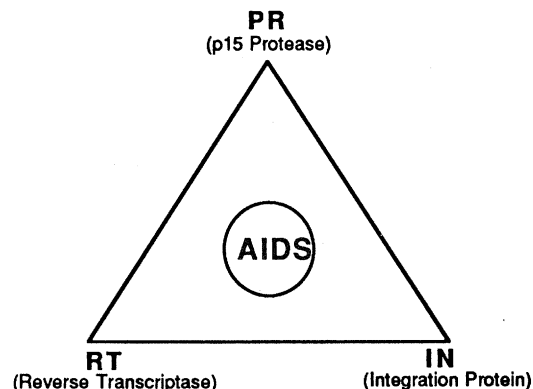
Educational programs and professional practice in the field of science policy are continually evolving, shifting their focus in response to the changing demands of today's society. This study provides an up-to-date and comprehensive assessment of graduate education and career patterns in science policy. Conducted under the auspices of the AAAS Committee on Science, Engineering and Public Policy and supported by AAAS and the National Science Foundation, the project presents empirical data from the programs, graduates, and employers in the field.

...a must for policy makers, students, employers, and anyone interested in gaining insight into science policy programs.

1986; 168 pp.; softcover \$10.00 (\$8.50 for AAAS members).

Order from: AAAS Marketing, Dept. SJ, 1333 H Street, NW, Washington, DC 20005. Please specify AAAS Publication #86-17, add \$2.00 postage & handling, and allow 4-6 weeks for delivery. VISA and MasterCard accepted. For shipments to CA, add applicable sales tax.

AIDS Drug Research Tools from MGR



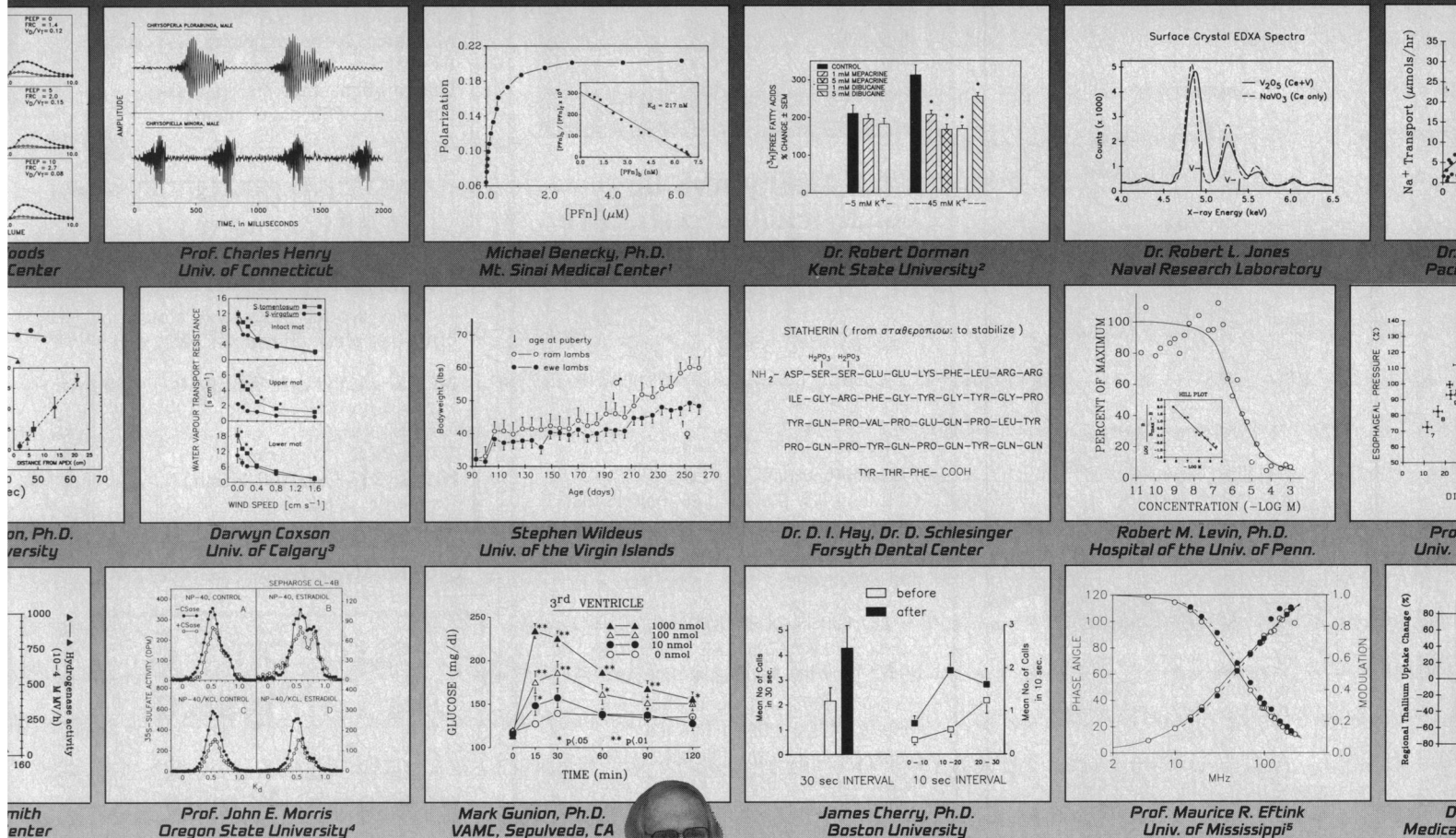
Critical reagents for the design and screening of drugs for AIDS therapy are available from MGR. Currently the best source for these reagents is avian myeloblastosis virus (AMV) and MGR has years of experience working with AMV.

Focus your AIDS research with dependable products from MGR. For more information, call or write:

Molecular Genetic Resources, Inc.
6201 Johns Road #8
Tampa, FL 33634

800-255-8142 813-886-5338 (Florida Residents call collect)

Over 10,000 leading Scientists are using Sigma-Plot!



The graphs above were sent to us by our customers. They were created using Sigma-Plot™, the leading PC software for the production of publication-quality charts and graphs for scientists. Sigma-Plot graphics have been published in literally hundreds of scientific journals, including *Science* and *Nature*. And it's no wonder, because Sigma-Plot is designed to create graphs the way you want to your specifications. It includes essential scientific features:

- Automatic error bars
- Multiple plots per page
- Polynomial curve fitting
- Log, semi-log, linear scales



- Export capability to Wordperfect 5.0, Pagemaker
- And much more...

Customers regularly tell us that Sigma-Plot is one of the finest applications programs they have used. And at under \$400, Sigma-Plot is in reach of nearly any budget. Find out yourself why over 10,000 leading researchers have chosen Sigma-Plot. For a FREE brochure or to order your own copy, call us today. Money-back guarantee.

Hardware Requirements: IBM PC, XT, AT, PS/2 or true compatible with 640k memory. CGA, EGA, VGA, or Herc. graphics. Supports HP plotters, Laserjet and Laserwriter printers, and selected dot-matrix printers.

65 Koch Road • Corte Madera, California 94925
Toll Free 800-874-1888 • Inside CA 415-924-8640
FAX: 415-924-2850 • Telex: 4931977

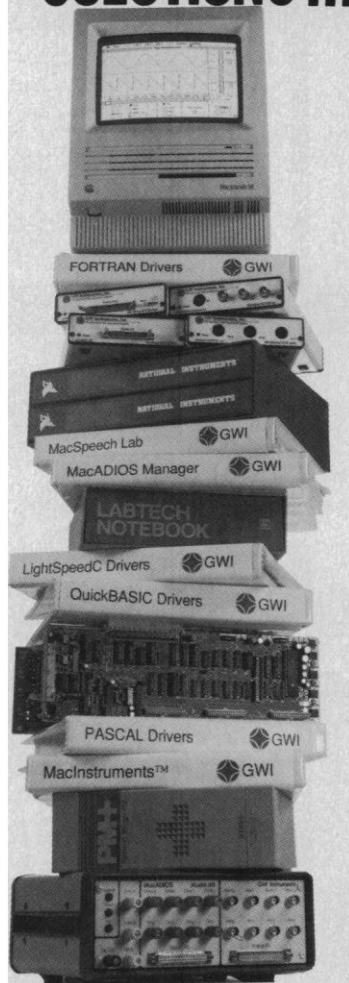
Jandel
SCIENTIFIC
"Microcomputer Tools for the Scientist"

In Europe: RJA Handels GmbH
Grosser Mühlenweg 14A, 4044 Kaarst 2, FRG
Phone: 2101/666268 FAX: 2101/64321

Circle No. 141 on Readers' Service Card

The graphs above were reprinted with permission of: 1.) *Biochemistry Journal* 1988, Vol. 27, pp 7565-71, Fig. 2. © 1988 American Chemical Society; 2.) *Brain Research Bulletin*, Vol. 21, Issue 3, pp. 445-450, Fig. 2. © 1988 Pergamon Press; 3.) *Canadian Journal of Botany*, 67, No. 1, 1989, National Research Council of Canada; 4.) *Endocrinology*, 122:242-253 (88), © 1988 The Endocrine Society; 5.) *Biochemistry Journal*, in press, © 1988 American Chemical Society. Their use does not imply endorsement by our customers' employers or publishers.

MACINTOSH® DATA ACQUISITION SOLUTIONS...



Yours is here. Let us help you find it!

GW has more Macintosh data acquisition products and experience than anyone. Call today and discuss your project with an experienced applications engineer.

FREE 56-PAGE CATALOG
617-625-4096



GW Instruments, Inc.

35 Medford Street • Somerville, MA 02143

The Macintosh Data Acquisition Company

Circle No. 44 on Readers' Service Card



WILL AMERICANS BE SCIENTIFICALLY LITERATE BEFORE COMET HALLEY RETURNS IN 2061?

Project 2061—a long-term effort launched by the AAAS—is designed to help make the answer "Yes—long before!"

The first phase of this massive nationwide effort to reform U.S. science education has produced six reports that recommend in detail what all citizens should know about science, mathematics, and technology.

They consist of an overview report, *Science for All Americans* (AAAS order no. 89-01S), by the National Council on Science and Technology Education, and reports by five independent panels: *Biological and Health Sciences* (#89-02S), *Mathematics* (#89-03S), *Physical and Information Sciences and Engineering* (#89-04S), *Social and Behavioral Sciences* (#89-05S), and *Technology* (#89-06S).

Send orders giving titles and AAAS order numbers—and a check, money order, or purchase order (made out to AAAS)—to AAAS Books, Dept. 2061, P.O. Box 753, Waldorf, MD 20604.

Prices: *Science for All Americans*: \$14.50 (AAAS members, \$11.50), 10–49 copies \$9.25 each, 50 or more \$8 each; each panel report: \$7.50 (AAAS members, \$6), 10–49 copies \$3.50 each, 50 or more \$3 each; all six reports (order no. 89-12X): \$35 (AAAS members, \$28), 10–49 sets \$18, 50 or more \$15.50. (For shipments to California, add 6% sales tax.)



PROJECT 2061

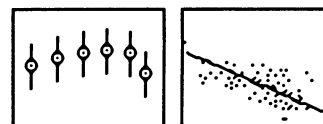
American Association for the
Advancement of Science

Statistical System - \$99

NCSS 5.0 - comprehensive, accurate, easy-to-use (menus) MS-DOS system. Spreadsheet data. 250 columns and 32,000 rows. Reads ASCII files.

Regression. ANOVA. Repeated Measures. Nonparametrics. T-Tests. Descriptive Stats. Factor, Cluster, & Discriminant analysis. Cross-tabulation. 300 page manual.

NCSS Graphics - \$59



Includes scatter plots, box plots, error-bar plots, 3D plots, etc.

NCSS Survival Analysis- \$59
Product-limit, Cox Reg., Probit, etc.

VISA/MC Welcome
NCSS, 865 East 400 North,
Kaysville, Utah 84037
(801)-546-0445

Circle No. 164 on Readers' Service Card

Astronomy & Astrophysics

Edited by
Morton S. Roberts

Selected from articles published in *Science* between 1982–1984, these 24 papers are divided into four parts: *Solar System, Structure and Content of the Galaxy, Galaxies and Cosmology, and Instrumentation*. The volume reveals a broad, coherent, and contemporary picture of our astronomical universe. Includes two Nobel Prize lectures. Fully indexed and illustrated. 1985; 384 pages.

Hardcover \$29.95
Softcover \$17.95
(AAAS members deduct 20%)

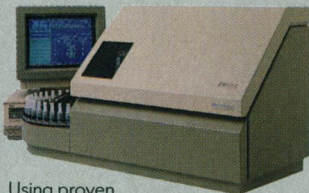
Order from AAAS Marketing,
Dept. Q, 1333 H Street, NW,
Washington, DC 20005.

Add \$1.50 postage and handling.

**American Association for the
Advancement of Science**

If your research can't wait for weeks while you wait for peptides, take a look at the new Excell™ Automated Peptide Synthesizer from MilliGen/Bioscience.

With the Excell system, you don't have to be an expert to synthesize high-quality, biologically active peptides. Simply enter your sequence, add prepackaged reagents, amino acid cartridges and reaction column, push "Start Synthesis," and walk away.



Using proven Fmoc/BOP + HOBt protocols (no HF), Excell achieves yields > 99% and cycle times < 1 hour.

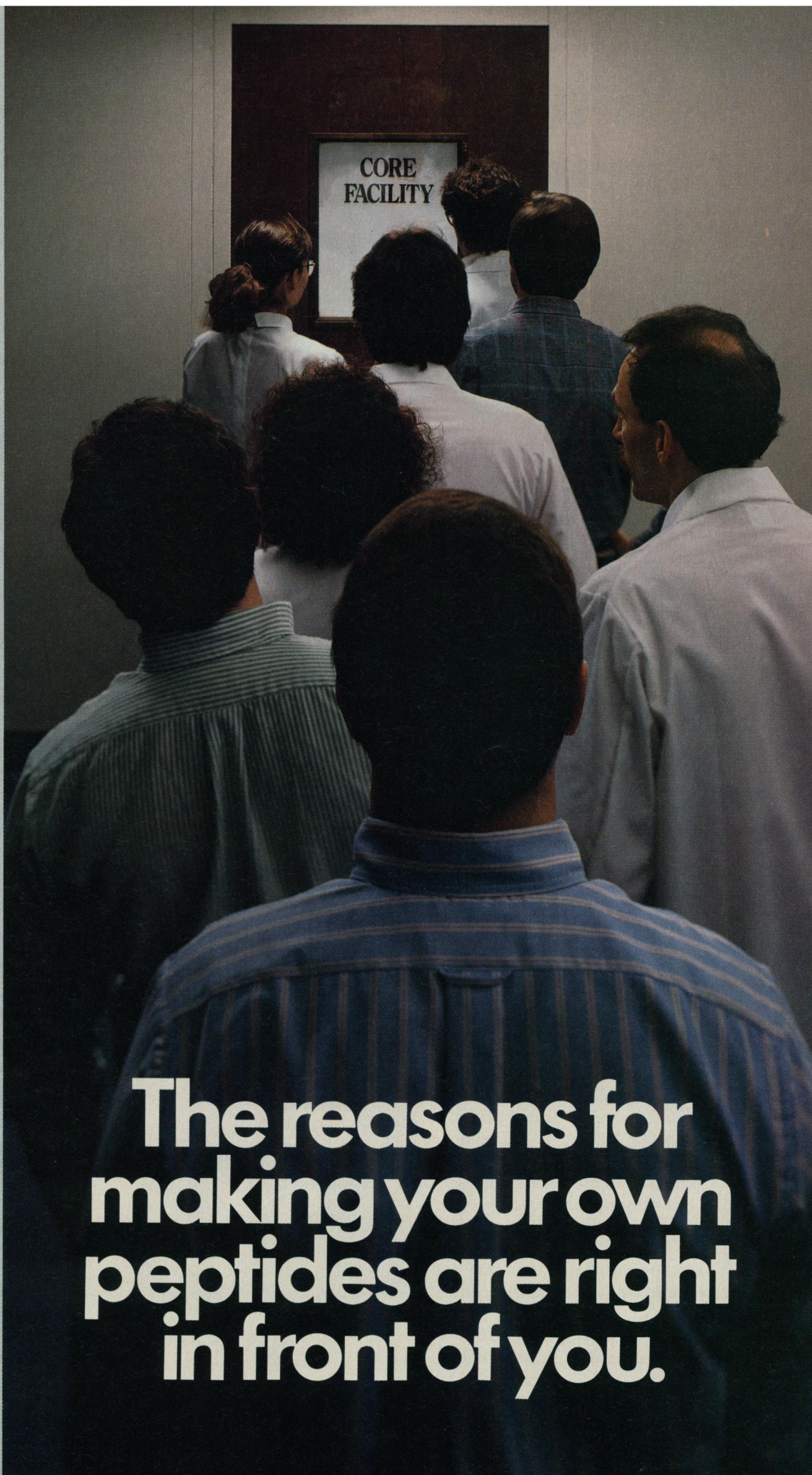
Excell system Expert™ software recommends the best protocol for your sequence, automatically assigns coupling strategies, calculates reagent amounts, and verifies the sequence. Self-prompting menus guide you through each step, while a real-time synthesis report documents them.

And since it's priced within the reach of most facilities, there's no reason to wait another day. For more information call 800-872-0071; in MA, 617-229-2870.

MilliGen/Bioscience
Division of MILLIPORE

France 30.45.70.00
Japan 471-7191
U.K. 923 816375
W. Germany (06196) 494-0
© 1989 Millipore Corporation

Circle No. 43 on Readers' Service Card



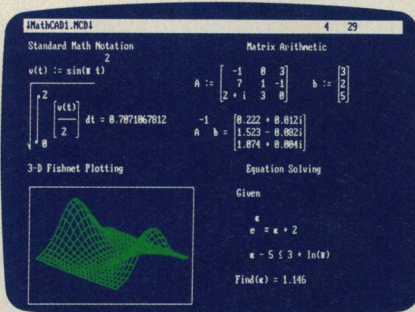
The reasons for making your own peptides are right in front of you.

After centuries of practice, mankind perfects scientific calculations: MathCAD.

Announcing MathCAD 2.5: The Dawn of a New Age.

What the historians will call it, only time will tell.

Perhaps the Century of Speed, or the Era of Ease. But whatever the name, this is the age of MathCAD 2.5, the only math package that looks and works the way you think.



MathCAD 2.5 includes 3-D plotting, HPGL sketch import, and PostScript output.

MathCAD is far and away the best-selling math package in the world. Because it lets you perform engineering and scientific calculations in a way that's faster, more natural and less error-prone than the way you're doing them now—whether you're using a scratchpad, calculator, spreadsheet or program that you wrote yourself.

And now we've made the best even better. MathCAD 2.5 is a dramatically improved version that includes three-dimensional plotting, enhanced numerical analysis, and the ability to import HPGL files from most popular CAD programs, including AutoCAD®. And now you can print on PostScript® compatible printers.

And like before, MathCAD's live document interface™ lets you enter



equations anywhere on the screen, add text to support your work, and graph the results. Then print your analysis in presentation-quality documents.

It has over 120 commonly used functions built right in, for handling equations and formulas, as well as exponentials, differentials, cubic splines, FFTs and matrices.

No matter what kind of math you do, MathCAD 2.5 has a solution for you. In fact, it's used by over 50,000 engineers and scientists, including electrical, industrial, and mechanical engineers, physicists, biologists, and economists.

But don't take our word for it; just ask the experts. PC Magazine recently described MathCAD as "everything you have ever dreamed of in a mathematical toolbox."

And for Macintosh® users, we present MathCAD 2.0, rewritten to take full advantage of the Macintosh interface. Entering operators and Greek letters into equations is pure simplicity!

Look for MathCAD 2.5 at your local software dealer, or give us a call. For more information, a free demo disk, or upgrade information*, dial 1-800-MATHCAD (in MA, 617-577-1017).

**If you purchased MathCAD 2.0 between 5/1/89 and 6/16/89, you can get a FREE upgrade to version 2.5 (otherwise, the upgrade cost is \$99.00 until June 30, 1989; afterwards, the cost will be \$149.00).*



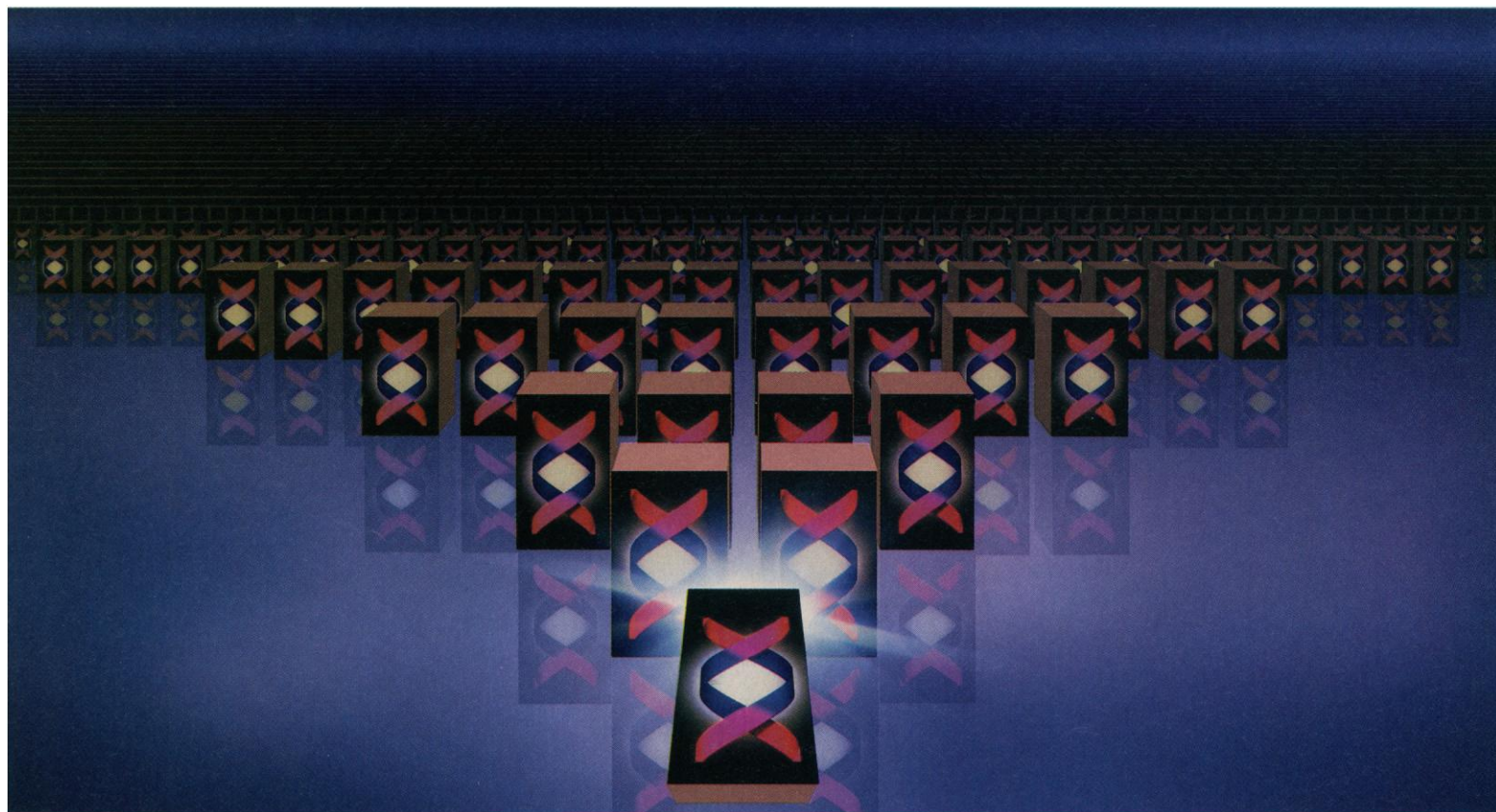
MathCAD®

MathSoft, Inc. One Kendall Square, Cambridge, MA 02139

Available for IBM® compatibles and Macintosh computers. TM and ® signify manufacturer's trademark or manufacturer's registered trademark respectively PS

Circle No. 116 on Readers' Service Card

Your choice for PCR products — Perkin-Elmer Cetus. The PCR technology leader.



Don't settle for products that try to imitate the revolutionary DNA Amplification System. Ours is the *only* licensed and approved system designed expressly for the patented GeneAmp™ PCR process, pioneered and developed by Cetus scientists.

PROVEN PCR PERFORMANCE

Our DNA Amplification System provides you with performance you can depend on. You'll perform the PCR process quickly and efficiently using our GeneAmp Reagent Kit with recombinant AmpliTaq™ DNA Polymerase. And for easy-to-use, dependable automation, our DNA Thermal Cycler has no peer. Superior technology and proven performance make it the system-of-choice worldwide.

UNMATCHED TECHNICAL SUPPORT

Count on outstanding support for your DNA Amplification System. Like a free instructional video with your DNA Thermal Cycler purchase. Or the toll-free technical support number you can call to get expert answers from our PCR staff. And we'll keep you up to date with PCR protocol developments, applications information, PCR Bibliographies and a subscription to our newsletter, *Amplifications*.

FAST DELIVERY OF TAQ DNA POLYMERASE

Ordering is easy. For overnight delivery of the GeneAmp Kit and AmpliTaq DNA Polymerase, call PE XPRESS at 1-800-762-4002. And we're fully stocked and ready for prompt delivery of DNA Thermal Cyclers.

For more information, contact your local Perkin-Elmer representative. Or, for literature, please call 1-800-762-4000.

**Only from Perkin-Elmer Cetus—
the PCR Technology Leader.**



PERKIN ELMER CETUS



Epitope Scanning & Mimotope Design Kits from Cambridge

Cambridge Research Biochemicals, under licence* from the Commonwealth Serum Laboratories, is offering a unique Multi-Pin Synthesis Technology which allows the concurrent synthesis and screening of hundreds of peptides in only a few days. Now any scientist can produce almost limitless numbers of novel peptides for immunological evaluation using ELISA-based systems.

The Epitope Scanning Kit permits identification of continuous epitopes within a protein antigen. All the possible sequential peptides derived from the protein sequence are synthesised. Peptides reacting with antibody are homologues of protein antigenic determinants.

The Mimotope Design Kit takes this technology one stage further, allowing the construction of novel peptide sequences capable of mimicking the actual epitopes of an antigen. Reactive peptides may have no homology to these epitopes and are therefore termed Mimotopes. Virtually any antigenic determinant may be mimicked by a synthetic peptide Mimotope.

Both Kits are supplied with extensive computer software support, a comprehensive materials and reagents package and a detailed instruction manual.

Contact our Technical Sales Department now for full details.

* EPIOTOPE SCANNING-INTERNATIONAL PATENT APPLICATION NOS. PCT/AU84/00039 & PCT/AU84/00038
MIMOTOPE DESIGN-INTERNATIONAL PATENT APPLICATION NOS. PCT/AU85/00165 & PCT/AU86/00110

CR14

**CAMBRIDGE
RESEARCH
BIOCHEMICALS**

Cambridge Research
Biochemicals Inc.,
Suite 202,
10 East Merrick Road,
Valley Stream,
New York 11580 USA.
Tel: (516) 825-1322
Toll Free Tel: (800) 327-0125
Fax: (516) 825-1519

Cambridge Research
Biochemicals Ltd.,
Button End, Harston,
Cambridge,
England CB2 5NX.
Tel: (0223) 871674
Toll Free Tel: (0800) 585396
Telex: 817694 CRBLTD G
Fax: (0223) 872381

influence, and he was a devoted teacher. Eminent biochemists grew up in his department. In addition to those already mentioned, the most notable were J. B. Sumner, who later was the first to crystallize an enzyme, urease, and Cyrus Fiske, who, with his gifted collaborator Yellapragada Subbarow, discovered phosphocreatine and adenosine triphosphate; the latter was discovered independently by Karl Lohmann in Germany, who has generally, but unfairly, received most of the credit.

In addition to the main text Meites has provided, in 60 pages of small print, a detailed study of the chemistry of Folin's analytical methods and procedures. Most readers will skip this, but it is there for those who have occasion to use it. The most serious deficiency in the book is the lack of an index, which is badly needed to trace the various characters who appear and reappear.

This book provides a helpful complement to the recent biography of Walter B. Cannon (to 1917) by Saul Benison, Clifford Barger, and Ellin Wolfe (Harvard University Press, 1987). Cannon and Folin worked closely together for a quarter century, in the teaching of first-year medical students, in matters of educational policy, and occasion-

ally in research. It is good that we now have studies of both of them.

JOHN T. EDSALL
Department of Biochemistry
and Molecular Biology,
Harvard University,
Cambridge, MA 02138

The Technological Past

Nuts and Bolts of the Past. A History of American Technology, 1776–1860. DAVID FREEMAN HAWKE. Harper and Row, New York, 1988. xii, 308 pp., illus. \$18.95.

Historians of technology have reason to rejoice that there is an apparently broad and deep popular interest in their subject. The subject is intrinsically interesting, and there is a growing realization that it may even have important potential public benefits: that technology assessment should include a historical dimension and that "technological literacy" might be better served by a course in the history of technology than yet another in mathematics or "how things work."

There is as yet, however, only a corporal's guard of professionally trained historians of

technology, and most of them have not ventured into the problematic waters of addressing the public on their subject. The public's interest in the field therefore is met, if at all, by popularizers who, at their worst, treat the hardware as a black box and perpetuate and elaborate myths about the personalities and institutions that are the other parts of the technological enterprise.

David Hawke's *Nuts and Bolts of the Past* is the latest in this sorry genre. The 262 pages of text are divided into 42 subsections, one treating "the founding fathers," another the sewing machine, yet another the Franklin Institute. Each chapter is typically based on one or two scholarly articles (perhaps a book in some cases) salted with some popular works of a previous generation and a smattering of published contemporary sources. The book represents no attempt at original research.

Nor does it offer new insights. Despite his clear dependence upon a few excellent recent studies, Hawke takes from them details rather than interpretations. The analytical contribution of the book is that some leading American technologists were "dirty fingernail people" and others were "song-and-dance men," that is, some inventors were

When you need the instrument fast.
When your long-term needs are uncertain.
When you lack capital for new instrumentation.

USAI is The Alternative.

OVA 128GC · HNU101 · GCs · AA/ICP · plus much more

RENT · LEASE · PURCHASE



**United States
Analytical Instruments**

US
1511 Industrial Road
San Carlos, CA 94070
(415) 595-8200
(800) 437-9701

Variability and Management of Large Marine Ecosystems

Edited by Dr. Kenneth Sherman, *Director, Narragansett Laboratory, National Oceanic and Atmospheric Administration*, and Dr. Lewis M. Alexander, *Director, Center for Ocean Management Studies, University of Rhode Island*

Large marine ecosystems (LMEs) are being subjected to increasing stress from industrial and urban wastes, aerosol contaminants, and heavy exploitation of renewable resources. This book is a state-of-the-art review of effective means for measuring changes in populations and productivity, physical-chemical environments, and management options for LMEs. For the first time, this volume treats LMEs holistically as regional management units by bringing together the all too often fragmented efforts to optimize ocean resources. 319 pp., 1986.

\$31.85; AAAS members \$25.50 (include membership number from *Science*).

Order from: Westview Press, Dept. AAAS, 5500 Central Avenue, Boulder, CO 80301
Add \$2.50 postage and handling for the first book ordered; 75¢ for each additional book.

Published by Westview Press for AAAS

Circle No. 168 on Readers' Service Card