

AMERICAN  
ASSOCIATION FOR THE  
ADVANCEMENT OF  
SCIENCE

# SCIENCE

25 MAY 1990

\$3.50

VOL. 248 ■ PAGES 933-1048





# The most advanced of the species thinks just like you.

**Resilient**  
allows balancing  
tubes by eye

**Efficient**  
8 plasmid DNA  
separations  
in 2 hours

**Reliable**  
10-year drive  
warranty

**Fast and  
powerful**  
90,000 rpm,  
694,000 g

**Calculates**  
CsCl speed  
reductions, run  
conversions  
and more

**ESP™**  
foresees CsCl precipi-  
tation and avoids it  
to optimize run times

**Environmentally  
sensitive**  
no chlorofluoro-  
carbons

**Self-contained  
heating and  
cooling**  
low heat output  
(3400 Btu/h)

## Introducing L and XL Ultracentrifuges, the Optima™ Series.

They're here. A whole new class of ultracentrifuges. The Optima™ L and XL.

Like you, these new ultracentrifuges can solve complex problems in seconds. The XL even has ESP,™ an Efficient Sedimentation Program to optimize conditions for the fastest separations possible.

But brains aren't everything. Our body is designed to be sensi-

tive to the world, and to you. The L and XL use no chlorofluorocarbons. For more comfort in your lab, they have only 1/3 the heat output of other models. And the drive is so stress-tolerant, you don't need to weigh samples anymore.

When you look at the entire species *ultracentrifuge*, the L and XL Optima Series is by far the most advanced.

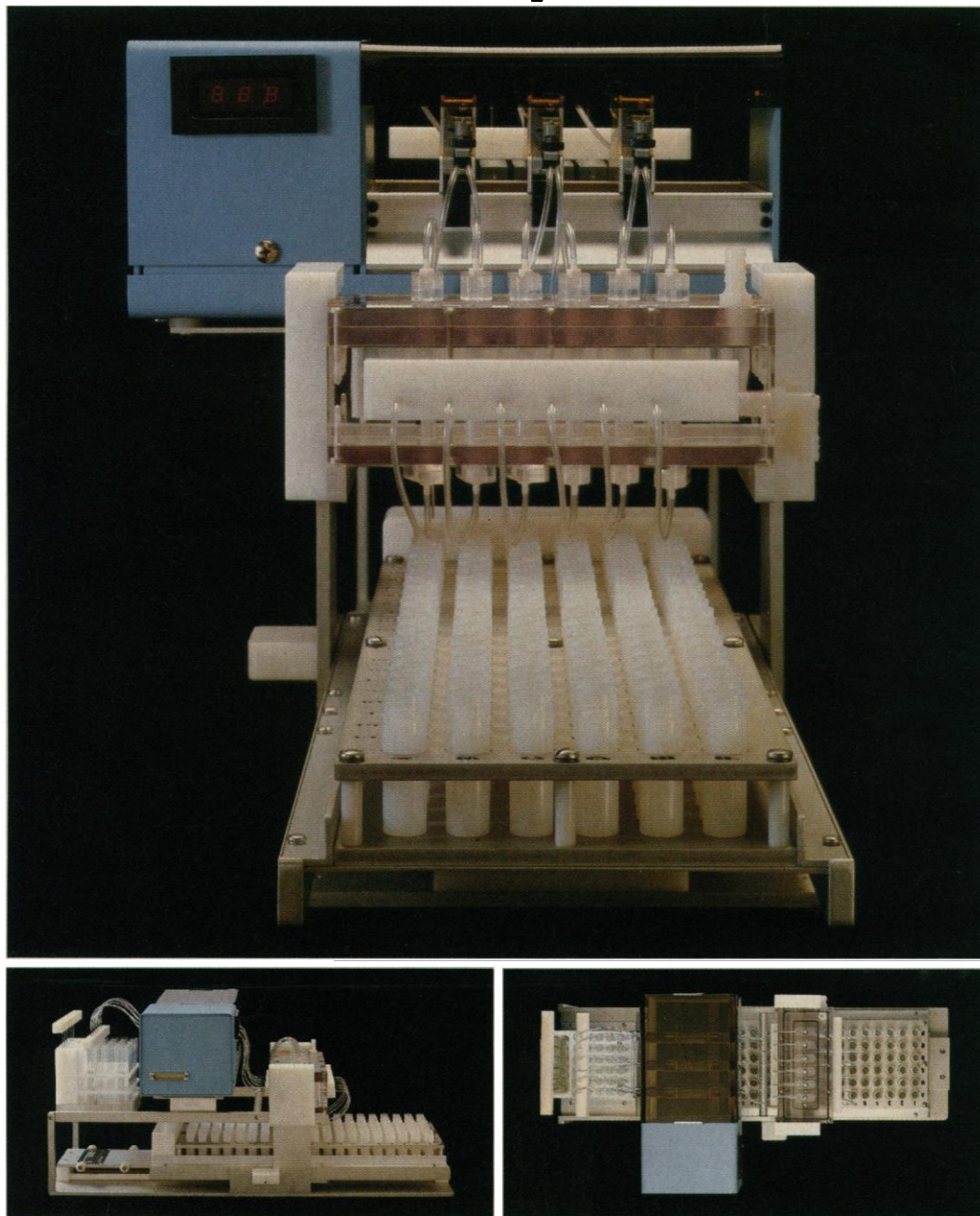
Circle No. 65 on Readers' Service Card

Find out more. Contact your Beckman representative. Or, Beckman Instruments, Inc., Spinco Division, 1050 Page Mill Road, Palo Alto, CA 94304. (800) 742-2345. Offices worldwide.

# BECKMAN



# Meet Baby Brother



Announcing Superfusion600—the multi-channel perfusion system for laboratories that *don't* require the computerized capabilities of Superfusion2000.

Like its big brother, Superfusion600 perfuses tissues with up to 6 different reagents, collects up to 20 separate effluents/sample, and offers chemical and/or electrical stimulation.

Available in two models, Superfusion600 processes 6 or 12 samples simultaneously— at a price that even the occasional user can afford. Call 1-800-678-1558 for our new brochure.

## **BRANDEL**

Harvesters ■ Automatic Deposit/Dispensing Systems ■ Counter-Compatible Systems ■ Superfusion 2000/600  
8561 Atlas Drive, Gaithersburg, MD 20877 USA ■ Toll Free: 1-800-678-1558 ■ Telex: 898083 ■ Fax: 301-869-5570

Circle No. 226 on Readers' Service Card

939 This Week in *Science*

## Editorial

941 Opportunities in Agricultural Research

## Letters

942 Civilian Technology Development: L. L. BERANEK, L. SMULLIN, K. TSIPIS ■  
"Progenote" or "Protogenote"?: S. A. BENNER AND A. D. ELLINGTON ■  
Quasicrystal Publications: F. W. GAYLE; J. HORGAN

## News & Comment

952 Data Sharing: A Declining Ethic? ■ Genome Project: An Experiment in  
Sharing ■ Agencies, Journals Set Some Rules ■ Geneva on  
the Beltway ■ The Great Clone Giveaway  
957 Information Decontrol Urged  
958 Neglected Neurotoxicants

## Research News

959 Fast, Cheap, and Out of Control  
962 Biotechnology Takes Root in the Third World ■ Growing Crops in Saltwater  
964 *Briefings*: Drugs and Biotechnology ■ Climate Experts Say It Again: Greenhouse  
Is Real ■ Baltimore Assembles Team ■ EARTHWINDS Around the World ■  
Science for Nonscience Majors ■ DOE Fills Biology Post ■ Citation Impact on  
the Coast ■ A Sailing Race to Mars? ■ Finland to Join CERN

## Articles

969 The Superswell and Mantle Dynamics Beneath the South Pacific: M. K. McNUTT  
AND A. V. JUDGE  
975 Radar Reflectivity of Titan: D. O. MUHLEMAN, A. W. GROSSMAN, B. J. BUTLER,  
M. A. SLADE

## Research Article

981 A New Redox Cofactor in Eukaryotic Enzymes: 6-Hydroxydopa at the Active  
Site of Bovine Serum Amine Oxidase: S. M. JANES, D. MU, D. WEMMER,  
A. J. SMITH, S. KAUR, D. MALTBY, A. L. BURLINGAME, J. P. KLINMAN

## Reports

988 Coincidence Counting in Time-of-Flight Mass Spectrometry: A Test for Chemical  
Microhomogeneity: M. A. PARK, K. A. GIBSON, L. QUINONES,  
E. A. SCHWEIKERT

■ **SCIENCE** is published weekly on Friday, except the last week in December, and with a supplement in March by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005. Second-class Non-profit postage (publication No. 484460) paid at Washington, DC, and at an additional entry. Copyright © 1990 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, \$20 (for postage and handling add per copy \$1.00 U.S., \$1.50 Canada, \$2.00 other foreign). Bulk rates on request. **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, 27 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. **Change of address:** allow 6 weeks, giving old and new addresses and 11-digit account number. **Postmaster:** Send Form 3579 to *Science*, P.O. Box 1723, 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 objectives 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, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.





**COVER** Enhanced Landsat Thematic Mapper image of the area of the Cady Mountains and Bristol Mountains in the eastern Mojave Desert, California. Color variations primarily denote contrasting iron- and hydroxyl-bearing constituents of the surficial rocks and sediments. The image enhancement reveals faults and associated structural features that were overlooked in previous field mapping. See page 1000. [Processing by Jet Propulsion Laboratory, California Institute of Technology]

- 990 Image Reconstruction of the Interior of Bodies That Diffuse Radiation: J. R. SINGER, F. A. GRÜNBAUM, P. KOHN, J. P. ZUBELLI
- 993 Ultradeep (Greater Than 300 Kilometers), Ultramafic Upper Mantle Xenoliths: S. E. HAGGERTY AND V. SAUTTER
- 996 Increase in the Stratospheric Background Sulfuric Acid Aerosol Mass in the Past 10 Years: D. J. HOFMANN
- 1000 Faults in the Mojave Desert, California, as Revealed on Enhanced Landsat Images: J. P. FORD, R. K. DOKKA, R. E. CRIPPEN, R. G. BLOM
- 1003 Reversal of Creatine Kinase Translational Repression by 3' Untranslated Sequences: J. L. C. CH'NG, D. L. SHOEMAKER, P. SCHIMMEL, E. W. HOLMES
- 1006 Blocking of the Initiation-to-Elongation Transition by a Transdominant RNA Polymerase Mutation: M. KASHLEV, J. LEE, K. ZALENSKAYA, V. NIKIFOROV, A. GOLDFARB
- 1009 Localization of PDGF-B Protein in Macrophages in All Phases of Atherogenesis: R. ROSS, J. MASUDA, E. W. RAINES, A. M. GOWN, S. KATSUDA, M. SASAHARA, L. T. MALDEN, H. MASUKO, H. SATO
- 1012 A Novel Nucleoprotein Complex at a Replication Origin: M. SERRANO, M. SALAS, J. M. HERMOSO
- 1016 Shared Human T Cell Receptor  $V_{\beta}$  Usage to Immunodominant Regions of Myelin Basic Protein: K. W. WUCHERPENNIG, K. OTA, N. ENDO, J. G. SEIDMAN, A. ROSENZWEIG, H. L. WEINER, D. A. HAFLER
- 1019 A Receptor for Tumor Necrosis Factor Defines an Unusual Family of Cellular and Viral Proteins: C. A. SMITH, T. DAVIS, D. ANDERSON, L. SOLAM, M. P. BECKMANN, R. JERZY, S. K. DOWER, D. COSMAN, R. G. GOODWIN

## Book Reviews

- 1025 Technical Workers in an Advanced Society, *reviewed by* P. MEIKSINS ■ Marmots, G. R. MICHENER ■ Ecology and Natural History of Tropical Bees, M. L. WINSTON ■ Electric Fields in Vertebrate Repair, A. E. SOWERS ■ Books Received

## Products & Materials

- 1030 Agarose for Pulsed-Field Electrophoresis ■ Growth Factor Monoclonal Antibodies ■ Genomic DNA Isolation Kit ■ Automated Separation of Proteins ■ Vertical Tube Gel Apparatus ■ PC Integrators for HPLC ■ Literature

### Board of Directors

Richard C. Atkinson  
*Retiring President,  
Chairman*

Donald N. Langenberg  
*President*

Leon M. Lederman  
*President-elect*

Mary Ellen Avery  
Francisco J. Ayala  
Eugene H. Cota-Robles  
Robert A. Frosch  
Joseph G. Gavin, Jr.  
John H. Gibbons  
Beatrix A. Hamburg  
Florence P. Haseltine  
William T. Golden  
*Treasurer*  
Richard S. Nicholson  
*Executive Officer*

### Editorial Board

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

### Board of Reviewing Editors

John Abelson  
Don L. Anderson  
Stephen J. Benkovic  
Gunter K-J Blobel  
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  
Harry A. Fozzard

Theodore H. Geballe  
Roger I. M. Glass  
Stephen P. Goff  
Corey S. Goodman  
Stephen J. Gould  
Eric F. Johnson  
Stephen M. Kosslyn  
Konrad B. Krauskopf  
Charles S. Levings III  
Richard Losick  
Joseph B. Martin  
John C. McGiff  
Anthony R. Means  
Mortimer Mishkin  
Roger A. Nicoll  
William H. Orme-Johnson III  
Carl O. Pabo  
Yeshayau Pocker

Dennis A. Powers  
Erkki Ruoslahti  
Thomas W. Schoener  
Ronald H. Schwartz  
Terrence J. Sejnowski  
Robert T. N. Tjian  
Virginia Trimble  
Emil R. Unanue  
Geerat J. Vermeij  
Bert Vogelstein  
Harold Weintraub  
Irving L. Weissman  
Zena Werb  
George M. Whitesides  
Owen N. Witte  
William B. Wood



# QIAGEN provides: The fastest protocols to pure nucleic acids

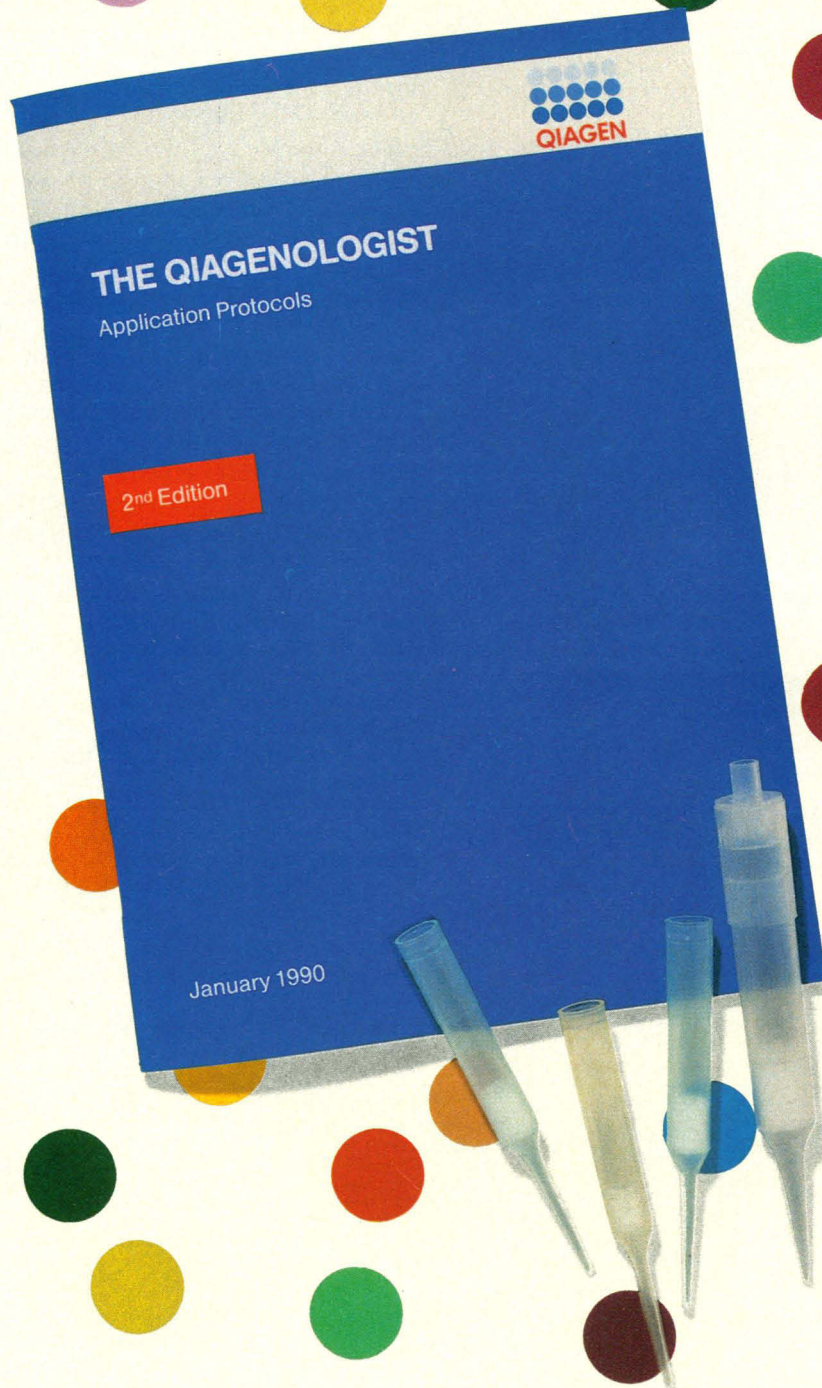
The 1990 updated version of the **QIAGENOLOGIST** is here! It is a complete collection of **application protocols** for different nucleic acid isolations using the **QIAGEN system**. It contains clear handling instructions and a comprehensive trouble shooting guide.

The QIAGEN system is ideal for:

- plasmid DNA
- lambda DNA
- M13 DNA
- DNA from gels
- labeled probes
- oligos
- run off transcripts

Many other application protocols will become available soon. They will be mailed to all QIAGEN users.

To obtain a **free copy** of the updated QIAGENOLOGIST, place your order today or to inquire about our product line **contact QIAGEN Inc., USA, DIAGEN GmbH or your nearest distributor.**



GERMANY: DIAGEN GmbH, Niederheider Str. 3, D-4000 Düsseldorf 13, Phone (211) 79 30 37, Fax (211) 79 04 44  
USA/CANADA: QIAGEN Inc., Studio City, CA 91604, Phone (800)-426-8157, 818-508-5258, Fax 818-508-5536  
DISTRIBUTORS: AUSTRALIA: Phoenix Stansens Scient.Div. (3) 544 8022 AUSTRIA: Bio-Trade (222) 828 46 94  
BENELUX: Westburg B.V. (33) 95 00 94 FRANCE: Cogter (1) 45 33 67 17 ISRAEL: Bio-Lab Laboratories Ltd.  
(2) 52 44 47 ITALY: Genenco (M-Medical) (55) 67 64 41 JAPAN: Funakoshi Pharmaceutical Ltd. (3) 295 5548  
PORTUGAL: Izasa Portugal, S.A. (3511) 758 07 40 SCANDINAVIA: Kebo Lab: Denmark: (2) 68 18 00,  
Finland: (0) 437 56 40, Norway: (6)-84 54 10, Sweden: (8) 621 34 00 SPAIN: Izasa S.A. (3) 254 81 00  
SWITZERLAND: Kontron Instruments AG (1) 435 4111 UK: Hybaid Ltd. (1) 977 3266



Circle No. 2 on Readers' Service Card



## This Week in SCIENCE

### A fair share

**I**T all boils down to a consideration of the three R's—raw data, reagents, and responsibility: how soon after new information is obtained or new research tools are developed should scientists be required to share these valuable commodities with the wider scientific community? What is a fair amount of time for an individual to mull over data and hoard reagents before making them widely available? What roles should be played by funding agencies (should they withhold funds?) or journals (should they block publication?) to enforce sharing policies as they are formulated? These issues and some of the new wrinkles that have surfaced as a result of patent and profit considerations and advances in technology, computing, and communication systems are discussed by Marshall and Roberts beginning on page 952. Now, with few actual policies in place, practices by individual scientists and scientific institutions run the complete gamut from blanket cooperation to suspected sabotage.

### Topography of Titan

**T**ITAN, the giant among Saturn's many moons, is the second largest moon in the solar system. (Jupiter's Ganymede is the largest.) Close-up observations of Titan made in 1980 during the Voyager 1 flyby led to the hypothesis that a deep liquid hydrocarbon ocean might completely cover the icy surface. This hypothesis is no longer valid: Titan's surface has been found to reflect and scatter radio waves in a manner that suggests a solid surface with a varied terrain rather than a global ocean. Scattered small hydrocarbon lakes have, however, not been ruled out and could accommodate the liquid hydrocarbons that the Voyager data strongly suggest are on the surface (page 975). The NASA/JPL 70-meter antenna in California was used to transmit powerful radio waves to Titan; the Very Large Array in New Mexico served as receiver of reflected waves. The pattern of reflectivity was strong

and diffuse, not specular as would be consistent with a global liquid reflecting surface. Muhleman *et al.* point out the similarities between radar reflection characteristics of Titan and those of Jupiter's icy moons Europa, Ganymede, and Callisto.

### What the shadow knows

**H**OW is it possible to deduce the shapes of structures that are inside objects that diffuse radiation? This is an old problem for which a new solution is described by Singer *et al.* (page 990). Many different types of particles (photons, neutrons, phonons, and other radiation sources) can now be beamed at solid targets. Inside the target object, particles may then be absorbed; however, if they are scattered, arrays of detectors that surround the object will record their emergence. With powerful new algorithms and iterated computations that have only become possible with the advent of supercomputers, measurements of scattered radiation can be turned into reconstructions. The methodology has potential applications for studying what is inside solid objects important in medicine, industry, and geophysics. For example, animal tissues could be probed with beams of infrared lasers, and shadowgraphs would then serve as the raw data from which internal shape can, with mathematical computations, be reconstructed.

### Stratospheric sulfur

**D**URING the last decade, there has been an annual increase of about 6% in the background level of sulfates in the stratosphere (page 996). Stratospheric aerosol droplets, which are aqueous spheres that contain between 60 and 80% sulfuric acid, were measured monthly with particle counters aboard balloons situated 20 kilometers above Laramie, Wyoming; supporting data have also been obtained at the North and South poles. The records obtained by Hofmann document the intermittent injection of

sulfur-containing gases into the stratosphere by volcanic eruptions and allow for the measurement of background nonvolcanic sulfuric acid levels between such bursts. The sulfate increases perturb stratospheric chemistry and photochemistry and are reflected in phenomena such as ozone depletion and stratospheric dehydration. In addition, there are close connections between these changes and the changing global climate. Sulfurous gases released from well-known anthropogenic sources—the burning of biomasses and fossil fuels, petroleum refining, and other industrial processes—do not fully account for the 6% rise; therefore, there is a need to identify other natural emitters or previously overlooked anthropogenic ones, such as emissions from airplanes flying increasingly close to the stratosphere as new air lanes are opened to alleviate crowding in the skies.

### Restricted response in multiple sclerosis

**M**YELIN basic proteins, which are targets for possibly pathogenic immune responses in multiple sclerosis, normally sheath nerve fibers; damage to these nerve coverings causes neurologic impairment, which is a hallmark of the disease. The immune responses to myelin basic proteins are made by T cells that recognize myelin basic protein structures through reactive receptors on their surfaces. Wucherpfennig *et al.* found that T cells that respond to the most important regions of myelin basic proteins use only a few types of receptors both in normal individuals and in those with multiple sclerosis (page 1016). In the case of the immunodominant target MBP(84–102), for example, many responding cells bear the V $\beta$ 17 variant of the T cell receptor, one of twenty types tested. The identification of limited numbers of markers on pathogenic T cells that may expand clonally in vivo and participate in autoimmunity could contribute to the development of a therapeutic approach for eliminating such autoreactive clones.

■ RUTH LEVY GUYER



# The Superspeeds from SORVALL®— designed to fit your workload.



The advanced features of the SORVALL® RC-5C give you utmost flexibility. When you enter your run, both "set" and "run" conditions are simultaneously displayed. You can instantly check *g*-force at any speed by touching the RCF Mode. Duplication of any run is easy and convenient, thanks to a built-in  $\omega^2 dt$  integrator that calculates the total centrifugal effect.

Are your procedures more routine? Then choose the practical RC-5B. This workhorse offers straightforward selection of run conditions in any sequence and allows you to change run parameters anytime during the run. No vacuum is required to achieve rotor speeds or maintain operating temperatures. You will find this time-tested instrument performing in laboratories worldwide.

Either way, whether you choose digital electronics to save you effort or opt for a simpler analog model and save money, SORVALL® Superspeeds give your research an edge. It's the edge that comes from the "working knowledge" built into all Du Pont Biotechnology products.

Call us...we speak your language—1-800-551-2121.  
In Canada, call 1-800-387-2179.

Or write Du Pont Company, Biotechnology Systems,  
P16-2130, Wilmington, DE 19880-0016.

**Working Knowledge  
in Biotechnology**



Circle No. 73 on Readers' Service Card



- 1** 9:00 Choose a precast gel from an extended range of 9 different PhastGel® media. Place gel and buffer strips in the separation unit.

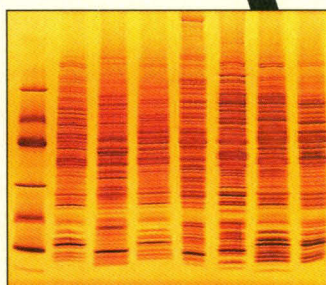
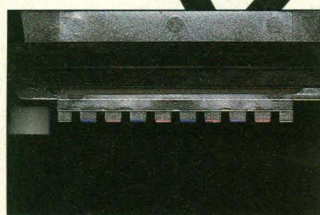


- 3** 9:07 Program and run the method.

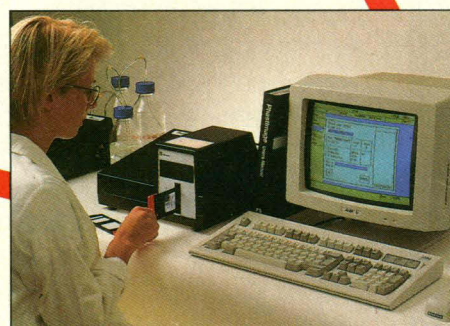
- 5** 9:37 Transfer proteins to a membrane in 15 minutes.



- 4** 9:37 Develop the gel automatically with silver or coomassie staining kits.



- 6** 10:07 Scan and evaluate your results.



- 2** 9:02 Load sample. Application is automated.

# 6 steps ahead

With PhastSystem™ you're at least 6 steps ahead of where you'd be with a conventional electrophoresis system. In the same time it takes to cast gels and prepare buffers for a conventional system, you could be ready to store results from a protein analysis run on PhastSystem. In less than an hour you can obtain accurate and reproducible results from any typical SDS – or native-PAGE separation. And an average isoelectric focusing run takes just 30 minutes.

Once you've gotten ahead, PhastSystem helps you to stay ahead. For fast, reproducible and economic transfer of PhastGel results, we now offer *PhastTransfer*™, a new electrophoretic blotting system. With the small format of PhastGel separation media, PhastTransfer uses less detection reagents than other electrophoretic blotting units. And it consumes only 5 ml of buffer.

Then when you need to accurately and reproducibly evaluate results –

whether they are in PhastGel media, an autoradiographic film or a PhastTransfer membrane – image analysis and evaluation with the aid of *PhastImage*™ is the final step. PhastImage is easy to operate and the same scanning procedure is used for one and two-dimensional gels.

PhastSystem — it's about time.



**Pharmacia**

Pharmacia LKB Biotechnology  
S-751 82 Uppsala, Sweden

We help you manage biomolecules

Circle No. 31 on Readers' Service Card

Head office Sweden Tel 46 (018) 163000. Australia Tel (02) 8883622. Austria Tel (0222) 6866250. Belgium Tel (02) 2424660. Brazil Tel 55-11 2845815/2898967. Canada Tel (514) 4576661. Denmark Tel (02) 265200. East Europe Tel 43 (0222) 921607. Federal Republic of Germany Tel (0761) 49030. Finland Tel (90) 5021077. France Tel (01) 64463636. Great Britain Tel (0908) 661101. Holland Tel (031) 348077911. India Tel (0812) 29634. Italy Tel (02) 2532844/26700475. Japan Tel (03) 4444811. Norway Tel (02) 549095. Soviet Union Tel 46 (08) 7998000. Spain Tel (34)-36754411. Sweden Tel 46 (08) 7998000. Switzerland Tel (01) 8211816. United States Tel (201) 4578000. Far East Tel 852 (5) 8148421. Middle East Tel 30 (1) 8947396. Other countries Tel 46 (08) 7998000. (8904) 2124



# The only thing that should come between you and your work.

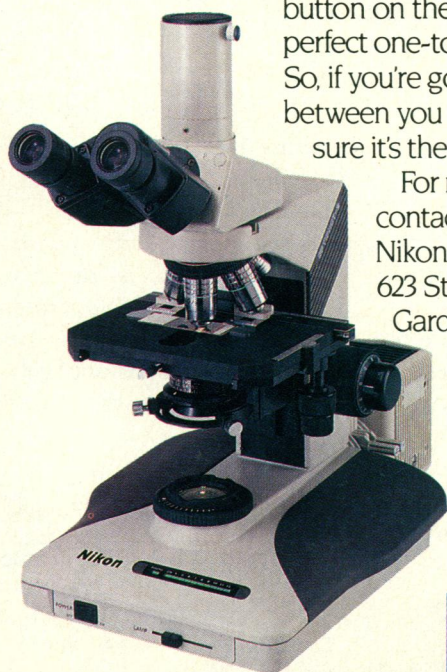
## The New Nikon Optiphot-2 Research Microscope

Beyond the theoretical limit of microscopy lies the performance of the Nikon Optiphot-2. With diffraction-limited, aberration-free Nikon CF optics, and a light path that is free of relay lenses, it introduces a new level of image resolution. The first time you use the Optiphot-2, you'll know it was designed with the researcher in mind.

Optiphot-2 makes it easy to work with low-contrast specimens, epi-fluorescence, ultra-low power objectives, multi- and dual-viewing systems, photomicrography or video microscopy. The powerful 100-watt halogen illuminator provides more than enough light for every application, including ultra-high resolution DIC.

The reversed nosepiece, the large, soft, focusing knobs and the coarse focusing preset provide nearly effortless operation. And for photomicrography, the new Auto-Photo button on the front panel facilitates perfect one-touch color exposures. So, if you're going to let anything get between you and your work, make sure it's the Nikon Optiphot-2.

For more information,  
contact your local dealer or  
Nikon Inc., Instrument Group,  
623 Stewart Avenue,  
Garden City, New York 11530.  
Or call (516) 222-0200.



Circle No. 128 on Readers' Service Card







Software for  
Data Acquisition & Control,  
Graphics, Analysis,  
Communications and  
Vision Applications

**KEITHLEY**

**METRABYTE/ASYST/DAC**

**VOL. 22 1990**

BECOMING  
THE FIRST NAME  
IN PC-BASED  
DATA ACQUISITION  
AND CONTROL  
SYSTEMS IS EASY  
WHEN YOU  
HAVE A GOOD  
LAST NAME.

You've known Keithley for years as the first name in sensitive test and measurement instrumentation. Now we're the first name in PC-based data acquisition and control hardware and software, too.

Introducing Keithley MetraByte/Asyst/DAC. The one company with the strength of three.

By bringing together three of the leaders in the PC-based data acquisition and control industry, Keithley now offers you a single source for hardware and software with the expertise to put it all together.

Keithley MetraByte and Keithley DAC manufacture the broadest range of high quality hardware in the data acquisition industry. Keithley Asyst supplies the acquisition and analysis software that works with the hardware from many manufacturers, as well as our own.

All together, Keithley MetraByte/Asyst/DAC has the answers...to hardware questions, to software questions, to application questions. And it's only one phone call away. You can reach the industry's most versatile technical support group at 508-880-3000.

And if you'd like to meet the people that can answer the questions, we offer seminars in cities nationwide. It's your chance to see how all the pieces fit together, discuss your application with an expert, and learn about the new products and support that could make your job a lot easier.

Keithley MetraByte/Asyst/DAC has it all. And, it's all in one catalog. Call 508-880-3000 and ask for your free copy.

When it comes to PC-based data acquisition and control hardware and software needs, it's all in a name. Keithley MetraByte/Asyst/DAC.

**KEITHLEY** METRABYTE/ASYST/DAC

PC Data Acquisition Hardware and Software

Circle No. 81 on Readers' Service Card



# ANNOUNCING THE DAWN OF A NEW ERA IN LABORATORY ANIMAL IDENTIFICATION

Simplicity itself: a programmable stand-alone system that doesn't require a computer hookup and uses *your* animal identification number.

## Background

Some two years ago Bio Medic Data Systems revolutionized laboratory animal identification by introducing an implantable micro-identification device with an encoded number. An interrogation system activates the implantable chip which then transmits its number. In effect: a truly foolproof system akin to adding a unique electronic "universal product code" to each animal.

## What are the Benefits?

This simple system obsoletes the traditional ear punching or tagging, toe clipping, and tail tattooing. As such, the age-old labor intensive techniques—in terms of the initial identification, the subsequent reading, and the inevitable re-dos—are replaced by a simple, easy, humane and remarkably efficient system. (A dramatic example: 200 animals can be identified in about 45 minutes.)

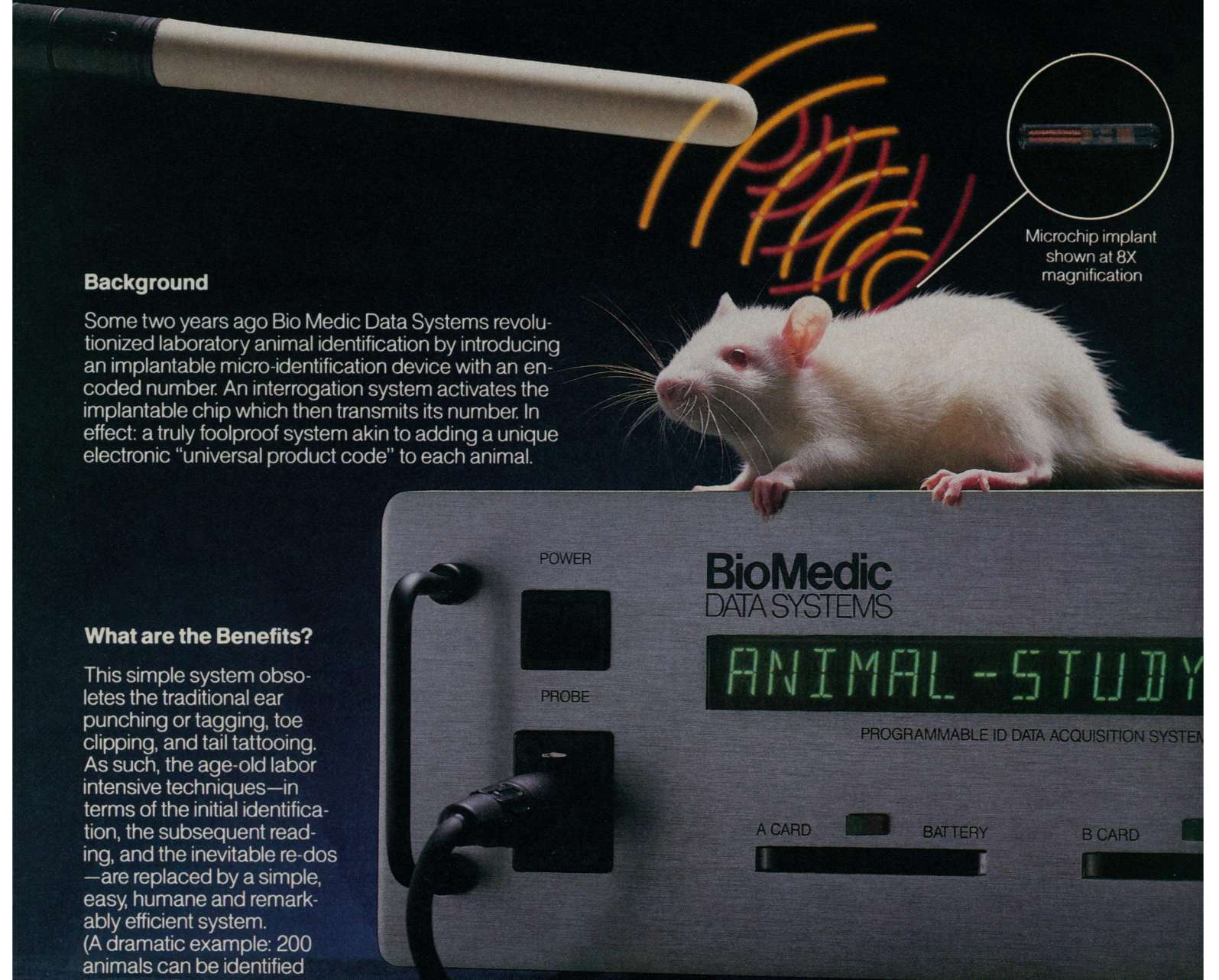
In addition: the imprecision of the conventional methods is replaced by *positive animal identification*. Animal misidentification or infection can indeed be catastrophic should they delay, impede, or destroy a crucial investigation. This simple foolproof system now converts ear punching or tagging, toe clipping, and tail tattooing into unacceptable risks... and who needs that when a positive animal identification system is now available!

## What about Tissue Response?

As a result of a 105-week subchronic evaluation in rats and mice, there have been:

- no significant effects on normal body weights.
- no palpable masses observed.
- no visible tissue reaction.

The tissue response to the implanted microchips is considered to be completely non-adverse.



Microchip implant  
shown at 8X  
magnification



## Announcing the Dawn of a New Era in Laboratory Animal Identification

You are now looking at the complete ELAMS™ (Electronic Laboratory Animal Monitoring System): the injection handle with 10 implantable microchips, the scanning wand that interrogates the chips, and the Programmable ID Data Acquisition System. Simplicity itself: Implant this chip, interrogate it, and key in *your* number. This stand-alone system does *not* require coupling to a computer. Nor does this system ask you to abandon *your* animal identification numbers; when an animal is identified, *your animal code is always subsequently displayed*.

Further: Since this system is not tied in to a computer, it can be used anywhere, even in hostile environments. However, should you choose, it can *easily* be coupled to a computer or a printer. For your additional protection, a back-up record can always be created in seconds. And this system works with *any* animal species.



Microchip is subcutaneously injected into the animal.

### What about GLP Compliance?

ELAMS™ meets and exceeds the GLP guidelines providing a positive animal identification method that is cost effective and accurate.



### To Learn More about the ELAMS™

We invite you to learn more about this new user-friendly (i.e., to both animals and people), state-of-the-art system. Just call our toll free number or drop us a line at ...

**BioMedic**  
DATA SYSTEMS  
a **BioMedic** company

Bio Medic Data Systems, Inc.  
255 West Spring Valley Avenue  
Maywood, New Jersey 07607  
Phone: 201/587-8300, Fax: 201/843-8816  
Toll free number: 1-800-526-BMDS

European Distributor: UNO bv  
P.O. Box 15, 6900 AA Zevenaar, Holland  
Marconistraat 31, 6942 PX Zevenaar  
Phone: 08360-24451, Fax: 08360-23785

Japanese Distributor:  
Yuasa Shoji Co., Ltd.  
13-10 Nihombashi-Odemmacho  
Chuo-Ku, Tokyo 103, Japan  
Phone: 03-665-6742, Fax: 03-665-6994

### Who is Using Bio Medic Data Systems' Implantable Micro Identification (IMI™)?

More than 45 organizations now have the Bio Medic Data Systems Implantable Micro Identification including Sandoz Research Institute, Schering Plough, C.I.I.T., General Motors, N.S.I. Technical Services, Stanford University, University of Miami, M.I.T. (Note that the Sandoz Research Institute has submitted the results of the first year of a two-year study for publication.)



# Unique inflammation research assays

Amersham announces the availability of:

**Platelet-activating factor (PAF) [ $^3\text{H}$ ] scintillation proximity assay (SPA) system**

**Order code TRK 990**

A rapid, simple and specific method for the measurement of PAF *in vitro* in the range 20–1280pg/tube.

**and**

**Prostaglandin  $\text{E}_2$  [ $^{125}\text{I}$ ] scintillation proximity assay (SPA) system**

**Order code RPA 539**

## **Stabilized $\text{PGE}_2$**

Dehydration of  $\text{PGE}_2$  is stabilized through simple methyl oximation.

## **High performance antiserum**

The antiserum used in the assay is raised against methyl-oximated  $\text{PGE}_2$  coupled to BSA.

**Sensitivity** 1.0pg/tube

**Working range** 1.25–160pg/tube

- Homogenous assays requiring no separation of bound from free
- Time saving
- Cost saving
- High performance
- Increased safety

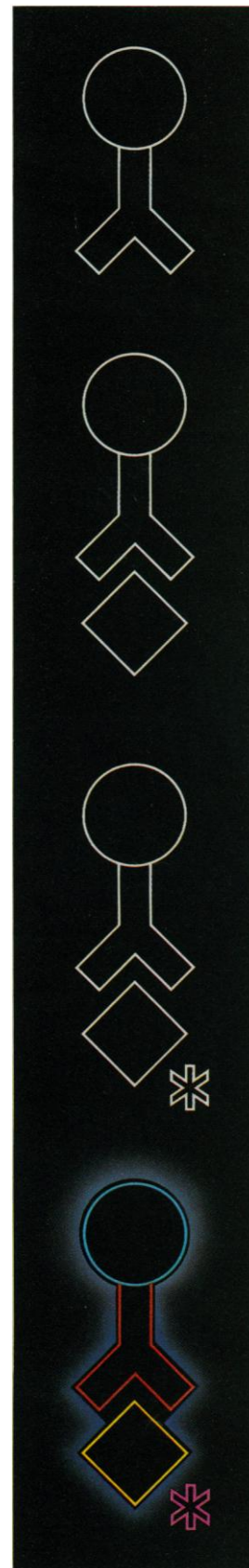
Full details on the theoretical and practical aspects of scintillation proximity assays are given in our technical booklet 'Scintillation Proximity Assays — principles and practice', available on request.

**Amersham International plc**  
Amersham UK

**Amersham**  
*Bringing science to life*

**UK Sales** Aylesbury (0296) 395222   **Amersham Australia Pty Ltd** Sydney (02) 888-2288   **Amersham Belgium SA/NV** Brussels (02) 770 0075  
**Amersham Buchler GmbH & Co KG** Braunschweig West Germany (053 07) 2 06-0   **Amersham Canada Ltd** Oakville, ONT (416) 847-1166  
**Amersham Corporation** Arlington Heights, IL USA (800) 323-9750   **Amersham Denmark ApS** Birkerød 45-82 02 22   **Amersham France SA** Les Ulis (1) 69 86 53 00  
**Amersham Japan** Tokyo (03) 816 6161   **Amersham Nederland BV** Houten 03403 76660   **Amersham – Norway branch** Gjetsum 02-54 63 18  
**Amersham Sweden AB** Solna 08-734 08 00

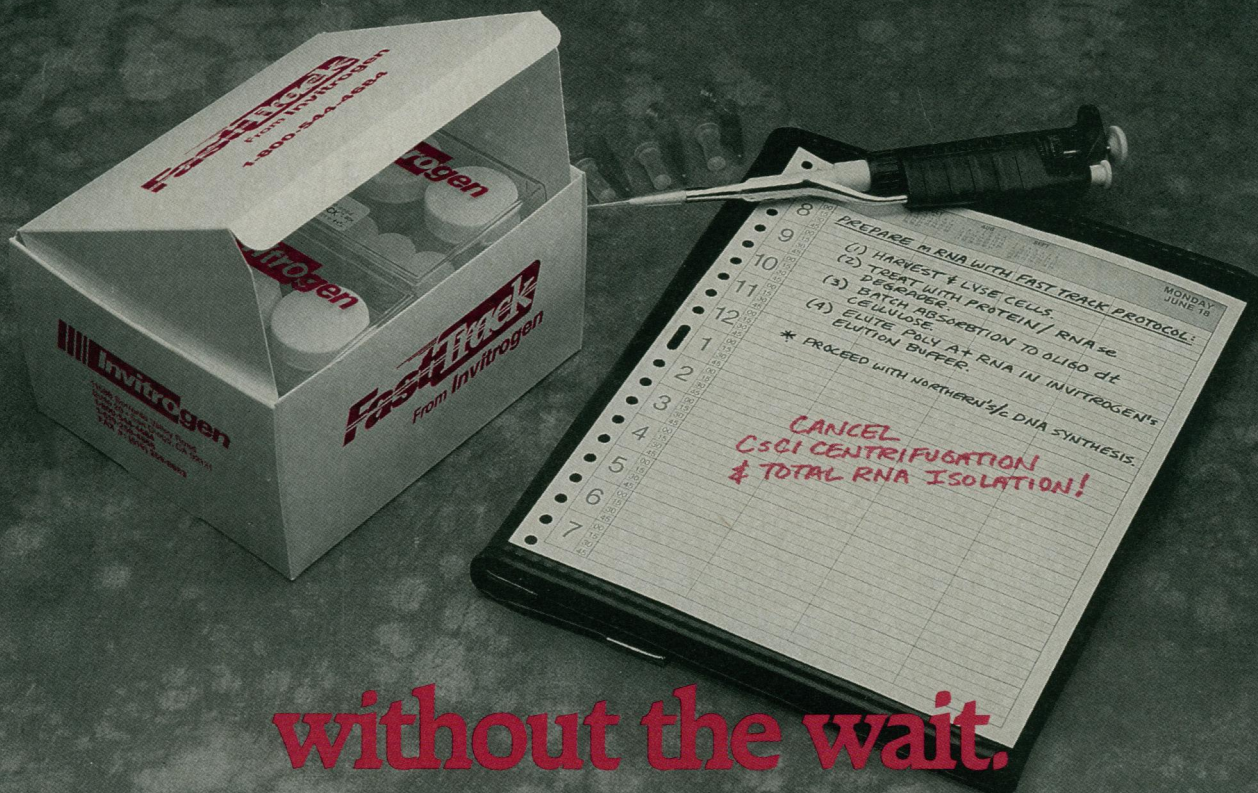
Circle No. 243 on Readers' Service Card





# FastTrack™

## The highest quality mRNA...

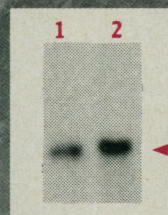


FastTrack is the only system available for the isolation of high quality, intact messenger RNA directly from cells or tissue in four hours or less with double the yield of conventional protocols. The entire procedure can be completed without ultracentrifugation, cesium chloride, toxic chemicals or total RNA isolation.

### FastTrack guarantees:

- Higher yields of full length transcripts
- Lower ribosomal contamination
- No need for total RNA isolation
- Speed and simplicity

FastTrack has been designed to provide consistent and improved results during **cDNA synthesis** by eliminating guanidine and phenol which inhibit reverse transcriptase activity, and for **Northern blotting** by removing ribosomal contaminants and providing stronger signals (see fig. 1).



**Figure 1.**

Lane 1. mRNA isolated using guanidinium, CsCl centrifugation and oligo dT column selection. (30 hrs).

Lane 2. mRNA isolated directly from cells with FastTrack (3 hrs).

For high quality mRNA without the wait, *get the message with FastTrack.*

Call Invitrogen at **1-800-544-4684**

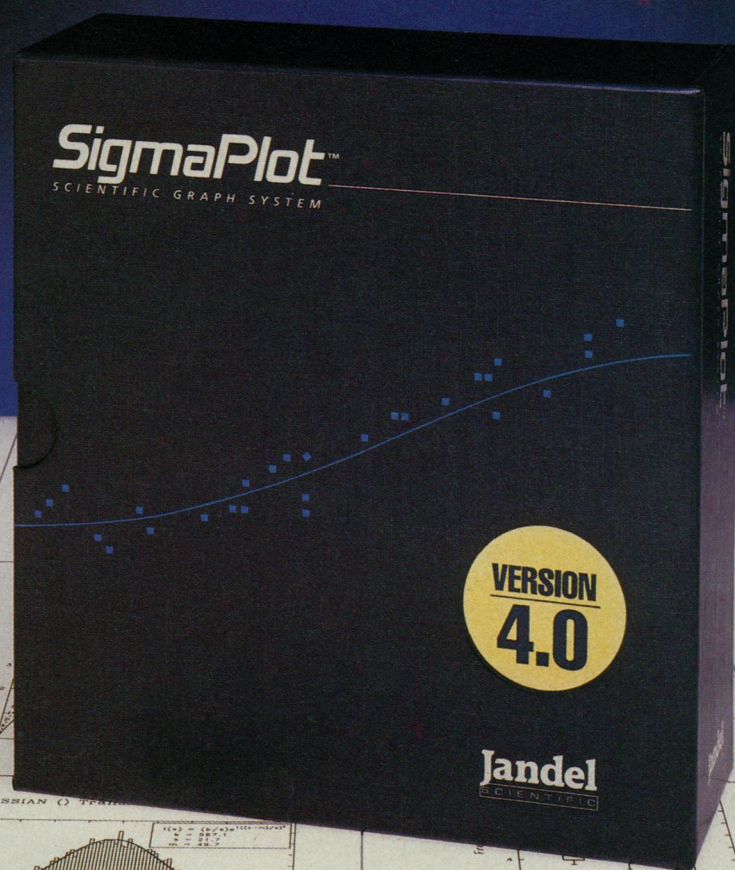
**Invitrogen**  
CORPORATION

11588 Sorrento Valley Rd., #20, San Diego, CA 92121

Circle No. 135 on Readers' Service Card



# IT'S HERE.



## Introducing SigmaPlot™ 4.0.

The powerful new version of the world's finest PC software for the production of publication-quality scientific charts and graphs...on your own IBM® or compatible personal computer.

## Used by over 15,000 scientists.

SigmaPlot, Version 3.1, is the software of choice worldwide for creating graphics for scientific papers and poster sessions. It was selected "Editor's Choice" by *PC Magazine* for its outstanding output. Now, Jandel's new SigmaPlot Version 4.0 gives you all of the advantages of 3.1...and much, much more.

## Designed with the scientist in mind.

SigmaPlot 4.0 is elegant and easy to use...with its pull-down menu interface, mouse and keyboard support, novice prompting, and full context-

sensitive interactive help. Input data directly from the keyboard, or from Lotus 123®, or ASCII files, into SigmaPlot's *huge* worksheet - 16,000 columns by 65,000 rows. Version 4.0's full mathematical transform language lets you plot mathematical functions or transform data. SigmaPlot 4.0 also gives you highly sophisticated non-linear curve fitting...and error bars that are complemented by confidence intervals and quality control lines.

## Outstanding plot output.

Extremely high-quality output is given, a result of extraordinary control over the appearance of your graphs. With SigmaPlot 4.0 you have outstanding page layout control, as well as control over individual width, color and position of independent graphic elements. You also have more fonts, more scales, and more graph types to

work with. Not to mention multiple axes, Greek, mathematical and European characters, descriptive statistics, and much more. You can easily export graphs into WordPerfect® 5.0, Pagemaker®, Ventura Publisher® and many other programs. And SigmaPlot outputs to plotters, slide makers, dot matrix printers, Postscript™ and HP Laserjet™ printers.

## Affordable and fully supported.

Priced under \$500, SigmaPlot 4.0 is well within reach of any research facility. And, like all Jandel products, SigmaPlot 4.0 comes with a money-back guarantee and the full technical support of Jandel's experts. It's what you'd expect from the leader in software for scientists. Find out how much you can do with SigmaPlot 4.0.

Call today for a FREE brochure:

**1-800-874-1888 (inside CA 415-924-8640).**

65 Koch Road • Corte Madera, CA 94925  
1-800-874-1888 (inside CA or Canada 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. 164 on Readers' Service Card



**AIDS  
TARGETED  
INFORMATION/ATIN**

**TARGETS  
YOUR  
LITERATURE  
SEARCH**

Expand your base of knowledge about AIDS/HIV with *AIDS Targeted Information/ATIN*. Every month, *ATIN* not only provides abstracts but also in-depth evaluations of the current published scientific literature on AIDS. Written by clinicians and researchers for clinicians and researchers, *ATIN* provides an authoritative command of the world's literature on AIDS. Published by Williams & Wilkins. Indexed. 12 issues per year. \$125.

To order call  
**1-800-638-6423**

Sponsored by the American Foundation  
for AIDS Research (AmFAR).

Circle No. 91 on Readers' Service Card

## PCR Primer Selection Program

Save time and avoid costly mistakes with a new IBM/PC program that scans flanking sequences for the "optimum" PCR primers.

- Simple sequence entry, editing, complementation, inversion, and verification.
- Automatic search of thousands of possible primer sequences. Search on 5' only, 3' only, or both flanking sequences simultaneously.
- Checks primers for
  - Primer/primer annealing
  - Primer-dimer formation
  - Runs of identical bases
  - Secondary structure
  - $T_m$  or GC content that is too low or too high. Rejects primer pairs that *differ* excessively in  $T_m$  or GC.
- Self-explanatory, extremely easy to use.
- Costs less than a pair of oligonucleotides (\$US165).

### EPICENTER SOFTWARE

PO Box 90073, Pasadena, CA 91109.  
(818) 304-9487 Fax (818) 449-0437

Circle No. 178 on Readers' Service Card

## There Are Some Important Holes In Our Story.

### PORETICS CORPORATION

151-I Lindbergh Avenue  
Livermore, CA 94550, USA

800-922-6090  
415-373-0500  
(Calif. and Intl.)

Circle No. 234 on Readers' Service Card

We mean the precise holes in our polycarbonate track-etch (PCTE) membrane filters. excellent thermal and chemical resistance – all are outstanding characteristics of our PCTE filters.

Holes that can be very important to you. And we manufacture our PCTE filters to the most exacting specifications and quality standards.

Precise pore sizes with narrow pore size distribution provides for accurate separations. If these benefits are important to your critical filtrations, try our polycarbonate screen membrane filters. Just call 800-922-6090 to discuss your applications with our technical staff.

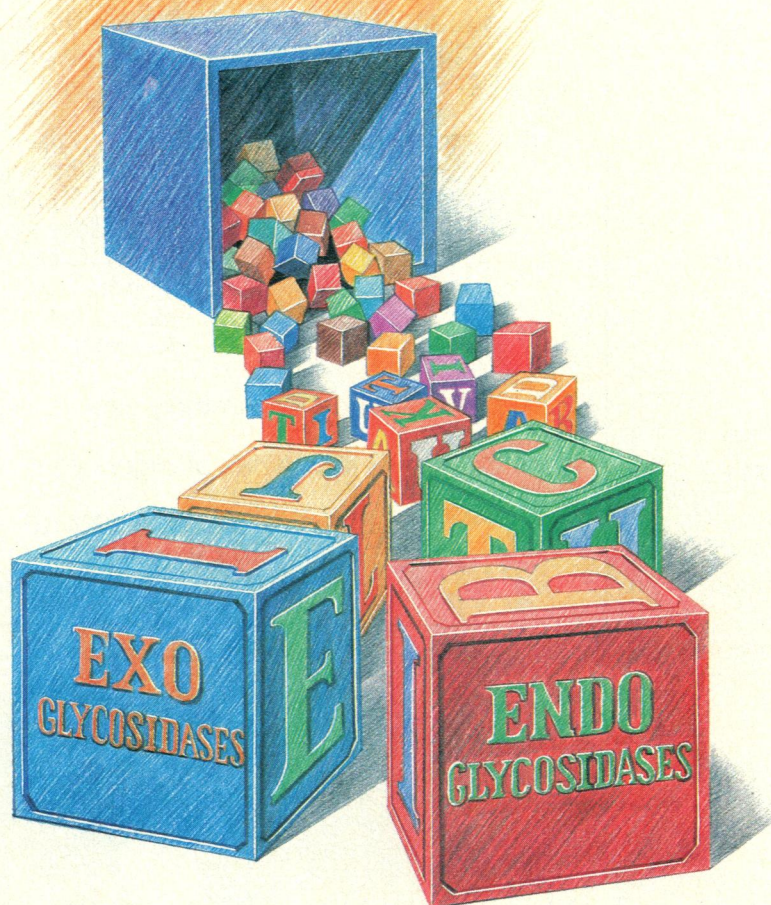
And samples are retained and evenly distributed in a single plane making them easy to see with optical or electron microscopes. And we'll follow up with the whole Poretics story.

Biologically inert, low non-specific binding, low tare weights, low extractables,

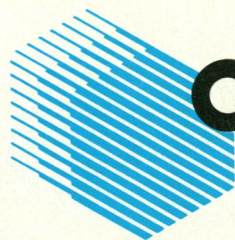


See us on Booth 1839 at  
ASBMB/AAI New Orleans

# GLYCOCONJUGATE RESEARCH



Oxford GlycoSystems' new range of exo- and endo- glycosidases are backed by more information, more quality control and more features than any enzyme available. The enzymes, rigorously tested for specificity and contaminating activities come to you ready-to-use with buffer and more information than you are used to. Contact us today for a product list and start to get to know us.



**Oxford GlycoSystems**

Circle No. 199 on Readers' Service Card

Oxford GlycoSystems Limited, Unit 4, Hitching Court, Blacklands  
Way, Abingdon, Oxon. OX14 1RG. Tel: 0235 553066

Oxford GlycoSystems, Inc., Cross Island Plaza,  
133-33 Brookville Boulevard, Rosedale, New York 11422, USA



# Biological Systems

Edited by Barbara R. Jasny and Daniel E. Koshland, Jr.

This collection of *Science* magazine articles explores some of the diverse biological systems in research today. The authors describe major experimental systems in terms of the state of the art, potential advantages, and possible disadvantages for particular kinds of research.

Organisms explored range from retroviruses to humans, and the aspects of biological processes in which they have been applied include developmental and molecular biology, genetics, immunology, and behavior. Genetic engineering is also discussed as a means of designing optimal systems for basic research and the biotechnology industry. The information presented will be especially useful to graduate students and to all researchers interested in learning the limitations and assets of biological systems currently in use.

## Contents:

Retroviruses — *Harold Varmus*

Research on Bacteria in the Mainstream of Biology — *Boris Magasanik*

Genetic Engineering of Bacteria from Managed and Natural Habitats — *Steven E. Lindow, Nickolas J. Panopoulos, Beverly L. McFarland*

Yeast: An Experimental Organism for Modern Biology — *David Botstein and Gerald R. Fink*

*Dictyostelium discoideum*: A Model System for Cell-Cell Interactions in Development — *Peter Devreotes*

*Xenopus laevis* in Developmental and Molecular Biology — *Igor B. Dawid and Thomas D. Sargent*

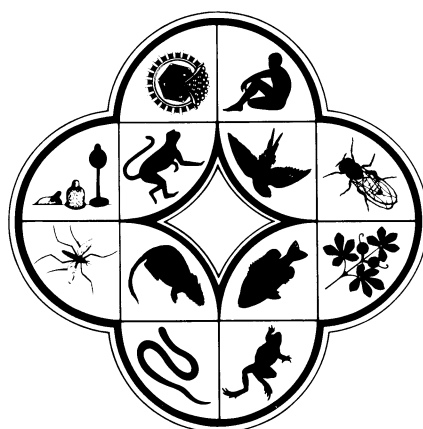
Parasitic Protozoans and Helminths: Biological and Immunological Challenges — *Adel A. F. Mahmoud*

The Nematode *Caenorhabditis elegans* — *Cynthia Kenyon*

*Drosophila melanogaster* as an Experimental Organism — *Gerald M. Rubin*

Plants: Novel Developmental Processes — *Robert B. Goldberg*

Genetically Engineered Plants for Crop Improvement — *Charles S. Gasser and Robert T. Fraley*



Fish as Model Systems — *Dennis A. Powers*

Contributions of Bird Studies to Biology — *Masakazu Konishi, Stephen T. Emlin, Robert E. Ricklefs, John C. Wingfield*

The Rat as an Experimental Animal — *Thomas J. Gill III, Garry J. Smith, Robert W. Wissler, Heinz W. Kunz*

Transgenic Animals — *Rudolf Jaenisch*

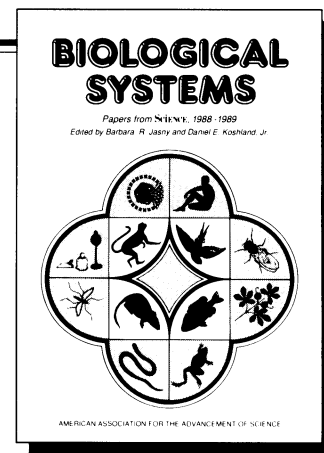
Cetaceans — *Bernd Würsig*

Primates — *Frederick A. King, Cathy J. Yarbrough, Daniel C. Anderson, Thomas P. Gordon, Kenneth G. Gould*

The Human as an Experimental System in Molecular Genetics — *Ray White and C. Thomas Caskey*

Fetal Research — *John R. Hansen and John T. Sladek, Jr.*

How Many Species Are There on Earth? — *Robert M. May*



1990; 288 pp.; fully indexed and illustrated  
#89-16S - softcover; \$31.50  
(AAAS members \$24.95)

**Order from:** AAAS Books, Dept. A9, P.O. Box 753, Waldorf, MD 20604 (FAX: 301-843-0159). To order by phone (VISA/MasterCard only), call 301-645-5643 (9am-4pm ET) and ask for AAAS. Individuals must prepay or use VISA/MC. For institutional purchase orders, add \$3.50 postage/handling. Please specify item #89-16S, and allow 2-3 weeks for delivery. For shipments to CA, add applicable sales tax.

**American Association for the Advancement of Science**