



AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

14 APRIL 1995
VOL. 268 • PAGES 173-336

\$7.00

**Signal
Transduction**

ROBUST PCR

TaqPlus™ DNA Polymerase

**Why on earth
would you ever use anything else?**

**The answer is...
you wouldn't.**

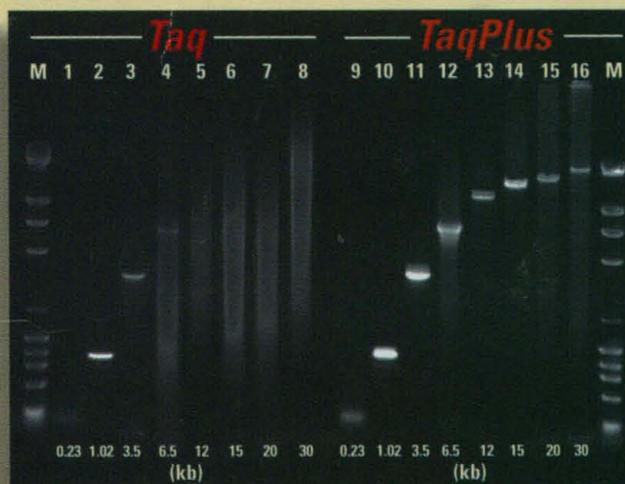
*Because Stratagene's
new TaqPlus™ DNA
polymerase† does it all!*

ROBUST PERFORMANCE

TaqPlus DNA polymerase boosts PCR yield. For long and short templates. For everyday PCR. Use it instead of Taq, and you'll understand the meaning of robust PCR!

LONG PCR

The robust nature of TaqPlus DNA polymerase makes it ideal for long PCR. It amplifies templates up to 35 kb long. So this potent polymerase is all you need.



TOUGH TEMPLATES

TaqPlus DNA polymerase reduces mismatch pausing. So more extension reactions reach completion in each cycle of PCR. Armed with this greater efficiency, TaqPlus DNA polymerase can even tame tough templates to bring out the bands.

TaqPlus™ DNA Polymerase is an optimized blend of Stratagene's highest quality Taq DNA polymerase† and Taq Extender™ PCR additive, the most powerful PCR-enhancement reagent available.^{1,2}

**You'll never
go back to Taq.**

REFERENCES
1. Nielson, K.B., Scott, B., Bauer, J.C., and Ketz, K. (1994) *Strategies* 7: 64-65.
2. Nielson, K.B., Schoettlin, W., Bauer, J.C., and Mathur, E. (1994) *Strategies* 7: 27.

FOOTNOTES:
† Purchase of this enzyme is accompanied by a license to use it in the polymerase chain reaction (PCR) process in conjunction with an authorized thermal cycler. This product is sold under licensing arrangements with Roche Molecular Systems, Inc., Hoffmann-La Roche Ltd. and The Perkin-Elmer Corporation.

TaqPlus™ polymerase
100 U Catalog #600203
500 U Catalog #600204

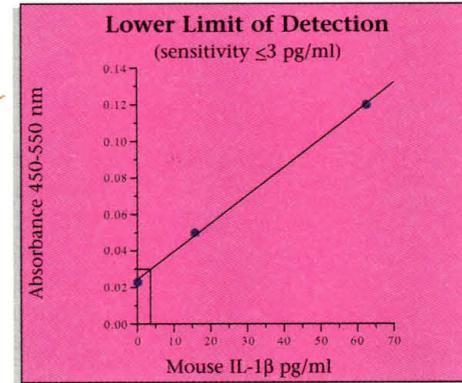
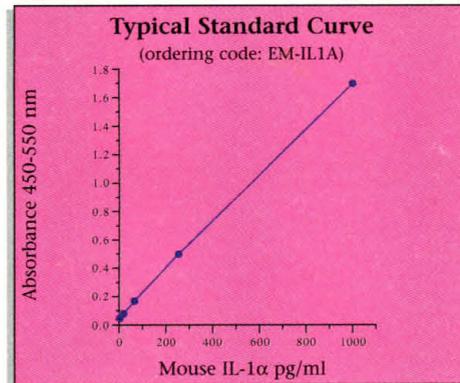
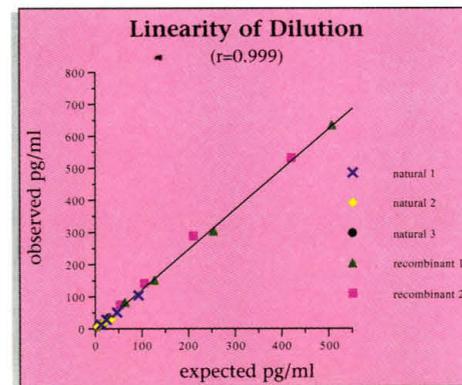
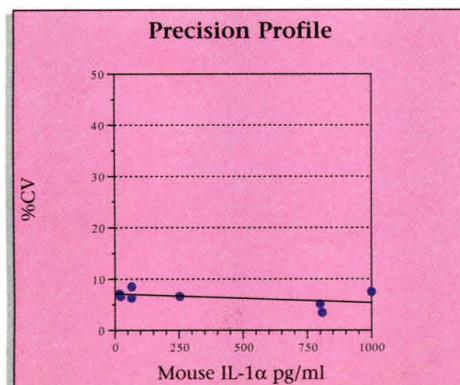
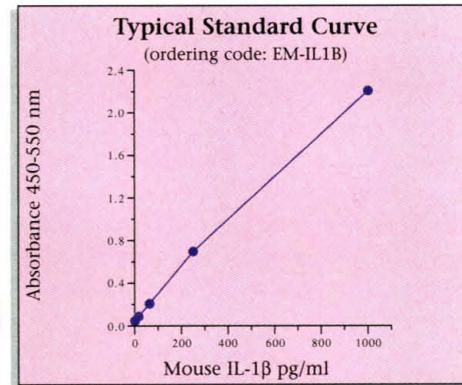
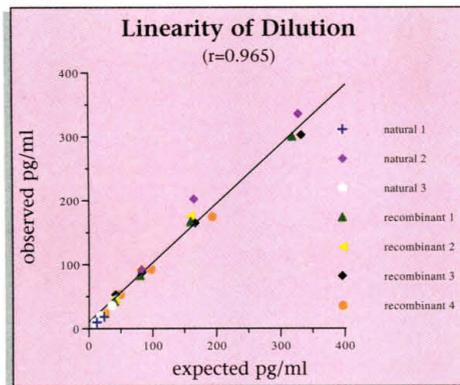
INTERNET MAIL
tech_services@stratagene.com
USA
Corporate Headquarters
(800) 424-5444
GERMANY
Stratagene GmbH
Telephone: (06221) 400634

UNITED KINGDOM
Stratagene Ltd.
Telephone: (0223) 420955
SWITZERLAND
Stratagene GmbH
Telephone: (01) 3641106



Circle No. 66 on Readers' Service Card

Introducing Two New ELISAs: Mouse IL-1 α Mouse IL-1 β



**Accuracy.
Performance.
Precision.**

Endogen Mouse IL-1 α ELISA

Ordering Code: EM-IL1A
Size: 96 determinations
Sensitivity: \leq 6 pg/ml
Assay Range: 0-1000 pg/ml
Assay Time: 3 hours
Sample Types: serum, plasma,
culture supernatants
Sample Types: 50 μ l

Endogen ELISAs

HUMAN	MOUSE	CELL ADHESION
• hIL-1 α	• mIL-1 α	• msICAM-1
• hIL-1 β	• mIL-1 β	• hsICAM-1*
• hIL-2	• mIL-2	• hICAM-3*
• hIL-4	• mIL-3	• hCD23*
• hIL-6	• mIL-4	• hCD44std*
• hIL-8*	• mIL-5	• hCD44var(v5)*
• hIL-10	• mIL-6	• hCD44var(v6)*
• hIFN α	• mIL-10	• hCu/ZnSOD*
• hIFN γ	• mIFN γ	• hE-selectin*
• hGM-CSF	• mGM-CSF	• hL-selectin*
• hTNF α	• mTNF α	• hMnSOD*
• hTNF β *		• hP-selectin*
• hsTNFR*		• shTNFR*

*Endogen distributes only in the U.S. for Bender & Co. GmbH

Technical Service Specialists are available to answer your questions or fax datasheets. Call today, 800-487-4885.

Endogen Mouse IL-1 β ELISA

Ordering Code: EM-IL1B
Size: 96 determinations
Sensitivity: \leq 3 pg/ml
Assay Range: 0-1000 pg/ml
Assay Time: 3 hours
Sample Types: serum, plasma,
culture supernatants
Sample Types: 50 μ l

640 MEMORIAL DRIVE, CAMBRIDGE, MA 02139 USA 617.225.0055 FAX 617.225.2040

For research use only. Not for use in diagnostic or therapeutic procedures.

Head Office for Europe: Biozol Diagnostica
TEL 49+(89) 3192053
FAX 49+(89) 3193611

In Japan: Funakoshi Co., Ltd.
TEL 81+(3) 56841622
FAX 81+(3) 56841633

ENDOGEN
800-487-4885

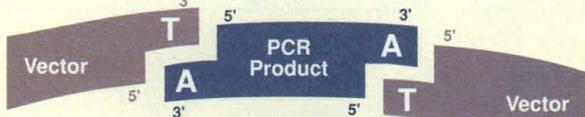
Circle No. 47 on Readers' Service Card



High-Efficiency Cloning of PCR Products.

The most efficient method to clone PCR products? TA Cloning® Kits from Invitrogen. The Original TA Cloning® Kit achieves guaranteed cloning efficiencies of > 80%! There's no modification or purification of your PCR product necessary. And that's not all! Our new Eukaryotic TA Cloning® Kits now allow direct cloning and mammalian expression of PCR products. To learn more about these state-of-the-art kits, contact Invitrogen today.

Original TA Cloning® Kit Catalog no. K2000-01 \$255
 Eukaryotic TA Cloning® Kit - Unidirectional Catalog no. K3001-01 \$290
 Eukaryotic TA Cloning® Kit - Bidirectional Catalog no. K3000-01 \$275

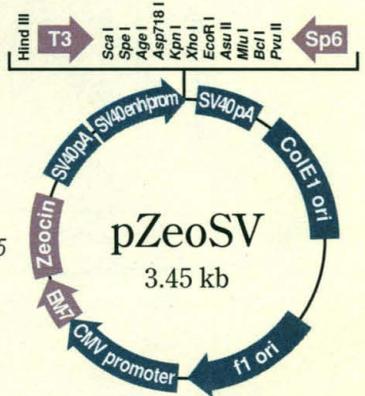


Circle No. 26 on Readers' Service Card³⁷

High-Powered Mammalian Expression.

The pZeoSV vector is the most efficient, cost-effective tool for high-level recombinant protein expression in mammalian cells. pZeoSV carries only one selectable marker, the unique Zeocin™ resistance gene. This keeps the vector extremely small—only 3.45 kb—for maximum transfection efficiency. Check out this efficient, high-powered mammalian expression system today.

pZeoSV Vector Kit Catalog no. V850-01 \$285
 Circle No. 27 on Readers' Service Card



Way Cool ST Gene Expr

The Surprisingly Affordable Electroporator II.

The Electroporator II connects directly to existing electrophoresis power supplies. This means you'll save thousands of dollars compared to traditional units with built-in power supplies. The

Electroporator II features variable capacitance and resistance controls, and accepts standard cuvettes for electroporation of bacteria, yeast, plant, and mammalian cells. Each unit comes complete with 10 cuvettes, a comprehensive manual, plus a one-year warranty. Call today for a demonstration of our affordable Electroporator II.

Electroporator II Catalog no. S1670-01 \$975

Circle No. 30 on Readers' Service Card

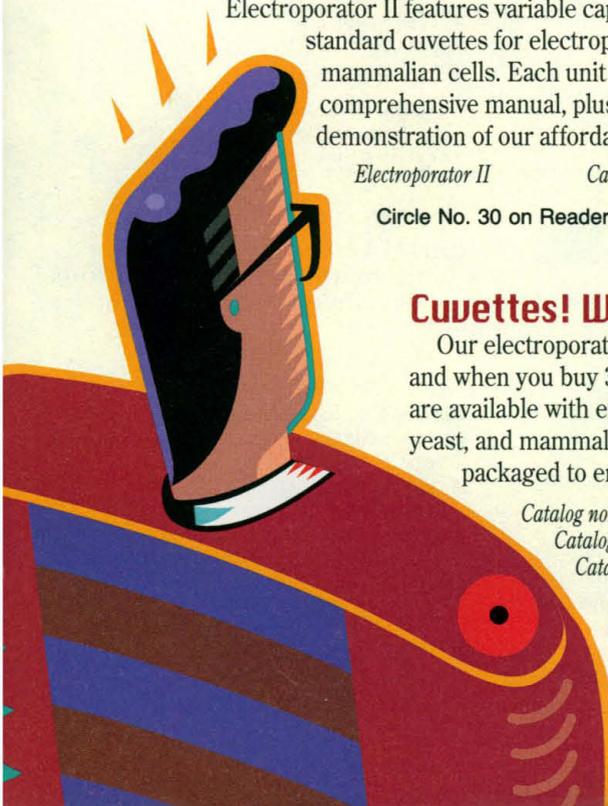
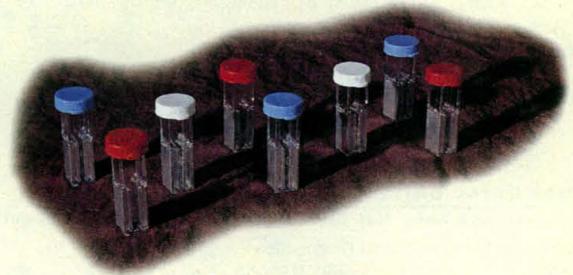


Cuvettes! We've Got Your Size!

Our electroporation cuvettes fit virtually all electroporation devices, and when you buy 3 bags of 50 cuvettes, you get one FREE! Our cuvettes are available with either 0.1, 0.2, or 0.4 cm gap sizes for efficient electroporation of bacteria, yeast, and mammalian cells. Each cuvette is sterilized by gamma irradiation and individually packaged to ensure sterility. Don't pay more! Order now and save!

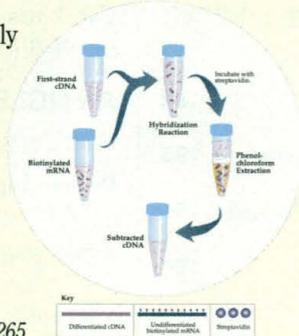
Catalog no. P410-50 0.1 cm \$130
 Catalog no. P450-50 0.2 cm \$130
 Catalog no. P460-50 0.4 cm \$130

Circle No. 31 on Readers' Service Card



The Only Kit for Subtracted cDNA.

Only one product gives you a simple, easy-to-follow method for the enrichment of differentially expressed genes. It's the Invitrogen Subtractor® Kit. The procedure uses the technique of subtractive hybridization to remove common messages from differentially expressed pools of cDNA. You can use the subtracted cDNA as a probe, or amplify and clone it to produce "hard copies" of enriched genes. If you need to isolate differentially expressed genes, call Invitrogen today to get the facts on the Subtractor® Kit.



Subtractor® Kit Catalog no. K4320-01 \$265
Circle No. 28 on Readers' Service Card

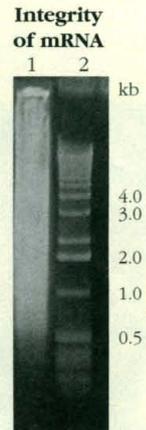
Exceptional Yields of mRNA.

The FastTrack® mRNA Isolation Kit produces very high yields of mRNA directly from tissues, plants, or cells. The kit utilizes gentle lysis and efficient binding of mRNA to oligo dT cellulose powder to isolate large amounts of pure, intact mRNA. Yields of 40-70 µg of mRNA are routinely achieved from 1×10^8 cells. Call Invitrogen today and start increasing your yield and quality of mRNA.

mRNA was isolated from 1×10^8 insect cells and resuspended in 30 µl of water. 10 µl was run on a 1% agarose gel (lane 1).

FastTrack® Kit Catalog no. K1593-02 \$235

Circle No. 29 on Readers' Service Card

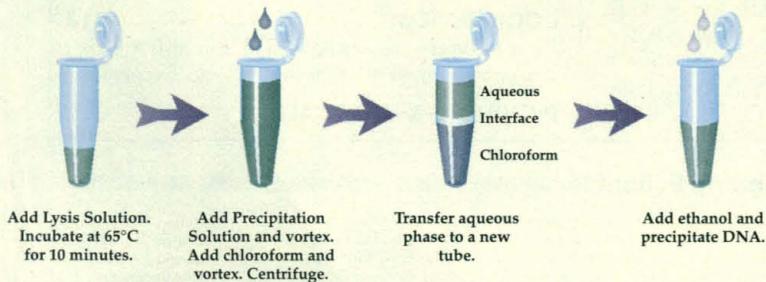


cutt From The Session Folks.

Genomic DNA in a Jiffy.

What's the fastest, easiest, most efficient way to isolate genomic DNA? That's simple: the Easy-DNA™ Kit. It works quickly and efficiently in only four steps, minimizing DNA degradation and loss. In less than 90 minutes, this simple procedure yields high-quality genomic DNA from a wide variety of samples for use in any molecular biology application. Make your life a little easier, isolate genomic DNA with the Easy-DNA™ Kit from Invitrogen.

Easy-DNA™ Kit Catalog no. K1800-01 \$165



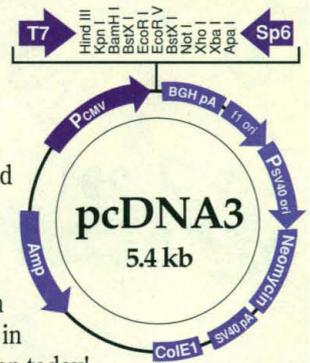
Circle No. 32 on Readers' Service Card

Genuine High-Level Mammalian Expression.

Invitrogen's pcDNA3 is the most versatile mammalian vector for high-level expression. Either transient or stable expression is achieved using the powerful cytomegalovirus (CMV) promoter/enhancer. Call our Technical Services Department and ask for the extensive citation list demonstrating successful mammalian expression with pcDNA3. Find out how you can express high levels of your recombinant protein in mammalian cells. Contact Invitrogen today!

pcDNA3 Catalog no. V790-20 \$195

Circle No. 33 on Readers' Service Card



Invitrogen®

Easy ordering and FAST delivery.

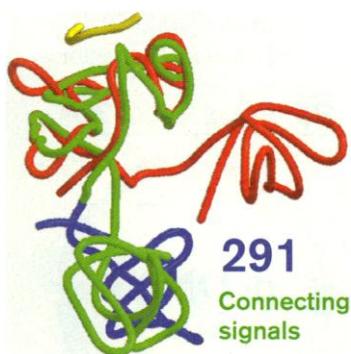
1-800-955-6288

3985 B Sorrento Valley Boulevard
San Diego, California 92121
Fax orders to 619-597-6201

Prices/Others valid in U.S. & Canada only.



192
Jack Gibbons, in
the hot seat



NEWS & COMMENT

OSTP: A Mixed Midterm Report Committee, Anyone?	192 193
U.S. Tells CERN to Wait for Support	195
Senate Votes R&D Cuts, ATP Trimmed	195
Claim-Jumping Charges Ignite Controversy at Meeting	196
Greenhouse Gases: Rio Signatories to Negotiate New Goals	197
Amateur Fossil Hunters Dig Up Trouble in Montana	198
Hubble Gets Help From a Cosmic Lens	199

RESEARCH NEWS

Dendrites Shed Their Dull Image	200
Extreme Ultraviolet Satellites Open New View of the Sky	202
Found: Ash From the First Stars?	203
Parasitology: Trypanosome Mystery Solved?	204

Cytokines Move From the Margins Into the Spotlight	205
--	-----

ARTICLES

SIGNAL TRANSDUCTION

Protein Lipidation in Cell Signaling	221
P. J. Casey	
Notch Signaling	225
S. Artavanis-Tsakonas, K. Matsuno, M. E. Fortini	
Integrins and Signal Transduction Pathways: The Road Taken	233
E. A. Clark and J. S. Brugge	
Calcium Signaling in Neurons: Molecular Mechanisms and Cellular Consequences	239
A. Ghosh and M. E. Greenberg	
Localization of Protein Kinases by Anchoring Proteins: A Theme in Signal Transduction	247
D. Mochly-Rosen	
Cytokine Signaling Through Nonreceptor Protein Tyrosine Kinases	251
T. Taniguchi	

POLICY FORUM

A Temporary Bridge	261
J. Roberts	

DEPARTMENTS

THIS WEEK IN SCIENCE	181	Shaffer, M. Blecher, J. P. Isacson, R. C. Peet • Low-Barrier Hydrogen Bonds: P. A. Frey
EDITORIAL	183	
Signals and Communication		
LETTERS	185	
Chimpanzee Kinship: C. J. Jolly, J. F. Oates, T. R. Disotell; P. A. Morin, J. J. Moore, D. S. Woodruff • The Theory of DNA Bending: G. S. Manning • Biotech Patents and "Usefulness": S. A. Bent, P. M. Booth, K. K. Costantino, P. B. C. Jones, G. L.		
SCIENCESCOPE	191	
RANDOM SAMPLES	207	
BOOK REVIEWS	313	<i>Plant Allometry</i> , reviewed by T. J. Givnish • Other Books of Interest • Vignettes • Books Received
PRODUCTS & MATERIALS	318	

Board of Reviewing Editors

Frederick W. Alt
Don L. Anderson
Michael Ashburner
Stephen J. Benkovic
David E. Bloom
Floyd E. Bloom
Piet Borst
Henry R. Bourne
Michael S. Brown
James J. Bull

Kathryn Calame
C. Thomas Caskey
Dennis W. Choi
John M. Coffin
F. Fleming Crim
Paul J. Crutzen
James E. Dahlberg
Robert Desimone
Bruce F. Eldridge
Paul T. Englund

Richard G. Fairbanks
Douglas T. Fearon
Harry A. Fozzard
Klaus Friedrich
Theodore H. Geballe
John C. Gerhart
Roger I. M. Glass
Stephen P. Goff
Peter N. Goodfellow
Corey S. Goodman

Ira Herskowitz
Eric F. Johnson
Stephen M. Kosslyn
Michael LaBarbera
Nicole Le Douarin
Charles S. Levinger III
Alexander Levitzki
Harvey F. Lodish
Richard Losick
Reinhard Lührmann

Diane Mathis
Anthony R. Means
Shigetada Nakanishi
Roger A. Nicoll
Stuart L. Pimm
Yeshayau Pocker
Dennis A. Powers
Ralph S. Quatrano
V. Ramanathan
Douglas C. Rees

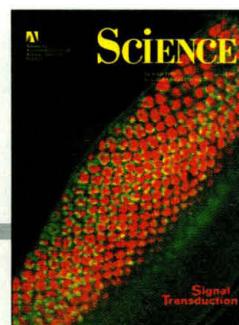
T. M. Rice
David C. Rubie
Erkki Ruoslahti
Gottfried Schatz
Jozef Schell
Ronald H. Schwartz
Terrence J. Sejnowski
Ellen Solomon
Thomas A. Steitz
Michael P. Stryker

Robert T. N. Tjian
Emil R. Unanue
Geerat J. Vermeij
Bert Vogelstein
Arthur Weiss
Zena Werb
George M. Whitesides
Owen N. Witte
William A. Wulf

COVER

During development of the *Drosophila* compound eye, the correct specification of many different cell types depends on the signaling activity of the Notch receptor protein. In the larval eye imaginal disc, expression of a truncated, nuclear form of Notch (green) prevents cells

from differentiating as neurons (red). See page 225 and other related Articles beginning on page 221 in this special issue on signal transduction. [Image: M. E. Fortini and S. Artavanis-Tsakonas]



PERSPECTIVES

Tyrosine Phosphatases and the Antibody Response 263

A. L. DeFranco and D. A. Law

Green Fluorescent Pets 264

D. C. Youvan

REPORTS

Spin Crossover in a Catenane Supramolecular System 265

J. A. Real, E. Andrés, M. C. Muñoz, M. Julve, T. Granier, A. Bousseksou, F. Varret

Imaging the Condensation and Evaporation of Molecularly Thin Films of Water with Nanometer Resolution 267

J. Hu, X.-D. Xiao, D. F. Ogletree, M. Salmeron

Organic Transistors: Two-Dimensional Transport and Improved Electrical Characteristics 270

A. Dodabalapur, L. Torsi, H. E. Katz

A Strategy for the Chemical Synthesis of Nanostructures 272

W. T. Müller, D. L. Klein, T. Lee, J. Clarke, P. L. McEuen, P. G. Schultz

Testing Cosmogonic Models with Gravitational Lensing 274

J. Wambsganss, R. Cen, J. P. Ostriker, E. L. Turner

Imaging the Pore Structure of Geomaterials 276

J. T. Fredrich, B. Menéndez, T.-F. Wong

A Modular Steel Freeway Bridge: Design Concept and Earthquake Resistance 279

W. H. Wattenburg, D. B. McCallen, R. C. Murray

Specific DNA-RNA Hybrid Binding by Zinc Finger Proteins 282

Y. Shi and J. M. Berg

Killing of Trypanosomes by the Human Haptoglobin-Related Protein 284

A. B. Smith, J. D. Esko, S. L. Hajduk

Identification of a Dual Specificity Kinase That Activates the Jun Kinases and p38-Mpk2 286

A. Lin, A. Minden, H. Martinetto, F.-X. Claret, C. Lange-Carter, F. Mercurio, G. L. Johnson, M. Karin

Crystal Structure of the Mammalian Grb2 Adaptor 291

S. Maignan, J.-P. Guilloteau, N. Fromage, B. Arnoux, J. Becquart, A. Ducruix

Recruitment and Activation of PTP1C in Negative Regulation of Antigen Receptor Signaling by FcγRIIB1 293

D. D'Ambrosio, K. L. Hippen, S. A. Minskoff, I. Mellman, G. Pani, K. A. Siminovitch, J. C. Cambier

Activity-Dependent Action Potential Invasion and Calcium Influx into Hippocampal CA1 Dendrites 297

N. Spruston, Y. Schiller, G. Stuart, B. Sakmann

Synaptic Activation of Voltage-Gated Channels in the Dendrites of Hippocampal Pyramidal Neurons 301

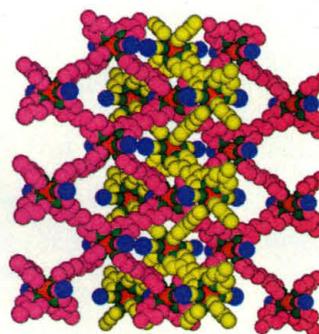
J. C. Magee and D. Johnston

Silver as a Probe of Pore-Forming Residues in a Potassium Channel 304

Q. Lü and C. Miller

Revealing the Architecture of a K⁺ Channel Pore Through Mutant Cycles with a Peptide Inhibitor 307

P. Hidalgo and R. MacKinnon



265

Spins and interlocking layers

AAAS Board of Directors

Francisco J. Ayala
Retiring President,
Chairman
Rita R. Colwell
President
Jane Lubchenco
President-elect

Anna C. Roosevelt
Alan Schriesheim
Jean E. Taylor
Chang-Lin Tien
Nancy S. Wexler

William T. Golden
Treasurer
Richard S. Nicholson
Executive Officer

William A. Lester Jr.
Simon A. Levin
Michael J. Novacek

■ **SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1333 H Street, NW, Washington, DC 20005.** Second-class postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 1995 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): \$97 (\$50 allocated to subscription). Domestic institutional subscription (51 issues): \$228. Foreign postage extra: Mexico, Caribbean (surface mail) \$53; other countries (air assist delivery) \$93. First class, airmail, student and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Printed in the U.S.A.

■ Indicates accompanying feature

Change of address: allow 6 weeks, giving old and new addresses and 11-digit account number. **Postmaster:** Send change of address to *Science*, P.O. Box 2033, Marion, OH 43305-2033. **Single copy sales:** \$7.00 per issue prepaid includes surface postage; 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, MA 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.



Particle physics: A burning topic of conversation?

Tune into
**The Nobel
Legacy**
on PBS.
For science
with spark.

In fact, it was a lively disagreement on a beach like this that inspired Nobel laureate Leon Lederman and his colleagues to imagine the 40-foot steel shield that detected the elusive muon neutrino, a subatomic particle. But that's not our point.

Our world is powerfully enriched by science and scientific

research. Yet science is an unlikely topic of conversation for much of the public. Many are simply unaware of science's everyday relevance.

This is why Baxter is underwriting *The Nobel Legacy*, a three-part PBS science series. Increasingly, the public is called upon to make important decisions about science,

on issues ranging from health-care delivery to supercollider funding. To make sound decisions, the public needs to become better informed.

Tune into *The Nobel Legacy* in April and May. In the medicine program, laureate Dr. J. Michael Bishop examines medical revolutions past and present. In

the physics program, Lederman dramatizes the startling uncertainty of subatomic particles. And in chemistry, laureate Dr. Dudley Herschbach probes chemistry's unlikely origins in nature.

Check local listings for dates and times.

Baxter

Water islands ...

The exact manner in which the first layer of water molecules sets down on a surface that is becoming wet has been difficult to follow experimentally. Scanning probe microscopies can in principle achieve atomic resolution, but their probe tips cannot be brought close to a wet surface without capillary forces perturbing the free liquid layer. Hu *et al.* (p. 267) have adapted an atomic force microscope by charging its tip and measuring the polarization forces induced in the surface layer with the tip at a small distance. Water in equilibrium with a mica surface shows two structures: At humidity up to 25 percent, water forms into two-dimensional islands less than 1000 angstroms across, but as the humidity increases the islands grow, and their morphology reflects the underlying geometry of the mica surface.

■

... and latex lands

Self-assembled monolayers (SAMs) and the atomic force microscope (AFM) have been put together to synthesize nanometer-scale structures. Müller *et al.* (p. 272) formed SAMs on a glass slide, terminating them with azide (N₃) groups. A platinum AFM tip, scanning the layers in the presence of hydrogen, selectively converted azides in some areas to amine groups. Derivatized latex beads then reacted only with the converted areas, generating a patterned surface structure.

■

Darkness visible

Comparing the observed distribution of galaxies in the sky with predictions from galaxy formation theories has been problematic because observa-

Signaling back and forth

The complex dendritic structure of hippocampal CA1 pyramidal neurons can transmit many thousands of individual synaptic inputs to the neuronal cell body where, if the integrated signal is high enough, an action potential is initiated. Investigations by Spruston *et al.* (p. 297) and Magee and Johnston (p. 301) into the propagation of signals along the dendrites reveal the complexity of a single neuron's signal-processing capabilities (see also news by Barinaga, p. 200). Spruston *et al.* demonstrate that somatic action potentials are transmitted back into the dendritic tree, activating different branches according to the pattern of the potentials. Magee and Johnston show that input through the tree turns on sodium and low threshold calcium channels but that the backpropagating action potentials are required for activation of the high threshold calcium channels. The backpropagating action potentials thus serve as a sophisticated feedback device to tell the dendritic tree whether and how the cell fired.

tions map out visible matter whereas theoretical universes tend to be dominated by invisible dark matter. Observations of gravitationally lensed quasars, however, whose images are split by galaxies along the line of sight, probe the underlying cosmic mass distribution, and Wambsganss *et al.* (p. 274) use computer simulation and ray-tracing to rule out a standard cosmology of critical density, with cold dark matter and a low Hubble constant, on the grounds that it predicts many more widely separated quasar image pairs than have been seen.

■

Filling in the gaps

The microscopic pore structure of rocks influences many physical properties, such as permeability and elasticity, but elucidating the three-dimensional connectivity of a material's porosity has been difficult. Friedrich *et al.* (p. 276) filled the pores in rock samples with a fluorescent epoxy and used laser confocal scanning microscopy to probe millimeter-thick sections of the material. Even in these relatively opaque

samples, use of intense laser light allowed vertical structure in the sections to be imaged so that a three-dimensional map of the



epoxy's distribution emerged. In a quartz sandstone, regions of high porosity had more sheet-like cracks than regions of low porosity; the loss of connectivity explains why permeability falls sharply with lower porosity.

■

Hybrid attraction

There are as many as a thousand different zinc finger proteins of the Cys₂His₂ type produced in higher vertebrates. Although the function of most of these proteins is unknown, many have been found to bind DNA in a sequence-specific manner. Shi and Berg (p. 282) have found that some zinc finger proteins bind to DNA-RNA hybrids in a sequence-specific manner and with a greater af-

finity than to DNA alone. Because DNA-RNA hybrids occur during replication, transcription, and retroviral reverse transcription, it is possible that some zinc finger proteins may perform a biological function during these processes.

■

Trypanocide identified

Although certain trypanosomes can cause human diseases such as African sleeping sickness, other closely related trypanosomes are harmless to humans and affect only cattle. This difference in host specificity is due to a protective factor in human blood, called trypanosome lytic factor (TLF). Smith *et al.* (p. 284; see also news by Schmidt, p. 204) have identified a key component of TLF as haptoglobin-related protein, an apolipoprotein that binds free hemoglobin in the blood. TLF has peroxidase activity, and may kill the cattle trypanosomes through oxidative damage.

■

Channel mapping

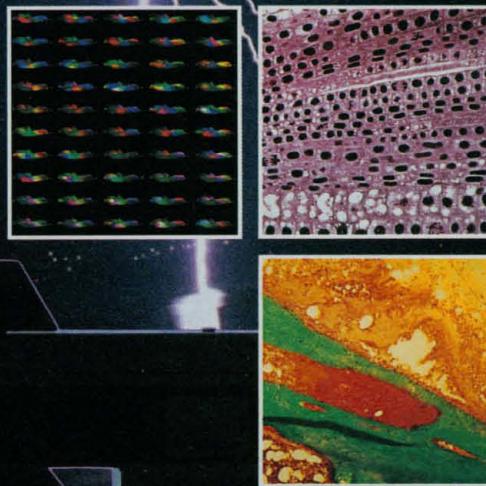
Neuronal function relies on the ability of ion channels to discriminate between sodium and potassium, two comparably sized alkali metal cations. Two reports provide further details of the architecture of the potassium channel pore in which this discrimination occurs. Lü and Miller (p. 304) use silver ions to probe for the sulfhydryl of cysteine residues that have been singly substituted into each of the amino acid positions lining the pore. Hidalgo and MacKinnon (p. 307) map residues framing the pore on the basis of complementary mutations in the channel and an inhibitory scorpion toxin that resides in the vestibule.

The Power to Inspire

Leica is the inspiration for throwing light on increasingly complex research problems. Leica provides an efficient range of equipment to suit the whole spectrum of your scientific work:

The universal LEICA DM R research microscope, the LEICA TCS 4D confocal module and the range of LEICA QUANTIMET image analysis systems can solve the most demanding applications.

By harnessing state-of-the-art technologies, research results can be produced in an incredibly short time. Only Leica can give you a coordinated product range from visualisation through analysis to results. Please call us for further details.



M&SI 1/94 e

Leica Microscopy and Scientific Instruments Group
CH-9435 Heerbrugg, Switzerland
Tel.: +41 71 70 30 19
Fax: +41 71 72 78 25

Circle No. 35 on Readers' Service Card

Leica

Picture Perfect



KODAK Products and Techware — the perfect match for scientific imaging.



When it comes to your biological imaging and analysis product needs, there's no better choice than KODAK products from Sigma-Aldrich Techware.

A single phone call is all it takes to gain immediate access to the complete KODAK Scientific Imaging Systems product line...as well as over 10,000 other brand name laboratory equipment and supply products.

In addition to a wide selection of top quality laboratory products, Sigma-Aldrich Techware backs each

purchase with unequalled service and support, including:

- Same day shipping
- Comprehensive technical support
- Competitive pricing



If your research calls for biological imaging and analysis products that are picture perfect, choose KODAK products from Sigma-Aldrich Techware—your single, most convenient source for brand name laboratory equipment and supplies.

SIGMA[®]

Where Science and Service Come Together.

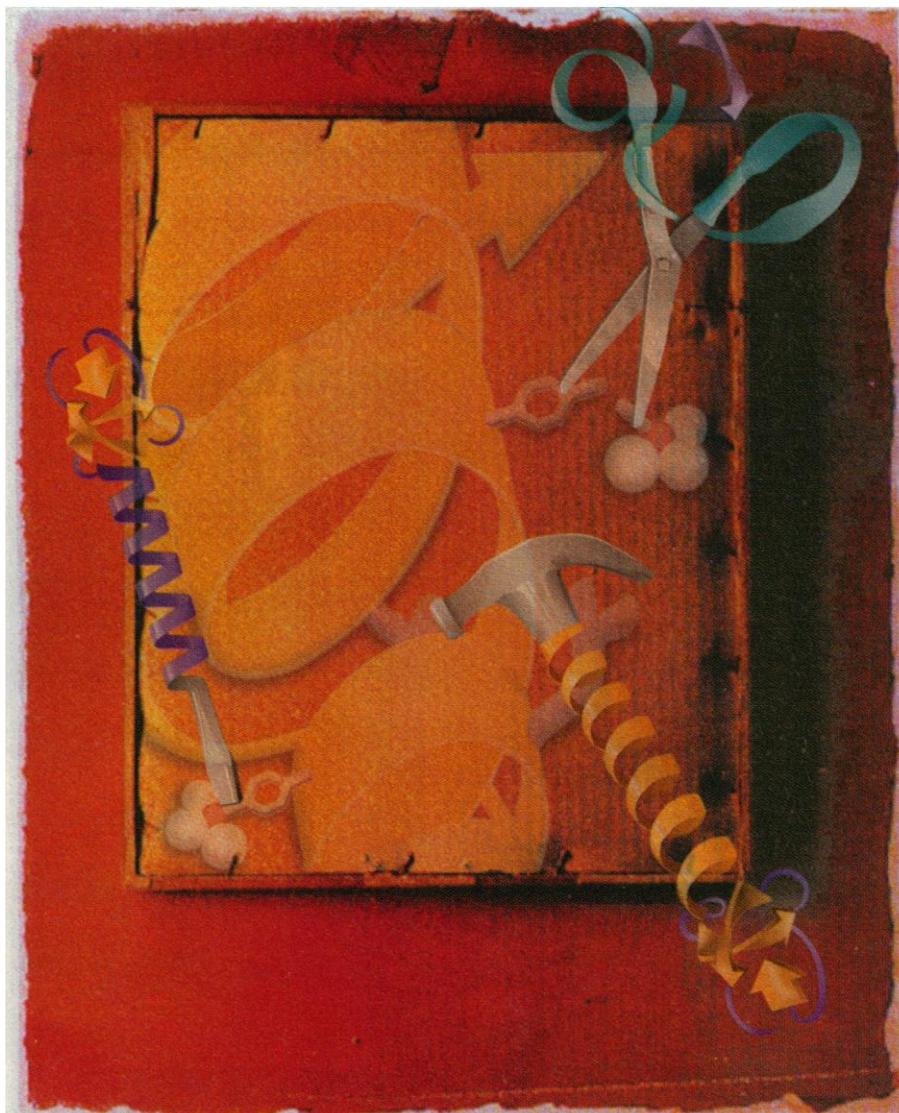
Call collect: 314-771-5750,
800-325-3010,
or contact your local Sigma office.

SIGMA-ALDRICH
Techware
FROM BENCHTOP TO BOOKSHELF

AUSTRALIA AUSTRIA BELGIUM BRAZIL CZECH REPUBLIC FRANCE GERMANY HUNGARY INDIA ITALY JAPAN
KOREA MEXICO NETHERLANDS POLAND SPAIN SWEDEN SWITZERLAND UNITED KINGDOM UNITED STATES

A Sigma-Aldrich Company

Circle No. 14 on Readers' Service Card



The Modern Art of Protein Modification

New England Biolabs offers new Protein Tools, including p34^{cdc2}/cyclin B, Protein Phosphatase 1 (PP1) and its specific

inhibitor, I-2, all from recombinant sources. These reagents feature exceptional purity, rigorous quality assessment and unparalleled low cost. They are complemented by Broad Range Protein Molecular Weight Markers available in unstained, prestained

and biotinylated versions. See the new 1995 catalog for full details.

For more information on Protein Modification products from New England Biolabs contact us at 1-800-NEB-LABS or via the internet at info@neb.com.

Protein Kinases/ Inhibitors

p34^{cdc2}/cyclin B

PKA

Casein Kinase I

Casein Kinase II

GSK-3

PKI (specific PKA inhibitor)

Protein Phosphatases/ Inhibitors

LAR

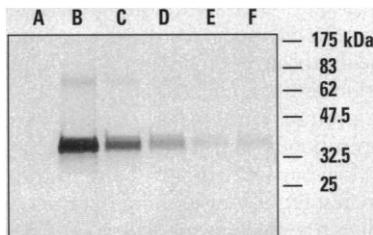
YOP

T-Cell

Lambda

PP1

I-2 (specific PP1 inhibitor)



SDS-PAGE/Autoradiograph of Histone H1 incubated with no enzyme (A) or 2 units of p34^{cdc2}/cyclin B kinase (B-F) under standard reaction conditions. After heat inactivation of kinase, Histone H1 was dephosphorylated using 0.1 (C), 0.2 (D), 0.5 (E), or 1 (F) unit of Protein Phosphatase 1 (PP1). Molecular weights were determined using prestained molecular weight marker (Cat# 7707).

New England Biolabs Inc. 32 Tozer Road, Beverly, MA 01915 USA 1-800-NEB-LABS Tel. (508) 927-5054 Fax (508) 921-1350 email: info@neb.com
 New England Biolabs Ltd., Canada Tel. (800) 387-1095 (905) 672-3370 Fax (905) 672-3414 email: info@ca.neb.com
 New England Biolabs GmbH, Federal Republic of Germany Tel. (0130) 83 30 31 (06196) 3031 Fax (06196) 83639 email: info@de.neb.com
 New England Biolabs (UK) Ltd. Tel. (0800) 31 84 86 (01462) 420616 Fax (01462) 421057 email: info@uk.neb.com

DISTRIBUTORS: Australia (075) 94-0299, Belgium (0800) 1 9815, Brazil (011) 66-3565, Denmark (31) 56 20 00, Finland (90) 420-8077; France (1) 34 60 24 24, Greece (01) 5226547; Hong Kong 649-9988; India (542) 311473; Israel (03) 5351205; Italy (02) 38103171; Japan (03) 3272-0671; Korea (02) 556-0311, Mexico (5) 519-3463; Netherlands (033) 95 00 94; New Zealand (09) 418-3039; Norway 22 22 04 11; Singapore 4457927; Sweden (08) 7348300; Switzerland (061) 481 47 13; Taiwan (02) 8802913

Circle No. 68 on Readers' Service Card

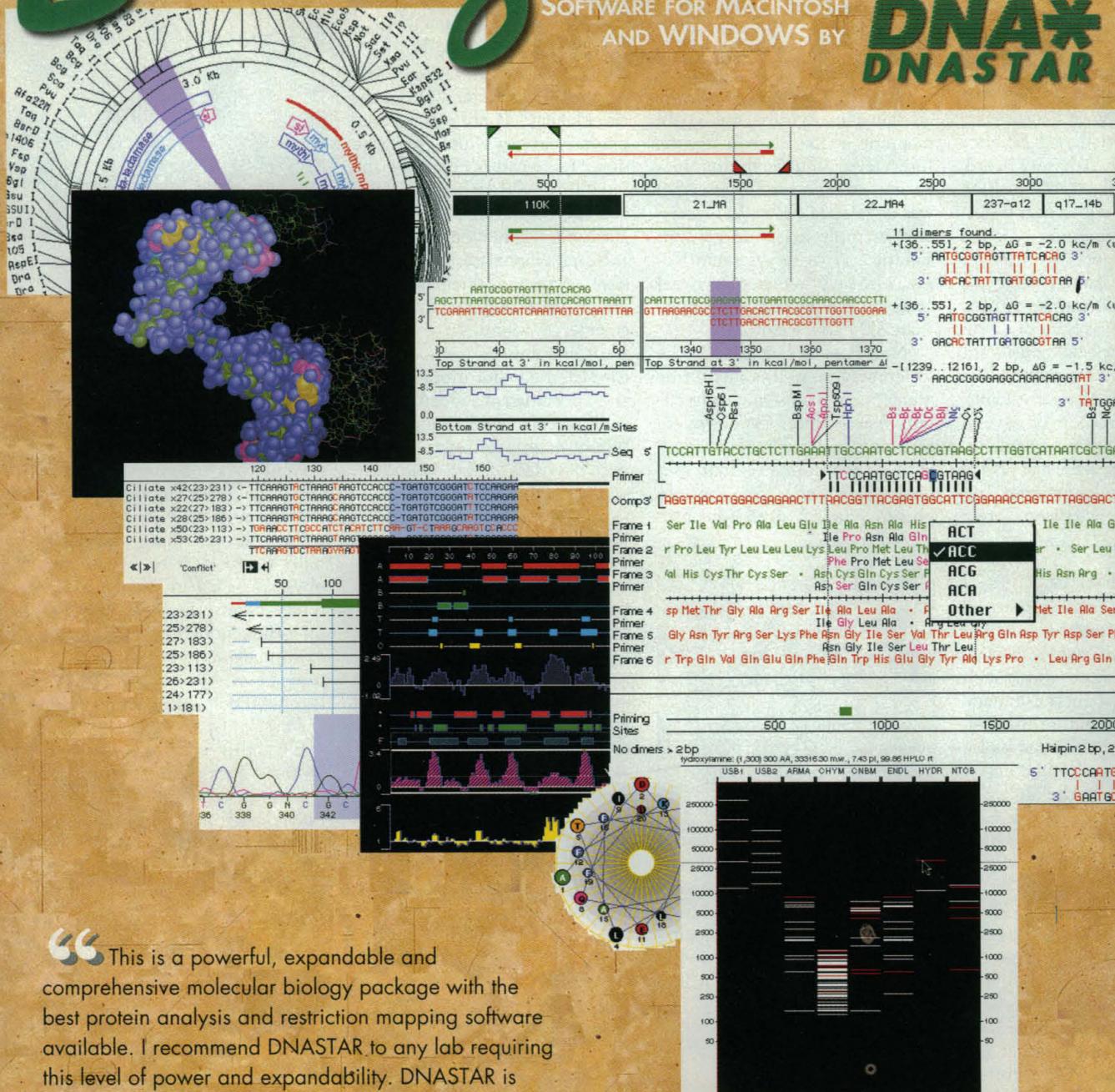
NEW ENGLAND
Biolabs®

20 years and beyond...

LaserGene

SOFTWARE FOR MACINTOSH
AND WINDOWS BY

DNASTAR
DNASTAR



BIOCOMPUTING

“ This is a powerful, expandable and comprehensive molecular biology package with the best protein analysis and restriction mapping software available. I recommend DNASTAR to any lab requiring this level of power and expandability. DNASTAR is currently unique in its support for networking as well.

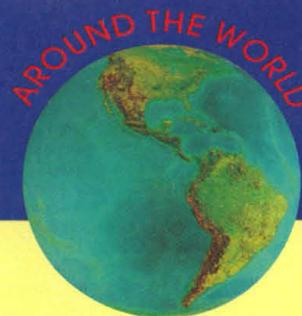
Peter Markiewicz, UCLA

LASERGENE is the best network system available. Easy installation and management make it an intelligent choice for every network. Simultaneous client licensing is a fair and honest method for delivering such sophisticated power.

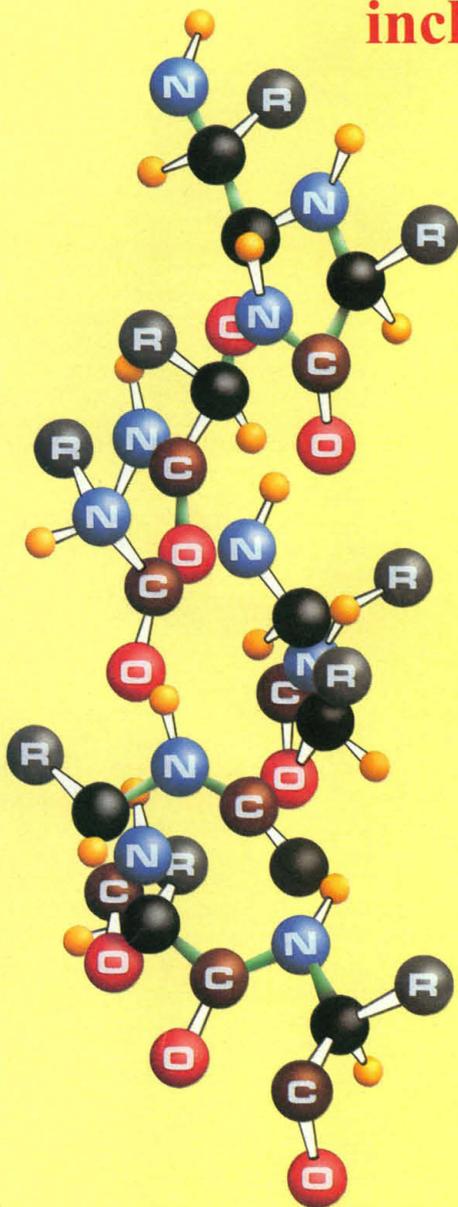
Mitch Sogin, Marine Biological Laboratory ”

Find out for yourself. Call DNASTAR for research consulting and evaluation software systems
 In USA: (608) 258-7420 Fax (608) 258-7439 In Europe: (44)-81-566 8282 Fax (44)-81-566 9555
 Circle No. 64 on Readers' Service Card Internet: support@dnastar.com

Custom made
PEPTIDES



**Mass Spectral and HPLC Analysis
included with all peptide orders**



\$ **20.**^{00*}
residue

Discovery Scale
\$150.00 per peptide
♦ 1 mg in 5 - 10 days
♦ Mass Spec. Included
♦ 8 - 15 residues

Serving your peptide needs since 1984

- 8 - 30 residues
- 15 - 40 mgs
- Shipped in 5 - 8 days

* desalted

Antiserum Production - \$1,150.00

- Peptide design and synthetic carrier conjugation
- Immunization of 2 rabbits
- Elisa testing
- 60 - 100 ml of antiserum

Peptide synthesized using latest Fmoc solid phase methods utilizing MAP resin technology which increases the antigenic response. Carrier protein conjugation service also available.

Full Line of Services

Phosphorylation, Cyclization, Dye labeling, large scale synthesis, and much more
Please call our technical staff for more information.

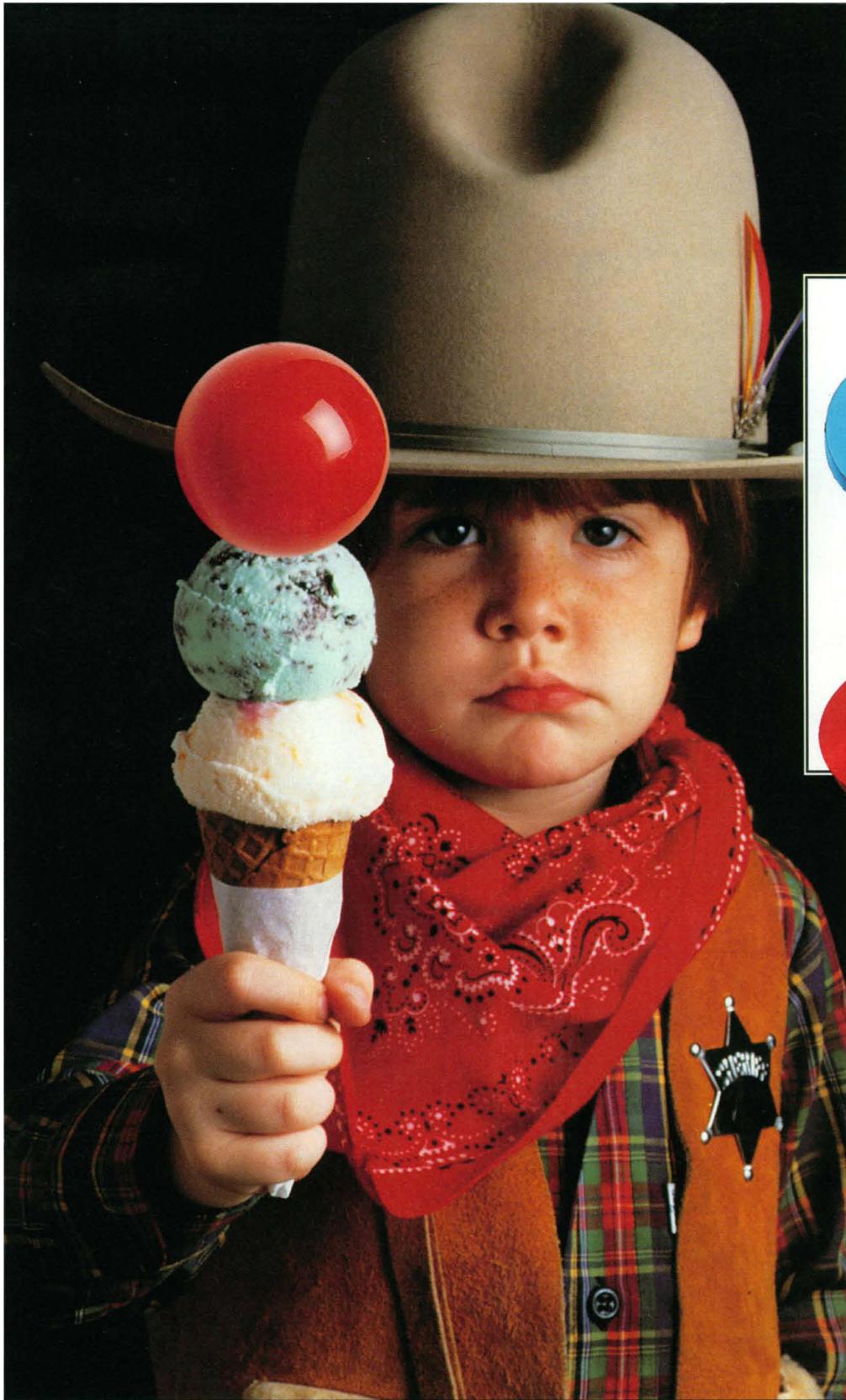
BIO-SYNTHESIS, INC.

Toll Free: (800) 227-0627

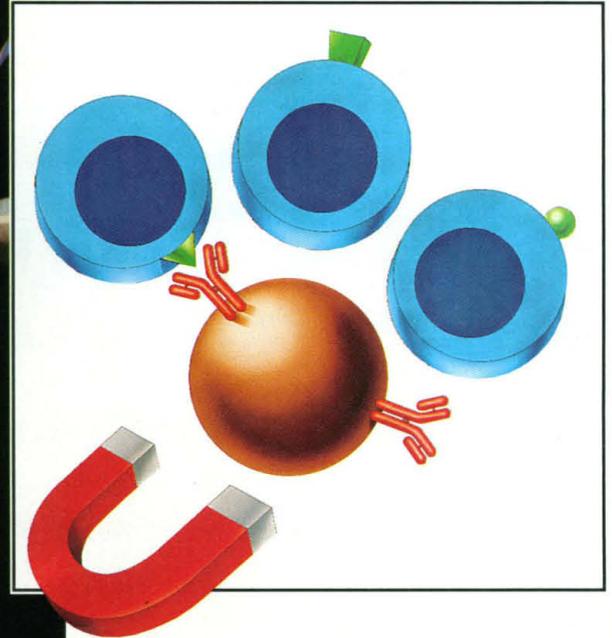
Fax: (214) 420-0442

Ph: (214) 420-8505

E-mail: Biosyn@aol.com



For some
only the best
will do



It takes talent
to recognize excellence,
but it takes
determination to use it.

Dynabeads®:

Opening new frontiers in
biomagnetic cell separation

Uniquely designed to minimize
cell loss and activation.

Big words? – Try us!

 **DYNAL**®

Making complicated bioseparations simple, rapid and reliable.

DYNAL A.S., P.O.BOX 158 SKØYEN, N-0212 OSLO, NORWAY. TEL: +47 22 06 10 00. FAX: +47 22 50 70 15

DYNAL (U.K.) LTD., TEL: (0151) 346 1234. FAX: (0151) 346 1223
DYNAL, INC., TEL: (800) 638 9416. FAX: (516) 326 3298
DYNAL FRANCE S.A., TEL: (44) 23 45 95. FAX: (44) 23 16 14

NIHON DYNAL K.K., TEL: (03) 3435 1558. FAX: (03) 3435 1526
DEUTSCHE DYNAL GMBH, TEL: (040) 36 68 11. FAX: (040) 36 60 40
DYNAL (AUSTRALIA) PTY. LTD., TEL: (1-800) 623 453. FAX: (03) 663 6660

Circle No. 12 on Readers' Service Card

It's a chemist's best friend.

Ask the very enthusiastic Ben Sallard why he and his fellow chemists in Process Tech use Power Macintosh™, and you'll get more reasons than can fit in one ad. A lot more.

Because they don't just use the RISC-based Power Macintosh to explore the intricacies of new chemical compounds. They also use it to collaborate with microbiologists, environmentalists, analysts and economists — in short, the different “ists” all around the world who help Sandoz Agro develop and market new products. They use Power Mac™ to connect to the Internet, where they can share select findings with the scientific community at large. (And make sure other findings haven't yet been found.) They even use Power Macintosh to save money.

Like the time they went off and optimized a deprotonization on a Mac™ instead of building a pilot plant. And saved \$30 million. That made the whole group look good. And bred a new kind of loyalty between Ben and his Mac. The kind usually reserved for someone named Spot.





Benjamin W. Sallard, Jr.
Chemist
Network Administrator
Process Technology Group
Sandoz Agro, Inc.
Des Plaines, Illinois

As part of a multinational life sciences company with more than 1,200 employees in the U.S. and Canada, Sandoz Agro specializes in the development and manufacture of environmentally sensitive biological, biochemical and chemical pest control products.

"If all you want to do is data acquisition, sure, you can do it on a Windows PC. But if you want to connect to a Novell server and a VAX and an AS/400, and you want to run business apps, and you need to do it now, then you need a Power Mac. Anyone who thinks there is a faster or easier way to accomplish all that is, well, barking up the wrong tree."



Process Tech scientists at Sandoz Agro are charged with finding the fastest, easiest and most cost-efficient ways to produce everything from herbicides and fungicides to flea control products for the family pet. Their latest finding? "Power Mac has the power we need to stay competitive."

Sandoz Agro chemists use LabVIEW and Power Mac to control and analyze complex chemical reactions from their desktops while they continue with other work. And that's just one example of the hundreds of powerful scientific, engineering and design applications that have been optimized for the RISC-based PowerPC™ chip at the heart of Power Macintosh.



Every Power Mac can read, write and format disks for DOS, Windows and OS/2. And every Power Mac lets you open and work with DOS and Windows files. If you need more compatibility than that, the Power Macintosh 6100/66 DOS Compatible includes both a 66 MHz 486DX2 and a PowerPC 601 microprocessor in one PC.



Macintosh™ has always been known for graphical aptitude. But what kind of graphic is this? It's the Frontier™ molecule, as visualized by a Sandoz Agro chemist with Chem3D Plus. And that's just the start. With Power Macintosh and Apple® innovations like QuickDraw™ 3D and QuickTime™ VR, 3-D visualization and virtual reality become as easy as, well, using a Mac.



Get to know Power Macintosh. To learn how Power Macintosh can fit into your scientific, engineering or design environment, call **800-487-6809** to receive free information by fax.

Or, if you prefer, give us a call at **800-554-3848** and ask for **ext. 550** to receive your free Power Macintosh Solutions Kit by mail.

Power Macintosh.
The business Macintosh.

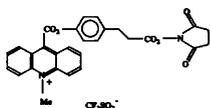


© 1995 Apple Computer, Inc. All rights reserved. Apple, the Apple logo, Macintosh and QuickTime are registered trademarks of Apple Computer, Inc. Mac, Power Mac, Power Macintosh and QuickDraw are trademarks of Apple Computer, Inc. PowerPC is a trademark of International Business Machines Corporation, used under license herefrom. All Apple products are designed to be accessible to individuals with disability. To learn more (U.S. only), call 800-776-2333 or TDD 800-833-6223.

Quality for the Next Century

Chemiluminescent Reagents

Acridinium C₂ NHS Ester



- Highest Specific Activity Direct Label Available
 - Label Peptides & Proteins Directly
 - Measure Proteins at < 0.2 attomole
 - Use Labeled Antibodies to Develop Fast, Super Sensitive Immunoassays
 - Our **Flashlight™** Acridinium Ester Labeled Reagents:
 - Streptavidin
 - GxMIgG
 - Protein A
 - Biotin
 - GxRIgG
 - Protein G
 - Stable to: Heat, Organics, and Reducing Agents
 - Conditions Enzymes Cannot Tolerate
 - Chemi- & Bioluminescent Substrates: Schiff's Bases, Coelentrazine & Firefly Luciferin
- Ask About Custom Labeling, Chemical Synthesis and Licensing!

100 % Quality Guarantee

Assay designs' products are guaranteed to work.

Because we have been making the highest quality immunoassay products for clinical diagnosis for over a decade you are assured of consistent results of the highest integrity.

Doesn't your research deserve the highest quality and performance? If so, call us today.

Ask About Our Educational Discounts!

Assay

designs, inc.

Telephone: (313) 668-6113
Fax: (313) 668-2793

In Japan: Funakoshi Co. Ltd.
Telephone: 81-3-5684-1622
Fax: 81-3-5684-1633

Circle No. 50 on Readers' Service Card

Immunoassay Kits

Correlate-EIA™ Enzyme Kits

- The Leader in Quality, Precision, and Reproducibility
- Stable, Color-Coded Reagents
- No Reconstitution! No Crimps!
- EIA Results in Less than 3 Hours
- Use Serum, Plasma, Media, Urine, or Saliva, Without Tedious Extractions

Also, Correlate-CLIA™ Kits: Chemiluminescent Immunoassays

- 10x more sensitive than any other kit
- Or, precise results in 15 minutes

Our Monoclonal PGE₂ Voted the Best!

- Kits currently available: PGE₂, TXB₂, PGF_{2α}, 6-keto-PGF_{1α}

Coming soon: cAMP and cGMP

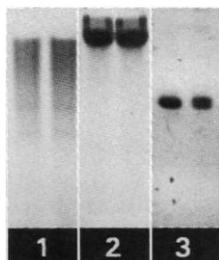
Miscellaneous Antisera Available

Lot Specific QC Analysis with Each Kit!

MOLECULAR RESEARCH CENTER, INC. presents SMART SOLUTIONS

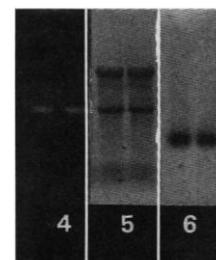
The most reliable and cost-effective reagents for DNA and RNA isolations. Using separation technology based on the recognition of target molecules by a liquid phase, these innovative reagents outperform traditional DNA and RNA isolation methods. No enzymatic treatments! No columns! No prolonged protocols!

DNAzol™, a new standard of simplicity and effectiveness in the isolation of high quality genomic DNA, developed by P. Chomczynski.



- Requires only 10 - 30 minutes
- Effective with cells, tissue and liquid samples, including blood.
- No phenol or other toxic agents
- Isolated DNA ② is ready for Southern blotting, restriction analysis ①, PCR ③, molecular cloning and other applications.

TRI REAGENT®, the most advanced version of the single-step method of RNA isolation.



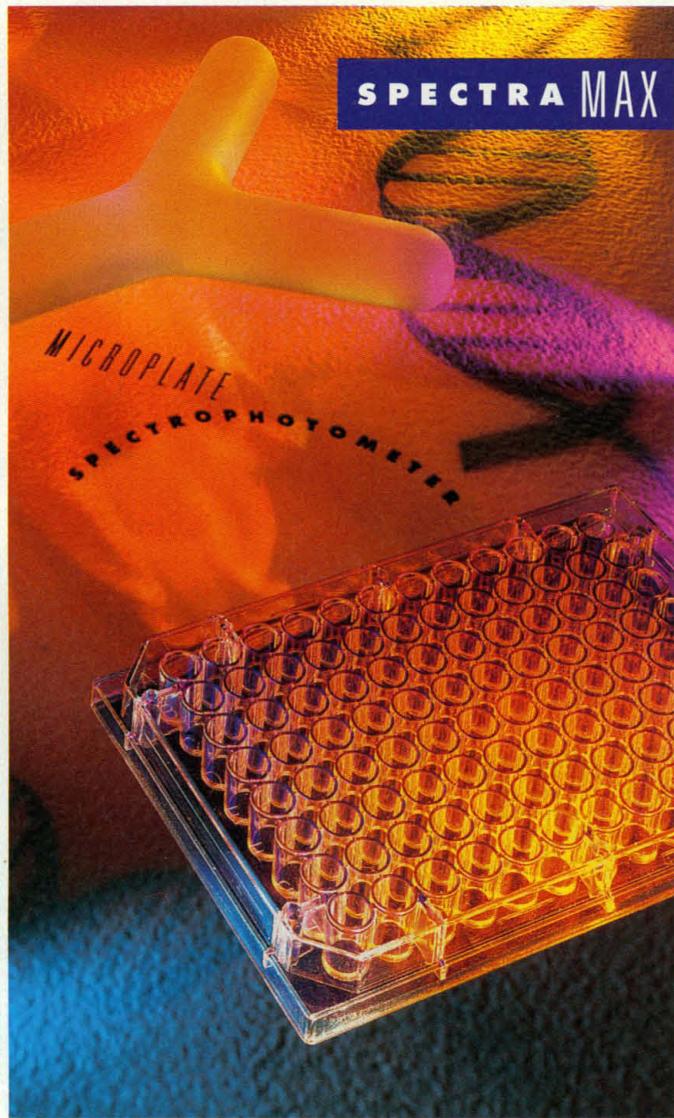
- Isolates high quality total RNA in less than one hour
- Can be used to simultaneously isolate RNA, DNA and proteins
- Effective with cells, tissue and liquid samples, including blood.
- Isolated RNA ⑤ is ready for Northern blotting ④, RT-PCR ⑥, and other applications

For information or to place an order from USA, Canada and countries not listed below call 1-800 462-9868, 513-841-0900 or Fax 513-841-0080.

MRC
MOLECULAR RESEARCH CENTER, INC
5645 Montgomery Rd. Cincinnati, OH 45212

AUSTRALIA: A.G.P. Technologies Pty Ltd 61-7-3419702 Fax 61-7-841-3422; FRANCE: Euromedex 33-88-180722 Fax 33-88-180725; GERMANY: BioTech Trade & Service GmbH 49-6227-51308 Fax 49-6227-53694; INDIA: Lab Care Products 91-11-6425156 Fax 91-11-6425156; ISRAEL: Tal Ron 972-8-472563 Fax 972-8-471156; ITALY: Bio-Optica Milano SpA 39-2-2640274 Fax 39-2-2153000; KOREA: Choong Il Chemical, Inc 822-2948411 Fax 822-2936556; MALAYSIA: Technicvest Sdn. Bhd 603-6320998 Fax 603-632-0994; SWITZERLAND: Lucerna Chem Ag 41-41-369636 Fax 41-41-369656; TAIWAN: Pan Asia Biomedical Technology, Inc. 886-2-7418169 Fax 886-2-7764372; UNITED KINGDOM: Molecular Research Centre Oxford 44-1993-706736 Fax 44-1865-351511.

Circle No. 2 on Readers' Service Card



SPECTRA MAX 250

Now... Read DNA, RNA, and Proteins Directly



SPECTRAmax 250:
IT'S MORE THAN A MICROPLATE READER



SPECTRAmax™ 250 combines the tunability of a spectrophotometer with the efficiency of a microplate reader. Simplify your analysis using the speed and convenience of a microplate format.

Direct UV measurements in a microplate

Directly determine the concentration of up to 96 different DNA, RNA, or protein samples in a few seconds using a SPECTRAplate UV transparent disposable or quartz microplate. Protocols are included to measure the purity of DNA samples by calculating A 260/A 280 ratios. Use up to six different wavelengths to quantitate your samples.

UV/VIS Spectra Scans

Perform a spectral scan from 250-750 nm, in 1 nm increments, on all 96 wells of your microplate to determine the absorption maxima of your sample. Analyze column fractions or characterize the composition of inorganic samples.

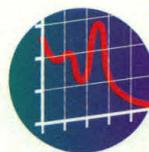
New SOFTmax® PRO

The built-in spreadsheet capabilities of SOFTmax® PRO give you complete control of calculations and data presentation.

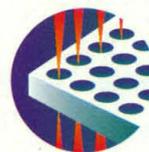
Discover the advantages of SPECTRAmax 250 – contact your local representative today at 1-800-400-9060



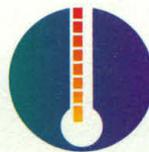
TUNABLE WAVELENGTH



SPECTRA ANALYSIS



UV TRANSPARENT MICROPLATE



PRECISE TEMP. CONTROL



1311 Orleans Dr., Sunnyvale, CA 94089
(800) 400-9060



In Perfect Balance

According to the ancient Chinese philosophy of yin and yang, the universe is composed of opposing but interdependent forces. ■ Interestingly, this philosophy resembles the concept of homeostasis, the natural balance that occurs within living organisms, including the harmony between antagonists and agonists that regulate vital functions. Thus, an important factor in the search for new medicines is the development of compounds that work together with the body's own restorative and regenerative abilities. ■ To lead healthy lives, we must seek balance with nature, with society, and within ourselves. Through pharmaceutical research, we are striving to help people attain this balance.

TAKEDA
Takeda Chemical Industries, Ltd.

Head Office: 1-1, Doshomachi 4-chome, Chuo-ku, Osaka 541, Japan Tokyo Head Office: 12-10, Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan

Circle No. 7 on Readers' Service Card

Optically enhanced densitometry for DNA, protein gels, blots, sequencing films and RFLP studies. Any type of image.

Densitometry and image analysis via transmission or reflectance, visible light or uv, using Mac or PC.

Worldwide. *No Limitations.*

We invite you to call for more details.



NightHawk™: The system for photodocumentation of ethidium bromide gels.



NO LIMITATIONS



Optically Enhanced Densitometry™:
0-3 O.D. combined with 42µm resolution and automatic calibration for superb 12-bit data input and software that knows what to do with it.



Circle No. 57 on Readers' Service Card

In North America:

Fisher Scientific
(U.S.A. Only)
Tel: 1.800.766.7000
Fax: 1.800.926.1166 or

PDI, Inc.
Tel: 1.800.777.6834
Fax: 1.516.673.4502

In Europe:

Contact your local
Pharmacia Biotech
office or Fax:
+31.1650.80449

In Japan:

Toyobo Co., LTD.
Tel: +81.6.348.3786
Fax: +81.6.348.3833

In Taiwan:

**Tseng Hsiang Life
Science LTD.**
Tel: +886.2.785.1156
Fax: +886.2.788.5896

In Korea:

**Seoulin Scientific
Co., LTD.**
Tel: +82.2.548.5911
Fax: +82.2.549.5572

In India:

Optima Biotech
Tel: +91.40.841208
Fax: +91.40.815183

In Rest of World:

PDI, Inc.
Attn: International Sales
Manager
405 Oakwood Road
Huntington Station,
NY, 11746 U.S.A.
Tel: 1.516.673.3939
Fax: 1.516.673.4502

MISSION POSSIBLE

What was once thought difficult, is now made easier.
TaKaRa offers a comprehensive line of innovative products and services
that will shape the future of and contribute to
the success of your genome research.

Custom Sequencing Service for megabase DNAs available
at Low Cost (\$1.99/bp*) with Rapid Turnaround Time.

Powerful PCR Products for Long and Accurate
DNA Amplification, Cloning, and Mutagenesis along with
an extensive and proven line of
Molecular Biology products.

Expert Technical Support Services assuring Maximum
Product Performance.

**subject to change*

Contact us to make your genome mission possible and successful.



BIOMEDICALS

TAKARA SHUZO CO., LTD.

Biomedical Group
Otsu, Shiga, Japan
Tel : +81 775-43-7247
Fax : +81 775-43-9254

Distributor (North and South Americas)



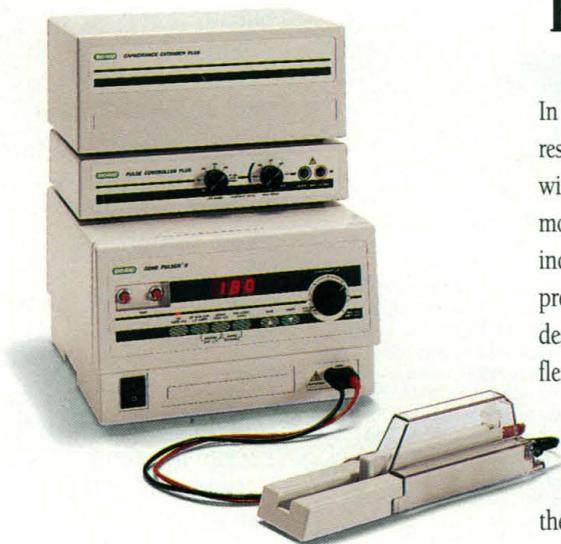
PanVera Corporation
Madison, WI 53711 USA
Tel : 800 791-1400
: +1 608-233-5050
Fax: +1 608-233-3007
e-mail: info@panvera.com

TaKaRa's PCR related products are sold under licensing arrangements with Roche Molecular Systems and F. Hoffmann-La Roche Ltd. and The Perkin-Elmer Corporation. Purchase of these products is accompanied by a limited license to use them in the Polymerase Chain Reaction (PCR) process for research in conjunction with a thermal cycler whose use in the automated performance of the PCR process is covered by the up-front license fee, either by payment to Perkin-Elmer or as purchased, i.e., an authorized thermal cycler.

Circle No. 8 on Readers' Service Card

PulseTrac

With **PulseTrac** Delivery the Gene Pulser® II System offers Unprecedented Electroporation Performance



In electroporation, precise pulse delivery is essential for reproducible results. The Gene Pulser II system provides maximum reproducibility with **PulseTrac**, an exclusive pulse delivery feature. **PulseTrac** monitors and compensates for subtle variations in the pulse circuit, including minute sample-to-sample differences, for unparalleled precision. The Gene Pulser II system retains the proven modular design of the original Gene Pulser system. This ensures maximum flexibility and accommodates future upgrades. Each module provides the greatest power and range of appropriate settings for optimizing a specific application. The result is unprecedented electroporation performance. To find out how **PulseTrac** and the Gene Pulser II system can deliver for you, call 1-800-4BIORAD or your local Bio-Rad representative today.

BIO-RAD

**Bio-Rad
Laboratories**

Life Science Group

US (800) 4BIORAD • AU 02-805-5000 • AT (1)-877 89 01 • BE 09-385 55 11 • CA (905) 712-2771 • CN (01) 2051873 • FR (1) 49 60 68 34 • DE 089 31884-0 • IT 02-21609 1 • JP 03-3534-7665 • HK 7893300 • NL 08385-40666 • NZ 09-443 3099 • SG (65) 443 2529 • ES (91) 661 70 85 • SE 46 (0) 8-735 83 00 • CH 01-810 16 77 • GB 0800 181134

SIG 071494

Circle No. 23 on Readers' Service Card

THE NEW STANDARD FOR NON-ISOTOPIC DETECTION

Rad-Free® Products for Detection of Southern, Northern and Westerns

S&S is widely recognized for having set the standard in transfer membrane technology. Now, to meet the evolving needs of researchers looking for an alternative to radioisotopes, we have developed the Rad-Free line of non-isotopic labeling and detection products. Based on the positive feedback from researchers using Rad-Free systems, it is clear that this integrated line of products is setting new standards for sensitive detection of Southern, northern, and western blots.

S&S Rad-Free non-isotopic detection products provide increased sensitivity and ease of use for the rapidly expanding segment of the research community exploring alternative options to radioactivity. Our modular line of kits and accessory products ensure consistency and compatibility for the probing and detection of membrane-immobilized nucleic acids and proteins.



Superior Sensitivity



100 pg 20 pg 4 pg .8 pg .16 pg .032 pg

Rad-Free probe labeling and chemiluminescent detection achieves low femtogram sensitivity after 70 minute exposure. Dilutions of EcoRI-linearized pUC19 (2.7 Kb) were immobilized on Max-S Nytran® membrane (0.2 µm), and probed with EcoRI-digested pUC19 at concentration of 65 ng of probe per ml of hybridization solution using the S&S Rad-Free Probe Labeling and Hybridization Kit. Blot was incubated with streptavidin alkaline phosphatase conjugate, followed by detection. Detection: Blot was placed on Rad-Free Lumi-Phos 530 chemiluminescent substrate sheet and exposed to x-ray film for 70 min. at 37°C.



100 50 25 12.5 6.25 3.13 1.6 .80 .40 .20 .10 .05 .025 .0125
β-galactosidase (ng)

Sensitive chemiluminescent detection of immunoblot on PVDF using Rad-Free Western Kit. 14 dilutions of β-galactosidase (from E. coli, MW 135 kD) were separated on a 10% gel. Transfer to Westran PVDF membrane was effected using the Pronto® Semi-Dry Blotter and a modification of the discontinuous buffer system of Kyhse-Andersen. A mouse MoAb to β-galactosidase was used to detect the antigen and the Rad-Free goat anti-mouse/alk-phos conjugate at 1:20,000 dilution was used to detect the MoAb. Target protein was visualized by a 1 hour exposure of the membrane to Rad-Free Lumi-Phos 530 substrate sheets on x-ray film.

† Sold as "Sammy Dry" outside the United States and Canada.

1-800-245-4024

Schleicher & Schuell

United States: Keene, NH, USA 03431 • Tel 800/245-4024 • 603/352-3810 • Fax 603/357-3627
Germany: P.O. Box 4, D-37582 Dassel, Germany • Tel (05561-7910) • Fax (05561-791 536)

Rad-Free Probe Labeling & Hybridization Kits

Non-enzymatic chemical labeling provides sensitivity comparable to ³²P with high signal-to-noise ratios. The system is easy to use and offers one-hour labeling with high, predictable yields of labeled probes.

Rad-Free Western Kits

Designed to detect <5 pg of blotted protein easily. Three conjugate kits are available: goat anti-mouse, goat anti-rabbit and goat anti-human.

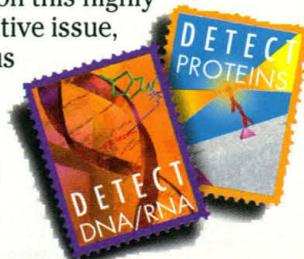
Choice of Rad-Free Substrates

Choice of detection with Lumi-Phos® 530 Chemiluminescent Substrate Sheets* or BCIP/NBT Colorimetric Substrate Tablets.

Choice of Membranes

Detection can be performed on S&S Protran/Optitran™ NC, Nytran® nylon or Westran® PVDF membranes.

Inevitably every lab will need to make a decision about isotopic use. Find out how S&S Rad-Free products can eliminate these concerns without sacrificing sensitivity or dependability. If you would like to receive technical literature on this highly sensitive issue, call us now.



* U.S. Patent No. 5,382,516
Lumi-Phos® is a registered trademark of Lumigen Inc., Detroit MI

ANNOUNCING JANDEL SIGMAPLOT 2.0 FOR WINDOWS

The Proof is in the Plotting

Numerous Scientific Graph Types

Contour, 3D Mesh, 3D Scatter, Grouped Bar Charts, Vector, Histograms, Stacked Bar Charts and many more

Customize Every Detail

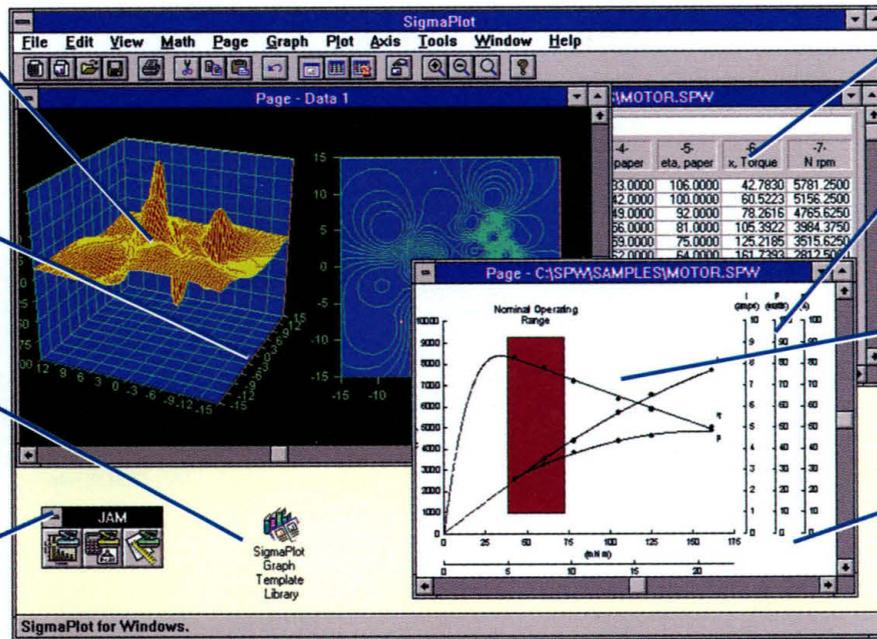
Multiple plots on one graph • Multiple graphs on one page • Bitmapped images within graphs

Optional SigmaPlot Graph Library

Instantly open one of over 150 publication and presentation-quality graph templates

SigmaLink™ to Other Jandel Products

With a single mouse click, switch between Jandel SigmaPlot, SigmaStat, and SigmaScan/Image



1,000,000,000 Cell Worksheet

Import Excel® 1-2-3®, Quattro®, dBASE® and others • Powerful transform language

Complete Axis Control

Multiple vertical and horizontal axes • Axis breaks • Linear, semi-log, log, logit, probit, and probability axis scales

Multidimensional Nonlinear Curve Fitting

10 independent variables • 25 parameters • Piecewise continuous, multifunctional, weighted, and Boolean functions

True WYSIWYG for Publication Quality Output

What you see really is what you get, so you will get the print output you want on any Windows-supported device

JANDEL SIGMAPLOT®: POWER AND FLEXIBILITY FOR THE MOST PRECISE PLOTS

Award-winning Jandel SigmaPlot 2.0 for Windows™ — the best just got better. For over twelve years, scientists have trusted SigmaPlot more than any other technical graphing program to prepare their graphs for publication. Now, new version 2.0 gives you contour plots, multi-line text, custom zooming, automatic legends, and more. You can control every detail of your graph to show data the way you want. We've made our point. Now let us prove it.

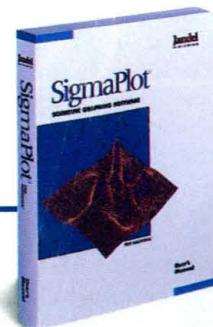
FOR MORE INFORMATION, OR TO ORDER JANDEL SIGMAPLOT 2.0 FOR WINDOWS CALL 1-800-4-JANDEL (1-800-452-6335)

OTHER JANDEL PRODUCTS

- SigmaPlot DOS No. 72 Macintosh No. 73
- SigmaPlot Graph Library, Volume One: Graph templates No. 74
- SigmaSuite™: Integrated graphics, statistics, image measurement No. 75
- SigmaStat®: Intuitive statistical software No. 76
- SigmaScan®/Image: Image measurement software No. 77
- Mocha®: Automated image analysis software No. 78
- TableCurve™ 2D: Automated curve fitting software No. 79
- TableCurve™ 3D: Automated surface fitting software No. 80
- PeakFit™: Peak analysis software No. 81

FOR MORE INFORMATION PLEASE CALL, FAX, OR E-MAIL:

Jandel Scientific: 2591 Kerner Blvd., San Rafael, CA 94901
415-453-6700 Fax: 415-453-7769
Internet: sales@jandel.com
In Europe: Jandel Scientific, Schimmelbuschstrasse 25, 40699 Erkrath, Germany 02104/36098 02104/33110 (FAX).
International Dealers: Australia 2 958 2688, 3 602 5088, Brazil 11 453 5588, Canada 519 767 1061, Denmark 42 15 05 44, France 05 90 37 55, India 40 84 1208, Israel 349 0823, Japan 3 3590 2311, 3 5689 8000, Kuwait 242 1851, South Africa, 12 663 4500, Switzerland 41 617 12 16 16, Taiwan 2 788 6777, 2 705 1590, UK 0800 89 49 82.
All company and/or product names are trademarks of their respective companies. ©1994 Jandel Corporation.



Jandel
SCIENTIFIC SOFTWARE

For more information circle the above reader's service number

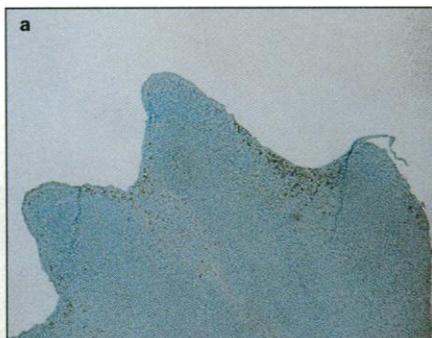
Unlocking the Secrets
of Programmed Cell Death

Access Apoptosis.

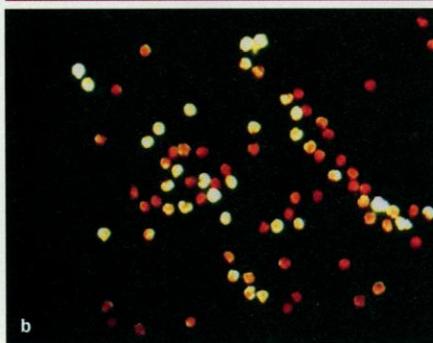
NEW APOPTAG™ CONTROL SLIDE



Apoptosis in 4-day post-weaning rat mammary gland (ApopTag™ Control Slide), Apoptag™ Peroxidase Kit and methyl green (X400)



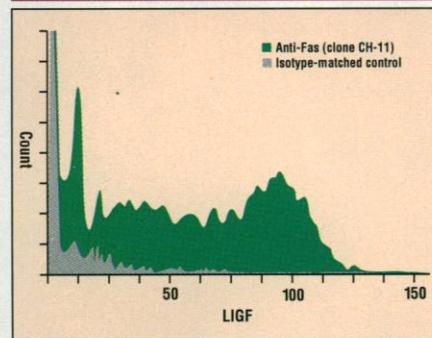
APOPTAG™ IN SITU APOPTOSIS DETECTION KITS



a. Developmental cell deletion in remodeling of mouse forelimb bud (14-day embryo), Apoptag™ Peroxidase Kit and methyl green (X200)²

b. Apoptosis of human peripheral blood lymphocytes in vitro, Apoptag™ Fluorescein Kit (yellow) and propidium iodide (red) (X400)³

NEW ANTI-FAS ANTIBODIES FOR APOPTOSIS RESEARCH



Anti-Fas (clone CH-11) labeling of unstimulated human peripheral blood lymphocytes, flow cytometry⁴ vs. an isotype-matched control monoclonal antibody

At Oncor, one of our missions is to help life scientists unlock the secrets of programmed cell death. Beginning with our breakthrough Apoptag™ *In Situ* Apoptosis Detection Kit, our line of innovative products for apoptosis research has now grown to include:

Apoptag™ *In Situ* Apoptosis Detection Kit Our popular Apoptag™ Detection Kit, in peroxidase and fluorescein versions, shows apoptotic cells in the context of the surrounding tissue. Able to detect individual apoptotic cells, easy-to-use Apoptag™ provides more information than DNA ladder analysis.

Apoptag™ Control Slides Available in packs of five, these new, positive control slides are valuable for reference and procedural troubleshooting.

Antibodies for Apoptosis Research The cell surface Fas antigen can mediate apoptosis. Our new monoclonal antibodies include Anti-Human Fas CH-11, UB2 and FITC-labeled UB2.

To learn more, call us. And investigate apoptosis with Oncor on your side.



ONCOR

209 Perry Parkway
Gaithersburg,
MD 20877

1-800-77-ONCOR
301-963-3500
Fax: 301-926-6129

For Research Use Only. Not for use in diagnostic procedures. Apoptag™ is a trademark of Oncor, Inc.

¹ Yonehara, S., et al, (1989) *J. Exp. Med.* 169:1747-1756.

² JFR Kerr, J Searle, BV Harmon & CJ Bishop, in: Potten, CS (ed) (1987) *Perspectives in mammalian cell death.* Oxford U. Press, pp. 93-128. Z Zakeri, D Quaglino, T Latham & R Lockshin, (1993) *FASEB Journal*; 7:470-478; and manuscripts submitted.

³ X Li, W James, F Traganos & Z Darzynkiewicz, (1993) manuscript submitted.

ACGT!



That's worthy
of a prize.

Pharmacia Biotech & SCIENCE Prize for Young Scientists

IN MOLECULAR BIOLOGY 1995

「Pharmacia Biotech & SCIENCE Prize for Young Scientists」奨学金制度を、SCIENCE誌と協力して設けました。1995年は、分子生物学分野を対象とします。最優秀賞受賞者には、20,000ドルを、また、7名までの受賞者には、5,000ドルを授与します。

応募方法

1994年1月1日から1994年12月31日までに博士号を授与されたかたであれば、どなたでも応募できます。対象となった博士論文につ

いて、優れている点、分子生物学の進歩にどのように貢献したかを、英文1000単語以内で、自由に書き表してください。受賞された方のエッセイは、SCIENCE誌に掲載いたします。

いて、優れている点、分子生物学の進歩にどのように貢献したかを、英文1000単語以内で、自由に書き表してください。受賞された方のエッセイは、SCIENCE誌に掲載いたします。

いて、優れている点、分子生物学の進歩にどのように貢献したかを、英文1000単語以内で、自由に書き表してください。受賞された方のエッセイは、SCIENCE誌に掲載いたします。

締切りは、1995年7月5日です。授賞式は、ファルマシア バイオテック本社のあるスウェーデンにて1995年12月に行われる予定です。

詳細については、インターネット (science-editors@aaas.org) または下記までお問い合わせください。日本語でのお問い合わせは、ファルマシア バイオテック株式会社 (担当: 清水、TEL 03-3492-7864、FAX 03-3492-9482) で受け付けております。

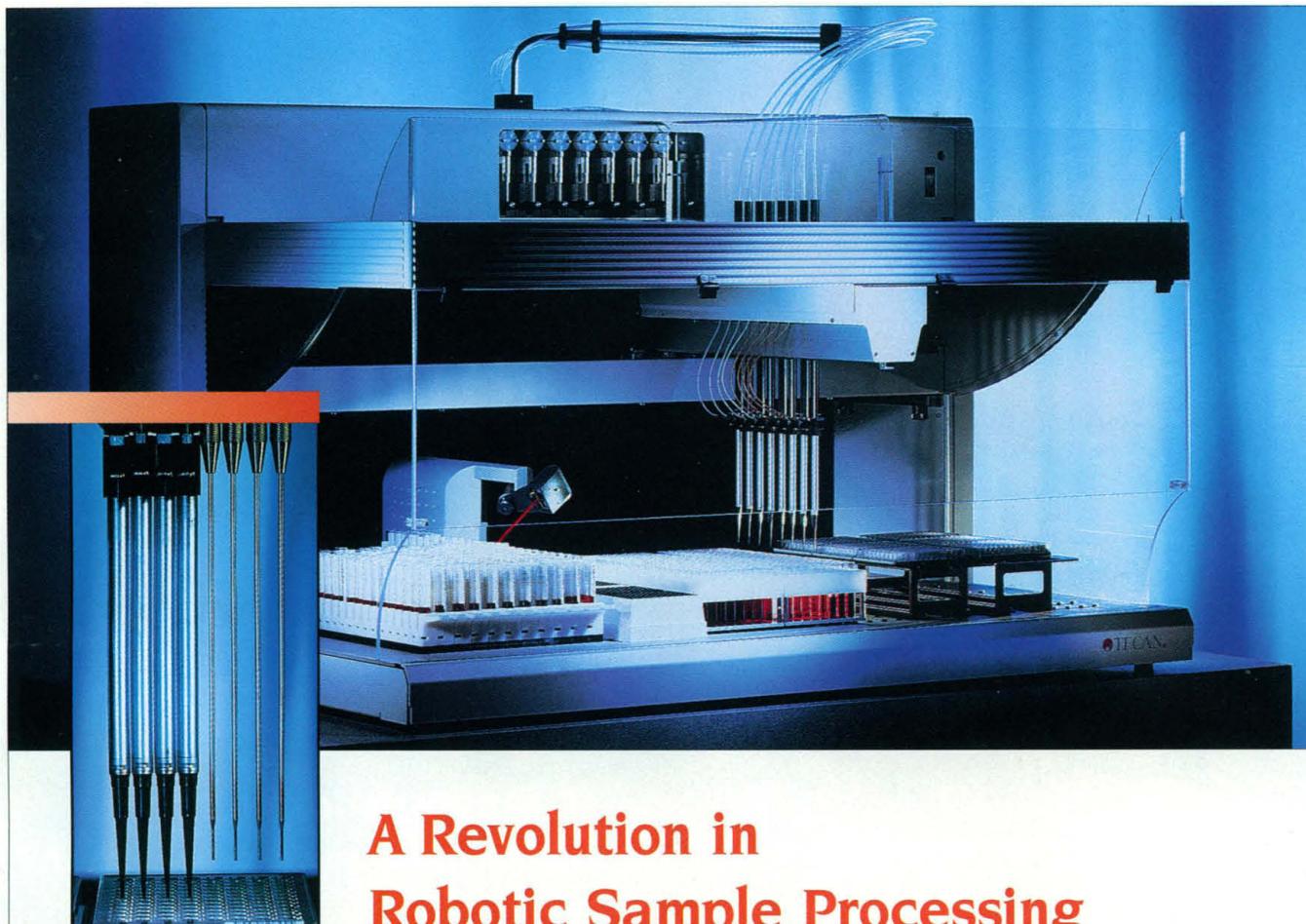
Full details can be requested from the administrator, at the address below,
or via Internet to: science_editors@aaas.org (US /ROW enquiries)
or to: science@science-int.co.uk (European enquiries)

SCIENCE

The Award Committee
Pharmacia Biotech & SCIENCE Prize for Young Scientists
US/ROW enquiries - 1333 H Street, NW, Washington, DC 20005 USA.
Tel: 202 326-6501, Fax: 202 408-8015
European enquiries - Science International, 14 George IV Street, Cambridge,
CB2 1HH, UK. Tel: +44 1223 302067, Fax: +44 1223 302068



Circle No. 60 on Readers' Service Card



A Revolution in Robotic Sample Processing

Choose 8 disposable tips, 8 standard tips or any combination of the two.

GENESIS, the new automated liquid handling technology from Tecan removes many of the limitations of sample processing. Beyond the needs of high throughput, full automation and greater flexibility, now changes in engineering allow you to choose:

- Combination of standard and disposable tips
- Four and eight tip arms
- Modular carriers for any type of tube, vial or container
- No constraints on worksurface positioning

Variable Liquid Level Detection on each tip monitors the change in capacitance as the tip enters or leaves the liquid.

Barcode Reading of both horizontal and vertical barcodes provides fast position identification and accurate positioning

of carriers, racks, and primary and secondary tubes. A true positive ID system is now ensured.

Windows™ Software combines a simple point and click graphical user interface with the power to control complex pipetting parameters and methodology.

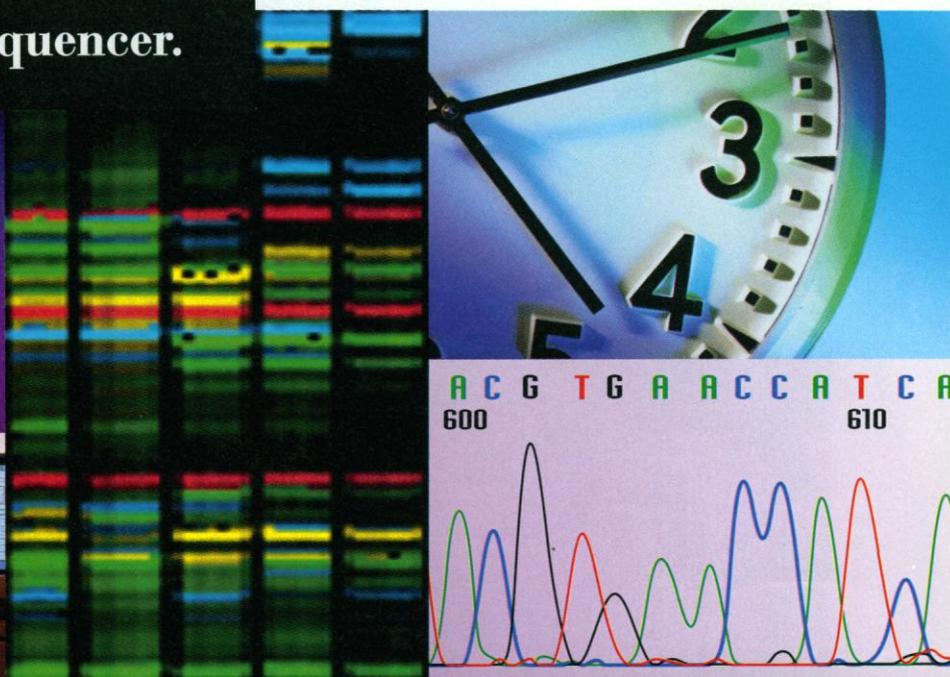
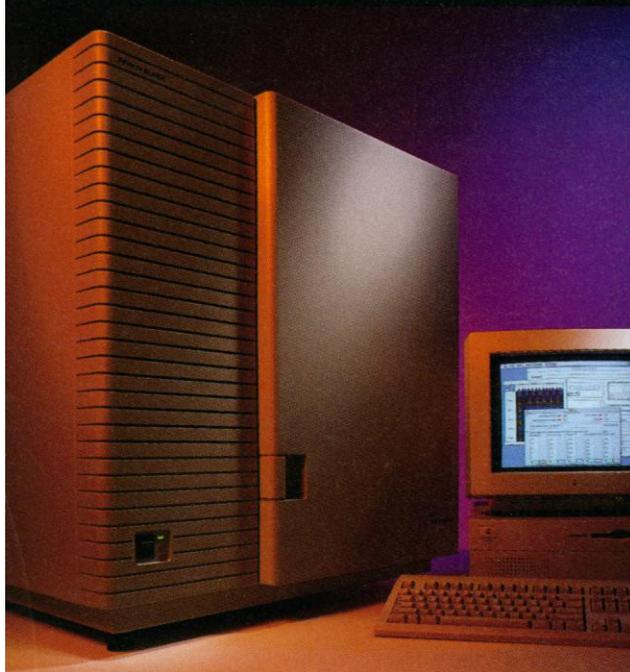
Safety is ensured with a built-in safety shield to protect from hazardous materials.

Application support for the design, optimization, and implementation of your application hardware and software. Proven engineering and service support are provided by Tecan's worldwide service organization.

Want more information? Call Tecan
1-800-33-TECAN.

 **TECAN.**
Research Triangle Park, NC

Introducing the new ABI PRISM™ 377 DNA Sequencer.



**Greater productivity,
no matter how you measure it.**

The ABI PRISM™ 377 DNA Sequencer goes beyond previous technology to bring you unprecedented productivity for all your DNA sequencing and fragment analysis applications.

The ABI 373 set the standard for accuracy and throughput with automated four-dye, one-lane detection. Now the ABI PRISM 377 raises that standard with powerful new hardware and software capabilities that take performance and reliability to new levels.

You've never seen a system this fast. Using simultaneous multicolor detection and advanced electrophoresis technology, the ABI PRISM 377 generates data four times faster than the ABI 373.

You'll also find that the 377's versatile vertical gel format offers even greater precision and more control for fine-tuning electrophoresis parameters.

And the ABI PRISM 377 is so easy to use, you'll be running samples with complete confidence in no time. A Macintosh Power PC

interface streamlines data collection and analysis with your choice of DNA Sequencing or GeneScan™ software.

Of course, the ABI PRISM 377 is backed by Perkin-Elmer's worldwide technical support organization. With over eight years of experience in genetic analysis, our Applied Biosystems Division offers you the most comprehensive range of systems, technologies, and applications expertise in the industry.

So if you're looking for greater DNA sequencing and fragment analysis productivity, find out how the ABI PRISM 377 measures up. For more information, call 1-800-345-5224. Outside the U.S. and Canada, contact your Perkin-Elmer representative.

PERKIN ELMER

Europe Langen, Germany Tel: 49 (0) 6103 708 301 Fax: 49 (0) 6103 708 310
Japan Tokyo, Japan Tel: (0473) 80-8500 Fax: (0473) 80-8505
Latin America Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223
Australia Melbourne, Australia Tel: (03) 212-8585 Fax: (03) 212-8502

Perkin-Elmer is a registered trademark and ABI PRISM and GeneScan are trademarks of The Perkin-Elmer Corporation. All other trademarks and product names are the property of their respective owners.

Clear things up with
Infinity™ Agarose Enhancer.



Now you see it. Now you don't.

Add new Infinity™ to agarose and you'll see dramatic improvement in resolution, clarity and gel strength. Infinity is a powder that is easily mixed with any agarose. It will not affect gelling or remelting characteristics.

See the difference Infinity makes.
Call 1-800-77-ONCOR.

oncor®

For research use only. Not for use in diagnostic procedures. Infinity™ is a trademark of Oncor, Inc.

209 Perry Parkway
Gaithersburg, MD 20877

Circle No. 55 on Readers' Service Card

Pharmacia Biotech & SCIENCE Prize for Young Scientists

IN MOLECULAR BIOLOGY 1995

Pharmacia Biotech and SCIENCE are joining forces to encourage scientists at the start of their careers with an award for graduate work in molecular biology. This major new worldwide prize will include US\$20,000 awarded to the best young scientist of the year, and up to 7 additional prizes of US\$5,000 each. Prizes will be presented in Stockholm, Sweden, during December 1995. The winning essay will be published in Science.

Full details can be requested from the administrator, at the address below, or via Internet to: science_editors@aaas.org

The Award Committee
Pharmacia Biotech & SCIENCE Prize for Young Scientists
1333 H Street, NW, Washington, DC 20005 USA.
Tel: 202 202 326-6501, Fax: 202 408-8015

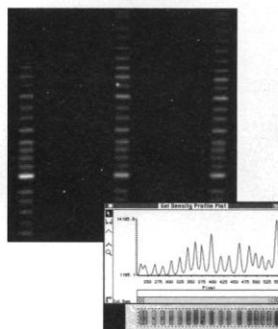
SCIENCE



When It Comes To Macintosh
Imaging Software...

IPLab is The Only Choice

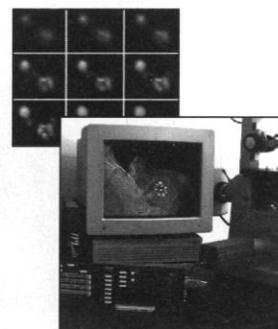
IPLab Gel



Macintosh Gel Analysis Software

- Single-lane density profile analysis with peak finding
- Molecular weight determination
- Localized background subtraction
- Supports 8-bit, 16-bit, TIFF, PICT and other file types
- Gel Documentation systems available for UV and white light

IPLab Spectrum



The Macintosh Imaging Solution

- Powerful image analysis software
- Acquisition and analysis systems for applications such as:
 - FISH
 - 3D visualization and deconvolution
 - Ratio imaging
- Compatible with video & digital cameras, filter wheels and motion control systems

IPLab Spectrum and IPLab Gel
From the Macintosh Imaging Experts
At Signal Analytics



Signal Analytics Corporation
440 Maple Ave E, Ste 201
Vienna, VA 22180
Tel (703) 281-3277
Fax (703) 281-2509

Circle No. 45 on Readers' Service Card

Announcing...



**NO ANNUAL FEE and a Special
9.9%[†] Annual Percentage Rate
(APR) on Cash Advances and
Balance Transfers for AAAS Members.**



Introducing the AAAS Visa® Gold card, with NO ANNUAL FEE. Many AAAS members have already discovered the benefits of the AAAS Visa Gold card. Now, through this special offer, you can join your colleagues in carrying the only credit card endorsed by the AAAS.

The American Association for the Advancement of Science is pleased to present a special introductory 9.9% APR on cash advances.* As a part of your welcome package you will receive two Premium Access Checks that you can use to pay off or pay down other credit cards and installment loans.

Extra benefits include:

- A 16.4% variable APR on purchases
- Higher lines of credit ... up to \$50,000
- 30 minute credit line increases

Now you can carry the AAAS card with these and many other unsurpassed benefits and pay no annual fee.

Call Now!

1-800-847-7378, ext. 400

Please use this priority code when calling: **NTMD**

†The Annual Percentage Rate (APR) for purchases is 16.4%, which may vary. The APR is 9.9% on cash advances through your first six statement closing dates commencing on the month after your account is opened and may vary thereafter (applies to both new and outstanding cash advance balances). The current indexed rate for cash advances is 16.4%, which may vary. The transaction fee for the purchase of wire transfers, money orders, bets, lottery tickets, and casino gaming chips is 2% of each such purchase; \$2 minimum, \$25 maximum. Transaction fee for two specifically designated Premium Access Checks® or Preferred Access Checks® will be waived. The information about the cost of the card described in this application is accurate as of 1/95. The information may have changed after that date. To find out what may have changed, call 1-800-847-7378.

*Cash advances cannot be used to pay off or pay down another MBNA® account. MBNA America,® Premium Access Checks and Preferred Access Checks are federally registered service marks of MBNA America Bank, N.A. MasterCard® is a federally registered service mark of MasterCard International, Inc., used pursuant to license. Visa® is a federally registered service mark of Visa U.S.A., Inc., used pursuant to license. © 1994 MBNA America Bank, N.A.