AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

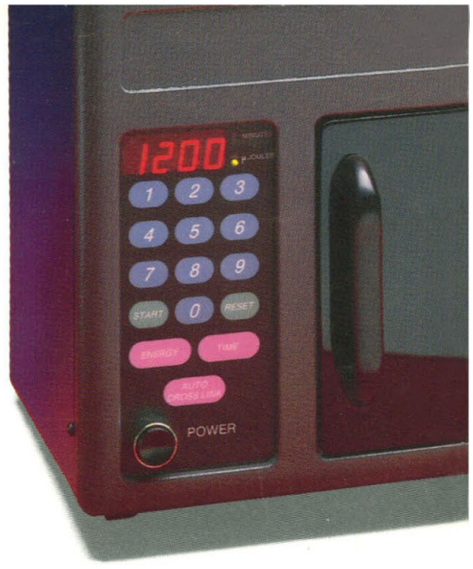
SCIENCE

17 JULY 1992 $6.00
VOL. 257 • PAGES 297-452

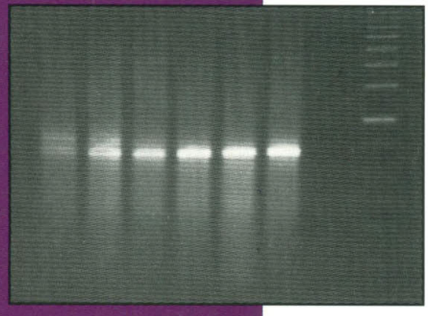
Science Innovations

From the Innovators of UV Crosslinking Apparatus

Stratalinker® UV Crosslinker*



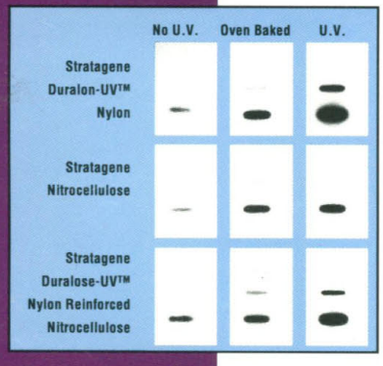
- **Reduce PCR** False Positives**
- **UV Crosslink DNA or RNA to Hybridization Membranes**
- **Fast Results**



Reduce PCR False Positives:

Contaminating DNA can be rendered inactive as a template for PCR by treatment in the Stratalinker® UV crosslinker. Reagents suspected of being contaminated can be pre-irradiated with 254 nm light (either in measured energy doses or by using the timer option) to prevent extraneous sequences from being amplified, which may result in false positives. Because of its simplicity and speed, pretreatment with the Stratalinker® UV crosslinker can be easily integrated into PCR protocols as a precautionary measure.

Six identical tubes, each containing 100 ng of contaminating DNA (4.8 kb linear fragment) in reaction buffer were irradiated at successively higher energy levels in the Stratalinker UV crosslinker. Following treatment, 100 ng of control DNA (4.1 kb linear fragment) was added to each tube, along with recommended amounts of primers, nucleotides, and polymerase. PCR was performed according to the GeneAmp† kit (Perkin-Elmer Cetus Instruments) instructions. Amplification of the contaminating DNA yields a 1.8 kb fragment, whereas the control DNA with the same primers yields a 1.1 kb fragment. Lanes 1-6: 0, 25, 50, 100, 200, and 400 mJ/cm2 UV energy, respectively. Lane 7: Stratagene's Kb size ladder (500 ng).



UV Crosslink DNA or RNA to Membranes:

The degree of ultraviolet crosslinking can dramatically affect the binding and sensitivity of nucleic acid hybridization (see accompanying chart). The versatile Stratalinker® UV crosslinker can be used for the following applications:

- Binding RNA or DNA to nitrocellulose, nylon or hybrid membranes for Northern, Southern, dot, or slot blot analysis (1, 2).
- Linking DNA to filters for bacterial or phage library screening.
- DNA nicking in agarose gels prior to blotting (3).
- Dimer formation to perform partial digests for rapid gene mapping (4).
- Confirming recA+ versus recA- genotypes in *E.coli* strains through UV sensitivity testing (5).

1. Khandjian, E.W. *Biotechnology* 5 February 1987.
2. Church, G.M., Gilbert, W. *P.N.A.S.* 81: 1991-1995, 1984.
3. Vollrath, D. and Davis, R.W. Nucl.Acids Res. 15:7865-7876, 1987.
4. Whittaker, P.A., Southern E.M. Gene 41: 129-134, 1986.
5. Maniatis, T., et al Molecular Cloning: A Laboratory Manual. Cold Spring Harbor Laboratory.

Stratagene Offers a Full Line of Hybridization Membranes:

Stratagene can provide you with an exceptional range of membranes displaying the highest signal to noise ratios of any membranes tested when used with the Stratalinker® UV crosslinker. Each lot is quality controlled for optimal performance.

Duralon-UV™ membranes 20 x 20cm catalog# 420100
Duralon-UV™ membranes 30cm x 3m roll catalog# 420101
FLASH™ nylon membranes 30cm x 3m roll catalog# 420120
Duralose-UV™ membranes 82mm circles catalog# 420111
Nitrocellulose membranes 137mm circles catalog# 420107

* patents pending

**The polymerase chain reaction (PCR) process is covered by patents issued to Cetus Corporation.
† GeneAmp is a registered trademark of Cetus Corporation

STRATAGENE®

Please contact Stratagene for a distributor near you.

Corporate Headquarters, USA
1-800-424-5444
Telefax: 619-535-5430

Germany, Stratagene GmbH
(06221) 40 06 34
Telefax: (06221) 40 06 39

United Kingdom, Stratagene Ltd.
(0223) 42 09 55
Telefax: (0223) 42 02 34

Stratagene France
Telephone: (0590) 72 36
Telefax: (1) 44 28 19 00

Circle No. 39 on Readers' Service Card

• Clean Up PCR* Reactions
• Purify Mini-prep DNA
• Clean Up Restriction Digests

with StrataClean™ Resin

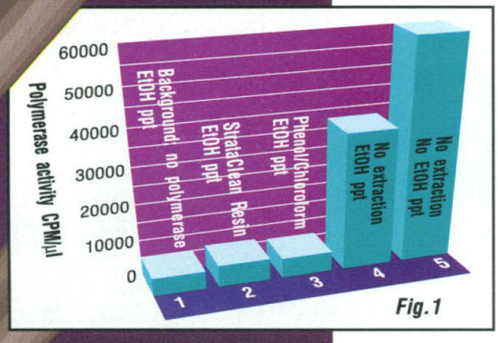


Fig.1

Remove Polymerase Activity after PCR with StrataClean Resin

StrataClean™ resin has proven to be a safe, fast, and efficient method for the removal of polymerase activity from PCR reaction mixtures. Using StrataClean resin, it is also possible to eliminate an ethanol precipitation step before cloning PCR amplified DNA.

Figure 1. Comparison of StrataClean resin and phenol/chloroform extraction methods for removal of Polymerase activity following amplification reactions. Four identical 100µl amplification reactions were treated as follows: no extraction; two extractions with StrataClean resin; two extractions with phenol/chloroform; and a single precipitation with ethanol. The samples were then assayed for polymerase activity at 72°C using a modified activated calf thymus/gap filling assay, essentially as described by Maki; *et. al.* (2). Background activity was measured by assaying an amplification reaction without any added polymerase.

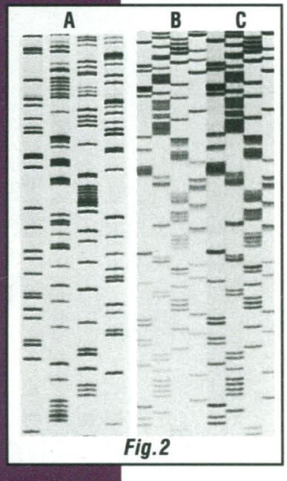


Fig.2

Sequence Quality Plasmid Templates from Mini-preps Using StrataClean Resin

StrataClean resin has also been shown to produce sequencing quality plasmid templates when used in either a rapid boiling mini-prep or as a substitute for phenol in a standard alkaline lysis mini-prep. The key to the rapid mini-prep is that no precipitation step is required. StrataClean resin is used to remove the unwanted cellular protein quickly and efficiently.

Figure 2. Sequence derived from DNA purified using StrataClean resin with both the standard rapid boiling mini-prep procedure and the alkaline lysis mini-prep procedure. Panel A: StrataClean resin rapid boiling mini-prep; Panel B: phenol/chloroform alkaline lysis mini-prep; Panel C: StrataClean resin alkaline lysis mini-prep.

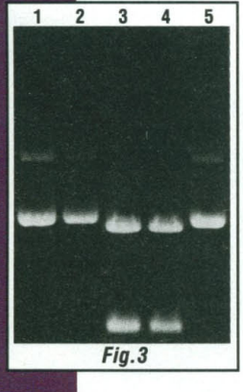


Fig.3

Extract Restriction Endonucleases and many DNA Modifying Enzymes from Nucleic Acids

Quantitative removal of restriction enzymes from DNA can be accomplished in a matter of minutes with StrataClean resin and eliminates the hazards associated with liquid phenol extractions. The StrataClean resin extraction relies on the use of patented hydroxylated silica particles which exhibit characteristics similar to phenol[1,2]. It is supplied as a 25% slurry which is non-toxic, non-flammable and odor-free. StrataClean resin has a very high affinity for proteins and a very low affinity for nucleic acids at neutral pH (>1900:1 respectively).

1. U.S. Patent Serial No. 4,923,978 2. Strategies Vol. 3 Number 4

Figure 3. Ethidium stained agarose gel. Lane 1: control uncut plasmid DNA, Lane 2: the same DNA after standard StrataClean resin extraction, Lane 3: plasmid DNA digested with 4 units *Pvu* II, Lane 4: plasmid DNA after standard StrataClean resin extraction then digested with *Pvu* II, Lane 5: 24 units *Pvu* II extracted with StrataClean resin from 20 microliters of 1X Universal buffer, plasmid DNA then added and incubated at 37°C for 18 hours.

* The polymerase chain reaction (PCR) process is covered by patents issued to Cetus Corporation.

STRATAGENE®

Please contact Stratagene for a distributor near you.

Corporate Headquarters, USA
1-800-424-5444
Telefax: 619-535-5430

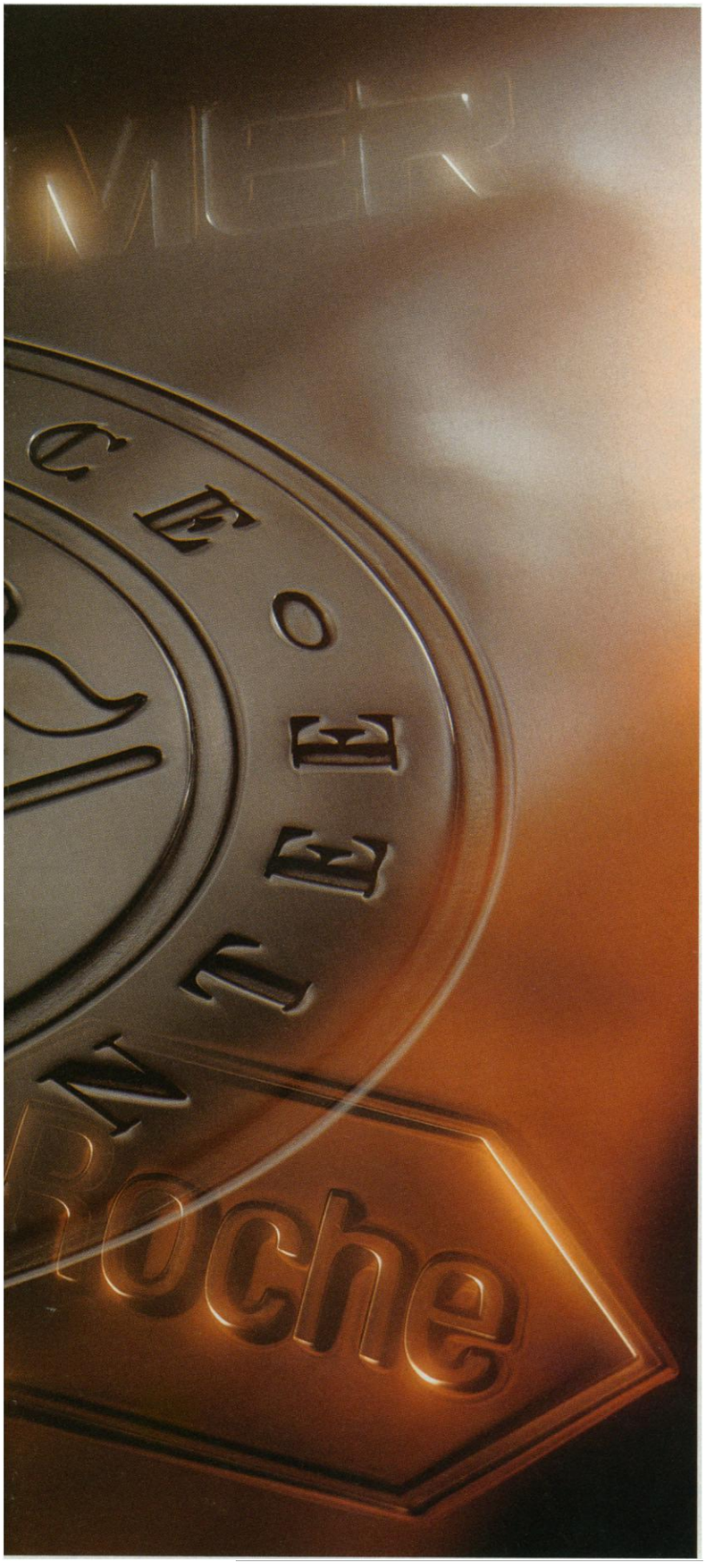
Germany, Stratagene GmbH
(06221) 40 06 34
Telefax: (06221) 40 06 39

United Kingdom, Stratagene Ltd.
(0223) 42 09 55
Telefax: (0223) 42 02 34

Stratagene France
Telephone: (0590) 72 36
Telefax: (1) 44 28 19 00

Circle No. 38 on Readers' Service Card


PERKIN
PERFORMAN
PCB
GUARA



LOOKING FORWARD

YOUR SCIENCE. OUR TECHNOLOGY. GUARANTEED PCR PERFORMANCE.

As your research uncovers new challenges, PCR technology must advance to meet your needs. Since 1987, Perkin-Elmer has been delivering PCR solutions to laboratories worldwide. By integrating instrumentation, reagents and technical support, Perkin-Elmer has set an uncompromising standard: the PCR Performance Guarantee.

Today, Perkin-Elmer's ongoing efforts to serve the scientific community are joined by Roche Molecular Systems, Inc., as the developer and manufacturer of PCR reagents. Our combined expertise in product innovation and quality manufacturing will accelerate the development and expansion of PCR applications.

The PCR Performance Guarantee is reaffirmed. The dedication and commitment of Perkin-Elmer's worldwide technical support organization are now enhanced by the cooperation of two world leaders. Perkin-Elmer and Roche. Looking forward to advancing PCR technology together. To receive more information, call 1-800-762-4000. Outside the U.S., contact your Perkin-Elmer sales representative.

PERKIN ELMER

Europe Vaterstetten, Germany Tel: 49-8106-381-115 Fax: 49-8106-6697
Canada Montreal, Canada Tel: 514-737-7575 Fax: 514-737-9726
Far East Melbourne, Australia Tel: 61-3-560-4566 Fax: 61-3-560-3231
Latin America Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223

Perkin-Elmer PCR reagents are developed and manufactured by Roche Molecular Systems, Inc., Branchburg, New Jersey, U.S.A.

Roche

Circle No. 18 on Readers' Service Card

ISSN 0036-8075
17 JULY 1992
VOLUME 257
NUMBER 5068

SCIENCE

AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

VISUALS UNLIMITED/CABISCO

324
The 13-sexed slime mold

POLICY FORUM

NEWS & COMMENT

RESEARCH NEWS

SPECIAL SECTION

RESEARCH ARTICLE

REPORTS

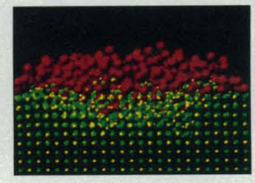
DEPARTMENTS

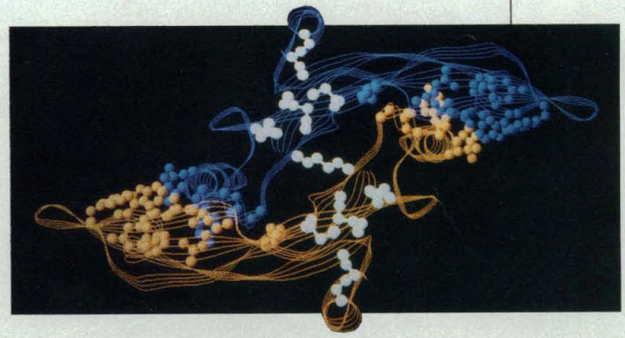
COVER

Color-enhanced image of a familiar formula written with an atomic force microscope. The lines of the letters are about 10 nanometers wide and 5 nanometers deep. The patterns are machined into a soft molybdenum oxide layer that was grown on a molybdenum sulfide substrate. See page 375. New techniques and instruments, especially in biomedical research, are the focus of the Science Innovations '92 meeting (21 to 25 July in San Francisco) sponsored by AAAS and *Science*; see related news stories on page 344. [Photo: Charles M. Lieber]

TECHNICAL COMMENTS

355
Smashing simulations





369
Transforming growth factor structure

◩ Indicates accompanying feature

■ **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.

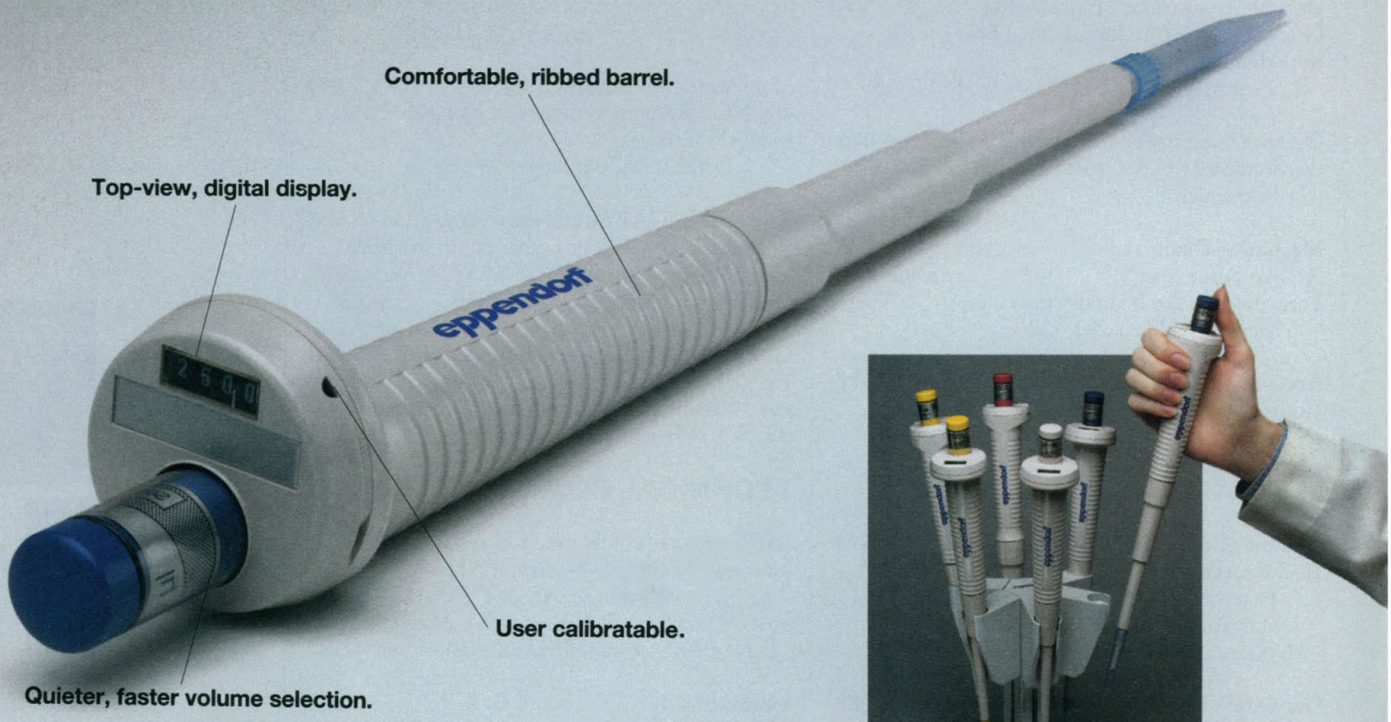
Domestic individual membership and subscription (51 issues): $87 ($47 allocated to subscription). Domestic institutional subscription (51 issues): $195. Foreign postage extra: Mexico, Caribbean (surface mail) $50; other countries (air assist delivery) $95. First class, airmail, student and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. **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:** $6.00 per issue prepaid includes surface postage; Guide to Biotechnology Products and Instruments, $20. Bulk rates on request.

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.

New Eppendorf® Pipettes

Calibratable, Serviceable, *and* Autoclavable.



New, convenient carousel stand —rotates for easy access.

The new Eppendorf Pipettes combine quality with innovative features to deliver accurate and reliable results. Adjustable- and fixed-volume models cover the range from 0.5 µl to 2500 µl.

The adjustable-volume pipettes can be recalibrated to ensure optimum performance, particularly when pipetting viscous or nonaqueous liquids. A full range of spare parts is available for easy maintenance.

All new Eppendorf Pipettes are completely autoclavable at 121° C, and are constructed of durable, chemical- and UV-resistant materials to extend the life of the pipette.

A new product...and a new guarantee. Brinkmann Instruments is so confident about the quality of the new Eppendorf Pipettes that, for a limited time, we are offering a 30-day return privilege.

Call 800-645-3050 for more information. In New York, call 516-334-7500, or write Brinkmann Instruments, Inc., One Cantiague Road, P.O. Box 1019, Westbury, NY 11590-0207. (In Canada: 800-263-8715 or 416-675-7911, 50 Galaxy Blvd., Rexdale, Ont. M9W 4Y5.)

eppendorf

BRINKMANN Quality products for research and control.

For information circle reader service number 23
For a demonstration circle reader service number 24

edited by PHIL SZUROMI

Precambrian predation

Animals first developed mineralized skeletons about 550 million years ago as part of a major evolutionary radiation known as the Cambrian explosion. The causes leading to this explosion are under debate; one hypothesis is that it was to escape predation. Bengtson and Zhao (p. 367) report fossil evidence supporting this notion. They report that about 3 percent of well-preserved fossils of the earliest known animals with mineralized skeletons (the late Precambrian *Cloudina*) have round holes, 40 to 400 micrometers in diameter, that are characteristic of attack by predators. Larger holes tend to occur in larger fossils; this observation suggests that the predator was selecting the prey for size.

Warm waters

Causes of recent sea level changes include continued slow rebound of the crust following deglaciation, melting of glaciers and ice sheets, and thermal expansion of the oceans following recent warming. Roemmich (p. 373) used hydrographic data collected during the past 42 years off the coast of southern California to evaluate the effect of thermal expansion. The data show that the upper 100 meters of the water column has warmed by 0.8°C, which resulted in a sea level rise of 0.9 millimeter per year, a value consistent with coastal tide gauge records.

Hemophilia and puberty

Patients with Hemophilia B Leyden, an inherited disorder linked to the X chromosome, usually improve after the onset of puberty because testosterone, an androgenic hormone, can promote transcription of the gene for the blood clotting factor IX. Crossley *et al.* (p. 377) found a form of the disease in which there is no improvement after puberty. In this form, mutations in the promoter region of the factor IX gene at positions –20 and –26 disrupted binding of a liver-enriched transcription factor, LF-A1/HNF4. Patients who recover also have mutations at –20 but no mutations at –26. The mutation at –26, however, is within an overlapping androgen-responsive element (ARE). If the ARE is intact (no mutation at –26), its activation by testosterone can direct transcription of factor IX even though the overlapping LF-A1/HNF4 site is inactivated by the mutation at –20.

Clusters colliding with surfaces

Laboratory experiments that produce conditions of high temperature and density could open up new chemical reaction pathways. Cleveland and Landman (p. 355) report on theoretical investigations into the dynamics of energetic collisions between solid surfaces and atomic clusters. They used molecular dynamics simulations to study the impact of large argon clusters (561 atoms) on sodium chloride surfaces. A "piling-up" of the shock wave and inertial confinement of material led to extreme conditions in the impact region. Reactants could be embedded in the clusters to catalyze reactions during the collision.

Dendritic cells as HIV-1 reservoirs

Infection with human immunodeficiency virus type–1 depletes the population of $CD4^+$ T cells in the human body, thus opening the door to opportunistic infections, but very few $CD4^+$ cells are infected with HIV-1 at any one time. Cameron *et al.* (p. 383) show that dendritic cells, a type of antigen-presenting cell that can stimulate the T cell response, can transfer the virus to $CD4^+$ cells that have been activated by superantigens. The dendritic cells carry HIV-1 but are not actively infected (the virus is not making copies). These cells form clusters with $CD4^+$ cells for antigen presentation; the T cells, which replicate in this process, are in the form most susceptible for infection. After cluster formation with the dendritic cells, the previously uninfected $CD4^+$ cells replicate virus and die after viral release.

NO effect

Nitric oxide (NO) has a number of physiological roles, including helping macrophages kill cells, acting as a neurotransmitter, and participating in vasodilation. Two reports discuss the mediatory role of NO and the enzyme that produces NO, NO synthase (NOS). A side effect of cardiac surgery is stunning, a depression of myocardial contractility. This effect may be caused by pro-inflammatory cytokines, polypeptides that are secreted by various cell types in response to injury. Finkel *et al.* (p. 387) show that inhibition of NOS can block the contractility effects of cytokines such as interleukin-2. Burnett *et al.* (p. 401) demonstrate that NO can mediate the penile erection response in rats. They found high levels of NOS activity in neurons that innervated blood vessels and the corpora cavernosa of the penis.

Functional N-type calcium channels

Excitable cells can release neurotransmitters in response to influxes of extracellular calcium, a process that is often mediated by N-type calcium channels. This family of voltage-sensitive channels, which are blocked by ω-conotoxin, are multisubunit proteins; although different subunits have been cloned and expressed, it has proved difficult to reconstitute a fully functional N-type calcium channel. Williams *et al.* (p. 389) report the sequence of a human neuronal α_1 subunit, α_{1B}, that when coexpressed with the human neuronal α_{2b} and β_2 subunits, form voltage-sensitive calcium channels with high-affinity ω-conotoxin binding sites.

Neuron survival

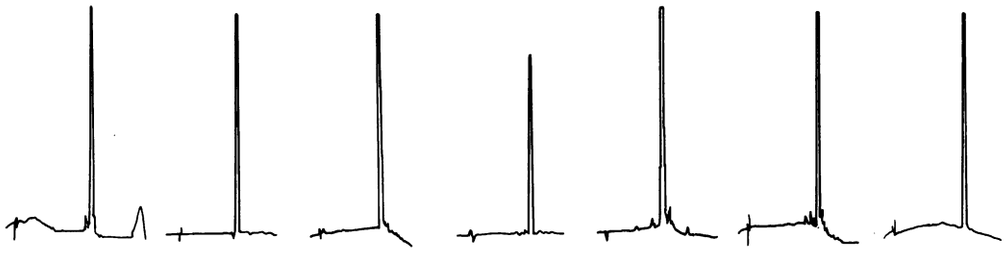
Mature vertebrate sympathetic neurons require neurotrophic factors such as nerve growth factor (NGF) for their survival, but the precursor cells that become sympathetic neurons do not require NGF; in fact, they are unresponsive to NGF and lack NGF receptors. Birren *et al.* (p. 395), working with an immortalized cell line of progenitor cells to sympathetic neurons, find that electrical activity (membrane depolarization) induces the expression of the signal-transducing part of the NGF receptor, $p140^{trk}$. Depolarization did not induce expression of the low-affinity NGF receptor p75. The cells expressing $p140^{trk}$ become responsive to NGF as well as fibroblast growth factor and developed into neurons.

Advanced ChemTech's Enhanced Model 350 Multiple Peptide Synthesizer.™

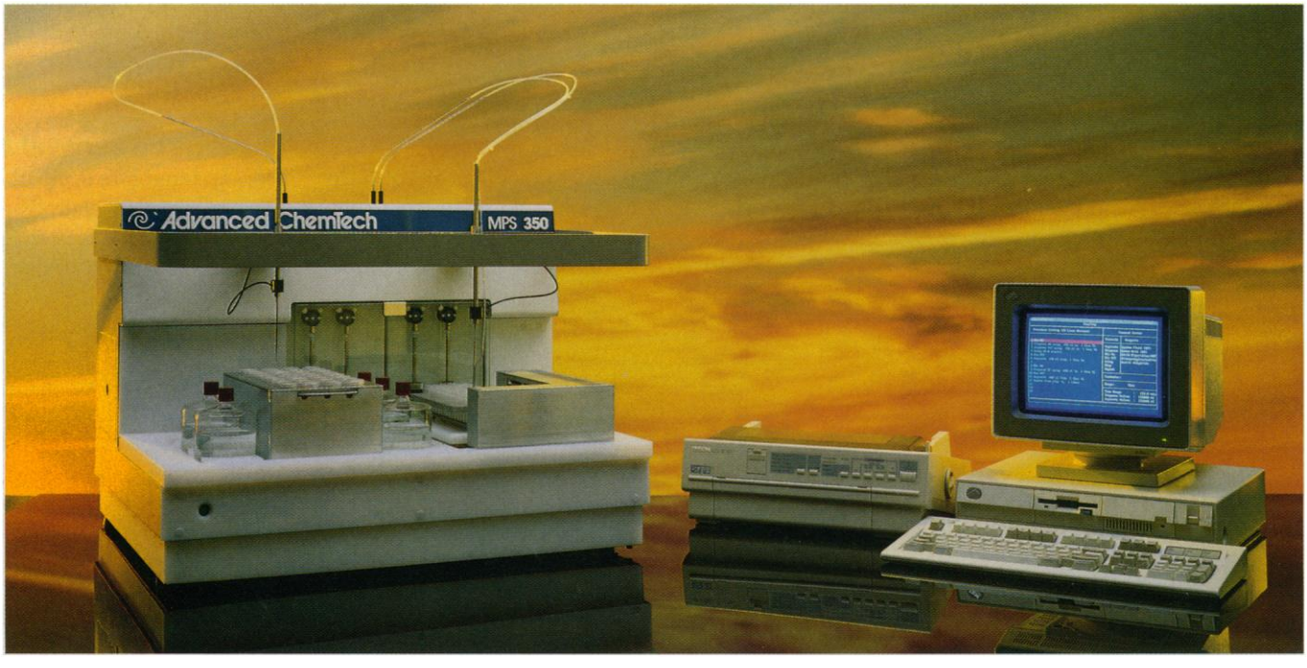
Up to 96 different peptides in one run.

5-100 μmole scale. $1 per coupling. Flexible Fmoc protocols.

Now with variable speed orbital shaker and built-in ventilation module.



HPLC profiles of crude peptides synthesized on ACT Model 350 (8-23 residues).

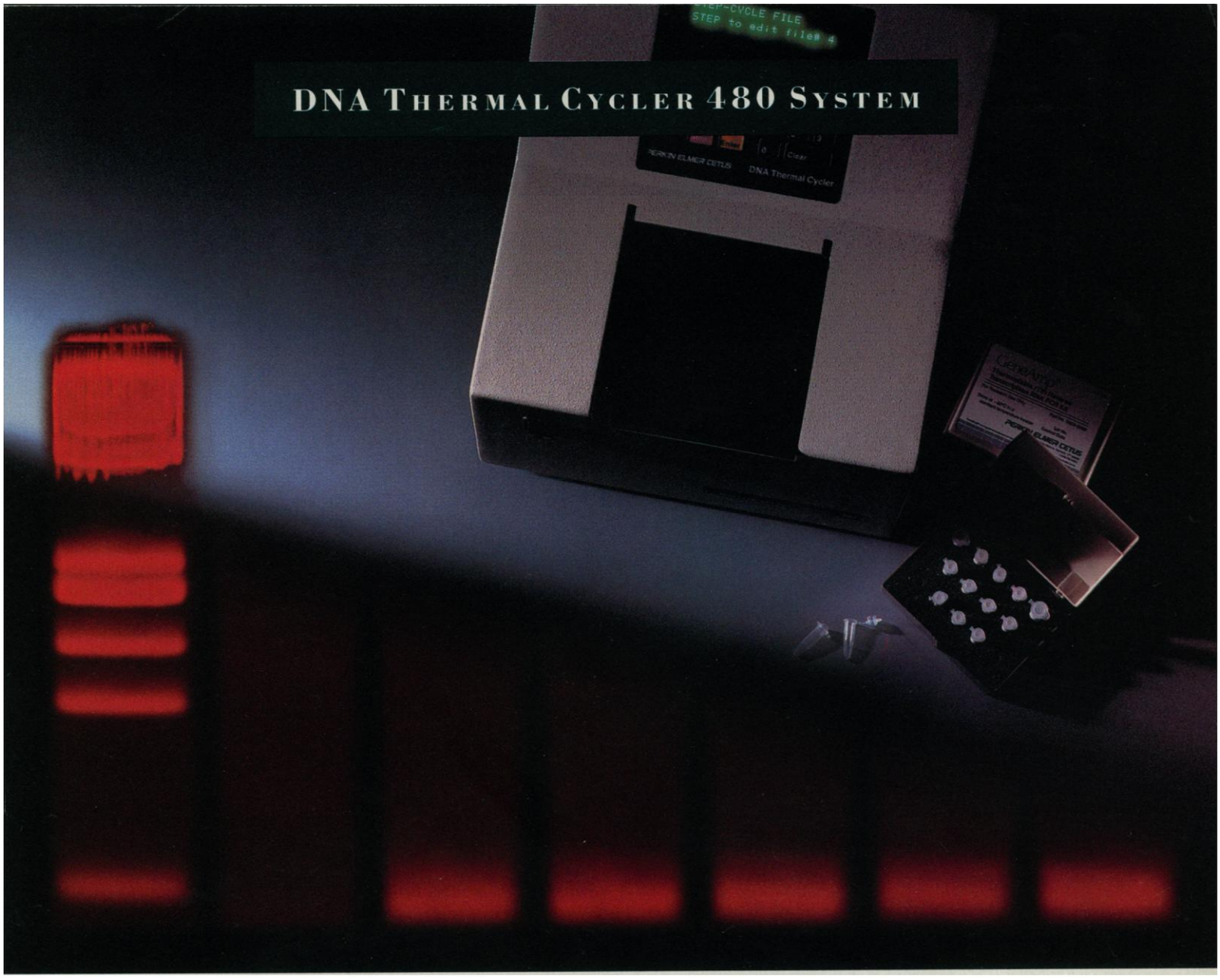


The ACT 350 MPS. Advanced peptide research today for tomorrow's breakthroughs.

Call 800-456-1403 FAX 502-968-1000

Advanced ChemTech

Circle No. 11 on Readers' Service Card



VISIBLY SUPERIOR PERFORMANCE.

Faster amplifications and greater specificity are now routine with the DNA Thermal Cycler 480 System. The advanced technology of the new Thin-Walled GeneAmp™ Reaction Tubes integrates with the DNA Thermal Cycler 480 and high-quality GeneAmp® PCR Reagents to provide a complete, system approach to your PCR requirements. Together with the commitment behind our PCR Performance Guarantee, they are your assurance of consistent results in your laboratory, every day.

The DNA Thermal Cycler 480 System with Thin-Walled GeneAmp Reaction Tubes. Visibly superior PCR performance. To order, or for more information, contact your local Perkin-Elmer sales representative. In the U.S., call 1-800-762-4001 for technical information.

PERKIN ELMER

Europe Vaterstetten, Germany Tel: 49-8106-381-115 Fax: 49-8106-6697
Canada Montreal, Canada Tel: 514-737-7575 Fax: 514-737-9726
Far East Melbourne, Australia Tel: 61-3-560-4566 Fax: 61-3-560-3231
Latin America Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223

Perkin-Elmer PCR reagents are developed and manufactured by Roche Molecular Systems, Inc., Branchburg, New Jersey, U.S.A.

Roche

Circle No. 15 on Readers' Service Card

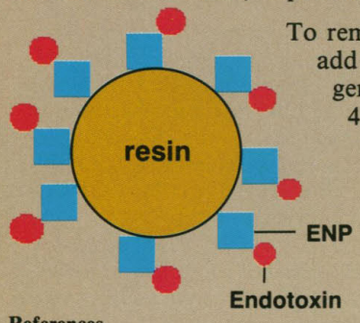
The Endotoxin Pollution Solution

END-X™ B15
Endotoxin Removal Device

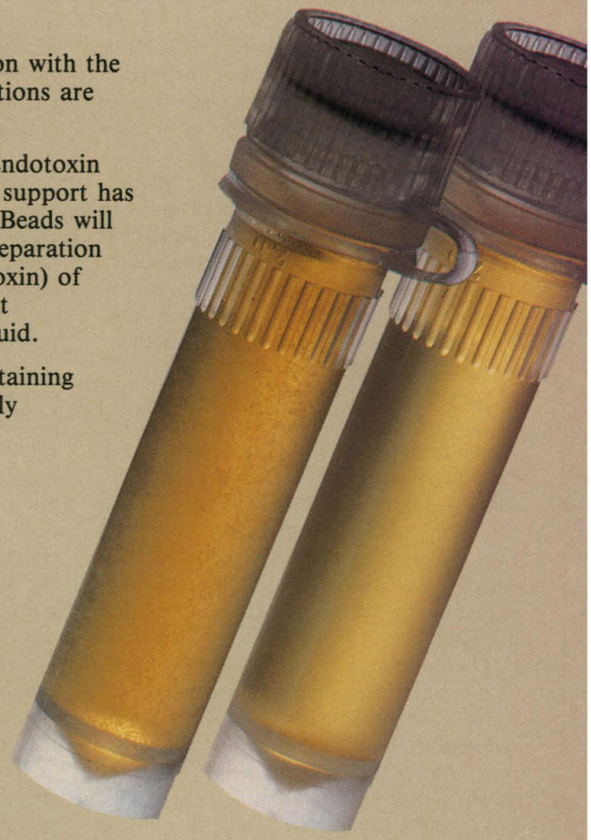
END-X™ B15 combines the specificity and performance of affinity separation with the ease and simplicity of micro-centrifugation. High value protein or drug solutions are effectively decontaminated, dramatically reducing endotoxin concentration.

END-X B15 consists of an endotoxin-free microcentrifuge tube containing Endotoxin Neutralizing Protein (ENP) covalently coupled to a bead support. The bead support has a mean diameter of about 65 microns and a density much greater than 1.0. Beads will sink to the bottom of the tube either by settling or centrifugation to allow separation from the sample. ENP has a high affinity for the lipopolysaccharide (endotoxin) of a wide variety of gram-negative bacteria (1, 2). By binding endotoxin present in fluids to the beads, ENP effectively removes endotoxin from the bulk liquid.

END-X B15 is intended for the treatment of sample volumes of 1-2 ml, containing no more than 50 nanograms of endotoxin. This corresponds to approximately 500 Endotoxin Units, depending upon the particular endotoxin.



To remove endotoxin from the liquid phase, simply add the solution to the tube and incubate with gentle rocking or rotation for a period of 4 - 24 hours. Remove the beads by settling (2-4 minutes) or by centrifugation.



References

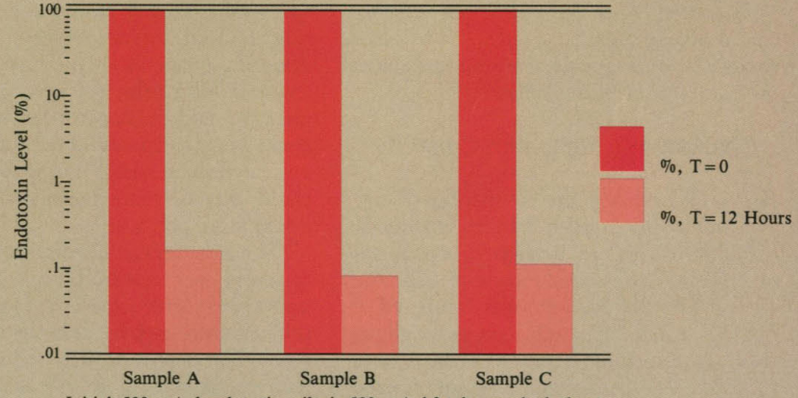
1. **Alpert, G., G. Baldwin, C. Thompson, N. Wainwright, T. J. Novitsky, Z. Gillis, G. R. Siber, J. Parsonnet, and G. R. Fleisher.** 1992. Limulus antilipopolysaccharide factor protects rabbits from meningococcal endotoxin shock. J. Infect. Dis. **165**:494-500.
2. **Wainwright, N. R., R. J. Miller, E. Paus, T. J. Novitsky, M. A. Fletcher, T. M. McKenna, and T. Williams** 1990. Endotoxin binding and neutralizing activity by a protein from *Limulus polyphemus*. p. 315-325. In A. Nowotny, J. J. Spitzer, and E. J. Ziegler, (ed.) Cellular and molecular aspects of endotoxin reactions. Elsevier Science Publishers B.V., Amsterdam.

Endotoxin removal from protein solutions by a 12 hour exposure to END-X BEADS.

Protein Solution	Initial Endotoxin ng/ml	Final Endotoxin ng/ml	Percent Endotoxin Removed
Human Serum Albumin in PBS 10mg/ml*	100 ng/ml	0.01 ng/ml	>99.9
Bovine fetal Serum 0.5 mg/ml	35 ng/ml	<0.0005 ng/ml	>99.9
Recombinant Hemoglobin 250 mg/ml	200 ng/ml	0.1 ng/ml	>99.9
Vaccine (Chicken) 2.5 mg/ml	1000 ng/ml	90.0 ng/ml	91.0**
Monoclonal (Mouse) 0.1 mg/ml	0.1 ng/ml	0.001 ng/ml	99.0

*Human serum and hemoglobin spiked with purified *E. coli* O113 endotoxin.
**Bead capacity exceeded - further reduction possible with additional beads.

Endotoxin Removal From Fetal Serum Protein Hydrolysate



Initial: 500 ng/ml endotoxin spike in 500 µg/ml fetal serum hydrolysate

Associates of Cape Cod, Inc.
Leading the World in LAL

For more information contact: Associates of Cape Cod, Inc.
P.O. Box 224 Woods Hole, MA 02543 Tel: 800-LAL-TEST Fax: 508-540-8680

Circle No. 42 on Readers' Service Card

OPTICAL FUSION

The storage of important scientific data should never be left to chance. Which is why more researchers are using optical disks for their secure data storage. With the fusion of WORM and erasable functionality into a 1 GByte disk drive, Maximum Storage's new *DUETTE*™ stands alone as the premier optical disk subsystem.

DUETTE makes optical storage easy. Just connect the drive to your computer, load the operating software and you're in business. *DUETTE* works just like a standard disk drive, so you already know how to use it.

Need archival permanence? Insert a WORM disk and write away. Want reusable storage? Use an erasable disk instead. With 1 GByte of capacity, these 5 1/4-inch removable disks are ideal for data-intensive scientific applications.

What's more, *DUETTE* is available for both PC and Sun SPARCstation platforms. Data interchange between these two popular computing environments is fully supported, so disks written by a PC can be read by a SPARCstation and vice versa. And support for other popular computing platforms will be available later this year.

Since 1987, Maximum Storage optical disk drives have been the choice of the research, medical and scientific community. With *DUETTE*, this choice is made even easier. And with our direct sales hot line, you can be assured of prices that will not send your budget into hyperspace.

If you're tired of risking your valuable data to bad sectors, stray magnetic fields and head crashes, then call or write for our informative data pack.

Or better yet, pick up the phone and order your *DUETTE* today.

AVAILABLE NOW!

To Order, Call Our Direct Sales Hot Line

1-800-THE-MAXX

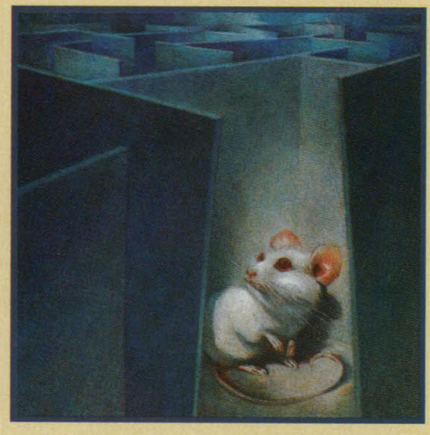
MAXIMUM

Optical Solutions With a Future

Maximum Storage, Inc. 5025 Centennial Blvd., Colorado Springs, CO 80919 (719) 531-6888

Circle No. 45 on Readers' Service Card

GETTING TO YOUR RESEARCH GOAL QUICKLY IS OFTEN A MATTER OF HAVING A DIFFERENT PERSPECTIVE.



Advancing Knowledge & Innovation

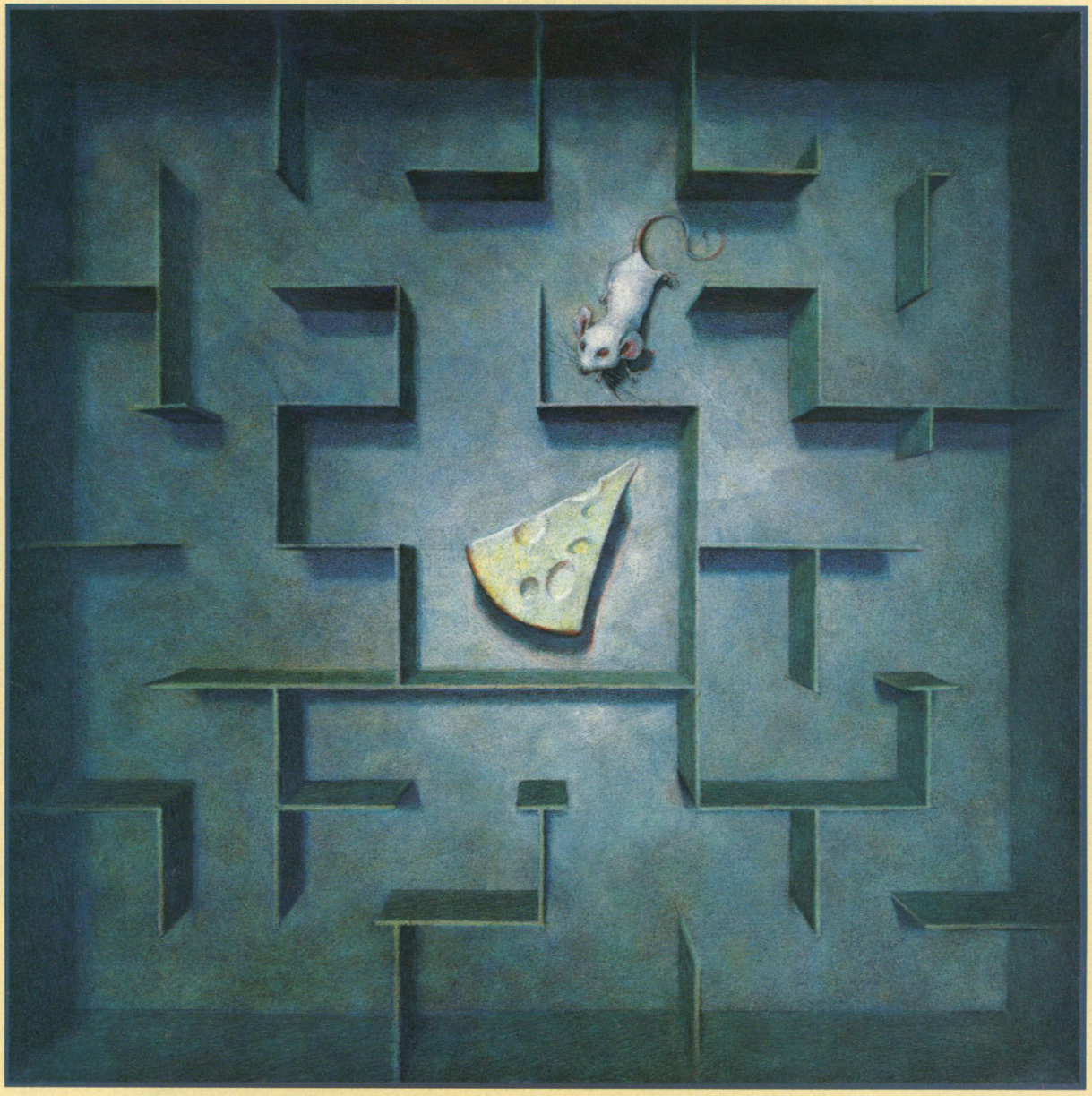
You may have a clear view of your research goal. But how you're going to get there may not always be so clear. What that requires is looking at data in new ways – ways nobody ever expected.

To find those ways, consider looking into Digital's Scientific Computing Environment.

You will see how our powerful open PCs and workstations support the most popular scientific and desktop applications. And how our robust software development environment and visualization tools enable you to quickly create specialized applications.

To expand your computing power, you will see that our massively parallel systems and supercomputers are capable of crunching huge amounts of data and reducing the time it takes

D I G I T A L. T H E



to execute complex simulations.

To expand your reach, our multivendor computing solutions easily integrate systems from IBM®, Sun®, Apple®, Cray® and many others. That way, instead of reinvesting in equipment, you can invest in your staff. And our networking capabilities make it easier for you to collaborate with colleagues around the world.

DIGITAL'S TECHNOLOGIES SPEED YOUR TIME TO DISCOVERY.

In the future, we'll continue to help you to further broaden your horizons, thanks to Alpha – our innovative, high performance 64-bit RISC-based architecture.

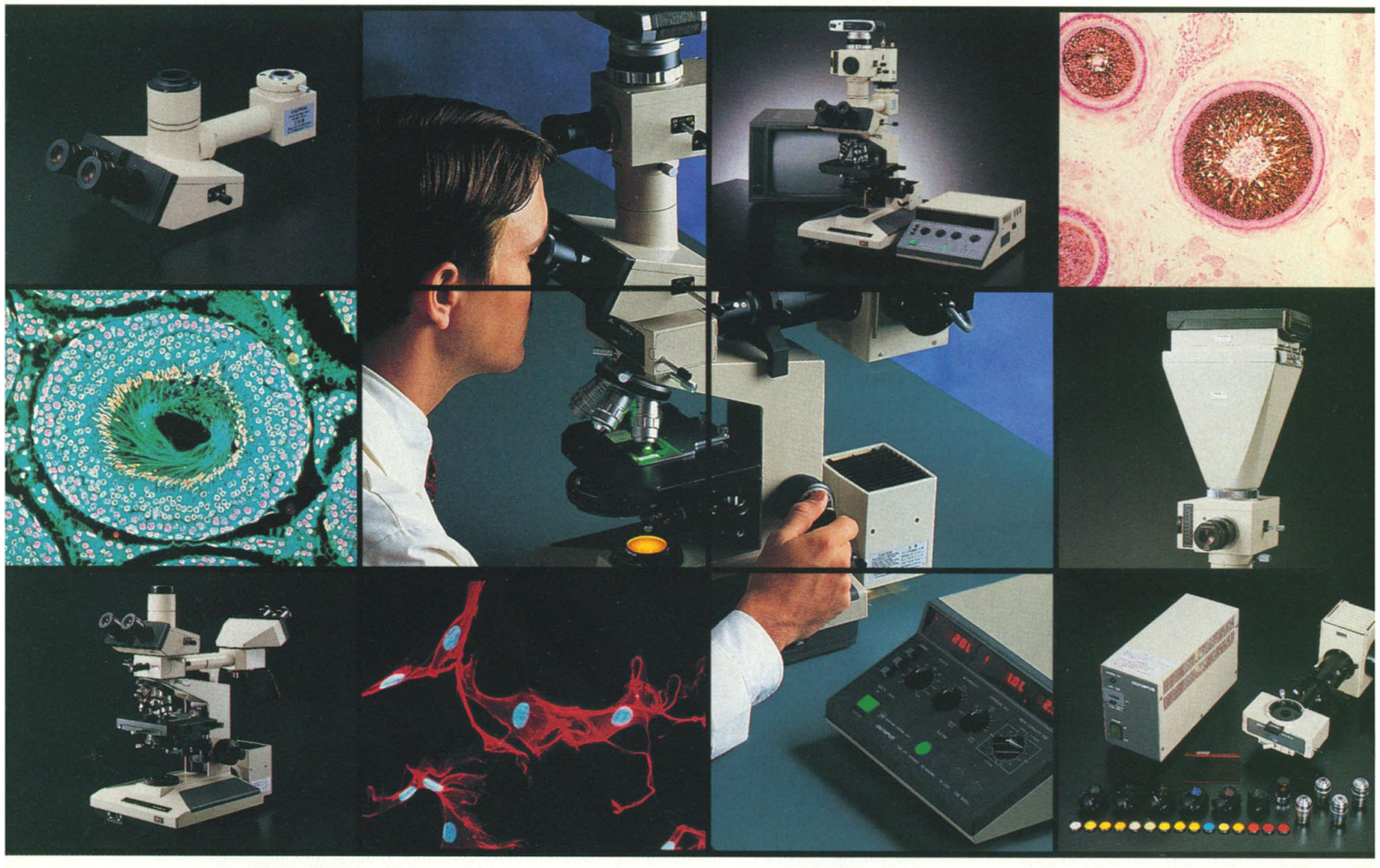
If you'd like to see how Digital can give you a different perspective, call 1-800-DEC-INFO, ext. 27 in the U.S., fax us in Europe at 32-2-729-82-03, or contact your local Digital representative.

digital™

OPEN ADVANTAGE.

Circle No. 25 on Readers' Service Card

You can't always predict the demands of advanced research.



But now you can be ready for them.

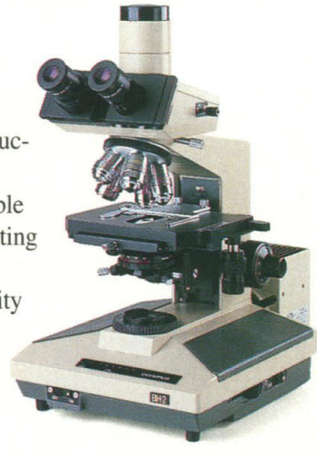
OLYMPUS BHS SERIES RESEARCH MICROSCOPES

The top-quality Olympus BHS System Microscope. Its capabilities grow with even your most ambitious advanced research applications.

Expandable. Versatile. Built for the future. With superior construction and optics that link a remarkable array of features and options.

The Olympus BHS perfects ergonomic design with an ultra-stable stand that eliminates vibration. And it refines the details. Like preventing wear with a ceramic-coated stage free of grooves that collect debris.

From there come possibilities. For outstanding publication-quality color photomicrography, the BHS offers a Light Intensity Pre-setting Switch that fine-tunes voltage for special film characteristics. Plus, superb optics and its 12V/100W halogen illumination system allow you to configure the BHS for incident light fluorescence, phase contrast, Nomarski DIC, polarized light, darkfield, and multiple viewing.



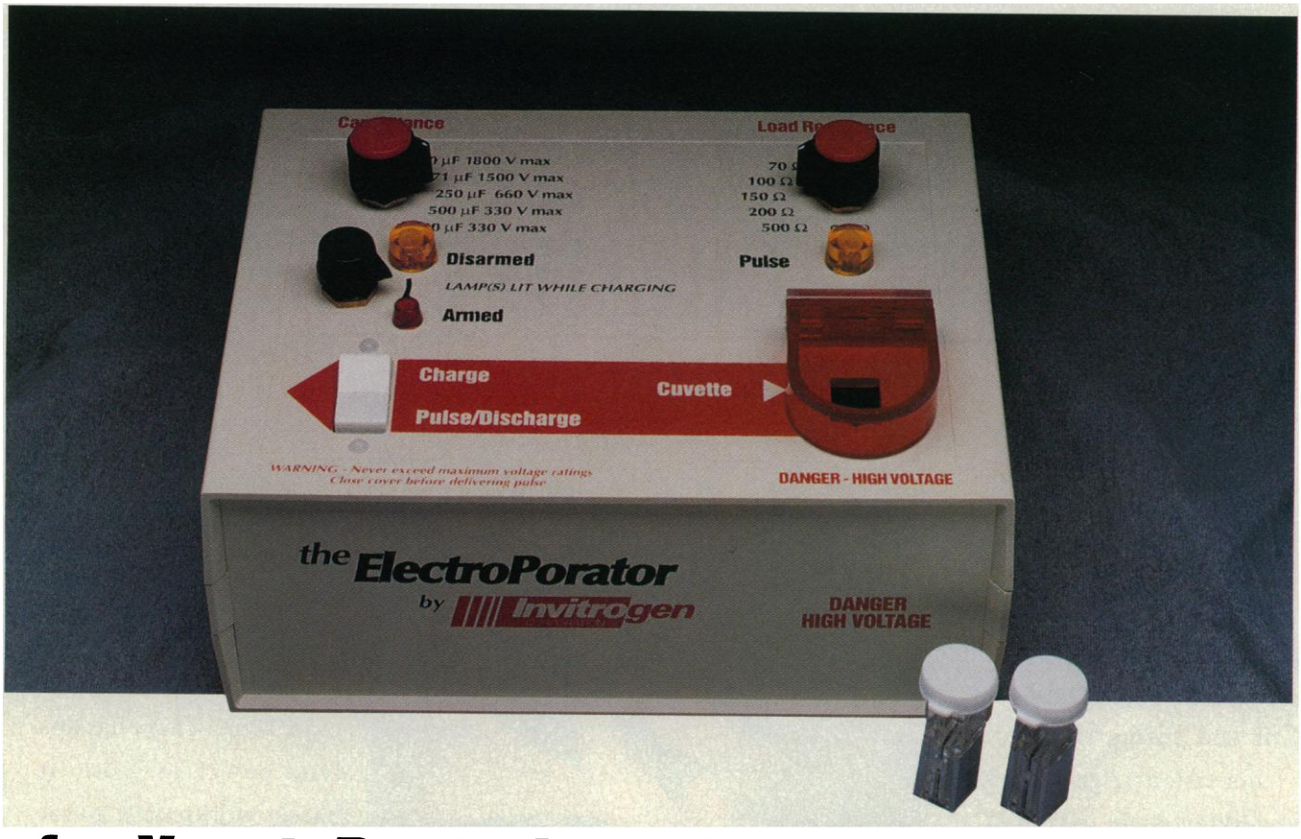
So wherever you're going, let Olympus go with you. For a demonstration call **1-800-446-5967**. Or write Olympus Corporation, Precision Instrument Division, 4 Nevada Dr., Lake Success, NY 11042-1179, Fax: 516-222-7920. In Canada: Carsen Group Inc., Markham, Ontario L3R 1E7.

OLYMPUS

The Image of Quality

Circle No. 2 on Readers' Service Card

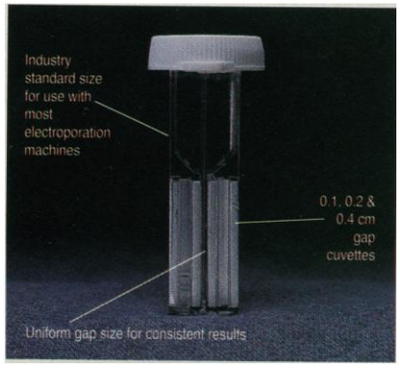
Affordable, High Efficiency Electroporation...



for Yeast, Bacteria and Mammalian Cells

The ElectroPorator™ from Invitrogen is a portable, benchtop unit with the versatility to electroporate bacteria, yeast and mammalian cells. The ElectroPorator™ works with existing power supplies for consistent results at an economical price.

- Versatile unit for transforming bacteria, yeast and mammalian cells at high efficiencies.
- Works with existing power supplies to conserve space and save research dollars.
- Accepts Invitrogen and industry standard cuvettes for maximum convenience.



ELECTROCOMPETENT *E. COLI*		
Strain	Efficiency	Cat #
TOP10F'	$1x10^9$	C665-11
INVαF'	$1x10^9$	C658-11
MC1061/P3	$1x10^9$	C663-11

The ElectroPorator™ has stepped capacitance settings ranging from 50-1000µF to allow electroporation of a wide variety of cells. Invitrogen is the source for electroporation equipment, electrocompetent cells and cuvettes.

Toll Free
1-800-955-6288
(619) 597-6200 Phone • (619) 597-6201 Fax

Invitrogen CORPORATION

3985•B Sorrento Valley Blvd., San Diego, CA 92121

BRITISH BIO-TECHNOLOGY PRODUCTS LTD
UK- Tel: (0865) 781045 Fax: (0235) 533420
France - Numéro Vert 05 90 72 49
Sweden - 020-Linjen 020 793149
Norway - Ring Grønt Nummer 050 11033
Denmark - Grønt Nummer 80 01 85 92
Belgium - Numéro Vert/Groen Nummer 78 11 04 68

CELBIO
Italy
Tel: 39-238103171
Fax: 39-238101465l

ITC
Germany/Switzerland
Tel: 62-21303907
Fax: 62-21303511

FUNAKOSHI CO., LTD.
Japan
Tel: 81-356841622
Fax: 81-356841633

BDH INC., CANADA - TEL: 800-565-7933 • BIO-TRADE, AUSTRIA - TEL: 43-1-8891819 • FINNZYMES, FINLAND - TEL: 35804208077 • MEDOS, AUSTRALIA - TEL: 61-38089077 * SANBIO BV, NETHERLANDS - TEL: 31-413251115 • TAL RON, ISRAEL - TEL: 972-8-472563 • TDI, SPAIN - TEL: 34-14091251 • ECOGEN, SPAIN - TEL: 34-934560607 • UNITED RESEARCH/GOODMAN BIOTECHNOLOGIES, INDIA - TEL: 59 1107

Circle No. 21 on Readers' Service Card

HyperChem™

MOLECULES LIKE THIS BELONG ON EVERY CHEMIST'S DESK.

Imagine your wildest molecule. No, not that one. Wilder. The most awesome, untamed, unruly molecule that ever rose from your imagination.

Now imagine modeling it and seeing it in three dimensions, right on your desktop. Right in your PC.

Impossible?

It's not only possible, it's practical. With HyperChem,™ the world's first Windows™-based molecular modeling software with the power to do serious science.

With HyperChem you'll be creating, viewing, manipulating and analyzing even your toughest molecular structures within minutes. Complicated molecules like alkaloids, proteins and DNA are no match for you and HyperChem.

You'll be calculating bond lengths, angles and torsions. Computing and displaying charge density and molecular orbital plots. Building proteins and nucleic acids quickly and easily from residue templates. And seeing your ideas emerge in 3D in stick, dot surfaces or rendered forms.

Go ahead, test assumptions. Do sanity checks. Perform "what-if" scenarios. Really pick apart a molecule. HyperChem has analytic power to spare. It barely works up a sweat over quantum mechanical calculations or molecular mechanics.

And when you want to let your colleagues in on your ideas, whisk the data to other Windows applications. Or create your own custom applications linked to HyperChem. What's more, HyperChem makes all this remarkably affordable and simple to do. It uses the Windows environment for PCs or Motif for Silicon Graphics® workstations.

So why not test some assumptions yourself?

Call 1-800-424-9737 for your free demo disk. Or 41-38-337637 in Europe. And see what the molecules inside your head are really like.

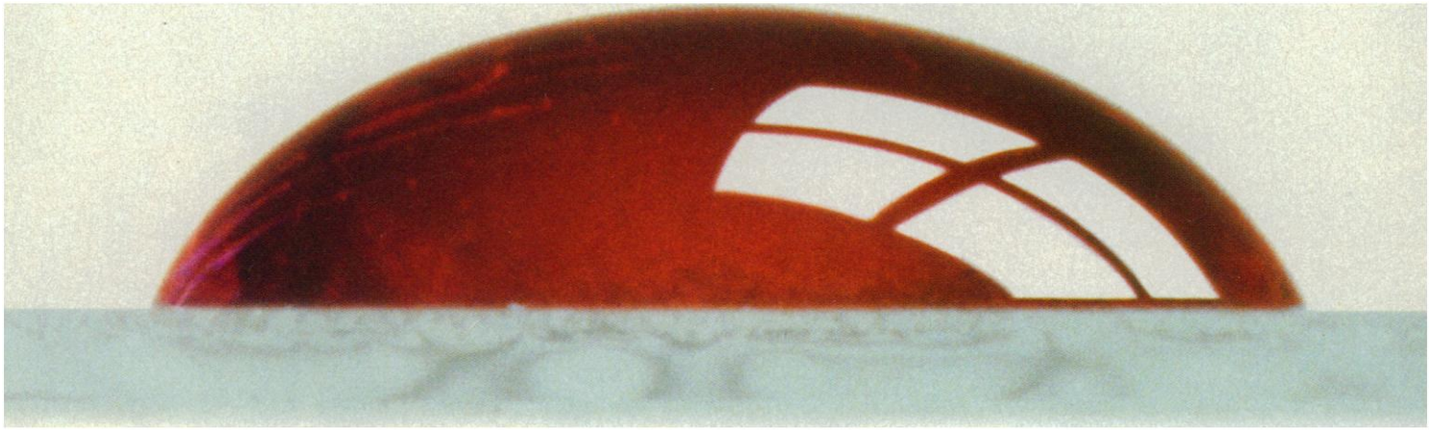
AUTODESK

See us at Science Innovation Booth 501, in San Francisco July 21-24.

C71392

Circle No. 26 on Readers' Service Card

Pure Half Megabase DNA, Even From A Drop of Blood...



Without Any Sweat or Tears!

Pure DNA, in as little as 30 minutes, for PCR, Southerns or RFLP when you use TurboGen™ and Micro-TurboGen™ isolation kits. TurboGen allows direct isolation of genomic DNA from 10^6 to $5x10^7$ cells, 50-500 mg of tissue or 2 ml of blood and Micro-TurboGen from $5x10^5$ cells, up to 50 mg of tissue and 5µl to 100µl of whole blood.

These systems feature;

- no spooling
- no incubation with proteolytic enzymes or purification with ion exchange resins
- high yield of pure DNA at a molecular weight of 20-700 kb (400 kb average).

Each TurboGen kit provides everything needed for 25 reactions in as little as 60 minutes and Micro-TurboGen allows 50 reactions in as little as 30 minutes.

If you want Pure DNA from cells, tissue or a drop of blood and you don't want all the sweat and tears that other kits can bring, call Invitrogen...

1-800-955-6288

Invitrogen CORPORATION

3985•B Sorrento Valley Blvd., San Diego, CA 92121

BRITISH BIO-TECHNOLOGY PRODUCTS LTD
UK- Tel: (0865) 781045 Fax: (0235) 533420
France - Numéro Vert 05 90 72 49
Sweden - 020-Linjen 020 793149
Norway - Ring Grønt Nummer 050 11033
Denmark - Grønt Nummer 80 01 85 92
Belgium - Numéro Vert/Groen Nummer 78 11 04 68

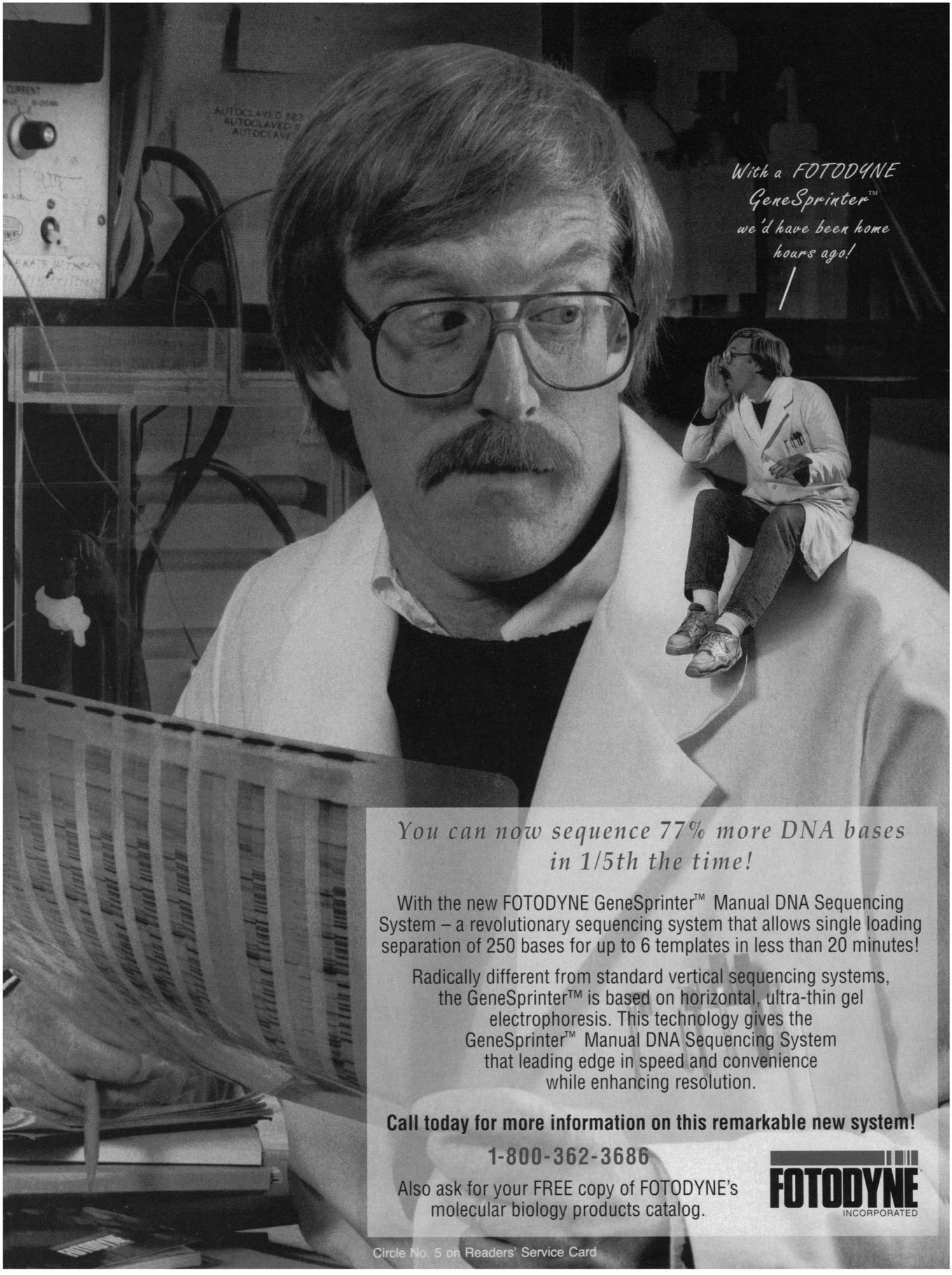
CELBIO
Italy
Tel: 39-238103171
Fax: 39-238101465l

ITC
Germany - Tel: 62-21303907
Fax: 62-21303511
Switzerland - Tel: 155-5044

FUNAKOSHI CO., LTD.
Japan
Tel: 81-356841622
Fax: 81-356841633

BDH INC., CANADA - TEL: 800-565-7933 • BIO-TRADE, AUSTRIA - TEL: 43-1-8891819 • FINNZYMES, FINLAND - TEL: 35804208077 • MEDOS, AUSTRALIA - TEL: 61-38089077 * SANBIO BV, NETHERLANDS - TEL: 31-413251115 • TAL RON, ISRAEL - TEL: 972-8-472563 • TDI, SPAIN - TEL: 34-14091251 • ECOGEN, SPAIN - TEL: 34-934560607 • UNITED RESEARCH/GOODMAN BIOTECHNOLOGIES, INDIA - TEL: 59 1107

Circle No. 22 on Readers' Service Card



You can now sequence 77% more DNA bases in 1/5th the time!

With the new FOTODYNE GeneSprinter™ Manual DNA Sequencing System – a revolutionary sequencing system that allows single loading separation of 250 bases for up to 6 templates in less than 20 minutes!

Radically different from standard vertical sequencing systems, the GeneSprinter™ is based on horizontal, ultra-thin gel electrophoresis. This technology gives the GeneSprinter™ Manual DNA Sequencing System that leading edge in speed and convenience while enhancing resolution.

Call today for more information on this remarkable new system!

1-800-362-3686

Also ask for your FREE copy of FOTODYNE's molecular biology products catalog.

FOTODYNE INCORPORATED

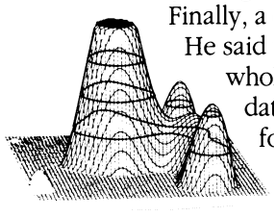
Circle No. 5 on Readers' Service Card

"Finding the right tool for the job made all the difference."

"My research project really took off when I switched to Axum for my technical graphics and data analysis."

When I hired a research assistant for this project, I knew I needed someone intelligent–someone with the flexibility and skills to do whatever needed to be done. Someone who worked quickly and efficiently–even while I was away. Someone who really understood that excellence is in the details.

I realized I needed the same qualities in my tools, and my software packages just weren't measuring up. I was spending more time switching from one program to another–trying to get my data presented the way I wanted it–than I was actually doing the research.



Finally, a colleague recommended Axum. He said that he used Axum for his whole research project–from the initial data analysis to the technical graphs for the research report and journal articles. I switched to using Axum right away.

Like a top-notch research assistant, Axum focused on the details, like tick marks and axes scaling, which meant I could focus on what I wanted the graphs to say. Plus, the large quantities of data that I dealt with turned out to be no problem for Axum.

NEW Axum 2.0

For some specialized analysis I decided to avoid the mainframe and tap into the power of Axum's built-in programming language. At one point I called TriMetrix for technical support, and was amazed by the way their rep helped me customize a program to do the analysis I needed. Axum even ran the program for me and printed the graphs after I'd left the office.

PC MAGAZINE EDITORS' CHOICE
March 26 1991
Axum Version 1.02

Axum helped me do the best work I've ever done. Now I'm convinced that Axum is the fastest way to get from my data to a finished project.

TRIMETRIX

Call us today for a **FREE** brochure on the Axum® Technical Graphics and Data Analysis package for PCs.

1-800-548-5653 ext. 430

Or, clip out this coupon and mail it to us.

Name _____

Company _____

Department _____

Address _____

City _____ State _____

Zip _____ Country _____

Telephone _____

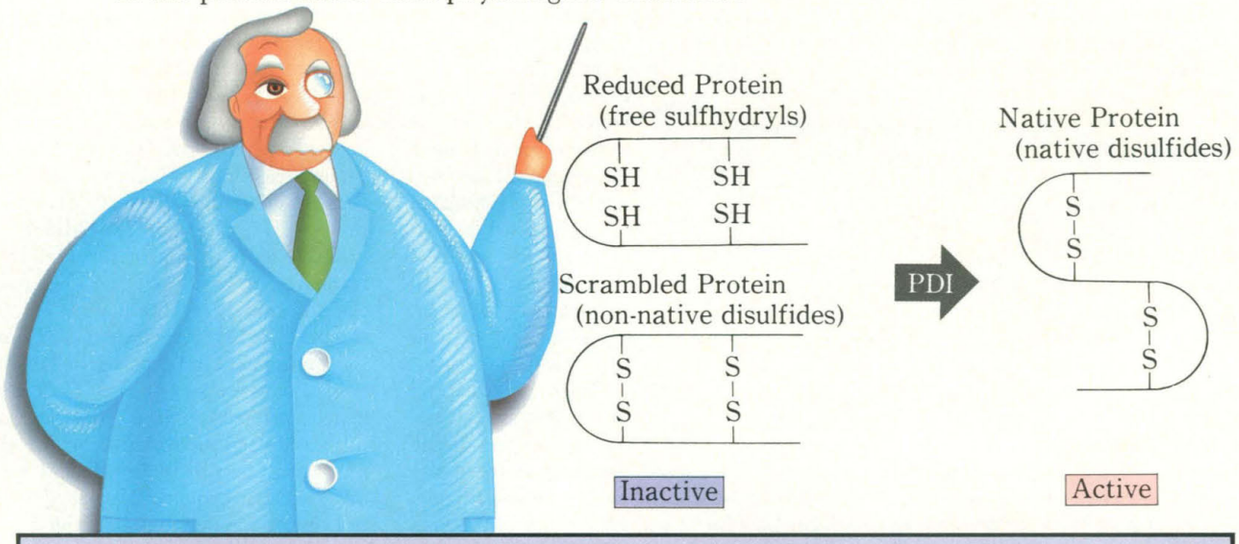
TriMetrix, Inc. • 444 NE Ravenna Blvd. • Suite 210
Seattle, WA 98115 • TEL: 206-527-1801
FAX: 206-522-9159

Axum features ultra-high resolution output by GraphiC™ from Scientific Endeavors Corporation.

Circle No. 43 on Readers' Service Card

RESTORE NATURAL ACTIVITY OF YOUR PROTEIN!

Protein Disulfide-isomerase (PDI) accelerates the exchange reactions between disulfide bonds in the presence of appropriate oxidizing or reducing reagents. Disulfide bonds are sometimes formed at random locations, resulting in a structure without activity. PDI refolds the mispositioned bonds to restore the natural activity of the protein under mild physiological conditions.



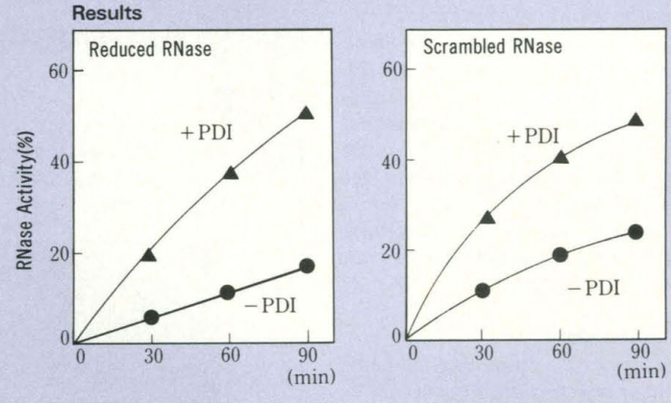
Application Example : Activation of Reduced-Denatured Ribonuclease A by PDI

Reduced-denatured RNase and Scrambled RNase (randomly formed disulfide bonds) are activated by Protein Disulfide-isomerase (PDI).

Refolding System

	Final conc.
Substrate protein	200μg/ml
Sodium phosphate buffer, pH 7.5	100mM
Glutathione	0.2mM
Reduced glutathione	2mM
PDI	20μg/ml

Results



Code No.7318:1mg/vial

TaKaRa BIOMEDICALS

TAKARA SHUZO CO., LTD.
Shijo-Higashinotoin, Shimogyo-ku,
Kyoto 600-91, Japan
Phone: +81 75-241-5167
Fax: +81 75-241-5208

TAKARA BIOCHEMICAL INC.
719 Allston Way, Berkeley
California 94710, USA
Phone: +510-649-9895
Fax: +510-649-8933
Toll Free: 1-(800)544-9899

Distributor:
Europe
PBS-Organics
Parc de l'Innovation BP 209.
67405 Illkirch Cedex France
Tel: 88 67 08 30
Fax: 88 67 38 61

ITC Biotechnology, GmbH
Postfach 103026, 6900 Heidelberg, Germany
Tel: (06221)303907
Fax: (06221)303511

British Bio-technology Products Ltd.
4-10, The Quadrant, Barton Lane, Abingdon
OX14 3YS, UK
Tel: (0235)529449
Fax: (0235)533420

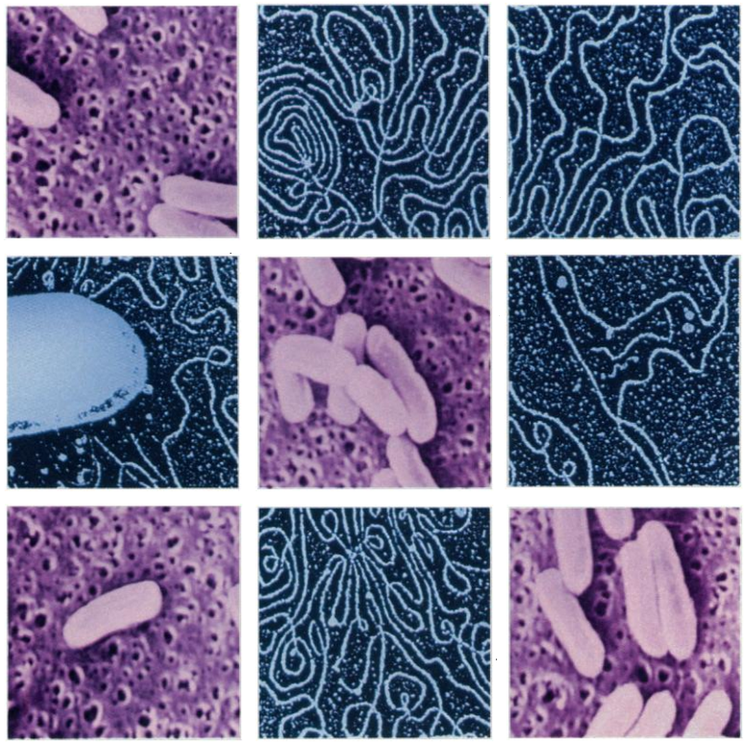
Australia
Medos Company Pty Ltd.
17 Millicent Street, Burwood Victoria 3125
Tel: (03)808 9077 Fax: (03)808 0926

Taiwan
Cheng Chin Trading Co., Ltd.
No. 75 Sec. 1, Hankow St. Taipei Taiwan
Tel: (02)331-3111 Fax: (02)382-2197

Canada
BIO/CAN SCIENTIFIC
2170 Dunwin Drive, Unit 5
Mississauga, Ontario CANADA L5L 1C7
Tel: 416-828-2455
Toll Free: 1-800-387-8125
Fax: 416-828-9422

Circle No. 44 on Readers' Service Card

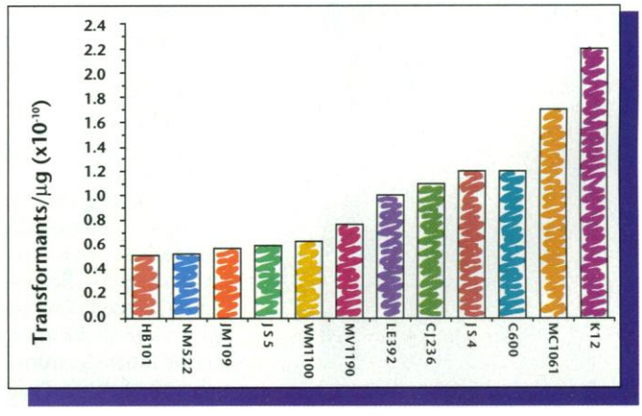
Transformation You Can Bank On



Introducing the Economical and Efficient E. coli Pulser™ Transformation System

Bio-Rad offers a complete *E. coli* electro-transformation system in the E. coli Pulser and Electro-Competent® *E. coli* cells. Designed to be economical, the system delivers precisely and exclusively the conditions required for the electroporation of *E. coli*. It provides you with the high efficiencies obtained only with electroporation, whether your application is construction of clone banks or mutagenesis. The system builds on Bio-Rad's established reputation for supplying a complete line of excellent gene transfer products. Our newest additions offer you the means to transform *E. coli* conveniently, consistently, reliably, and safely. You can bank on it!

For more information on our new E. coli Pulser transformation system call 1-800-4BIORAD.



Electro-transformation efficiencies (transformants/µg plasmid DNA) obtained with 12 different strains of *E. coli* using the E. coli Pulser and 0.1 cm cuvettes.

BIO-RAD

Life Science Group

*U.S. (800) 4BIORAD • **California** Ph. (510) 741-1000 • **New York** Ph. (516) 756-2575 • **Australia** Ph. 02-805-5000 • **Austria** Ph. 0222-87 78 901 • **Belgium** Ph. 091-85 55 11 • **Canada** Ph. (416) 624-0713 • **China** Ph. 2564308 • **France** Ph. 01-49 60 68 34 • **Germany** Ph. 089-318 84 0 • **Italy** Ph. 02-21609 1 • **Japan** Ph. 03-3534-7515 • **Kowloon** Ph. 7893300 • **The Netherlands** Ph. 08385-40666 • **New Zealand** Ph. 09-443 3099 • **Spain** Ph. (91) 661 70 85 • **Switzerland** Ph. 01-810 16 77 • **United Kingdom** Ph. 0800 181134*

Circle No. 4 on Readers' Service Card

Oncogene Science Postdoctoral Awards

For Outstanding Research in Gene Transcription

Postdoctoral scientists are invited to submit abstracts detailing their research over the last two years. Final year graduate students may also apply. Projects will be judged by a distinguished panel of scientists and preference given to research showing potential therapeutic application towards the treatment of human disease. Three $2,000 awards will be made. In addition, each winner will receive an all-expenses paid invitation to present a 20 minute talk at the Fourth Oncogene Science International Conference. One page abstracts should be accompanied by a brief curriculum vitae and sent to the Awards Committee, Oncogene Science Inc., 106 Charles Lindbergh Blvd., Uniondale, New York, 11553. Completed applications for both the meeting and the award must be submitted on or before August 15, 1992.

The Hormonal Control of Gene Transcription

edited by P. Cohen and J.G. Foulkes

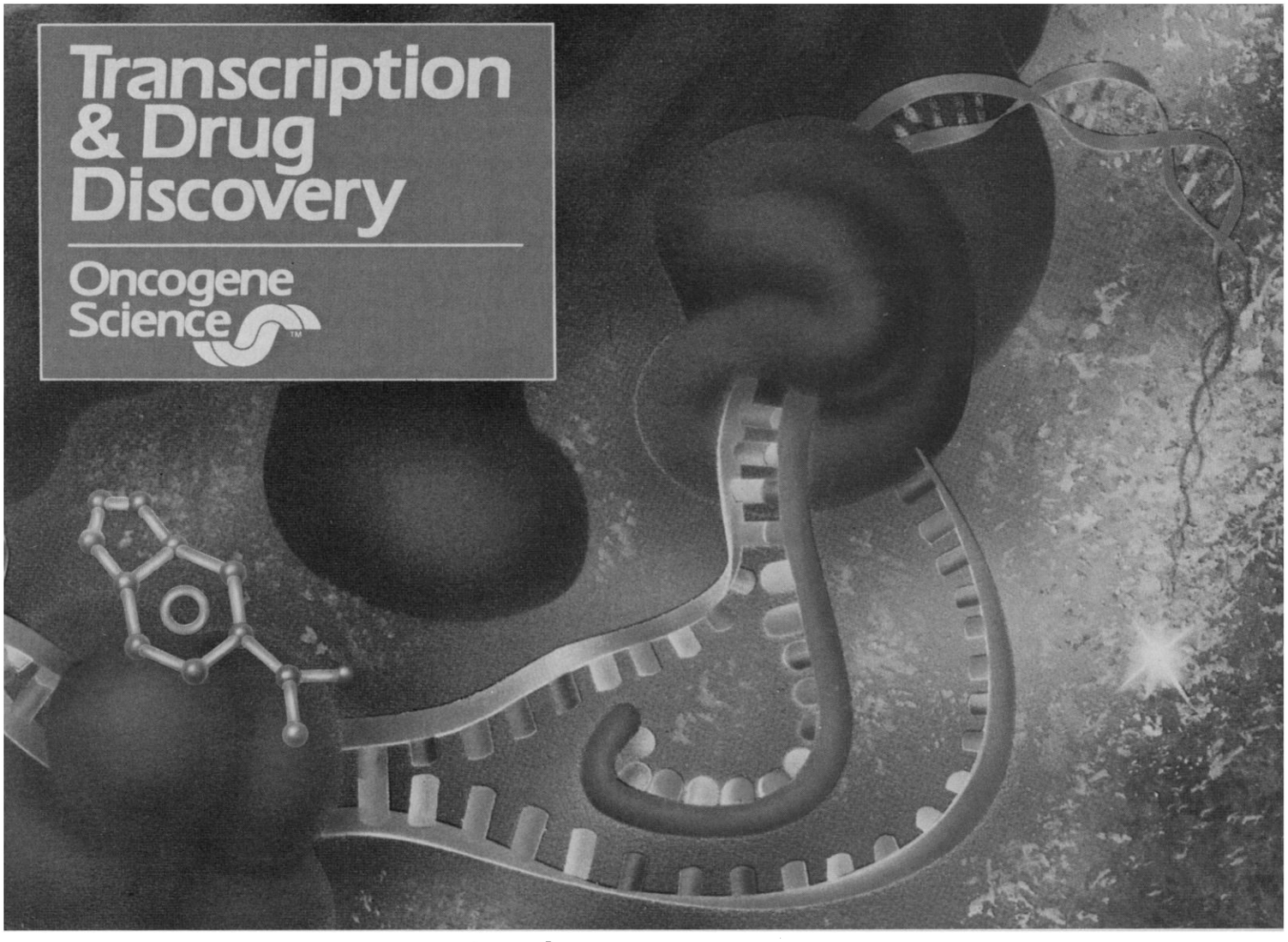
This highly detailed book contains 22 chapters and nearly 500 pages dealing with the mechanisms by which hormones and other signals control transcriptional machinery in both fully differentiated tissues and in developing embryos. Authors contibuting chapers include two Nobel Laureates and many of the leading investigators in the field of gene transcription. Price is $235, with delivery in 1-2 weeks.

Circle No. 36 for More Information

Monoclonal and Polyclonal Antibodies and DNA Probes to p53, myc, fos, and jun

Oncogene Science's high quality, purified antibodies and probes to p53, c-myc, c-fos, and c-jun are the performance standards for both specificity and reproducibility in gene and gene product identification. The antibodies are purified by non-denaturing liquid chromatography so that they yield the strongest signals and the lowest possible backgrounds in immunoprecipitations, western blots, and in staining cells and formalin-fixed, paraffin-embedded sections. Antisense, cDNA, genomic DNA, as well as a over 300 fourty-mer oligo-nucleotide probes are available to many genes.Call 1-800-662-2616 (516-222-0023 in NY and outside the U.S.) for data sheets or for a complete catalog.

Circle No. 37 for a Complete Catalog



4TH INTERNATIONAL

Oncogene Science Conference at Cold Spring Harbor Laboratory

Application Deadline August 15

OCTOBER 22-24, 1992

Speakers to include:

H. Blau
G. Crabtree
B. Cullen
T. Curran
G. Foulkes
D. Granner
F. Grosveld
S. McKnight
M. Parker
B. Roizman
M. Rosenfeld
J. Scott
P. Sharp
R. Weinberg

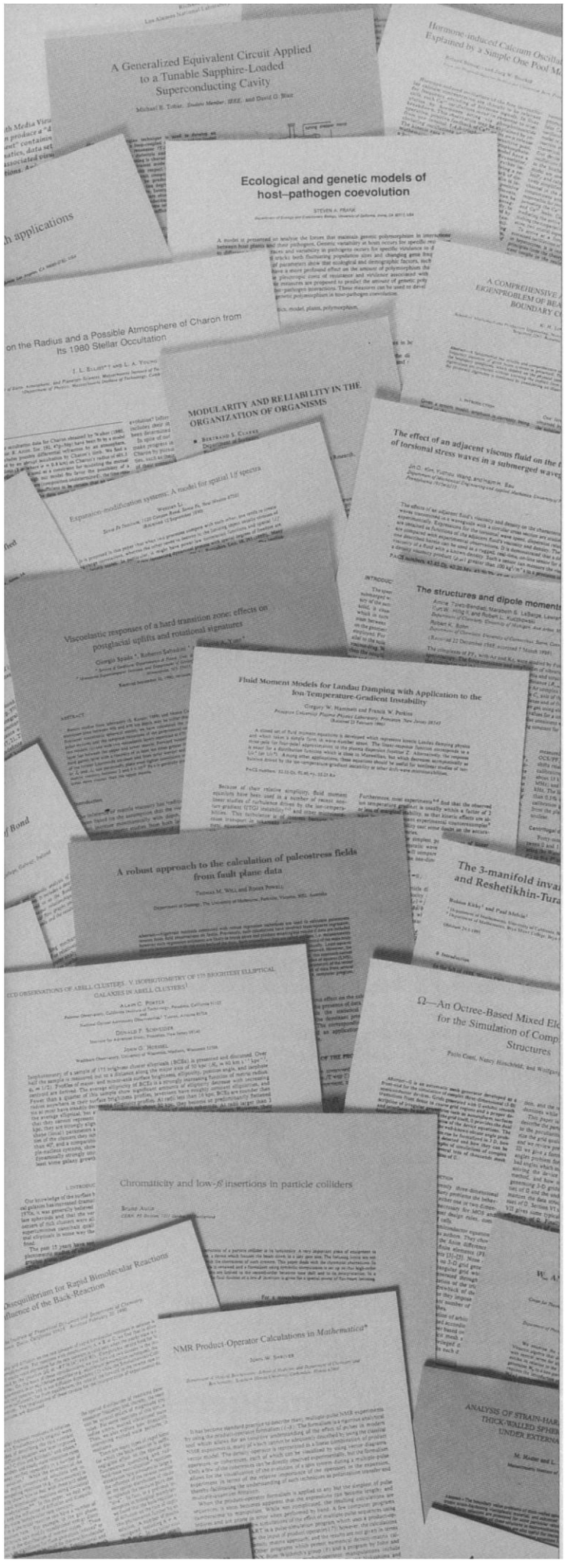
The meeting will focus on gene transcription as a novel target for drug discovery.

Therapeutic areas to be covered include:

- Cancer
- CNS
- Immunosuppression
- Metabolism
- Retenoids
- Thalassemias
- Viruses

For further information and registration materials write:

Oncogene Science, Inc.
106 Charles Lindbergh Blvd.
Uniondale, NY 11553
fax: 516/222-0114



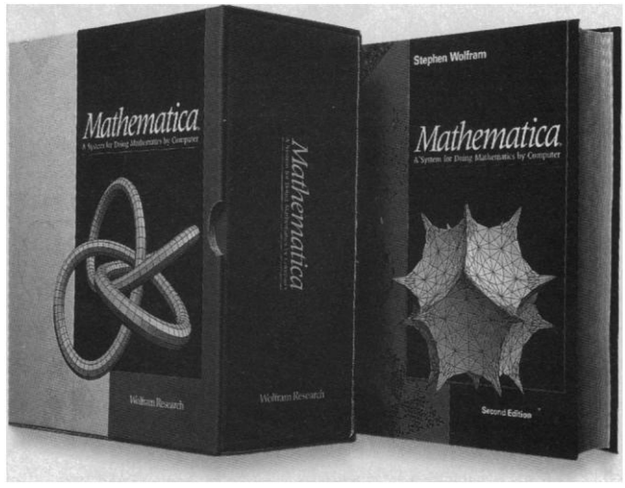
For calculations that count, you need *Mathematica*

Here are just a few of the papers published recently that have used *Mathematica* to do their calculations. From the purest mathematics to the most applied biotechnology, *Mathematica* is the standard tool used for calculations large and small. Within *Mathematica* you can do numerical and symbolic computations, produce three-dimensional plots, create high-level programs, or communicate with your existing programs. And you can do it on a variety of systems—from Macintosh computers to PCs to workstations.

More than 150,000 scientists, engineers, analysts, and students now use *Mathematica* every day, to get more results more reliably and more quickly than ever before. In fact, among the users of *Mathematica* is a remarkable array of the world's leading researchers. Can you afford not to use *Mathematica* in your research? Call us today at 1-800-441-MATH to find out just how easy it is to get started.

Mathematica®

The Standard for Technical Computing



Wolfram Research, Inc., 100 Trade Center Drive, Champaign, IL 61820-7237, USA
217-398-0700; fax: 217-398-0747; email: info@wri.com

Circle No. 20 on Readers' Service Card