

AMERICAN  
ASSOCIATION FOR THE  
ADVANCEMENT OF  
SCIENCE

# SCIENCE

14 DECEMBER 1990  
VOL. 250 ■ PAGES 1489-1628

\$3.50



Side-by-side comparisons  
of capillary electrophoresis  
systems aren't easy.



Because nothing compares with the total automation of the P/ACE™ System.

**Truly unattended methods development...**

Powerful PC control allows you to vary parameters within methods. And link methods together. Automatically change rinse sequences. And inlet and outlet buffers. Samples and sample volumes. Temperature. Voltage. Detection wavelength.

And much more. In fact, with P/ACE, you automatically increase your productivity.

**And automated fraction collection...**

P/ACE is the *only* system available today with the capability to collect peaks after separation for further purity checks and identification. Automatically.

**Proven worldwide.**

The growing network of P/ACE users spans the globe. Like no other CE system, P/ACE is improving results and increasing productivity in leading laboratories every day.



**From Beckman — the leader in capillary electrophoresis.**

Though we make everything else so easy, we're proud to make side-by-side comparisons difficult.

For more information, call 800/742-2345 (in the U.S.), or write to Beckman Instruments, Inc., 1050 Page Mill Road, Palo Alto, CA 94303-0803. Offices in major cities worldwide.

**BECKMAN**

# Research Information Systems, Inc.

## The Leader in Scientific Information Management

For computerized current awareness services, bibliographic management or grant management, more scientists depend on Research Information Systems than on all other products of this type combined.

### **Reference Manager**

*The leading bibliographic management program.*

No other system offers the power and flexibility of Reference Manager. This easy-to-use software imports references from most leading on-line scientific data bases and CD-ROMs, enables exceptionally rapid retrieval of references, and automatically reformats bibliographies in virtually any style. Reference Manager truly takes the pain out of publishing.

### **Reference Update**

*The first computerized current awareness service.*

Reference Update represents an entirely new approach to the familiar problem of staying abreast of current developments in the fields of biology and medicine. With Reference Update, a personal computer, and a few minutes each week, you can be aware of important

developments in your area of interest just days after publication. Our powerful search software provides rapid retrieval by author name(s), title and keywords, or journal along with a variety of reporting functions.

### **Abstract Express**

Subscribers to Reference Update can now obtain abstracts of articles in seconds with the use of a modem or FAX machine.

### **Grant Accountant**

*The efficient grant management software.*

Grant Accountant is designed specifically for academic departments that must deal with the problem of administering grant funds. One of the first software packages of its type, it tracks expenditures and provides up-to-date reports on the status of all accounts. Grant Accountant serves as any easy-to-use system of checks and balances when it is time to reconcile laboratory expenditures with institutional reports.

Call today for detailed information and a sample weekly issue of the Reference Update service.



**Research Information Systems, Inc.**

Camino Corporate Center, 2355 Camino Vida Roble, Carlsbad, CA 92009 USA  
(800) 722-1227, (619) 438-5526, Fax (619) 438-5573

Circle No. 31 on Readers' Service Card

1495 This Week in *Science*

## Editorial

1497 Incorporation of New Science into Risk Management

## Letters

1498 When Kin Correlations Are Not Squared: T. J. BOUCHARD, JR., D. T. LYKKEN, M. MCGUE, N. L. SEGAL, A. TELLEGEN ■ Frazil Ice: S. F. DALY ■ Imprisoned in Sudan: H. BRINNEL, M. CABANAC, R. HALES, E. NADEL, T. NAGASAKA ■ Carcinogenesis Debate: B. N. AMES AND L. S. GOLD ■ Primate Research Institute: AIDS Research Program: P. A. MARX; K. WRIGHT

## News & Comment

1500 Europe: Betting Heavily on Fusion  
1501 U.S. Fusion Program: Struggling to Stay in the Game  
1503 Third Strike for NCI Breast Cancer Study  
1504 Deficits Trip U.K. Science Funding Agencies  
1505 Parallel Track: Where Should It Intersect Science?  
1506 NIH Panel: Bovine Hormone Gets the Nod  
1507 Cold Fusion at Texas A&M: Problems, But No Fraud  
1508 Brown Gets Science Committee Post  
William Happer to Be DOE Research Chief?

## Research News

1509 Human Brain Disease Engineered in Mice  
1510 Viewing the Universe as a Coat of Chain Mail ■ Keck's First Light  
1512 Introns Pop up in New Places—What Does It Mean?  
1513 Nitrogenase Structure Revealed  
1514 *Briefings*: Virology Dead, Says Duesberg ■ Cyanide in Them Thar Hills ■ Hopeful News for CF Pilot Studies ■ NEA Dumps on Science Art ■ No Conflict on Conflict of Interest ■ Paradigm Wars

## Articles

1524 New Physicians: A Natural Experiment in Market Organization: A. E. ROTH  
1529 Astrophysics and Cosmology Closing in on Neutrino Masses: A. DAR  
1533 A View of Interphase Chromosomes: L. MANUELIDIS

## Research Article

1541 Interfacial Catalysis: The Mechanism of Phospholipase A<sub>2</sub>: D. L. SCOTT, S. P. WHITE, Z. OTWINOWSKI, W. YUAN, M. H. GELB, P. B. SIGLER

## Reports

1547 Melting of Diamond at High Pressure: G. GALLI, R. M. MARTIN, R. CAR, M. PARRINELLO  
1549 Stable Isotopic Evidence for a Pedogenic Origin of Carbonates in Trench 14 near Yucca Mountain, Nevada: J. QUADE AND T. E. CERLING  
1552 The Kangmar Dome: A Metamorphic Core Complex in Southern Xizang (Tibet): Z. CHEN, Y. LIU, K. V. HODGES, B. C. BURCHFIELD, L. H. ROYDEN, C. DENG  
1556 Evolution of a Balanced Sex Ratio by Frequency-Dependent Selection in a Fish: D. O. CONOVER AND D. A. VAN VOORHEES

■ **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 © 1990 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$80. Domestic institutional subscription (51 issues): \$150. Foreign postage extra: Canada \$46, other (surface mail) \$46, air mail via Amsterdam \$85. First class, airmail, school-year, and student rates on request. **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 1723, Riverton, NJ 08077. **Single copy sales:** Current issue, \$3.50; back issues, \$5.00; Biotechnology issue, \$6.00 (for postage and handling, add per copy \$0.50 U.S., \$1.00 all foreign); Guide to Biotechnology Products and Instruments, \$20 (for postage and handling add per copy \$1.00 U.S., \$1.50 Canada, \$2.00 other foreign). Bulk rates on request. **Authorization to photocopy** material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that the base fee of \$1 per copy plus \$0.10 per page is paid directly to CCC, 27 Congress Street, Salem, Massachusetts 01970. The identification code for *Science* is 0036-8075/83 \$1 + .10. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objectives are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.



COVER An Asian cobra. Snake and insect venoms provide experimentalists with proteins for the study of biological action at the membrane surface. Venom phospholipase A<sub>2</sub> from a Chinese cobra, which is closely related to the one shown here, forms crystals of an inhibitor complex, the structure of which reveals the molecular mechanism of interfacial catalysis. See page 1560. [Photograph by Jessie Cohen, courtesy of National Zoological Park, Smithsonian Institution]

- 1558 Acetylcholine Binding by a Synthetic Receptor: Implications for Biological Recognition: D. A. DOUGHERTY AND D. A. STAUFFER
- 1560 Crystal Structure of Cobra-Venom Phospholipase A<sub>2</sub> in a Complex with a Transition-State Analogue: S. P. WHITE, D. L. SCOTT, Z. OTWINOWSKI, M. H. GELB, P. B. SIGLER
- 1563 Crystal Structure of Bee-Venom Phospholipase A<sub>2</sub> in a Complex with a Transition-State Analogue: D. L. SCOTT, Z. OTWINOWSKI, M. H. GELB, P. B. SIGLER
- 1566 Bacterial Origin of a Chloroplast Intron: Conserved Self-Splicing Group I Introns in Cyanobacteria: M.-Q. XU, S. D. KATHE, H. GOODRICH-BLAIR, S. A. NIERZWICKI-BAUER, D. A. SHUB
- 1570 An Ancient Group I Intron Shared by Eubacteria and Chloroplasts: M. G. KUHSEL, R. STRICKLAND, J. D. PALMER
- 1573 Complementation of the Mitotic Activator, p80<sup>cdc25</sup>, by a Human Protein-Tyrosine Phosphatase: K. L. GOULD, S. MORENO, N. K. TONKS, P. NURSE
- 1576 Genetic Mechanisms of Tumor Suppression by the Human p53 Gene: P.-L. CHEN, Y. CHEN, R. BOOKSTEIN, W.-H. LEE
- 1580 Norwalk Virus Genome Cloning and Characterization: X. JIANG, D. Y. GRAHAM, K. WANG, M. K. ESTES
- 1583 Homologous Recombination and Stable Transfection in the Parasitic Protozoan *Trypanosoma brucei*: M. G.-S. LEE AND L. H. T. VAN DER PLOEG
- 1587 Spontaneous Neurodegeneration in Transgenic Mice with Mutant Prion Protein: K. K. HSIAO, M. SCOTT, D. FOSTER, D. F. GROTH, S. J. DEARMOND, S. B. PRUSINER
- 1590 Broadly Neutralizing Antibodies Elicited by the Hypervariable Neutralizing Determinant of HIV-1: K. JAVAHERIAN, A. J. LANGLOIS, G. J. LAROSA, A. T. PROFY, D. P. BOLOGNESI, W. C. HERLIHY, S. D. PUTNEY *et al.*
- 1593 Secretion of Neurotoxins by Mononuclear Phagocytes Infected with HIV-1: D. GIULIAN, K. VACA, C. A. NOONAN
- 1596 Poliovirus Mutants Resistant to Neutralization with Soluble Cell Receptors: G. KAPLAN, D. PETERS, V. R. RACANIELLO

## Book Reviews

- 1600 Reappraisals of the Scientific Revolution, *reviewed by* A. E. SHAPIRO ■ From Cologne to Chapel Hill; The Right Place at the Right Time; From Design to Discovery, J. F. BUNNETT ■ Food Hoarding in Animals, D. F. SHERRY ■ The Theory of Coherent Atomic Excitation, K. RZĄŻEWSKI ■ Books Received

## Products & Materials

- 1605 Automated Amino Acid Analysis ■ Hybridization Incubator ■ Spectropolarimeter System ■ Genetic Thermal Cycler ■ Microforge ■ Population Dynamics Software ■ Literature

### Board of Directors

Richard C. Atkinson  
*Retiring President,  
Chairman*

Donald N. Langenberg  
*President*

Leon M. Lederman  
*President-elect*

Mary Ellen Avery  
Francisco J. Ayala  
Eugene H. Cota-Robles  
Robert A. Frosch  
Joseph G. Gavin, Jr.  
John H. Gibbons  
Beatrix A. Hamburg  
Florence P. Haseltine

William T. Golden  
*Treasurer*

Richard S. Nicholson  
*Executive Officer*

### Editorial Board

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

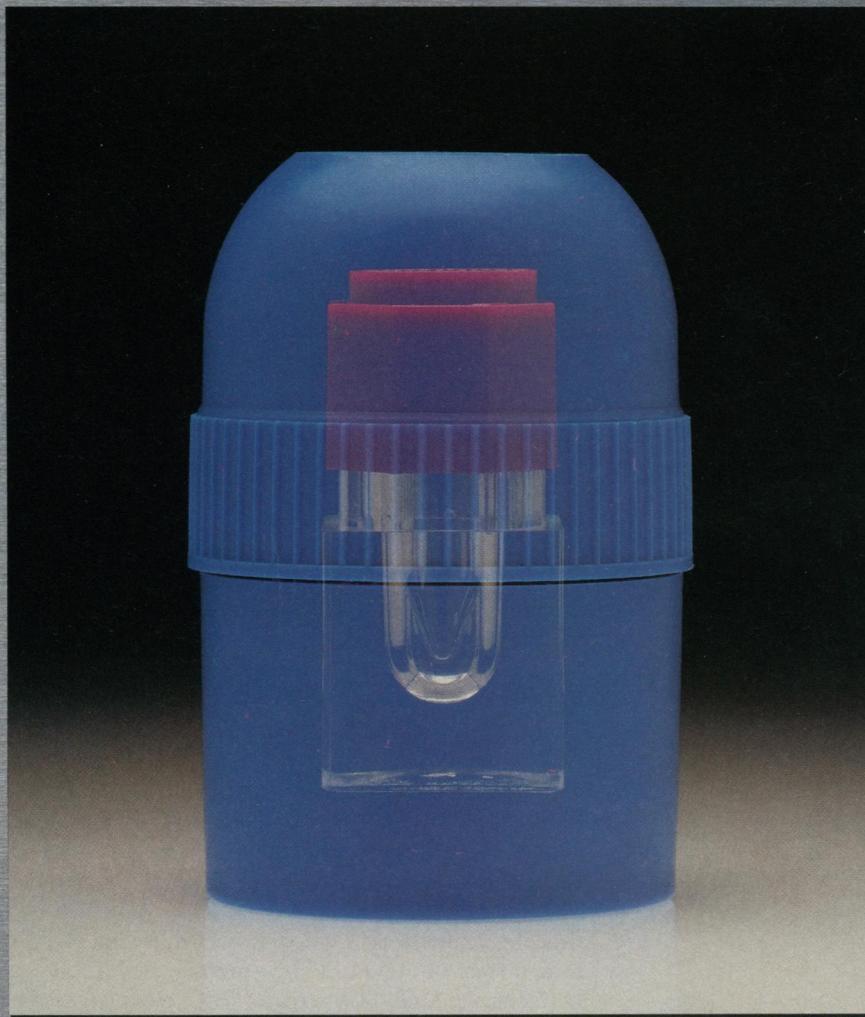
### Board of Reviewing Editors

John Abelson  
Don L. Anderson  
Stephen J. Benkovic  
Gunter K.-J. Blobel  
Floyd E. Bloom  
Henry R. Bourne  
James J. Bull  
Kathryn Calame  
Charles R. Cantor  
Ralph J. Cicerone  
John M. Coffin  
Robert Dorfman  
Bruce F. Eldridge  
Paul T. Englund  
Fredric S. Fay  
Harry A. Fozzard

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

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

# Look to the Leader.



## First in Safety and Convenience... NEN<sup>®</sup> Research Products.

Since 1985, the unique NENSURE<sup>™</sup> system from Du Pont has set the standard for radiochemical packaging. Based on proven performance over thousands of shipments, the system provides:

- Ease of use
- Safe storage of unused product
- Reduced radiation exposure

Many NEN<sup>®</sup> Research Products, including <sup>32</sup>P-, <sup>35</sup>S-, and <sup>125</sup>I-labeled compounds are already

packaged in the NENSURE system. Some <sup>3</sup>H and <sup>14</sup>C radiochemicals are also shipped in the NENSURE system, and more are being added regularly.

From the radiochemicals to the packaging, no one offers more to meet your research needs than Du Pont. Call your Du Pont representative to order NEN Research Products and see for yourself.

United States 1-800-551-2121 • Canada 1-800-387-2179 • Australia (008) 226326 • France (01) 4550-6141 •  
Fed. Rep. of Germany (06172) 87-2600 • Italy (055) 247 8044 • Japan 03-224-8763 • Latin America/Asia  
Pacific (302) 992-4033 • Switzerland (01) 841 0330 • United Kingdom (0438) 734680

*Better things for better living*



Circle No. 168 on Readers' Service Card

## This Week in SCIENCE

### Catalytic mechanism

**P**HOSPHOLIPASES are lytic enzymes that cleave aggregated phospholipids at membrane surfaces. They are abundant in mammalian pancreatic juice and in the venom of snakes and insects. Because the catalytic activities of phospholipases result in the release of substances that trigger inflammatory reactions, insights into how these enzymes work might clarify the nature of destructive inflammatory responses and lead to the development of inhibitory pharmaceuticals. Furthermore, the actions of phospholipases may be much like those of other enzymes that act at interfaces. Three papers this week by Sigler, Scott, White, and colleagues provide new data on the structure and likely mode of action of phospholipase A<sub>2</sub> molecules (pages 1541, 1560, and 1563). Crystal structures were solved for bee venom phospholipase A<sub>2</sub> in a complex with a transition state analog and for snake venom phospholipase A<sub>2</sub> in a similar complex or uninhibited. Although the snake and bee phospholipases are different, their catalytic surfaces and interactions with the analogs and with calcium ions were virtually identical. On the basis of the stereochemical observations, mechanisms are proposed to explain how the substrate enters the enzyme's active site and how its cleavage is accomplished.

### Nuclear waste repository

**A** site in the Yucca Mountains of southern Nevada has been selected as a possible burial place for nuclear waste. How suitable a choice is it? Specifically, how likely is it that in the foreseeable future the underlying water table (currently about 250 meters below the proposed site) will rise to the level of the repository and transport radioactive materials to discharge points? Studies by Quade and Cerling indicate that the level of the regional water table remained below the elevation of the proposed repository for at least the last 300,000 years (page 1549). Carbon and oxygen isotopes in layered carbonates at Trench 14, which

is near the site, matched those associated with modern desert soil carbonates (which formed independent of ground water) rather than those of nearby springs. If radioactive wastes are eventually buried at the Yucca Mountain site, it appears that they will remain where they are interred.

### Balanced sex ratio

**W**HY do so many species of organisms produce approximately equal numbers of male and female progeny? Does the balanced sex ratio reflect a selection process that leads to equal numbers of males and females or is it merely a nonadaptive consequence of a genetic sex-determining mechanism (equal numbers of male and female sex chromosomes)? Conover and Van Vorhees have studied sex-ratio determination in populations of Atlantic silversides whose sex is determined both by an environmental factor (water temperature) and by genetics (sex-determining genes) (page 1556). The larvae that develop when the water temperature is cold become females; those that develop in warmer water become males. Once sex is determined it is irreversible. When the silversides were grown in tanks of sea water held at constant extreme temperatures, sex ratios were highly skewed; with time, frequency-dependent selection of the minority sex drove the sex ratio back to 1:1. The results provide experimental support for a 60-year-old theory that the balance is adaptive. They also suggest that, despite dramatic changes in the environment, the ratio can return to 1:1 even in species whose sex ratio normally is under the influence of environmental factors. Therefore, extinction in the face of a changed environment would not be inevitable.

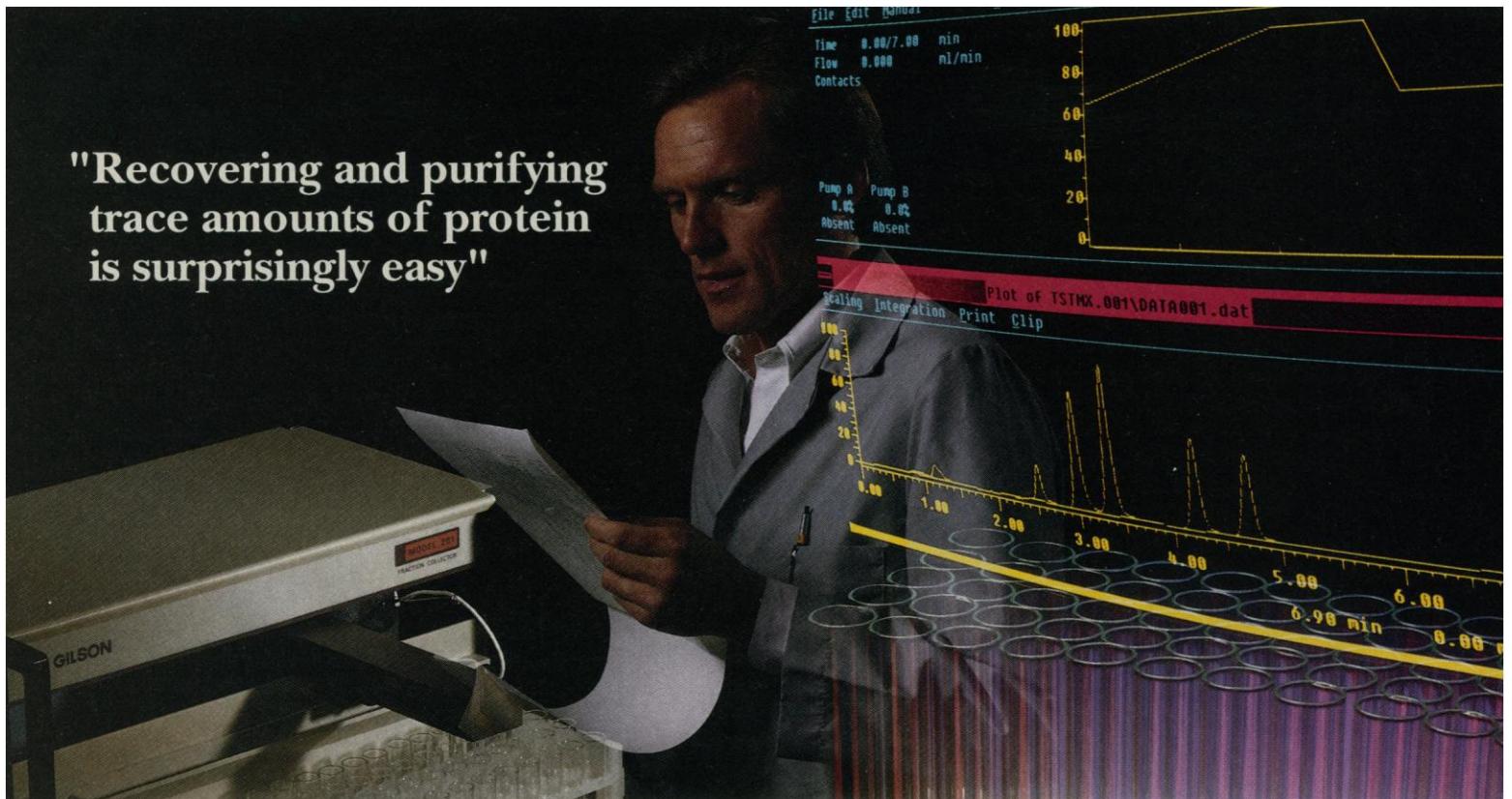
### Targeted gene insertions

**P**ARASITIC protozoa cause tremendous morbidity and mortality worldwide, both in animals and in humans. There is, therefore, keen interest in understanding their biology and

in preparing vaccines from live attenuated organisms (those that reproduce and induce immunity but are not pathologic). One approach to both of these goals is to disrupt or alter the functioning of the parasite's own genes or to insert new genes into the parasite's chromosomes. Lee and Van der Ploeg describe methods for targeting genes to specific sites on the chromosomes of *Trypanosoma brucei*, the parasite that causes sleeping sickness in humans (page 1583). They confirmed that the genes were stably integrated into the chromosome and properly expressed. Successful integration was achieved through recombination between homologous regions on the plasmid that carried the new genes and on the target site of the chromosome. Because the majority of the integration events occurred by homologous recombination, detailed analyses of these protozoal genomes should now be possible.

### AIDS neurologic damage

**T**HE AIDS virus can have devastating effects on the nervous system of an infected individual. In the worst cases, paralysis, seizures, and global dementia can result. In vitro studies suggest that the neurologic damage may be induced by toxic substances that are secreted by HIV-1-infected mononuclear phagocytic cells (page 1593). Cells in this lineage reside in the brain (microglia) or invade the brain (macrophages and multinucleated macrophage-like giant cells) and, when activated by the infection, may chronically release their poisons. Partial characterization of the secreted toxin suggested that it was unlike any known HIV-1 protein or previously characterized toxic substance secreted by activated macrophages. It acted through the neuronal NMDA receptors, which have been implicated in a variety of neuropathologic conditions. Giulian *et al.* propose that the neurologic consequences of HIV-1 infections might be reduced by suppressing macrophage activation, blocking synthesis of the neurotoxin, or blocking the NMDA receptors. ■ RUTH LEVY GUYER



**"Recovering and purifying trace amounts of protein is surprisingly easy"**

## Chromatographers speak out about the Gilson Auto-Preparative HPLC system

The Gilson Auto-Preparative HPLC system has one pump for mobile phase delivery, another for repetitive sample injection. And that, according to a chromatographer in radiation oncology and cancer research, makes it surprisingly easy to recover trace amounts of protein from complex sample matrices. Repetitive injection of small volumes of sample allows the use of high-efficiency analytical or semi-prep columns for high throughput, excellent resolution, and very pure fractions.

**"Overnight operation has really increased throughput"**

A pharmaceutical QC lab supervisor likes the capacity and reliability of the system. A multi-mode fraction collector with 120- or 540-tube capacity is the key. The collector—either the Gilson 201 or 202—has a stationary rack design. Unlike collectors with carousel racks, it won't jam. The collector acts as a system controller, and multicycle capability allows collection of fractions from the repetitive runs into the same set of tubes for automated sample purification.

**"Analytical and prep run results are reproducible"**

After method development with an analytical system, many labs switch to preparative scale sample purification. Or switch back and forth to perform purity checks. With Gilson HPLC pumps, you simply replace the pump head to change the flow rate. Eight interchangeable pump heads offer flow rates as high as 200 ml/min.

**"It's a compact system that saves bench space"**

The Gilson Auto-Preparative system is made up of modular components. The basic system stack, including the detector and pumping modules, has a footprint of about one square foot. And the 201 fraction collector offers 120-tube capacity in an equally compact space.

**"Upgrading to gradient analysis was easy"**

The modular design that makes our systems easy to fit on a crowded bench also makes it easy to upgrade the system. Going from isocratic to

gradient with the Auto-Preparative system simply requires the addition of pumping modules and, when necessary, a controller. All components from the original system are used, so none of your initial investment is lost.

**To hear more, contact us today**

We'll start by sending you a data sheet on this and other Gilson HPLC systems. Then, if you'd like, we'll put you in touch with some of the researchers we've been talking to. You can ask them for yourself about the performance of the Gilson Auto-Preparative HPLC system. Just mark the reader service number below. Or call us toll-free at 800-445-7661. (In Wisconsin call 608-836-1551.)

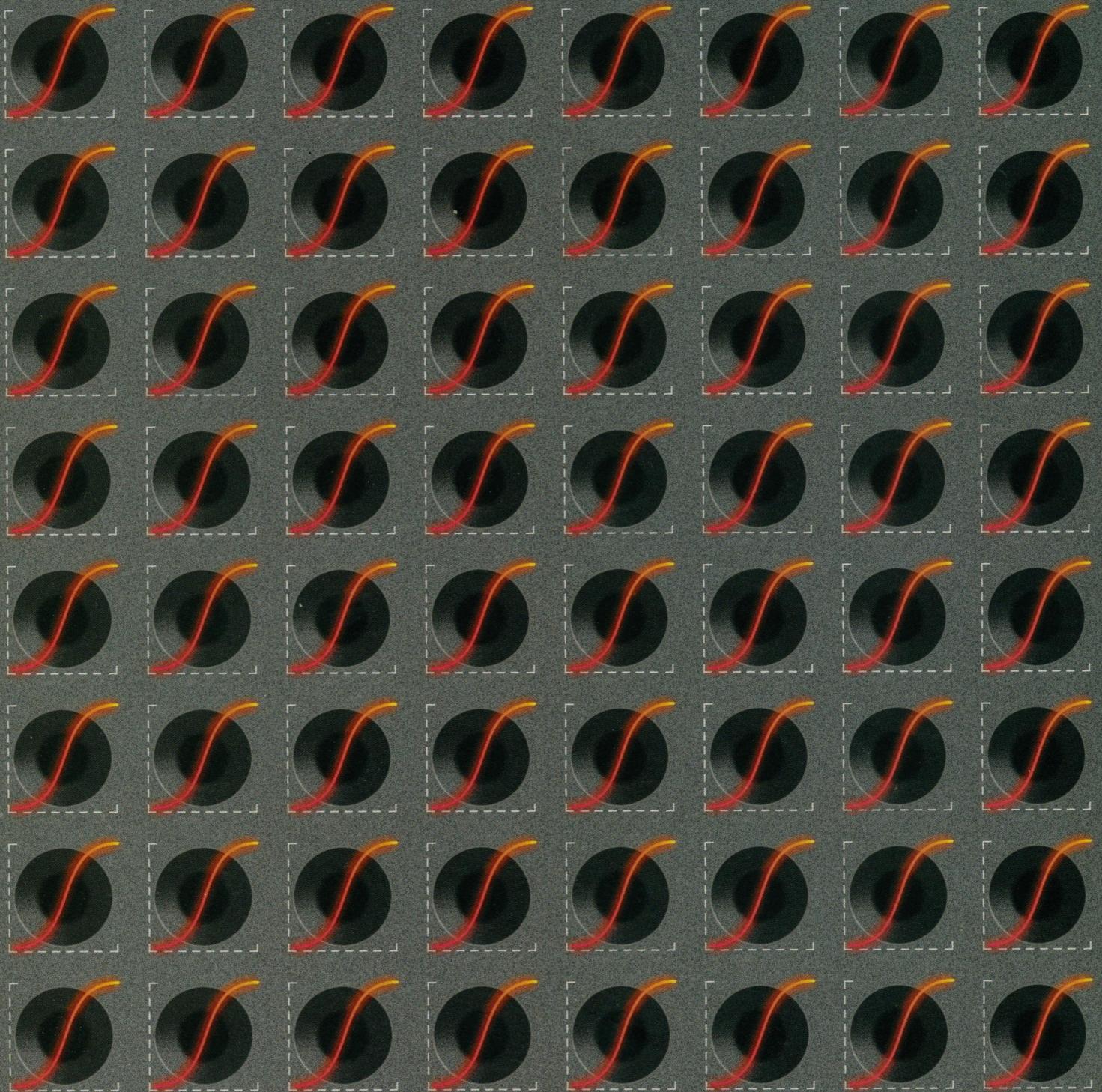


**GILSON®**

Gilson Medical Electronics, Inc., Box 27, 3000 W. Beltline Hwy., Middleton, WI 53562 USA, Tel: 608-836-1551, TLX: 26-5478, FAX: 608-831-4451  
 Gilson Medical Electronics (France) S.A., 72 rue Gambetta, B.P. No. 45, 95400 Villiers-le-Bel, France, Tel: (33) 1 34.29.50.00, TLX: 606682, FAX: (33) 1 34.29.50.80

Circle No. 165 on Readers' Service Card

# Pure Power x 96.



# Second Generation PCR Technology.



**Speed.** The new GeneAmp®



**PCR System 9600** combines

thin-walled MicroAmp™ Reaction Tubes, a 96-well format, unique sample block design and high



performance PCR protocols. Our second generation PCR technology provides the

fastest amplification system available,

unleashing the power you need to accelerate your research.

**Precision.** The GeneAmp PCR System 9600's integrated design accurately controls sample

temperature and completely eliminates the need for oil, providing unparalleled uniformity

and the highest reproducibility of your results.

**Confidence.** The GeneAmp PCR System 9600 is backed by the Perkin-Elmer Cetus

**PCR Performance**

**Guarantee.** A com-

mitment that brings

you the expertise and



resources of the industry leader. For tech-

nical information and to order in the U.S., call

1-800-762-4001. Or call 1-800-762-4000 for

literature. Outside the U.S., contact your

local Perkin-Elmer representative.

## **PERKIN ELMER CETUS**

Europe Vaterstetten, Germany Tel: 49-8106-381-112 Fax: 49-8106-6697

U.K. Beaconsfield, England Tel: 44-0494-676161 Fax: 44-0494-678324

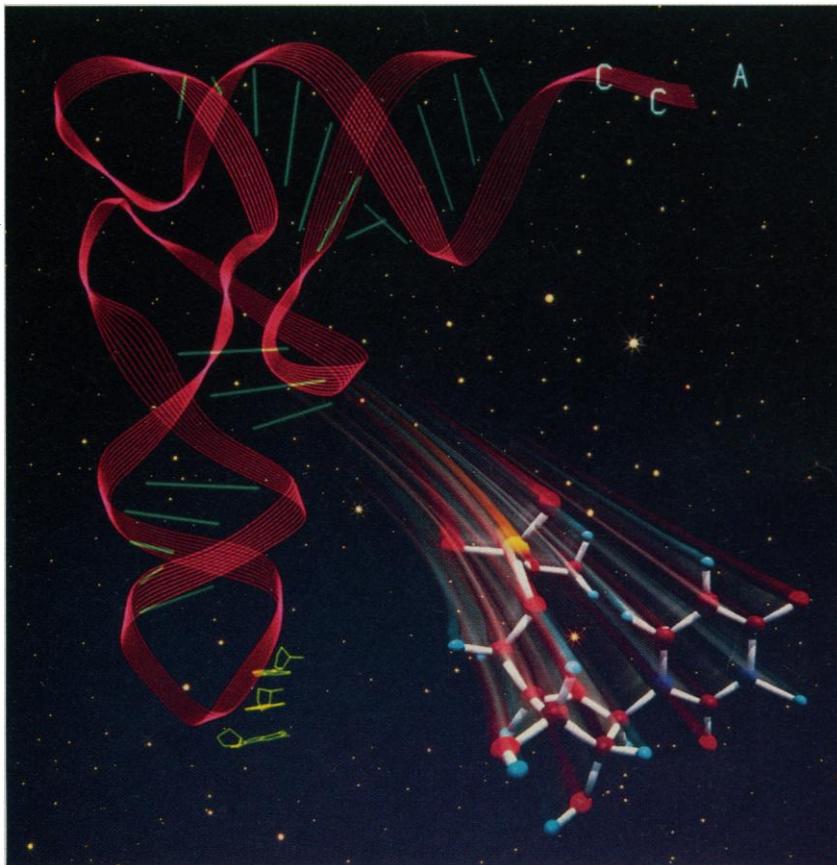
Canada Montreal, Canada Tel: 514-737-7575 Fax: 514-737-9726

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

GeneAmp is a registered trademark and MicroAmp is a trademark of Cetus Corporation.  
The PCR process is covered by U.S. patents issued to Cetus Corporation.

Circle No. 196 on Readers' Service Card



## MilliGen/Biosearch gives RNA synthesis a quantum push forward.

MilliGen/Biosearch, in collaboration with the industry's key investigators, pioneered the research and development of RNA synthesis. Our complete RNA Synthesis Package is the only one available today.

We've dramatically improved the quality of automated RNA synthesis by producing the industry's purest monomers and reagents. (High resolution mass spectroscopy and elemental analysis attest to the purity of our monomers, while the isomeric purity of every batch of RNA amidites is proven by NMR.) Only chemistry of this quality – proven by T<sub>2</sub>RNAse digest and NMR – can assure biologically active RNA.

Give your RNA work a quantum push forward in such areas as antisense and ribozyme research, tRNA structure and function studies, direct expression studies, as well as improved hybridization assays.

**Free tRNA-shirt or RNA synthesis cartridge.** Mention this ad with your order for an RNA amidite kit and receive a tRNA-Shirt (s,m,l,xl). Orders of \$2000 also receive a cartridge pre-programmed with the RNA synthesis protocol for the MilliGen/Biosearch Cyclone™ Nucleic Acid Synthesizer. Contact us today: call **1-800-872-0071**, or write to MilliGen/Biosearch, 186 Middlesex Turnpike, Burlington, MA, U.S.A. 01803.

MilliGen/Biosearch  
Division of MILLIPORE

PHOTO: LARRY KEENAN, WALDO BASCOM ©1990. RNA ILLUSTRATION: JANE RICHARDSON ©1990.

Circle No. 149 on Readers' Service Card

## R & D A New Twist

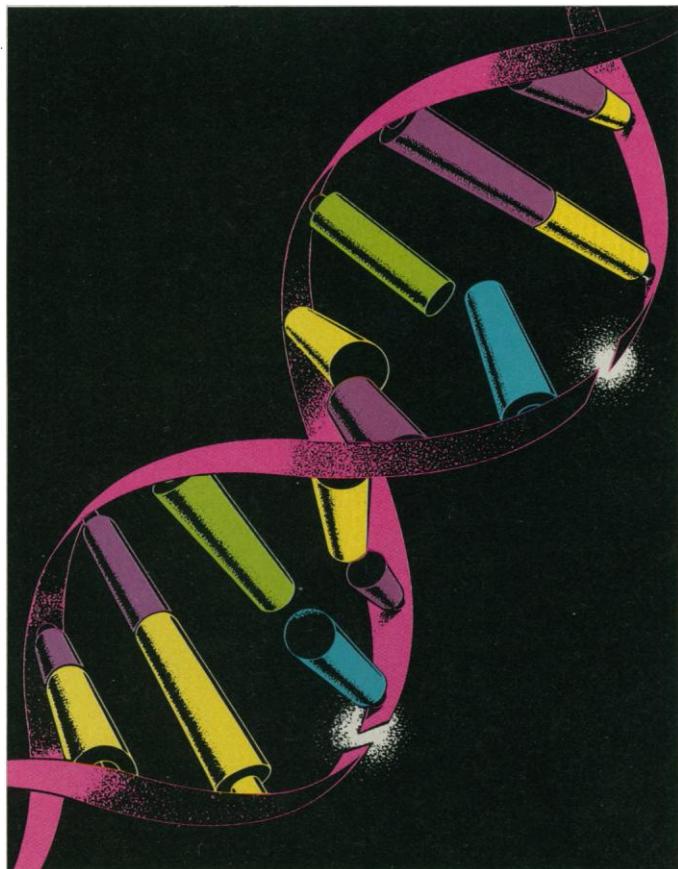
In the scientific world, "R & D" stands for Research and Development. It's an important part of your professional life. But when it comes to your personal life, "R & D" could stand for *Responsibilities* and *Dreams*. And in this day and age, it takes a lot of both to see a family through.

That's why the American Association for the Advancement of Science makes the AAAS Term Life Insurance Plan available to you. It's an easy and affordable way to protect your family's future. The Plan provides benefits that can be used to help with basic living expenses and can enable your family to follow through with the plans you made together. You can request up to \$240,000 of coverage for yourself. And generous protection is available for your family too.

Don't experiment with your family's financial security! Contact the Administrator of the AAAS Term Life Insurance Plan today. We'll send a brochure and application right away.

**Administrator**  
**AAAS Group Insurance Program**  
**1255 23rd Street, N.W., Suite 300**  
**Washington, D.C. 20037**  
**Toll-Free: 1 800 424-9883**  
**Wash., D.C.: (202) 457-6820**

# Reagents for Genetic Engineering from TaKaRa



## **Sse 8387 I**

### **Unique Eight-Base Cutter for Genome DNA Analysis**

5' ... CCTGCA<sup>▼</sup>GG ... 3'

Code No. 1183A      400 units

Code No. 1183B      2,000 units

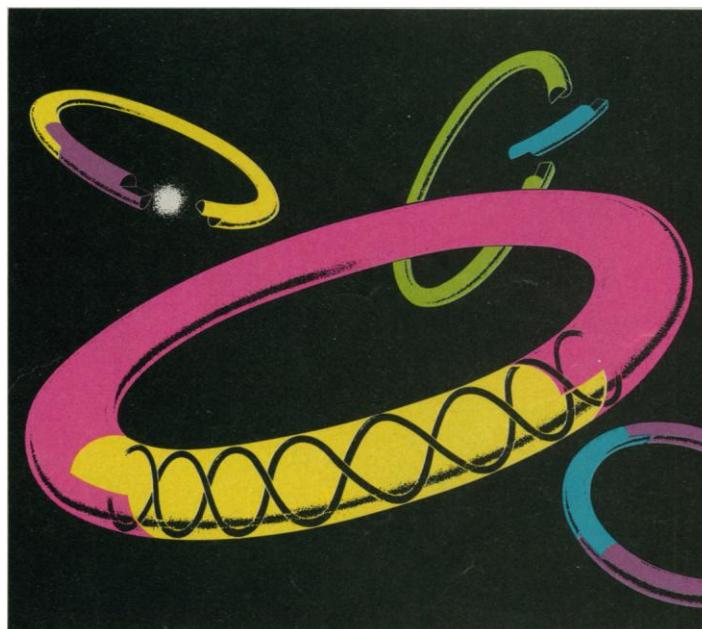
- No C<sub>P</sub>G<sub>S</sub> (methylation signals for mammalian system) in restriction sequence
- Quality of genome analysis is confirmed by digestion of *Staphylococcus aureus* Chromosomal DNA in 0.5% agarose block and pulsed-field electrophoresis.

## **DNA Ligation Kit**

**Just 30 minutes!**

**Rapid reaction to complete ligation.**

- Higher ligation efficiency than ordinary ligation reaction with T4 DNA ligase
- Available for insertion of foreign DNA into plasmid vector, linker ligation, blunt-end ligation, and for construction of  $\lambda$ -library
- No additional reagents needed



**TAKARA BIOCHEMICAL INC.**

719 Allstone Way, Barkley California 94710 USA

Phone: 415-649-9895 Fax: 415-649-8933 Toll Free 1-(800) 544-9899

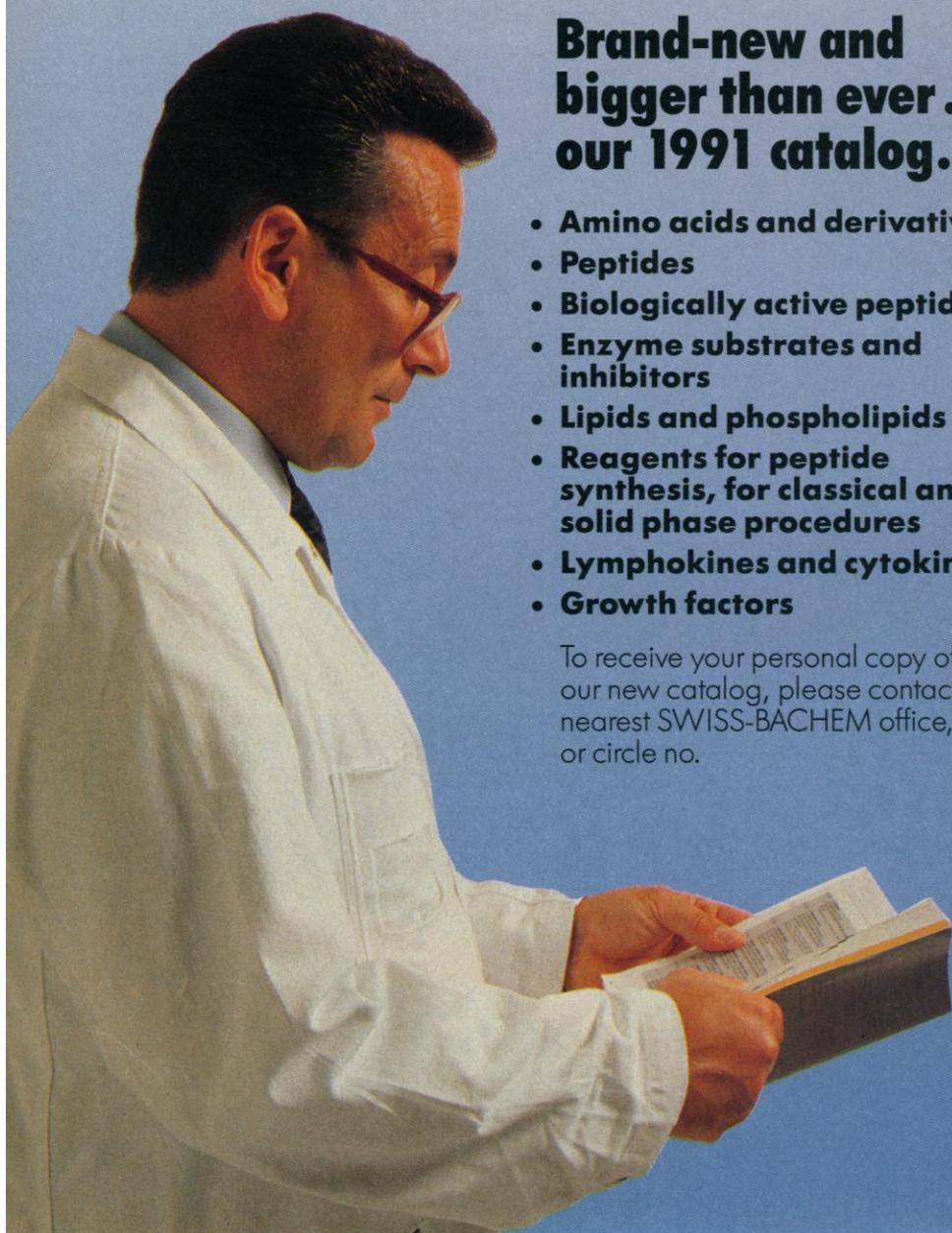
**TAKARA SHUZO CO., LTD.**

Shijo-Higashinotoin, Shimogyo-ku, Kyoto 600-91, Japan

Phone: +81 75-241-5167 Fax: +81 75-241-5208

Circle No. 212 on Readers' Service Card

# BACHEM



## Brand-new and bigger than ever... our 1991 catalog.

- Amino acids and derivatives
- Peptides
- Biologically active peptides
- Enzyme substrates and inhibitors
- Lipids and phospholipids
- Reagents for peptide synthesis, for classical and solid phase procedures
- Lymphokines and cytokines
- Growth factors

To receive your personal copy of our new catalog, please contact your nearest SWISS-BACHEM office, or circle no.



THE SWISS BACHEM GROUP – FOR BETTER SERVICE, WORLDWIDE

**BACHEM**  
Feinchemikalien AG

serving you worldwide  
except areas mentioned  
Hauptstrasse 144  
CH-4416 **Bubendorf**  
Phone: 061/931 23 33  
Fax: 061/931 25 49  
Telex: 966081

**BACHEM**  
Bioscience Inc

subsidiary of BACHEM Switzerland  
serving the American continents  
3700 Market Street  
**Philadelphia, PA 19104**  
Phone: 215/387 00 11  
Fax: 215/387 11 70  
Telex: 910 250 2352

**BACHEM**  
Biochemica GmbH

subsidiary of BACHEM Switzerland  
serving Germany and USSR  
Lessingstrasse 26  
D-6900 **Heidelberg**  
Phone: 0 62 21/16 30 91  
Fax: 0 62 21/ 2 14 42  
Telex: 461 352

Circle No. 215 on Readers' Service Card



To design these  
microscopes  
takes a  
supercomputer  
powerful  
enough to send  
man to the stars.



It is an analytical  
mind of formid-  
able proportion.  
Computing opti-  
cal formulae

of daunting complexity. Rigorously  
testing its calculations on intricate,  
self-generated models. Then meticu-  
lously honing the chosen formula for  
*absolutely* optimum performance.

And it accomplishes all this at  
speeds that defy belief. Procedures  
once monitored on a calendar are  
now clocked.

The ends justify these means—  
optics of exceptional clarity and bril-  
liance. On such microscopes as the  
AHS, IMT2 and BH2, these optics  
couple with innovative design and  
precision machining to give you the  
one thing a microscope must provide:  
Superior vision.

The microscopes of Olympus—  
they'll change the way you look  
at things.

For a demo or tech information,  
call toll-free: 1-800-446-5967.

Olympus Corporation, Precision  
Instrument Division, 4 Nevada Drive,  
Lake Success, New York 11042-1179.

In Canada: W. Carsen Co., Ltd., Ontario.

**OLYMPUS®**  
The Image of Quality.

For information circle reader service number 158  
For a demonstration circle reader service number 159

Think of it as  
two centrifuges  
in one...



# SORVALL<sup>®</sup> RC-28S SUPRAspeed<sup>™</sup>

#### Perform a wide range of isolations in one unit

Ranging from superspeed to low-end ultraspeed, RC-28S SUPRAspeed achieves a force of 100,000xg. It's ideal for multi-step separations...from nuclei to microsomes. That's SORVALL versatility.

#### Use existing rotors or select new ones

Choose from your existing inventory of SORVALL superspeed rotors or select from a range of SORVALL fixed angle and swinging bucket SUPRAspeed rotors. That's SORVALL economy.

#### Operate with ease

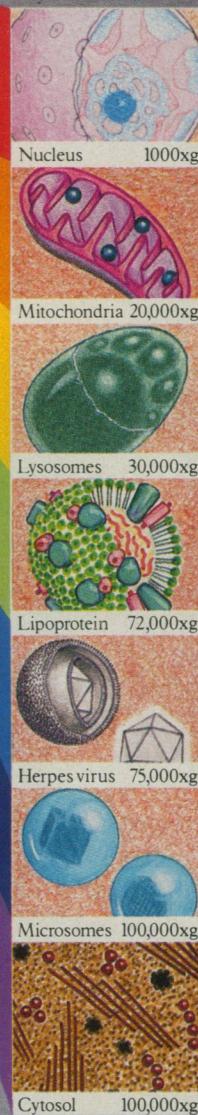
SORVALL SUPRAspeed offers multiple programming, an RCF calculator, and an automatic rotor

recognition system to eliminate the need to remember rotor codes or worry about proper rotor seating. That's SORVALL convenience.

#### Get an extra measure of protection

The RC-28S automatically enters optimum temperature, speed and acceleration/deceleration conditions, while the rotor recognition system prevents overspeed. That's SORVALL safety.

Put the versatility, economy, convenience, and safety of the SORVALL RC-28S to work for you. Contact your Du Pont representative or call 1-800-551-2121.



*Working Knowledge In Biotechnology*



Circle No. 169 on Readers' Service Card

