

AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

23 AUGUST 1991

\$6.00

VOL. 253 ■ PAGES 825-940



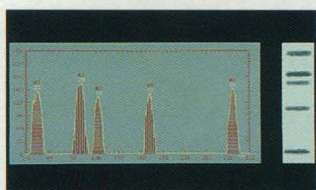
Digitize:



Rapidly scan autoradiographs, photographs, drawings, text, stained gels and more. Scan images at 300 dots per inch (85 μ spot size)

in 256 shades of gray. Edit scanned images using the powerful tools of the StrataScan's digital image processing and editing software.⁽¹⁾

Densitometry:



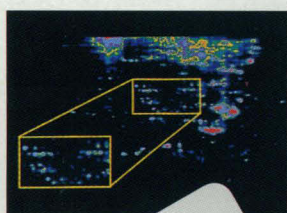
Quantitate individual or multiple lanes; spots or bands; and slot and dot blots.⁽²⁾

Adjust image

contrast, subtract background, enlarge or reduce, without altering the original data. Output your data in tabular form or export it to other programs for additional analysis or presentation.

Document:

Create Presentation quality composite images for handouts, overheads, slides and journals.



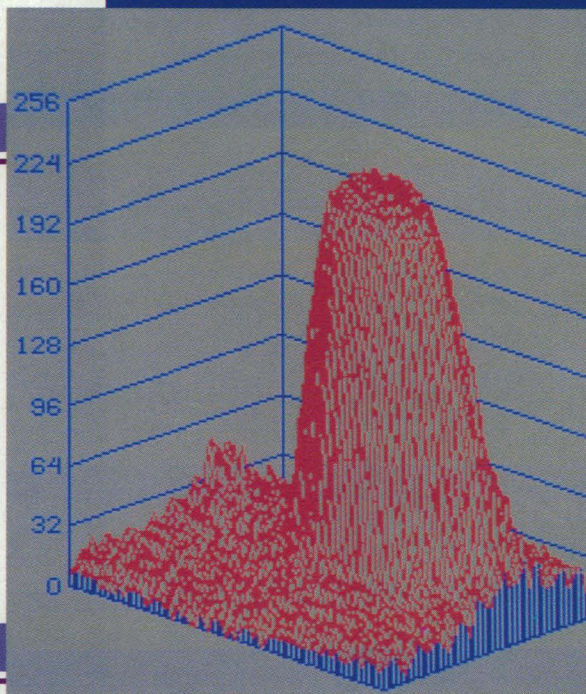
STRATAGENE®

Corporate Headquarters:
11099 North Torrey Pines Rd.
La Jolla, CA 92037
Ordering and Tech. Service:
800-424-5444
Fax: 619-535-5430
Telex: 9103809841

Stratagene GmbH
Postfach 105466
D-6900
Heidelberg, Germany
Telephone: (06221) 40 06 34
Telefax: (06221) 40 06 39

Circle No. 168 on Readers' Service Card

Experience The Third Dimension



The **StrataScan™ 7000** Graphic Arts and Densitometry System combines state-of-the-art hardware innovations and well crafted software to bring sophisticated densitometry analysis and presentation quality documentation to your laboratory.

Stratagene's **StrataScan™ 7000** Graphic Arts and Densitometry System



Stratagene Ltd.
Cambridge Innovation Centre
Cambridge Science Park
Milton Road
Cambridge CB4 4GF
Telephone: (0223) 420955
Telefax: (0223) 420234
Telex: 81417 INNCEN G

Please contact Stratagene for a distributor near you.

References
1. Fox, J.S. (1989). *Strategies* 2: 53-55
2. Bauer, J.C., and Fox, J.S. (1991). *Strategies* 4: 6-7

Take The *Pyrococcus** Challenge



- Less Non Specific Priming and False Background Extension Products
- Same Cost as *Taq* DNA polymerase
- Higher Thermostability than Vent**

- High Fidelity DNA Synthesis; 12 fold lower error rate than *Taq* polymerase, and five fold lower error rate than Vent DNA polymerase

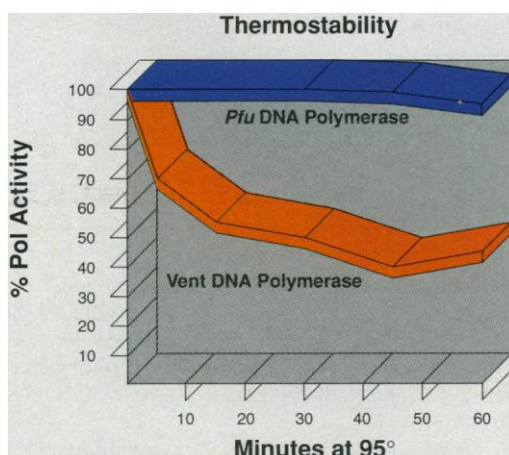


Figure 1: Thermostability of *Pfu* and Vent DNA Polymerases at 95°C.

To determine the thermostability of *Pfu* and Vent DNA polymerases at 95°C, 37.5 units of each enzyme were diluted to a final volume of 150 µl in the recommended reaction buffer and incubated at 95°C. At 0, 5, 15, 30, 45 and 60 minute time points, duplicated 10 µl aliquots (2.5 units) were assayed at 75°C for DNA polymerase activity.

* Patents Pending

** Vent™ is a trademark of New England Biolabs

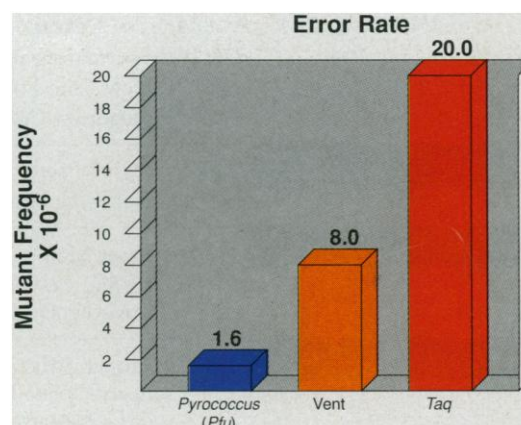


Figure 2: Polymerase fidelity was measured by modification of an assay described by Kohler *et al* (1991) *Pro. Natl. Acad. Sci. USA*, in press. Error rates reflect mutations per nucleotide incurred in the *lacI* gene during DNA synthesis. Vent is derived from *Thermococcus litoralis* and was obtained from New England Biolabs. *Pfu* is derived from *Pyrococcus furiosus* and is sold by Stratagene. *Taq* polymerase is derived from *Thermus aquaticus* and was obtained from Cetus Perkin Elmer.

<i>Pyrococcus</i> Polymerase	Catalog #
100 units	600135
500 units	600136

1. Bryant, F.O. and Adams, M.W.W. (1989) *J. Biol. Chem.* 264:5070-5079.
2. Fiala, G. and Stetter, K.O. (1986) *Arch Microbiol.* 145:56-61.
3. Eckert, K.A. and Kunkle, T.A. (1990) *Nucleic Acids Res.* 18:3739-3744.
4. Chien, A., Edgar, D.B. and Trela, J.M. (1976) *J. Bac.* 127:1550-1557.



STRATAGENE®

Corporate Headquarters:
Ordering and Tech. Services: 800-424-5444
FAX: 619-535-5430, TELEX: 9103809841

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

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

831 This Week in *Science*

Editorial

833 Resources of Plant Germplasm

Letters

834 Women Lab Heads: M. FREISTADT ■ Shaking the Family Tree: G. N. VAN VARK AND A. BILSBOROUGH ■ EC Biotechnology Policy: S. COONEY ■ Support for Jenny Harrison: P. ST. LAWRENCE

Policy Forum

838 The End of Mandatory Retirement for Tenured Faculty: A. REES AND S. P. SMITH

ScienceScope

841 Sorting out germ line gene therapy; sussing out researchers' discontent; etc.

News & Comment

842 Get-the-Lead-Out Guru Challenged
845 Greenhouse Bandwagon Rolls On
846 Jawboning Prehistory
Has Challenger Knocked Out Galileo?
847 Policy-Making: Getting Better Data
848 Small Is Beautiful for University Space Outfit ■ In Search of a Free Launch
850 Post-Mortem on Storb Resignation
A Changing of the Guards
A Reprieve for MIT's Magnet Lab
851 *Briefings*: Gene Zapping ■ The Case of the Missing Milkweed ■ Searching for the Perfect Fit ■ African Research Waning

Research News

852 Forecasting the Global AIDS Epidemic ■ Computing the Problem
854 The Education of Silicon Linguists ■ Know-Nothing Translation
856 Speculating in Precious Computronium
857 New Clue Found to Alzheimer's
858 Quantum Cryptography's Only Certainty: Secrecy

Perspectives

859 Sigma Factor Relatives in Eukaryotes: J. A. JAEHNING
860 Declining Amphibian Populations: D. B. WAKE

Articles

861 Laser Manipulation of Atoms and Particles: S. CHU
866 Ex Situ Conservation of Plant Genetic Resources: Global Development and Environmental Concerns: J. I. COHEN, J. T. WILLIAMS, D. L. PLUCKNETT, H. SHANDS

Research Articles

872 Atomic Structure of Acetylcholinesterase from *Torpedo californica*: A Prototypic Acetylcholine-Binding Protein: J. L. SUSSMAN, M. HAREL, F. FROLOW, C. OEFNER, A. GOLDMAN, L. TOKER, I. SILMAN
879 Impact-Induced Cleaving and Melting of Alkali-Halide Nanocrystals: R. D. BECK, P. ST. JOHN, M. L. HOMER, R. L. WHETTEN

- **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 © 1991 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): \$82 (\$47 allocated to subscription). Domestic institutional subscription (51 issues): \$150. 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. **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 Marbled salamanders (*Ambystoma opacum*) are among the many amphibian species that breed at Carolina bays, natural wetlands of the southeastern Atlantic Coastal Plain. *Ambystoma opacum* is one of the amphibian species that has been monitored daily at a protected wetland, Rainbow Bay in South Carolina, for the past 12 years by investigators at the Savannah River Ecology Laboratory. See page 892. [Photographed by David E. Scott, Savannah River Ecology Laboratory]

Reports

- 884 ^{13}C NMR Spectroscopy of K_xC_{60} : Phase Separation, Molecular Dynamics, and Metallic Properties: R. TYCKO, G. DABBAGH, M. J. ROSSEINSKY, D. W. MURPHY, R. M. FLEMING, A. P. RAMIREZ, J. C. TULLY
- 886 $(\text{Rb}_x\text{K}_{1-x})_3\text{C}_{60}$ Superconductors: Formation of a Continuous Series of Solid Solutions: C.-C. CHEN, S. P. KELTY, C. M. LIEBER
- 888 Interpretation of Snow-Climate Feedback as Produced by 17 General Circulation Models: R. D. CESS, G. L. POTTER, M.-H. ZHANG, J.-P. BLANCHET, S. CHALITA, R. COLMAN, D. A. DAZLICH, A. D. DEL GENIO, V. DYMNIKOV *et al.*
- 892 Declining Amphibian Populations: The Problem of Separating Human Impacts from Natural Fluctuations: J. H. K. PECHMANN, D. E. SCOTT, R. D. SEMLITSCH, J. P. CALDWELL, L. J. VITT, J. W. GIBBONS
- 895 A Polypeptide from Tomato Leaves Induces Wound-Inducible Proteinase Inhibitor Proteins: G. PEARCE, D. STRYDOM, S. JOHNSON, C. A. RYAN
- 898 Evidence of Lactate Dehydrogenase-B Allozyme Effects in the Teleost, *Fundulus heteroclitus*: L. DiMICHELE, K. T. PAYNTER, D. A. POWERS
- 900 Related RNA Polymerase-Binding Regions in Human RAP30/74 and *Escherichia coli* $\sigma 70$: S. MCCracken AND J. GREENBLATT
- 903 Requirement for Positive Selection of $\gamma\delta$ Receptor-Bearing T Cells: F. B. WELLS, S.-J. GAHM, S. M. HEDRICK, J. A. BLUESTONE, A. DENT, L. A. MATIS
- 905 Targets for Cell Cycle Arrest by the Immunosuppressant Rapamycin in Yeast: J. HEITMAN, N. R. MOVVA, M. N. HALL
- 909 Factor XI Activation in a Revised Model of Blood Coagulation: D. GAILANI AND G. J. BROZE, JR.
- 912 Stimulation of Protein Tyrosine Phosphorylation by NMDA Receptor Activation: H. BADING AND M. E. GREENBERG

Technical Comments

- 915 Proliferative Breast Disease: Diagnosis and Implications: D. L. PAGE AND W. D. DUPONT; M. SKOLNICK, C. J. MARSHALL, W. MCWHORTER, D. GOLDGAR, L. CANNON-ALBRIGHT, J. H. WARD, H. EYRE, G. B. SCHUMANN, D. T. BISHOP ■ Critical Velocity of Stick-Slip Motion: M. O. ROBBINS AND P. A. THOMPSON

Book Reviews

- 917 Women in the Field, reviewed by N. G. SLACK ■ Sage: A Scholarly Journal on Black Women, E. M. HAMMONDS ■ Some Other Books of Interest ■ Books Received

Products & Materials

- 921 Monoclonal Antibodies ■ Cryopreservation Vessel ■ Portable Ultraviolet Darkroom ■ Differential Equation Solving Software ■ Digitizer for DNA Base Input ■ Perfusion Chromatography System ■ Custom Anti-Peptide Antibodies ■ Still Video Gel Documenter ■ Literature

Board of Directors

Donald N. Langenberg
*Retiring President,
Chairman*

Leon M. Lederman
President

F. Sherwood Rowland
President-elect

Mary Ellen Avery
Francisco J. Ayala
Eugene H. Cota-Robles
Robert A. Frosch
Joseph G. Gavin, Jr.
Florence P. Haseltine
Jean'ne M. Shreeve
Warren M. Washington

William T. Golden
Treasurer

Richard S. Nicholson
Executive Officer

Editorial Board

Charles J. Arntzen
Elizabeth E. Bailey
David Baltimore
William F. Brinkman
E. Margaret Burbidge
Pierre-Gilles de Gennes
Joseph L. Goldstein
Mary L. Good
Harry B. Gray
John J. Hopfield
F. Clark Howell
Paul A. Marks
Yasutomi Nishizuka
Helen M. Ramey
Robert M. Solow
Edward C. Stone
James D. Watson

Board of Reviewing Editors

John Abelson
Frederick W. Alt
Don L. Anderson
Stephen J. Benkovic
Floyd E. Bloom
Henry R. Bourne
James J. Bull
Kathryn Calame
Charles R. Cantor
Dennis W. Choi
Ralph J. Cicerone
John M. Coffin
Bruce F. Eldridge
Paul T. Englund
Fredric S. Fay

Douglas T. Fearon
Harry A. Fozzard
Theodore H. Geballe
Margaret J. Geller
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
Harvey F. Lodish
Richard Losick
Anthony R. Means
Mortimer Mishkin
Roger A. Nicoll
William H. Orme-Johnson III
Stuart L. Pimm
Yeshayau Pocker

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

Pure nucleic acids – QIAGEN does them all !

QIAGEN is all you need

No matter what type of nucleic acid you want to isolate –
QIAGEN columns are all you need.

It's this fast

1. **Adsorb** a cell lysate
2. **Wash** away contaminants
3. **Elute** pure nucleic acid

It's this convenient

Ready-to-use kits for all types of nucleic acids –
4 Column sizes for any size prep –
Gravity flow alone results in optimal separations –
Numerous lab-tested protocols are included in our booklet THE QIAGENOLOGIST.

It's this pure

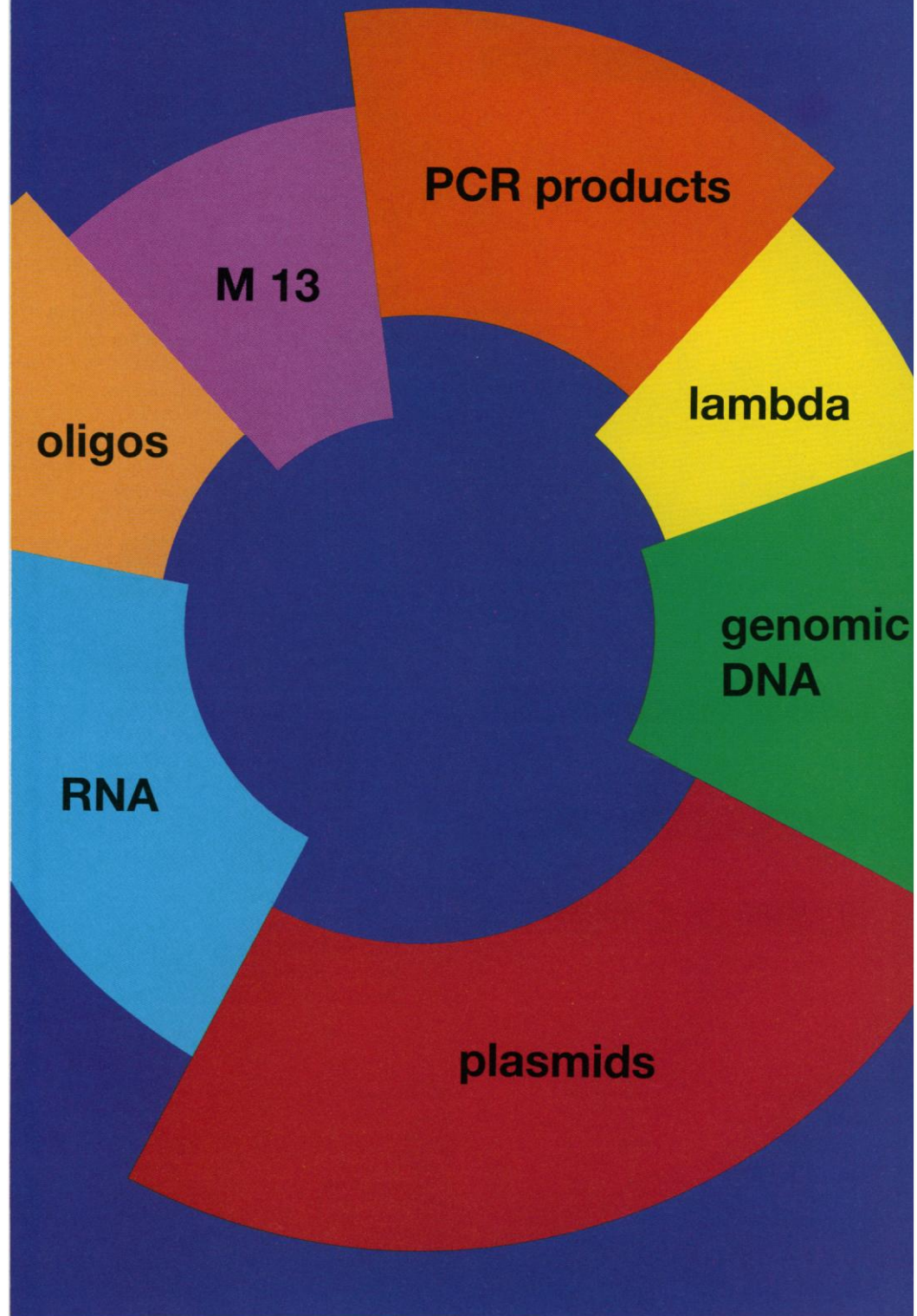
QIAGEN-purified nucleic acids are equal in purity to those isolated on CsCl gradients.
Subsequent applications such as transfections, clonings, sequencing, transcription and translation reactions proceed with optimal efficiency.

It's this versatile

At the heart of the system is a unique anion exchange resin with the broadest possible separation range – QIAGEN.
It enables the selective isolation of the various classes of nucleic acids, including dsDNA, ssDNA and RNA.

For more information

call or write to QIAGEN Inc.,
QIAGEN GmbH or your nearest distributor.



USA/CANADA: QIAGEN Inc., Chatsworth, CA 91311, Phone (800) 426-8157, (818) 718-9870, Fax (818) 718-2056
GERMANY: QIAGEN GmbH, Niederheider Str. 3, D-4000 Düsseldorf 13, Phone (0211) 79 30 37, Fax (0211) 79 04 44
DISTRIBUTORS: **AUSTRALIA:** Phoenix Stansens Scient.Div. (3) 544 8022 **AUSTRIA:** Bio-Trade (222) 828 46 94
BENELUX: Westburg B.V. (NL-33) 95 00 94 **FRANCE:** Cogier (1) 45 33 67 17 **ISRAEL:** Bio-Lab Laboratories Ltd.
 (2) 52 44 47 **ITALY:** Genenco (M-Medical) (55) 67 64 41 **JAPAN:** Funakoshi Co., Ltd. (3) 5684 1622
KOREA: LRS 924-8697 **PORTUGAL:** Izasa Portugal, S.A. 758 07 40 **SCANDINAVIA:** Kebo Lab: Denmark: (44) 68 18 00,
 Finland: (90) 437 56 40, Norway: (02) 30 11 20, Sweden: (08) 621 34 00 **SPAIN:** Izasa S.A. (3) 401 01 01
SWITZERLAND: Kontron Instruments AG (1) 733 5 733 **TAIWAN:** Formo (2) 736 7125 **UK:** Hybaid Ltd. (81) 977 3266



Circle No. 19 on Readers' Service Card

This Week in SCIENCE

Nanoscale impacts

When a projectile smashes into a solid surface, it can bounce off the surface, stick, become implanted, or shatter. These different outcomes reflect differences in how the impact momentum is distributed between surface and projectile. Beck *et al.* have used cluster-beam techniques for studying what happens when tiny crystalline objects—alkali-halide clusters of various sizes—collide with soft graphite or hard silicon surfaces, both of which are chemically inert with respect to the clusters (page 879). The momentum and the angle of impact as well as the size of the clusters could all be controlled; different combinations produced different fragmentation patterns in the clusters and differences in how the impact energy was deposited. At low energies, the clusters scattered on impact. At higher energies the crystals turned molten and then evaporated. This cluster-beam technology should be useful for the fabrication of new types of surfaces and for studying impact phenomena; impacts on the nanoscale may even provide clues to the physical features of macroscale impacts.

Amphibian census

A 12-year study of amphibians at a breeding pond in South Carolina provides some much-needed data on the extent of natural variation that can occur in populations of frogs and salamanders over the long term (page 892). Amphibians have been considered useful bioindicators of the health of the environment. So when reports appeared that numerous amphibian populations around the world were declining in number or disappearing altogether, scientists became concerned that there might be some general or global factor that was killing them. The Rainbow Bay study shows that there can be wide population fluctuations from year to year without there being a crisis. Every day for more than a decade Pechmann *et al.* counted females that came to the pond to breed

and also juvenile recruits. (In an average year the pond fills in the winter with a meter of water but dries out in spring or summer.) Some of the variation could be accounted for by differences in annual rainfall and the occurrence in some years of drought conditions. But many factors figure into accurate assessments of population trends, and these are discussed by the authors and by Wake in a perspective (page 860).

Systemin

When a leaf is damaged by a predator, certain defensive genes of the plant are activated. One substance that can turn on two of the wound-inducible plant genes is a small palindromic polypeptide that has been isolated from tomato plant leaves (page 895). Pearce *et al.* named the polypeptide systemin, because, after it was placed on the wounded leaves of young plants, it was found to circulate throughout the plant in the phloem. The amino acid sequence of systemin was determined, and a copy of the 18-amino acid natural molecule was produced. Both natural and synthetic systemin activated the genes that produce proteinase inhibitors I and II, which accumulated in the leaves. Previous studies have shown that, in addition to their activation by wounding, these proteinase inhibitors can be activated by a range of nonprotein substances, including oligosaccharides and plant hormones (abscisic acid and methyl jasmonate). The functions of the polypeptide systemin in plants may be analogous to those of peptide hormones in animals, which activate a variety of signal transduction pathways.

Positive selection

T lymphocytes differentiate in the thymus. The cells with $\alpha\beta$ receptors on their surfaces must encounter self antigens in the thymus in order to differentiate properly; that is, they are "positively selected" by antigens. Positive selection has now been

shown to be a requirement for the differentiation, maturation, and exit from the thymus of a population of T cells that bear $\gamma\delta$ receptors as well (page 903). Wells *et al.* studied this phenomenon in genetically engineered mice that produced $\gamma\delta$ -bearing cells but that lacked the self antigens with which these receptors react. Normal numbers of the $\gamma\delta$ -bearing cells appeared in the thymus during early development, but the cells did not mature, did not respond in vitro to assays that assessed the effectiveness of their $\gamma\delta$ receptors, and did not travel to the peripheral lymphoid organs. Although the experiments evaluated only one subset of $\gamma\delta$ -bearing cells, the similarity of these results with those of $\alpha\beta$ -bearing cells suggests that positive selection in the thymus may be a general requirement for all T cells regardless of the types of receptors they bear.

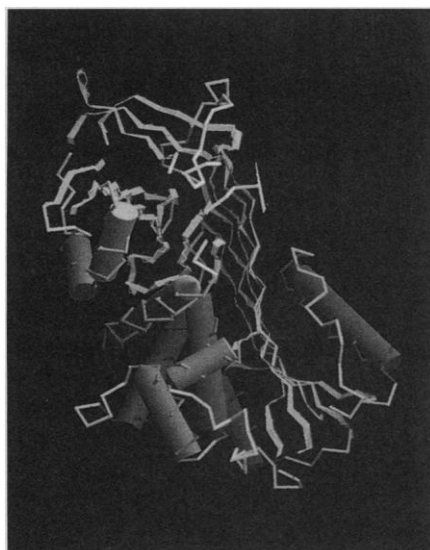
Immunosuppressor's target

Immunosuppressive drugs poison the immune system's helper T cells. They do this by interfering with the transduction of important intracellular signals. The molecular targets of two structurally similar immunosuppressive agents, rapamycin and FK506, were studied by Heitman *et al.* in a yeast cell system that is relatively simple and can be manipulated genetically (page 905). When exposed to rapamycin, sensitive yeast cells stopped growing. Rapamycin's target inside the cells was a widely distributed protein called FKBP. This protein was also the target for FK506, which, in competition experiments, could block the rapamycin effect. Two other genes that promote the toxicity of rapamycin were also identified, and genetic studies suggested that their products interact with the toxic complex. FKBP is present in T cells and other human cells; whether rapamycin binding will be suppressive in any given cell type may depend on whether proteins besides the target FKBP—perhaps homologs of the two proteins identified in yeast—are also available in the cell.

■ RUTH LEVY GUYER

VITAL NEW INFORMATION FOR LIFE SCIENCE RESEARCHERS

Technological Advances in Protein/Peptide Research: Trends & Techniques for the '90s



A WORLDWIDE SCIENTIFIC SEMINAR TOUR SPONSORED BY APPLIED BIOSYSTEMS

Rapid advances in protein/peptide research have broadened the applications and increased the challenges of this dynamic field. As some scientists delve more deeply into the complexities of protein/peptide structure and function, and others find this information becoming vital to new areas of research, the incorporation of the latest powerful techniques becomes essential.

This event will feature leaders from a variety of scientific disciplines who will provide an overview of the trends and advances which are reshaping protein/peptide research. In addition, leading scientists from Applied Biosystems will chair interactive workshops discussing many techniques readily applicable to participants' current research needs.

The information presented at "Technological Advances in Protein/Peptide Research" can provide information critical to your research in today's demanding scientific environment. Call today to register for this important one-day offering in a city near you.

PLENARY SESSION TOPICS

- **Advances in Protein Structure Analysis/Prediction**
- **The Functional Role of Post Translational Modification**
- **Current Trends in Modern Glycobiology**
- **Characterization of Peptide/Protein-Based Therapeutics**

SPECIAL WORKSHOPS

- **The Role of PDMS in the Protein Structure Laboratory**
- **Microanalysis of Electroblooded Proteins**
- **Immunochemical Applications of Synthetic Peptides**
- **Capillary Electrophoresis and the Structural Analysis of Proteins and Peptides**
- **Approaches to Glycoprotein Structural Analysis**
- **New Approaches to the Micropreparative Isolation of Membrane and Native Proteins**

New York, NY: Monday, October 14

Boston, MA: Tuesday, October 15

Atlanta, GA: Wednesday, October 16

Houston, TX: Thursday, October 17

Irvine, CA: Friday, October 18

San Francisco, CA: Monday, October 21

Rockville, MD: Wednesday, October 23

Philadelphia, PA: Thursday, October 24

Chicago, IL: Tuesday, October 29

Indianapolis, IN: Wednesday, October 30

SPACE IS LIMITED

*For more information and to register,
please call Applied Biosystems'
Seminar Registration Hotline
toll-free at 1-800-874-9868 x 7500.*



Pure mRNA in Minutes...

...Directly from Small or Large Samples of Cells or Tissue.

FastTrack™ and MicroFastTrack™ set the industry standard in high quality mRNA isolation.

MicroFastTrack™*: 20 Reactions

- Ideal for PCR, Northern and cDNA synthesis
- Isolation from samples ranging in size from 10^3 - 10^6 cells or 10-250mg of tissue.
- Reproducible yields of high quality mRNA.

FastTrack™*: 6 Reactions

- mRNA isolation for Northern, cDNA, library construction, PCR, microinjection, RNA protection studies and *in vitro* translation.
- Isolation from samples ranging in size from 10^7 - 10^8 cells or 0.4-1.0 gram of tissue.
- Fast, efficient recovery of large amounts of polyA⁺ RNA from a variety of sources.

Both systems offer:

- High yields of intact mRNA with low ribosomal contamination.
- Eliminate the need for total RNA isolation or the use of toxic chemicals.
- The most cost effective means of generating high quality mRNA.
- Consistency, convenience and the fastest isolation time.

For the very best in direct mRNA isolation FastTrack™ and MicroFastTrack™ are the choice of thousands of research labs worldwide. When the quality of your mRNA is important, turn to the original source for purity, reliability and convenience; turn to Invitrogen.

Toll Free 1-800-955-6288

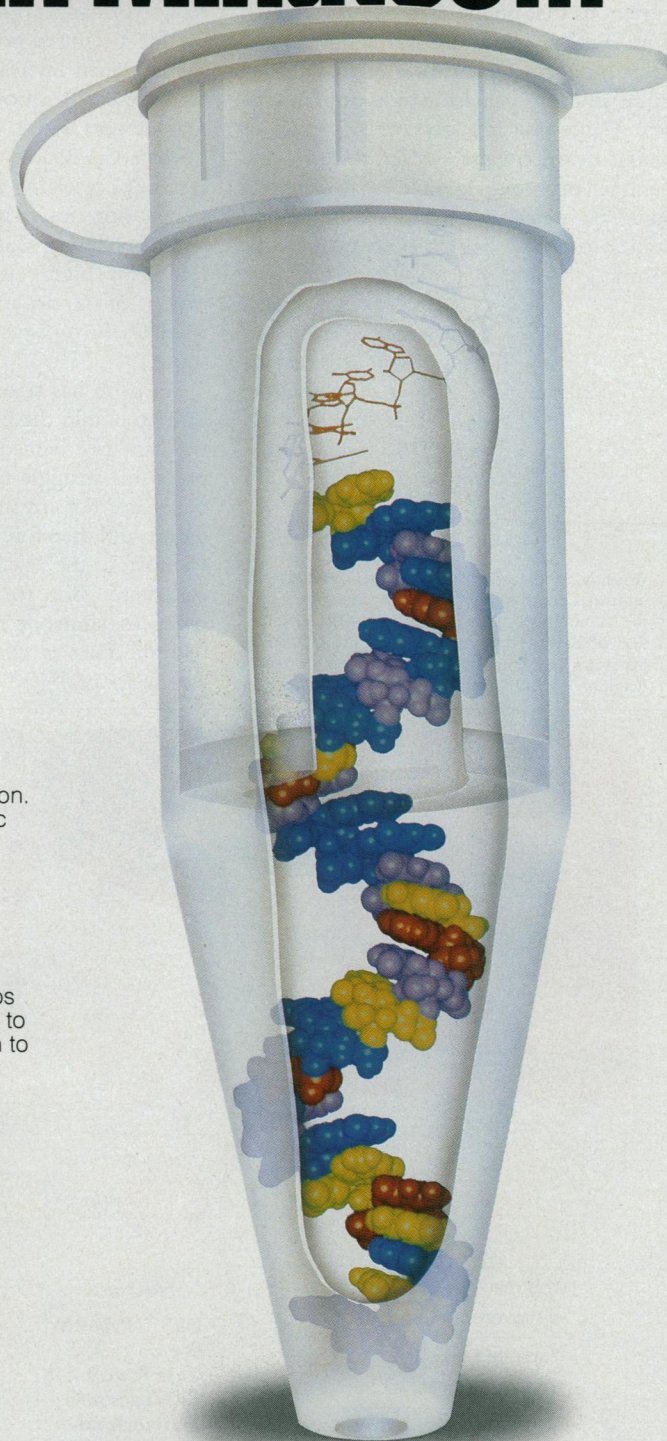


3985 • B Sorrento Valley Blvd. • San Diego, CA 92121
(619) 597-6200 Phone • (619) 597-6201 Fax

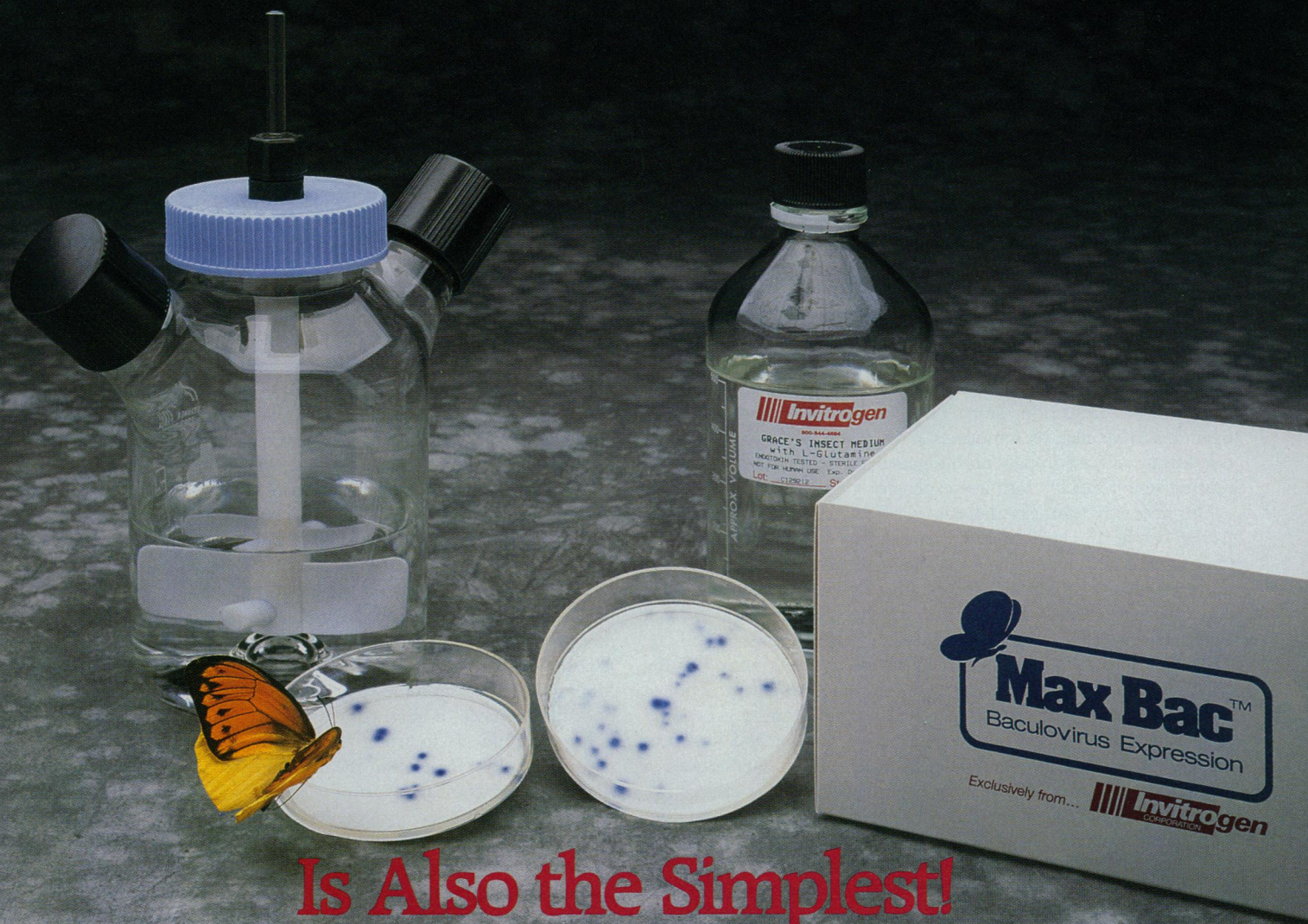
 BRITISH BIOTECHNOLOGY LTD, UK - TEL: 44-235529449 • AMS BIOTECHNOLOGY UK LTD, UK - TEL: 44-993822786 • BDH INC., CANADA - TEL: 800-268-0310 • BIO-TRADE, AUSTRIA - TEL: 43-2228284694 • CELBIO, ITALY - TEL: 39-24048646 • FUNAKOSHI PHARMACEUTICALS, JAPAN - TEL: 81-356841622 • ITC BIOTECHNOLOGY GMBH, GERMANY - TEL: 06221-303907 • KEBO LABS AB, SWEDEN - TEL: 46-86213400 • MEDOS COMPANY PTY LTD, AUSTRALIA - TEL: 61-38089077

*patent pending. mRNA model courtesy of BIOSYM

Circle No. 163 on Readers' Service Card



The Most Sophisticated System for Maximum Protein Expression...



Is Also the Simplest!

The MaxBac™ baculovirus expression kit is the most efficient means for generating large amounts of recombinant proteins (up to 500mg/L) from cloned genes. The recombinant proteins produced are antigenically and functionally similar to their natural counterparts.

The MaxBac™ expression system offers:

- /// High level recombinant protein expression.
- /// Simple visual or immunological identification of recombinants.
- /// Production of functionally active proteins from cloned genes.
- /// Unique glycosylation for comparison of proteins from other eukaryotic systems.

/// Production of proteins which are better suited to crystallography studies.

/// Proper transport and modification of recombinant proteins.

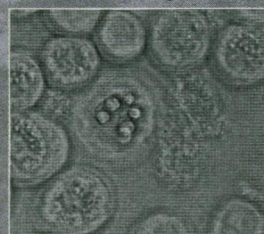


Figure 1. Infected Sf9 insect cells showing viral occlusions.

/// A sophisticated alternative to prokaryotic and mammalian expression systems.

ably generate recombinant proteins, including the recently developed BlueBac transfer vector. The BlueBac vector im-

parts a blue color to recombinants grown on indicator media, allowing fast, accurate differentiation and plaque purification. Find out why MaxBac, the most sophisticated system for protein expression, is also the simplest. To get more information on the MaxBac kit, custom baculovirus expression or individual MaxBac components call toll free:

1-800-955-6288

Invitrogen
CORPORATION

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

(619) 597-6200 Phone • (619) 597-6201 Fax

BRITISH BIOTECHNOLOGY LTD, UK - TEL: 44-235529449 • AMS BIOTECHNOLOGY UK LTD, UK - TEL: 44-993822786 • BDH INC., CANADA - TEL: 800-268-0310 • BIO-TRADE, AUSTRIA - TEL: 43-2228284694 • CELBIO, ITALY - TEL: 39-24048646 • FUNAKOSHI PHARMACEUTICALS, JAPAN - TEL: 81-356841622 • ITC BIOTECHNOLOGY GMBH, GERMANY - TEL: 06221-303907 • KEBO LABS AB, SWEDEN - TEL: 46-86213400 • MEDOS COMPANY PTY LTD, AUSTRALIA - TEL: 61-38089077

Circle No. 164 on Readers' Service Card

A NEW DIMENSION IN SAVINGS

You already know New England Biolabs has unsurpassed quality and the widest selection of enzymes available for recombinant DNA research. Now compare our prices!



These charts compare the small package retail price for a selection of modifying enzymes and restriction endonucleases common to four of the major suppliers in the US. The data represents the relative \$/unit cost.

Key: Orange - New England Biolabs, current prices Aug 1991; Pink - Gibco BRL Life Technologies Inc., July 1991 price list; Green - Promega, Jan 1991 price list and July 1991 addendum; Blue - Boehringer Mannheim, Feb/Mar 1991 price list.

At New England Biolabs, our reputation is based on our higher standards...now discover our lower prices. Through our continuing efforts in the cloning and over-expression of restriction/modification systems, we offer premium reagents at the most affordable prices.

Over 10 years of experience in cloning and overexpressing

Restriction/ Modification Systems

- The most cleavage site specificities available from one source. Over 140 different cleavage site specificities
- The most cloned enzymes in production
- The largest selection of 8 base cutters, including our newest enzyme *Pme* I (GTTT ∇ AAAC)

Stringent quality control of our products keeping you in touch with the latest advances in Genomic research

VentTM DNA Polymerase, the first of the 2nd generation of thermal stable polymerases that provides an alternative to Taq DNA Polymerase

A landmark program for the recycling of our polystyrene shipping containers

New England Biolabs is a cooperative laboratory of experienced scientists dedicated to providing research products of the highest purity to the worldwide scientific community.

Call the NEB customer service specialists and discover a whole new dimension in great prices and great selection.



New England Biolabs Inc. 32 Tozer Road, Beverly, MA 01915 USA 800-NEB LABS (US and MA)
Tel. (508) 927-5054 Fax (508) 921-1350

Circle No. 136 on Readers' Service Card