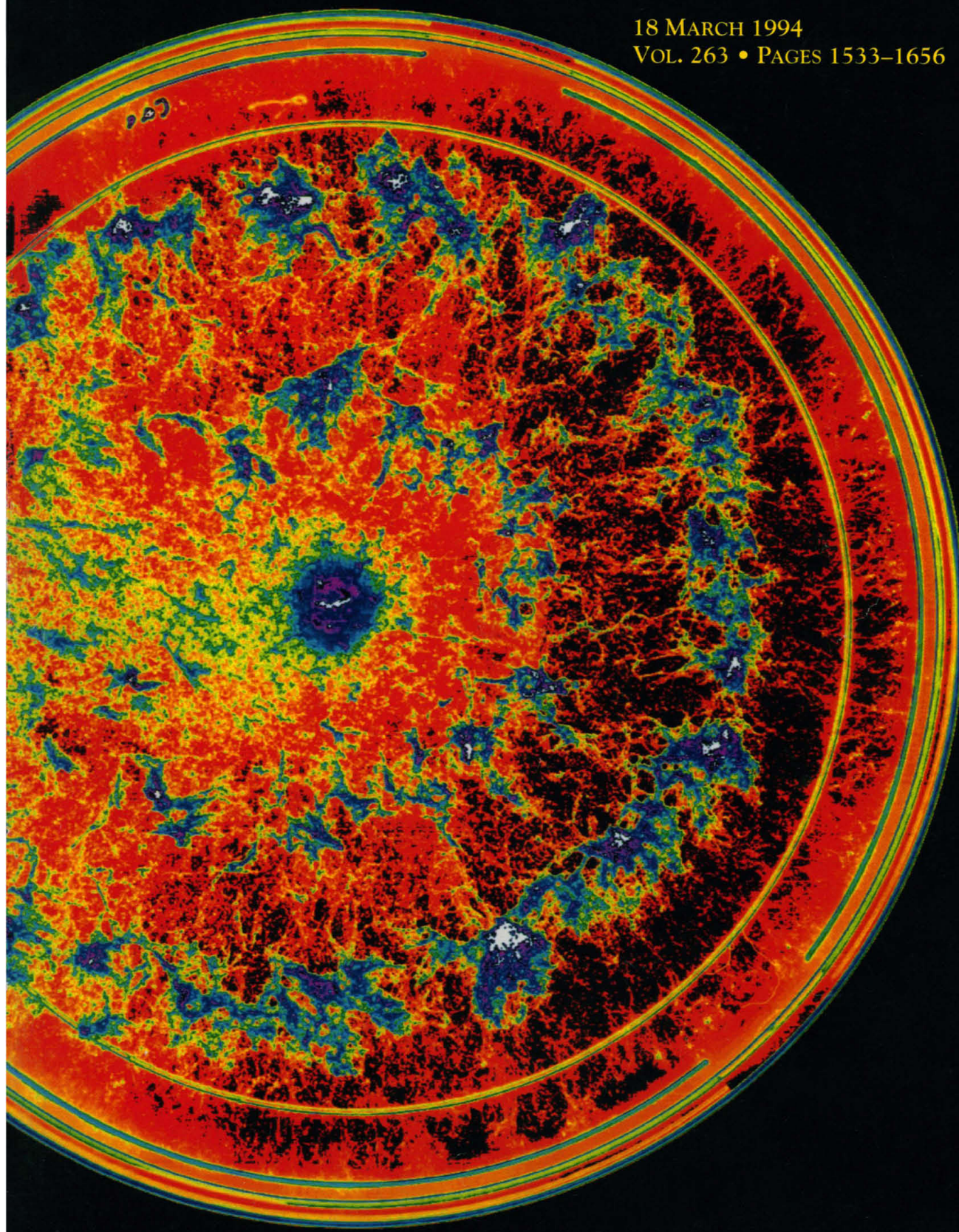


AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

18 MARCH 1994
VOL. 263 • PAGES 1533-1656

\$6.00



A BOLD LEAP in Cloning



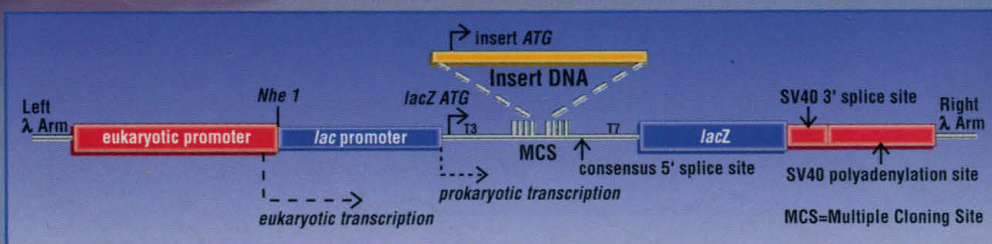
**lambda ZAP
Express/pBK**

**lambda
ZAP/pBluescript**

lambda phage

**filamentous
phage**

plasmids



Vector Technology

Introducing:

The ZAP Express™ Vector*

- Eukaryotic Expression
- Prokaryotic Expression
- Increased Cloning Capacity
- 12 Unique Cloning Sites:
Xho I and *Eco*R I for library construction
Sal I and *Eco*R I for antisense library construction
*Bam*H I for genomic libraries
Sma I for blunt-ended cloning
Hind III, *Sac* I, *Apa* I, *Kpn* I, *Spe* I, *Xba* I, *Not* I
- Blue/White Color Selection
- Kanamycin and G418 Selection

Stratagene has developed the most powerful Lambda ZAP® vector* to date, the multifunctional ZAP Express™ vector, which allows both eukaryotic and prokaryotic expression. In addition, the ZAP Express vector offers 12 unique cloning sites and an insert capacity of up to 12 kb.

The introduction of Stratagene's Lambda ZAP vectors has increased the appeal of phage cloning by providing the ability to excise the Bluescript® SK (-) phagemid from the vector using M13 helper phage.¹⁻⁴ Inserts cloned into the ZAP Express vector can be excised rapidly out of the phage in the form of the kanamycin-resistant pBK-CMV phagemid. This *in vivo* excision feature significantly reduces the time and effort required to analyze the DNA insert.

The ZAP Express vector now makes it possible to construct, screen and analyze clones or cDNA libraries in an excisable lambda phage vector by DNA hybridization, prokaryotic expression or eukaryotic expression, without the need for subcloning.

* U.S. Patent No. 5,128,256

References:

1. Alting-Mees, M.A., et al. (1992) *Strategies*. Volume 5, Number 3.
2. Alting-Mees, M.A., Vaillancourt, P., and Short, J.M. (1993) "Phagemids and Other Hybrid Vectors" in *Plasmids A Practical Approach* (K.G. Hardy, ed.) pp 197-223.
3. Short, J.M., et al. (1988) *Nucleic Acids Res.* 16: 7583-7600.
4. Short, J.M., and Sorge, J.A. (1992) *Methods Enzymol.* 216: 495-508.

ZAP Express™ cDNA Synthesis Kit

Stratagene's new ZAP Express cDNA synthesis kit allows the construction of cDNA fragments ready for directional insertion. The kit is guaranteed to produce up to 2.0×10^6 pfu/5 μ g of control poly(A)⁺ mRNA and includes sufficient reagents to produce five vector-ligated cDNA libraries.

ZAP Express™ Vector Kits

Undigested Vector	Catalog # 239201
<i>Eco</i> R I/CIAP-Treated	Catalog # 239211
<i>Bam</i> H I/CIAP-Treated	Catalog # 239212
<i>Eco</i> R I/ <i>Xho</i> I/CIAP-Treated	Catalog # 239213
pBK-CMV Vector	Catalog # 212209
pBK-RSV Vector	Catalog # 212210
ZAP Express™ cDNA Synthesis Kit	Catalog # 200403

Please call Stratagene or the Stratagene distributor nearest you for complete details on our new systems and full line of innovative products and services.



STRATAGENE®
(800) 424-5444

USA:

Corporate Headquarters

Telephone: (800) 424-5444

Fax: (619) 535-0034

Internet:

tech_services@stratagene.com

Germany:

Stratagene GmbH

Telephone: (06221) 400634

Telefax: (06221) 400639

United Kingdom:

Stratagene Ltd.

Telephone: (0223) 420955

Telefax: (0223) 420234

Switzerland:

Stratagene GmbH

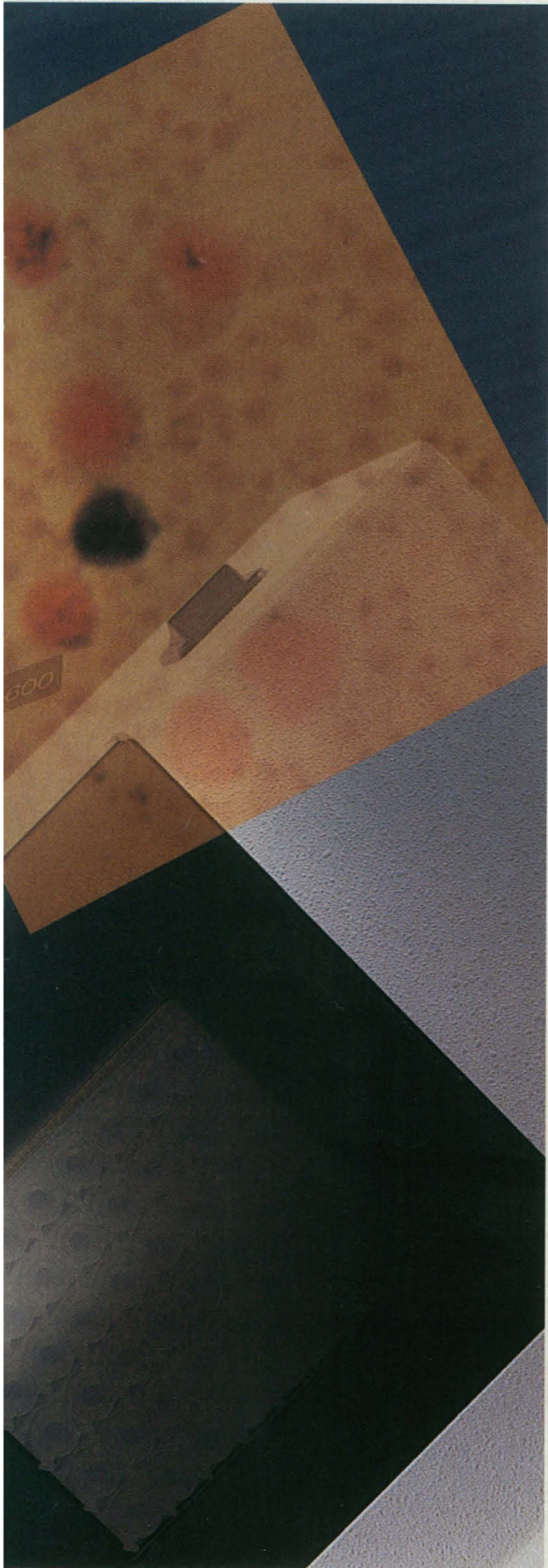
Telephone: (01) 3641106

Telefax: (01) 3657707

Circle No. 29 on Readers' Service Card

GENEAMP PCR INSTRUMENT SYSTEMS®





There's No Limit To What You Can Achieve With Our Thermal Cyclers.

In research and product development, being first makes all the difference. GeneAmp® PCR Instrument Systems get you started quickly and easily. They are available with pretested reagents and protocols. Our standard of quality—the highest in the industry—translates into consistently superior performance and unmatched reliability.

In fact, our track record in reliability has allowed us to reduce prices on all GeneAmp PCR Instrument Systems and offer an extended warranty.

What about the future? GeneAmp PCR Instrument Systems are the tools for continuing innovations in laboratories around the world, including our own. This means new methodologies can be applied to your research as soon as they are available. Our new Applied Biosystems Division integrates our expertise and experience in PCR with a reputation for innovation, leadership and support in nucleic acid synthesis, genetic analysis and protein research. Together, we offer you the most comprehensive range of systems, technologies and support for your research.

Invest in the PCR instrument system that won't limit your achievements. For information about our new reduced prices and extended warranty, call 1-800-345-5224 in the U.S., or contact your local Perkin-Elmer sales representative.

PERKIN ELMER

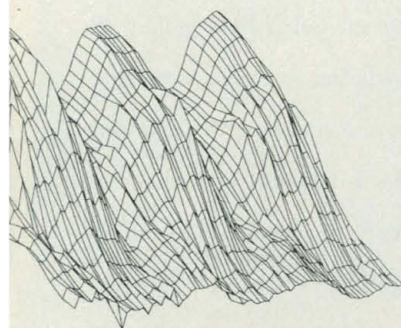
Europe Weiterstadt, Germany Tel: 49-6150-101-0 Fax: 49-6150-101-101
Canada Mississauga, Canada Tel: 800-668-6913 Fax: 905-821-8246
Japan Tokyo, Japan Tel: 81-4-7380-8500 Fax: 81-4-7380-8505
Latin America Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223
Australia Melbourne, Australia Tel: 61-3-212-8585 Fax: 61-3-212-8502

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



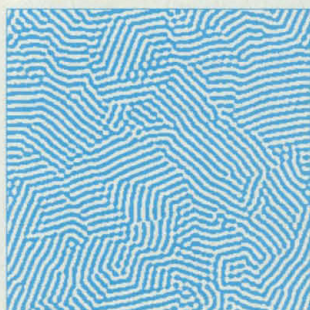
Perkin-Elmer is a registered trademark of The Perkin-Elmer Corporation.
GeneAmp is a registered trademark of Roche Molecular Systems, Inc.
The GeneAmp PCR process is covered by U.S. patents owned by Hoffmann-La Roche Inc. and Hoffmann-La Roche Ltd.

Circle No. 8 on Readers' Service Card



1562 & 1587

A puzzling trend in
atmospheric chemistry



1569

Chaos in space and
time

NEWS & COMMENT

French Gene Mappers at Crossroads 1552
Dispute Over Company Link Roils CEPH
Généthon: An Industrial Approach to
Isolating Genes

**Nicotine Scrutinized as FDA Seeks to
Regulate Cigarettes** 1555

**Professor Slams MIT Over Center
Closure** 1556

**India Expands Electronic Research
Network** 1557
The First Steps Toward a Virtual Library

Public Health Agency Shakeup Opposed 1558

RESEARCH NEWS

Stalking the Start of Colon Cancer 1559

**Fire Ants Parlay Their Queens Into a
Threat to Biodiversity** 1560

**Did Pinatubo Send Climate-Warming
Gases Into a Dither?** 1562

**Molecule Makers Learn the Rules of
a Crooked Game** 1563

The Calculated Approach to Protein Folding

**'Long PCR' Leaps Into Larger DNA
Sequences** 1564

PERSPECTIVES

Spatiotemporal Chaos 1569
M. C. Cross and P. C. Hohenberg

**Time Is the Essence: Molecular
Analysis of the Biological Clock** 1570
T. L. Page

ARTICLE

Why Snakes Have Forked Tongues 1573
K. Schwenk

RESEARCH ARTICLE

**Negative Feedback Defining a
Circadian Clock: Autoregulation of
the Clock Gene frequency** 1578
B. D. Aronson, K. A. Johnson, J. J. Loros,
J. C. Dunlap

DEPARTMENTS

THIS WEEK IN SCIENCE 1541

EDITORIAL 1543
Need for Enhanced Nuclear Safeguards

LETTERS 1545
Reacting to Gasoline Additives: J. P. Middaugh •
Is Dioxin a Human Carcinogen? (Continued):
S. S. Sternberg • Cell Transplantation and Re-
search Design: D. L. Felten • An Inclusive Budget
Process: D. Lightfoot • Superconductor Radiation
Damage After Doping: R. L. Fleischer

SCIENTESCOPE 1551

RANDOM SAMPLES 1566

New CF Drug Goes Pro Bono • Journal Quails
Over Oiled Turtles • A Lunar Idea • First Satellite
of an Asteroid Discovered • Lefty Longevity: An-
other Study • Soviet-Style Conundrums for U.S.
Youth • U.K. Research Council Gets Oxford Head

BOOK REVIEWS 1633

Center on the Periphery, reviewed by F. Aaserud •
The Neuroscience of Animal Intelligence, M. E.
Bitterman • *The Desert's Past*, D. P. Adams •
Vignettes • Books Received

PRODUCTS & MATERIALS 1638

Board of Reviewing Editors

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

Kathryn Calame
C. Thomas Caskey
Dennis W. Choi
John M. Coffin
Paul J. Crutzen
Robert Desimone
Nicole Le Douarin
Bruce F. Eldridge
Paul T. Englund
Richard G. Fairbanks
Douglas T. Fearon

Harry A. Fozzard
Klaus Friedrich
Theodore H. Geballe
Margaret J. Geller
John C. Gerhart
Roger I. M. Glass
Stephen P. Goff
Peter N. Goodfellow
Corey S. Goodman
Stephen J. Gould
Ira Herskowitz

Eric F. Johnson
Stephen M. Kosslyn
Michael LaBarbera
Charles S. Levings III
Alexander Levitzki
Harvey F. Lodish
Richard Losick
Diane Mathis
Anthony R. Means
Shigetada Nakanishi
Roger A. Nicoll

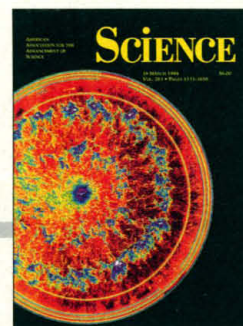
William H. Orme-
Johnson III
Stuart L. Pimm
Yeshayau Pocker
Dennis A. Powers
Ralph S. Quatrano
V. Ramanathan
Douglas C. Rees
T. M. Rice
Erkki Ruoslahti
David C. Rubie

Gottfried Schatz
Jozef Schell
Ronald H. Schwartz
Terrence J. Sejnowski
Ellen Solomon
Thomas A. Steitz
Michael P. Stryker
Richard F. Thompson
Robert T. N. Tjian
Emil R. Unanue
Geerat J. Vermeij

Bert Vogelstein
Harold Weintraub
Zena Werb
George M. Whitesides
Owen N. Witte
William A. Wulf
Keith Yamamoto

The circadian rhythm in asexual reproduction in the bread mold *Neurospora crassa* is illustrated by alternating growth rings of surface mycelia (red) and aerial hyphae (blue and yellow). Aerial hyphae extend above the growth surface to produce asexual spores. Studies

of this rhythm have authenticated an initial gear in a circadian clock and suggest the algorithm by which such clocks may be assembled. See page 1578; related Reports on pages 1603 and 1606 and Perspective on page 1570. [Image: Reed Detar. Colorization: Jay C. Dunlap]



REPORTS

5-Coordinate Si Compounds as Intermediates in the Synthesis of Silicates in Nonaqueous Media

1585

B. Herreros, S. W. Carr, J. Klinowski

Recent Changes in Atmospheric Carbon Monoxide

1587

P. C. Novelli, K. A. Masarie, P. P. Tans, P. M. Lang

Sound Velocities in Dense Hydrogen and the Interior of Jupiter

1590

T. S. Duffy, W. L. Vos, C.-s. Zha, R. J. Hemley, H.-k. Mao

Short-Lived Chemical Heterogeneities in the Archean Mantle with Implications for Mantle Convection

1593

J. Blichert-Toft and F. Albarède

Growth of Diamond from Atomic Hydrogen and a Supersonic Free Jet of Methyl Radicals

1596

S. S. Lee, D. W. Minsek, D. J. Vestyck, P. Chen

An in Vitro System for Adhesion and Fusion of Maize Gametes

1598

J.-E. Faure, C. Dignonnet, C. Dumas

Biodegradable Long-Circulating Polymeric Nanospheres

1600

R. Gref, Y. Minamitake, M. T. Peracchia, V. Trubetskoy, V. Torchilin, R. Langer

Loss of Circadian Behavioral Rhythms and *per* RNA Oscillations in the *Drosophila* Mutant *timeless*

1603

A. Sehgal, J. L. Price, B. Man, M. W. Young

Block in Nuclear Localization of *period* Protein by a Second Clock Mutation, *timeless*

1606

L. B. Vosshall, J. L. Price, A. Sehgal, L. Saez, M. W. Young

Activation of Phosphatidylinositol-3' Kinase by Src-Family Kinase SH3 Binding to the p85 Subunit

1609

C. M. Pleiman, W. M. Hertz, J. C. Cambier

Requirement for Transcription Factor IRF-1 in NO Synthase Induction in Macrophages

1612

R. Kamijo, H. Harada, T. Matsuyama, M. Bosland, J. Gerecitano, D. Shapiro, J. Le, S. I. Koh, T. Kimura, S. J. Green, T. W. Mak, T. Taniguchi, J. Vilček

Positive and Negative Thymocyte Selection Induced by Different Concentrations of a Single Peptide

1615

E. Sebzda, V. A. Wallace, J. Mayer, R. S. M. Yeung, T. W. Mak, P. S. Ohashi

Requirement for BDNF in Activity-Dependent Survival of Cortical Neurons

1618

A. Ghosh, J. Carnahan, M. E. Greenberg

Long-Range Cis Preference in DNA Homology Search over the Length of a *Drosophila* Chromosome

1623

W. R. Engels, C. R. Preston, D. M. Johnson-Schlitz

Mutation of a *mutL* Homolog in Hereditary Colon Cancer

1625

N. Papadopoulos, N. C. Nicolaides, Y.-F. Wei, S. M. Ruben, K. C. Carter, C. A. Rosen, W. A. Haseltine, R. D. Fleischmann, C. M. Fraser, M. D. Adams, J. C. Venter, S. R. Hamilton, G. M. Petersen, P. Watson, H. T. Lynch, P. Peltomäki, J.-P. Mecklin, A. de la Chapelle, K. W. Kinzler, B. Vogelstein

Coatomer Interaction with Di-Lysine Endoplasmic Reticulum Retention Motifs

1629

P. Cosson and F. Letourneur

1559 & 1625
Colon cancer gene



AAAS Board of Directors

Eloise E. Clark
Retiring President,
Chairman
Francisco J. Ayala
President
Rita R. Colwell
President-elect

William A. Lester Jr.
Simon A. Levin
Anna C. Roosevelt

Alan Schriesheim
Jean'ne M. Shreeve
Chang-Lin Tien
Warren M. Washington
Nancy S. Wexler

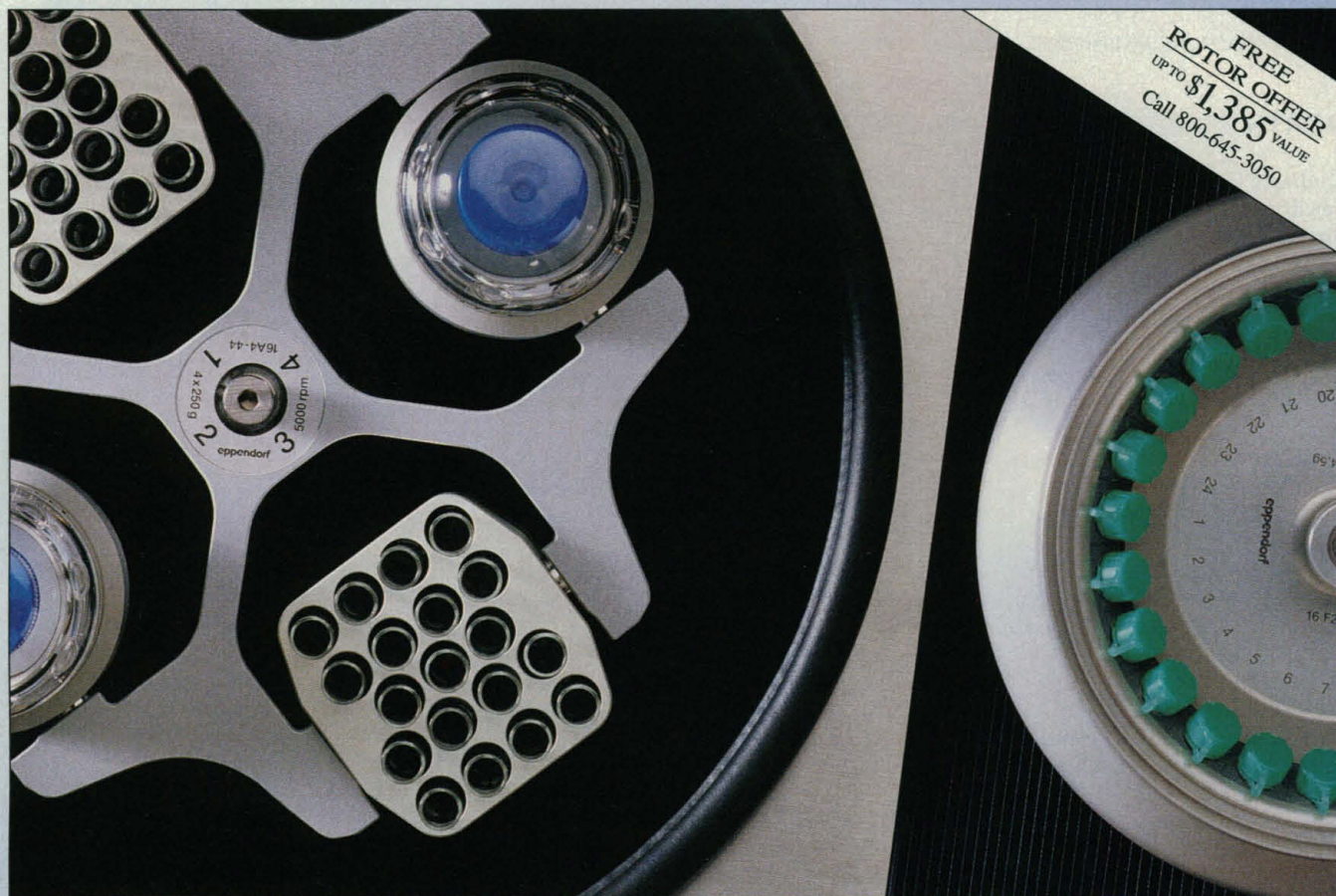
William T. Golden
Treasurer
Richard S. Nicholson
Executive Officer

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. Copyright © 1994 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): \$92 (\$50 allocated to subscription). Domestic institutional subscription (51 issues): \$215. 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 #125488122. 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, MA 01970. The identification code for *Science* is 0036-8075/93 \$1 + .10. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

NEW EPPENDORF® CENTRIFUGES WITH MICRO AND MACRO CAPABILITIES...



MORE VERSATILITY THAN EVER BEFORE.

Eppendorf, the name you trust for quality and innovation, expands your options for centrifugation with new benchtop designs.

Our expanded line of centrifuges now includes new Model 5416 and Refrigerated Model 5403. Both models accommodate *interchangeable* rotors for tube sizes from 0.25 mL to 100 mL. The variable-speed, brushless motor generates up to 15,000 rpm and over 23,000 x g. Refrigerated Model 5403 features a temperature control range of -10°C to 40°C and uses a *CFC-free* refrigerant to protect the environment.

In addition, our new economical Micro Centrifuge Model 5410 offers outstanding value without sacrificing important operating features.

When you're looking for a reliable benchtop centrifuge, there's just one name to remember—Eppendorf.



eppendorf

BRINKMANN Quality products for research and control.

Brinkmann Instruments, Inc., One Cantiague Road, P.O. Box 1019, Westbury, NY 11590-0207 • 800-645-3050, FAX: 516-334-7506
Brinkmann Instruments (Canada) Ltd., 6670 Campobello Road, Mississauga, Ont. L5N 2L8 • 800-263-8715, FAX: 416-826-5424

Eppendorf® is a registered trademark of Eppendorf-Netheler-Hinz GmbH. BRK-10556 5201-303

For information circle reader service number 12
For a demonstration circle reader service number 13

Everyday genetics

Such diverse biological processes as wake-sleep cycles, reproduction, growth, and motor activity run on cycles of approximately 24 hours called circadian rhythms. This week, three papers shed light on our understanding of the underlying cellular machinery that is responsible for the working of the biological clock. Aronson *et al.* (p.1578) have demonstrated that the *frequency* (*frq*) gene of the fungus *Neurospora crassa* has properties that allow it to be a central component of a cellular circadian oscillator. The *frq* gene product inhibits its own



transcript as part of a negative feedback loop, which results in a daily oscillation in the production of the *frq* transcript. Working on a different system, Sehgal *et al.* (p.1603) and Voshall *et al.* (p.1606) have isolated and characterized *timeless* (*tim*), a mutation in *Drosophila* that abolishes circadian rhythms. Mutations in *tim* affect the oscillation of mRNA from another gene that is required for circadian rhythmicity, *period* (*per*), and also block the nuclear localization of the PER protein.

Si fi ve

Chemical reaction intermediates are often species with unusual coordination numbers. Silicon is normally found in 4- or 6-coordinated forms, but Herreros *et al.* (p. 1585) find evidence from nuclear magnetic reso-

Too much of a good thing

T cell maturation requires positive selection, but it has been a puzzle how the interaction of the T cell receptor (TCR) with a combination of a major histocompatibility complex molecule and a peptide can lead to both positive and negative selection. Sebzda *et al.* (p. 1615) followed selection in thymic organ culture containing T cells that expressed transgenic TCRs. Exposure of the cultures to low concentrations of a peptide recognized by the TCR induced positive selection, but higher concentrations led to deletion, a result that supports the affinity-avidity model for T cell selection.

nance and powder x-ray diffraction that synthesis of sodalite, a zeolite, proceeds through a 5-coordinated silicon intermediate.

Volcanic reduction

Carbon monoxide, a trace atmospheric gas, comes from anthropogenic sources, biomass burning, and oxidation of natural and anthropogenic hydrocarbons; it is lost mainly by reaction with OH, an important atmospheric oxidant. Global CO levels, a sensitive indicator of the oxidative capacity of the atmosphere, have generally increased during the past 30 years, but Novelli *et al.* (p. 1587) present recent measurements indicating a decrease over the past 2 to 5 years. This may be a response to production of tropospheric OH following the Mount Pinatubo eruption. Recent deviations from long-term trends are also being seen in levels of other gases, as discussed in a news story by Kerr (p. 1562).

A pressing question

Laboratory measurements of the equation of state of hydrogen at high pressure cannot reach conditions appropriate to giant planet interiors, so planetary modeling demands theoretical extrapolation. Recent observations of global oscillations of Jupiter,

which measure its internal sound speed, hint at a discrepancy with the current models. Duffy *et al.* (p. 1590) have compressed hydrogen to 24 gigapascals in the laboratory, and use their data to refine predictions of the Jovian interior. The discrepancy is reduced, but does not go away; the observations and the extrapolations cannot both be right.

Mixed well and baked

If, as is likely, the Earth's interior was considerably hotter in the Archean, the mantle would have convected more vigorously and be more thoroughly mixed. Blichert-Toft and Albarède (p. 1593) found that the range of neodymium isotopic compositions in basalts erupted from the mantle about 2.7 billion years ago is smaller than in modern basalts, and conclude that the mantle was convecting 10 times more vigorously then as now.

Fertilizing plants

In vitro fertilization of animal eggs has provided insights into the processes of fertilization and offers a degree of control over the early stages of development, but in higher plants the fertilization process has long been inaccessible to experimenters. Faure *et al.* (p. 1598) have identified culture conditions that permit

adhesion and fusion of maize sperm and egg cells. Fusion was mostly restricted to sperm and egg cell pairs, suggesting that the processes of gamete-specific recognition and blocks to polyspermy may remain intact.

Colon cancer genes

Defective DNA repair has been implicated as a critical step in the etiology of hereditary non-polyposis colorectal cancer (HNPCC). Tumor cell extracts from most HNPCC patients show aberrant mismatch repair, and a subset of these patients carries mutations in *hMSH2*, a mismatch repair gene on chromosome 2p. By searching a database of expressed human genes, Papadopoulos *et al.* (p. 1625 and news story by Service, p. 1559) have identified three new DNA repair genes, one of which, *hMLH1* (on chromosome 3p), was found to be mutated in a colon cancer cell line and in newly studied HNPCC families. Most HNPCC cases, it now appears, can be attributed to mutations in DNA repair genes.

Activity aids longevity

Why neuronal survival should depend on neuronal activity has been unclear. Ghosh *et al.* (p. 1618) show that survival of rat cortical neurons in culture is enhanced by activation of voltage-sensitive calcium channels (VSCCs) but reduced by activation of *N*-methyl-D-aspartate (NMDA) receptors, although both serve to increase calcium influx. The difference seems to be that expression of brain-derived neurotrophic factor (BDNF), which protects neurons, is more strongly stimulated by activation of VSCCs than by activation of NMDA receptors.

DISCOVER *How* *Fast* and *Easy* it is to QUANTITATE *Nucleic Acid*.

How FAST is FAST?

The DNA DipStick gives you results in 10 minutes. Now that's fast! It's hours faster than electrophoresis or radioactive assays. The simple DNA DipStick protocol requires no agarose gels or spectrophotometry and eliminates the use of ethidium bromide and radioactivity.

WE'RE SENSITIVE, TOO.

The DNA DipStick is so sensitive it uses five times less DNA for quantitation than spectrophotometry and ten times less than EtBr staining. That's plenty sensitive to measure nucleic acid concentrations and yields associated with techniques such as mRNA isolation, PCR, plasmid preparation and more.



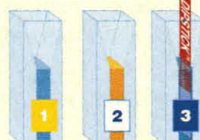
Spot 1 µl of RNA, DNA, or oligonucleotides on the membrane. Allow to dry.



Prepare DipStick for coupling by incubating in wash solution.



Transfer the DipStick to coupling solution.



Wash the DipStick, then transfer to the developing solution.



Compare spot intensities to standards. Keep as a permanent record of your results.

TRY it TODAY!

Each DNA DipStick™ Kit contains all the reagents necessary to carry out 50 independent quantification assays (up to 150 samples). Discover how quickly you can quantitate nucleic acid. Call today and ask for the DNA DipStick™ Kit, catalog no. K5632-01.

Try it and if it's not the fastest, most sensitive way to quantitate nucleic acid, we'll cheerfully credit your purchase.

3985 B Sorrento Valley Blvd.

San Diego, CA 92121

1-800-955-6288

FAX 1-619-597-6201

Invitrogen

European Headquarters: Invitrogen BV

De Scheip 26, 9351 NV Leek
The Netherlands
Tel: (0) 5945-15175
Fax: (0) 5945-15312

Toll free Telephone Numbers
The Netherlands 06-02208848
Belgium 078-111173
Germany 0130 8100 43
Switzerland 155-1966
Austria 0660-8127

UK Tel: +44 (0)235 531074 FAX: +44 (0)235 533420
France 05 90 72 49
Sweden 020 793149
Norway 800 11033
Denmark 80 01 85 92

**RD
SYSTEMS**

CELBO

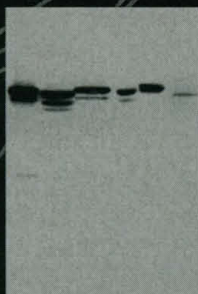
Italy
Tel: 39-238103171
Fax: 39-238101465

3

Japan
Tel: 81-356841622
Fax 81-356841633

Austria 43-1-8891819 Australia 61-38089077 Finland 35-804208077
Israel 972-8472563 Spain 34-3-4560607 Singapore 65-779-1919

QUALITY ANTIBODIES FOR SIGNAL TRANSDUCTION RESEARCH



Anti-ISGF3,
Western blot.



Anti-inducible
Nitric oxide synthase (NOS),
Immunofluorescence.

PROTEIN Kinase C

STRUCTURAL
PROTEINS

TYROSINE
KINASES

TUMOR
MARKERS

Ras
pathway

MAP Kinase
pathway

PHOSPHATASES

NOS

SUBSTRATES

PHOSPHOTYROSINE

SH 2 - DOMAINS



Transduction Laboratories

1-800-227-4063

Telephone 606-277-1399

Facsimile 606-276-2251

In Europe, contact

AFFINITI

Research Products Limited

Telephone: (+44)602-436100

Facsimile: (+44) 602-436300

In Japan, contact

FUNAKOSHI CO., LTD.

Telephone: 81-3-5684-1622

Fax: 81-3-5684-1633

Half-Day DNA. And That's Just The Half Of It.



Synthesizing primers, probes, linkers, or gene fragments? Cut your time — and your reagent use — in half with the Millipore Expedite™ Nucleic Acid Synthesis System.

For instance, a pair of 20-mer PCR primers can be synthesized in about an hour and worked up in about 15 minutes, so you can start using your new DNA before noon.

How's that possible? Because no matter how many columns you're running — 1, 2, 3, or 4 — the total cycle time is under 4 minutes. The Expedite system's exclusive alternating phase synthesis allows columns to act independently, so each is always synthesizing.

Expedite reagents speed things along further. Oligonucleotides made with Expedite brand


chemistry can be deprotected in only 15 minutes at 55°C or 2 hours at room temperature.

But speed is just half the story. The Expedite system's patented microfluidics plate provides for extremely low internal volume. Reagent delivery to the column is cut by as much as 50% over other systems. So, you get more couplings per chemistry changeout; more DNA synthesized per dollar.

Now you've got the whole picture. So how about an Expedite video demo? Just give us a call and we'll send it to you, expeditiously. 1-800-872-0071.



MILLIPORE



SAMPLING, PROCESSING, SCREENING RESULTS.

Fully automated.

TRAC brings

innovation and

flexibility to microplate

handling. TRAC is the high

throughput solution for

screening of new drugs

from TECAN and SLT.

TECAN - anything else is a compromise

 **TECAN.**

● Tecan AG, Hombrechtikon, Switzerland. Tel. 055 41 81 11, Fax. 055 42 38 83, Hotline 055 41 82 82 ● Tecan France SA, Voisins-le-Bretonneux, France. Tel. 1 30 64 90 70, Fax. 1 30 64 90 64
● Tecan Asia PTE. Ltd., Singapore 0512. Tel. 779 7033, Fax. 777 5582 ● Tecan UK Ltd., Reading, England. Tel. 0491 875087, Fax. 0491 875432 ● Tecan Japan Co. Ltd., Fuchu City, Tokyo 183, Japan.
Tel. 04 2334 1790, Fax. 04 2334 0401 ● SLT Labinstruments, Deutschland GmbH, 7180 Crailsheim, Germany. Tel. 07951 5035, Fax. 07951 5038 ● Tecan US Inc., NC27709, USA. Tel. 919-361-5200, Fax. 919-361-5201

Worldwide sales and support are provided by an additional, extensive and specialist network of Representatives. To find out more information about your local Tecan Representative contact Tecan AG

Circle No. 11 on Readers' Service Card



NEW SORVALL® PLUS SUPERSPEEDS. THEY'LL IMPROVE MORE THAN YOUR WORKING ENVIRONMENT.

50% Quieter, 20% Cooler, *plus* SUVA® CFC-Replacement Coolant.

The first thing you'll notice about the new RC-5B PLUS and RC-5C PLUS Superspeed centrifuges* is the substantially reduced sound. They're 50% quieter. Then you'll notice the cooler operating temperature – 20% cooler. But we didn't stop with cooler and quieter. We also included SUVA® refrigerant, a new DuPont replacement coolant that reduces ozone depletion and global warming.

In addition to the reliable performance you expect from a SORVALL®, you'll get 21,000 rpm

without a vacuum, plus increased brush life that results in less maintenance.

We've also introduced the first of a new line of biosafety tested** SUPER-LITE™ rotors which are up to 50% lighter than conventional rotors. That's not all. They offer higher g forces and faster acceleration and deceleration times which yield quicker separation times.

For more information on how to improve your workplace and the earth's environment, call 1-800-551-2121.

* Manufactured under a quality system registered by UL.
Manufactured under a quality system approved by BSI.

** Tested by Biosafety Unit, Division of Biologics, PHLS CAMR, Porton Down, U.K.

SORVALL®...a better choice.

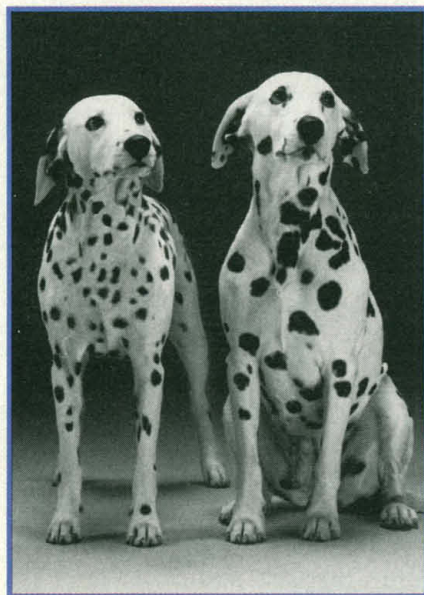


Circle No. 15 on Readers' Service Card

BIOSEARCH

D N A
P R O T E I N S
C A R B O H Y D R A T E S

P R E - C A S T G E L S
G E L S / R E A G E N T S
I M A G E A N A L Y S I S
1 - D E L E C T R O P H O R E S I S
2 - D E L E C T R O P H O R E S I S



Spot the difference!

2-D electrophoresis has long been acknowledged as a powerful tool for purifying proteins on an analytical scale, but not on a preparative scale because of limited loading capacity. Until now.

Using Millipore's Investigator™ 2-D Electrophoresis System and a Preparative Accessories Package, you can prepare enough protein for sequencing or other assays. Load up to 1 mg and retrieve 1-10 µg from a purified spot. You can even run five gels simultaneously for duplicate samples – with the same high resolution that has made the Investigator 2-D Electrophoresis System the most widely used dedicated 2-D system.

On a free gel!

Place your order for a Preparative Accessories Package (with or without an Investigator System) by September 30, 1994 and receive a free package of pre-cast gels. For more information call 1-800-MILLIPORE or our fax on demand information retrieval system at 1-800-MILLIFX and request #1703. In Japan, call (81) (3) 3471-8191. In Europe, contact the local office or fax us in France (33) (1) 30.12.7189.

MILLIPORE

Circle No. 19 on Readers' Service Card

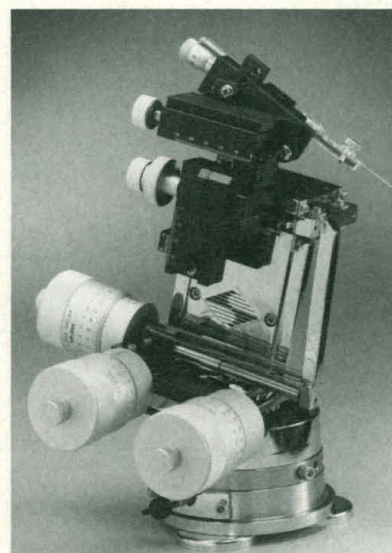
SIMPLE, YET ELEGANT.

MP-85

A classic Huxley type micromanipulator design offering stable, drift free operation for patch clamp and intracellular recordings.

Ultrafine movement has zero backlash.

Ultrafine (Huxley) resolution is 0.2 microns.
Coarse travel:
X - 37 mm
Y - 20 mm
Z - 26 mm



Construction is of solid brass with chrome plating. Mounted on a precision stainless steel rotating base featuring a positive stop and lock.



Sutter Instrument Company

40 Leveroni Court, Novato, CA 94949 Ph: (415) 883-0128 Fax: (415) 883-0572

Circle No. 30 on Readers' Service Card

CUSTOM DNA SYNTHESIS

PURE & SIMPLE

● Price **\$2¹⁹**
as low as per base plus set up

- Superb Technical Support
- Impeccable Quality
- World's Fastest Service

MIDLAND

THE UNDISPUTED #1
CUSTOM DNA SYNTHESIS SERVICE

THE MIDLAND CERTIFIED REAGENT COMPANY

3112-A West Cuthbert Avenue
Midland, Texas 79701

Phone 1-800-247-8766 FAX 915-694-2387

Circle No. 2 on Readers' Service Card