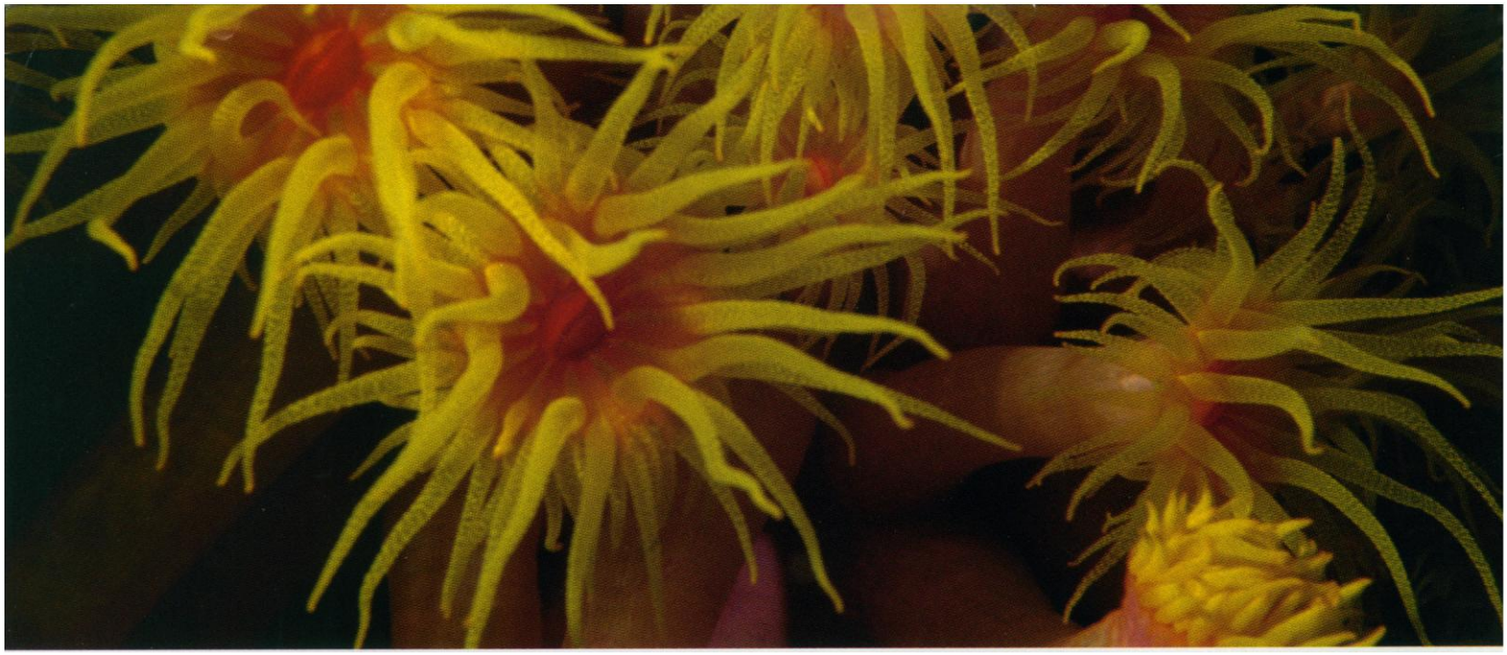
19 November 1999

Science

Vol. 286 No. 5444
Pages 1433–1636 $8

Frontiers in Optics

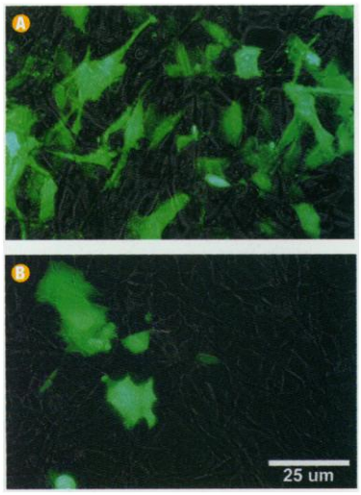
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Cup Coral

Survival of the fittest: FuGENE™ 6 Transfection Reagent

Succeed in this "publish or perish" world by performing previously impossible experiments with FuGENE™ 6 Transfection Reagent*. Make that research breakthrough before someone else does.



Expression of GFP in MC3T3-E1 cells, following transfection with vector phGFP-S65T using (A) FuGENE 6 Reagent or (B) leading supplier's liposomal transfection reagent (LF). *(Data courtesy of S. Ritter, Univ. of Texas, Houston, TX, USA)*

What researchers are saying about FuGENE 6 Reagent

"FuGENE 6 Reagent has been the best thing introduced for transfections in a very long time. . ." *(M. Connelly, State University of New York, Stony Brook, NY, USA)*

"FuGENE 6 Transfection Reagent is far superior to any other transfection method currently available with regards to ease-of-use, time and amount of materials required." *(A. Thomson, Royal Perth Hospital, Perth, Australia)*

Ensure your survival!

Join the hundreds of labs around the world that have discovered FuGENE 6 Reagent to be superior to other methods of transfection. Order FuGENE 6 Reagent today and ensure your survival!

Cat. No.		Pack Size
1 815 091		0.4 ml
1 814 443		1.0 ml
1 815 075	Multi-pack	5 x 1.0 ml
1 988 484	Custom-pack	Inquire

Roche

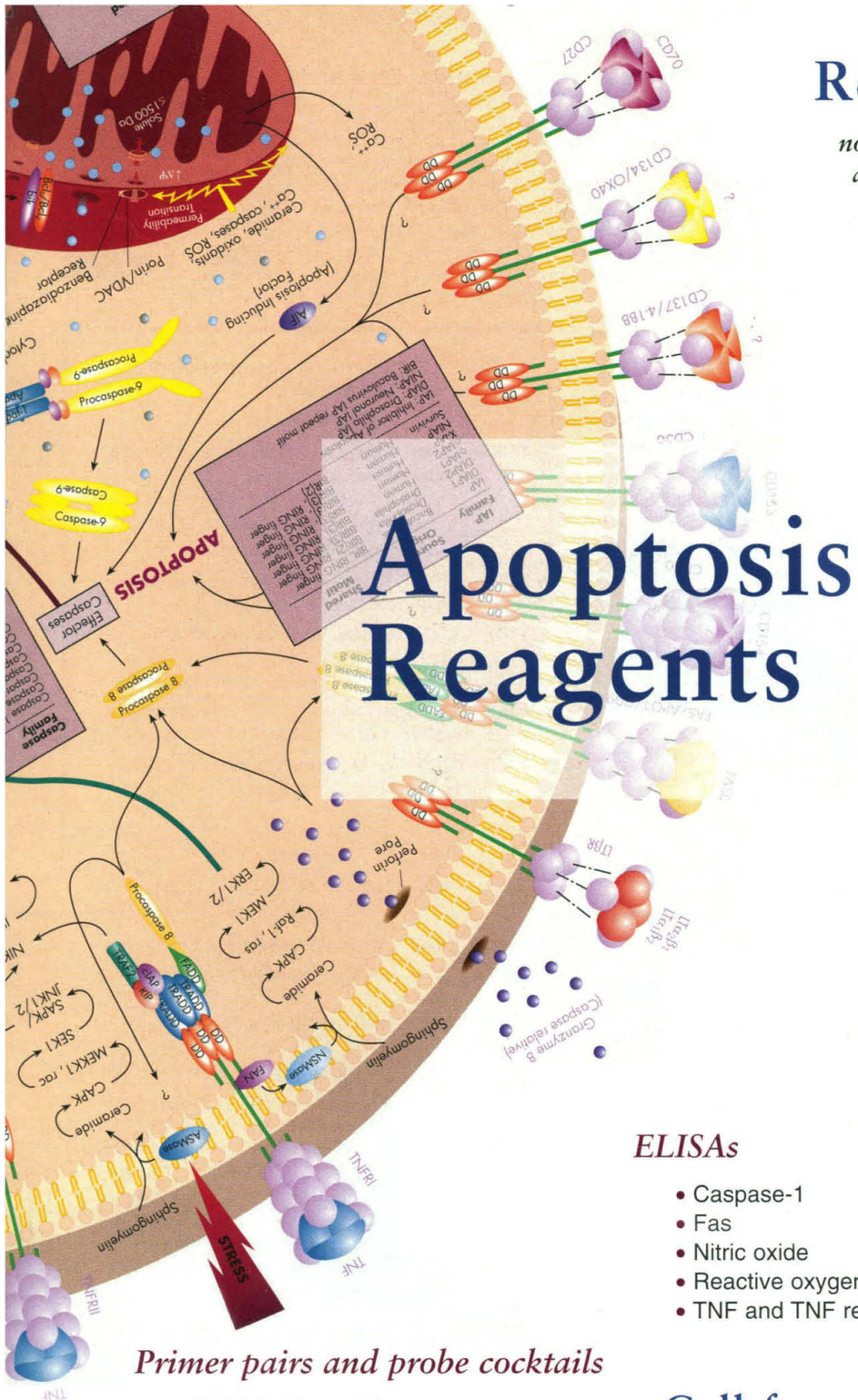
Roche Molecular Biochemicals

*See **http://biochem.roche.com/techserv/fugene.htm** for a current list of more than 200 transfected cell types.

Argentina 541 954-555; **Australia** (02) 9899 7999; **Austria** (01) 277 870; **Belgium** (02) 247 4930; **Brazil** +55 (11) 66 3565; **Canada** (514) 686 7050; (800) 361 2070; **Chile** 0 56 (2) 375 2000 (Central); **China** 86 21 6427 5586; **Columbia** +57 (1) 3412797; **Czech Republic** (0324) 45 54, 58 71-2; **Denmark** 49 13 82 32; **Egypt** 0020 2 340 2660 (Scientific Office) 0020 2 360 9000 (Distrib. Bagneid); **Finland** (09) 429 2342; **France** 04 76 76 30 86; **Germany** (0621) 759 856; **Greece** (01) 67 40 238; **Hong Kong** (852) 2485 7596; **India** (22) 4314653; **Indonesia** 62 (21) 2523820, Ext. 755; **Iran** 0098 21 208 2266 (Teb Technology) 0098 21 878 5656 (Tuba Nigen; **Republic of Ireland** (800) 40 90 4; **Israel** 972-3-6 49 31 11; **Italy** 039 247 4109-4181; **Japan** 03 5443 5284; **Kenya** 00254 2 744 677; **Kuwait** 4832600-01, -02, -03; **Malaysia** 60 (03) 755 5039; **Mexico** (5) 227 8967, -61; **Netherlands** (036) 539 4911; **New Zealand** (09) 276 4157; **Nigeria** +234 1 521767; **Norway** 22 07 65 00; **Philippines** (65) 27 27 500; **Poland** (22) 374235; **Portugal** (01) 417 17 17; **Russia** (49) 621 759 8636; **Saudi Arabia** 00966 1 4010333; **Singapore** 65 27 27 500; **South Africa** (011) 886 2400; **South Eastern Europe** +43 (1) 277 87; **South Korea** 02 569 6902; **Spain** (93) 201 4411; **Sweden** (08) 404 8800; **Switzerland** 0 41/7 99 616; **Taiwan** (02) 736 7125; **Thailand** 66 (2) 274 0708-13; **United Kingdom** (0800) 521 578; **USA** (800) 428 5433

FuGENE™ is a trademark of Fugent, L.L.C., USA.

Circle No. 25 on Readers' Service Card



R&D Systems

now offers over 200 products for use in apoptosis research. This extensive range of kits and reagents allows you to customize and optimize apoptosis detection in your specific research model.

Apoptosis Reagents

Apoptosis detection kits

- Annexin V
- Disruption of mitochondrial membrane potential
- DNA laddering
- TUNEL with *in situ*, flow cytometry or microplate-based analysis

Activity assays

- Caspases
- Cell Proliferation
- PARP

Recombinant proteins and antibodies

- Bcl-2 family proteins
- Caspases
- Cytochrome c
- Fas
- IAP family proteins
- TNF and TNF receptors
- TRAIL and TRAIL receptors
- others

ELISAs

- Caspase-1
- Fas
- Nitric oxide
- Reactive oxygen species
- TNF and TNF receptors

Primer pairs and probe cocktails

- Bcl-2 family proteins
- Survivin
- TNF

Call for a copy of our new 1999/2000 Apoptosis Catalog

FOR RESEARCH USE ONLY. NOT FOR USE IN DIAGNOSTIC PROCEDURES

USA and Canada
R&D Systems, Inc.
614 McKinley Place N.E.
Minneapolis MN 55413, USA.
Tel: 1-800-343-7475
Fax: 612-379-6580
e-mail: info@rndsystems.com

UK & Europe
R&D Systems Europe Ltd.
4-10 The Quadrant, Barton Lane
Abingdon, OX14 3YS, UK.
Tel: +44 (0)1235 529 449
Fax: +44 (0)1235 533420
e-mail: info@rndsystems.co.uk

Germany
R&D Systems GmbH
Borsigstraße 7
D-65205 Wiesbaden
Tel: 06122 90980
Fax: 06122 909819
e-mail: infogmbh@rndsystems.co.uk

Europe Free Phone
Belgique/België: 0800 10 468
Danmark: 80 01 85 92
France: 0800 90 72 49
Nederland: 060 225607
Norge: 800 11033
Sverige: 020 79 31 49
Switzerland: 0800 55 2482

R&D SYSTEMS

1-800-343-7475

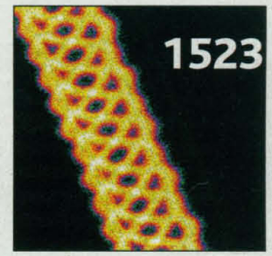
www.rndsystems.com

Circle No. 55 on Readers' Service Card

VOLUME 286 19 NOVEMBER 1999 NUMBER 5444

Science

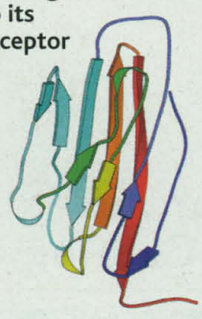
www.sciencemag.org



COVER Output of a semiconductor nonlinear optical interferometer used in digital signal regeneration at very high speed (the trace shows signal probability as a function of time). Such devices are being developed to directly process the optical data signals carried in fiber-optic networks for the Internet and telecommunications, without needing conversion to electronic signals. This topic is part of the Frontiers in Optics special section beginning on p. 1499. [Image: D. Cotter *et al.*]

1460
The resurrection of Thomas Bayes

1579
Binding of adenovirus to its receptor



AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Domestic individual membership and subscription (51 issues): $110 ($62 allocated to subscription). Domestic institutional subscription (51 issues): $325; Foreign postage extra: Mexico, Caribbean (surface mail) $55; other countries (air assist delivery) $90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. **Printed in the U.S.A.**

SCIENCE'S COMPASS

AMERSHAM PHARMACIA BIOTECH & SCIENCE
Prize FOR YOUNG SCIENTISTS

1491
Grand Prize Essay

SCIENCE ONLINE
www.scienceonline.org

SCIENCE
THE JOURNAL
www.sciencemag.org

SCIENCENOW
DAILY NEWS SERVICE
www.sciencenow.org

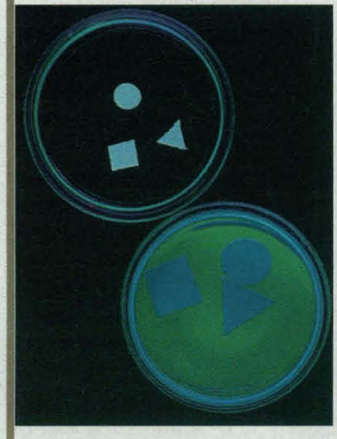
NEXT WAVE
WEEKLY CAREER UPDATES
www.nextwave.org

GRANTSNET
RESEARCH FUNDING DATABASE
www.grantsnet.org

NEUROAIDS
EXPERIMENTAL WEB SITE
www.sciencemag.org/NAIDS

SCIENCE'S STKE
SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT
www.stke.org

www.sciencemag.org/cgi/content/full/286/5444/1443a



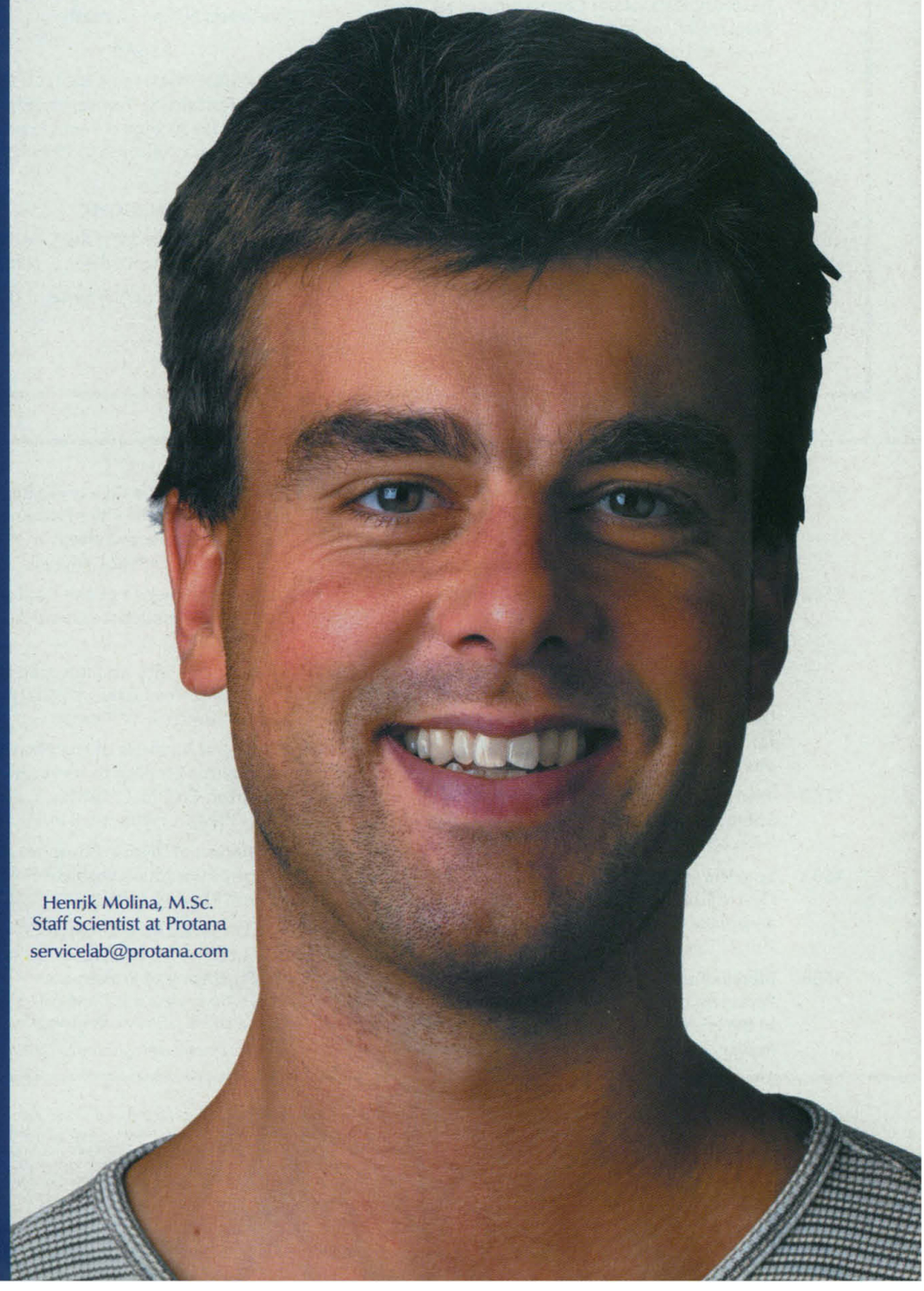
1543
Making multiple contacts

Change of address: allow 4 weeks, giving old and new addresses and 8-digit account number. **Postmaster:** Send change of address to *Science*, P.O. Box 1811, Danbury, CT 06813–1811. **Single copy sales:** $8.00 per issue prepaid includes surface postage; bulk rates on request. **Authorization to photocopy** material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that $4.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification code for *Science* is 0036-8075/83 $4.00. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

Henrik is smiling!

Using our unique functional proteomics technology he just discovered another novel membrane protein which is now being patented

Visit our Website or contact us to learn how our functional proteomics technology can make you smile as well



Henrjk Molina, M.Sc.
Staff Scientist at Protana
servicelab@protana.com

PROTANA
the functional proteomics leader

MDS Protana A/S, Staermosegaardsvej 16
DK-5230 Odense M, Denmark

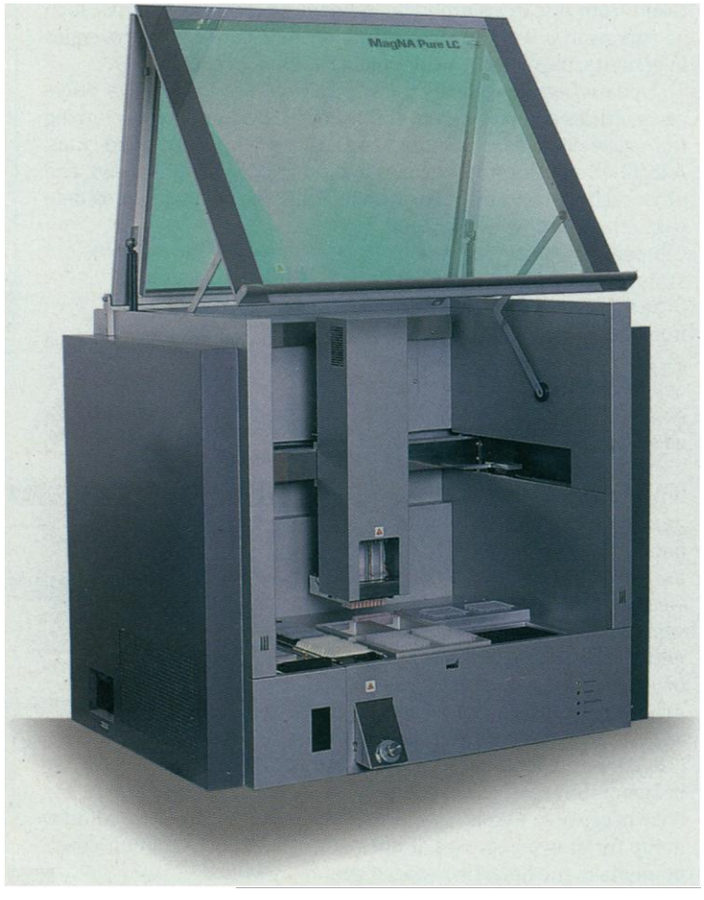
Telephone: (+45) 63 15 20 30
Facsimile: (+45) 63 15 20 40

E-mail: protana@protana.com
Website: www.protana.com

Circle No. 44 on Readers' Service Card

The aurora borealis is formed when the earth's magnetosphere causes charged particles from the sun to collide with atmospheric gasses, emitting light.

MagNA Pure LC: Experience Flexibility and Walk-away Precision in Template Preparation



Isolate pure, PCR-ready nucleic acids from a wide variety of sample types in less than 1 hour. Increase the precision of every pipetting step while letting MagNA Pure LC do all the work! Reaction mixes are ready for real-time PCR when you return.

- Walk away from manual nucleic acid preparation.
- Increase the accuracy of your quantitative PCR.
- Automate PCR reaction set-up for 96-well plates, LightCycler Capillaries, PCR strips, or tubes.
- Achieve reproducible quality and yields of pure DNA, RNA, and mRNA.

For more information on MagNA Pure LC, visit http://biochem.roche.com/magnapure.htm or call us at 1-800-428-5433.

Roche

USA (800) 428 5433

Roche Diagnostics Corporation
Roche Molecular Biochemicals
Indianapolis, Indiana

Circle No. 54 on Readers' Service Card

BREAKING UP

Like the oceans, our atmosphere supports large-scale waves. Atmospheric waves in the troposphere, which are caused by air flow over mountains, have been studied for many years, but analogous structures in the stratosphere have been more difficult to observe. Eckermann and Preusse (p. 1534) used infrared emission measurements made from the space shuttle Atlantis to identify stratospheric mountain waves at altitudes between 15 and 30 kilometers above the Andes. They inferred that waves there were breaking above 30 kilometers. These results may be used to improve climate forecasts and atmospheric mixing models.

STATIONARY FRONTS IN THE OUTER CORE

Determining the detailed dynamic structure of the liquid outer core is important for understanding how the core evolved and how Earth's magnetic field is generated. Sumita and Olson (p. 1547) performed laboratory experiments to approximate the pattern of flow in the outer core when a large anomalous lateral heat flux from the mantle to the core is added to simulate heterogeneous mantle convection. In their model, a stationary spiral front in the "outer-core" liquid that separates warm liquid flowing "eastward" from cold liquid flowing "westward." Such a front in Earth's outer core could account for some variations in the geomagnetic field and for the anisotropy of the inner core.

SMALL FOAM CELLS WITH CO_2 GELS

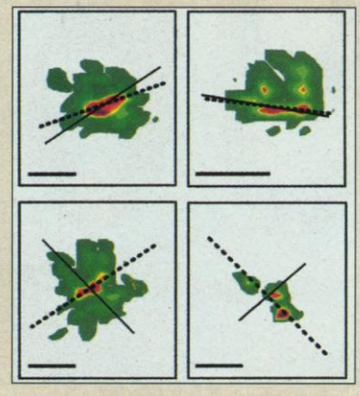
The formation of foams with both low density and small cell size has been difficult to achieve. Shi *et al.* (p. 1540) have developed families of surfactants with high affinity for liquid carbon dioxide that increased its viscosity substantially and formed a gel even at a few weight percent. When the CO_2 was vented, low-density foams with submicrometer pores were formed. The use of CO_2 as a "blowing agent" could replace less environmentally benign compounds.

PINPOINT PERFORMANCE

Quantum-well resonant tunneling diodes can exhibit large increases in conductivity at particular voltages. Chen *et al.* (p. 1550) show that junctions formed from two gold electrodes separated by a monolayer of electroactive molecules can exhibit very large peaks in current at low temperatures; for one device at 60 kelvin, the "peak-to-valley" ratio of the currents exceeded 1000. Defects and pinholes in the monolayer, which can degrade performance, were minimized by confining the molecules to a region only tens of nanometers in diameter.

KEEPING TRACK THROUGH FEEDBACK

Information in the central nervous system is normally viewed as flowing from the periphery to the neocortex, but there is also massive feedback, such as from the cortex to the thalamus. Murphy *et al.* (p. 1552) provide evidence for a specific role of these cortico-thalamic connections in the visual system. They mapped regions of greatly increased



presynaptic terminal (bouton) density of corticogeniculate feedback axons that terminate in the dorsal lateral geniculate nucleus. The regions of maximum density are almost always elongate, and the axis of elongation depends on the visual orientation preference of the parent cells. These results are consistent with a model of spatiotemporal processing that would use such feedbacks to improve the ability of the visual system to track objects in space and time.

WARMING UP

The large, rapid warming that occurred 55.5 million years ago, the latest Paleocene thermal maximum, is one of the most dramatic episodes contained in the geological record of the past 100 million years. In only 10,000 to 20,000 years, the deep oceans warmed by 6°C, the oceans experienced a huge injection of isotopically light carbon, and benthic foraminifera suffered mass extinction. Many researchers attribute these events to a colossal release of methane from clathrates on the sea floor. Katz *et al.* (p. 1531; see the news story by Kerr) present complementary stratigraphic, isotopic, and foraminiferal abundance records from a sediment core from the subtropical Northwestern Atlantic Ocean that document this event and provide strong evidence for the methane hypothesis. Their findings provide a specific example of what must have happened at numerous other locations on the sea floor near the end of the Paleocene.

DECIPHERING A DROUGHT

The drought conditions in the West African Sahel region that have persisted since the mid-1950s may have been caused by variations in sea surface temperature, changes in land use, or some combination of both effects. Zeng *et al.* (p. 1537) used a coupled atmosphere-land-vegetation model to explore dynamic interactions between the distribution of vegetation and the atmospheric budgets of water and energy. Their results suggest that the multidecade drying trend originated in oceanic forcing but that vegetation interactions may have amplified its magnitude.

PRESSURE EFFECTS IN HYDROGEN FRACTIONATION

A fundamental assumption of stable isotope geochemistry has been that isotopic fractionation is independent of pressure. Recently, however, theoretical calculations have suggested that this assumption should not hold true for hydrogen at pressures and temperatures commonly found in the Earth's mantle. Horita *et al.* (p. 1545) present experimental results that quantify the isotopic fractionation of hydrogen between the hydrous mineral brucite, $Mg(OH)_2$, and pure water between 15 and 800 megapascals at 380°C. These data may help resolve decades of questions about the hydrogen isotopic composition of high-temperature, high-pressure geological materials formed in the presence of water.

BACTERIAL ADAPTATION IN CYSTIC FIBROSIS

The major cause of death for patients with cystic fibrosis is the massive chronic infections with *Pseudomonas aeruginosa* that they acquire. Ernst *et al.* (p. 1561) have found that the bacteria adapt to the particular environment of the patients' lungs by synthesizing lipopolysaccharides with a specific

CONTINUED ON PAGE 1443

MultiShot™ Chemically Competent *E. coli*— For Faster High-Throughput Transformations

It's a fast-paced world. To keep up you need high-performance tools for fast results. That's the idea behind high-throughput cloning. It's also the reason we make MultiShot™ Chemically Competent *E. coli*. MultiShot™ *E. coli* are ready to use for a quick start in all of your high-throughput cloning applications.

Time-Saving Format. Each MultiShot™ *E. coli* Kit includes five 96-well plates. Each well contains 15 µl of high-efficiency, chemically competent TOP10 *E. coli*. There's no need to prepare, test, or aliquot your own competent cells. You'll be up to speed in no time.

Guaranteed Results. The high transformation efficiency of MultiShot™ *E. coli* ensures that you'll have plenty of colonies for downstream analysis. In addition, the TOP10 *E. coli* genotype is optimized for efficient cloning without restriction activity. It's the strain to use for the best results in most cloning applications.

Pick Up the Pace. Fast times call for fast methods. Accelerate your high-throughput transformations with MultiShot™ Chemically Competent *E. coli*. Don't get caught below 96. Call Invitrogen today.

European Headquarters:
Invitrogen BV
P.O. Box 2312
9704 CH Groningen
The Netherlands
Tel: +31 (0) 50 5299 299
Fax: +31 (0) 50 5299 281
Email: tech_service@invitrogen.nl
www.invitrogen.com

International Toll Free Numbers:
Tel: 00800 5345 5345*
Fax: 00800 7890 7890*
This number operates in all European countries excluding Finland and Sweden

Finland:
Tel: 990800 5345 5345
Fax: 990800 7890 7890
Sweden:
Tel: 009800 5345 5345
Fax: 009800 7890 7890

Distributors:
Austria 0222 889 18 19
Australia 1 800 882 555
China 010 6255 3477
Hungary 01 280 3728
India 91 80 8391453
Israel 02 584 1111
Italy 02 38 19 51
Japan 03 5684 1622
Malaysia 03 736 9198
Poland 058 344 19 80
Portugal 01 453 7085
Singapore 65 2922130
South Korea 02 3471 6500
Spain 03 450 2601
Taiwan 886 2 238 10844
Thailand 246 7243

From all other countries, call our European headquarters at +31 (0) 50 5299 299.

United States Headquarters:
Invitrogen
1600 Faraday Avenue
Carlsbad, California 92008
Tel: 1-800-955-6288
Fax: 760-603-7201
Email: tech_service@invitrogen.com
http://www.invitrogen.com

Circle No. 38 on Readers' Service Card

structure. This modification in lipid A is associated with an increased inflammatory response and resistance to antimicrobial agents.

EVERY BREATH YOU TAKE

Respiratory rhythms are generated by nerve cells in the brainstem. In an effort to identify the neurons and the mechanisms responsible for respiratory rhythmogenesis and frequency modulation, Gray *et al.* (p. 1566) analyzed the role of an area in the ventrolateral medulla, called the preBötzinger complex. They show that neurokinin-1 positive neurons anatomically define the preBötzinger complex and that a subpopulation of these neurons coexpressing opioid receptors can generate rhythms and modulate respiration frequency.

EXPERT AT REPAIRS

High levels of ultraviolet and ionizing radiation can cause extensive DNA damage and chromosomal breakage that can prove lethal to an organism. White *et al.* (p. 1571) determined the genome sequence of *Deinococcus radiodurans*, the most radiation-resistant bacterium known. The sequence analysis suggests that several factors contribute to radiation resistance: a large number of DNA repair genes, many of which are redundant; polyploidy, which can allow homologous recombination of double-strand DNA breaks; and the presence of a system that exports damaged nucleotides from the cell. The bacteria's natural resistance to radiation may prove useful in the bioremediation of contaminated radiation and toxic sites.

ADENOVIRUS ATTACHMENTS

Adenoviruses cause an array of diseases in animals and humans and are also used as vectors for gene therapy. They bind to their host cell receptors (the coxsackie and adenovirus receptor, or CAR) by means of a globular domain that extends from a fiber attached to the viral capsid. Two reports focus on the receptor-virus interaction. Bewley *et al.* (p. 1579) crystallized the complex of an adenovirus knob with CAR and determined that the receptor interacts at the interface between knob monomers, specifically in a region that is highly conserved among adenoviruses. Even areas where there were shape mismatches between the receptor and the viral knob contributed to high-affinity interactions. The identification of the receptor-binding region were confirmed in the mutational analysis of Roelvink *et al.* (p. 1568), who also were able to redirect an adenovirus to a new receptor.

ALLIED AGAINST INVASIONS

Introductions of exotic and invasive species are among the leading causes of biodiversity decline, but what makes an ecosystem susceptible to invasion? Stachowicz *et al.* (p. 1577) investigated this question experimentally by manipulating species richness in rocky intertidal communities and monitoring subsequent invasion by an introduced species. Increased species diversity enhanced the community's resistance to invasion. This result implies that loss of diversity and invasion might reinforce each other by a negative feedback cycle, thereby accelerating extinction rates among the world's threatened biota.

TECHNICAL COMMENT SUMMARIES

How Tangled Are Prokaryote Phylogenies?

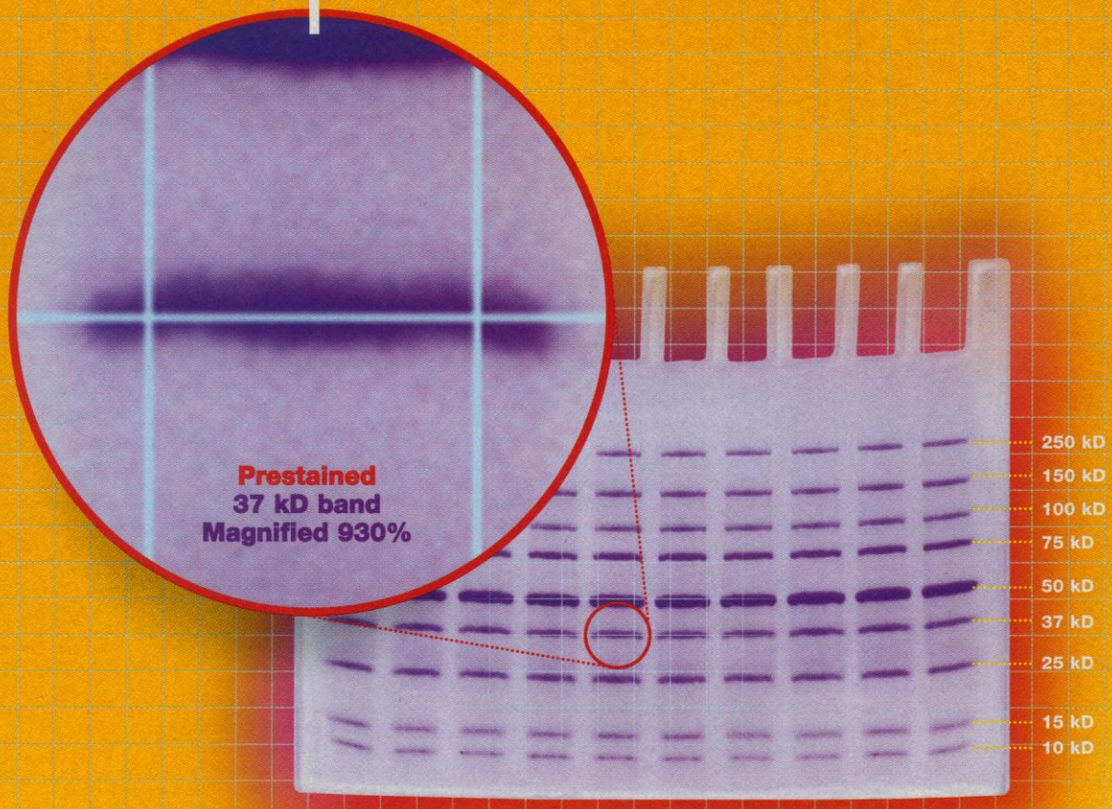
The full text of these comments can be seen at www.sciencemag.org/cgi/content/full//286/5444/1443a

Doolittle (Reviews, 25 June, p. 2124) examined the problems, perhaps severe, posed by extensive lateral gene transfer (LGT) in constructing meaningful phylogenies, particularly for bacteria and archaea. Three comments debate other approaches for reconstructing phylogenies and the overall prevalance of LGT.

Huynen *et al.* argue that higher order approaches, for example, examining the total gene content, can be useful and should be taken into consideration. Stiller and Hall caution that it remains unclear whether LGT is as widespread as current phylogenies suggest. Gupta and Soltys propose instead that the presumed prevalence of LGT can be used instead to infer alternative relationships among archaea and bacteria.

Doolittle responds and notes that the "strongest evidence for the importance of LGT is not within-genome inhomogeneities...but the varying gene content of the collection of genomes now available....Each new prokaryote genome that appears contains dozens, if not hundreds, of genes not found in genomes of its nearest sequenced relatives, but found elsewhere...."

incredibly precise



new Precision Protein Standards™

New Ready-to-Use Prestained and Unstained Standards That Migrate to Their True Molecular Weight.
Engineered from the ground up and highly purified to yield bands of unrivaled clarity and sharpness. Precision Protein Standards migrate to their true molecular weight, so you get reliable molecular weight determinations every time, without lot-to-lot variability, even prestained! See us at **precision.bio-rad.com** for additional information.

Order Today and Try Them Now!

Catalog #	*Description*
161-0362	Precision Protein Standards, Unstained, 150 applications (10 µl/application), 1500 ul
161-0372	Precision Protein Standards, Prestained, 50 applications (10 µl/application), 500 ul

What Will You Discover Next?

Visit our Life Science web site at discover.bio-rad.com.
Call toll free at 1-800-4BIORAD (1-800-424-6723); outside the US, call (510) 741-6996.

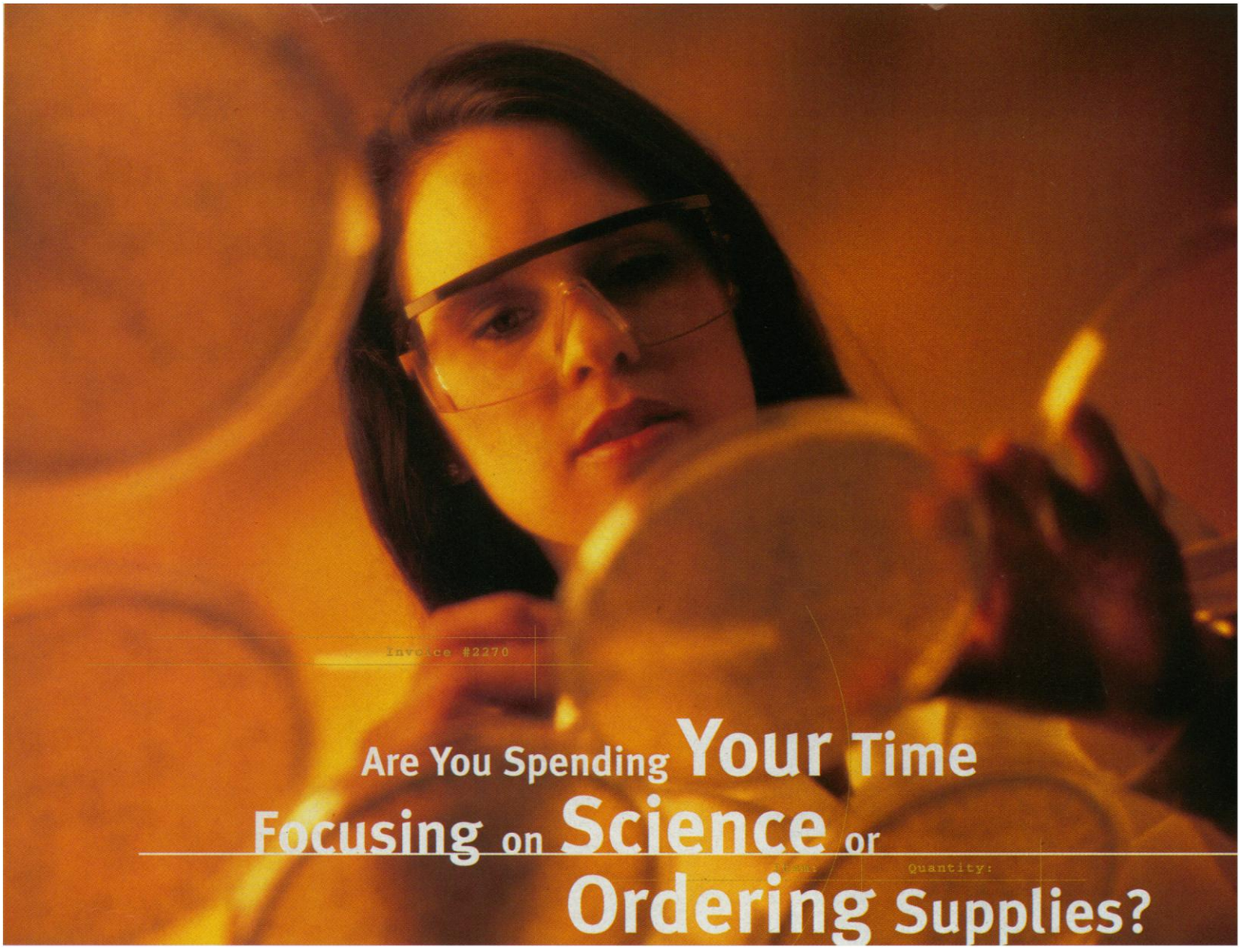
BIO-RAD

Circle No. 46 on Readers' Service Card

www.sciencemag.org
Science

Published by the **American Association for the Advancement of Science (AAAS)**, *Science* serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

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.



Chemdex™ —Your One-Stop Shop for Life Science Supplies

The hours you spend ordering lab supplies cut into your day, distracting you from your research. You have more important things to do than search through dozens of catalogs for the product you need or track the status of your order.

Chemdex offers a faster, easier way to order lab supplies with an online marketplace that contains hundreds of thousands of products from the suppliers you know and trust. When you buy through Chemdex, you get:

> An expanding database of reagents, instruments and equipment
> One, simple electronic order form that can be used for multiple suppliers
> A fast, easy-to-use search engine
> A "personal favorites" page for quick and easy re-ordering
> Rapid, real-time order tracking
> World-class customer service and support

Make Chemdex your one-stop shop for laboratory supplies. Go to www.chemdex.com. You'll spend less time placing orders, and more time focusing on science.

Circle No. 26 on Readers' Service Card

www.chemdex.com

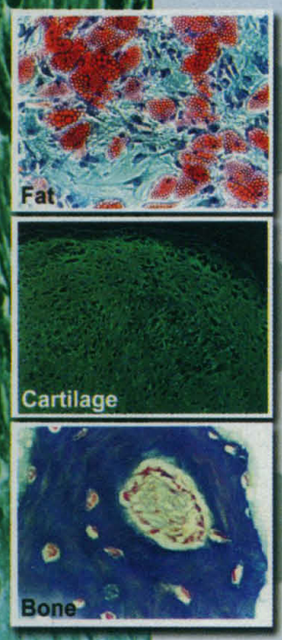
Chemdex
Accelerating Science

BIOWHITTAKER
A CAMBREX Company

Now Available, Exclusively From POIETICS™

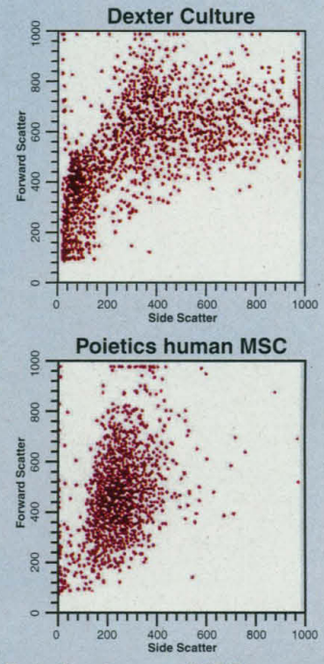
Normal Human
Mesenchymal Stem Cells

Standardized Cell Culture System containing Cells and Medium
Quality Tested and Guaranteed

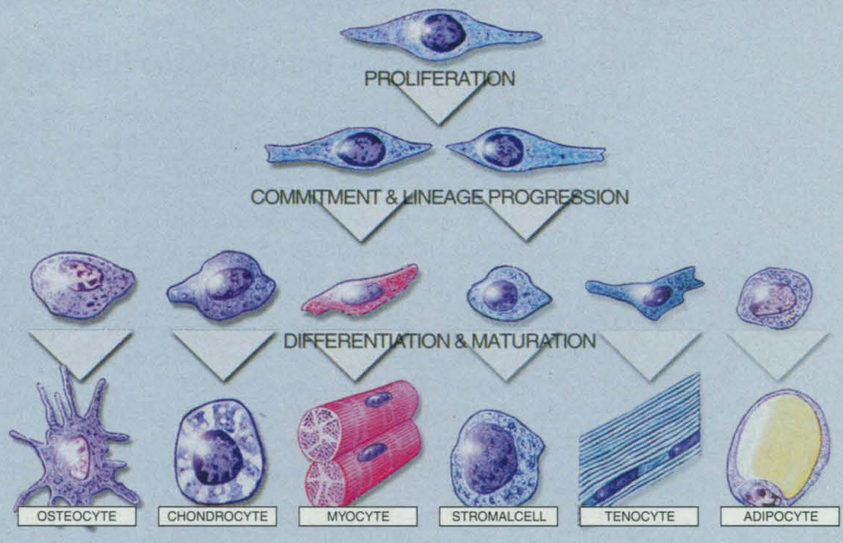


QC Tested for:

- **Adipogenic Lineage as indicated by Neutral Lipid**
- **Chondrogenic Lineage as indicated by Collagen Type II**
- **Osteogenic Lineage as indicated by Calcium Mineral**



Poietics human MSCs are more homogeneous than a Dexter Culture



Specifications and Characterization:

- Cells cryopreserved in passage two
- Recover 750,000 cells/amp
- Flow cytometric analysis of surface antigens:
  Positive for:
  SH2; SH3; CD29; CD44
  Negative for:
  CD14; CD34
- Cells test negative for HIV-1, hepatitis B & C, mycoplasma, bacteria, yeast and fungi
- Performance guaranteed using Poietics Mesenchymal Stem Cell Growth Medium (MSCGM™)

* Not for use in humans. For research use only.

BioWhittaker is a certified ISO-9001 Quality Management System Company
USA, Can.:(800) 852-5663 • **UK:** 011 8 979 5234
Europe: 32 87 32 16 11 • **All others:** 301-898-7025
E-mail: cs@biowhittaker.com
www.biowhittaker.com, www.clonetics.com or www.poietic.com

OSIRIS Under license from Osiris Therapeutics, Inc.

Circle No. 41 on Readers' Service Card

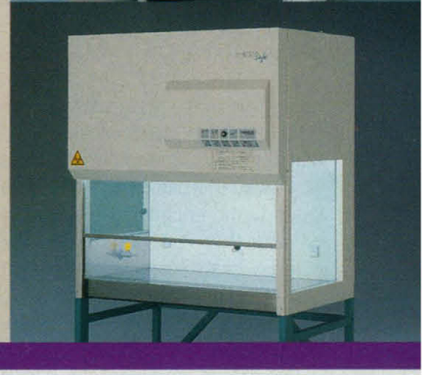
SORVALL®

Centrifuges

&

Heraeus

Incubators, ovens and biological safety cabinets



Two leaders in laboratory equipment.

On one side of the globe, there was SORVALL® – a leading U.S.-based supplier of lowspeed, superspeed and ultraspeed centrifuges and continuous cell separation systems. On the other side, there was Heraeus Instruments – the German company widely known for its incubators, ovens, safety cabinets and freezers.

Two established companies, with complementary product strengths and similar commitments to service. Both serving research and commercial laboratories.

Are now one worldwide company.

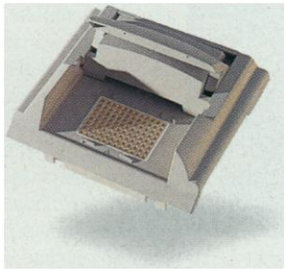
The products are still distinct, but the two companies have now merged to form Kendro Laboratory Products. A new, unified resource for laboratory equipment, with sales and support personnel strategically located throughout the world. So wherever you are, and whatever you need for your lab, there's only one name you need to remember from now on. Kendro Laboratory Products.

Want to get in touch with your nearest Kendro Representative? Start by paying us a visit on the Web, at www.kendro.com. And discover a whole new world of laboratory solutions.

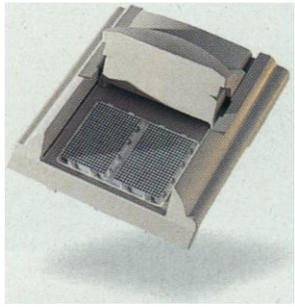
Kendro
Laboratory Products

Circle No. 56 on Readers' Service Card

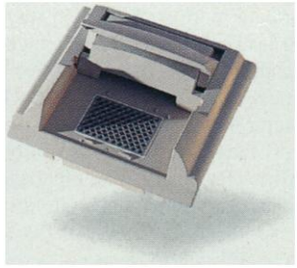
Offices worldwide. In the US, call 1-800-522-SPIN, Fax 203-270-2210. In Europe, 49 (6181) 35-300, Fax 49 (6181) 35-59 44. In Asia Pacific, 203-270-2080, Fax 203-270-2210. Or contact your local Kendro Laboratory Products Representative. *www.kendro.com*



96-well 0.2 mL block



Dual 384-well 0.02 mL block



new
60-well 0.5 mL block

Flexible formats, uncompromised performance

Thanks to the new 60-well 0.5 mL block, the GeneAmp® PCR System 9700 now offers a high-volume option, for the ultimate in flexibility. But regardless of the sample block you select, you're investing in the industry's premier thermal cycler capabilities, including oil-free operation, compact 30 x 41 cm footprint, intuitive graphical user interface, and high-speed, uniform heating and cooling. Guaranteed performance and reliability, all within budget. For more information or to place an order, call 650.638.5800, contact your local sales representative, or go to www.pebiosystems.com.

The GeneAmp® PCR System 9700: we've got you covered.

GeneAmp® PCR System 9700

Applied Biosystems

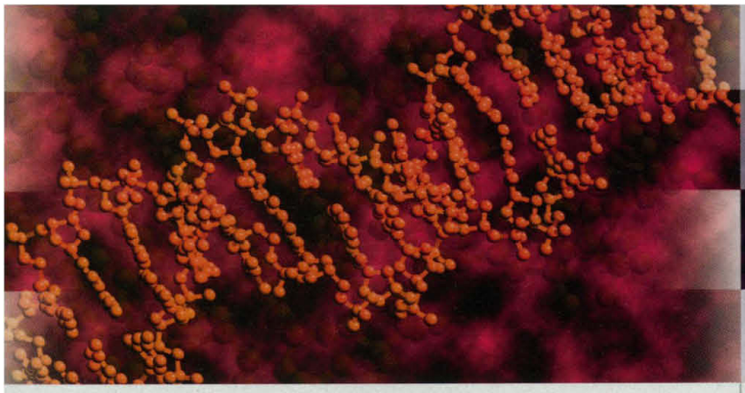
PE Biosystems
A PE Corporation Business

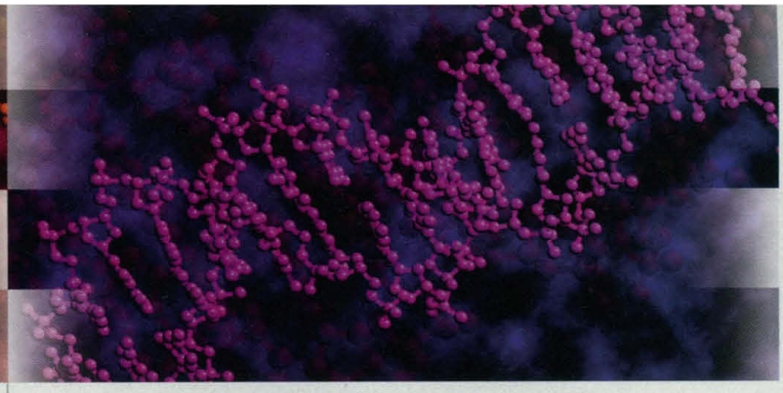
Roche

ISO 9000 CERTIFIED

PE Corporation, formerly The Perkin-Elmer Corporation, is committed to providing the world's leading technology and information for life scientists. PE Corporation consists of the PE Biosystems and Celera Genomics businesses. PE Biosystems comprises four divisions—Applied Biosystems, PE Informatics, PerSeptive Biosystems, and Tropix.

Circle No. 58 on Readers' Service Card





Amplify your success!

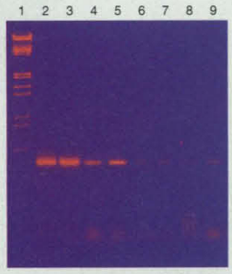
Mastercycler® Family

- Mastercycler gradient – the gradient cycler which set the standard, optimizes your PCR* in one run
- Mastercycler – the specialist for your everyday routines
- Mastercycler personal – small, fast and flexible

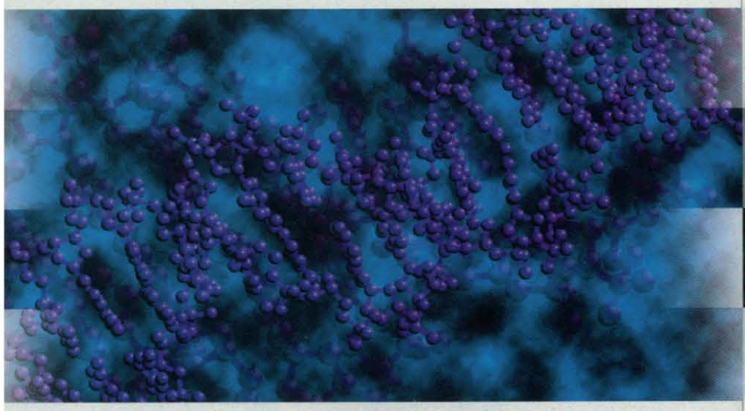
Amplify your success!

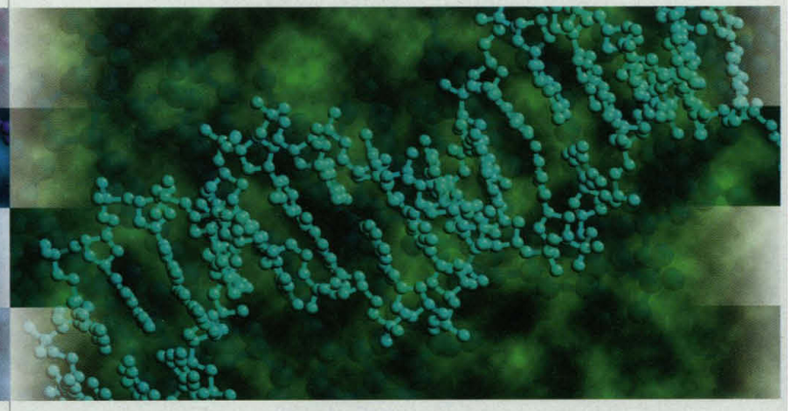
PCR Reagents

- Taq DNA Polymerase (for all common PCR protocols)
- MasterTaq Kit (for your sophisticated protocols)
- dNTP Set (Set of four separate deoxynucleotides)
- dNTP Mix (ready-to-use mix of four deoxynucleotides)



● GAPDH specific DNA fragment

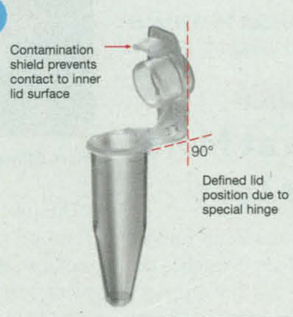




Amplify your success!

PCR Consumables

- Strips and single tubes (0.2 and 0.5 ml)
- Plates (96 wells and 384 wells)
- *In situ* frames
- Work trays, frames and racks
- Various sealing options
- Heat sealer



Amplify your success!

Customer Support

- Application specialists – experienced molecular biologists provide practical, individual support
- Telephone Hotline – rapid assistance from scientific experts

Life Science Application
Hotline: +49 180-3 666 789

eppendorf® is a registered trademark.

*PCR (Polymerase Chain Reaction) is protected by patent held by Hoffmann-La Roche.

eppendorf

In touch with life

professional PCR system

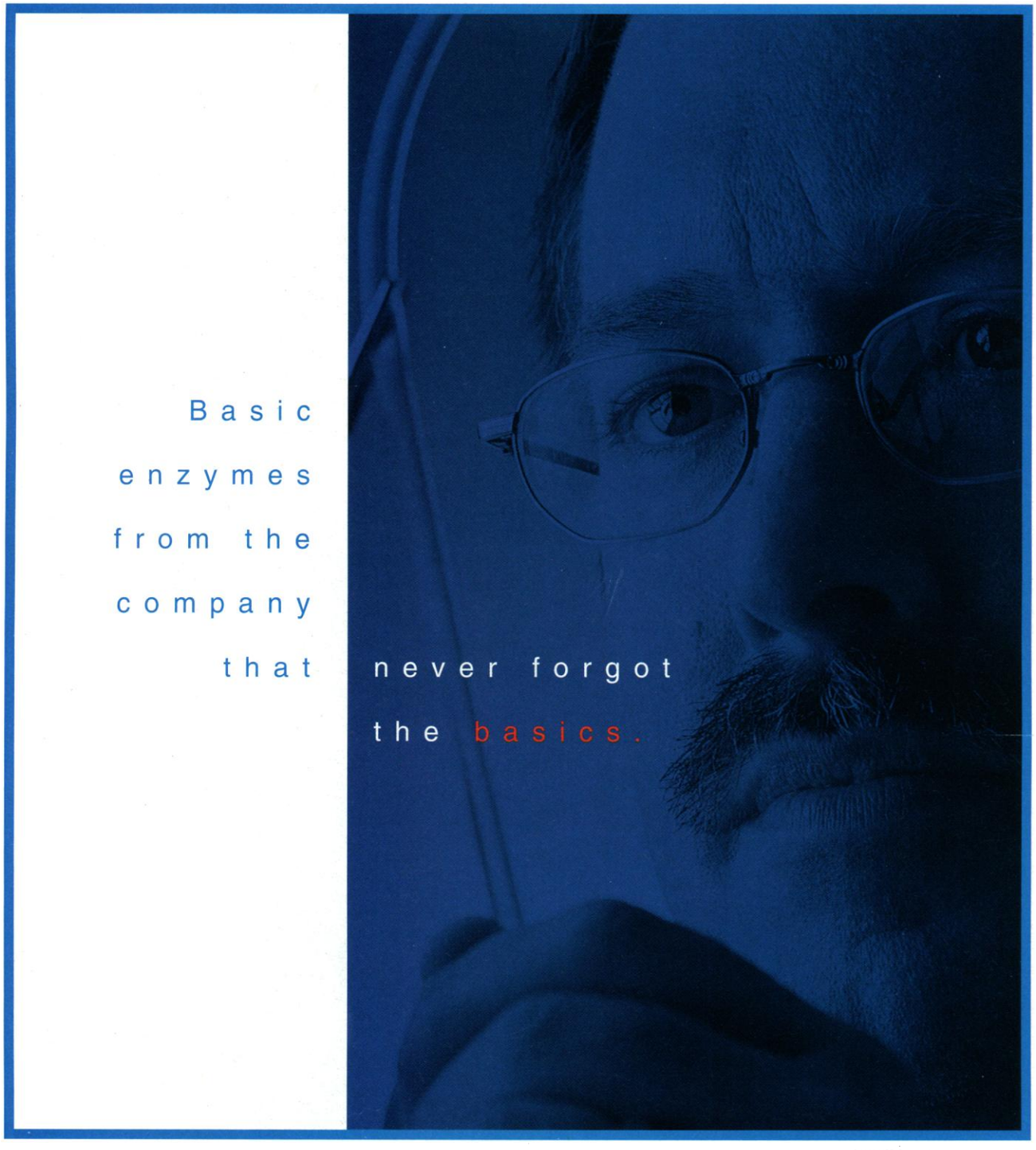
Circle No. 9 on Readers' Service Card

Eppendorf – Netheler – Hinz GmbH · 22331 Hamburg · Germany · Phone +49 40-5 38 01-0 · Fax +49 40-5 38 01-556

e-mail: eppendorf@eppendorf.com · eppendorf home page: http://www.eppendorf.com

Eppendorf Scientific, Inc. · One Cantiague Road · Westbury, NY 11590-0207 · Phone 800-421-9988 or 516-876-6800 · Fax 516-876-8599

e-mail: eppendorf@eppendorfsi.com · website: www.eppendorfsi.com



The basic elements of your research – modifying enzymes, ultrapure biochemicals and reagents – have always been the basics of our business. So while many companies are pursuing multiple technologies, we are continuing to concentrate on one goal – to supply you with consistently pure, superior quality enzymes, biochemicals and convenience reagents. USB also gives you a level of service that is becoming rare in this business. Our customer service and technical support representatives know our products and your needs. Superior products. Superb service. Just two of the reasons why more researchers and large-scale manufacturers are turning to USB. To learn more, visit us at www.usbweb.com. Or call 1.800.321.9322. USB. When you start with better raw materials, you finish with better results.

For your authorized USB distributor outside the United States, contact your local Amersham Pharmacia Biotech office.

USB Corporation
26111 Miles Road
Cleveland, OH 44128
1.800.321.9322
www.usbweb.com

usb®

Rediscover the chemistry™

Circle No. 17 on Readers' Service Card

Enjoy cOmplete protection of all your protein samples

Tired of time-consuming searches for the right protease inhibitor?

Tired of weighing and dissolving inhibitors?

Then try Roche Molecular Biochemicals' Complete Protease Inhibitor Cocktail Tablets–a giant step forward in convenient protease inhibition!

Achieve convenient, reliable protease inhibition with Complete Tablets
To inhibit all possible serine, cysteine, and metallo-proteases, simply dissolve one Complete Protease Inhibitor Cocktail Tablet in 50 ml or 10 ml water or aqueous buffer (*e.g.,* cell-lysis buffer). Simplify protein extractions on eukaryotic cell lines, animal tissues, plants, yeast, or bacteria by eliminating the need to weigh inhibitor after inhibitor.

With these convenient tablets, you can:

- deliver the same inhibitor dosage every time for greater reliability
- use a product that is non-toxic, readily soluble, and stable in aqueous solutions
- select EDTA-free tablets that will not affect the stability or function of metal-dependent proteins.

Complete Tablets	Cat. No.	Vol. per tablet
20 tablets	1 697 498	50 ml
3 x 20 tablets	1 836 145	50 ml
25 Mini tablets	1 836 153	10 ml
Complete Tablets, EDTA-free		
20 tablets	1 873 580	50 ml
25 Mini tablets	1 836 170	10 ml

Order from our complete protease inhibitor line today!
Or, to learn more about our protease inhibitors, request our *Complete Guide for Protease Inhibition* from your local representative or check our web site at ***http://biochem.roche.com/prod_inf/manuals/protease/protinhb.pdf***

cOmplete
PROTEASE INHIBITOR
COCKTAIL TABLETS

Roche

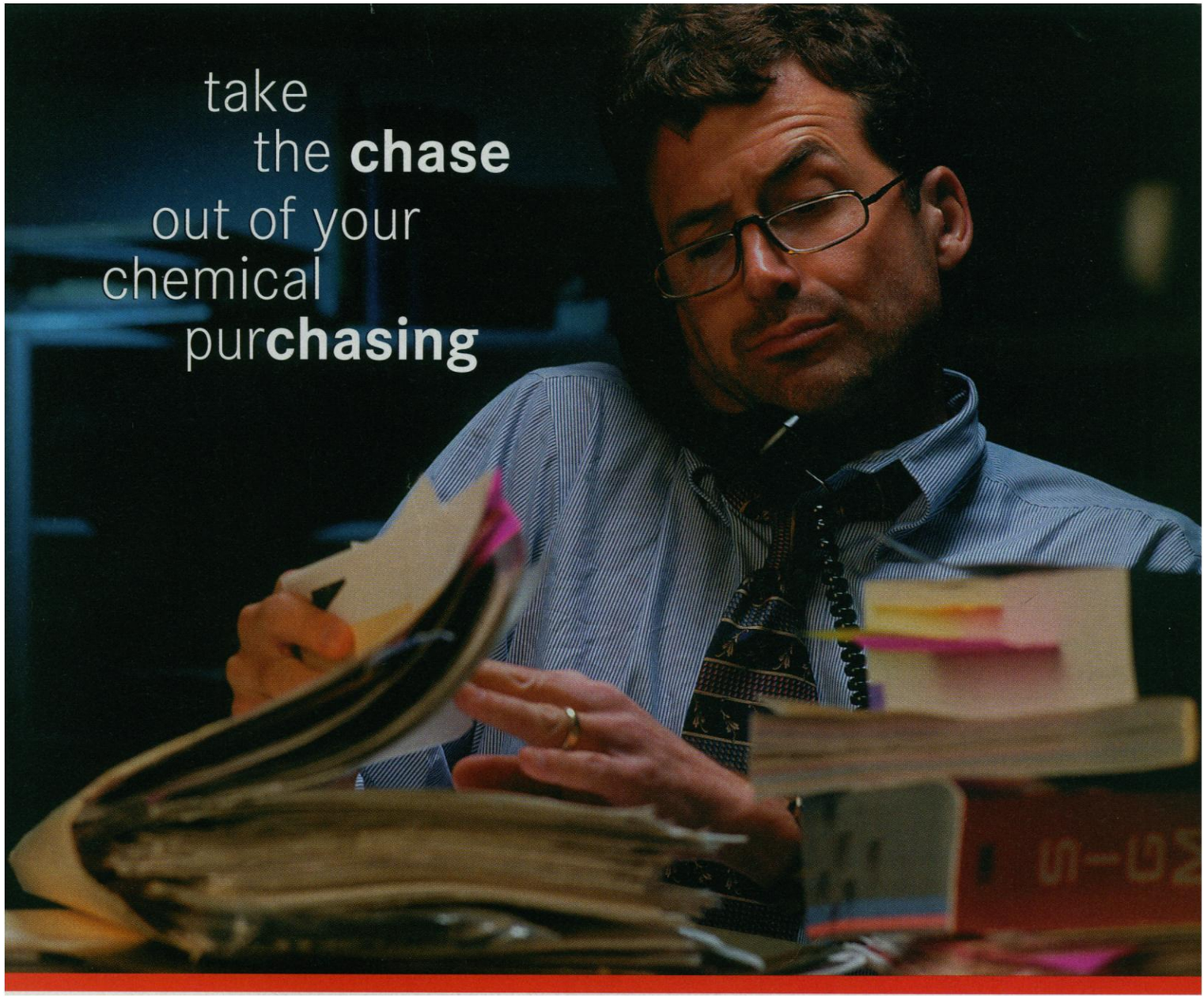
Roche Diagnostics GmbH
Roche Molecular Biochemicals
Mannheim, Germany

Internet: ***http://biochem.roche.com***

Complete is a trademark of a member of the Roche Group.

Argentina 54 1 951-0023-6, 54 1 952-6081-3, 54 1 954-5555 (FAX) 54 1 952-7589; **Australia** (02) 9899 7999; **Austria** (01) 277 870; **Baltic States** (FAX) 49 621 759 4068; **Belgium** (02) 247 4930; **Brazil** +55 (11) 66 3565; **Canada** (450) 686 7050; (800) 361 2070; **Chile** 0 56 (2) 375 2000 (Central); **China** 86 21 6427 5586; **Czech Republic** (0324) 45 54, 58 71-2; **Denmark** 49 13 82 32; **Egypt** 0020 3619947 (Scientific Office) 0020 2 360 9000 (Distrib. Bagneid); **Finland** (09) 429 2342; **France** 04 76 76 30 86; **Germany** (0621) 759 8568; **Greece** (01) 67 40 238; **Hong Kong** (852) 2485 7596; **India** (22) 4314653; **Indonesia** 62 (21) 2523820, Ext. 755; **Iran** 0098 21 208 2266 (Teb Technology) 0098 21 878 5656 (Tuba Nigen); **Republic of Ireland** (800) 40 90 41; **Israel** +972 6 6380569 (FAX) 972 6 6389591; **Italy** 039 247 4109-4181; **Japan** 03 5443 5284; **Kenya** 00254 2 744 677; **Kuwait** 4832600-01, -02, -03; **Malaysia** 60 (03) 755 5039; **Mexico** (5) 227 8967, -61; **Netherlands** (036) 539 4911; **New Zealand** (09) 276 4157; **Nigeria** +234 1 521767; **Norway** 22 07 65 00; **Philippines** (65) 27 27 500; **Poland** (22) 374235; **Portugal** (01) 417 17 17; **Russia** (49) 621 759 8636; **Saudi Arabia** 00966 1 4010333; **Singapore** 65 27 27 500; **South Africa** (011) 886 2400; **South Eastern Europe** (FAX) 49 621 759 4068; **South Korea** (02) 3471-6500; **Spain** (93) 201 4411; **Sweden** (08) 404 8800; **Switzerland** 0 41/7 99 6161; **Taiwan** (02) 736 7125; **Thailand** 66 (2) 274 0708-13; **United Kingdom** 0808 100 99 98; **USA** (800) 428 5433

Circle No. 48 on Readers' Service Card



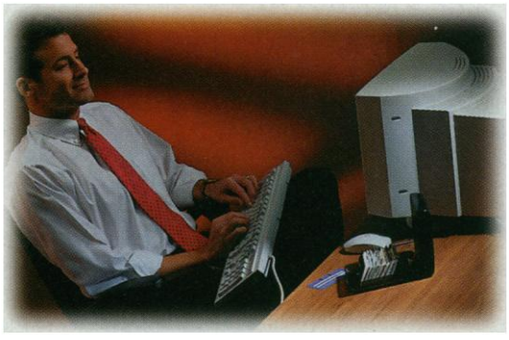
TRY OUR eCOMMERCE SOLUTION @ www.sigma-aldrich.com

EASY ON-LINE ORDERING

The Sigma-Aldrich PipeLine™ eCommerce system offers simple, on-line access to over 200,000 products from the Sigma-Aldrich brands: Sigma, Aldrich, Fluka, Supelco and Riedel-de Haën. Now you can place multi-brand orders for biochemicals, chemicals, equipment and laboratory supplies from all of our brands in a single transaction.

FIND WHAT YOU NEED FAST

With eight different ways to search, including product name, product number, CAS number, molecular formula and structure, pinpointing products is a snap.



Stop the chase and log on today.
It will make your job easier.
www.sigma-aldrich.com

A TOTAL INFORMATION RESOURCE

Because we are a manufacturer, we offer not only quality products but the technical knowledge and support to back them up.

- Over 90,000 on-line MSDS's
- Over 2 million on-line Certificates of Analysis
- Thousands of data sheets and technical bulletins

SIGMA-ALDRICH

3050 Spruce Street, St. Louis, MO 63103 • 800-521-8956 or 314-771-5765

Circle No. 37 on Readers' Service Card

High fidelity PCR goes PLATINUM.

Wide range of target sizes. 200 ng K562 genomic DNA were amplified in duplicate with 1.25 units of PLATINUM *Pfx* DNA Polymerase or 2.5 units of *PfuTurbo* DNA Polymerase. PLATINUM *Pfx* DNA Polymerase reactions were assembled at room temperature, and *PfuTurbo* DNA Polymerase reactions were assembled on ice. Targets were 256-bp human beta globin (HBG); 1.0-kb, 1.8-kb, 5.2-kb, and 8.4-kb human myosin heavy chain (HMY HC); 2.7-kb, 4.5-kb, and 7.5-kb myelin oligodendrocyte glycoprotein (MOG); and 802-bp thrombospondin (TS) fragments.

Introducing PLATINUM *Pfx* DNA Polymerase for the best performance in high fidelity PCR.

You no longer have to compromise on yield and specificity if you want low error rate PCR. New PLATINUM® *Pfx* DNA Polymerase combines the benefits of a novel and highly processive "proofreading" DNA polymerase with our hot start PLATINUM technology to provide you higher accuracy, yield, specificity, and sensitivity for the best high fidelity PCR available.

- **Higher Fidelity:** PLATINUM *Pfx* DNA Polymerase provides greater fidelity than *PfuTurbo*® DNA Polymerase.*
- **Higher Specificity:** PLATINUM *Pfx* DNA Polymerase is precomplexed with specific antibodies that temporarily inhibit DNA polymerase and 3´ exonuclease activities during PCR assembly and the initial step of PCR. This significantly reduces or eliminates nonspecific amplification and mispriming.
- **Higher Yield and Sensitivity:** PLATINUM *Pfx* DNA Polymerase is a highly processive enzyme requiring fewer units per reaction and less starting template, resulting in up to 20-fold greater yield than *PfuTurbo* DNA Polymerase.
- **Easy to Use:** Eliminates time-consuming optimization, permits room temperature setup, and facilitates ability to automate PCR.

PLATINUM *Pfx* DNA Polymerase is the latest addition to a growing portfolio of GIBCO BRL® products from Life Technologies designed to support the evolving research needs of the life scientist.

For additional information, contact TECH-LINE,℠ TECH-ONLINE,℠ or your Life Technologies representative.

Product	Cat No.	Size
PLATINUM *Pfx* DNA Polymerase†	11708-013	100 units
	11708-021	250 units
	11708-039	500 units

LIFE TECHNOLOGIES™

Essential Technologies for the Science of Life™

Internet Ordering and Information: **www.lifetech.com**

U.S. Academic Orders/TECH-LINE: (800) 828-6686
U.S. Government Orders/TECH-LINE: (888) 584-8929
U.S. Industrial Orders/TECH-LINE: (800) 874-4226
Latin America Orders/TECH-LINE: (301) 610-8709 **Canada Orders:** (800) 263-6236

These products are for laboratory research use only and are not intended for human or animal diagnostic, therapeutic, or other clinical uses, unless otherwise stated. Quantities subject to change without notice. *PfuTurbo*® is a registered trademark of Stratagene. ©1999 Life Technologies, Inc. 99-082CRE

*unpublished test data

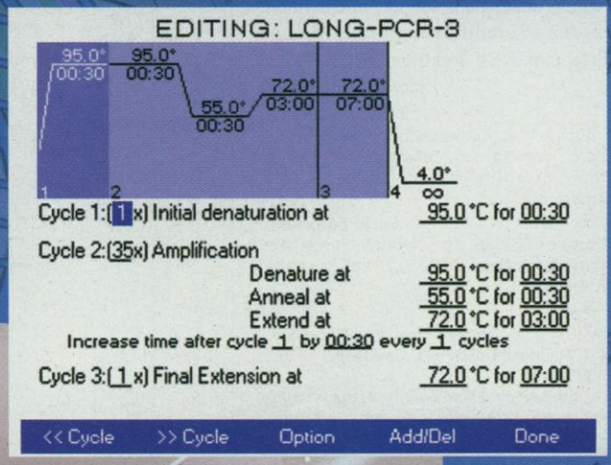
Purchase of these products is accompanied by a limited license to use them in the Polymerase Chain Reaction (PCR) process for research and development in conjunction with a thermal cycler whose use in the automated performance of the PCR process is covered by the up-front license fee, either by payment to Perkin-Elmer or as purchased, i.e., an authorized thermal cycler. These products are sold under licensing arrangements with F. Hoffmann-La Roche Ltd, Roche Molecular Systems, Inc., and The Perkin-Elmer Corporation.
† Licensed to Life Technologies, Inc. under U.S. Patent 5,338,671 and foreign equivalents for use in research only.

Circle No. 23 on Readers' Service Card

amplify your PCR* expectations

The iCycler™ Thermal Cycler Excels at Performance, Reliability and Ease-of-Use.

The iCycler features the most intuitive interface, including comprehensive informational screens, validation reports and a graphical textual display of a protocol on one screen.



- Effortless interface
- Directly upgradeable for Real Time PCR
- Rapid and reliable cycling
- Interchangeable sample blocks
- Out of the box and running in just minutes

Practice of the patented polymerase chain reaction (PCR) process requires a license. The iCycler includes a licensed thermal cycler and may be used with PCR licenses available from the Perkin-Elmer Corp. Its use with authorized reagents also provides a limited PCR license in accordance with the label rights accompanying such reagents. Some applications may require licenses from other parties.

What Will You Discover Next?

Visit our Life Science web site at discover.bio-rad.com.
Call toll free at 1-800-4BIORAD (1-800-424-6723); outside the U.S., call (510) 741-6996.

BIO-RAD

Circle No. 47 on Readers' Service Card