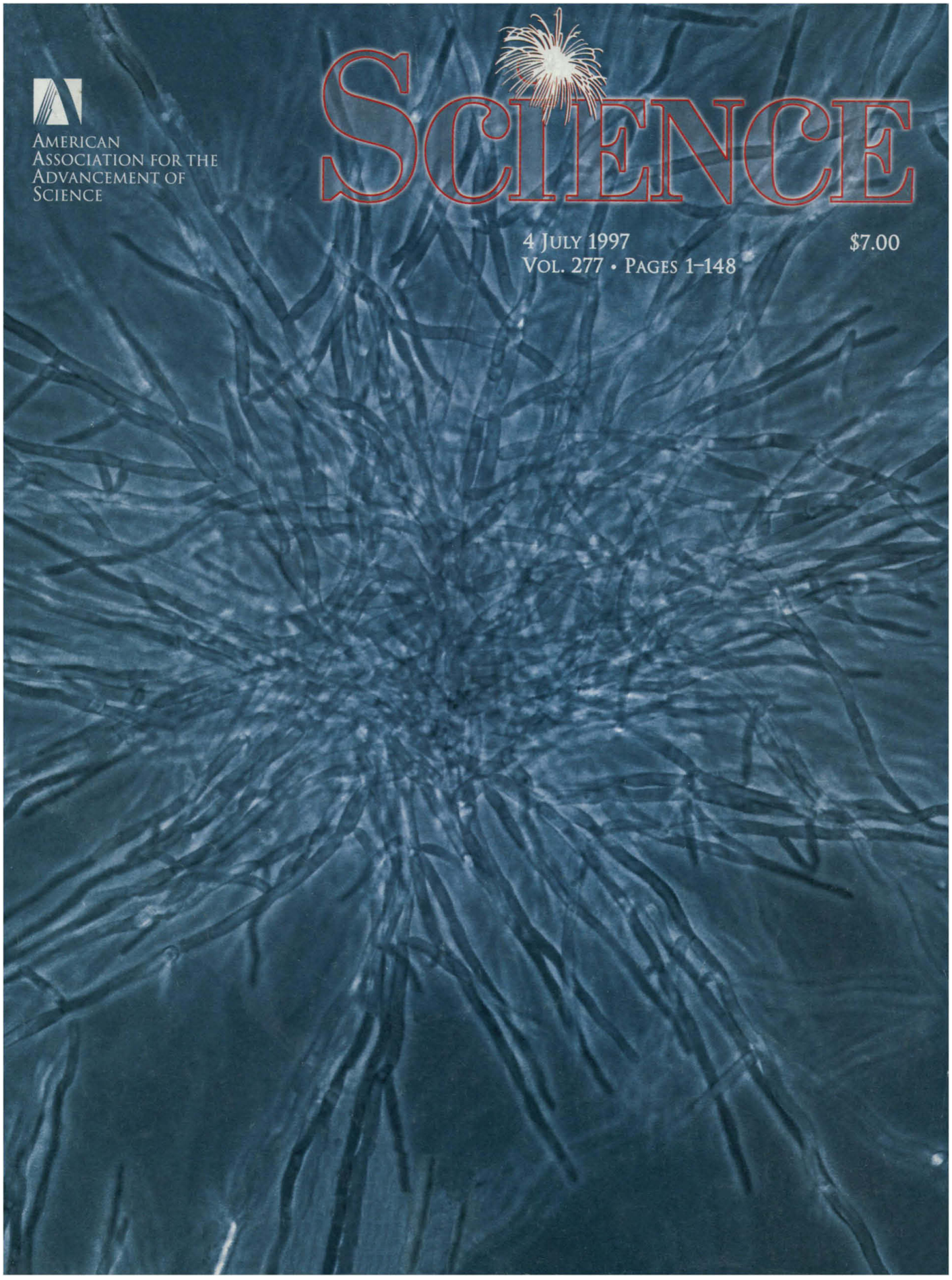


AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

4 JULY 1997
VOL. 277 • PAGES 1–148

$7.00

XL10-GOLD

ULTRACOMPETENT CELLS*

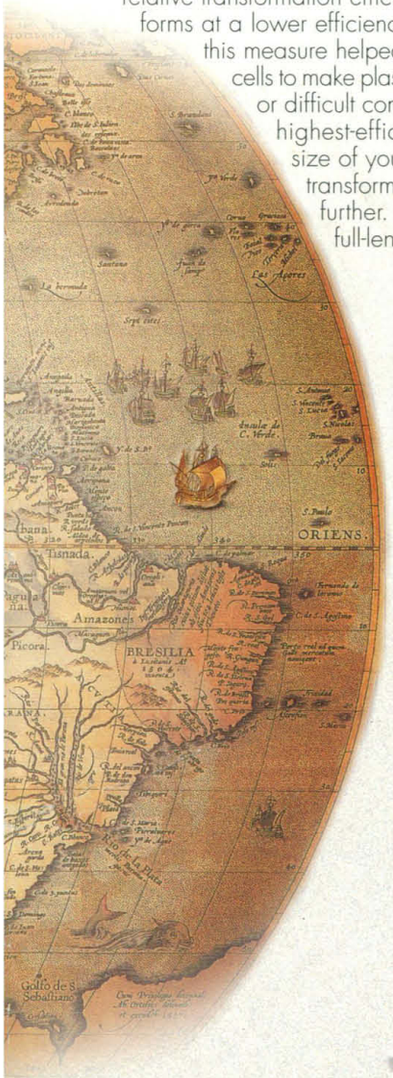
The World of Competent Cells will Never be the Same!

THAT WAS THEN.

Until now, supercoiled pUC DNA was a useful measure of relative transformation efficiency. Since ligated DNA transforms at a lower efficiency than supercoiled pUC DNA, this measure helped you find the highest-efficiency cells to make plasmid libraries and transform large or difficult constructs. However, even with the highest-efficiency cells available, as the size of your ligated DNA increased, your transformation efficiency decreased even further. And your chances of finding full-length clones diminished.

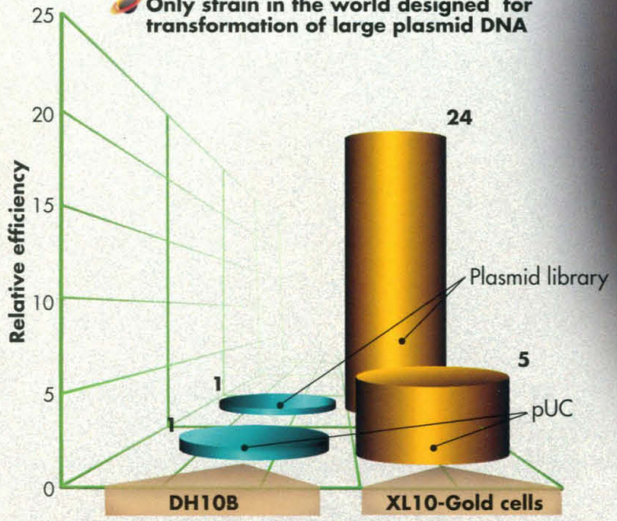
THIS IS NOW!

Today, pUC DNA is no longer a meaningful measurement for true transformation efficiency. Epicurian Coli® XL10-Gold™ ultracompetent cells were designed for extremely efficient transformation of ligated DNA. With XL10-Gold cells, plasmid libraries are larger, more complex and contain more full-length clones. Now, it's easy to construct plasmid libraries, clone large inserts or clone anything into large plasmids, and you have the highest probability of finding your clone!



DISCOVER THE POWER OF CLONING WITH XL10-GOLD ULTRACOMPETENT CELLS

- **Larger primary libraries**
- **Increased probability of finding your full-length clone**
- **20- to 30-fold higher transformation efficiency of ligated DNA**
- **Only strain in the world designed for transformation of large plasmid DNA**



Equal amounts of pUC DNA or a cDNA ligation mixture were transformed into DH10B or XL10-Gold competent cells according to manufactures instructions. Efficiency (cfu/µg DNA) was calculated. Relative transformation efficiency for pUC and the cDNA ligation were determined seperately.

XL10-GOLD ULTRACOMPETENT CELLS

If it doesn't get in, you won't find it.

UNITED STATES:
Stratagene Cloning Systems
(800) 424-5444
INTERNET MAIL:
techservices@stratagene.com

AUSTRALIA: (02) 9417 7866
AUSTRIA: (0222) 3 68 99 51
BRAZIL: 11 5561-1771
CANADA: 905-713-1201
DENMARK: 86 10 10 55
FRANCE: (01) 34 60 24 24
GERMANY: (0130) 84 09 11
HONG KONG: 578-5839
ISRAEL: 03-5761520
ITALY: 02-58.01.34.09
JAPAN: (Funakoshi) (03)5684-1622
(Toyobo) (03)3660-4819
KOREA: (02)-556-0311
MALAYSIA: 3-7031888
NETHERLANDS: 033 495 00 94
NEW ZEALAND: 9 443-5867
NORWAY: 22 20 01 37
PORTUGAL: 01-441 06 84
SINGAPORE: 2730898
SPAIN: 1 729 03 33
SWEDEN: (8) 6800845
SWITZERLAND: (061) 6 93 05 40
THAILAND: (662) 308-0611
UNITED KINGDOM: 0800 585370

OTHER COUNTRIES CALL
STRATAGENE USA: (619) 535-5400

*Patent pending

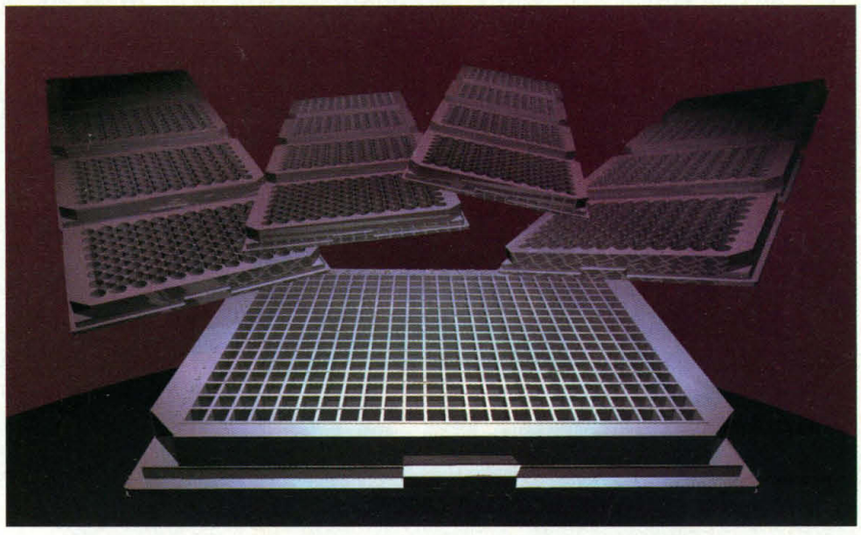
Epicurian Coli® XL10-Gold™ ultracompetent cells
(5 x 100 µl) CATALOG # 200314
(10 x 100 µl) CATALOG # 200315

STRATAGENE®

Circle No. 59 on Readers' Service Card

The Future of Microplate Assays Is Here...

384-well Radioisotopic and Luminescence Counting!



TopCount & LucLite for HTS Luciferase Reporter Assays

TopCount HTS Revolutionizes Microplate Counting — Again

- Measure radioisotopic and luminescence assays in both 96- and 384-well microplates.
- Process 12 luminescence samples simultaneously for throughputs of 10,000 samples per hour, or more.
- Stack up to 40 plates or 15,000 samples for unattended counting.
- Interface with robotic systems for complete automation.

Meeting Microplate Counting Demands Today and in the Future
Assays have been scaled down from test tubes to 24-well microplates and the 96-well format. Now, the next step in assay miniaturization is here with the TopCount™ HTS. Continue today's assays in 96-well plates while converting assays to the higher density 384-well plates — the screening format of the future. With the TopCount HTS you can do both without risk or compromise.

Less Reagents, Less Handling, More Samples
The Packard 384-well plate accommodates assay volumes of up to 80 µL. This allows practical miniaturization of assays such as scintillation proximity, in-plate binding, liquid scintillation, Cerenkov and luminescence.

TopCount Harnesses the Power of Luminescence
Packard has pioneered the field of high throughput microplate luminescence. Now up to 12 wells can be measured simultaneously in 96- or 384-well plates for throughputs never before possible. Ultra-sensitive photon counting is combined with innovative reagents, such as LucLite™ with a five hour half-life, for measuring the luciferase reporter gene. Greater capacity, greater throughput.

To complement sample throughput, TopCount now has an extended 40 plate stacker. Load up to 40 plates with the TopCount ZipLoad stacker, carry them safely to the TopCount, load and count. It's that easy.

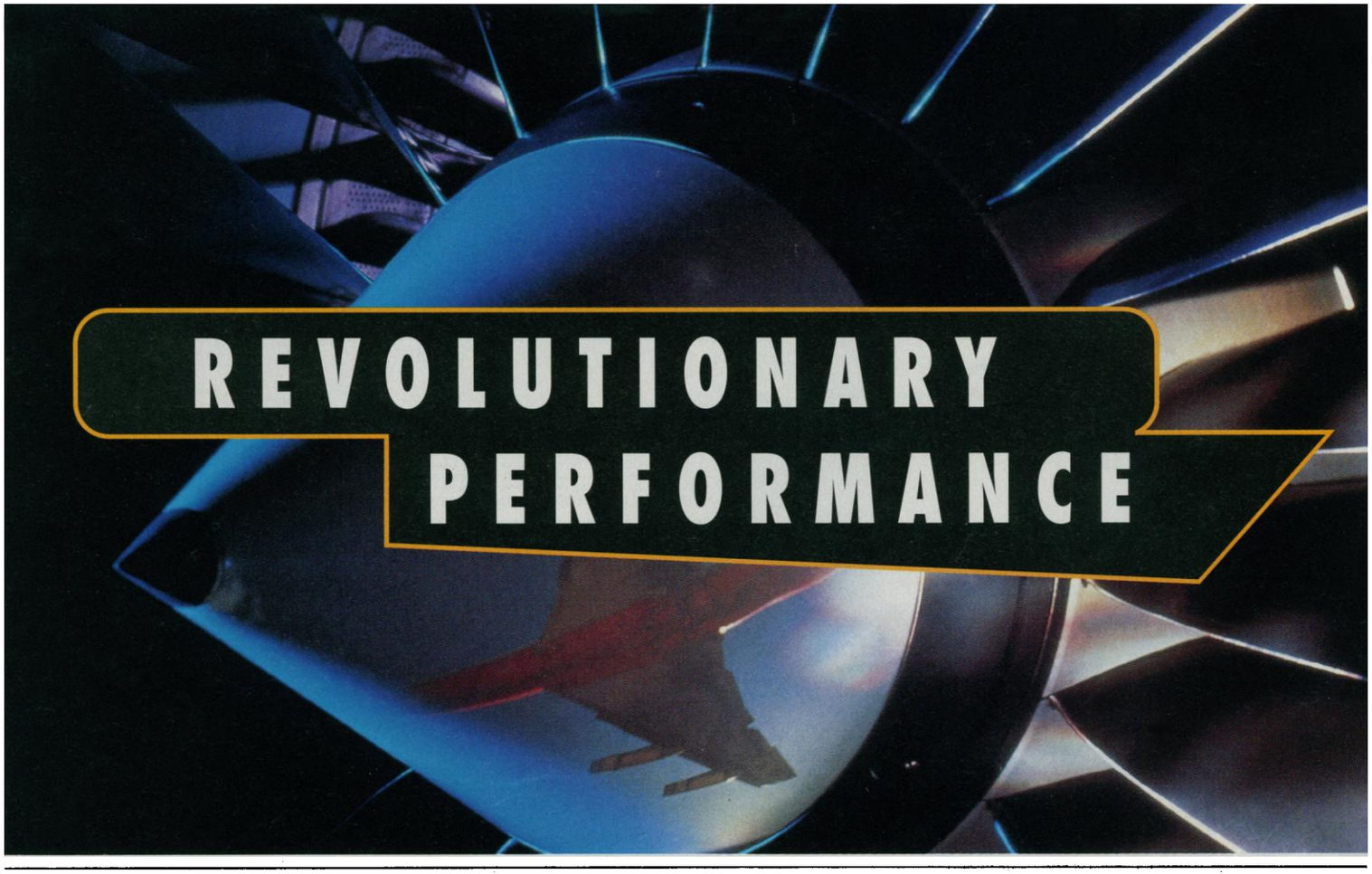
Contact Packard at 800-323-1891 (U.S. only) or 203-238-2351 for more details. Or, visit our Web Site at http://www.packardinst.com.

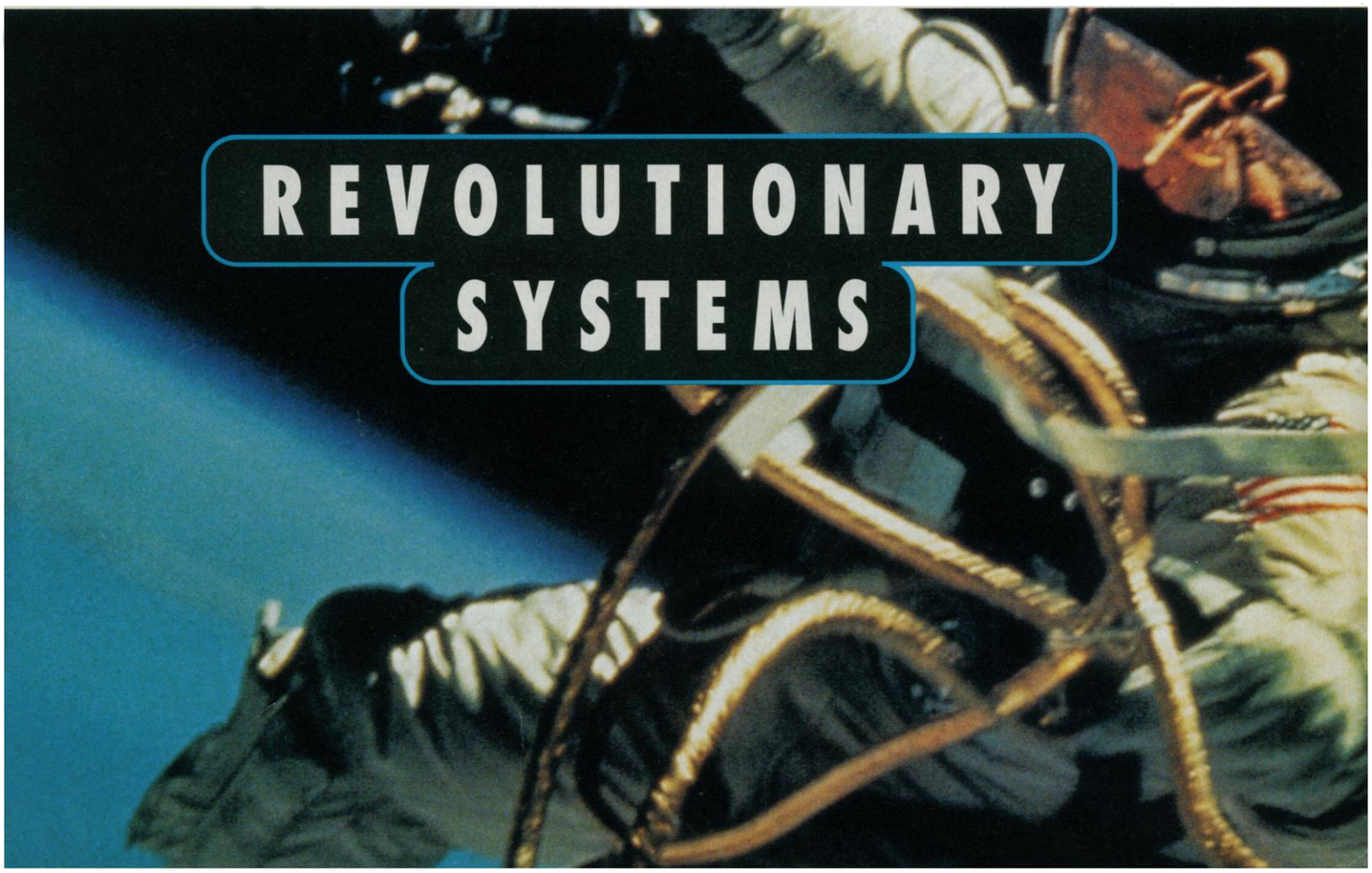
Circle No. 42 on Readers' Service Card

Packard
A Packard BioScience Company

Packard Instrument Company
800 Research Parkway
Meriden, CT 06450 U.S.A.
Tel: 203-238-2351
Toll Free: 1-800-323-1891
FAX: 203-639-2172
Web Site: http://www.packardinst.com
Email: webmaster@packardinst.com

Packard International Offices:
Australia 03-9543-4266 or 1 800 335 638;
Austria 43-1-2702504; **Belgium** 31(0)2/481.85.30;
Canada 1-800-387-9559; **Central Europe** 43 456 2230 015;
Denmark 45-43909023 or 45-43907151;
France (33) 1 46.86.27.75; **Germany** (49) 6103 385-151;
Italy 39-2-33910796/7/8; **Japan** 81-3-3866-5850;
Netherlands 31-50-549 1296; **Russia** 7-095-259-9632;
Switzerland (01) 481 69 44;
United Kingdom 44 (0)118 9844981


REVOLUTIONARY
PERFORMANCE


REVOLUTIONARY
SYSTEMS

ISSN 0036-8075
4 JULY 1997
VOLUME 277
NUMBER 5322

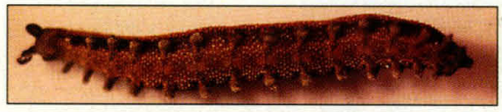
SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

EVAN BURROWS

48 & 55
Angiogenic balancing act

NEWS



34
Linking development and evolution

SPECIAL NEWS REPORT

EVOLUTION AND DEVELOPMENT

PERSPECTIVES

DEPARTMENTS

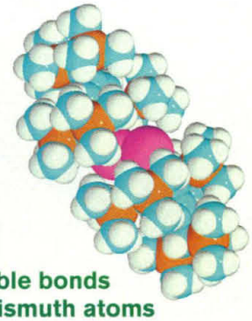
■ **SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005.** Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): $105 ($58 allocated to subscription). Domestic institutional subscription (51 issues): $260. 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. IPM #1069624. **Printed in the U.S.A.**

COVER

Colony of *Candida albicans* carrying a deletion of the *TUP1* gene. This pathogenic yeast normally switches between single-cell and filamentous states, and both forms are found in its infected mammalian hosts. The *tup1* deletion mutant strain grows exclusively as filaments, as seen here on a plate of low-nutrient medium (the width of the field is ~200 micrometers). See page 105 and the related Perspective on page 52. [Image: Burkhard R. Braun and Alexander D. Johnson]

RESEARCH ARTICLES

REPORTS



78
Double bonds by bismuth atoms

91
In a pickle

On the Web

Next Wave Forum: What is the best form of graduate student funding?
www.nextwave.org

Indicates accompanying feature

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:** $7.00 per issue prepaid includes surface postage; bulk rates on request.

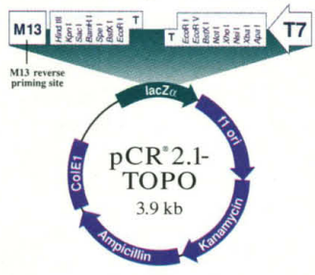
TOPO-Cloning™ IS:

- **a** The reproduction of a sauce, frosting, garnish or other topping for food.
- **b** The act of duplicating geographical topographies.
- **c** A new way to clone *Taq*-generated PCR products in 5 minutes with ≥95% efficiency.

Answer Is (c). TOPO-Cloning™ is a revolutionary, 5-minute method for cloning *Taq*-generated PCR products. Available only in the new TOPO TA Cloning® Kit, TOPO-Cloning™ provides the fastest, easiest, and most efficient way to clone PCR products.

Five-Minute Cloning. TOPO TA Cloning® is fast because it uses topoisomerase I instead of ligase. The vector, pCR®2.1-TOPO, is provided "cloning-ready." You just:

- Add 1 µl of your PCR reaction
- Incubate for 5 minutes on your benchtop
- Transform



It's that easy! No special primers or extra steps are required. What's more, the kit comes with everything you need including linearized pCR®2.1-TOPO, competent cells, PCR reagents, (except *Taq*) and controls.

≥95% Recombinants. But that's just part of the story. TOPO TA Cloning® also delivers remarkable results. To prove it, we cloned *Taq*-generated PCR products into pCR®2.1-TOPO and obtained ≥95% recombinants for most inserts (see table)!

Results obtained using the TOPO TA Cloning® Kit

PCR Product Size	Efficiency (# white/total)
700 bp	99%
800 bp	98%
2,000 bp	97%
3,100 bp	89%

TOPO-Cloning™ Is: the fastest, most efficient method for PCR Cloning. And it's only available from the PCR Cloning Experts at Invitrogen. Want to know more? Call or check out our web site at www.invitrogen.com.

1600 Faraday Avenue, Carlsbad, California 92008
Telephone: 800-955-6288 Facsimile: 760-603-7201
Email: tech_service@invitrogen.com

Invitrogen®

Circle No. 45 on Readers' Service Card

EUROPEAN HEADQUARTERS:
Invitrogen BV
De Schelp 12, 9351 NV Leek
The Netherlands
Tel: +31 (0) 594 515 175
Fax: +31 (0) 594 515 312

TOLL FREE TELEPHONE NUMBERS:
Belgium 0800 111 73
Sweden 020 795 369
Finland 990 31 800 5345
France 00 31 800 5345
Germany 0130 8100 43
Netherlands 0800 022 88 48
Denmark 800 188 67
Switzerland 0800 551 966
UK 0800 96 61 93

DISTRIBUTORS:
Australia 1 800 882 555
Hong Kong 886 2 381 0844
Israel 02 652 2102
Italy 02 38 19 51
Japan 03 5684 1616
Korea 822 569 6902
Malaysia 03 731 5626
Singapore 65 779 1919
Spain 03 450 2601
Taiwan 886 2 381 0844
Thailand 66 22 467243

From all other countries, please contact our European headquarters at +31 (0) 594 515 175.

THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Sister system

Studies of very young stars can provide clues to the origin of our sun and solar system. The closest well-studied region, about 150 parsecs away, contains large dark clouds of cold hydrogen and helium and is an x-ray source. Kastner *et al.* (p. 67) found that a much closer system containing the young sunlike star TW Hya and several other young stars, but lacking dark clouds, is a strong x-ray source and is about 20 million years old. Molecules of CO and HCN orbit the stars in a solar-system–like disk.

Disappearing act

Not all of the current-carrying electrons in a superconductor are in the electron-paired Bose condensate. At finite temperatures, some of these electrons are in quasi-particle (QP) excited states, and their dynamics can reveal much about the superconducting state. Because QPs respond strongly to temperature gradients, Krishana *et al.* (p. 83; see the Perspective by Lee, p. 50) studied the thermal conductivity of $Bi_2Sr_2CaCu_2O_8$ using a bridge-balancing method to measure thermal gradients. An anomalous plateau behavior at low temperatures (near 20 kelvin) was found, which they suggest could be an abrupt phase transition of the superconducting condensate to a superconducting state in which the QP heat current vanishes.

Bismuth double bonds

Double bonds between nonmetals are seen for the lighter main group elements of the periodic table, but for heavier elements, overlap between the atomic *p*-orbitals becomes increasingly difficult and destabilizes the formation of the molecular π orbitals. Tokitoh *et al.* (p. 78) show that a double bond between two bismuth atoms, a sixth row element, can be stabilized in a highly sterically crowded compound. Relativistic electronic effects may be important for forming such a bond.

Ozone versus particulates

Ozone and fine airborne particles are the focus of new standards recently proposed by the United States Environmental Protection Agency, and emissions of volatile organic compounds (VOCs) and nitrogen oxides (NO_x) affect the formation of both pollutants. Meng *et al.* (p. 116) used a three-dimensional model of the metropolitan Los Angeles air basin, which takes into account a large set of gas-phase and aerosol species and their interactions, to study pollution-reduction strategies. Controlling VOC and NO_x emissions reduced ozone formation but had much less effect on particulates because of the effects of chemical coupling with other precursor species.

Quantum dot spectra

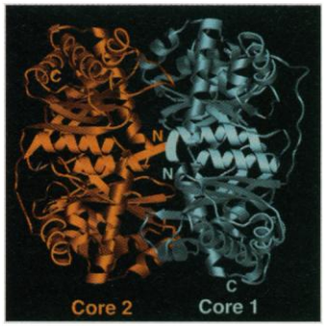
In quantum dots (QDs), small structure sizes or applied potentials or both confine and localize electrons. Gammon *et al.* (p. 85) have developed a technique that allows optical and nuclear magnetic resonance spectra to be recorded from semiconductor QDs with a lateral resolution of 10 nanometers. Such measurements can provide insights into the effects of local strain and composition.

Migration window

The first migration of people to North America from Asia evidently occurred at the end of the last glaciation when sea level was much lower. Accurate local sea-level histories are necessary to track likely migration routes. Josenhans *et al.* (p. 71) used detailed bathymetry, seismic data, cores, and radiocarbon dates to reconstruct the sea-level history of the continental shelf of British Columbia. Sea level rose rapidly by up to 5 centimeters per year during the time of early occupation, and the shelf edge was available for human migration from about 14,500 to 10,000 years ago.

Cytochrome bc_1 complex

An essential part of the respiration chain is the mitochondrial cytochrome bc_1 complex. Xia *et al.* (p. 60) crystallized this complex and were able to construct atomic models of several of its protein components from x-ray



studies. The four iron centers and two inhibitor binding sites were located, and other aspects of the structure could be interpreted with respect to physiological data.

More than just prions at work

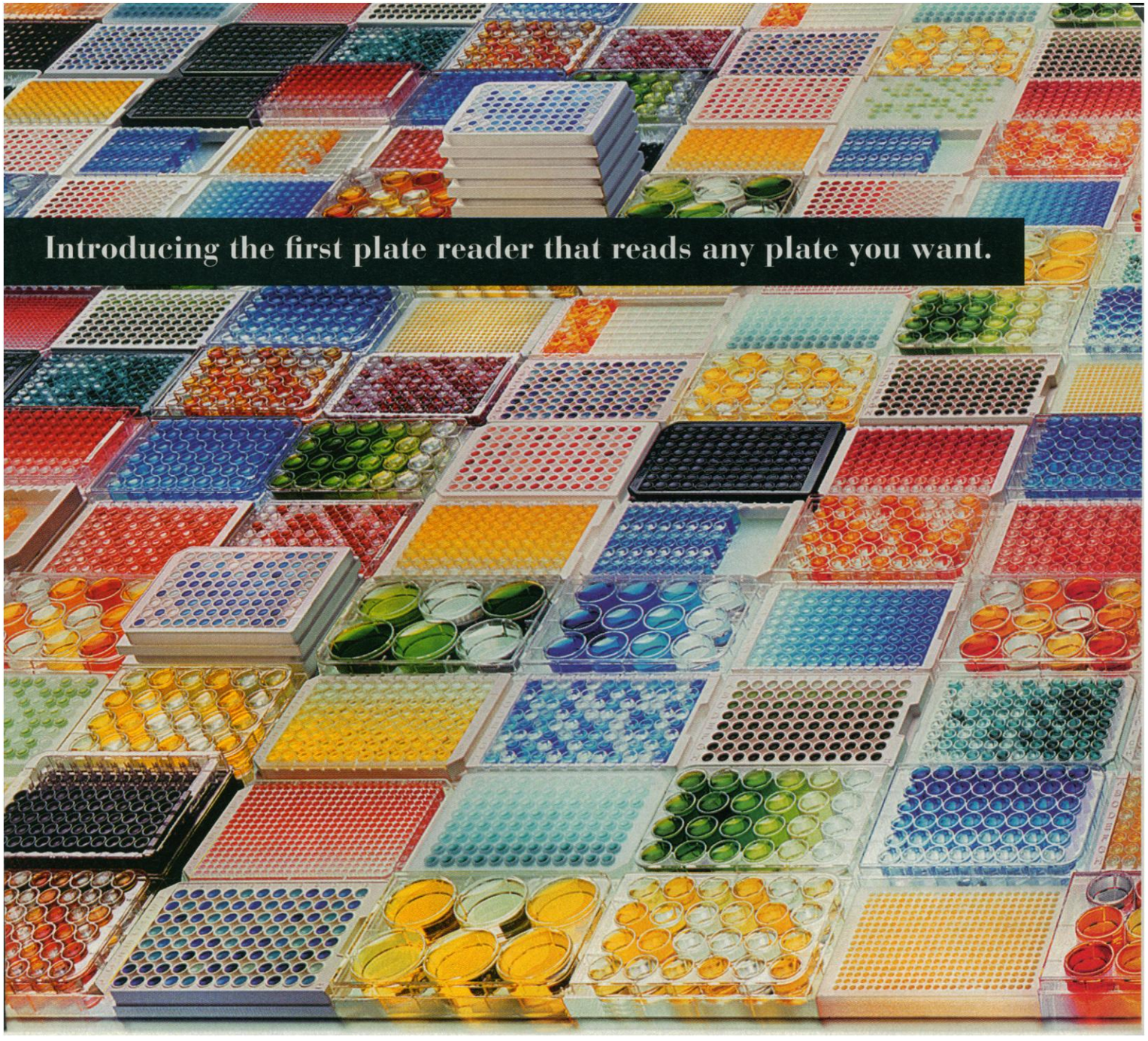
The reports of a human variant of bovine spongiform encephalopathy (BSE) has made the understanding of the transmission of these agents even more imperative. Prions are protein agents with a protease-resistant conformation that propagates by inducing abnormal conformational changes in the normal protein and are suspected to cause diseases such as BSE and Creutzfeldt-Jakob disease (CJD). Manuelidis *et al.* (p. 94) found that, after numerous serial passages of a strain of CJD in guinea pigs and Syrian hamsters, a strain capable of inducing a disease in rats similar to BSE was observed. Disease pathology was seen in the absence of the protease-resistant form of the prion protein, which suggests that other features may be important for inducing disease.

Recycling litter

What effect does leaf litter from streamside vegetation have on aquatic ecosystems? Wallace *et al.* (p. 102) excluded detritus for 3 years from a long stretch of a stream and found that for habitats composed of cobble, pebble, and gravel substrate, the effects were dramatic. The abundance and biomass of invertebrates, from detritivores to predators, declined greatly. Removal of detritus had no effect on the inhabitants of moss-covered bedrock, illustrating the use of different energy sources by neighboring in-stream invertebrate assemblages.

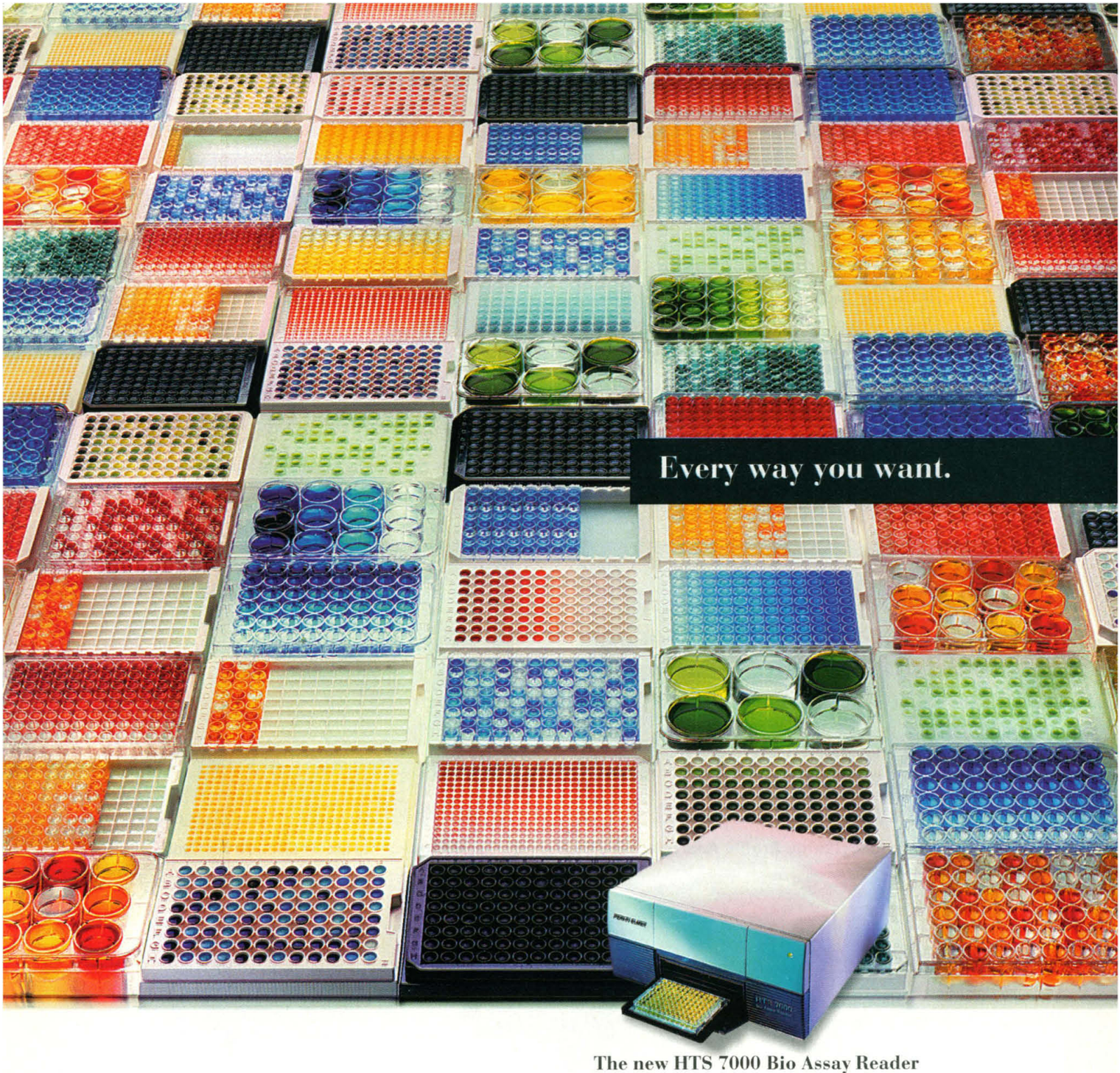
Downstream effects of rapamycin

The mammalian target of the immunosuppressant rapamycin (mTOR) is a member of an intriguing group of proteins that function in the cell division cycle and DNA repair. The mTOR molecule and related proteins are similar to phosphoinositide kinases, but whether their physiological targets are phosphoinositides or proteins has been unclear. Brunn *et al.* (p. 99) present evidence that mTOR functions as a protein kinase to phosphorylate the eukaryotic initiation factor (eIF)-4E–binding protein PHAS-1. PHAS-1 inhibits translation initiation by binding to eIF-4E, and this binding is inhibited when PHAS-1 is phosphorylated by mTOR.



Now do all your plate reading, from assay development to high-throughput screening, with one remarkably easy-to-use instrument. The new HTS 7000™ system reads 6- to 384-well microplate formats and strip wells. Absorbance and fluorescence with interchangeable filter slides. UV absorbance at 260 nm for DNA. From the top or from the bottom. With thermostating and plate-shaking capabilities. *All without opening the instrument.*

With the HTS 7000 system, it's easy to:
Read with precision. Results are consistent from run to run, plate to plate.
Read with sensitivity. The HTS 7000 Bio Assay Reader detects less than 3 picograms of fluorescein in a 200 µL sample.
Read for speed. A 96-well plate takes less than 25 seconds. A 384-well plate takes less than 60 seconds.
Read with versatility. It lets you exploit



The new HTS 7000 Bio Assay Reader

the full range of fluorescent dyes as well as colorimetric methods such as ELISAs. So you can run cell proliferation assays ... test newly developed leads ... explore cell adhesion ... detect low protein concentrations ... quantitate DNA mini-preps ... and much more. Automatically—thanks to our Windows®-based user interface, HTSoft™ software, with preprogrammed protocols.

The new HTS 7000 Bio Assay Reader. There simply isn't a better way to catch up on your reading.

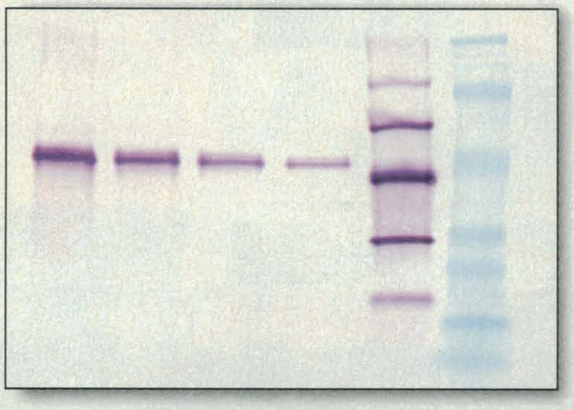
Circle No. 39 for Literature

PERKIN ELMER

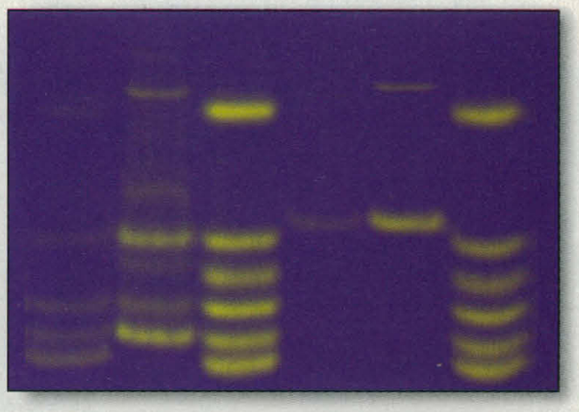
U.S.A. Tel: **1-800-762-4000** Fax: 203-761-2882
Canada Tel: 1-800-561-4646 Fax: 416-674-9520
Europe Tel: 49-7551-81-3521 Fax: 49-7551-1612
Japan Tel: 81-45-314-8381 Fax: 81-45-314-5142
Latin America Tel: (5511) 578-9600 Fax: (5511) 276-1864
On the Internet: http://www.perkin-elmer.com

Circle No. 40 for a Sales Call

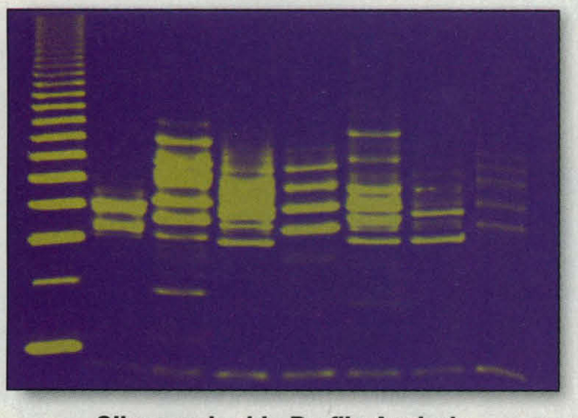
The Simple Alternative for Glycoprotein and Carbohydrate Analysis



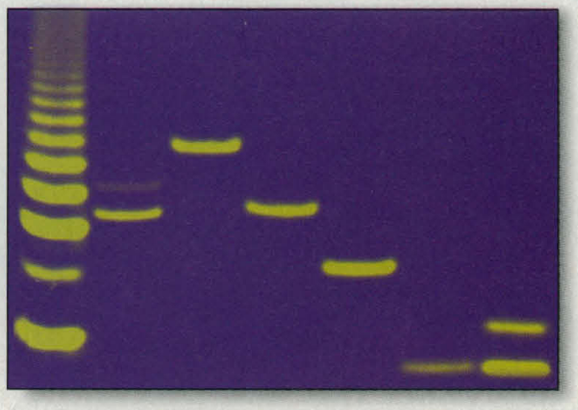
Glycoprotein Detection



Monosaccharide Compositional Analysis

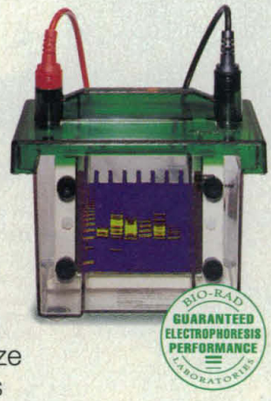


Oligosaccharide Profile Analysis



Oligosaccharide Sequence Analysis

- ✓ Confirm glycosylation
- ✓ Remove carbohydrates for protein analyses
- ✓ Identify types of oligosaccharides present
- ✓ Determine monosaccharide composition
- ✓ Isolate, quantitate and characterize N- and O-linked oligosaccharides



Bio-Rad's new glycoanalysis kits answer fundamental questions about the structure of glycoproteins and carbohydrates with simple and inexpensive PAGE methodology. To find out more about this simple alternative for glycoprotein analysis, call 1-800-4BIORAD, or contact your local sales representative.

ISO 9001 registered | www.bio-rad.com

BIO-RAD **Bio-Rad Laboratories**

Life Science Group

U.S. (800) 4BIORAD **Australia** 02-9914-2800 **Austria** (1)-877 89 01 **Belgium** 09-385 55 11 **Canada** (905) 712-2771 **China** (86-10) 2046622
Denmark 39 17 9947 **Finland** 90 804 2200 **France** (1) 43 90 46 90 **Germany** 089 31884-0 **Hong Kong** 7893300 **India** 91-11-461-0103
Israel 03 951 4127 **Italy** 02-21609.1 **Japan** 03-5811-6270 **The Netherlands** 0313 18-540666 **New Zealand** 09-443 3099
Singapore (65) 272-9877 **Spain** (91) 661 70 85 **Sweden** 46 (0) 8 627 50 00 **Switzerland** 01-809 55 55 **United Kingdom** 0800 181134 Sig 030197

Circle No. 51 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.

INFORMATION RESOURCES

SUBSCRIPTION SERVICES

For change of address, missing issues, new orders and renewals, and payment questions, please contact AAAS at Danbury, CT: 800-731-4939 or Washington, DC: 202-326-6417, FAX 202-842-1065. Mailing addresses: AAAS, P.O. Box 1811, Danbury, CT 06813 or AAAS Member Services, 1200 New York Avenue, NW, Washington, DC 20005 • **Other AAAS Programs:** 202-326-6400

REPRINTS & PERMISSION

Reprints: Ordering/Billing, 800-407-9191; Corrections, 202-326-6501 • **Permissions:** 202-326-7074, FAX 202-682-0816

INTERNET ADDRESSES

science_editors@aaas.org (for general editorial queries); science_news@aaas.org (for news queries); science_letters@aaas.org (for letters to the editor); science_reviews@aaas.org (for returning manuscript reviews); science@science-int.co.uk (for the Europe Office); membership@aaas.org (for member services); science_classifieds@aaas.org (for submitting classified advertisements); science_advertising@aaas.org (for product advertising)

INFORMATION FOR CONTRIBUTORS

See pages 98–99 of the 3 January 1997 issue or access www.sciencemag.org/misc/con-info.shtml.

EDITORIAL & NEWS CONTACTS

North America

Address: 1200 New York Avenue, NW, Washington, DC 20005
Editorial: 202-326-6501, FAX 202-289-7562
News: 202-326-6500, FAX 202-371-9227 • **Bureaus: Berkeley, CA:** 510-841-1154, FAX 510-841-6339, **San Diego, CA:** 619-942-3252, FAX 619-942-4979, **Chicago, IL:** 312-360-1227, FAX 312-360-0537, **Boston, MA:** 617-566-7137, FAX 617-734-8088

Europe

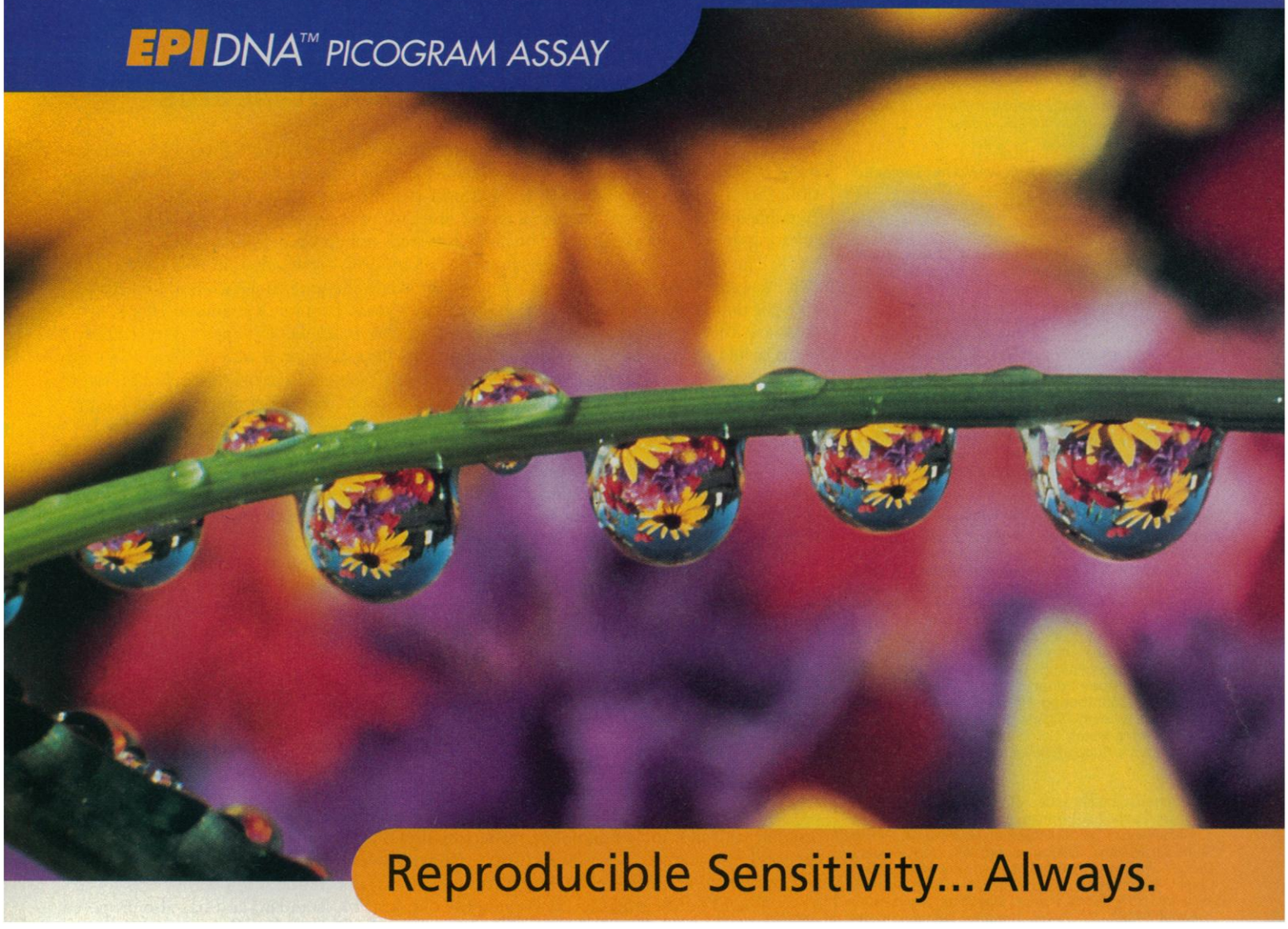
Headquarters: 14 George IV Street, Cambridge, UK CB2 1HH; (44) 1223-302067, FAX (44) 1223-302068
Paris Correspondent: (33) 1-49-29-09-01, FAX (33) 1-49-29-09-00

Asia

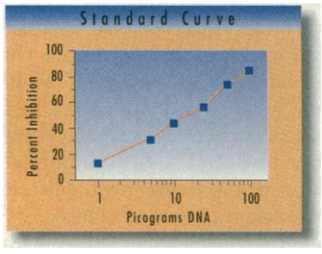
News Bureau: Dennis Normile, (81) 3-3335-9925, FAX (81) 3-3335-4898; dnormile@twics.com • **Japan Office:** Carl Kay, Esaka 1-chome 16-10-305, Suita-shi, Osaka-fu 564 Japan; (81) 6-387-5483, FAX (81) 6-337-6809; science@japanese.co.jp • **China Office:** Hao Xin, (86)10-6255-9478; science@public3.bta.net.cn

The Most Advanced Trace DNA Measure

EPIDNA™ PICOGRAM ASSAY



Reproducible Sensitivity... Always.



The EpiDNA™ Picogram Assay Test Kit accurately measures from 1 to 100 picograms of DNA in 100 µl of sample. Sample concentration is read from a standard curve.

Unique Biochemistry Ensures Highest Sensitivity... Fast.

New from Genetic Vectors, the EpiDNA™ Picogram Assay Test Kit accurately and cost-effectively measures trace amounts of DNA in only 2.5 hours. Specifically designed to process 1 to 100 picograms of DNA in 100 µl of sample, the EpiDNA assay can run from 12 to 96 tests at a time and is both highly sensitive and non-radioactive. The assay responds equally well for both single and double-stranded DNA as well as for DNA sizes that range from restriction fragments to millions of base pairs.

- *Includes 384 complete tests*
- *Uses highly-sensitive kinetic ELISA*
- *Ideal for nucleic acid detection and measurement*
- *Simple, reproducible protocol*

Call **Toll Free 1-888-GEN-VECT (1-888-436-8328)** to discover a cost-effective detection method that offers both high sensitivity and speed.

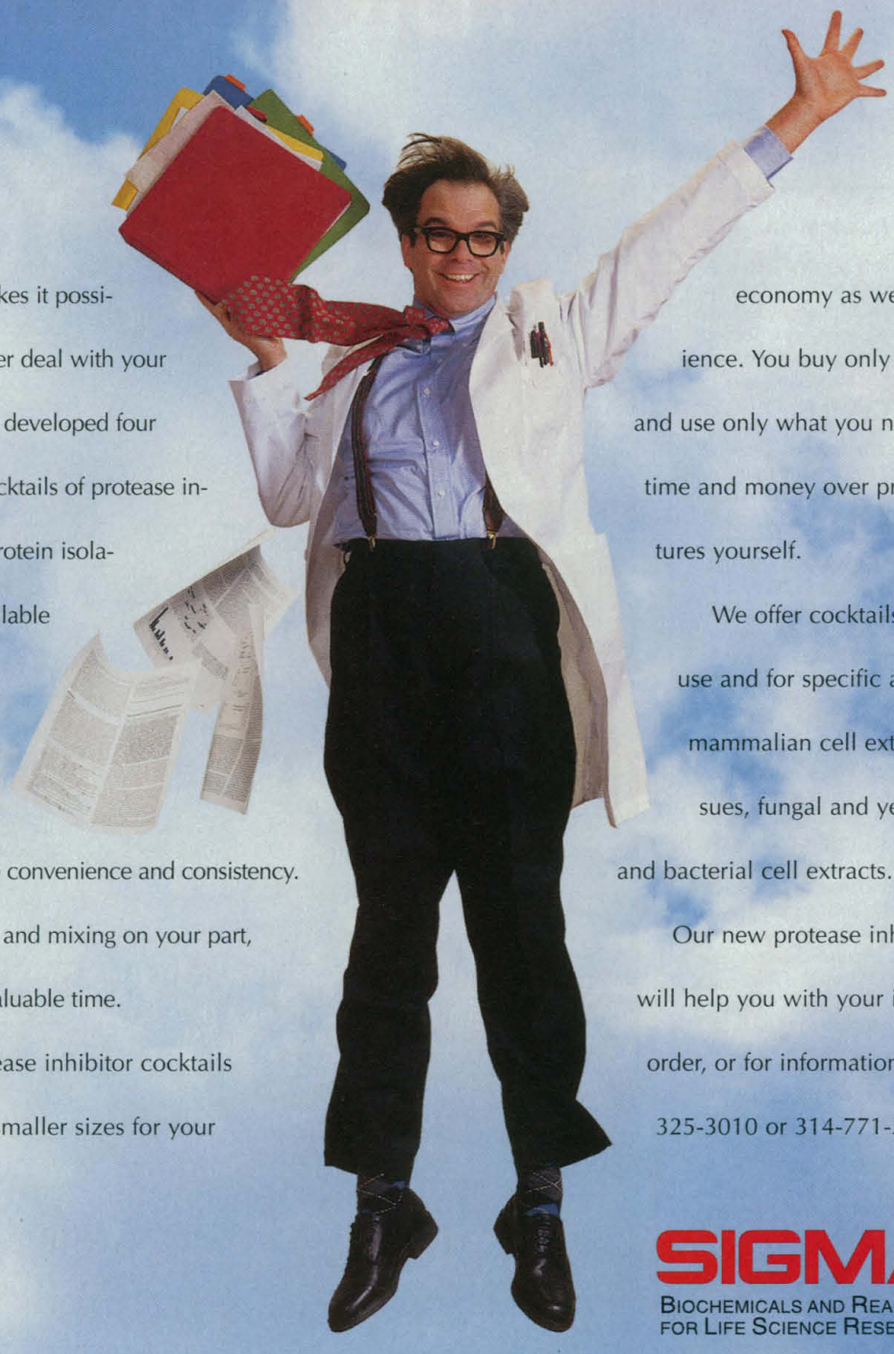
GENETIC VECTORS
The Art of Perfecting Science.

Genetic Vectors, Inc. *Grove 2000 Building, Suite 100, 2000 South Dixie Highway, Miami, FL 33133 Tel: 305-859-7800 Fax: 305-859-9006*

Circle No. 49 on Readers' Service Card

LET US HELP YOU WITH YOUR INHIBITIONS.

Introducing 4 New Protease Inhibitor Cocktails From Sigma.



Sigma now makes it possible for you to better deal with your inhibitions. We've developed four pre-formulated cocktails of protease inhibitors for your protein isolation research. Available as powders or liquids, our four new inhibitor cocktails offer you complete convenience and consistency. With no weighing and mixing on your part, they'll save you valuable time.

Our new protease inhibitor cocktails are packaged in smaller sizes for your economy as well as convenience. You buy only what you need and use only what you need — saving time and money over preparing mixtures yourself.

We offer cocktails for general use and for specific applications: mammalian cell extracts and tissues, fungal and yeast extracts, and bacterial cell extracts.

Our new protease inhibitor cocktails will help you with your inhibitions. To order, or for information, call 1-800-325-3010 or 314-771-5750.

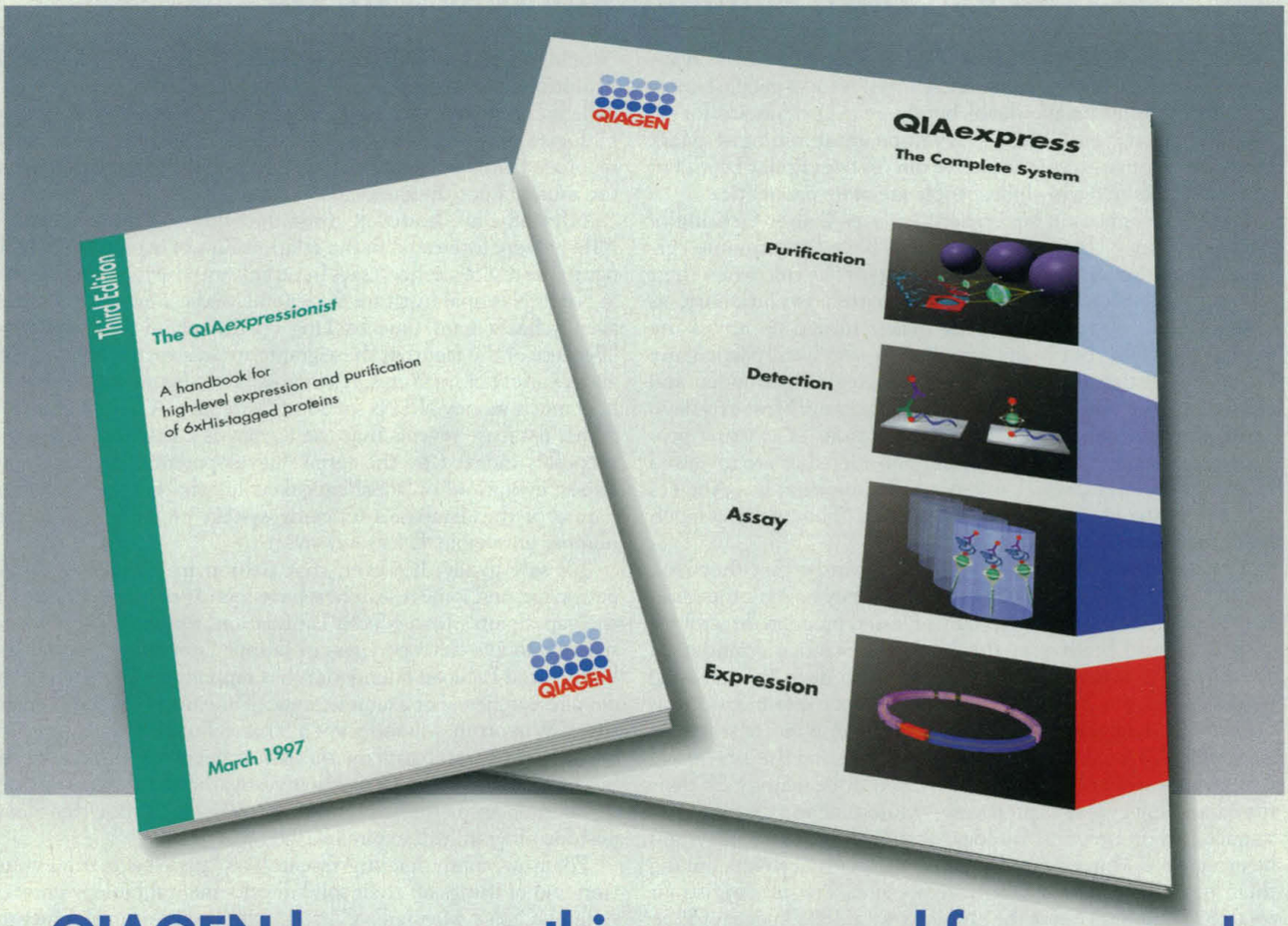
SIGMA®
BIOCHEMICALS AND REAGENTS
FOR LIFE SCIENCE RESEARCH

Sigma • P.O. Box 14508 • St. Louis, MO. 63178 • USA
http://www.sigma.sial.com

A Member of the Sigma-Aldrich Family.

Circle No. 34 on Readers' Service Card

Working with 6xHis-tagged proteins?



QIAGEN has everything you need for success!

QIA*express* provides unique high-affinity Ni-NTA matrices, a comprehensive handbook, and expert technical support — the complete system to work with 6xHis-tagged proteins.

Express

- pQE Expression Vectors
- QIA*express* Kits

Purify

- Ni-NTA Agarose
- Ni-NTA Superflow
- Ni-NTA Silica
- Ni-NTA Spin Kits

Detect

- Ni-NTA Conjugates
- RGS·His Antibody
- Tetra·His Antibody **New**
- Penta·His Antibody **New**
- Anti·His Antibody Selector Kit **New**

Assay

- Ni-NTA HisSorb™ Strips

Call today for your free QIA*express* Brochure and the new QIA*expressionist!*

Circle No. 56 on Readers' Service Card

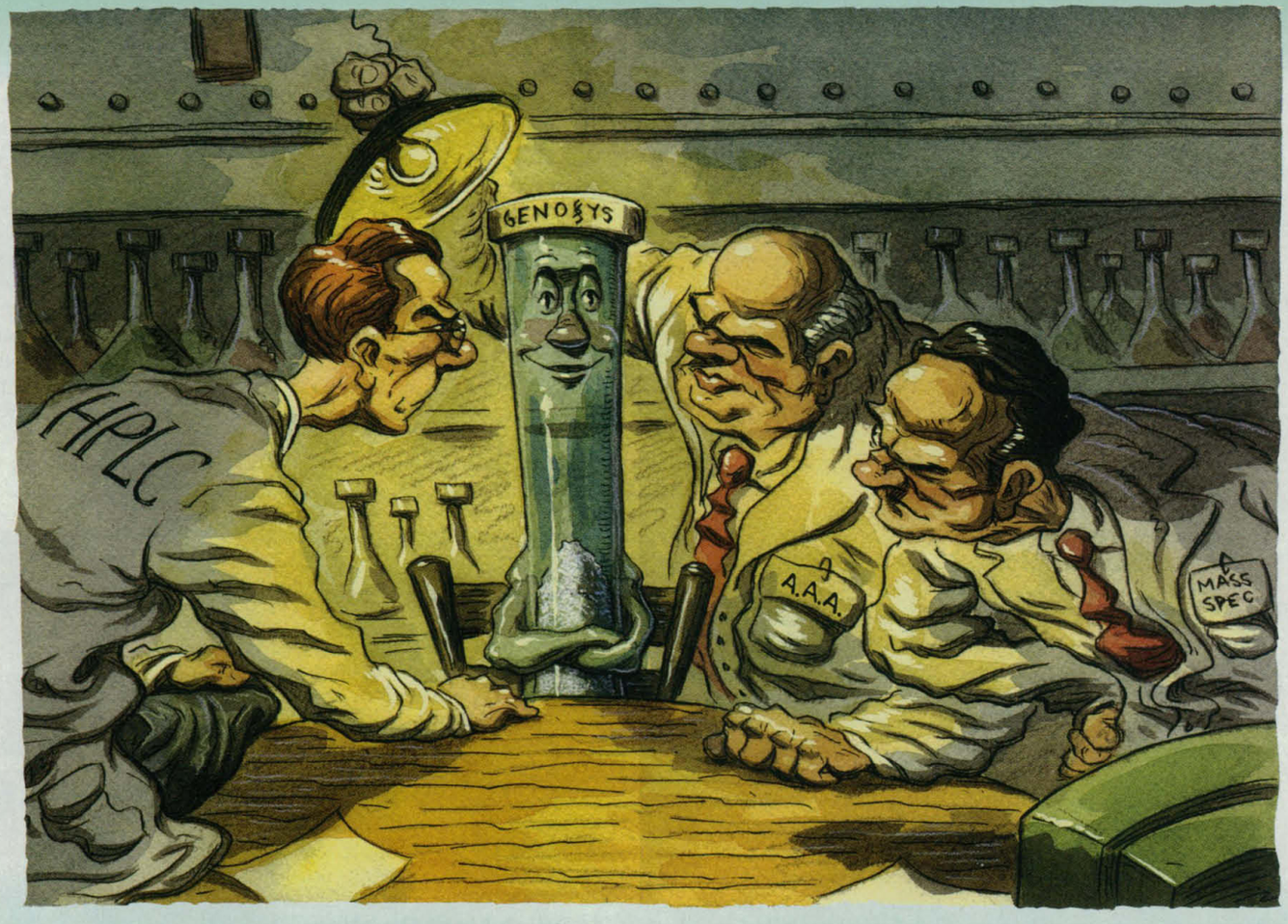
http://www.qiagen.com

Germany:	USA:	Australia:	Canada:	France:	Switzerland:	UK:
QIAGEN GmbH	QIAGEN Inc.	QIAGEN Pty Ltd.	QIAGEN Inc.	QIAGEN S.A.	QIAGEN AG	QIAGEN Ltd.
Tel. 02103-892-240	Tel. 800-426-8157	Tel. 03-9489-3666	Tel. 905-501-0151	Tel. 01-60-920-930	Tel. 061-319-30-30	Tel. 01293-422-999
Fax 02103-892-255	Fax 800-718-2056	Fax 03-9489-3888	Fax 905-501-0373	Fax 01-60-920-925	Fax 061-319-30-33	Fax 01293-422-922

DISTRIBUTORS: Austria/Hungary/Slovenia: (1)-889 18 19 **Belgium/Luxembourg:** 0800-1-9815 **China/Hong Kong:** (021) 65242386 or (852) 2896-6283 **Czech Republic:** (02) 49 53 77 **Denmark:** 43 86 87 88 **Finland:** (09)-804 551 **Greece:** (01)-643 6138 **India:** (011)-542 1714 **Israel:** (02)-652 44 47 **Italy:** (055) 500 1871 **Japan:** (03)-5684-1620 **Korea:** (02) 924-8697 **Malaysia:** (03)-731 2099 **Mexico, Central & South America:** (1)-805-294-7940 **The Netherlands:** (033)-495 00 94 **New Zealand:** (09) 418 3039 **Norway:** 022 90 00 00 **Poland:** (071) 735 813 **Portugal:** (1)-758 07 40 **Singapore:** (65) 445 7927 **Slovak Republic:** 07-37 38 00 **South Africa:** (021) 981 1560 **Spain:** (93)-401-01-01 **Sweden:** (08) 621 34 00 **Taiwan:** (02) 880 2913 **Thailand:** (02) 412 5672 **In other countries contact:** QIAGEN GmbH

QIAGEN

Custom Peptides for Born Skeptics



Would you rather trust your results to an unpurified peptide, or to one that's guaranteed pure?

No, that's not a trick question. Because — for about what you pay for a crude product from other suppliers — you can get a fully characterized, guaranteed >70% pure custom peptide from Genosys.

You'll get proof of performance to convince even the most hardened skeptic: mass spectral analysis for composition, and HPLC verification of purity. Plus a cast-in-stone, 100% satisfaction guarantee.

Of course, you can also choose higher levels of purity to suit your research, as well as the exact quantity you need. Along with just about any modification you can think of: MAPS, biotin, N–acetylation, C–amidation, phosphorylation, D–amino acids, or KLH / BSA conjugation. Hassle-free antisera services, too. And if you're doing mapping studies, you'll want to check out our time-saving SPOTs™ custom peptide array system.

Skeptical? Call today to discuss your requirements. To erase all doubts, just place an order.

Let us Quote on Your Next Custom Peptide and We'll Send You Our New "Biologically Active" T-Shirt*

Visit our World Wide Web Site
http://www.genosys.com

Genosys Biotechnologies, Inc.
The Woodlands, TX U.S.A.
Phone: (800) 498-2098 or (281) 363-3693
Fax: (281) 363-2212
eMail: info@genosys.com

Europe:
Genosys Biotechnologies, Inc.
Cambridge, UK
Phone: (+44) (0) 1223 839000
Fax: (+44) (0) 1223 839200
eMail: genosys@genosys.co.uk

Australia: AMRAD Pharmacia Biotech
Phone: 008-252-265

New Zealand: AMRAD Pharmacia Biotech
Phone: 0800-733-893

Taiwan: Cashmere Scientific Company
Phone: 866-2-821-3004


* Offer valid while supplies last.

GENOSYS

1-800-498-2098

Circle No. 52 on Readers' Service Card

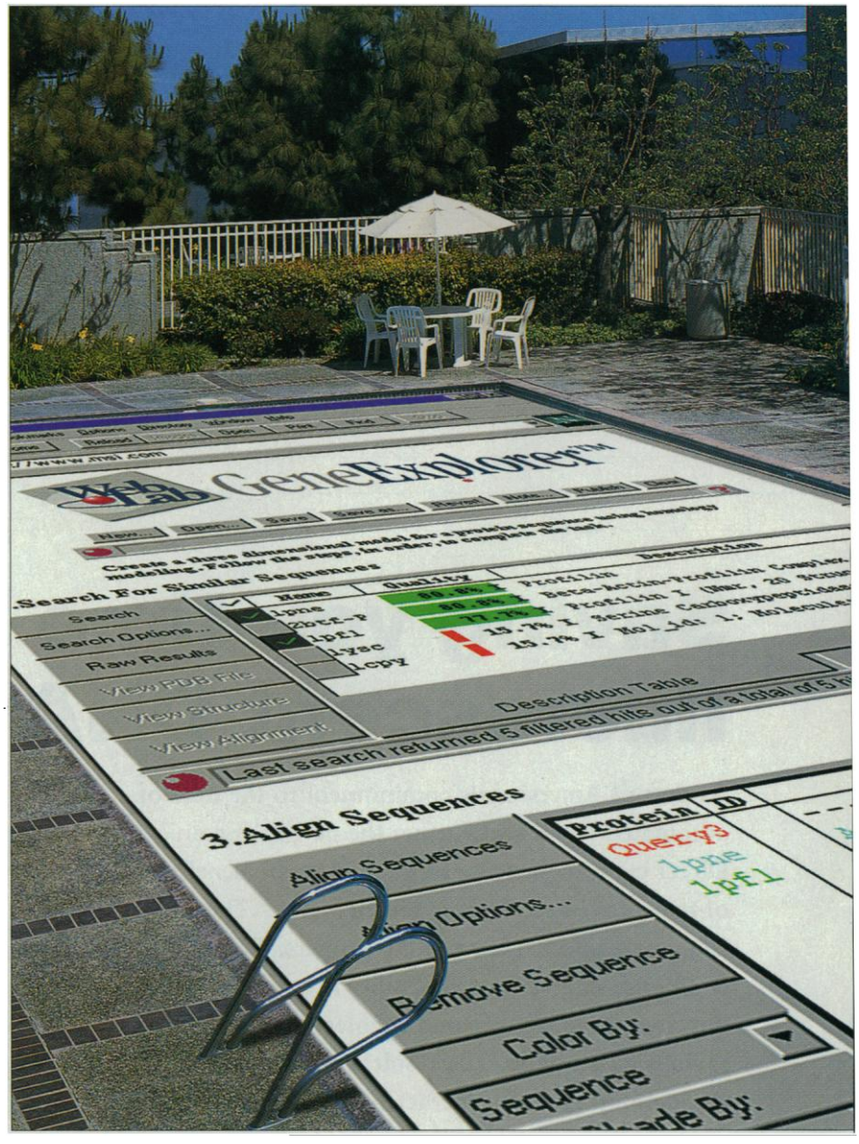
Now Everyone Can Swim In The Deep End Of The Gene Pool

Finally, Graphically Integrated Bioinformatics Solutions

Introducing Gene Explorer,™ an interactive graphical environment for the analyses of DNA and protein sequences, as well as protein structures. From restriction analysis to virtual mutagenesis, Gene Explorer aims to satisfy the computational needs of molecular biologists within a single software environment. It helps you focus your research on the most promising directions, hypotheses, and candidate genes.

Because Gene Explorer relies on MSI's WebLab™ technology, you can access its graphically rich interface from your desktop computer using a Web browser such as Netscape Navigator. Computations take place on your centralized servers, such as the Silicon Graphics Origin 200™ and Origin 2000,™ and results are communicated using your corporate intranets. WebLab combines the ease of commercial quality desktop computing, the power of validated computational algorithms, and the communications infrastructure offered by the World Wide Web.

Gene Explorer from MSI.
The best way to discover
the undiscovered.



For more information or a demonstration, contact us today. Or, visit our Web site at http://www.msi.com.

The first 50 people to complete the Gene Explorer information form will receive a free pair of goggles.

Circle No. 63 on Readers' Service Card

msi molecular simulations

Molecular Simulations Inc. • 9685 Scranton Road • San Diego, CA 92121 • (619) 458-9990 • Fax (619) 458-0136
U.K. (44) 1223-413300 • France (33) 1-69-353232 • Germany (49) 8106-35-93-0 • Asia/Pacific (61) 2-9954-4322 • Japan (81) 3-3818-6511

SiliconGraphics Computer Systems

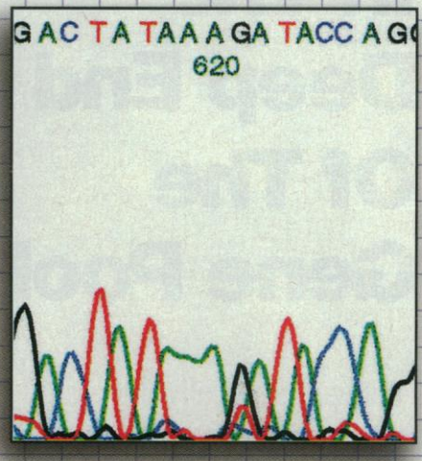
DYEnamic Direct
cycle sequencing kits

THERMO Sequenase + DYEnamic ET PRIMERS

FEWER CYCLES

DIRECT LOAD

LESS TEMPLATE



Saving you time in fluorescent DNA sequencing

As part of Amersham's commitment to the field of automated DNA sequencing, the new DYEnamic Direct cycle sequencing kits combine the benefits of two proven sequencing technologies - Thermo Sequenase and DYEnamic ET primers. This combination gives you flexibility in protocol setup, improves performance and enables significant time savings to be made. The result? Increased throughput, greater accuracy and higher productivity.

- Direct load option eliminates need for ethanol precipitation
- As few as 5 cycles needed or as little as 10ng ssDNA
- Available with either -21 forward or -28 reverse ET primers, or without primer for added flexibility
- Bright loading dye to aid sample loading

Amersham LIFE SCIENCE

FOR MORE INFORMATION, CONTACT YOUR LOCAL OFFICE

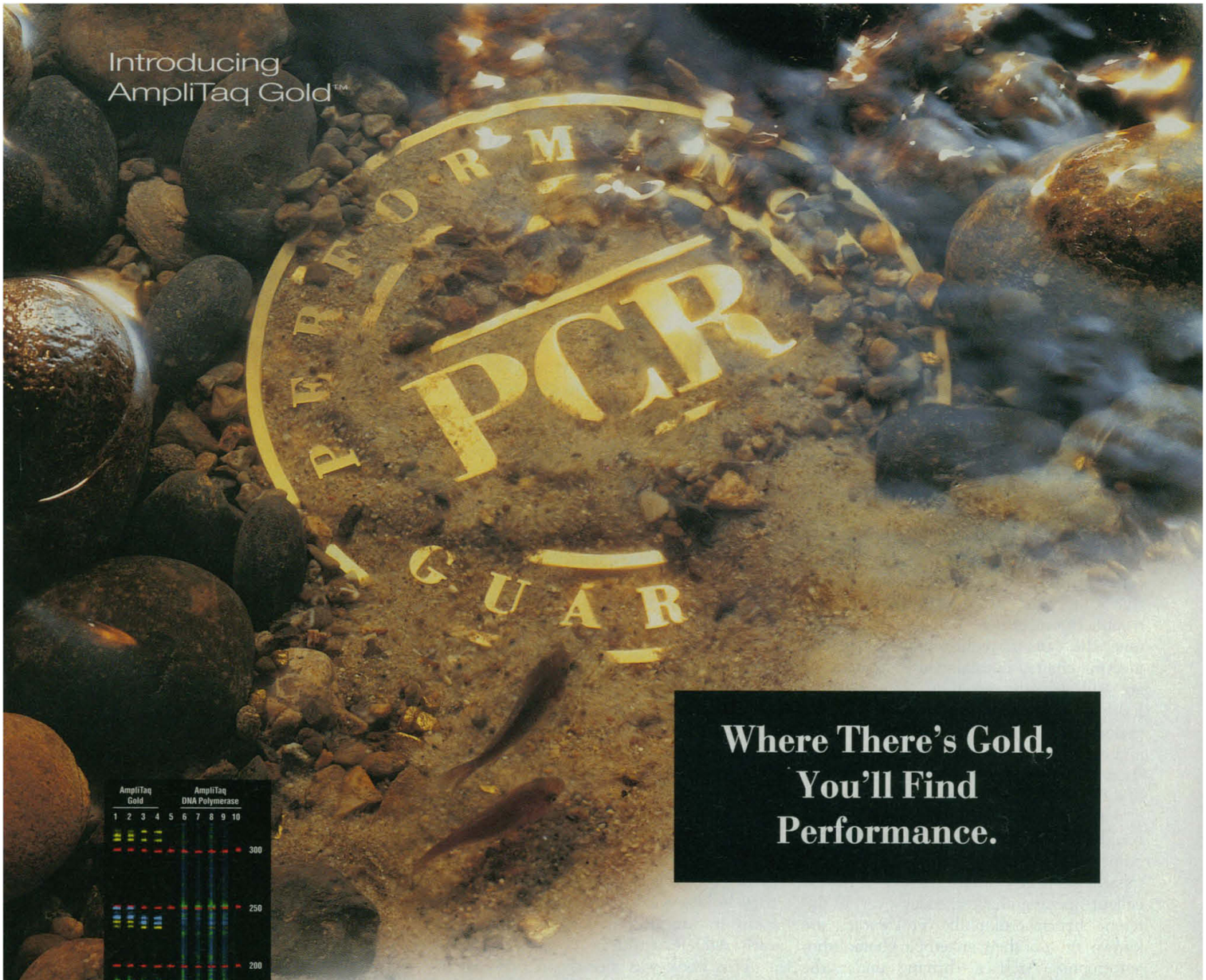
http://www.amersham.co.uk/life

http://www.amersham.com/life

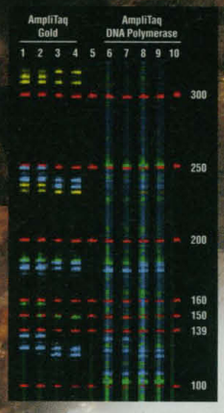
EUROPE	+44 (0)1494 544550
USA	1 800 323 9750
JAPAN	(03) 59 92 2828

MDYD

Circle No. 35 on Readers' Service Card



Where There's Gold, You'll Find Performance.



Co-amplification of 8 human STR loci. L1, 2: male control DNA; L3, 4: female control DNA; L5: AmpliTaq negative control; L6, 7: male control DNA; L8, 9: female control DNA; L10: negative control.

Amplification of HIV-1 Control DNA. L2: 0 copies, AmpliTaq DNA Polymerase, No Hot Start; L3: 10 copies, AmpliTaq DNA Polymerase, No Hot Start; L4: 10 copies, AmpliTaq DNA Polymerase, manual Hot Start; L5: 10 copies, AmpliTaq Gold.

For PCR performance with higher yield, better specificity and more reliable results, discover AmpliTaq Gold™.

This new version of AmpliTaq® DNA Polymerase provides the specificity of Hot Start PCR, without all the extra steps. In most cases, you can substitute AmpliTaq Gold directly in existing PCR amplification protocols—without re-optimization.

You'll find AmpliTaq Gold saves time and money with dramatically lower drop-out rates, improved specificity, and easier multiplexing.

It also gives you consistently better PCR results. Because AmpliTaq Gold remains inactive until heated, conditions that lead to primer-dimer formation and mispriming are eliminated.

And of course, you have the continued assurance of knowing that AmpliTaq Gold is backed by PE Applied Biosystems' exclusive PCR Performance Guarantee.

So discover AmpliTaq Gold, and discover high performance PCR. To request information, call 1-800-327-3002. Outside the U.S. and Canada, contact your local PE Applied Biosystems representative. On the Internet, visit our home page at http://www. amplitaqgold.com, or e-mail pebio@perkin-elmer.com.

PE *Applied Biosystems*

Europe Langen, Germany Tel: 49 (0)6103 708 301 Fax: 49 (0)6103 708 310
Japan Tokyo, Japan Tel: (047) 380-8500 Fax: (047) 380-8505
Latin America Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223
Australia Melbourne, Australia Tel: 1 800 033 747 Fax: 61 3 9212-8502

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

Roche

ATCC, THE ONE SOURCE FOR

Media

Serum

Cells

Life just got easier! One call...one order to ATCC brings you ATCC's authentic cell lines plus our own Vitacell™ brand Media and Fetal Bovine Serum. The same media and serum ATCC uses to grow our own cell lines. Thoroughly QC tested in our own labs. High purity, high reliability, high quality. That's the Vitacell™ brand of media and serum from ATCC.

When your research validation is critical, order directly from ATCC. Authentic, pure cell lines...and now, the same quality of media and serum. All from ATCC. The one source.

ATCC®

12301 Parklawn Drive, Rockville, MD 20852 • 1-800-638-6597 • Fax: 1-301-816-4361 • E-mail: sales@atcc.org

Circle No. 48 on Readers' Service Card