BOSE-EINSTEIN CONDENSATES OF EXCITED ATOMS PAGE 461

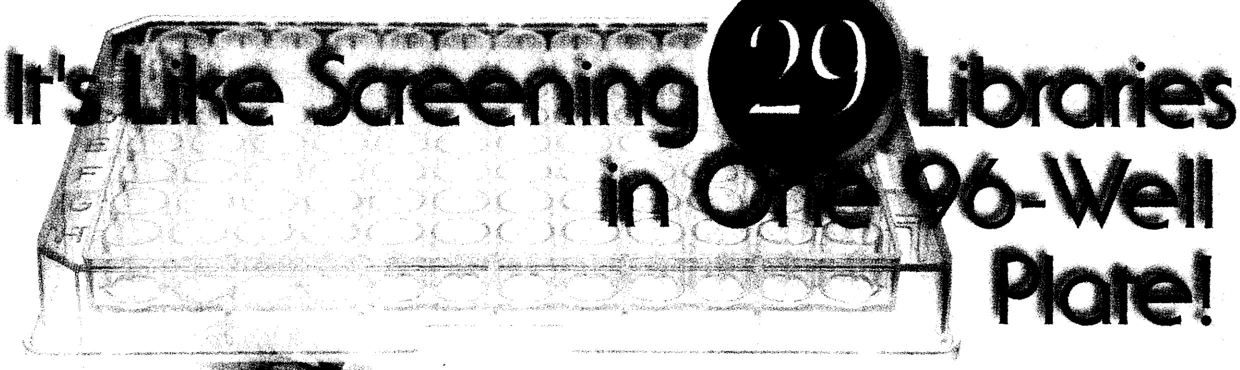
Science

20 April 2001

Vol. 292 No. 5516
Pages 385–588 $9

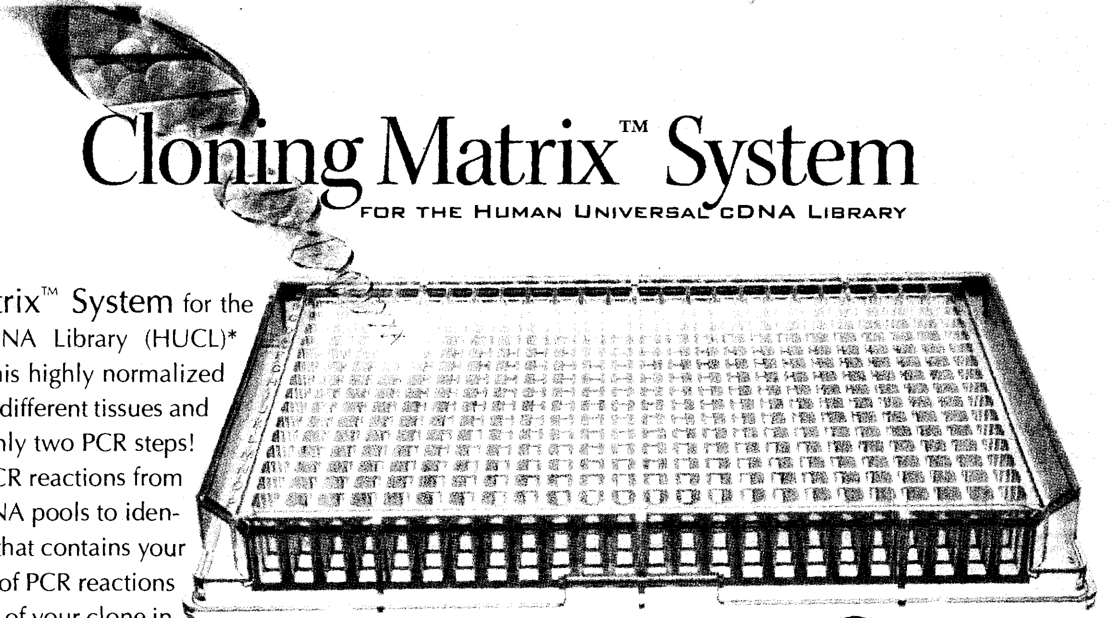
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

It's Like Screening 29 Libraries in One 96-Well Plate!



Cloning Matrix™ System

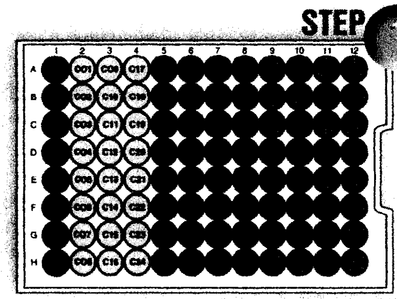
FOR THE HUMAN UNIVERSAL cDNA LIBRARY



The Cloning Matrix™ System for the Human Universal cDNA Library (HUCL)* allows you to screen this highly normalized library representing 29 different tissues and find your clone with only two PCR steps! First you run a set of PCR reactions from the 96-well plate of DNA pools to identify the 384-well plate that contains your clone. Your second set of PCR reactions shows you the location of your clone in the 384-well plate. That's all! It's much faster than hybridization and more accurate than RT-PCR, without radioactivity.

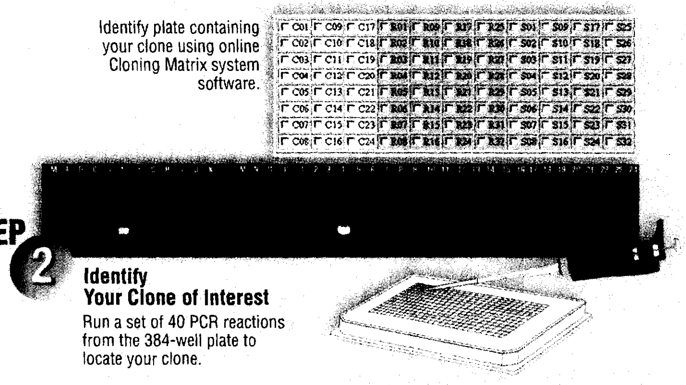
The easy-to-use Cloning Matrix system uses the high-quality HUCL collection of primary clones, extensively normalized to ensure that you can isolate even a rare, unknown or low-abundance gene. And, your final clone is not a PCR product but a cDNA clone that has been individually picked and cultured in your microwell plate from the original library.

- ***Same-day results***
- ***Faster than hybridization***
- ***More accurate than RT-PCR***
- ***No radioactivity or hybridization***
- ***29 different human tissues represented on one plate***
- ***Average cDNA insert size of 1.7 kb with 50% full length genes***



STEP 1 **Screen the Master Plate**
Run PCR reactions from the 96-well master plate to identify positive PCR results.

Identify plate containing your clone using online Cloning Matrix system software.



STEP 2 **Identify Your Clone of Interest**
Run a set of 40 PCR reactions from the 384-well plate to locate your clone.

Start Your Analysis

Finding your clone is easy with the

Cloning Matrix™ System

Cloning Matrix™ System for the Human Universal cDNA Library #937840

STRATAGENE®

STRATAGENE USA and CANADA
ORDER: (800) 424-5444 x3
TECHNICAL SERVICES: 800-894-1304

STRATAGENE EUROPE
Belgium, Germany, The Netherlands, Switzerland, United Kingdom
European Toll-Free Numbers
ORDER: 00800 7000 7000
TECHNICAL SERVICES: 00800 7400 7400
Austria
0800 312 526
France
00800 7000 7000 or 0800-100391

INTERNET
email: techservices@stratagene.com
website: www.stratagene.com

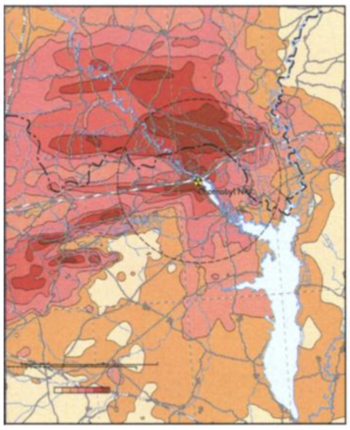
* Purchase of these products includes a limited license to use these products for research purposes. For information on commercial use licenses, please contact Stratagene's Product Manager for Libraries at 800-894-1304

Circle No. 39 on Readers' Service Card

For more information visit our website
www.stratagene.com

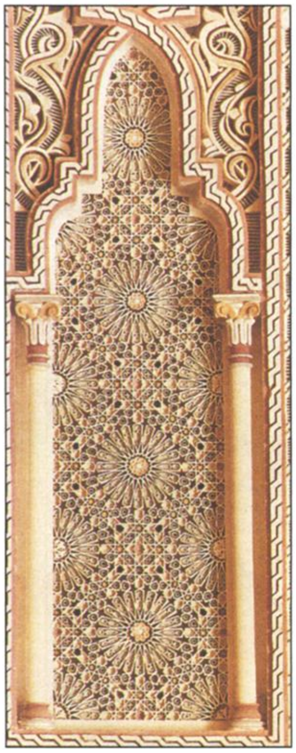
Science

Volume 292 20 April 2001 Number 5516



420
15 years after the explosion

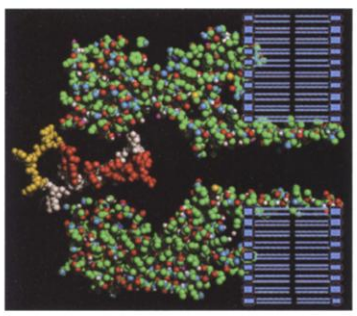
NEWS



445
Algorithmic beauty

SCIENCE'S COMPASS

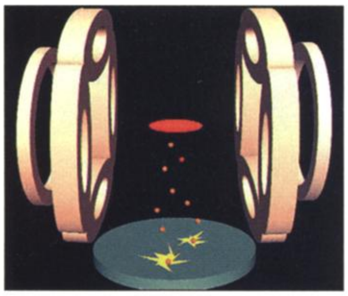
DNA sequencing in nanopores **515**



RESEARCH

RESEARCH ARTICLES

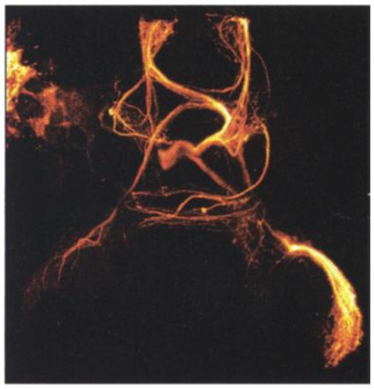
REPORTS



461
Condensing a cloud of metastable helium

COVER 491

Female African elephants and their dependent offspring live in matrilineal groups led by the oldest female, or matriarch. Research reveals that group members are dependent on the matriarch for their store of social knowledge. The removal of these key individuals, often targets for illegal hunters because of their large size, could have serious consequences for the conservation of this endangered species. [Photo: K. McComb]



507
Chaos at the optic chiasm

www.sciencexpress.org

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. Copyright © 2001 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): $115 ($64 allocated to subscription). Domestic institutional subscription (51 issues): $370; Foreign postage extra: Mexico, Caribbean (surface mail) $55; other countries (air assist delivery) $87. 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.**

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:** $9.00 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 $9.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification code for *Science* is 0036-8075/83 $9.00. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

Science online

www.scienceonline.org

CONTENT HIGHLIGHTS AS OF 20 APRIL 2001

science magazine www.sciencemag.org

SCIENCE EXPRESS www.sciencexpress.org

A Silent Slip Event on the Deeper Cascadia Subduction Interface
H. Dragert, K. Wang, T. S. James

Aseismic slip along the Cascadia subduction zone, inferred from geodetic data, may trigger a reassessment of seismic hazard in the Pacific Northwest.

A GDP/GTP Exchange Factor Involved in Linking a Spatial Landmark to Cell Polarity
P. J. Kang, A. Sanson, B. Lee, H.-O. Park

A signaling protein, Bud5, is found to be crucial for yeast cells in linking polarity markers in the membrane to the selection of new bud sites.

Structural Basis of Transcription: RNA Polymerase II at 2.8 Å Resolution P. Cramer, D. A. Bushnell, R. D. Kornberg

Structural Basis of Transcription: An RNA Polymerase II Elongation Complex at 3.3 Å Resolution A. L. Gnatt, P. Cramer, J. Fu, D. A. Bushnell, R. D. Kornberg

▼ 411 High-resolution structures of yeast RNA polymerase II—both in its inactive state and in the act of transcription—provide insight into how the enzyme transcribes DNA into messenger RNA.

science's stke www.stke.org

Perspective: A New Role for Protein Methylation—Switching Partners at the Phosphatase Ball M. Mumby

A posttranslational modification that regulates signal transduction.

science's next wave www.nextwave.org

Canada: Picking Stocks—Other Helpful Sites C. Boulakia

In this month's "Personal Finances for Scientists" column, we visit several Web sites that just might help you pick a winning stock.

Canada: Peer Review for Novices L. McKarney

How graduate students and postdocs can benefit from the journal peer review process.

US: Behavioral Style: Understanding Communication Styles Can Advance Your Relationships—and Your Career Prospects, Part 2 D. Jensen

Mix two different behavioral styles together and a reaction occurs—that's the science of interpersonal chemistry.

US: Butting Heads—Conflict Resolution for Postdocs, Part 2 A. Agrawal

The ombudsman: a resource that can help postdocs and other members of the research community deal with conflict at an informal stage.

UK: Absent with Leave P. H. Dee

Research going nowhere? Then run away! A visit to another lab to learn a new technique can widen your horizons and get your project moving again.

GrantsNet
www.grantsnet.org
RESEARCH FUNDING DATABASE

NeuroAIDS
www.sciencemag.org/NAIDS
EXPERIMENTAL WEB SITE

ONLINE STAFF

*SCIENCE*NOW EDITORS Laura Helmuth, Martin Enserink, Erik Stokstad

SCIENCE'S NEXT WAVE EDITORIAL: MANAGING EDITOR Crispin Taylor; EDITORS Robert Metzke (Germany), Kirstie Urquhart (UK); CONTRIBUTING EDITORS Lesley McKarney (Canada), Mark Sincell; PROJECT MANAGER Emily Klotz; WRITERS Katie Cottingham, Mona Mort; MARKETING: MARKETING MANAGERS Karen Horting (US and Canada), Hazel Crocker (Europe); PROGRAM DIRECTOR Lisa Kozlowski; MARKETING ASSOCIATE Joey D'Adamo

SCIENCE'S STKE EDITOR Bryan Ray; ASSOCIATE EDITORS Lisa Chong, Nancy Gough, John Nelson

ELECTRONIC MEDIA MANAGER David Gillikin; INTERNET PRODUCTION MANAGER Betsy Harman; ASSISTANT PRODUCTION MANAGER Wendy Stengel; SENIOR PRODUCTION ASSOCIATE Lisa Stanford; ASSOCIATES Carla Cathey, Mark Croatti, Robert Owens, Louis Williams

Daily coverage of science and science policy by *Science*'s news team

sciencenow
www.sciencenow.org

NOW!

ADDITIONAL RESOURCE

SCIENCECAREERS.ORG

Job Alerts e-mails: Specify the criteria of the type of job you're looking for, then let Job Alerts do the looking. Once a week, when the job postings are updated, you'll receive an e-mail with all of the job postings that meet your criteria.

ADDITIONAL RESOURCE

AD SUPPLEMENT / IN THIS ISSUE

SPECIAL FEATURE

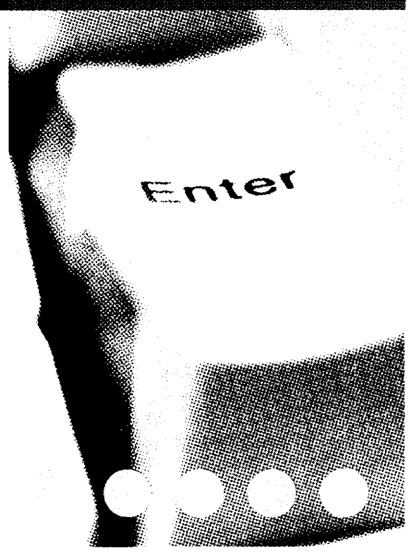
Careers & Events in Drug Discovery: This ad supplement examines the types of career opportunities in drug discovery and outlines the skills needed for these jobs. Look for it on page 527.

LAB TECHNOLOGY TRENDS

AD SUPPLEMENT / 4 MAY ISSUE

LAB TECHNOLOGY TRENDS

Technologies in DNA Chips and Microarrays, Part 1: This ad supplement takes an in-depth look at this leading-edge area that allowed researchers to complete a working draft of the human genome in remarkably short time. Look for it in the 4 May issue.



THIS WEEK IN Science

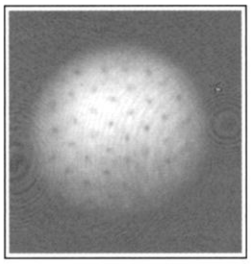
edited by Phil Szuromi

Eros: A Beaten Asteroid

The NEAR-Shoemaker spacecraft has mapped the asteroid 433 Eros for about 1 year. In October 2000, the spacecraft completed a close-approach to the asteroid surface and obtained images with a resolution of 1 to 5 meters with the multispectral imager (Veverka *et al.*, p. 484) and collected complimentary topographic details with the laser rangefinder (Cheng *et al.*, p. 488). The fine-scale observations include meter-sized blocks, degraded craters, smooth, flat-floored craters, a lack of small craters, and evidence for linear fractures. These features suggest that Eros has a complex regolith produced by multiple impact events in which the size and strength of the impactors varied to produce its heterogeneous surface character.

476 Stable Vortex Lattices in Bose-Einstein Condensates

In macroscopic quantum systems, the application of an external parameter—a magnetic field in the case of superconductors, or an induced rotation in the case of superfluids—results in the formation of vortices. These vortices penetrate the system and dissipate energy, and they also possess quantized units of angular momentum. Abo-Shaeer *et al.*, p. 476 (see the 23 March news story by Voss) now show that large, ordered arrays of vortices can be formed and observed in a rotating Bose-Einstein condensate. The vortices are much more stable than had been predicted and may prove a useful testing ground of vortices in superfluids.



An Excited Bose-Einstein Condensate

The formation of a Bose-Einstein condensation (BEC), whether as a liquid in the case of helium (He) or as weakly interacting, dilute atomic gases (seen for H, Li, Na, and Rb), dissipates energy during cooling. This process would seem to require that the atoms come together in their lowest energy or ground state, but Robert *et al.* (p. 461; see the Perspective by Inguscio and the 23 March news story by Voss) now show that a cloud of metastable helium atoms, excited some 20 electron volts in energy into the 2 $^3S_1$ triplet spin state, can be coaxed into forming a BEC. In their experiment, a magnetic field spin-polarizes the atoms in cloud and forces out any atoms with the opposite spin. With the spins all pointing the same direction, inelastic collisions that would otherwise destroy the delicate condensate are suppressed. They have also implemented a single-atom detection scheme with a multichannel plate that represents a large step on the road to quantum atom optics. This work may open a route to forming a dilute-gas BEC of ground-state He.

Quantum Solutions to Difficult Problems

There are certain problems, for example, factoring or searching for the shortest route connecting several points (the traveling salesman problem), that classically appear to grow exponentially in computational time with the number of digits (in factoring) or points that can be tried (in a search). So far, classical algorithms for solving the wide range of related "NP-complete" problems that could yield answers in polynomial time have remained elusive. From simulations, Farhi *et al.* (p. 472; see the news story by Anderson) show that quantum computers may be more effective at solving such problems. At least for the number of qubits they could simulate on their classical computer, they show that the adiabatic evolution of their quantum computer would yield a result to some examples of NP-complete problems in polynomial time.

Adsorption on Very Small Clusters

Small metal clusters have been characterized through a number of spectroscopic methods, but there is still great interest in the details of how these clusters react with small molecules. Nauta *et al.* (p. 481) have made complexes between magnesium atoms and small clusters (two and three atoms) and HCN in liquid helium droplets. In this environment, high-resolution infrared laser spectroscopy of the C–H vibrational band reveals rotational state information that allows much structural information to be deduced. A qualitative change in the adsorbate-metal cluster bonding occurs between the Mg_2–NCH and Mg_3–NCH complexes that is reflected in a change in Mg–N bond length.

How Cells Sense Oxygen

Mammalian cells are exquisitely sensitive to changes in oxygen concentration. When oxygen becomes limiting (hypoxia), the cells increase the transcription of genes that enhance oxygen delivery or that facilitate metabolic adjustment to reduced oxygen availability. This adaptive response is mediated by hypoxia-inducible factor (HIF), which is stable under hypoxic conditions but is degraded in the presence of oxygen by a ubiquitin ligase containing the von Hippel-Lindau (VHL) tumor suppressor protein. Ivan *et al.* (p. 464) and Jaakkola *et al.* (p. 468) have found that VHL binds to a specific domain of the HIF-1 subunit only when a conserved proline in that domain is hydroxylated (see the Perspective by Zhu and Bunn). The enzymes that catalyze prolyl hydroxylation require oxygen as a substrate, which suggests that this protein modification plays a key role in cellular oxygen sensing. This discovery could open up new therapeutic possibilities for the many diseases in which hypoxia plays a crucial role, including cancer, ischemic heart disease, hypertension, and stroke.

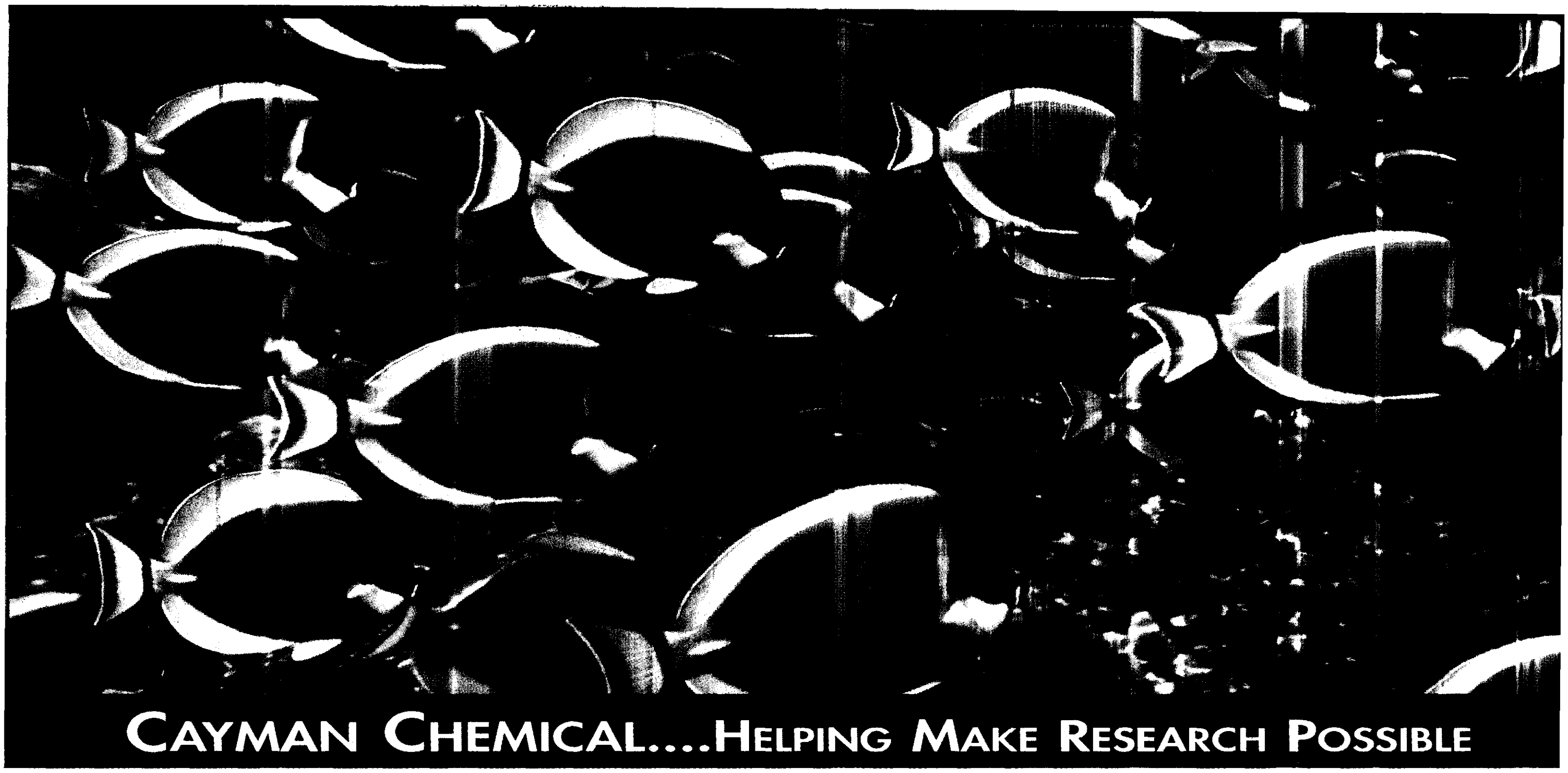
Big Mama Knows Best

African elephants live in matrilineal family groups that range over large areas and that frequently interact with other similar groups. McComb *et al.* (p. 491; see the cover and news story by Pennisi) show that the oldest female, or matriarch, acts as a repository for the group's social knowledge. Multiple playback experiments

Published online in *Science* Express

CONTINUED ON PAGE 395

CREDIT: J. R. ABO-SHAEER *ET AL.*



COX-1/COX-2

Chemiluminescent Inhibitor Screening Assay
Selective Inhibitors
COX Activity Assay
Recombinant Human COX-2

Immunoassays

PGE_2
8-Isoprostane
cAMP & cGMP
LTB_4
TXB_2
Histamine

Nitric Oxide

NO_2/NO_3 Assay Kits
Colorimetric & Fluorometric
sGC Antibody
NO Donors
NOS Enzymes & Antibodies

Neurochemistry

CGRP EIA Kit
CB_1 & CB_2 Receptor Antibodies
Anandamides
Prion Protein Antibodies

Obesity

15-deoxy $\Delta^{12,14}$ PGJ_2
PPARγ Polyclonal Antibody
Leptin EIA Kit

Setting the standard for twenty years!
Cayman CHEMICAL

1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
1-888.364.9897
Phone 734.971.3335
Fax 734.971.3420

For more information on these and our entire product line, visit us at www.caymanchemical.com/science

Circle No. 45 on Readers' Service Card

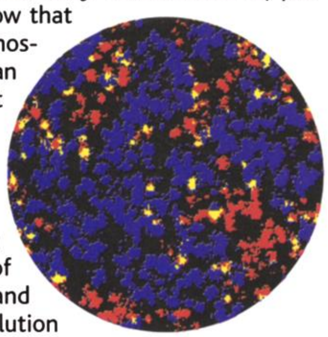
were performed during a period of 9 years to test vocal discriminatory abilities. Families with older matriarchs were better than those with young matriarchs at distinguishing the contact calls of other groups well or poorly known to them. These superior abilities appear to correlate with greater reproductive success on families with older matriarchs and suggest that age and experience may influence reproductive success through its effects on the acquisition of social knowledge. However, older elephants have the larger tusks prized by hunters and poachers; thus, whole populations may be affected by the removal of a few key individuals.

What Parents Will Do for Children

Understanding why species differ in their parental care tactics has been a central goal for evolutionary ecologists studying life history evolution. Ghalambor and Martin (p. 494; see the news story by Pennisi) test the prediction that life-history differences between bird species result in differences in how parents resolve the trade-off between feeding their young and reducing the predation risk to their offspring and to themselves. In a survey of nearly 200 bird species, they show that clutch size is negatively correlated with adult survival. They also manipulated predation risk to phylogenetically paired species in North and South America and show that parents with smaller clutch sizes and greater chances of survival are less willing to place themselves at risk than those with large clutch sizes.

More Efficient in Groups

Competition between organisms that share a common glucose resource leads to an evolutionary dilemma analogous to the "tragedy of the commons"—overexploitation of a common resource. Pfeiffer *et al.* (p. 504; see the Perspective by Cox and Bonner) present simulation models and a range of examples to show that organisms using pathways that produce adenosine triphosphate (ATP) with high rate but low yield (anaerobic) can outcompete those that produce ATP with low rate but high yield (aerobic). This situation leads to an inefficient use of a vital resource. They also suggest that the evolution of respiratory sugar metabolism required cooperation between cells, which suggests that an energetic bonus was reaped when the transition was made from single cells to multicellularity. This study is an example of how concepts derived from whole-organism ecology and evolution can apply to a very different sphere—the evolution of biochemical pathways.



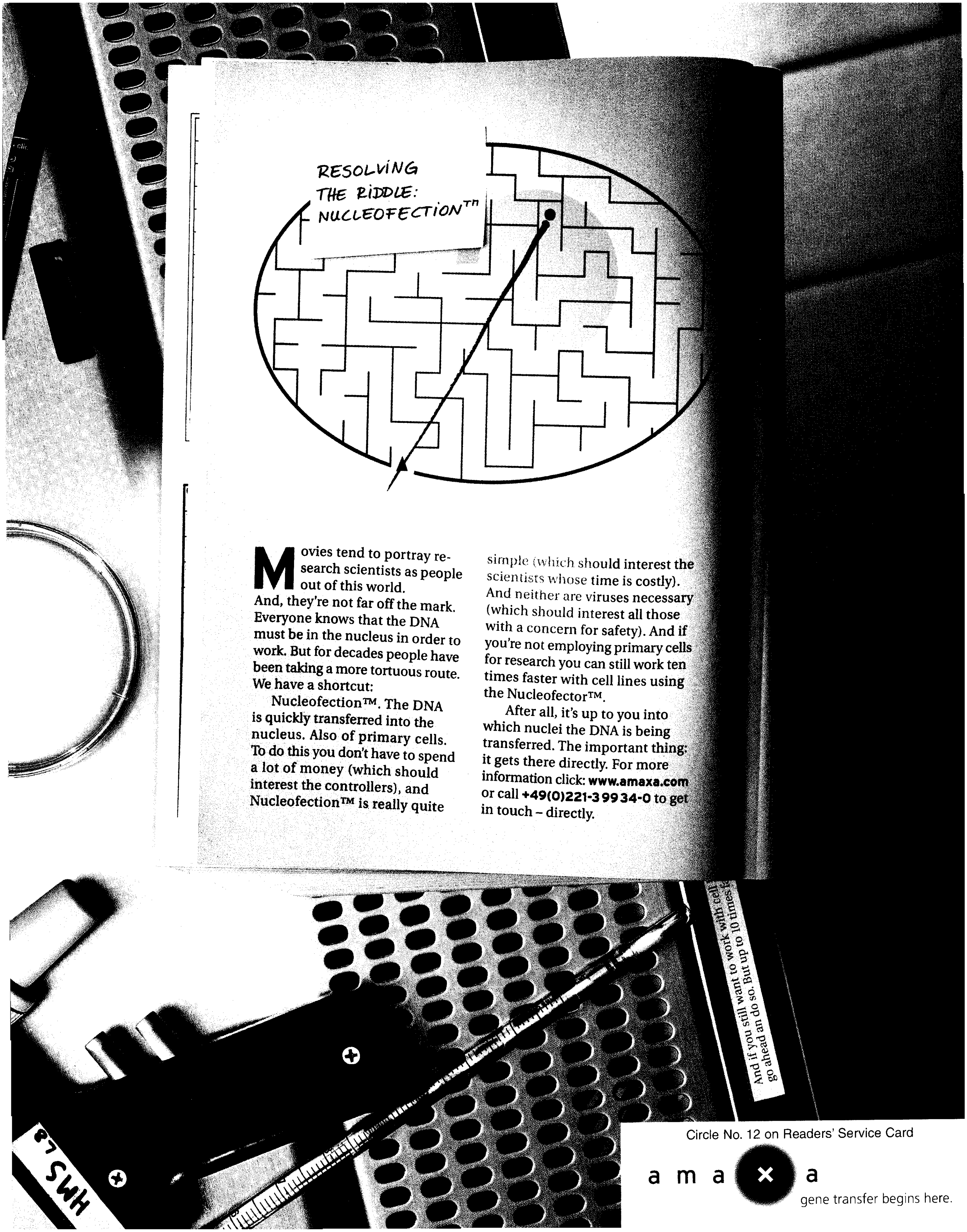
CREDIT: T. PFEIFFER *ET AL.*

The Protein Code Turns 21

All organisms construct proteins from the same set of 20 amino acids (the only known variants being formyl-methionine and selenocysteine, although many amino acids can be modified after their incorporation into polypeptide chains). Is it possible to extend the set of 20 amino acids in vivo to include new chemical functionalities in proteins? Two papers report success toward this goal in *Escherichia coli* (see the Perspective by Böck). Using genetics, Döring *et al.* (p. 501) identified mutations in the editing function of valyl-tRNA synthetase that result in high levels of incorporation of the nonnatural amino acid aminobutyrate. Wang *et al.* (p. 498) used a combination of genetics and molecular biology to add an orthogonal tyrosyl tRNA–tyrosyl tRNA synthetase pair with altered substrate specificity so that they could incorporate *O*-methyl-L-tyrosine at high fidelity.

Sharing the Roundabout

The midline of the fruit fly and the zebrafish share more than just topology. Fricke *et al.* (p. 507) show that zebrafish use a receptor encoded by the gene *astray* for guiding axons from the developing eyes to the brain, crossing the midline on their way to form the optic chiasma. The *astray* receptor is similar to the receptor encoded by the gene *roundabout* that is responsible for guidance of growing axons across the midline in *Drosophila*. Chimeras made by exchanging eyes of mutant and wild-type zebrafish demonstrated that the relevant site of expression of *astray* is in the eye.


RESOLVING THE RIDDLE: NUCLEOFECTION™
Movies tend to portray research scientists as people out of this world. And, they're not far off the mark. Everyone knows that the DNA must be in the nucleus in order to work. But for decades people have been taking a more tortuous route. We have a shortcut:
Nucleofection™. The DNA is quickly transferred into the nucleus. Also of primary cells. To do this you don't have to spend a lot of money (which should interest the controllers), and Nucleofection™ is really quite simple (which should interest the scientists whose time is costly). And neither are viruses necessary (which should interest all those with a concern for safety). And if you're not employing primary cells for research you can still work ten times faster with cell lines using the Nucleofector™.
After all, it's up to you into which nuclei the DNA is being transferred. The important thing: it gets there directly. For more information click: www.amaxa.com or call +49(0)221-39934-0 to get in touch – directly.
And if you still want to work with cell
go ahead an do so. But up to 10 times

Science

www.sciencemag.org

1200 New York Avenue, NW
Washington, DC 20005
Editorial: 202-326-6550, FAX 202-289-7562
News: 202-326-6500, FAX 202-371-9227
Permissions: 202-326-7074, FAX 202-682-0816
Subscriptions: 800-731-4939 or 202-326-6417, FAX 202-842-1065

Bateman House, 82-88 Hills Road
Cambridge, UK CB2 1LQ
(44) 1223-326500, FAX (44) 1223-326501

EDITOR-IN-CHIEF **Donald Kennedy**
EDITOR **Ellis Rubinstein**
MANAGING EDITOR **Monica M. Bradford**

DEPUTY MANAGING EDITORS R. Brooks Hanson Katrina L. Kelner
NEWS EDITOR Colin Norman

EDITORIAL/COMPASS SUPERVISORY SENIOR EDITORS Barbara Jasny, Guy Riddihough, Phillip D. Szuromi; SENIOR EDITOR/PERSPECTIVES Orla Smith; SENIOR EDITORS Gilbert J. Chin, Pamela J. Hines, Paula A. Kiberstis (Boston), L. Bryan Ray, Linda R. Rowan; ASSOCIATE EDITORS Lisa D. Chong, Marc S. Lavine, Beverly A. Purnell, H. Jesse Smith, Valda Vinson; EDITOR, *SCIENCE* ONLINE Stewart Wills; ASSOCIATE BOOK REVIEW EDITOR Sherman J. Suter; ASSOCIATE LETTERS EDITOR Christine M. Pearce; INFORMATION SPECIALIST Janet Kegg; CONTRIBUTING EDITOR Kevin Ahern; EDITORIAL MANAGER Cara Tate; SENIOR COPY EDITORS Jeffrey E. Cook, Harry Jach, Etta Kavanagh, Barbara P. Ordway; COPY EDITORS Jason Llewellyn, Joshua Marcy, Monique Martineau, John Meade; EDITORIAL COORDINATORS Carolyn Kyle, Ellen E. Murphy, Beverly Shields; PUBLICATIONS ASSISTANTS Chris Filiatreau, Joi S. Granger, Jeffrey Hearn, Charlene King, Elise Laffman, Gail Murphy, Anita Wynn; EDITORIAL ASSISTANT Patricia M. Moore; EDITORIAL SUPPORT ASSISTANTS Osa Atoe, Christopher Kenny, Brian White; EXECUTIVE ASSISTANT Sylvia S. Kihara; ADMINISTRATIVE SUPPORT Patricia F. Fisher

science_editors@aaas.org (for general editorial queries)
science_letters@aaas.org (for letters to the editor)
science_reviews@aaas.org (for returning manuscript reviews)
science_bookrevs@aaas.org (for book review queries)

NEWS SENIOR CORRESPONDENTS Eliot Marshall, Jean Marx; DEPUTY NEWS EDITORS Robert Coontz, Jeffrey Mervis, Leslie Roberts; CONTRIBUTING EDITORS Elizabeth Culotta, Polly Shulman; NEWS WRITERS Martin Enserink, Laura Helmuth, Constance Holden, Jocelyn Kaiser, Richard A. Kerr, Andrew Lawler (Boston), David Malakoff, Elizabeth Pennisi, Charles Seife, Robert F. Service (Pacific NW), Gretchen Vogel, John Davenport (intern); CONTRIBUTING CORRESPONDENTS Marcia Barinaga (Berkeley, CA), Kathryn Brown, Barry A. Cipra, Jon Cohen (San Diego, CA), Daniel Ferber, Ann Gibbons, Robert Irion, Charles C. Mann, Virginia Morell, Evelyn Strauss, Gary Taubes, David Voss, Ingrid Wickelgren; COPY EDITORS Linda B. Felaco, Daniel T. Helgerman; ADMINISTRATIVE SUPPORT Scherraine Mack, Fannie Groom; BUREAUS: Berkeley, CA: 510-652-0302, FAX 510-652-1867, Boston, MA: 617-542-5098, San Diego, CA: 760-942-3252, FAX 760-942-4979, Pacific Northwest: 541-342-6290

PRODUCTION DIRECTOR James Landry; MANAGER Wendy K. Shank; ASSOCIATES Rebecca Doshi, Vicki J. Jorgensen, Tara L. Kelly, Jessica K. Moshell

ART DESIGN DIRECTOR C. Faber Smith; ART DIRECTOR Alan T. Stonebraker; ASSOCIATE ART DIRECTOR Stephanie D. Halvorson; ILLUSTRATORS Cameron Slayden, Katharine Sutliff; ASSOCIATES Holly Bishop, Joshua Moglia, Debra J. Morgenegg, Preston Morrighan; PHOTO RESEARCHER Leslie Blizard

SCIENCE INTERNATIONAL

EUROPE (science@science-int.co.uk) EDITORIAL: SUPERVISORY SENIOR EDITOR Andrew M. Sugden; SENIOR EDITOR/PERSPECTIVES Julia Uppenbrink; SENIOR EDITORS Caroline Ash, Stella M. Hurtley; ASSOCIATE EDITORS Ian S. Osborne, Stephen J. Simpson, Peter Stern; EDITORIAL SUPPORT Jenny Parker, Sarah Parker; ADMINISTRATIVE SUPPORT Janet Mumford, Liz Ellis, Viv Hogarth; NEWS: EUROPEAN NEWS EDITOR Richard Stone, CORRESPONDENT Michael Balter (Paris: (33) 1-49-29-09-01, FAX (33) 1-49-29-09-00); CONTRIBUTING CORRESPONDENT Robert Koenig (Bern); John Pickrell (intern)

ASIA Japan Office: Asca Corporation, Eiko Ishioka, Fusako Tamura, 1-8-13, Hirano-cho, Chuo-ku, Osaka-shi, Osaka, 541-0046 Japan; (81) 6-6202-6272, FAX (81) 6-6202-6271; asca@os.gulf.or.jp JAPAN NEWS BUREAU: Dennis Normile (contributing correspondent, (81) 3-3335-9925, FAX (81) 3-3335-4898; dnormile@twics.com); CHINA REPRESENTATIVE Hao Xin, (86) 10-6307-4439 or 6307-3676, FAX (86) 10-6307-4358; science@public3.bta.net.cn; INDIA Pallava Bagla (contributing correspondent (91) 11-271-2896; pbagla@ndb.vsnl.net.in)

PUBLISHER **Richard S. Nicholson**
ASSOCIATE PUBLISHER **Beth Rosner**
MEMBERSHIP/CIRCULATION DIR. **Michael Spinella**

MEMBERSHIP/CIRCULATION (membership@aaas.org) DEPUTY DIRECTOR Marlene Zendell; MEMBER SERVICES: MANAGER Michael Lung; SENIOR SPECIALIST Mary Curry; COORDINATOR Jantell Stone; SPECIALISTS Laurie Baker, Pat Butler; REPRESENTATIVES Elizabeth Early, Elizabeth Haberkorn, Katrina Smith; MARKETING: ASSOCIATES Lauri Sirois, Deborah Stromberg; EUROPE SENIOR EXECUTIVE Ruth Jackson; EXECUTIVE Martin Paine; RESEARCH: MANAGER Renuka Chander; BUSINESS AND FINANCE: MANAGER Teressa Ellis; ADMINISTRATIVE SUPPORT Zadia McKinnon; COMPUTER SPECIALIST Charles Munson

SUBSCRIPTION SERVICES For change of address, missing issues, new orders and renewals, and payment questions: 800-731-4939 or 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

REPRINTS Ordering/Billing/Status 800-407-9190; Corrections 202-326-6501

MEMBER BENEFITS For Credit Card: MBNA 1-800-847-7378; Car Rentals: Hertz 1-800-654-2200 CDP#343457, Dollar 1-800-800-4000 #AA1115; AAAS Travels: Betchart Expeditions 1-800-252-4910; Life Insurance: Seabury & Smith 1-800-424-9883; Other Benefits: AAAS Member Services 1-202-326-6417.

FINANCE AND ADVERTISING BUSINESS MANAGER Deborah Rivera-Wienhold; SENIOR ANALYST Randy Yi; FINANCIAL ANALYSTS Lisa Donovan, Jessica Tierney-Rubin; RIGHTS AND PERMISSIONS: ASSOCIATE Emilie David; ASSISTANT Karen Lentz MARKETING: DIRECTOR John Meyers; ASSOCIATES Mary Ellen Crowley, Amanda Donathen, Allison Pritchard ELECTRONIC MEDIA: MANAGER David Gillikin; INTERNET PRODUCTION MANAGER Lizabeth Harman; ASSISTANT PRODUCTION MANAGER Wendy Stengel; SENIOR PRODUCTION ASSOCIATE Lisa Stanford; PRODUCTION ASSOCIATES Carla Cathey, Mark Croatti, Robert Owens, Louis Williams ADMINISTRATIVE SUPPORT Joyce Scott

PRODUCT ADVERTISING (science_advertising@aaas.org) NATIONAL SALES MANAGER Richard Teeling: 973-694-9173, FAX 973-694-9193 • NORTHEAST AND E. CANADA Elizabeth Pointek: 978-969-1542, FAX 413-480-0008• MIDWEST Rick Bongiovanni: 330-405-7080, FAX 330-405-7081 • WEST COAST/W. CANADA Neil Boylan: 415-673-9265, FAX 415-673-9267 • MID-ATLANTIC AND SOUTHEAST SALES Christopher Breslin: 443-512-0330, FAX 443-512-0331 NEW MEDIA SALES MANAGER Chris Peterson: 410-560-3960, FAX 410 560-3961 • UK/SCANDINAVIA/FRANCE/ITALY/BELGIUM/NETHERLANDS Andrew Davies: (44) 7-071-226-216, FAX (44) 7-071-226-233 • GERMANY/SWITZERLAND/AUSTRIA Tracey Peers: (44) 1-782-752-530, FAX (44) 1-782-752-531 JAPAN Mashy Yoshikawa: (81) 3-3235-5961, FAX (81) 3-3235-5852 • TRAFFIC MANAGER Carol Maddox; TRAFFIC ASSOCIATE Halimah S. Whitby; SENIOR SALES ASSOCIATE Sheila Myers

RECRUITMENT ADVERTISING (science_classifieds@aaas.org); PRODUCTION MANAGER Jennifer Rankin U.S.: SALES MANAGER Gabrielle Boguslawski: 718-491-1607, FAX 202-289-6742; WEST COAST SALES MANAGER Kristine von Zedlitz; EAST COAST SALES MANAGER Jill Steinberg; INTERNET SALES MANAGER Beth Dwyer; ASSISTANT SALES MANAGER Daryl Anderson; SENIOR SALES COORDINATOR Erika Bryant; SALES COORDINATORS Rohan Edmonson, Caroline Gallina, Shirley Young; SALES REPRESENTATIVES Kathleen Clark, Jody Fenty, Christina Geiger, Bren Peters-Minnis; ASSISTANTS Sussy Castilla, Emnet Tesfaye; ASSOCIATES Christine Hall, Dawn Bruno, Dina Freeman; PUBLICATIONS ASSISTANTS Robert Buck, Jane Vaughn; U.K./EUROPE: SALES MANAGER Debbie Cummings; PROMOTIONS COORDINATOR Richard Walters; INTERNET SALES EXECUTIVE Tracy Holmes; SALES EXECUTIVE Bonnie Price Lofton; AUSTRALIA/NEW ZEALAND: Keith Sandell: (61) 02-9922-2977, FAX (61) 02-9922-1100 JAPAN: Mashy Yoshikawa: (81) 3-3235-5961, FAX (81) 3-3235-5852

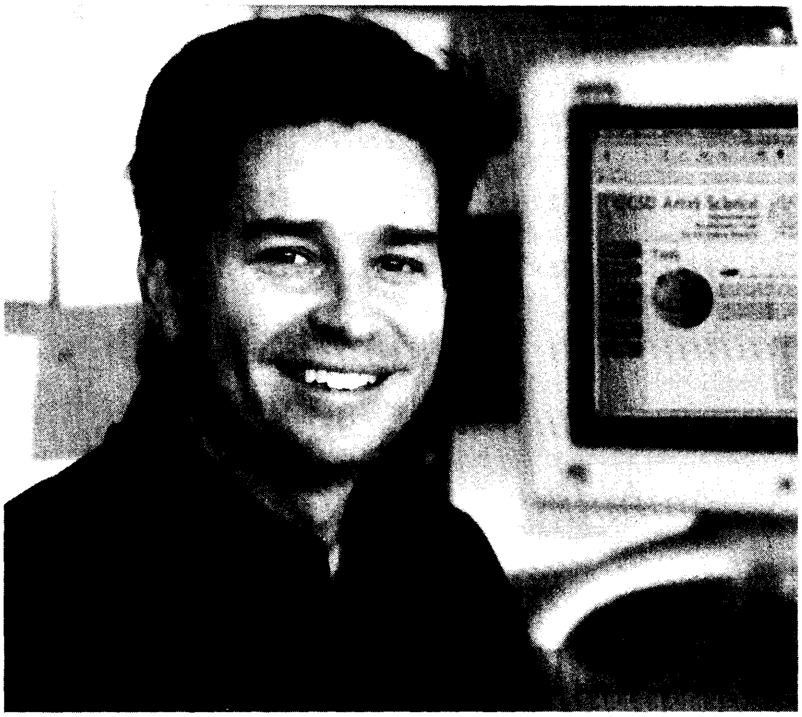
Published by the American Association for the Advancement of Science (AAAS), *Science* serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing 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 FOR CONTRIBUTORS

See pages 145 and 146 of the 5 January 2001 issue or access www.sciencemag.org/misc/con-info.shtml.

Finally, Efficient Intracellular Protein Delivery!



We have used the BioPORTER reagent to study the molecular mechanism of apoptosis and we are planning on using it to investigate host/pathogen relationships. BioPORTER reagent is a new and powerful tool in the functional genomics arsenal.

-Jacques Corbeil
Veterans Medical Research Foundation
Virology and Infectious Diseases Sections
UCSD

Thanks to the BioPORTER reagent, we are quickly getting into a very exciting phase of apoptosis research.

-John C. Reed
Burnham Institute.

BioPORTER™ Protein Delivery Reagent

- **Direct delivery of proteins, peptides, and various macromolecules into cells**
- **Fast and efficient**
- **Easy to use and stable**

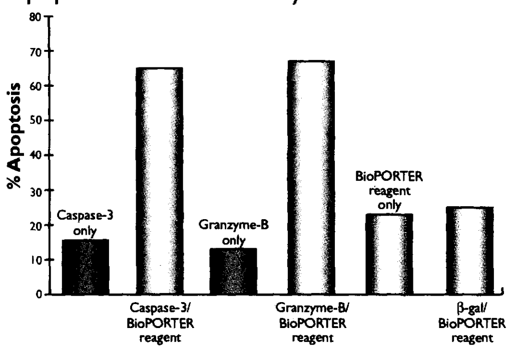
BioPORTER protein delivery reagent is the first and only lipid-based protein delivery system that effectively translocates macromolecules into living cells.* BioPORTER makes proteins or peptides directly available to cellular processes without the need for transcription and translation. BioPORTER reagent interacts non-covalently with the protein or peptide of choice and forms a protective vehicle for immediate delivery into cells.

Now your protein or peptide can be directly available for a variety of studies like intercellular signaling pathways, cell cycle regulation, control of apoptosis, study of oncogenesis and transcription regulation. Call GTS today to speed up your functional protein studies with the BioPORTER protein delivery reagent.

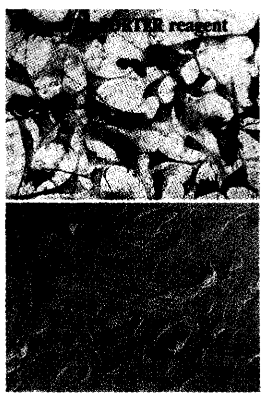
* US and worldwide patents pending

BioPORTER™ Protein Delivery Reagent	
24 reactions	Catalog # BP502401

Apoptotic Protein Delivery in Ki-ras 267B1Cells



Granzyme B (450 ng), Caspase-3 (3.3 ng) or β-galactosidase (2 μg) were added to Ki-Ras 267 cells (prostate cancer) with or without BioPORTER reagent. 24 hours after protein delivery, cells were directly analyzed for apoptosis by flow cytomerty using an Annexin V-FITC assay kit.



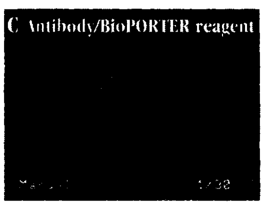


Fig. B/C FITC-Antibody or β-gal Delivery Into Mouse Fibroblasts FITC-labeled antibody (2 μg) or β-gal (0.5 μg) were delivered with 2.5 μl of BioPORTER reagent into NIH/3T3 cells grown on coverslips in serum free conditions. Cells were examined 4 hours after protein delivery.

D

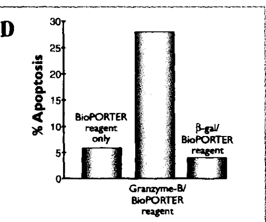


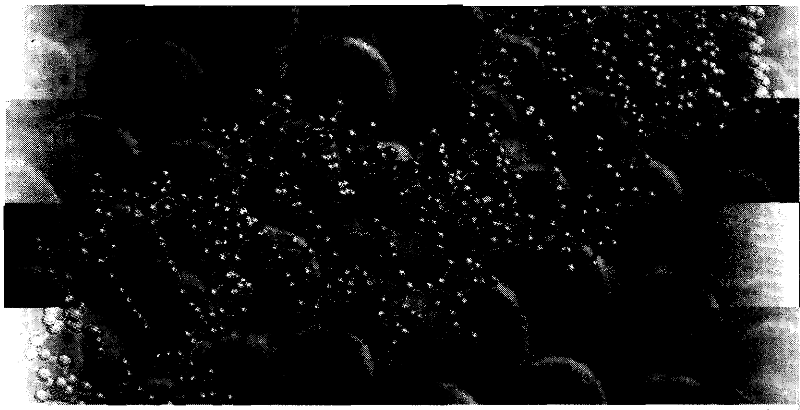
Fig. D Functional Granzyme-B Delivery Into Jurkat Cells Granzyme-B (450 ng) or β-gal (1 μg) were delivered into cells growing in serum-free medium. 24 hours after protein delivery, cells were directly analyzed for apoptosis by flow cytomerty using Annexin V-FITC.

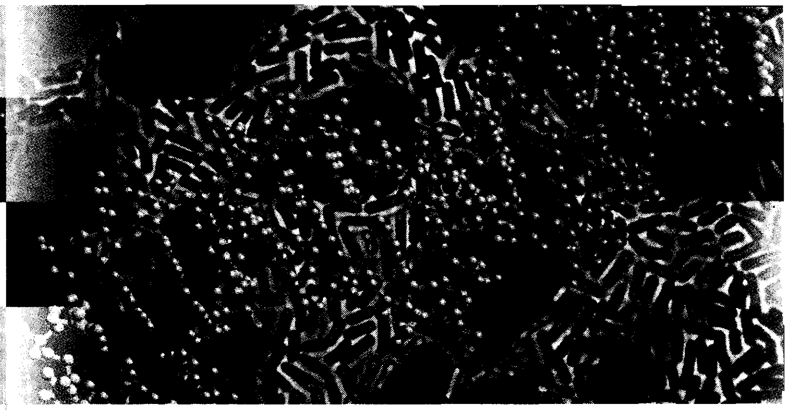
To Order: 888-428-0558

Fax: 858-623-9494
10190 Telesis Court, San Diego, CA 92121, USA
For more information and a list of distributors visit the Gene Therapy Systems web site @
http://www.genetherapysystems.com

GTS
Gene Therapy Systems
"innovations in gene therapy"

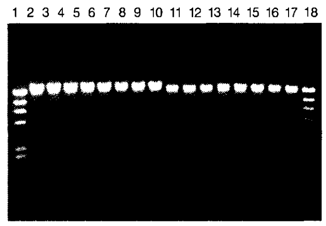
Circle No. 33 on Readers' Service Card





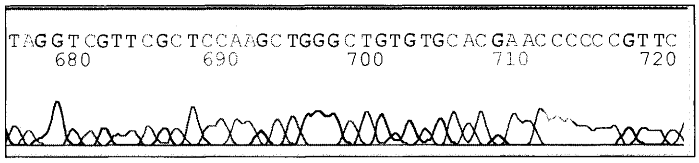
Perfect gDNA from Blood

- Ultra-pure genomic DNA
- Extremely high-molecular weight DNA, with no degradation
- Suitable for long range PCR (up to 24 Kb)
- Consistent high yields
- Rapid, easy handling
- Wide range of applications, also for animal blood



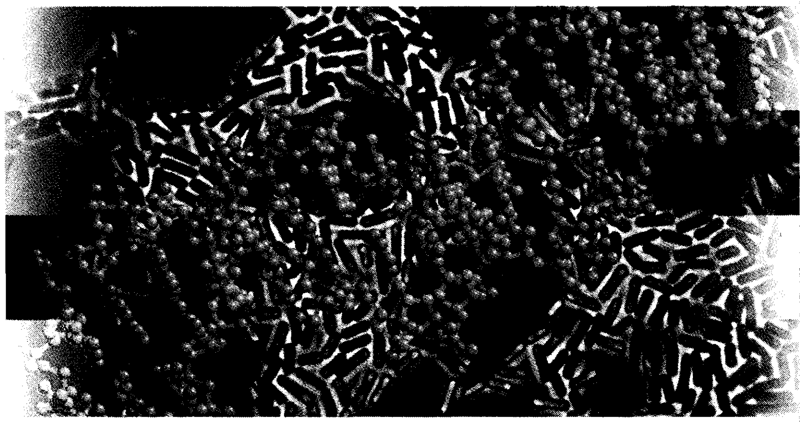
● Yields obtained using the Eppendorf Perfect gDNA Blood Kit and from a competing product. 200 µl fresh human whole blood, 5 µl eluate volume applied.
Lanes 1 and 18: λ *Hind* III Marker
Lanes 2 to 9: Eppendorf gDNA Blood Kit
Lanes 10 to 17: Competing kit

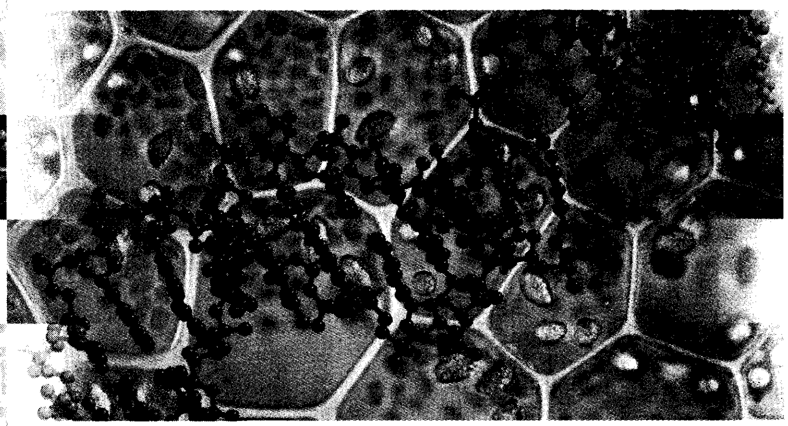
Perfectprep Plasmid 96 Vac Direct Bind



● Part of an ABI Model 3700 automated fluorescent DNA cycle sequencing of pUC19 prepared by the Perfectprep Plasmid 96 Vac, Direct Bind method. Phred Q > 20 = 701.

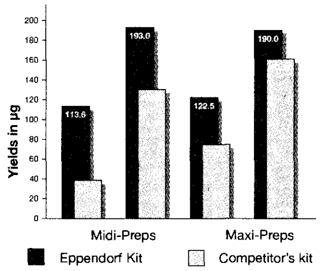
- Ultra-pure plasmid DNA in 96-well format
- Long read lengths with low error rate in sequencing reactions
- Reproducible high yields
- Very consistent elution volumes
- Rapid, easy handling: 96 samples in 30 minutes





Perfectprep® Plasmid

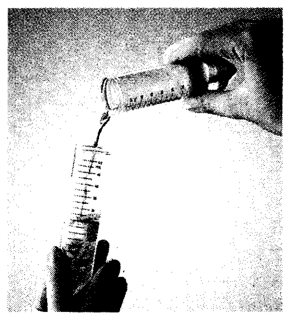
- Ultra-pure plasmid DNA in next to no time
- Consistent high yields
- Outstanding results in sensitive downstream applications (e.g. sequencing, cloning, transfection)
- Easy to handle
- Culture sizes from 1 ml to 800 ml



● Yields obtained using the Perfectprep Kit and a competitor's kit from different bacteria strains with high-copy and low-copy plasmids

Phase Lock Gel®

- Unique barrier simplifies the phenol/chloroform extraction
- Up to 30 % higher nucleic acid yields
- Simple pipetting or decanting of the aqueous DNA solution
- Reduced periods of contact with phenol vapors



Application Hotline:
+49 180-3 66 67 89

eppendorf

In touch with life

Circle No. 6 on Readers' Service Card

Eppendorf AG · 22331 Hamburg · Germany · Phone +49 40-5 38 01-0 · Fax +49 40-5 38 01-556 · e-mail: eppendorf@eppendorf.com · Internet: www.eppendorf.com

Brinkmann Instruments, Inc. One Cantiague Rd. · Westbury, NY 11590-0207 · Phone 800-645-3050 or 516-334-7500 · Fax 516-334-7506
e-mail: info@brinkmann.com · Internet: www.brinkmann.com

2001 Tyler Prize

Jared M. Diamond, Ph.D.

University of California, Los Angeles

Thomas E. Lovejoy, Ph.D.

Smithsonian Institution & The World Bank

The Tyler Prize Medallion

Tyler Prize

The Tyler Prize was established in 1973 by the late John and Alice Tyler as an international award honoring achievements in environmental science, energy and medical discoveries of worldwide importance conferring great benefit on humanity. The Tyler Prize consists of a cash award of $200,000 and the Tyler Prize gold medallion.

The Tyler Prize Executive Committee announces the award of the Tyler Prize for Environmental Achievement to Jared M. Diamond, Ph.D. of the University of California, Los Angeles, and Thomas E. Lovejoy, Ph.D., of the Smithsonian Institution and the World Bank. Drs. Diamond and Lovejoy are recognized for their pioneering roles in conceiving, testing, and demonstrating the theories that today guide the practice of Conservation Biology.

Dr. Diamond, a professor of physiology at the UCLA School of Medicine, conducted ecological studies of bird diversity in New Guinea that enabled him to formulate theories explaining forces structuring communities in nature. His work has led to the recognition of a sub-field of community ecology based on "assembly rules", competition and community dynamics. His theories on area requirements for species led to the theoretical justification of large natural areas. He has significantly contributed to the understanding of ecology by non-ecologists through his regular column in the journal Nature, articles in Discover magazine and two books—The Third Chimpanzee, and Guns, Germs and Steel for which he was awarded the Pulitzer Prize for nonfiction in 1998. Dr. Diamond was awarded the National Medal of Science in 1999.

Dr. Lovejoy, chief biodiversity advisor to the president of the World Bank, on detail from the Smithsonian Institution is a tropical biologist who has worked in the Amazon basin of Brazil since 1965. He is credited with coining the term biological diversity, now shortened to biodiversity, and with Diamond, helped create the field of conservation biology. His research vision led to the adoption of conservation measures in the Amazon. For 14 years, he led the World Wildlife Fund-U.S. In senior advisory positions in the Reagan, Bush and Clinton administrations, and with international organizations, he injected sound science into public policy. Beginning in 1987, he held important environmental positions with the Smithsonian Institution and moved on loan to the World Bank in 1998.

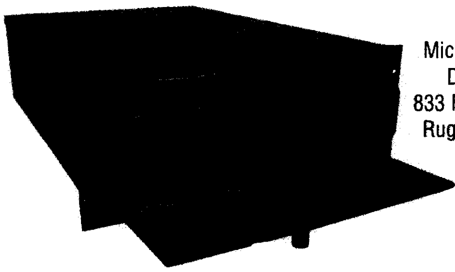
For additional information contact Dr. Linda Duguay, Executive Director, The Tyler Prize
Phone (213) 740-9760, Fax (213) 740-1313, Email tylerprz@usc.edu
Home Page www.tylerprize.usc.edu

The Tyler Prize is administered by the University of Southern California

Genomic Research Leaders Choose Microway® Scalable Clusters

Eos Biotechnology, Marine Biological Laboratory, Millennium Pharmaceuticals, Mount Sinai Medical School, NIH, Pfizer, and Rockefeller University All Choose Microway Custom Clusters and Workstations for Reliability, Superior Technical Support and Great Pricing.

- **Microway Dual Alpha Rackmounts and Towers** *For maximum performance choose the Alpha based 1U CS20, 4U UP2000+ or 4U 264DP - 833 MHz/DDR Cache*
- **Dual Pentium III and Pentium 4 Clusters**
- **Myrinet, Gigabit Ethernet or Dolphin Wulfkit High Speed Low Latency Interconnects**
- **RAID and Fibre Channel Storage Solutions**



Microway® Screamer™ Dual Alpha UP2000+ 833 MHz, 4MB Cache in RuggedRack™ Chassis with Redundant Power Supply

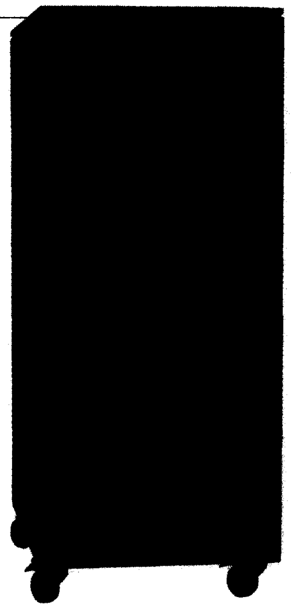
Microway Designs Cost-Effective, Custom Linux and UNIX Workstations and Beowulf Clusters for Genomic Research... That WORK!

Microway has been serving the scientific computing community since 1982, when our pioneering software made it possible to use an 8087 in the IBM-PC. In 1987 we created the world's first PC parallel processing systems. Since then, our QuadPuter™ architecture has migrated from Transputers to i860s and finally to Alphas in 1995. Over the past five years, we have engineered and delivered over 300 clusters that utilized PVM or MPI running on Tru64 UNIX or Linux. As a software developer and hardware manufacturer, we know the value of extensive testing and validation. We are experts at configuring and validating the low latency interconnects we employ in our clusters. Our technical support is legendary — the systems we sell arrive at your site and WORK! Los Alamos chose Microway to maintain and upgrade its 144 node Alpha Avalon Cluster because of our reputation. Examples of large clusters which we have sold include 400+ nodes at the University of Wisconsin and 200+ nodes at Rockefeller University. **Microway is API Networks' Top North American Channel Partner.**

API NetWorks

Microway offers five different Alpha packaging options — 4U RuggedRack™, 3U, full tower, QuadPuter and 1U. Our 264DP features two 21264's with up to 4 GB of memory in our custom 4U RuggedRack, which features front accessible redundant power supplies and hard disks. We also offer a dual Alpha UP2000+ running at 833MHz with 2GB of memory in all five options. Our QuadPuter chassis holds 4 processors and up to 4GB memory. The 1U CS20 dual Alpha is the highest density, computational platform available.

Microway custom configures **Linux, NT and UNIX workstations, clusters and servers** plus state of the art **RAID** systems. If you need a quality product that is fine tuned and built to last, from a company that will be around to support you for years to come, **Microway is The Number One Choice.**



"Most Powerful, Highest Density Computational Platform On the Planet"

Microway Scalable 25 Node 50 Processor Cluster Using CS20 Dual 833 MHz Alphas and Myrinet Interconnect Yielding Peak Throughput of 82.5 Gigaflops.

"I have ordered numerous Alpha and Intel-based servers and workstations from Microway running both Tru64 UNIX and Linux. We have been very happy with both the performance and great value of Microway's products. The major UNIX vendors don't come close to Microway in this regard, and we have also found that Microway provides better value than other Linux hardware vendors. I have also used Microway's tech support and was pleased with their response. We've been using their systems for over a year and have had only a couple of minor incidents which were dealt with promptly."

— David Kristofferson, Ph.D., MBA, Director of Information Systems, Eos Biotechnology, Inc.

Find out why over 75% of Microway's sales come from repeat customers. Please call 508-746-7341 for a technical salesperson who speaks your language!

Visit us at www.microway.com

Circle No. 46 on Readers' Service Card

Microway®
Technology you can count on℠

Research Park Box 79, Kingston, MA 02364 • 508-746-7341 • info@microway.com