



AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

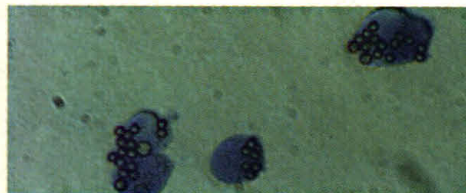
19 APRIL 1996
VOL. 272 • PAGES 321-452

\$7.00



Sometimes
the best ideas
are the
simple ones.

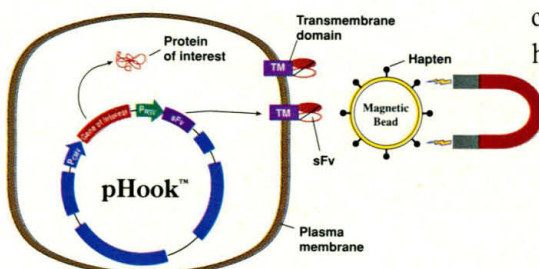
*Introducing the only way to rapidly
select transiently transfected cells.*



*Transfected SKBR-3 cells after
selection with Capture-Tec™ Beads*

Selection for Transients.

The problem with transient transfection is that efficiencies are typically low and variable, from 5 - 50%. Often, research requires the use of homogeneous cell populations. Invitrogen's new Capture-Tec™ System allows you to purify a population of transiently transfected cells that contain your gene of interest just hours after transfection.



It's Simple.

The key to selection is the innovative pHook™ vectors. These vectors express a single-chain antibody (sFv) to a specific hapten molecule. This sFv is displayed on the surface of the transfected cells. Your gene of interest is either cotransfected with or subcloned into a pHook™ vector. Transfected cells are selected with hapten-coated magnetic beads. It's that simple.

Imagine the Possibilities.

Captured cells can be used to study temporal events along developmental pathways, acute effects of constitutive mutations, or in any experiment that requires a homogeneous population of transfected cells. These easy-to-use kits come complete with vector, hapten-coated beads, and a control vector. A convenient magnetic stand is also available. Call Invitrogen today for more information on this exciting new technology!



Telephone (619) 597-6200
Fax (619) 597-6201
<http://www.invitrogen.com>
1-800-955-6288

EUROPEAN HEADQUARTERS:
Invitrogen BV
De Schelp 12, 9351 NV Leek
The Netherlands
Tel: +31 (0) 594 515 175
Fax: +31 (0) 594 515 312
Email: tech_service@invitrogen.nest.nl

TOLL FREE TELEPHONE NUMBERS:
Austria 0660 8127
Belgium 0800 111 73
Denmark 800 188 67
Finland 990 31 800 5345
France 19 31 800 5345
Germany 0130 8100 43
The Netherlands 06 022 8848
Norway 800 113 70
Sweden 020 795 369
Switzerland 155 1966
UK 0800 96 61 93

Distributors:
Australia 03 9562 6888
Hong Kong 886 2 381 0844
Israel 02 524 447
Italy 02 38 10 31 71
Japan 03 5684 1616
Korea 822 569 6902
Singapore 65 779 1919
or 29 29 783
Spain 03 450 2601
Taiwan 886 2 381 0844
From all other countries, please contact our
European headquarters at +31 (0) 594 515 175.

Circle No. 30 on Readers' Service Card

With Stratagene's New Seamless™ Cloning Kit*



make large-scale changes to genes in 1 day!

PRECISE

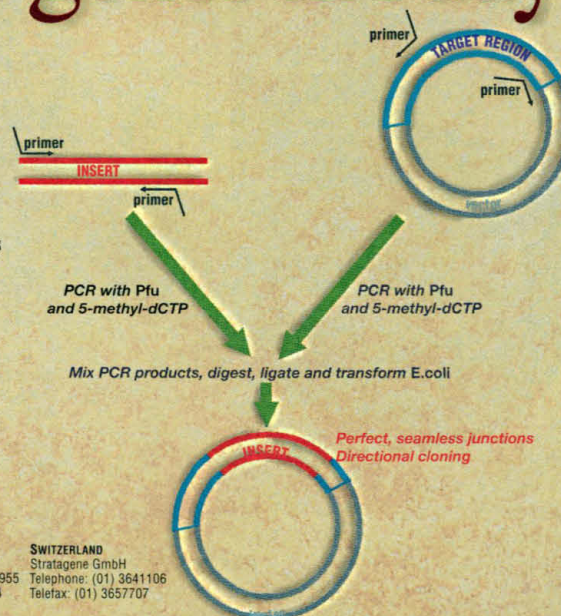
- Directional
- Low background
- >90% cloning efficiency
- No extraneous bases

VERSATILE APPLICATIONS

- Expression cloning
- Domain substitution
- Insertions and deletions of DNA sequences
- Chimeric gene construction: receptors, antibodies, and other fusion proteins

SIMPLE 1 DAY CLONING

1. Design your primers
2. PCR†
3. Digest/Ligate
4. Transform *E. coli*



- No restriction sites needed
- No fragment isolation
- No extraneous nucleotides
- Seamless directional cloning

Another creative cloning solution from Stratagene!

SEAMLESS™ CLONING KIT CATALOG# 214400

Padgett, K.A., and Sorge, J.A. (1996) Gene 168:31-35

*PATENT PENDING

† Purchase of these enzymes is accompanied by a license to use them in the Polymerase Chain Reaction (PCR) process in conjunction with an Authorized Thermal Cycler. Stratagene's PCR products are sold under licensing arrangements with Roche Molecular Systems, Inc., F. Hoffmann-La Roche Ltd. and The Perkin-Elmer Corporation.

INTERNET MAIL
techservices@stratagene.com

USA
Corporate Headquarters
(800) 424-5444
(619) 535-5400
Fax: (619) 535-0045

GERMANY
Stratagene GmbH
Telephone: (06221) 400634
Telefax: (06221) 400639

UNITED KINGDOM
Stratagene Ltd.
Telephone: (01223) 420955
Telefax: (01223) 420234

SWITZERLAND
Stratagene GmbH
Telephone: (01) 3641106
Telefax: (01) 3657707



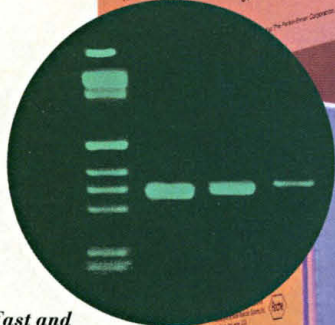
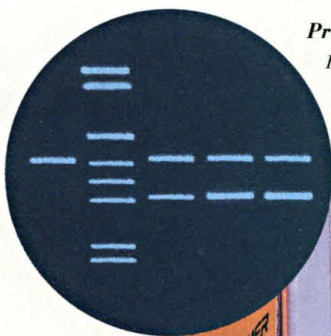
Circle No. 62 on Readers' Service Card

NEW!
FOR LONG RT PCR, TRY THE
GENEAMP® XL RNA PCR KIT

Great choices for guaranteed RNA PCR.

Proven.

For gene expression detection, cDNA synthesis and cloning, the GeneAmp® RNA PCR Kit utilizes MuLV RT and AmpliTaq® DNA Polymerase.



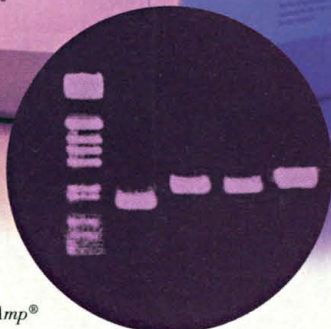
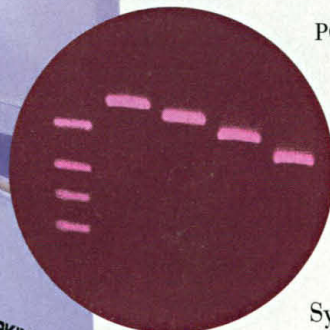
Fast and Easy-to-Use.

The GeneAmp® EZ rTth RNA PCR Kit uses a single buffer, single-enzyme system for faster and easier multi-sample screening.



Economical.

The GeneAmp® RNA PCR Core Kit combines proven performance and cost efficiency utilizing your own positive controls.



Powerful.

For RNA with problematic secondary structure, the GeneAmp® Thermostable rTth Reverse Transcriptase RNA PCR Kit offers higher sensitivity and features rTth DNA Polymerase for high-temperature reverse transcription and PCR.

Not everyone is looking for the same thing in an RNA PCR kit. Different applications have different requirements. And different laboratories have specific needs and preferences.

With our family of GeneAmp RNA PCR Kits, you can perform RNA PCR the way that works best for you—and your samples.

Each Perkin-Elmer kit offers different advantages. All are optimized on our GeneAmp® PCR Instrument Systems and are backed by our unique PCR Performance Guarantee. Every kit comes complete with reverse transcription and PCR components.

Perkin-Elmer offers the world's most comprehensive range of technologies, expertise, and support in PCR, genetic analysis, nucleic acid synthesis, and protein research.

GeneAmp RNA PCR Kits. Now five choices—guaranteed. To order or to request information, call 1-800-327-3002. Outside the U.S. and Canada, contact your local Perkin-Elmer representative. On the Internet, contact us at <http://www.perkin-elmer.com>.



PERKIN ELMER

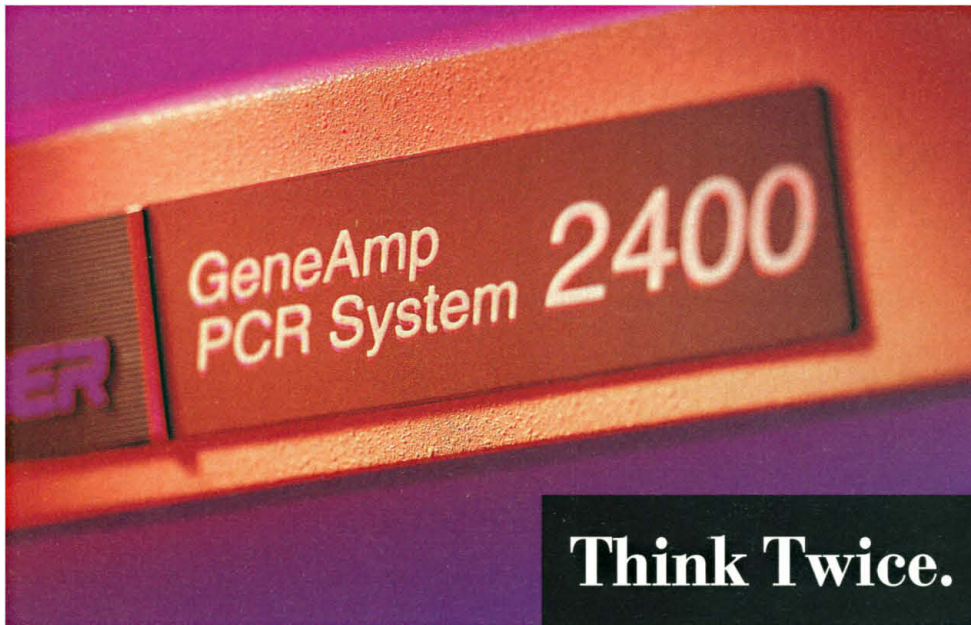
Mississauga, Canada Tel: (800) 668-6913 Fax: (905) 821-8246
Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223
United States Tel: 1-800-345-5224 Fax: 415-572-2743

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

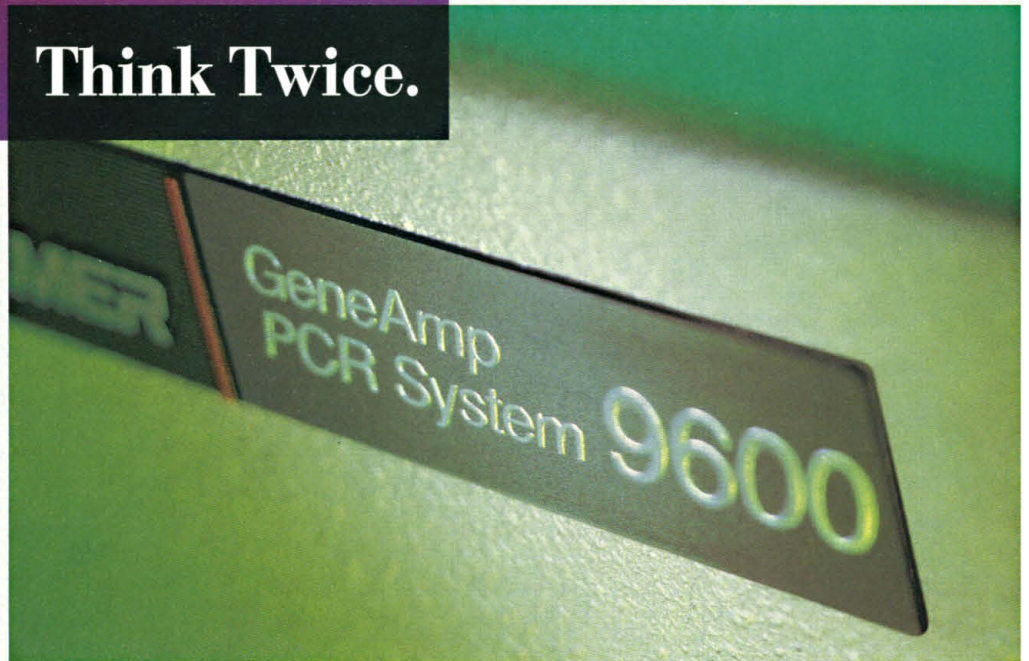


GeneAmp and AmpliTaq are registered trademarks of Roche Molecular Systems, Inc. The GeneAmp PCR process is covered by the U.S. patents owned by Hoffmann-La Roche, Inc. and F. Hoffmann-La Roche Ltd. Perkin-Elmer is a registered trademark of The Perkin-Elmer Corporation.

PCR Thermal Cyclers



Think Twice.



Thinking about a high performance thermal cycler for PCR at an affordable price? Think *twice*—about the GeneAmp® PCR System 2400 and the GeneAmp® PCR System 9600 from Perkin-Elmer.

Both GeneAmp® PCR Instrument Systems set the standard for reliable performance for oil-free PCR applications. And both offer unprecedented accuracy, reproducibility and speed.

Designed for the individual researcher, the 24-well System 2400 features a unique graphical user interface for faster, easier programming. The System 9600 is ideal for 96-well applications and lets you use PCR protocols developed on the 2400, to achieve the same results without reoptimization.

Perkin-Elmer offers a full line of optimized PCR reagents, specialty kits for advanced applications, and disposables for GeneAmp PCR Instrument Systems. All are backed by our PCR performance guarantee, worldwide technical sup-

port and comprehensive expertise—just what you expect from the leader in PCR technology.

So think twice. Choose the system that fits your throughput needs and budget. With the GeneAmp PCR System 2400 and the GeneAmp PCR System 9600, you can't go wrong.

To order or to request information, call 1-800-345-5224. Outside the U.S. and Canada, contact your local Perkin-Elmer representative. You can also visit our home page on the Internet at <http://www.perkin-elmer.com>.

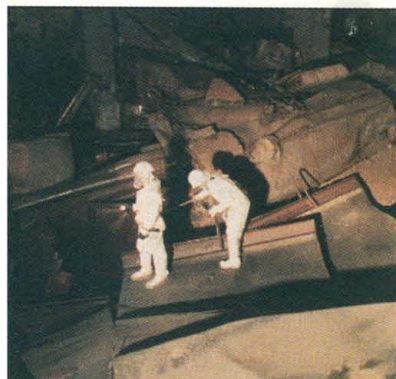
PERKIN ELMER

Europe: Langen, Germany Tel: 49 6103 708 301 Fax: 49 6103 708 310
Japan: Tokyo, Japan Tel: (0473) 80-8381 Fax: (0473) 80-8505
Latin America: Mexico City, Mexico Tel: 52-5-651-7077 Fax: 52-5-593-6223
Australia: Melbourne, Australia Tel: (03) 9212-8585 Fax: (03) 9212-8502

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



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



352

Ten years after Chernobyl



398

Steroid hormones in plants

NEWS

- URI Tries Downsizing by Formula **342**
How Much Is a Program Worth? **343**

- Deliberate Flood Renews Habitats **344**

- Report Urges NSF to Promote Teaching **345**

- First Americans: Not Mammoth Hunters, But Forest Dwellers? **346**

- Gambling on a Martian Landing Site **347**

- A 24-Hour Circadian Clock Is Found in the Mammalian Retina **349**

SPECIAL NEWS REPORT

- The Explosions That Shook the World **352**
Power Needs Keep Flawed Reactors Running **354**

- Chernobyl Research Becomes International Growth Industry **355**

- Children Become the First Victims of Fallout **357**

- Leukemia Studies Continue to Draw a Blank **358**
Poor Dose Data Hamper Study of Cleanup Workers **360**

PERSPECTIVES

- Giant Magnetoresistance in Transition Metal Oxides **369**
C. N. R. Rao and A. K. Cheetham

- Green Light for Steroid Hormones **370**
D. W. Russell

- Histone Deacetylase: A Regulator of Transcription **371**
A. P. Wolffe

ARTICLE

- Paleoindian Cave Dwellers in the Amazon: The Peopling of the Americas **373**
A. C. Roosevelt, M. Lima da Costa, C. Lopes Machado, M. Michab, N. Mercier, H. Valladas, J. Feathers, W. Barnett, M. Imazio da Silveira, A. Henderson, J. Sliva, B. Chernoff, D. S. Reese, J. A. Holman, N. Toth, K. Schick

DEPARTMENTS

- THIS WEEK IN SCIENCE **329**

- EDITORIAL **333**
Ambiguity in the Practice of Science
F. Grinnell

- LETTERS **335**
Politics and Science: H. D. Kay; H. Lardy • Internet Access: M. E. Gozum; R. L. Meier and R. Standish; R. F. S. Job; J. J. Beintema • Nile Delta Erosion: R. L. Wiegel • New Database: J. Vondrasek and A. Wlodawer • Affirmative Action: E. B. Hook • DOE Privatization: R. I. Mateles

- SCIENCESCOPE **341**

- RANDOM SAMPLES **351**
The Last of the Cahokians • Hollywood Chain Reaction • History Standards Embrace Science • Spying on Marine Microorganisms

- BOOK REVIEWS **363**
Engineers of Dreams, reviewed by E. L. Kemp • *Physics of the Magnetopause*, F. Bagenal • *Conservation Genetics* • Books Received

- PRODUCTS & MATERIALS **428**

Board of Reviewing Editors

Frederick W. Alt
Don L. Anderson
Michael Ashburner
Stephen J. Benkovic
Alan Bernstein
David E. Bloom
Piet Borst
Henry R. Bourne
Michael S. Brown
James J. Bull
Kathryn Calame
Dennis W. Choi

David Clapham
Adrienne E. Clarke
John M. Coffin
F. Fleming Crim
Paul J. Crutzen
James E. Dahlberg
Robert Desimone
Paul T. Englund
G. Ertl
Richard G. Fairbanks
Douglas T. Fearon
Harry A. Fozzard

Roger I. M. Glass
Stephen P. Goff
Peter N. Goodfellow
Corey S. Goodman
Peter Gruss
Philip C. Hanawalt
Nobutaka Hirokawa
Tomas Hökfelt
Tasuku Honjo
Susan D. Iversen
Eric F. Johnson
Stephen M. Kosslyn

Michael LaBarbera
Nicole Le Douarin
Charles S. Levings III
Harvey F. Lodish
Richard Losick
Reinhard Lührmann
Ruth Lynden-Bell
Seth Marder
Diane Mathis
Anthony R. Means
Shigetada Nakanishi
Kim Nasmyth

Roger A. Nicoll
Staffan Normark
Stuart L. Pimm
Yeshayau Pocker
Ralph S. Quatrano
Martin Raff
V. Ramanathan
Douglas C. Rees
T. M. Rice
David C. Rubie
Erkki Ruoslahti
Gottfried Schatz

Jozef Schell
Ronald H. Schwartz
Terrence J. Sejnowski
Thomas A. Steitz
Michael P. Stryker
Tomoyuki Takahashi
Masatoshi Takeichi
Keiji Tanaka
Robert T. N. Tjian
Yoshinori Tokura
Emil R. Unanue
Geerat J. Vermeij

Bert Vogelstein
Arthur Weiss
Zena Werb
George M. Whitesides
Owen N. Witte
William A. Wulf

Quartz spear point (6.4 centimeters long, museum catalog number 1273) from the Tapajós River. Excavations in a painted cave at Monte Alegre, Brazil, at the confluence of the Tapajós and Amazon rivers uncovered stone tools, pigment, and food remains from a late

Ice Age culture. These early foragers, distinct from the Clovis and Folsom cultures of North America, penetrated the equatorial lowlands of South America. See page 373 and the related News story on page 346. [Photo: R. Fialdini, Museu Paraense Emilio Goeldi, and B. Safra]



REPORTS

Molecularly Adsorbed Oxygen Species on Si(111)-(7×7): STM-Induced Dissociative Attachment Studies

R. Martel, Ph. Avouris, I.-W. Lyo

385

Spatiotemporal Chaos in Electroconvection

M. Dennin, G. Ahlers, D. S. Cannell

388

Continental Crust, Crustal Underplating, and Low-Q Upper Mantle Beneath an Oceanic Island Arc

K. Suyehiro, N. Takahashi, Y. Ariie, Y. Yokoi, R. Hino, M. Shinohara, T. Kanazawa, N. Hirata, H. Tokuyama, A. Taira

390

Rapid Exchange Between Soil Carbon and Atmospheric Carbon Dioxide Driven by Temperature Change

S. E. Trumbore, O. A. Chadwick, R. Amundson

393

Engineered Interfaces for Adherent Diamond Coatings on Large Thermal-Expansion Coefficient Mismatched Substrates

R. K. Singh, D. R. Gilbert, J. Fitz-Gerald, S. Harkness, D. G. Lee

396

A Role for Brassinosteroids in Light-Dependent Development of *Arabidopsis*

J. Li, P. Nagpal, V. Vitart, T. C. McMorris, J. Chory

398

Switching from Cut-and-Paste to Replicative Tn7 Transposition

E. W. May and N. L. Craig

401

Independent Modes of Natural Killing Distinguished in Mice Lacking *Lag3*

T. Miyazaki, A. Dierich, C. Benoist, D. Mathis

405

A Mammalian Histone Deacetylase Related to the Yeast Transcriptional Regulator Rpd3

J. Taunton, C. A. Hassig, S. L. Schreiber

408

Regulation of an Early Developmental Checkpoint in the B Cell Pathway by Igβ

S. Gong and M. C. Nussenzweig

411

Homocysteine Antagonism of Nitric Oxide-Related Cytostasis in *Salmonella typhimurium*

M. A. De Groote, T. Testerman, Y. Xu, G. Stauffer, F. C. Fang

414

CNS Gene Encoding Astrotactin, Which Supports Neuronal Migration Along Glial Fibers

C. Zheng, N. Heintz, M. E. Hatten

417

Circadian Rhythms in Cultured Mammalian Retina

G. Tosini and M. Menaker

419

Requirement for α -CaMKII in Experience-Dependent Plasticity of the Barrel Cortex

S. Glazewski, C.-M. Chen, A. Silva, K. Fox

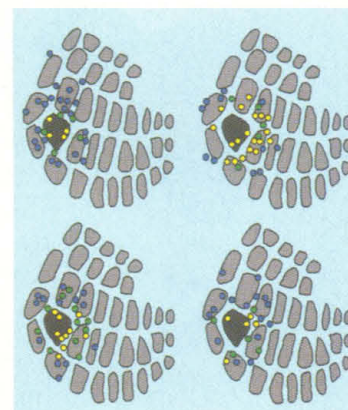
421

TECHNICAL COMMENTS

Does Macroscopic Quantum Coherence Occur in Ferritin?

J. Tejada, A. Garg, S. Gider, D. D. Awschalom, D. P. DiVincenzo, D. Loss

424



421

LTP linked to experience-dependent plasticity

AAAS Board of Directors

Rita R. Colwell
Retiring President,
Chairman
Jane Lubchenco
President
Mildred S. Dresselhaus
President-elect

Marcia C. Linn
Michael J. Novacek
Anna C. Roosevelt
Jean E. Taylor
Nancy S. Wexler

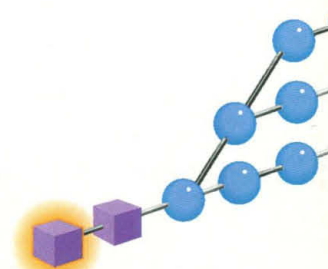
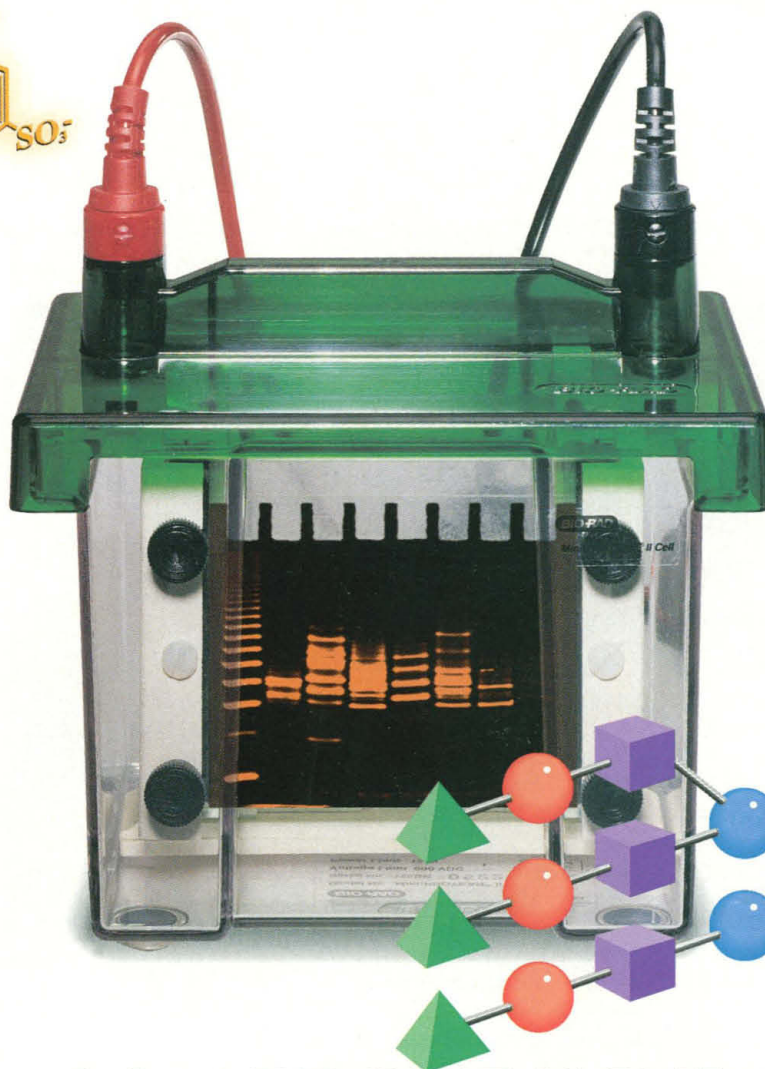
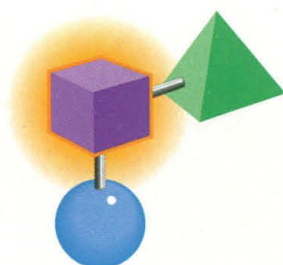
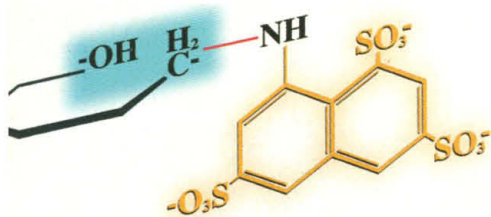
Sheila Jasanoff
William A. Lester Jr.
Simon A. Levin

William T. Golden
Treasurer
Richard S. Nicholson
Executive Officer

■ **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. Second-class postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 1996 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): \$102 (\$55 allocated to subscription). Domestic institutional subscription (51 issues): \$250. 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. Printed in the U.S.A.

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. **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 0036-8075/93 \$4.00. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.



Your Mini-PROTEAN® II Cell can separate *more* than just proteins

Answering fundamental questions about the structure of carbohydrates and glycoproteins just got easier. With Bio-Rad's new Glyco Analysis Kits, you can capture important information about glycoproteins using simple and familiar electrophoresis techniques and the Mini-PROTEAN II Cell. *Confirm glycosylation. Separate the oligosaccharides*

**Introducing a simple alternative for
glycoprotein and carbohydrate analysis!**

from the protein for further study. Characterize and sequence. And the new Glyco Doc Imager will assist you in documentation and quantification. To find out more about this simple alternative for glycoprotein analysis, call 1-800-4BIORAD, or contact your local sales representative.



ISO 9001 Registered

BIO-RAD

**Bio-Rad
Laboratories**

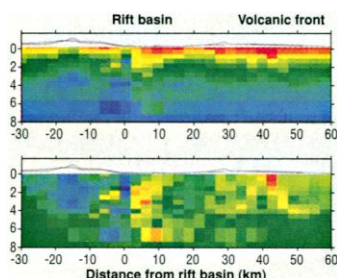
Life Science Group

U.S. (800) 4BIORAD California (510) 741-1000 Australia 02-9914-2800 Austria (1)-877 89 01 Belgium 09-385 55 11 Canada (905) 712-2771 China (01) 2046622 Denmark 39 17 9947
Finland 90 804 2200 France (1) 49 60 68 34 Germany 089 31884-0 Hong Kong 7893300 India 91-11-461-0103 Italy 02-21609 1 Japan 03-5811-6270 The Netherlands 0318-540666
New Zealand 09-443 3099 Singapore (65) 272-9877 Spain (91) 661 70 85 Sweden 46 (0) 8-735 83 00 Switzerland 01-809 55 55 United Kingdom 0800 181134 SIG 020996

Circle No. 31 on Readers' Service Card

Clues to continents

When two oceanic plates collide, one plate is usually forced to subduct beneath the other. Earthquakes and volcanism occur as the plates grind against each other, eventually forming an oceanic island arc. Suyehiro *et al.* (p. 390) used local seismicity along with a reflection and refraction survey to model the structure of the crust and upper mantle beneath the Izu-Ogasawara island arc. A relatively high velocity granitic zone was found at mid-crustal levels, which suggests that continental crust may be derived



from oceanic subducting slabs. Such a mechanism might help explain how continents formed.

Holding fast

Diamond coatings are desirable on metal and metal carbide parts as hard, wear-resistant coatings, but adherence of such films on these substrates is often poor, in part because the different thermal expansion properties of the coating and the substrate. Singh *et al.* (p. 396) pretreated the substrate by laser-induced microroughening and improved the adherence of diamond coating as measured by scratch and indentation tests.

Evading NO

Bacteria that infect a host have their own mechanisms of deflecting the host's defenses. De

Paleoindian life in the Amazon rainforest

Sites in North America, such as Clovis, indicate the emergence approximately 11,000 years ago of a culture based on hunting large game over open habitats. Consistent evidence for the situation in South America for this same period has been more difficult to obtain. Roosevelt *et al.* (p. 373; see cover and the news story by Gibbons, p. 346) surveyed several Amazonian sites and found evidence from a cave campsite for a culture based on tropical floodplain and forest foraging. This site, which appears to have been occupied between 10,000 and 11,200 years ago, revealed finely chipped stone tools and stylized rock paintings.

Groote *et al.* (p. 414) report that *Salmonella typhimurium* protects itself from noxious nitric oxide (NO) produced by the cells of infected mice by producing homocysteine. The homocysteine apparently accepts transfer of nitrosonium from S-nitrosothiols, thus diverting NO away from sensitive cellular targets. Mutant bacteria that fail to synthesize homocysteine were more susceptible to NO donor compounds and were less virulent in mice. Accumulation of homocysteine occurs in association with human vascular and neurological disease, and its interaction with signals mediated by NO could represent a mechanism for these effects.

Steroids in plant development

In animals, steroid hormones are crucial in development, but the physiological role of plant steroids has been unclear. Li *et al.* (p. 398; see the Perspective by Russell, p. 370) now show that a mutation in the *DET2* gene in *Arabidopsis*, which is similar in sequence to genes for mammalian steroid 5 α -reductases, leads to defects in light-regulated developmental steps. However, the mutants can be rescued by application of the plant steroid brassinolide. These results suggest a role for

plant steroids in the transduction of light-mediated developmental signals.

View to a killer

Homology between the *Lag3* gene, which is expressed in activated natural killer (NK) cells and stimulated T cells, and the *CD4* gene suggested that its product, LAG3, might be involved in controlling T cell responses. Miyazaki *et al.* (p. 405) produced *Lag3* knockout mice and found that these mice are apparently normal except for defects in the killing of certain target tumor cells by NK cells; the killing of nontransformed cells deficient in major histocompatibility complex class I molecules still occurred. These results suggest multiple NK pathways and that LAG3 acts as receptor or coreceptor for defining these modes.

Histones and transcription

Modifications of histone proteins bound to DNA are thought to influence the access of transcription factors to regulatory sites in the DNA. Inhibition of histone deacetylase in mammalian cells causes arrest of the cell cycle in G₁ or G₂ phase. Taunton *et al.* (p. 408; see the

Perspective by Wolffe, p. 371) have purified and cloned the histone deacetylase catalytic subunit from human Jurkat T cells. The predicted protein is similar to RPD3, a transcription factor from yeast. These results help to explain how regulatory modification of histones contributes to transcriptional regulation at specific promoters.

Following a lead

During development of the vertebrate brain, cortical neurons migrate away from their birthplaces to form the distinctive layers of the mature brain. The neurons follow routes defined by fibers of glial cells. Zheng *et al.* (p. 417) find that the protein astrotactin, known to aid this guided migration in the cerebellum, is expressed in various parts of the brain where laminar structures are formed by migrating neurons. Astrotactin mediates the interaction between migrating neuron and guiding glial cell fiber.

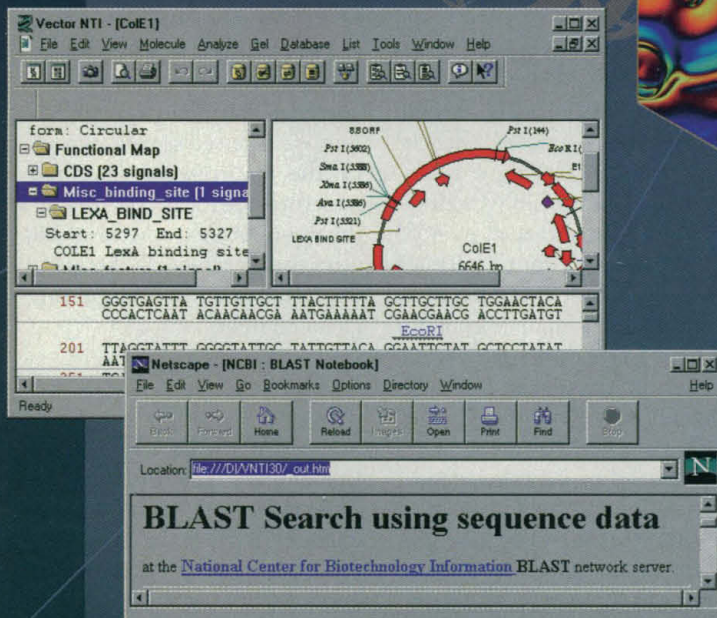
Links to LTP

In mammals, stable changes in sensory input can induce changes in the brain itself. The relation between such experience-dependent plasticity and molecular responses to stimulation, such as the long-term potentiation (LTP) seen at individual synapses, has been unclear. Glazewski *et al.* (p. 421) find that adult, but not adolescent, mice lacking the gene for α -CaMKII, a protein known to be involved in LTP, show less than normal modulation of their cortical response when sensory input from their whiskers is changed, thus linking LTP and experience-dependent plasticity.

Vector NTI

The Universal Software Solution for Bio-Medicine

InforMax's revolutionary new software, Vector NTI, is the cutting edge in computer support of molecular biology. Our approach in designing biological software integrates mathematical precision and deep understanding of your needs, so you can fully enjoy excellent graphics, thorough analyses and clear, simple and precise logic. Just install our demo version and let Vector NTI speak for itself.



Vector NTI features:

- Access to Internet resources
- Automatic design of molecules
- Advanced PCR analysis
- Maintaining parent-descendent trees
- Professional quality database
- Dynamic electrophoresis simulation
- Graphical editing of molecules
- Publication quality graphics

To receive a free demo, download it from our Web site or send us a request via email or fax for a hard copy. Please specify the platform you use (MAC or Windows).

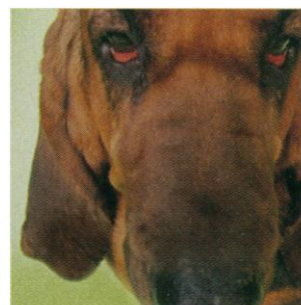
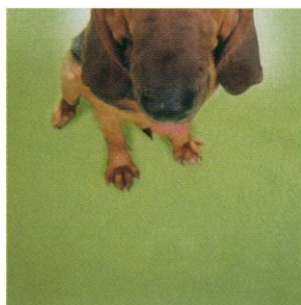
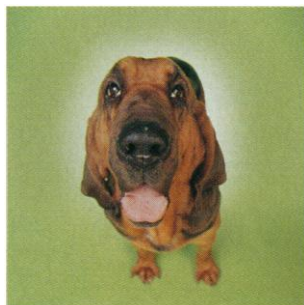


InforMax, Inc.
444 North Frederick Avenue, Suite 308
Gaithersburg, MD 20877 USA
(800) 357-3114 or (301) 216-0586

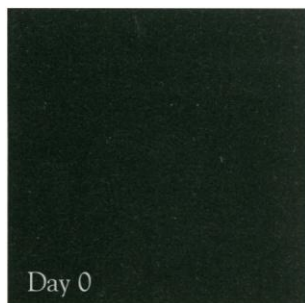
Fax (301) 216-0087
informax@informaxinc.com
<http://www.informaxinc.com> or
<http://www.access.digex.net/~informax/home.html>
Circle No. 55 on Readers' Service Card

Problem Solving • Consulting • Software Development • System Integration

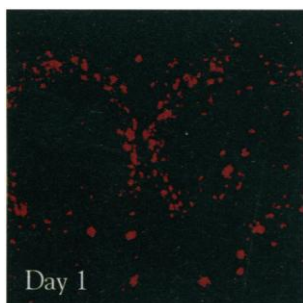
TRACKS LIKE CRAZY.



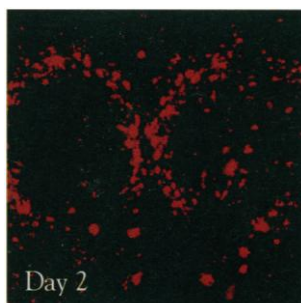
SO DO THESE.



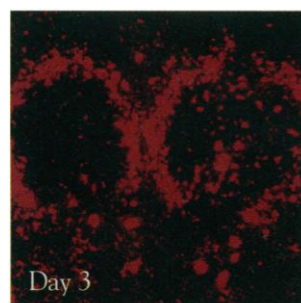
Day 0



Day 1



Day 2



Day 3

PKH Fluorescent Cell Linker Kits. Only From Sigma.

PKH kits always get their cell. That's because we're the only people who have everything you'll need in a single kit. Our PKH linker kits provide intense, fluorescent labeling of live cells over an extended period of time, with no apparent toxic effects. PKH linker kits are effective for a variety of cell types and exhibit no leaking, nor transfer from cell to cell — offering stable, clear, intense, accurate and reproducible fluorescent labeling of cells.

Our red and green fluorescent linkers mimic existing fluorophores, allowing you to use existing detection equipment and current fluorescent filters.

Our kits offer a combination of fluorescent cell linkers and diluent with everything very easy to use. Because of the easy use and effectiveness, the success of our PKH kits is well-documented. In short, we offer everything you need for easy and completely accurate cell tracking.

So if you want to track like crazy, put the best "tracker" on the case. PKH Fluorescent Cell Linker Kits — only from Sigma. The others? They're still barking up the wrong tree.

For ordering or information, call 1-800-325-3010 (USA/Canada) or 314-771-5750 (call collect outside USA and Canada), or contact your local Sigma office.

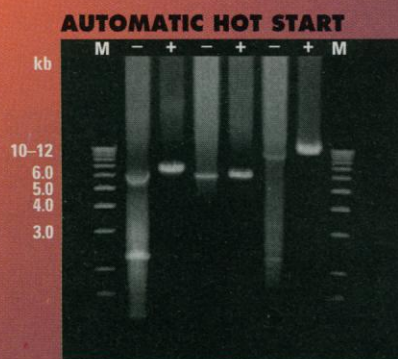
SIGMA
BIOSCIENCES™

Sigma Chemical Company
P.O. Box 14508
St. Louis, MO 63178 USA

Distributed for Phanos Technologies

Circle No. 47 on Readers' Service Card

GET THE CLONTECH PCR ADVANTAGE



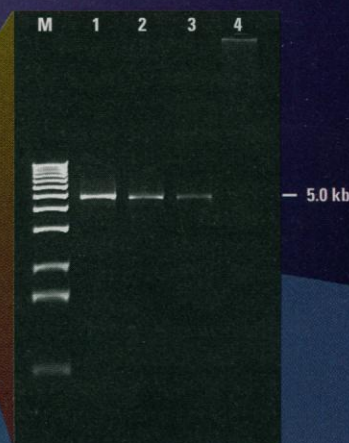
Amplification of three different single-copy genes from human genomic DNA with (+) [using the Advantage Tth Polymerase Mix] and without (-) TthStart Antibody. M = 1-kb DNA ladder.

LONGER DISTANCES



Amplification of a pWE15 cosmid clone (38 kb) and the full-length human mitochondrial genome (16.5 kb) using the Advantage Genomic PCR Kit. M = λ /Hind III DNA size markers.

HIGHER YIELD



Advantage cDNA PCR Kit (Lane 1) vs. three other commercial enzyme blends (Lanes 2-4) used to amplify the full-length TFR cDNA. M = 1-kb DNA ladder.

Advantage™ PCR Kits and Polymerase Mixes

CLONTECH's new **Advantage™ PCR Reagents**—specially formulated enzyme and buffer systems that offer you several distinct advantages:

- **Automatic hot start**—our polymerase mixes contain **TaqStart** or **TthStart Antibody** for improved specificity and greater convenience. Only from CLONTECH.
- **Greater PCR efficiency and sensitivity, even for templates that are well within the range of conventional PCR.**
- **Longer distance amplification**—amplify genomic DNA of up to 40 kb and cDNA of up to 10 kb.
- **Increased fidelity**—important in PCR cloning experiments.
- **Optimum performance with our PCR-based Application Kits.**

Choose from our complete PCR Kits or separately available polymerase mixes:

Advantage cDNA PCR Kit (#K1905-1) & Advantage KlenTaq Polymerase Mix (#8417-1) are designed for amplification of cDNA and general templates of up to 10 kb. This system gives more robust amplification and a broader Mg^{++} range than cloned *Taq* DNA polymerase.

Advantage Genomic PCR Kit (#K1906-1) & Advantage Tth Polymerase Mix (#8418-1) are designed for amplification of genomic DNA templates of up to 40 kb. This system provides excellent results in PCR applications involving large targets and/or complex templates such as genomic DNA.

For more information or to order call 1-800-662-CLON or contact your local distributor.

DON'T EXPERIMENT WITH ANYTHING ELSE.

CLONTECH

1020 East Meadow Circle, Palo Alto, California 94303 USA

FAX: 800/424-1350 415/424-1064 • TEL: 800/662-CLON 415/424-8222

e-mail: tech@CLONTECH.com orders@CLONTECH.com • internet: <http://www.clontech.com>

©1995, CLONTECH Laboratories, Inc.

Purchase of Advantage PCR Reagents is accompanied by a limited license to use them in the Polymerase Chain Reaction (PCR) process for research 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.

Come Visit us at AACR Booths #208-210

Circle No. 49 on Readers' Service Card

(AD59033)

The truth about membranes in black & white



Dear Researcher

As a leading supplier to the Life Science market, Amersham has built its reputation upon the quality of its products, supported by excellent technical service.

The Hybond range of membranes is internationally recognized as offering the highest quality choice for nucleic acid and protein blotting applications.

Amersham remains committed to ensuring that it supplies you with the very best materials and support available. With this in mind, Hybond-N now has a new formulation available exclusively from Amersham.

The new Hybond-N has been extensively tested before launch to ensure optimum performance. In fact, the new formulation has a sensitivity specification five times higher than the old Hybond-N. We are very confident that the new membrane will equal or even exceed the quality and performance standards of the products you have been using.

Amersham's commitment to providing a high level of technical support has led us to publish a new Hybond Blotting Guide which offers expert advice in all blotting applications. It is a comprehensive guide to good blotting practice, cross referenced to troubleshooting sections and contains helpful hints and tips to avoid common pitfalls.

Please contact your local Amersham representative for further information and your copy of the Hybond Blotting Guide.

Yours faithfully

Trevor Nicholls

Commercial Managing Director
Life Science Business

Registered in England and Wales 1002610
Registered Office: Amersham International plc, Amersham Place, Little Chalfont, Buckinghamshire, England HP7 9NA

Hybond™

Amersham International plc
Amersham Place, Little Chalfont,
Buckinghamshire, HP7 9NA England.
Tel: 01494 544000
Fax: 01494 542929

For further information contact your local office.

Australia
Sydney (02) 894-5188
Belgium
Gent (092) 41-52-70
Canada
Oakville (905) 847-1166
Denmark
Birkerød (45) 82-02-22
Far East
Hong Kong (852) 802-1288

France
Les Ulis (1) 69-1828-00
Germany
Braunschweig (05307) 930-0
Iberica
Madrid (91) 304-42-00
Italy
Milan (02) 508-8220
Japan
Tokyo (03) 38-16-6161
Nederland
's-Hertogenbosch (073) 41-83-35

Norway
Gjetting (67) 54-63-18
Sweden
Solna (08) 734-08-00
Switzerland
Zurich (01) 3157050
UK Sales
Little Chalfont (0800) 515313
USA Arlington Heights
IL (800) 323-9750
Export Office
Little Chalfont (0) 1494 544100

All goods and services are sold subject to the terms and conditions of sale of the company within the Amersham Group which supplies them. A copy of these terms and conditions is available on request.
Amersham and Hybond are trademarks of Amersham International plc.
© Amersham International plc 1995. All rights reserved.

Amersham LIFE SCIENCE

Circle No. 59 on Readers' Service Card

MHFB

The new UNO II Thermocycler

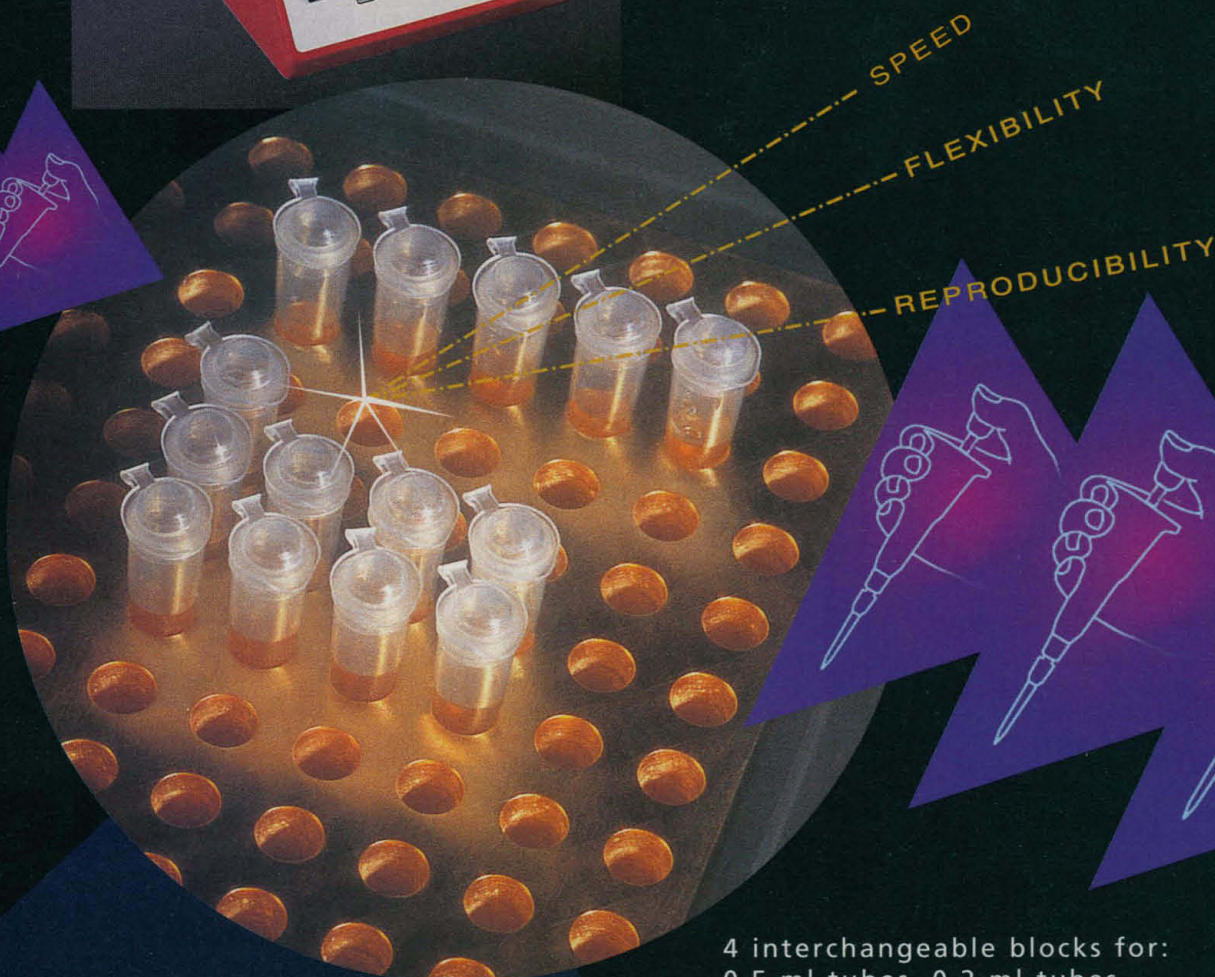


GOLD PLATED SILVER BLOCK

Fast ramping rates for heating (3.0°C/s) and cooling (2.0°C/s)

NEW 384 block format for high throughput (e.g. cycle sequencing)

UNIQUE adjustable heated lid applies optimized downward pressure



4 interchangeable blocks for:
0.5 ml tubes, 0.2 ml tubes,
microtitre plates (96 or 384 wells)
or slides

Excellent block uniformity
($\pm 0.5^{\circ}\text{C}$ after 15s)

Award winning intuitive software

Biometra[®]

Germany Biometra GmbH
UK Biometra Ltd
US Biometra Inc

Tel: 0551/50 68 60 Fax: 0551/50 68 666
Tel: 01622 678872 Fax: 01622 752774
Tel: 1-800 932 7250 Fax: 813 282 1936

Internet: biometra.gottingen.info@biometra.co.uk
e-mail: sales@biometra.co.uk
Internet: biometra@gate.net

Circle No. 6 on Readers' Service Card

Get It

BLOGGERSM



**Screen Over
150,000 P1 or
PAC/BACTM
Clones With Our
Double Spotted
High Density Filters**

Our high density filters can be hybridized with your choice of probes. Genome Systems double-spots up to 150,000 colonies on 22 by 22 cm filters, (36,864 spots per filter). Double-spotting makes it easy to identify true positive colonies over the background noise generated by hybridization probes. In addition, the clone address can be easily determined by the position of the two hybridization signals created by double spotting.

GenomeSystemsIncTM

**8620 Pennell Drive
St. Louis, Missouri 63114, USA**

**800 - 430 - 0030 or, 314 - 692 - 0033
Facsimile: 314 - 692 - 0044**

France: Appel gratuit, 0590 - 2104

Germany: Rufen sie uns an zum ortstarif, 0130 - 81 - 9081

UK: Call us free on, 0800 - 89 - 3733

email address: Genome@MO.net

From a single copy gene, a multi-gene family, or an entire YAC clone, you can identify the cognate clones. Or let Genome Systems convert even the largest YAC into overlapping sets of P1 or PAC/BACTM clones in a matter of days.

Our services also include; P1 (85kb) genomic library screening service (human, ES mouse for knockouts, rat and drosophila).

- New!** Human PAC/BACTM (120kb+ insert) genomic library screening service.
- New!** Fluorescent in-situ hybridization (FISH).
- New!** YAC library screening service (human, mouse).
- New!** Go GermlineSM ES and MEF cells for making mouse knockouts.
- New!** Custom robotic colony picking and spotting services.
- New!** "Down To The Well"TM PCR¹able DNA pools.

Other P1 or PAC/BACTM services include:

- DNA Preparation
- DNA Insert End Sequencing
- DNA Insert Orientation
- DNA Subcloning

1. The PCR process is covered by patents owned by Hoffman-La Roche.





Point. Click. Save.

Order low-cost GIBCO BRL Custom Primers on the Internet.

Now along with high quality and low cost, we're delivering something new: fast, easy electronic ordering. Just enter your sequence, or cut and paste your file directly into our order screen from your desktop computer.

Reliable performance, lower cost.

Highly automated computer-controlled production and monitoring of coupling efficiencies throughout synthesis ensure you of the highest quality primers – at just \$1.19 per base plus setup.*

Easy ordering.

Use our quick and easy Internet options or our convenient fax order form. Find us via any World Wide Web browser at <http://www.lifetech.com> or send us an e-mail at primers@lifetech.com.

For ordering information or a fax order form, call 800-828-6686. For industrial orders, call 800-874-4226.

LIFE TECHNOLOGIES™
Producer of GIBCO BRL Products

* Setup Charge: \$5.00 for deprotected or \$10.00 for deprotected/desalted primers.

U.S.A. Orders

To Order/TECH-LINE™: (800) 828-6686
Facsimile: (800) 331-2286
Industrial Orders: (800) 874-4226
Industrial Facsimile: (800) 352-1468

Latin America Orders

To Order/TECH-LINE™: (301) 840-4027
Facsimile: (301) 258-8238

Canada Orders

To Order: (800) 263-6236
TECH-LINE™: (800) 757-8257
Facsimile: (800) 387-1007

Internet

info@lifetech.com
<http://www.lifetech.com>

TECH-LINE™ and the Life Technologies logo are marks of Life Technologies, Inc. For research use only. Not intended for human or animal diagnostic or therapeutic use.

© 1996 Life Technologies, Inc.

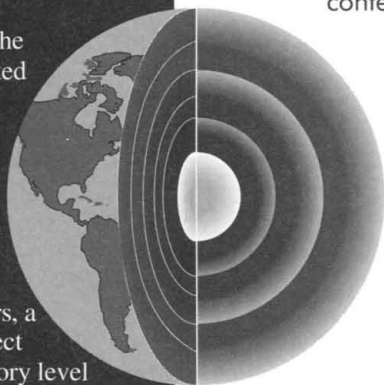
Circle No. 35 on Readers' Service Card

AN INTEGRATED BODY OF KNOWLEDGE FOR SUSTAINABLE DEVELOPMENT

The EOLSS embodies the spirit of 'science for sustainable development' as promulgated in Agenda 21 by the United Nations at its summit conference in Rio de Janeiro in 1992. The overall focus is on quality indices and on an integrated assessment of the quality of life, and the encyclopedia is intended to provide much needed scientific support for policies and decisions that should ensure lasting local, regional and global welfare.

The organization of the subject matter is thematic, so that the user is guided logically through the body of knowledge to levels of increasing depth and diversity. The encyclopedia is itself organized into six areas. The systems of Water, Energy, Environment and Food & Agriculture comprise the four major components of the total Earth system concerned with life support. A fifth area, Global Issues, describes the global life support system on the basis of Earth system and global change science, including both its physical and human dimensions. Common Science and Technology, the sixth area, is included as a reference base for the other five areas. Information in all six areas of the encyclopedia is considered from a historical perspective, extending from the origin of knowledge to the current state of understanding, whilst pointers to future trends are included also.

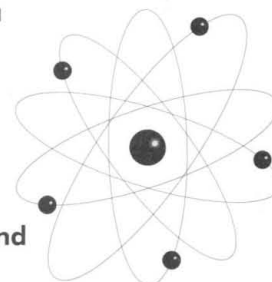
The EOLSS is gathering the support of an unprecedented number of renowned scientists worldwide. The vision and direction required to ensure a standard of excellence throughout the work are provided by the Board of General Advisors, a distinguished body of select experts. At the next advisory level is the Board of Consulting Editors, which has responsibility for editorial control of the encyclopedia and is assisted by the Honorary Editorial Advisory Board. Finally, high quality will be assured throughout the EOLSS by the Configuration Control Board. The union of all these boards is known as the International Editorial Council. This advisory body of over 600 prominent international experts from diverse fields of science and technology includes 13 Nobel Laureates.



EOLSS

Encyclopedia of Life Support Systems

Intensive efforts are under way on the compilation of a major new reference work - the Encyclopedia of Life Support Systems (EOLSS) - which is being conceived as essential guidance for the achievement of global security through sustainable development. Its body of knowledge has been carefully designed to integrate all fundamental aspects of the science, technology and management of systems of life support, both natural and engineered. In total, it will represent a comprehensive knowledge base describing the physical, economic and social processes occurring on our planet on a global scale.



READERSHIP

The EOLSS is intended to have popular appeal, educational relevance and professional and research utility. It will be future-oriented and is intended to provide guidance in the formulation of policy. Users of the encyclopedia will therefore include professionals and practitioners, researchers, university teachers, students, managers and decision makers.

PROGRESS TO DATE

In view of the importance of adopting a systematic approach to the integration of the body of knowledge for the EOLSS, teams from the USA, Japan, Russia, Europe and China were invited to develop outlines for the coverage of the encyclopedia. This led to five independent proposals for the overall list of contents. These parallel efforts have ensured the inclusion of a variety of approaches to common problems, characterized by the different conditions prevailing in contrasting world regions. From all of these proposals the Configuration Control Board of the EOLSS has prepared a unified list of contents which is to be finalized at a forthcoming major workshop in the Bahamas (28 April to 4 May 1996). Over 350 members of the International Editorial Council are expected to attend.

INTERNATIONAL CONNECTIONS

During the development of the EOLSS, collaborative links have been established with commercial companies, universities and research and development organizations from all over the world and these are now contributing to the collective effort. United Nations bodies, including UNIDO, UNESCO, FAO, WHO and the World Bank, together with other major international organizations, are also participating through representation on the International Editorial Council.

Further information may be obtained from:

The Executive Editor, EOLSS Publishers Company Ltd, Burgoine House,
8 Lower Teddington Road, Hampton Wick, Kingston upon Thames,
Surrey KT1 4ER, United Kingdom
Telephone: +44 (0)181 943 9303. Fax: +44 (0)181 943 9312
E-mail: 101567.3417@compuserve.com
or accessed directly at:
<http://www.laas.fr/eolss/eolss.html> (Europe) or
<http://ace.unm.edu/eolss/eolss.html> (North America)

Circle No. 60 on Readers' Service Card

**EOLSS-A MAJOR NEW
INTERNATIONAL
PUBLISHING
ENTERPRISE**

Centrifuge 5415 C
The classic microcentrifuge

- 3 fixed-angle rotors for 18 x 1.5/2 ml, 24 x 0.5 ml or 30 x 0.4 ml microcentrifuge tubes
- Rotational speed variable from 1,000 to 14,000 rpm (~16,000 x g)
- 10 s acceleration to max. speed



Centrifuge 5410
Compact centrifuge for beginners

- Ultra-simple operation
- 12-place rotor for 1.5/2 ml or 0.4/0.5 ml microcentrifuge tubes (with adapters)
- Fixed rotational speed 14,000 rpm (~ 12,800 x g)
- Fulfills IEC 1010-2-020
- Excellent noise reduction

Centrifuge 5417 C
Allround microcentrifuge for professionals

- High capacity due to 30-place fixed-angle rotors for 1.5/2 ml microcentrifuge tubes (adapters for other tubes available)
- Aerosol-tight rotor and 12-place swing-bucket rotor
- Rotational speed variable from 500 to 14,000 rpm (~ 20,800 x g)
- 10 s acceleration to max. speed
- Fulfills IEC 1010-2-020
- Dimensions (H x W x D): 22.7 x 32.6 x 36.9 cm



Also available as refrigerated Centrifuge 5417 R

- Temperature range between - 9 °C and + 40 °C
- Sample temperature ≤ 4 °C at max. speed
- Standby refrigeration
- Cooling aggregate built in back of centrifuge
- Dimensions (H x W x D): 22.7 x 32.6 x 59.7 cm

Thank you for demanding the ultimate from us

Thanks to you our Centrifuge 5415 C has proven to be a real "winner". It runs and runs and runs, in laboratories all over the world. It is always quick and always reliable. However, your demands have increased, and this has led us to develop our classic model even further. Obviously, we have retained all of its renowned good qualities, and have only concentrated on those aspects which could be improved.

The new Centrifuges 5417 C and 5417 R are maintenance-free, pleasantly quiet and, with room for 30 samples, offer considerably greater capacity. Extremely short acceleration and deceleration times, as well as a greater RCF (g-number),



30-place rotor of Centrifuge 5417 C/R

- Simple symmetrical loading of rotor: opposite rotor segments have the same code

guarantee shorter centrifugation times, and thus save time. The compact refrigerated Centrifuge 5417 R maintains a sample temperature of 4 °C, even at maximum speed.

Regardless of which centrifuge you choose, the 5417 C or 5417 R, you are choosing the classic model of tomorrow.

50
years
eppendorf

Eppendorf - Netheler - Hinz GmbH · 22331 Hamburg · Germany · Tel. (40) 5 38 01-0 · Fax (40) 5 38 01-556
 e-mail: eppendorf@eppendorf.com · eppendorf home page: <http://www.eppendorf.com/eppendorf>
 Brinkmann Instruments, Inc., One Cantiague Road, P.O. Box 1019, Westbury, NY 11590-0207 · 800-645-3050, Fax: 516-334-7506
 Brinkmann Instruments (Canada) Ltd., 6670 Campobello Road, Mississauga, Ont. L5N 2L8 · 800-263-8715 · Fax: 905-826-5424

Circle No. 29 on Readers' Service Card

AMES II THE NEW AMES II ASSAY... ENHANCED FOR HIGH THROUGH-PUT SCREENING

NEW AMES II —

- COST EFFECTIVE
- SIMPLIFIED
- AVAILABLE IN
MANUAL OR
AUTOMATED
SYSTEMS

Ames II, a new version of the Ames Assay, has been developed to identify base-pair substitution mutations upon detection of mutagens. Ames II comes in a 96 and 384-well microtiter format for easy use.

Six *Salmonella typhimurium* strains have been constructed, each of which carries a different missense mutation in the histidine operon that is designed for reversion via the base substitution unique to each strain. The strains have been combined for use as a single rapid screening mixture.

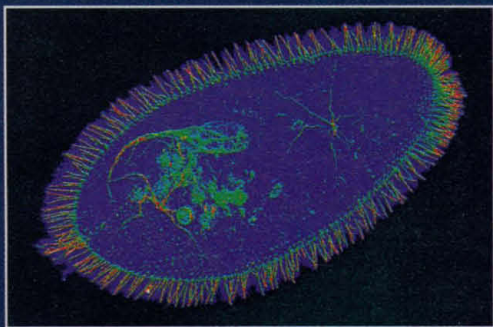
Ames II identifies missense mutational spectra caused by mutagens without the need to sequence. Low spontaneous reversion frequencies allow detection of mutagens at lower concentrations without loss of sensitivity to a large range of doses.



For more information, or to order a Test Assay Kit, contact:

Xenometrix, Inc. • 2860 Wilderness Place • Boulder, Colorado 80301 USA • Tel: (303) 447-1773 • Fax: (303) 447-1758 • Toll Free in USA: 1-800-436-2869
UK: Cambridge Bioscience • ++44-1223-316855 Japan: Funakoshi Co., Ltd • ++81-3-5684-1622 Switzerland: Xenometrix GmbH • ++41-61-482-1434

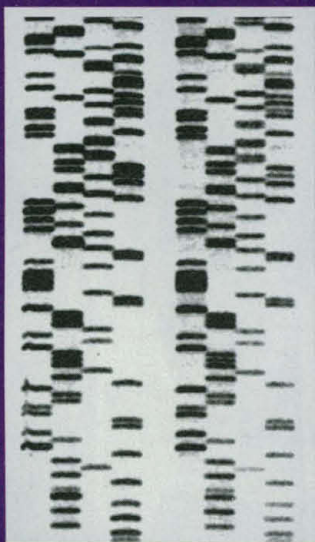
Circle No. 23 on Readers' Service Card



Confocal image courtesy of Ann Fleury, Michel Laurent and Andre Adoutte.



MORE IMAGING OPTIONS THAN YOU CAN IMAGINE



You now have more options and more choices with Bio-Rad's complete line of Image Analysis products.

We offer image analysis systems to suit any application.

- STORAGE PHOSPHOR IMAGING SYSTEMS
- FLUORESCENT GEL IMAGING SYSTEM
- DENSITOMETRY SYSTEMS
- QUANTITATION AND SPECIALIZED SOFTWARE
- CONFOCAL IMAGING SYSTEMS

For more information call 1-800-4BIORAD.

integrated systems



**MRC 1024 CONFOCAL
CONFOCAL
MICROSCOPY**



**LASERSHARP
SOFTWARE (PC)**



**GS-700 DENSITOMETER
DENSITOMETRY**



**GS-525 MOLECULAR IMAGER®
STORAGE
PHOSPHOR IMAGING**



**GEL DOC™ 1000
FLUORESCENT GEL
IMAGING**

**MOLECULAR ANALYST®
SOFTWARE (PC & MACINTOSH®)**

BIO-RAD

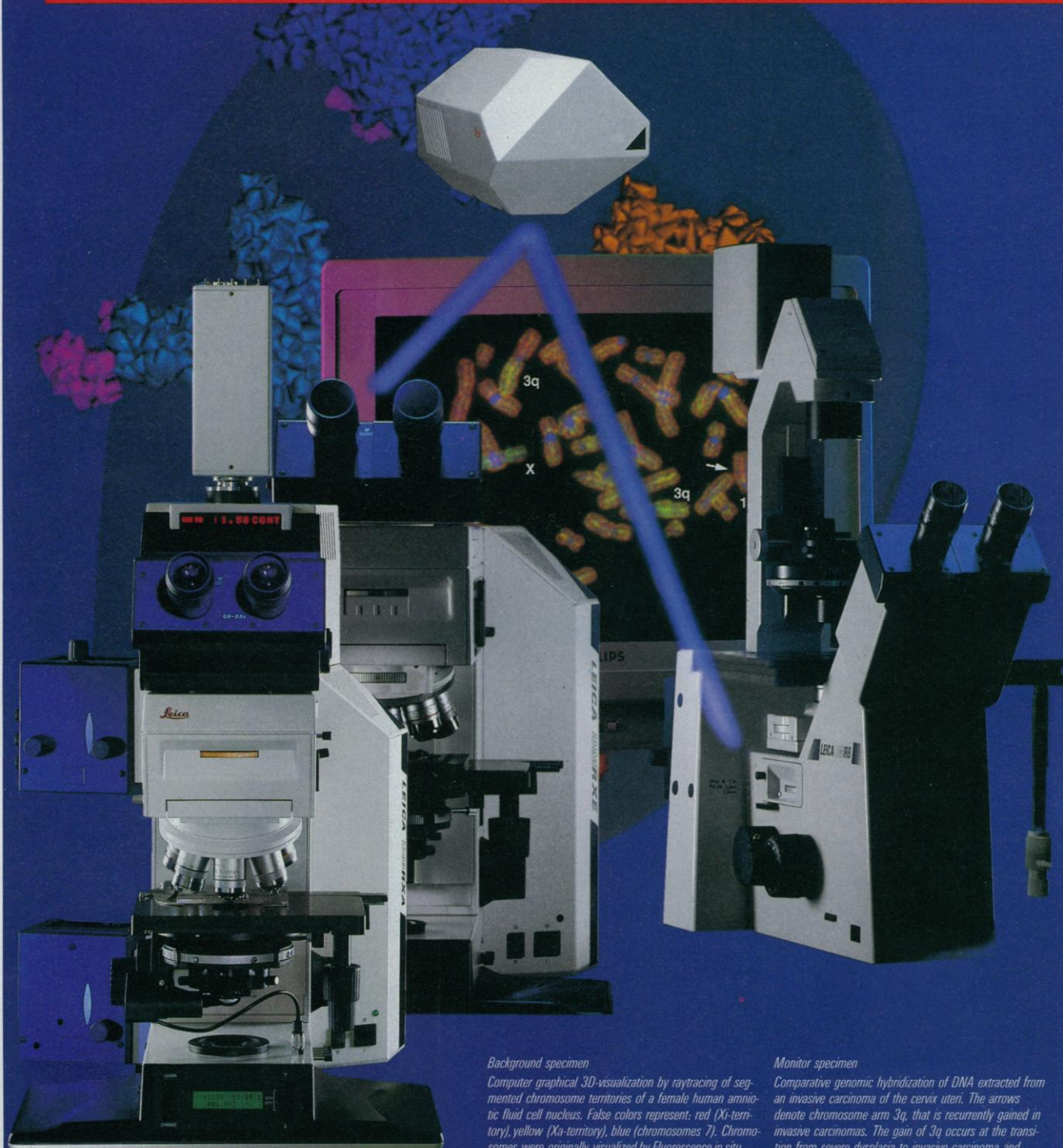
**Bio-Rad
Laboratories**

Molecular
Bioscience Group

U.S. (800) 4BIORAD California (510) 741-1000 Australia 02-9914-2800 Austria (1)-877 89 01 Belgium 09-385 55 11 Canada (905) 712-2771 China (01) 2046622 Denmark 39 17 9947
Finland 90 804 2200 France (1) 49 60 68 34 Germany 089 31884-0 Hong Kong 7893300 India 91-11-461-0103 Italy 02-21609 1 Japan 03-5811-6270 The Netherlands 0318-540666
New Zealand 09-443 3099 Singapore (65) 272-9877 Spain (91) 661 70 85 Sweden 46 (0) 8-735 83 00 Switzerland 01-809 55 55 United Kingdom 0800 181134 SIG 020996

Circle No. 33 on Readers' Service Card

Top Solutions for Excellent Research



The LEICA TCS 4D UV confocal laser scanning system is designed as an ultra compact spot scanner with short beam path and single detector pinhole. The system is perfectly suited for imaging multi-labeled specimens. The TCS 4D UV features extreme sensitivity, high resolution, perfect superimposing and long term stability. The TCS 4D scanner head is user-switchable between Leica's upright and inverted microscope models without recalibration.

Background specimen

Computer graphical 3D-visualization by raytracing of segmented chromosome territories of a female human amniotic fluid cell nucleus. False colors represent: red (Xi-territory), yellow (Xa-territory), blue (chromosomes 7). Chromosomes were originally visualized by Fluorescence in situ suppression hybridization.

Courtesy of R. Eils, S. Dietzel, E. Schröck, T. Cremer.

Monitor specimen

Comparative genomic hybridization of DNA extracted from an invasive carcinoma of the cervix uteri. The arrows denote chromosome arm 3q, that is recurrently gained in invasive carcinomas. The gain of 3q occurs at the transition from severe dysplasia to invasive carcinoma and serves as a genetic marker of tumor progression.

Courtesy of E. Schröck and T. Ried, National Center for Human Genome Research/NIH.

DAS Mikroskop LEICA DM RXA has been specially designed as the workstation for the latest developments in biology and medicine which require automatic execution of program-controlled routines. Together with LEICA Q-FISH software and the perfect chromatic correction offered by Leica optics, it's the ideal solution for FISH analysis and other new life science applications.

Leica Microscopy and Scientific Instruments Group
CH-9435 Heerbrugg, Switzerland

Tel.: +41 71 70 30 19
Fax: +41 71 72 78 25

Circle No. 18 on Readers' Service Card

Leica