



Science

29 January 1999

Vol. 283 No. 5402
Pages 593-748 \$8



AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

STRATAGENE

Building the Perfect Competent Cell

Stratagene has been building better competent cells for more than 10 years. We were first to break the transformation-efficiency barrier with our XL2-Blue ultracompetent cells. Large plasmid transformation is now possible because of our newly-discovered Hte phenotype, found in our revolutionary XL10-Gold™ strain. The Hte phenotype also increased the efficiency of our BL21-Gold derivatives, the best cells for protein expression. And for cloning unstable DNA, we designed the SURE® strain. Call us today and get more information on our complete line of innovative competent cells.

Hte

High transformation efficiency and large plasmid transformation

- XL10-Gold™ cells
- BL21-Gold cells and derivatives

McrA-, McrCB- and Mrr-
Allows cloning of methylated DNA

- XL1-Blue MRF™ cells
- XL2-Blue MRF™ cells
- XL10-Gold™ cells
- SURE® cells

EndA-
Provides high-quality miniprep DNA

- BL21-Gold cells and derivatives
- XL1-Blue cells
- XL2-Blue cells
- XL10-Gold™ cells
- SURE® cells

RecA-
Eliminates general recombination

- XL1-Blue cells
- XL2-Blue cells
- XL10-Gold™ cells
- SURE® cells

Dam- and Dcm-
Allows cleavage with methylation sensitive enzymes

- SCS110 cells
- JM110 cells

UvrC-, UmuC-, SbcC-, RecB-, and RecJ-
Allows cloning of unstable DNA

- SURE® cells
- SURE² cells

LacI
Allows inducible gene expression

- XL10-Gold™ cells
- XL1-Blue cells
- SURE® cells

LacZΔM15
Blue/White color screening

- XL10-Gold™ cells
- XL1-Blue cells
- SURE® cells

UNITED STATES AND CANADA:
(800) 424-5444
INTERNET MAIL:
techservices@stratagene.com

STRATAGENE EUROPE:
Austria: 01 7956 7036
Germany: 069 9509 6197
Switzerland: 01 800 9045
United Kingdom: 01 713 651 056

FOR MORE INFORMATION:
www.stratagene.com

Circle No. 49 on Readers' Service Card



STRATAGENE

PHOSPHO~SPECIFIC ANTIBODIES

NEW
ENGLAND
BIOLABS

FOR THE ANALYSIS OF

PROTEIN PHOSPHORYLATION IN SIGNALING PATHWAYS

Our latest offering of Phospho-Specific Antibodies includes:

NEW MONOCLONAL MAP Kinases

p44/42 MAPK (T202/Y204) E10 Monoclonal	#9106
SAPK/JNK (T183/Y185) G9 Monoclonal	#9255
p38 MAP Kinase (T180/Y182) Monoclonal	Available Soon

MAP Kinases

p44/42 MAPK (T202/Y204)	#9100
SAPK/JNK (T183/Y185)	#9250
p38 MAP Kinase (T180/Y182)	#9210

Apoptosis/Survival

Akt (S473)	#9270
Bad (S112, S136)	#9290
Akt (T308)	#9275
GSK-3 α (S21)	Available Soon

Checkpoint Signaling

cdc2 (Y15)	#9110
Rb (S249/T252, T373, S780, S795, S807/811)	#9300
p53 (S392)	#9281

CONTACT NEB TO REQUEST A **FREE SAMPLE**
OF p44/42 MAPK (T202/Y204) E10 MONOCLONAL



NUCLEAR TRANSLOCATION OF MAPK VISUALIZED WITH PHOSPHO-p44/42 MAP KINASE E10 MONOCLONAL

Confocal images of immunostaining with Phospho-p44/42 MAP Kinase E10 Monoclonal Ab (green) and propidium iodide (red) in rat hippocampus from tissue sections of control and 15 minute transient cerebral ischemia followed by 30 minutes of reperfusion. Photo shows high resolution dentate gyrus (top) and low resolution hippocampus (bottom). Yellow represents overlay of red and green. (Provided by Dr. Bingren Hu, UCSD).

For a complete listing of our Phospho-Specific Antibodies, visit www.neb.com or call 1-800-NEB-LABS

- New England Biolabs Inc. 32 Tozer Road, Beverly, MA 01915 USA 1-800-NEB-LABS Tel. (978) 927-5054 Fax (978) 921-1350 email: info@neb.com
- New England Biolabs Ltd., Canada Tel. (800) 387-1095 (905) 672-3370 Fax (905) 672-3414 email: info@ca.neb.com
- New England Biolabs GmbH, Federal Republic of Germany Tel. 0800/BIOLABS (06196) 3031 Fax (06196) 83639 email: info@de.neb.com
- New England Biolabs (UK) Ltd. Tel. (0800) 31 84 86 (01462) 420616 Fax (01462) 421057 email: info@uk.neb.com

DISTRIBUTORS: Australia (07) 5594-0299; Belgium (0800) 1 9815; Brazil (011) 366-3565; Denmark (39) 56 20 00; Finland (9) 584-121; France (1) 34 60 24 24; Greece (01) 5226547; Hong Kong 2649-9988; India (542) 311473; Israel (03) 9229013; Italy (02) 381951; Japan (03) 5820-9408; Korea (02) 556-0311; Mexico (5) 280-5691; Netherlands (033) 495 00 94; New Zealand 0800 807809; Norway 22 09 15 00; Singapore 4457927; Spain (03) 902 20 30 90; Sweden (08) 30 60 10; Switzerland (061) 486 80 80; Taiwan (02) 28802913

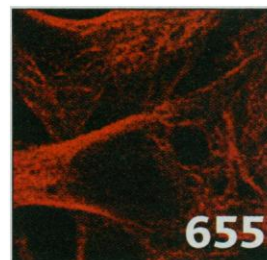
Circle No. 32 on Readers' Service Card

NEW ENGLAND
BioLabs Inc.

Science

www.sciencemag.org

Cover Cellular distribution of active Src tyrosine kinases. β -Arrestins are proteins that bind to agonist-occupied G protein-coupled receptors and terminate receptor-G protein coupling, thus blocking signaling. However, when β -arrestins associate with c-Src they function as adapter proteins, linking G protein-coupled receptors to tyrosine kinase-dependent growth regulatory pathways. Image width $\sim 50 \mu\text{m}$. [Immunofluorescent micrograph: S. S. G. Ferguson and N. Bechard].



613

High-level boost for high-end computing

NEWS

NEWS OF THE WEEK

- | | |
|--|---|
| <p>610 ACADEMIC RESEARCH: Genomic, Nanotech Centers Open \$200 Million Push by Harvard</p> <p>611 TERRORISM: Defending Against Bugs and Bytes</p> <p>613 COMPUTING: Gore Presents Plan to Spend \$366 Million</p> <p>614 CONDENSED MATTER PHYSICS: Getting to the Bottom of Water</p> <p>615 BIOMEDICAL RESEARCH: NCI Asked to Increase Focus on Minorities</p> <p>616 ASTROPHYSICS: Gamma Burst Promises Celestial Reprise</p> <p>▼ 617 MATERIALS SCIENCE: From New Phosphor, a Double Crop of Photons</p> | <p>617 CLONING: Report Casts Doubt on Korean Experiment</p> <p>619 DRUG DELIVERY: Silicon Chips Find Role as in Vivo Pharmacist</p> |
|--|---|

NEWS FOCUS

- | |
|--|
| <p>620 SPACE: The Art of the Orbit
NEAR's Risky Embrace With Eros</p> <p>623 SOCIETY FOR INTEGRATIVE AND COMPARATIVE BIOLOGY: Meeting Spotlights Creatures Great and Small</p> <p>625 ASTRONOMY: The Mystery of the Migrating Galaxy Clusters</p> <p>626 ATOM OPTICS: Videotape Brings Atoms to a Focus</p> <p>627 ASTRONOMY: Subaru Opens Up World for Japan</p> |
|--|

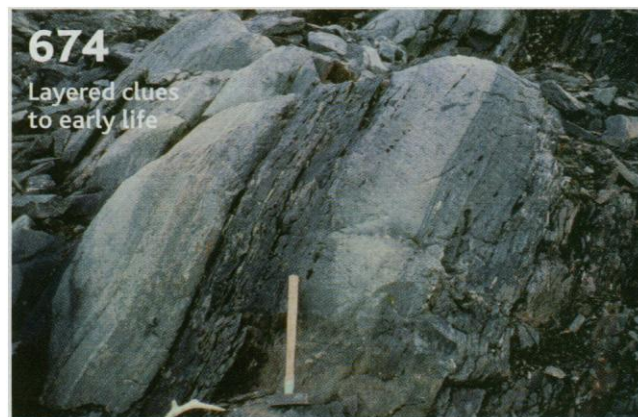
RESEARCH

RESEARCH ARTICLE

- ▼ 655 **β -Arrestin-Dependent Formation of β_2 Adrenergic Receptor-Src Protein Kinase Complexes** L. M. Luttrell, S. S. G. Ferguson, Y. Daaka, W. E. Miller, S. Maudsley, G. J. Della Rocca, F.-T. Lin, H. Kawakatsu, K. Owada, D. K. Luttrell, M. G. Caron, R. J. Lefkowitz

REPORTS

- | | |
|---|---|
| <p>661 "Dip-Pen" Nanolithography R. D. Piner, J. Zhu, F. Xu, S. Hong, C. A. Mirkin</p> <p>▼ 663 Visible Quantum Cutting in $\text{LiGdF}_4:\text{Eu}^{3+}$ Through Downconversion R. T. Wegh, H. Donker, K. D. Oskam, A. Meijerink</p> <p>666 Argon-Lead Isotopic Correlation in Mid-Atlantic Ridge Basalts P. Sarda, M. Moreira, T. Staudacher</p> <p>668 Electrical Conductivity in the Precambrian Lithosphere of Western Canada D. E. Boerner, R. D. Kurtz, J. A. Craven, G. M. Ross, F. W. Jones, W. J. Davis</p> <p>671 Continental Drainage in North America During the Phanerozoic from Nd Isotopes P. J. Patchett, G. M. Ross, J. D. Gleason</p> | <p>674 ^{13}C-Depleted Carbon Microparticles in >3700-Ma Sea-Floor Sedimentary Rocks from West Greenland M. T. Rosing</p> <p>676 Coordinated Regulation of Iron-Controlling Genes, H-Ferritin and <i>IRP2</i>, by c-MYC K.-J. Wu, A. Polack, R. Dalla-Favera</p> <p>▼ 680 T Lymphocyte Costimulation Mediated by Reorganization of Membrane Microdomains A. Viola, S. Schroeder, Y. Sakakibara, A. Lanzavecchia</p> |
|---|---|



DEPARTMENTS

NETWATCH
599

THIS WEEK IN SCIENCE
601

SCIENCESCOPE
613

RANDOM SAMPLES
629

CONTACT SCIENCE
637

NEWS AND NOTES
707

NEW PRODUCTS
709



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 © 1999 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): \$110 (\$62 allocated to subscription). Domestic institutional subscription (51 issues): \$325; Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A.

SCIENCE'S COMPASS

EDITORIAL

- 637 **Basic Research in China** Z. Lilan

LETTERS

- 639 **Animal Rights Brochure** L. G. Navar. **Shrimp and Salmon Farming** J. Forster; R. E. Turner. **Responses** M. Beveridge *et al.*; J. Primavera *et al.* **The Conditional Mutator Phenotype in Human Tumor Cells: Correction** M. Meuth, B. Richards, B. Schneider. **Corrections and Clarifications**

POLICY FORUM

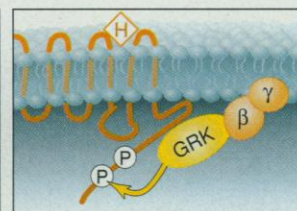
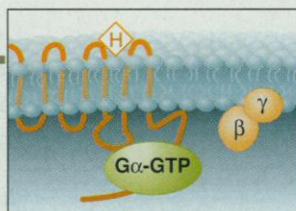
- 642 **SCIENCE POLICY: Interdisciplinary Research: From Belief to Reality** N. Metzger and R. N. Zare

BOOKS ET AL.

- 644 **MYCOLOGY: *Magical Mushrooms, Mischievous Molds*** G. W. Hudler, reviewed by L. M. Kohn
645 **HISTORY OF PHYSICS: *Physicists in Conflict*** N. A. Porter, reviewed by P. W. Anderson
645 **Browsings**

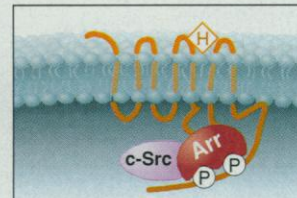
PERSPECTIVES

- 646 **SURFACE CHEMISTRY: Reactions on Semiconductor Surfaces** H. E. Ruda



650

Arrestin promoting signaling



- 648 **MARS: Water, Climate, and Life** B. M. Jakosky

- 649 **IMMUNOLOGY: Costimulation: Building an Immunological Synapse** M. L. Dustin and A. S. Shaw

- 650 **SIGNAL TRANSDUCTION: The Path to Specificity** C. S. Zuker and R. Ranganathan

TECH.SIGHT

- 652 **SOFTWARE: *MacVector 6.5*** reviewed by I. Rajagopal

- 682 **Transduction of Human CD34⁺ Cells That Mediate Long-Term Engraftment of NOD/SCID Mice by HIV Vectors** H. Miyoshi, K. A. Smith, D. E. Mosier, I. M. Verma, B. E. Torbett

- 686 **Acetogenesis from H₂ Plus CO₂ by Spirochetes from Termite Guts** J. R. Leadbetter, T. M. Schmidt, J. R. Graber, J. A. Breznak

- 689 **Thymidine Phosphorylase Gene Mutations in MNGIE, a Human Mitochondrial Disorder** I. Nishino, A. Spinazzola, M. Hirano

- 693 **Immortal Time: Circadian Clock Properties of Rat Suprachiasmatic Cell Lines** D. J. Earnest, F.-Q. Liang, M. Ratcliff, V. M. Cassone

- 695 **Horizontal Propagation of Visual Activity in the Synaptic Integration Field of Area 17 Neurons** V. Bringuier, F. Chavane, L. Glaeser, Y. Frégnac

- 699 **Chemical Etiology of Nucleic Acid Structure: Comparing Pentopyranosyl-(2' → 4') Oligonucleotides with RNA** M. Beier, F. Reck, T. Wagner, R. Krishnamurthy, A. Eschenmoser

682

HIV-based vector for gene therapy in hematopoietic stem cells



- 703 **Reduced Immunotoxicity and Preservation of Antibacterial Activity in a Releasable Side-Chain Carbapenem Antibiotic** H. Rosen, R. Hajdu, L. Silver, H. Kropp, K. Dorso, J. Kohler, J. G. Sundelof, J. Huber, G. G. Hammond, J. J. Jackson, C. J. Gill, R. Thompson, B. A. Pelak, J. H. Epstein-Toney, G. Lankas, R. R. Wilkening, K. J. Wildonger, T. A. Blizzard, F. P. DiNinno, R. W. Ratcliffe, J. V. Heck, J. W. Kozarich, M. L. Hammond

SCIENCE ONLINE
www.scienceonline.org

SCIENCE
THE JOURNAL
www.sciencemag.org

SCIENCENOW
DAILY NEWS SERVICE
www.sciencenow.org

NEXT WAVE
WEEKLY CAREER UPDATES
www.nextwave.org

GRANTSNET
RESEARCH FUNDING DATABASE
www.grantsnet.org

NEUROAIDS
EXPERIMENTAL WEB SITE
www.sciencemag.org/NAIDS

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

Leave complexity, hard work and inaccuracy behind you, and take off for a new world of rapid, cost-effective scanning of disease-related mutations in genes using

PASSPORT kits for EMD assays

This speedy and highly sensitive technology not only detects the presence of mutations and polymorphisms in a sample, but also indicates the approximate location. Blind studies of clinical samples show that more than 98% of all unknown mutations were successfully detected*.

The ability of PASSPORT™ kits to analyse fragments of several kilobases creates the conditions for high throughput operation compared with SSCP and direct sequencing. You can boost productivity by up to 50% or more over direct sequencing, according to our simulations. There's no need to sequence samples that do not display mutations or polymorphisms.

The convenience of the ready-to-use kits means that the EMD™ assay can be completed in less than an hour before electrophoresis. Detection can be performed manually by radioactivity using ³²P, or automatically using automated fluorescent analysers.

Looking for a faster, more accurate route? Call in Europe +44 (0) 1494 544550; in the US 1-800 526 3593; in Japan +81 3 5331 9336 and from the rest of the world +44 (0) 1494 544100.

Or take a trip to our web site, but hold on to your hat:

www.biotech.pharmacia.se/autodna

* Clinical Chemistry 1998; 44:4 731-739

PASSPORT – what you need to travel fast in gene mutation analysis

Amersham Pharmacia Biotech UK Limited, Amersham Place, Little Chalfont, Buckinghamshire, England HP7 9NA. All goods and services are sold subject to the terms and conditions of sale of the company within the Amersham Pharmacia Biotech group which supplies them. A copy of these terms and conditions of sale is available on request.

Circle No. 48 on Readers' Service Card


amersham pharmacia biotech

NANO-PENS

An atomic force microscope (AFM) tip, coated with alkane thiols, can write fine "lines" (as narrow as 30 nanometers) and "dots" of molecules on polycrystalline gold films. Piner *et al.* (p. 661) found that water from the air forms a meniscus between the AFM tip and the substrate, and this bridge allows alkane thiols to move continuously down the tip and decorate the gold surface. Although several factors control linewidth, the method could prove useful in patterning and modifying nanostructures.

TWO PHOTONS FROM ONE

In conventional fluorescent lamps, ultraviolet (UV) emission from hot mercury vapor excites the phosphor lining the tube, which then emits visible light. Although the conversion is efficient (about 90% on a per photon basis), the use of mercury poses environmental problems, and its vaporization leads to delay in turning on a fluorescent lamp. Wegh *et al.* (p. 663; see the news story by Antia) show that mercury can be replaced with an inert gas, xenon, by using a phosphor that combines rare-earth lanthanide atoms that can efficiently transfer the energy between each other. A quantum efficiency of nearly 200% can be achieved because this downconversion process creates two visible photons from a single high-energy UV photon.

RECYCLING RARE GASES

Argon in the mantle is released into Earth's atmosphere as basaltic magmas erupt. The accumulation of argon in the atmosphere (and its isotopic signature) can then be used to trace the amount of degassing over time. Sarda *et al.* (p. 666), however, provide evidence from a survey of argon and lead isotopes in basalts all along the Mid-Atlantic ridge that some atmospheric argon may be recycled back into the mantle, where it is poorly mixed. Rocks with low argon-40/argon-39 ratios, an indication of atmospheric argon usually attributed to atmospheric contamination, tend to contain radiogenic lead, an indication of recycled crustal material.

TRAPPED LITHOSPHERE POWERS ON

Measurements of the conductivity of the lithosphere (crust and the uppermost part of the mantle) can provide information about the composition and structural evolution of the subsurface that may not be

obtained with other remote sensing techniques. Boerner *et al.* (p. 668) conducted a magnetotelluric survey (part of the LITHO-PROBE Alberta Basement Transect) over the southern Archean Churchill Province and the adjacent, younger proterozoic terrane northeast of the province. Analysis and modeling of the data indicate that the Churchill Province lithosphere is more conductive than the adjacent proterozoic terrane. The higher conductivity may be due to the presence of hydrous minerals formed by metasomatism when the Churchill Province was tectonically trapped between two proterozoic subduction zones.

WEATHERING HEIGHTS

Mountain building (orogenic activity) leads to weathering and erosion. Patchett *et al.* (p. 671) use neodymium isotopes to trace the relation between orogenic activity and sedimentation since about 600 million years ago across North America. The data show that the Appalachian orogen was the dominant source of sediment from 450 to about 150 million years ago, even far from the orogen along the Arctic and northwestern coasts of the continent.

TRACES OF EARLY LIFE

Most of Earth's oldest sedimentary rocks are metamorphosed, which has made it difficult to identify early fossils or determine when life on Earth began. The oldest fossils that have been found date to about 3500 million years ago. One common signature of life is the presence of carbon with a low carbon-13/carbon-12 ratio. Rosing (p. 674) reports such low ratios for graphite layers and globules in metamorphosed sedimentary rocks dated at about 3700 million years ago in Greenland.

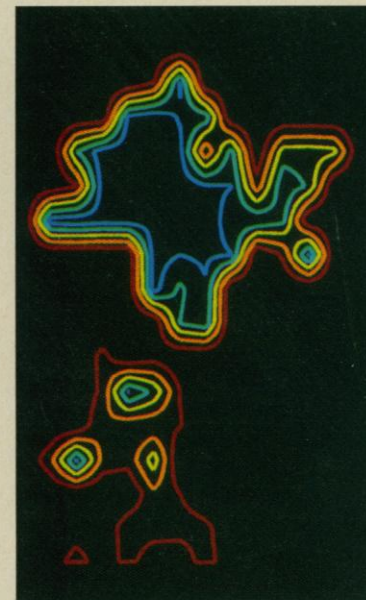
UNDER ARRESTIN

The β -arrestin proteins function to "turn off" signaling through receptors coupled to heterotrimeric guanine nucleotide binding proteins (G proteins). Binding of β -arrestin to the receptor prevents further activation of G proteins and targets the receptor for sequestration by endocytosis. Luttrell *et al.* (p. 655; see the cover and the Perspective by Zuker) now show that β -arrestin also functions to promote mitogenic signaling from β_2 adrenergic receptors. The β -arrestin 1 protein binds the tyrosine kinase c-Src and brings that protein with it when it binds an activated receptor. Kinase activity of c-Src appeared to be enhanced by binding to β -

arrestin 1, and inhibition of such recruitment of c-Src by β -arrestin inhibited β_2 adrenergic receptor-mediated activation of mitogen activated protein kinases. Arrestins thus have both positive and negative influences on signaling through G protein-coupled receptors.

A WIDER VIEW

The size of the receptive field of neurons in the visual cortex, traditionally determined from measurements of neuronal firing activity, is usually put at about 2° of visual angle. Intracellular recordings from single neurons made by Bringuier *et al.* (p. 695) show that the synaptic integration field, the



area where presentation of a visual stimulus causes subthreshold changes of postsynaptic responses, actually reaches up to 20° of visual angle. Thus, many more connections than previously thought influence the response of a single neocortical neuron. This result has important implications for the potential spatial and temporal integration capacity of the brain.

MYC AS IRONMASTER

The c-MYC protein is a transcription factor that controls the proliferation, differentiation, and death of cells, and its aberrant expression contributes to tumorigenesis. Wu *et al.* (p. 676) show that c-MYC coordinately regulates a gene expression

CONTINUED ON PAGE 603

Time in a Bottle. Expression-Ready Human Genes.

Over 100
Human Kinases

Chances are, your research project is time-sensitive. Cloning and expressing the human genes you need will take weeks, and there are no guarantees. GeneStorm™ expression-ready human clones give you a faster, better way.

GeneStorm™ Clones are recombinant human genes cloned into a state-of-the-art mammalian expression vector. Each vector has practical features including a polyhistidine sequence for convenient purification and an epitope tag for orientation, and transfected into mammalian cells, gene expression is meticulously verified

for each of the GeneStorm™ clones. All this is done so that GeneStorm™ clones are immediately ready to use in your project. GeneStorm™ clones are ideal for dozens of research applications, from screening chemical libraries to antigen generation. And there are hundreds of GeneStorm™ human clones available from functional groups you need like kinases, transcription factors, and receptors, to name a few.

To learn more about these indispensable time-saving research tools, contact Invitrogen or visit our continually-updated GeneStorm™ web site (www.invitrogen.com/genestorm).



Circle No. 19 on Readers' Service Card

European Headquarters:

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

Toll Free Phone Numbers:

Belgium 0800 111 73
Denmark 800 188 67
Finland 900 31 800 5345
France 00 31 800 5345
Germany 0130 8100 43
The Netherlands 0800 022 88 48
Norway 800 113 70
Sweden 020 795 369
Switzerland 0800 551 966
United Kingdom 0800 96 61 93

Distributors:

Australia 1 800 882 555
China 010 6255 3477
Hungary 01 280 3728
India 91 80 839 1453
Israel 02 652 2102
Italy 02 38 19 51
Japan 03 5684 1616
Korea 82 2 569 6902

Malaysia 03 432 1357
Poland 058 41 42 26
Portugal 01 453 7085
Singapore 65 779 1919
Slovak Republic 07 3707 368
Spain 03 450 2601
Taiwan 080 231 530
Thailand 246 7243

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

United States Headquarters:

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

program controlling cellular iron metabolism. It represses transcription of the gene encoding H-ferritin, a protein that sequesters intracellular iron, and it activates transcription of the gene encoding iron regulatory protein-2, which increases the intracellular iron pool. Downregulation of H-ferritin was required for c-MYC-mediated cell transformation and stimulation of DNA synthesis, which suggests that this effect on iron metabolism is one of the ways in which c-MYC controls cell proliferation.

BUGS THAT ENERGIZE TERMITES

Spirochetes (slender, long bacteria with a flexible helical shape) are an unusually abundant and diverse component of the microbiota of the termite gut. Leadbetter *et al.* (p. 686) report the successful culturing of these bacteria and reveal their ability to form acetate from hydrogen and carbon dioxide in culture. Because the bulk of a termite's energy requirement is met by the oxidation of acetate, spirochetes are likely to play a major role in termite nutrition.

SENDING RAFTS TO T CELL RECEPTORS

When T cells bind antigen, other proteins soon arrive near the T cell antigen receptor (TCR). The key to this reorganization turns out to be costimulation. Viola *et al.* (p. 680; see the Perspective by Dustin and Shaw) found that lipid rafts bring in the signaling components that augment T cell signaling only in response to costimulation. Thus, a costimulatory signal from CD28 is not necessarily the summoning of a parallel signaling pathway that could join the TCR pathway in the nucleus. Costimulation may instead augment and sustain TCR signaling at the surface by initiating the reorganization of key cellular components to antigen-bound TCRs.

IMPROVED VIRUSES FOR GENE THERAPY

Hematopoietic stem cells (HSCs) are important targets for genetic treatment of many human diseases. However, they tend to be quiescent, which renders them resistant to retroviral vectors. Miyoshi *et al.* (p. 682) showed that a vector based on human immunodeficiency virus-type 1 could stably and highly efficiently transduce HSCs. These HSCs were then used to reconstitute nonobese diabetic/severe combined immunodeficient (NOD/SCID) mice.

MITOCHONDRIAL MUTATIONS

Mitochondrial neurogastrointestinal encephalomyopathy (MNGIE) is a genetic disease that is characterized by a wide spectrum of neurologic and muscular abnormalities. Patients with MNGIE show multiple deletions of mitochondrial DNA, but the disease is inherited in a Mendelian fashion and, therefore, is due to a defect in a nuclear gene. Nishino *et al.* (p. 689) show that the defective gene is *TP*, which encodes thymidine phosphorylase, a protein that regulates the availability of thymidine for DNA synthesis. This work may lead to new insights into nuclear control of mitochondrial DNA replication and potential new therapies for mitochondrial diseases.

RESTORING CIRCADIAN CLOCKS

Circadian rhythms control physiological activities during the course of the day in response to the day-light cycle in most organisms. Earnest *et al.* (p. 693) looked at metabolic activity in cell lines derived from one of the central controllers of the mammalian clock situated in the brain, the suprachiasmatic nucleus (SCN). These immortalized cells maintained a circadian rhythm in their activities in cell culture, and the cells could be transplanted into animals that had their SCN removed to restore circadian activities.

FLEXIBILITY OVER STABILITY

One of the difficulties in recreating early biochemistry is, of course, knowing only which molecules have survived and not which were available but did not survive. Beier *et al.* (p. 699) have synthesized a family of pentose-derived oligonucleotides that can plausibly be thought to have formed through the same chemical reactions that produced RNA. From their finding that all family members form stronger Watson-Crick base pairs than RNA, they propose that the survival of RNA did not result from maximization of double-stranded stability, but may in fact have balanced stability against flexibility.

AGAINST ANTIBIOTIC RESISTANCE

The ability of staphylococci to resist β -lactam antibiotics took away a powerful weapon against disease. Rosen *et al.* (p. 703) present a solution to the problem by redesigning an antibiotic so that it has strong antibacterial activity against resistant organisms but can release a side chain that had been causing animals to develop an immune response that would make the antibiotic toxic.

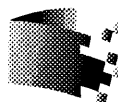
Buried Treasure

Science-ONLINE

Science
E-MARKETPLACE

Science
E-MARKETPLACE

HOME HELP SEARCH ARCHIVE
FEEDBACK ORDER



Science's
Literature
Library

Welcome to Literature Library, highlighting catalogs, brochures, technical applications sheets and more from leading scientific companies.

Look For Literature Information
Using One Of These Indexes:

- ▶ Company Listing
- ▶ Category Listing:
 - ▶ Analytical Instruments
 - ▶ Antibodies and Assays
 - ▶ Biologicals
 - ▶ Cell Culture
 - ▶ Chromatography Systems and Supplies
 - ▶ DNA Sequencing/Fragment Analysis
 - ▶ DNA/RNA Purification Systems
 - ▶ Image Analysis Instrumentation
 - ▶ Laboratory Supplies



www.scienceonline.org



E-MARKETPLACE



Literature
Library



Science's
Literature Library

www.scienceonline.org
Click on E-MARKETPLACE,
then click on Literature Library

Of course it leaves you speechless. It's designed for

visual

thinkers.



STARTING
@
\$3,395

For people whose world revolves around images not words, the new Silicon Graphics®

visual workstations offer the ultimate in graphics performance on Windows NT.® Featuring our Integrated Visual Computing (IVC) architecture with the Cobalt™ graphics chipset, these breakthrough machines move graphics data six times faster than other AGP 2X-based workstations* — a massive 3.2GB per second. Plus, I/O bandwidth is up to 12 times greater than other PC workstations.** So you can now get the outrageous 2D, 3D and digital media performance you expect from Silicon Graphics — for about the price of a mere clone. The Silicon Graphics 320™ workstation starts at just \$3,395. Or choose



the Silicon Graphics 540™ workstation: Starting at \$5,995 and supporting up to four Intel® Pentium® II Xeon™ processors, it's the most scalable Windows NT workstation around. But enough words. After all, a picture is worth so much more.

Silicon Graphics 320 Visual Workstation

- Silicon Graphics Integrated Visual Computing architecture with Cobalt graphics chipset
- Supports up to two Intel® Pentium® II processors (up to 450MHz)
- Integrated 10/100 Ethernet, IEEE-1394†, USB and professional video I/O
- Ultra ATA or optional Ultra2 SCSI drives up to 28GB total capacity
- Microsoft® Windows NT® Workstation 4.0
- Add the SuperWide™ 17.3" Silicon Graphics 1600SW™ digital flat panel monitor (shown) for only \$2,495

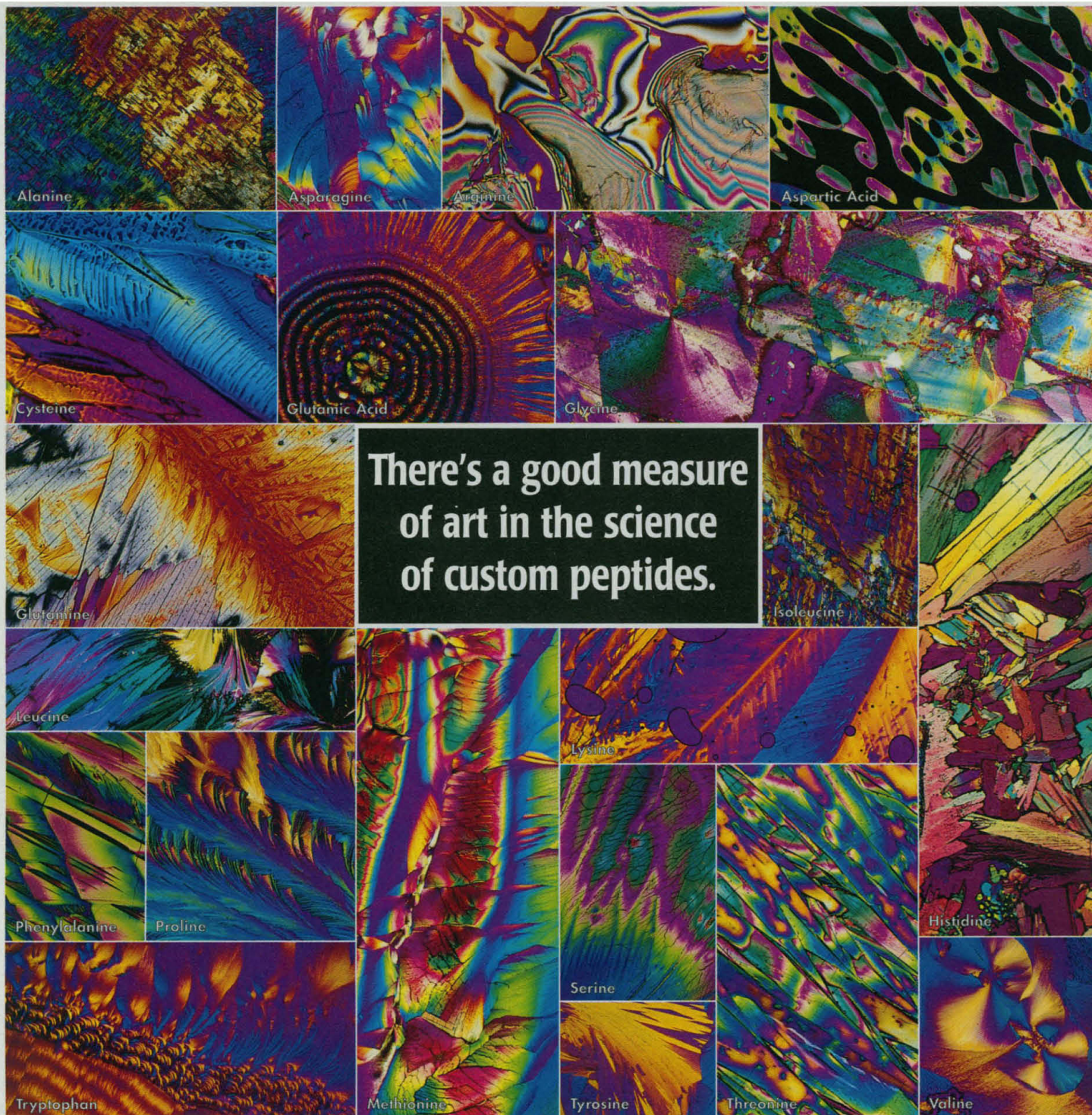


SiliconGraphics

To get information, find a local reseller or to order, call 1 888 SGI-6315 or visit us at www.sgi.com/go/visual

*Bandwidth based on graphics to main memory. **I/O bandwidth as compared to 32-bit PCI. †For information on the 1999 availability of the Silicon Graphics 540 workstation, please call 1 888 SGI-6315. ‡Requires additional software under Windows NT 4.0. Prices quoted are for U.S. only.
© 1999 Silicon Graphics, Inc. All rights reserved. Silicon Graphics is a registered trademark, and the Silicon Graphics logo, Silicon Graphics 320, Silicon Graphics 540, SuperWide, Cobalt and Silicon Graphics 1600SW are trademarks of Silicon Graphics, Inc. Intel, the Intel Inside logo and Pentium are registered trademarks, and Pentium II Xeon is a trademark of Intel Corporation. Microsoft, Windows and Windows NT are registered trademarks of Microsoft Corporation. All other trademarks are property of their respective owners.

Circle No. 30 on Readers' Service Card



There's a good measure
of art in the science
of custom peptides.

Peptides aren't always so pretty. In fact, some sequences can be downright adventuresome. The art is knowing which ones.

Your project may depend on our peptide. So before we put your sequence together,

Let us quote on your peptide and we'll send you a free micrograph T-shirt.

1-800-498-2098

<http://www.genosys.com>

we'll take it apart — with a thorough analysis, just to make sure

there won't be any surprises later.

And if we see a potential problem, we'll tell you. That way, we can talk it over, and

offer suggestions to improve your odds of success. Then, because every Genosys custom peptide comes with a 100% satisfaction guarantee, we'll do our best to get it right.

Of course, you'll get proof of performance: mass spectral analysis for composition, and HPLC for purity. Antisera service and a wide variety of modifications are also available.

Want a closer look? Let us quote on your peptide, and we'll send you a free poster. To see something really beautiful, place an order.

Micrographs courtesy of Michael W. Davidson, director of the Optical Microscopy Division of the National High Magnetic Field Laboratory.

**FREE micrograph T-shirt
with your quotation**



GENOSYS

Genosys Biotechnologies, Inc., The Woodlands, Texas, Phone: (281) 363-3693, E-Mail: info@genosys.com

Cambridge, U.K., Phone: (+44) (0)1223 839000, E-Mail: genosys@genosys.co.uk

Hokkaido, Japan, Phone: 81 133 73 5005, E-Mail: genosys@genosys.co.jp

Circle No. 10 on Readers' Service Card

EDITOR-IN-CHIEF
Floyd E. Bloom

EDITOR
Ellis Rubinstein

MANAGING EDITOR
Monica M. Bradford

EDITORIAL

DEPUTY EDITORS Philip H. Abelson (*Engineering and Applied Sciences*); John I. Brauman (*Physical Sciences*); Thomas R. Cech (*Biological Sciences*)

SENIOR EDITORS Gilbert J. Chin, R. Brooks Hanson, Pamela J. Hines, Barbara Jasny, Paula A. Kiberstis, Linda J. Miller, L. Bryan Ray, Phillip D. Szuroni; ASSOCIATE EDITORS Lisa D. Chong, Beverly A. Purnell, Linda R. Rowan; EDITORIAL ASSISTANT Carolyn Kyle; MANUSCRIPT ASSISTANTS Candace Gallery, Amy Herda, Patricia M. Moore, Anita Wynn; ADMINISTRATIVE SUPPORT Sylvia Kihara
SCIENCE'S COMPASS: SENIOR EDITOR Katrina L. Kelnner; ASSOCIATE BOOK REVIEW EDITOR Sherman J. Suter; CONTRIBUTING EDITORS David F. Voss, Kevin Ahern; ASSISTANTS Brent Gendelman, Jeffrey Hearn;

PUBLISHER
Richard S. Nicholson

ASSOCIATE PUBLISHER
Beth Rosner

MEMBERSHIP/CIRCULATION DIRECTOR
Michael Spinella

MEMBERSHIP/CIRCULATION
DEPUTY DIRECTOR Marlene Zendell

MEMBER SERVICES: MANAGER Michael Lung; SUPERVISOR Mary Curry; REPRESENTATIVES Laurie Baker, Pat Butler, Christine Ford, Mari Pope, Jantell Smith
SUBSCRIPTION SERVICES: 202-326-6417
MARKETING: MANAGER Scott Oser; COORDINATOR Lauri Sirois; EUROPE MANAGER Jane Pennington; ASSOCIATE Ruth Jackson
RESEARCH: MANAGER Renuka Chandler
BUSINESS AND FINANCE: MANAGER Dwight Theall; ASSISTANT Susan Maxim; COMPUTER SPECIALIST Charles Munson

FINANCE AND ADVERTISING

BUSINESS AND FINANCE: BUSINESS MANAGER Deborah Rivera-Wienhold; SENIOR ANALYST Randy Yi; FINANCIAL ANALYST Lisa Donovan
RIGHTS AND PERMISSIONS: ASSOCIATE Lincoln Richman; ASSISTANT Emilie David
MARKETING: DIRECTOR John Meyers; ASSOCIATES Allison Pritchard, Chris Harbaugh
ELECTRONIC MEDIA: MANAGER David Gillikin; COMPUTER SPECIALIST Wendy Green; PRODUCTION ASSOCIATES Mark Croatti, Ellen McGuire

INFORMATION SPECIALIST Janet Kegg

LETTERS AND TECHNICAL COMMENTS: EDITOR Christine Gilbert; ASSOCIATE EDITOR Steven S. Lapham; ASSISTANT Charlene King
TECH.SIGHT: CONTRIBUTING EDITORS Richard Peters, Robert Sikorski
EDITING AND PROOFREADING: DIRECTOR Dawn McCoy; SUPERVISOR Cara Tate; SENIOR COPY EDITORS Cay Butler, Harry Jach, Barbara Ordway, Christine M. Pearce; COPY EDITORS: Jeffrey E. Cook, Etta Kavanagh, Jason Llewellyn, Joshua Marcy
COPY DESK: Joi S. Granger, Abigail Hollister, Monique Martineau, Ellen E. Murphy, Beverly Shields

NEWS

NEWS EDITOR Colin Norman; FEATURES EDITOR Tim Appenzeller; DEPUTY NEWS EDITORS Elizabeth Culotta (contributing editor), Jean Marx, Jeffrey Mervis, Richard Stone; NEWS WRITERS Martin Enserink, Michael Haggmann (intern), Constance Holden, Jocelyn Kaiser, Richard A. Kerr, David Kestenbaum, Andrew Lawler, David Malakoff, Eliot Marshall, Elizabeth Pennisi, Robert F. Service, Gretchen Vogel
BUREAU: BERKELEY, CA Marcia Barinaga (contributing correspondent); SAN DIEGO, CA Jon Cohen; CHICAGO, IL James Glanz; COPY EDITORS Linda B. Felaco, Daniel T. Helgerman; CONTRIBUTING CORRESPONDENTS Barry A. Cipra, Ann Gibbons, Charles C. Mann, Anne Simon Moffat, Virginia Morell, Evelyn Strauss, Gary Taubes, Ingrid Wickelgren; ADMINISTRATIVE SUPPORT Scherraine Mack, Fannie Groom

PRODUCTION

DIRECTOR James Landry; MANAGER Wendy K. Shank; ASSISTANT MANAGER Elizabeth A. Harman; ASSOCIATES Vicki J. Jorgensen, Tara L. Kelly, Jessica K. Moshell, Rebecca Thomas

PRODUCT ADVERTISING

NATIONAL SALES MANAGER NORTHEAST AND E. CANADA Richard Teeling; 973-904-9774, FAX 973-904-9701 • MIDWEST/ SOUTHEAST Elizabeth Mosko; 773-665-1150, FAX 773-665-2129 • WEST COAST/W. CANADA Neil Boylan; 415-673-9265, FAX 415-673-9267 • MID ATLANTIC AND U.S. INSIDE SALES Christopher Breslin; 202-326-6544, FAX 202-682-0816 • INTERNET SALES Laura Tellez; 202-326-6599, FAX 202-682-0816
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) 1-260-297-530, FAX (44) 1-260-271-022
JAPAN Mashy Yoshikawa; (81) 3-3235-5961, FAX (81) 3-3235-5852 • TRAFFIC MANAGER Carol Maddox; SALES ASSOCIATES Sheila Myers, Sandra Walls; ADMINISTRATIVE SUPPORT Jessica Tierney

RECRUITMENT ADVERTISING

SALES AND PRODUCTION OPERATIONS MANAGER Terri Seiter Azie u.s.: SALES MANAGER Gabrielle Boguslawski; 718-491-1607, FAX 202-289-6742; SALES SUPERVISOR Daryl Anderson; SALES REPRESENTATIVES Troy Benitez, Beth Dwyer, Bren Peters-Minnis, Kristin Westapher; ASSISTANTS Erika Bryant, Kathleen Clark; Christina Geiger
PRODUCTION: SENIOR ASSOCIATE Jennifer Rankin; ASSOCIATE Elizabeth Lenox
COPY EDITOR/PROOFREADER Chris Filiatreau
U.K./EUROPE: SALES MANAGER Debbie Cummings; SALES EXECUTIVE Sabine Lenuid; ASSISTANT Elisabeth Py; (44) 1-223-326-5000, FAX (44) 1-223-326-532
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

BOARD OF REVIEWING EDITORS

Frederick W. Alt
Children's Hospital, Boston
Don L. Anderson
California Institute of Technology
Michael Ashburner
University of Cambridge
Frank S. Bates
Univ. of Minnesota, Minneapolis
Stephen J. Benkovic
Pennsylvania State University
Alan Bernstein
Mount Sinai Hospital, Toronto
Michael J. Bevan
University of Washington, Seattle
Seth Blair
University of Wisconsin, Madison
David E. Bloom
Harvard Institute for International Development
Piet Borst
The Netherlands Cancer Institute
Henry R. Bourne
Univ. of California, San Francisco
James J. Bull
University of Texas at Austin
Kathryn Calame
Columbia Univ. College of Physicians & Surgeons
Dennis W. Choi
Washington Univ. School of Medicine, St. Louis
Joanne Chory
The Salk Institute
David Clapham
Children's Hospital, Boston

Adrienne E. Clarke
University of Melbourne, Parkville
F. Fleming Crim
University of Wisconsin, Madison
Paul J. Crutzen
Max-Planck-Institut für Chemie
James E. Dahlberg
University of Wisconsin Medical School, Madison
Robert Desimone
National Institute of Mental Health, NIH
Hans Eklund
Swedish Univ. of Agricultural Sciences, Uppsala
Paul T. Englund
Johns Hopkins University School of Medicine
G. Ertl
Max-Planck-Gesellschaft
Richard G. Fairbanks
Lamont-Doherty Earth Observatory
Douglas T. Fearon
University of Cambridge
Harry A. Fozzard
The University of Chicago
Roger I. M. Glass
Centers for Disease Control
Peter N. Goodfellow
SmithKline Beecham, UK
Jack F. Greenblatt
University of Toronto
Peter Gruss
Max Planck Institute of Biophysical Chemistry

Philip C. Hanawalt
Stanford University
Paul Harvey
University of Oxford
M. P. Hassell
Imperial College at Silwood Park
Nobutaka Hirokawa
University of Tokyo
Tomas Hökfelt
Karolinska Institutet
Tasuku Honjo
Kyoto University
Susan D. Iversen
University of Oxford
Eric F. Johnson
The Scripps Research Institute
Hans Kende
Michigan State University
Elliott Kieff
Harvard University
Jeffrey T. Kiehl
National Center for Atmospheric Research, Boulder
Judith Kimble
University of Wisconsin, Madison
Stephen M. Kosslyn
Harvard University
Michael LaBarbera
The University of Chicago
Antonio Lanzavecchia
Basel Institute for Immunology
Nicole Le Douarin
Institut d'Embryologie Cellulaire et Moléculaire du CNRS
Norman L. Letvin
Beth Israel Hospital, Boston

Harvey F. Lodish
Whitehead Institute for Biomedical Research
Richard Losick
Harvard University
Seth Marder
California Institute of Technology
Diane Mathis
Institut de Chimie Biologique, Strasbourg
Susan K. McConnell
Stanford University
Anthony R. Means
Duke University Medical Center
Stanley Meisel
University of California, Davis
Douglas A. Melton
Harvard University
Andrew Murray
Univ. of California, San Francisco
Elizabeth G. Nabel
The Univ. of Michigan Medical Center
Shigetada Nakanishi
Kyoto University
Kim Nasmyth
Research Institute of Molecular Pathology, Vienna
Roger A. Nicoll
Univ. of California, San Francisco
Staffan Normark
Swedish Institute for Infectious Disease Control
Kiyotaka Okada
Kyoto University

Bert W. O'Malley
Baylor College of Medicine
Roy R. Parker
University of Arizona, Tucson
Stuart L. Pimm
The Univ. of Tennessee, Knoxville
Yeshayahu Pocker
Univ. of Washington, Seattle
Martin Raff
University College London
Douglas C. Rees
California Institute of Technology
T. M. Rice
ETH-Hönggerberg, Zürich
David C. Rubie
Universität Bayreuth
Erkki Ruoslahti
The Burnham Institute, CA
Gottfried Schatz
Biozentrum, Basel
Jozsef Schell
Max-Planck-Institut für Züchtungsforschung
Ronald H. Schwartz
National Institute of Allergy and Infectious Diseases, NIH
Terrence J. Sejnowski
The Salk Institute
Christopher R. Somerville
Carnegie Institute of Washington, Stanford, CA
Michael P. Stryker
Univ. of California, San Francisco
Cliff Tabin
Harvard Medical School
John Jen Tai
National Taiwan University

Tomoyuki Takahashi
University of Tokyo
Masatoshi Takechi
Kyoto University
Keiji Tanaka
RIKEN Institute
David Tilman
Univ. of Minnesota, St. Paul
Robert T. N. Tjian
Univ. of California, Berkeley
Yoshinori Tokura
University of Tokyo
Derek van der Kooy
University of Toronto
Geerat J. Vermeij
University of California, Davis
Bert Vogelstein
Johns Hopkins Oncology Center
Gerhard Wegner
Max-Planck-Institut für Polymerforschung
Arthur Weiss
Univ. of California, San Francisco
Zena Werb
Univ. of California, San Francisco
George M. Whitesides
Harvard University
Ian A. Wilson
The Scripps Research Institute
Alan P. Wolfe
National Institute of Child Health and Human Development, NIH
Martin Zatz
National Institute of Mental Health, NIH

ART

DESIGN DIRECTOR Amy Decker Henry; ART DIRECTOR C. Faber Smith; ASSOCIATE ART DIRECTOR Elizabeth Carroll; SCIENTIFIC ILLUSTRATOR Katharine Sutliff; GRAPHICS ASSOCIATES Holly Bishop, Preston Morrighan, Darcel Pugh, Patricia M. Riehn; PHOTO RESEARCHER Leslie Blizard

SCIENCE INTERNATIONAL EUROPE

EDITORIAL: OFFICE HEAD AND SENIOR EDITOR Richard B. Gallagher; ASSOCIATE EDITORS Stella M. Hurtley, Ian S. Osborne, Peter Stern, Julia Uppenbrink; EDITORIAL ASSOCIATE Belinda Holden
NEWS: EDITOR Daniel Clery; CONTRIBUTING CORRESPONDENTS Michael Balter (Paris) Robert Koenig (Bern); UK EDITOR, SCIENCE'S NEXT WAVE John MacFarlane; ADMINISTRATIVE SUPPORT Janet Mumford, Liz Ellis

ASIA

JAPAN NEWS BUREAU: Dennis Normile (contributing correspondent); CHINA REPRESENTATIVE Hao Xin; INDIA CORRESPONDENT Pallava Bagla (contributing correspondent)

SCIENCE NOW: www.sciencenow.org
EDITOR Erik Stokstad

SCIENCE'S NEXT WAVE: www.nextwave.org

MANAGING EDITOR Wendy Yee; SENIOR EDITOR Nicole Ruediger
WRITER Melissa Merti; CANADA EDITOR Charles Boulakia; ASSISTANT Suzanne Moore

AAAS BOARD OF DIRECTORS

RETIRING PRESIDENT, CHAIR M. R. C. Greenwood
PRESIDENT Stephen Jay Gould
PRESIDENT-ELECT Mary Lowe Good
TREASURER William T. Golden
EXECUTIVE OFFICER Richard S. Nicholson

Lewis M. Branscomb; Robert D. Goldman; Alice S. Huang; Sheila Jasanoff; Sally Gregory Kohlstedt; Marcia C. Linn; Neena B. Schwartz; David E. Shaw

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.



Plate: Image of NIH 3T3 transfected with green fluorescent protein (GFP).
Background: CHO-K1 transfected with β -Gal plasmid.

Finally, a transfection reagent that makes you smile, every time!

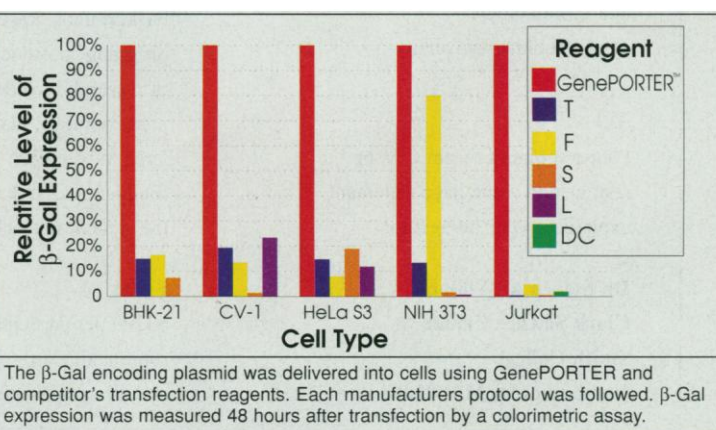
Introducing

GenePORTER™ Transfection Reagent*

GenePORTER™ reagent, which incorporates direct hydrophilic conjugation (DHC) technology*, is the latest innovation from the lab of Dr. Philip Felgner, inventor of lipofection. We at Gene Therapy Systems are so confident as to the performance of our product, we stand behind it with a double-your-satisfaction guarantee† on cell types listed. In a variety of cell lines, GenePORTER reagent consistently delivers higher levels of transfection than any other commercially available product. Without compromising transfection efficiency, this robust reagent performs in a wide range of conditions, including different ratios of plasmid and reagent. GenePORTER reagent is easy to use and does not require enhancers or special handling of cells, saving time, cost, and reagents. Order GenePORTER reagent today. The results will make you smile.

GenePORTER™
Transfection
Reagent

75 reactions • T201007
150 reactions • T201015
750 reactions • T201075



Transfected Cell Types†

HeLa S3	BHK-21
293	CHO-K1
Jurkat	CV-1
NIH 3T3	COS-1
B16-F0	COS-7
PC-12	

* Patents pending.

† If you do not get better transfection results following our protocol, kit purchase price will be refunded or double-the-kit price will be applied to your GTS, Inc. account toward future purchases. Offer valid in USA only and ends 1/31/99. Guarantee is limited to cell types in this ad. The purchased GenePORTER reagent must be returned using the GTS, Inc. return policy. This offer is limited to one T201007 or T201015 kit per customer.

Circle No. 49 on Readers' Service Card



To Order: 888-428-0558

Fax: 619-587-1499

10190 Telesis Court
San Diego, CA 92121, USA

For the complete product list
check out the GTS Website @

<http://www.genetherapysystems.com>

GTS International Distributors

Australia • ASTRAL +61-2-9540-2055 Austria • BIO-TRADE +43 1 889 18 19
Denmark, Finland, Norway, Sweden • KEBO Lab +46 8 621 35 07 France •
OZYME +1 30 85 92 92 Germany • Biozym Diagnostik GmbH +49 5152-9020
Japan, Rep. of China, Korea • Takara +81-77-543-7231 Switzerland • Axon
Lab AG +41 56 484 80 80 Taiwan • PROtech, Ltd. 886-2-23810844 Takara
+81-77-543-7231 United Kingdom • Lifescience LTD. +44 0 1923 241515

NEW ENGLAND BIOLABS

Molecular Biology and PCR

Summer Workshops

WHEN:

Session 1: May 30 - June 12, 1999

Session 2: June 20 - July 3, 1999

Session 3: July 11 - July 24, 1999

WHERE:

Clark Science Center

Smith College

Northampton, MA

FACULTY:

Dr. Steven A. Williams

Dept. of Biological Sciences,

Smith College and

Molecular and Cellular Biology,

University of Massachusetts

Dr. Barton Slatko

New England Biolabs, Inc.

DNA Sequencing Group

Dr. Alan L. Scott

Dept. of Molecular Microbiology

and Immunology,

Johns Hopkins University

TO APPLY:

Please submit a recent C.V. or resume and a one page statement explaining your interest to:

Dr. Steven A. Williams

Clark Science Center

Smith College

Northampton, MA 01063

We are pleased to announce the fourteenth annual New England Biolabs Molecular Biology Summer Workshops held at Clark Science Center, Smith College, Northampton, MA, USA. Over 1,200 research scientists have attended this intensive program in the past thirteen years.

INTENSIVE BENCH EXPERIENCE:

This intensive, two-week course emphasizes hands-on molecular biology laboratory work. About eight hours each day will be spent working at the bench. All of the work is hands-on; there are no demonstrations.

EXPERIMENTS WILL INCLUDE:

Construction and screening of genomic and cDNA libraries, PCR, RT-PCR, PCR subcloning, purification of DNA and RNA, restriction enzyme digestion, gel electrophoresis, construction of recombinant DNA molecules, cloning in plasmid and phage vectors, cloning strategies, bacterial transformation, Southern and Northern transfer and hybridization methods for labeling DNA, DNA sequencing, etc. All of these techniques are woven into a cohesive research project carried out by each participant during the two-week session. Lectures and discussion sessions (at least three hours each day) will deal with all of the above topics and the application of these methods in molecular biology research.

INTENDED FOR BEGINNERS IN MOLECULAR BIOLOGY:

No previous experience in molecular biology is required or expected. Forty-eight participants per session will be selected from a variety of disciplines and academic backgrounds. Last year's participants included principal investigators, directors of programs, postdoctoral fellows, graduate students, and research assistants. Their fields of research included medicine, biochemistry, ecology, immunology, microbiology, pharmacology, plant biology, genetics, physiology, and others. They came from large universities, small colleges, medical schools, hospitals, industry, and private foundations; 75% came from the USA, and 25% from overseas. With seven instructors, the student to teacher ratio is 7 to 1.

FEE:

\$3200 per participant includes lab manual, use of all equipment and supplies, and room and board (all rooms are singles). Fee includes the use of the libraries, computers and all campus athletic facilities.

APPLICATIONS MUST BE RECEIVED BY March 10, 1999.

Notification of acceptance status will be mailed by March 13, 1999. Late applications will be accepted for our wait list. Payment in full will be due by April 10, 1999.


Your application should include a brief C.V. and a one page statement explaining your reasons for taking the course. Please specify the session to which you are applying (1, 2, 3) and indicate one of the other sessions as a second choice. Women and minorities are especially encouraged to apply. **For additional information, please visit our web site (<http://math.smith.edu/~sawlab/neb.html>) or contact us at (413) 247-3004.**



It does
 Oligo Data
 Calculations
 Dilution Series
 BCA
 Protein
 Assays
 Primer/Probe Stock
 PCR
 MASTER MIX
 CALCULATIONS
 Codon lookup table
 Oligo
 T_m CALCULATIONS
 Quantitation
 via Beer's
 Law
 Wavelength

all the
 routine
 stuff so
 you can
 do all the
 cool
 stuff!

MBA
 2000
 DNA Concentration



On the verge of another breakthrough in bioscience?

Need some serious assistance to match the hectic pace of molecular biology protocols and experiments?

Get a new Assistant! The Molecular Biology Assistant 2000™ System. The next revolution in tailored solutions from Perkin-Elmer. With crowded bench space, and changing work areas, this compact and innovative productivity tool is ready—when and where you are. For instant help computing concentration and amounts of biomolecules—in the units needed for setup. For finding the volumes needed for microplate or tube dilutions in a flash. For quick OD²⁶⁰ checks, finding concentrations of DNA and protein solutions. For running quantitative colorimetric analysis from stored standard curves.

Conversions are no problem...they are dynamic: picomoles, ODU's, and copy number all in context for the next step.

Experienced and insightful assistance for designing and using new oligos. Intuitive and truly fun to use? Finally! With a bright color touch screen and graphical display. And personalizable. Your specific absorbance-based methods and curves are stored...with names you create...on top level buttons in the folder you choose. Your local currency, your local time/date convention, your style. Even a time-stamped log of your day's work for reference. Job done.

To get this talented new Assistant started in your lab next week, **order one risk-free for 30 days by calling 1-877-MORE-MBA.** And visit www.perkin-elmer.com/mba2000 for a free T-shirt offer and to see how much of the routine stuff it will do, so you can do the cool stuff. Start planning that next discovery experiment—now!

Circle No. 25 For Literature
 Circle No. 26 For a Sales Call



Get **MORE** Connected.

The lines of advanced communication are OPEN. It's the Perkin-Elmer commitment to building relationships by sharing information and solving problems together. So no matter how far-reaching your needs, our worldwide support and service teams will take you where you need to go. Experience MORE of what PE can do for you. For the location nearest you, or a complete listing of our worldwide offices, visit us at www.perkin-elmer.com. E-MAIL us at info@perkin-elmer.com. Or, in the U.S., call 1-800-762-4000 or fax 1-203-762-4228.

Perkin-Elmer is a registered trademark and MBA 2000 is a trademark of The Perkin-Elmer Corporation.

PERKIN ELMER
 Look to us. And see more.





New Insights



power on
cycling
run completed

Get a new perspective on your PCR:

- ◆ High speed thermal cycling in glass capillaries (30 cycles in 20 minutes!)
- ◆ Realtime on-line fluorescence monitoring
- ◆ Highly accurate quantification during log-linear PCR phase
- ◆ Mutation detection with continuous monitoring of hybridization kinetics

LightCycler™

PCR perfected!

ROCHE MOLECULAR BIOCHEMICALS

Licensed from Idaho Technology, Inc.

Internet: <http://biochem.roche.com>. Austria (01) 277 870; Australia (02) 9899 7999; Belgium (02) 247 4930; Canada (450) 686 7050 (800) 361 2070; Denmark 45 16 09 50; France 04 76 76 30 86; Germany (0621) 759 85 68; Italy 039 247 4109-4181; Japan 03 5443-5284; Netherlands (036) 53 94 911; Spain (93) 201 4411; Sweden (08) 404 88 00; Switzerland (0 41) 799 61 61; United Kingdom (0800) 521 578; USA (800) 428 5433

LightCycler™ is a trademark of and licensed from Idaho Technology, Inc.

© 1999 Roche Diagnostics. All rights reserved

Circle No. 42 on Readers' Service Card





PCR optimization in one single experiment



The determination of the right annealing temperature is crucial for establishing a new PCR experiment. The new all-round genius **Mastercycler® gradient** is an innovative, compact thermal cycler for even the most demanding PCR* applications. Its gradient function enables a temperature gradient of up to 20 °C to be generated across the block, thus optimizing the annealing, denaturation, or extension temperature in one single experiment. Its 96-position all-in-one universal block can accommodate 96 x 0.2 ml tubes, 77 x 0.5 ml tubes, or one 96-well plate – without block exchange.

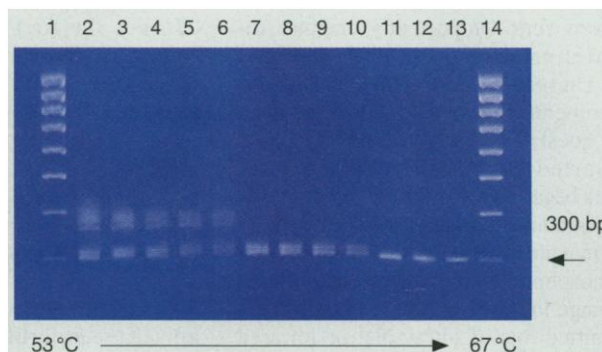
The exact block homogeneity ensures reproducible results. Variable, high incubation speeds as well as time and temperature increments for hot-start, touch-down, and long PCR provide maximum programming flexibility.

The **Mastercycler® personal** is designed to meet personal applications. Its 25-position all-in-one universal block holds 25 x 0.2 ml tubes, 16 x 0.5 ml tubes, or one microplate in a 5 x 5 grid.

Personal memory cards for 10 individually developed protocols allow an easy and comfortable method transfer between both Mastercycler models.

Circle No. 34 on Readers' Service Card

Of course, both Mastercyclers are licensed and authorized for PCR.



● Experimental determination of optimal annealing temperature. The calculated primer annealing temperature was 56.5 °C, the actual annealing temperature is 63.5 °C. The ribosomal spacer region of mycoplasmas from H9 cell cultures was amplified.

*PCR (Polymerase Chain Reaction) is protected by patent. The patent is held by Hoffmann-La Roche. Practice of the patented Polymerase Chain Reaction (PCR) process requires a license. The Eppendorf Thermal Cyclers are Authorized Thermal Cyclers and may be used with PCR licenses available from the Perkin-Elmer Corporation. Their use with Authorized Reagents also provides a limited PCR license in accordance with the label rights accompanying such reagents.

eppendorf



Eppendorf – Netheler – Hinz GmbH · 22331 Hamburg · Germany · Phone (+49) 40-53801-0 · Fax (+49) 40-53801-556
website: www.eppendorf.com · e-mail: eppendorf@eppendorf.com

Eppendorf Scientific, Inc. · One Cantiague Road · Westbury, NY 11590-0207 · USA · Phone 800-421-9988 or 516-876-6800 · Fax 516-876-8599
website: www.eppendorfsi.com · e-mail: eppendorf@eppendorfsi.com

eppendorf® is a registered trademark.

The Leading Edge in Neuroscience

For over 18 years, neuroscientists have depended on the quality, expertise and service of RBI. Today, our company manufactures and distributes over 1,600 chemical and biochemical products for investigating cell signaling pathways in the central and peripheral nervous systems.

PRODUCTS FOR SIGNALING PATHWAYS

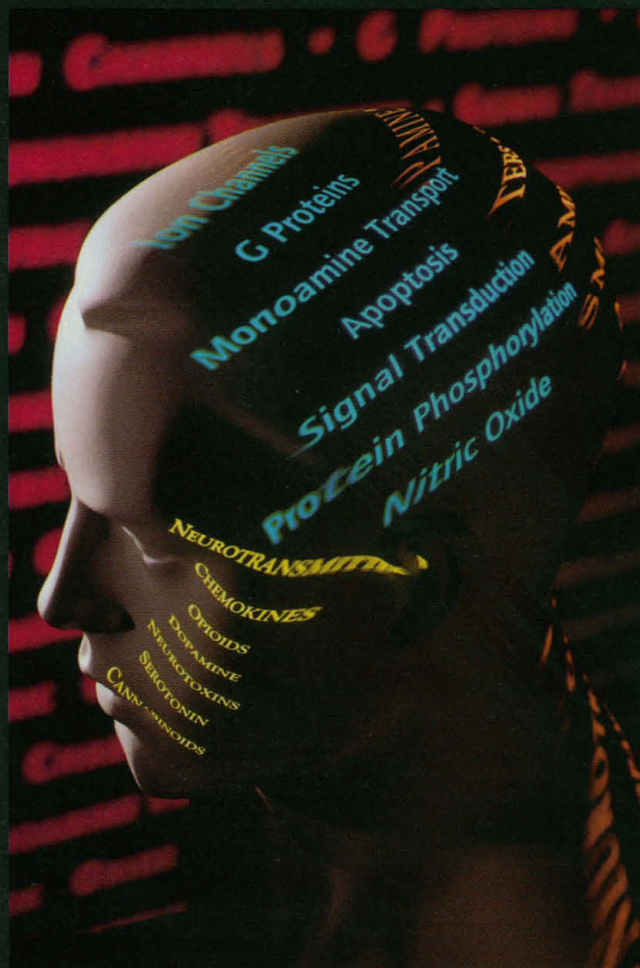
AGONISTS
ANTAGONISTS
ANTIBODIES
CHEMOKINES
ENZYME INHIBITORS
NEUROTOXINS
RECOMBINANT
RECEPTORS

Pure Excellence

The consistent quality and high purity of RBI products are recognized worldwide. All are backed with detailed documentation, including structures, physical properties and references to protocols.

**Visit us at the
1998 SFN Meeting
Booth 717, 719**

DISCOVER WHAT THOUSANDS OF NEUROSCIENTISTS HAVE ALREADY FOUND.



**RBI Provides the Most Comprehensive
Selection of Specific High-Purity
Compounds to Study Signaling Systems.**

RBI®
SIGNALING INNOVATION

RBI is a Member of the Sigma-Aldrich® Family of Companies
Tel: 508.651.8151 Fax: 508.655.1359 www.callrbi.com

APPLICATIONS

Ca²⁺ SIGNALING
PROTEIN
PHOSPHORYLATION
ION CHANNEL
MODULATION
CELL STRESS/
NO SYSTEMS
APOPTOSIS
G PROTEINS
IP₃ / DAG

Expertise, Support and Service You Can Trust

We develop and manufacture many of our products, so you can count on us for expert technical support and responsive customer service.

Make the RBI Discovery Today

The 1998 RBI Catalog features over 1,600 research products for neuroscience, signal transduction and peripheral nervous system studies. We offer the most complete listing of high-purity neurochemicals in the world.

**For a free catalog, call
us at 800-736-3690
or 508-651-8151 or
visit our web site at:
www.callrbi.com.** RBI — it
could be the most important
discovery you make today.

Steady-Glo™ Luciferase Assay System



Improve Your Luc...

- Greater Light Output
- Greater Precision
- More Convenient
- Optimized for 96 and 384 well plates
- More complete technical information

**PUT US
TO THE TEST**
and convince yourself.
To find out how to obtain a
sample of the Steady-Glo™ Reagent,
call your local Promega Branch
Office or Distributor.

LUCIFERASE ASSAY FOR HIGH THROUGHPUT SCREENING

The Steady-Glo™ Luciferase Assay System, new from Promega, is designed to yield reliable and robust results in high throughput screening applications. The Steady-Glo™ reagent provides stable luminescence with a half-life greater than 5 hours. The system is optimized for both 96 and 384 well plates, and is broadly compatible with mammalian cell culture conditions.

The new standard in glow-type luciferase reporter gene assays

Steady-Glo™ Reagent Provides:

■ Greater Sensitivity

Greater light output than other extended-lifetime luciferase assay reagents results in increased sensitivity.

■ Greater Assay Precision

Steady-Glo™ Reagent is less sensitive to mixing conditions, evaporation and pipetting errors, resulting in improved assay reproducibility in multi-well plates. This is particularly useful in 384 well plates.

■ Greater Convenience

Supplied in 10ml or 100ml sizes, the reagent does not require thawing, measuring or temperature equilibration before use. Simply mix buffer with lyophilized substrate and add to cells in growth medium. Please inquire about bulk packaging.

■ More Complete Technical Information

From Promega, the leader in supplying luciferase reporter assays, Steady-Glo™ Reagent is supported by extensive performance data and by our excellent Technical Services staff. For more information, visit www.promega.com/hts/



NORTH AMERICA
Promega Corporate Headquarters
2800 Woods Hollow Rd., Madison, Wisconsin
Toll Free in USA (800) 356-9526
Toll Free FAX in USA (800) 356-1970
Phone (608) 274-4330
FAX (608) 277-2516

Fisher Scientific
Toll Free in USA (800) 766-7000
FAX (800) 926-1166
VWR Scientific Products
Toll Free in USA (800) 932-5000

Steady-Glo is a trademark of Promega Corporation.
Patent pending. U.S. Pat. No. 5,283,179 and others. Certain applications of this product may require licenses.

Circle No. 39 on Readers' Service Card

Fisher Scientific Canada
Toll Free in Canada (800) 234-7437

EUROPE
▲ Austria +800-77663422
▲ Belgium 0800-180398
Czech Republic 02 206 10151
Denmark 44 94 88 22
Finland 358 9 7552550
France 0800 48 79 99
Germany +800-77663422
Greece 1 6436138
Hungary 1 251 0344
Ireland 018224222

▲ Italy 800 69 1818
▲ Luxembourg (+31)(0)71 532 4244
▲ The Netherlands 0800-0221910
Norway 22715090
Poland 98 3414726
Portugal 1 3613620
Russia 095 135 4206
Slovak Republic 95 632 4729
Slovenia 0 64 351 510
Spain 93 404 52 14
Sweden and Iceland 0346 83050
▲ Switzerland 01 830 70 37
▲ United Kingdom 0800 378994

LATIN AMERICA
Argentina and Uruguay 1 383 3000
Brazil bioBRAS (Belo Horizonte) 31 2919877
Promicro (Sao Paulo) 118690699
Chile 22472976
Colombia 1 271 5319
Ecuador 32582483
Mexico 5 261 4718
Venezuela 2 265 0891

MIDDLE EAST/AFRICA
Egypt 2 245 1785
Israel 8 9477077

Lebanon 1 249836
South Africa 21 961 1560
Turkey 216 385 8321

PACIFIC ASIA
▲ Australia 1 800 225 123
China, People's Republic
▲ Representative Office
Promega Beijing 10 68498287
(SP)
(SABC)
Hong Kong 216 483 5136
India 379 432 2510
2646 6101
11 684 6565

Indonesia 21 489 1718
▲ Japan 03 3669 7981
Korea (02) 478 5911
Malaysia 3 7048600
New Zealand 93664784
Pakistan 92 51 518 469
Singapore 775 7284
Taiwan 0223825378
Thailand 2 295 2532
▲ Indicates Promega Branch Office or Representative Office.
©1999 Promega Corporation. All Rights Reserved. Prices and specifications subject to change without prior notice. Rev.010299



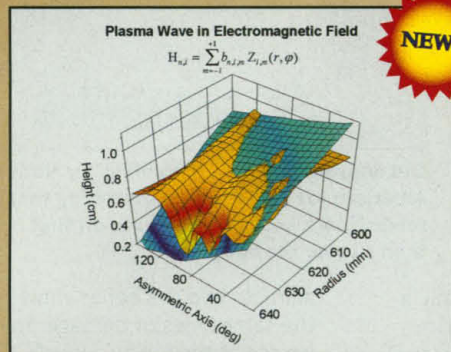
Promega

The Essential Desktop Tools for Scientists and Engineers™

SigmaPlot®

EXACT GRAPHS FOR EXACT SCIENCE

Scientists and engineers use SigmaPlot 5.0 to create the exact technical graphs they want to present their research results.

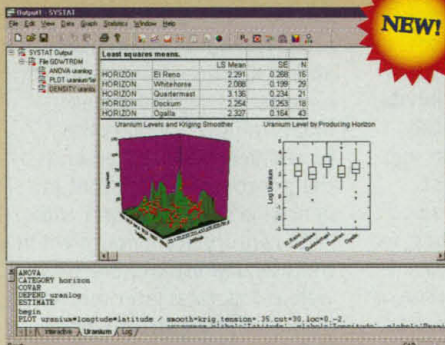


- New automation features maximize your productivity
- New Function Wizard plots built-in or custom functions
- New Function Solver for solving algebraic equations

SYSTAT®

RESEARCH-QUALITY STATISTICS AND GRAPHICS

SYSTAT 8.0 provides the most extensive selection of reliable statistics and high-quality, interactive graphics.

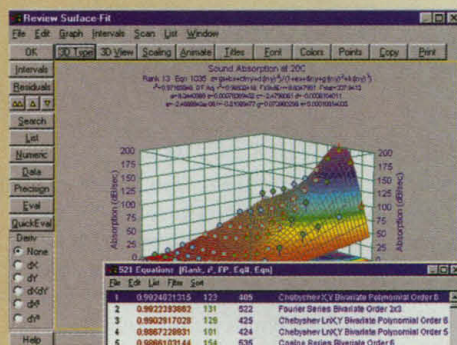


- Never worry about finding the right statistic or perfect graph
- New browser interface and powerful computation engine dramatically increases your analytical power
- Rich text Output Organizer™ creates compelling reports

TableCurve® 2D and 3D

AUTOMATED CURVE AND SURFACE FITTING

TableCurve 2D 4.0 and 3D 3.0 are powerful curve and surface fitting packages that instantly fit and rank built-in equations, enabling you to find the ideal model to your XY and XYZ data in seconds.

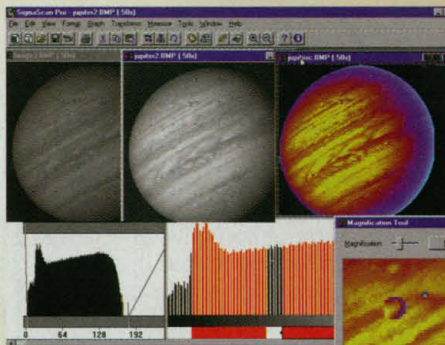


- Automation takes trial and error out of curve and surface fitting
- Fit user-defined functions
- Graphically review and print publication-quality curve fits

SigmaScan® Pro

POWERFUL IMAGE ANALYSIS FOR YOUR PC

SigmaScan Pro 4.0 provides powerful and comprehensive image analysis to turn visual information into reliable statistics, understandable graphs and valuable scientific conclusions.

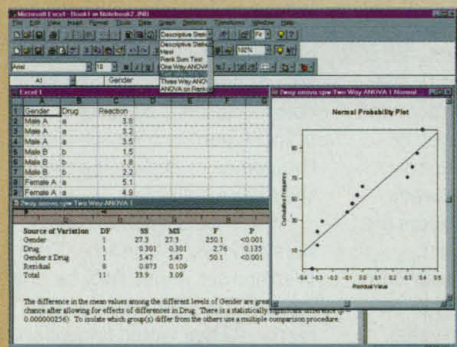


- Easily count, measure and analyze digital images
- Keyboard Macro Recorder automates repetitive tasks
- Sophisticated filtering tools enhance images for greater clarity

SigmaStat®

ADVISORY STATISTICAL SOFTWARE

SigmaStat 2.0 has an easy-to-use "expert system" design that guides you through every step of your statistical analysis.

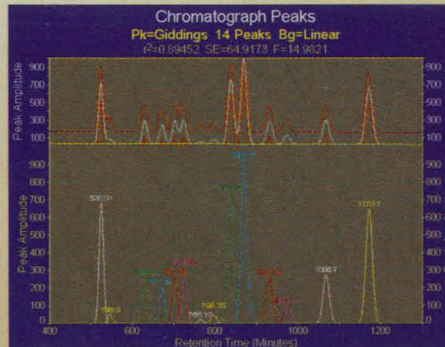


- Intuitive Advisor Wizard suggests which test to run and runs it
- Creates a detailed report of statistical results
- Add SigmaStat to Microsoft® Excel or SigmaPlot for a more powerful, integrated solution

PeakFit®

AUTOMATED PEAK SEPARATION AND ANALYSIS

PeakFit 4.0 is a nonlinear peak separation and analysis package for spectroscopy, chromatography and electrophoresis.



- Advanced curve fitting techniques separate overlapping peaks
- Non-linear curve fitting gives accurate peak analysis and conclusive results
- Advanced smoothing and manipulation techniques to accurately process noisy data

SPSS
science

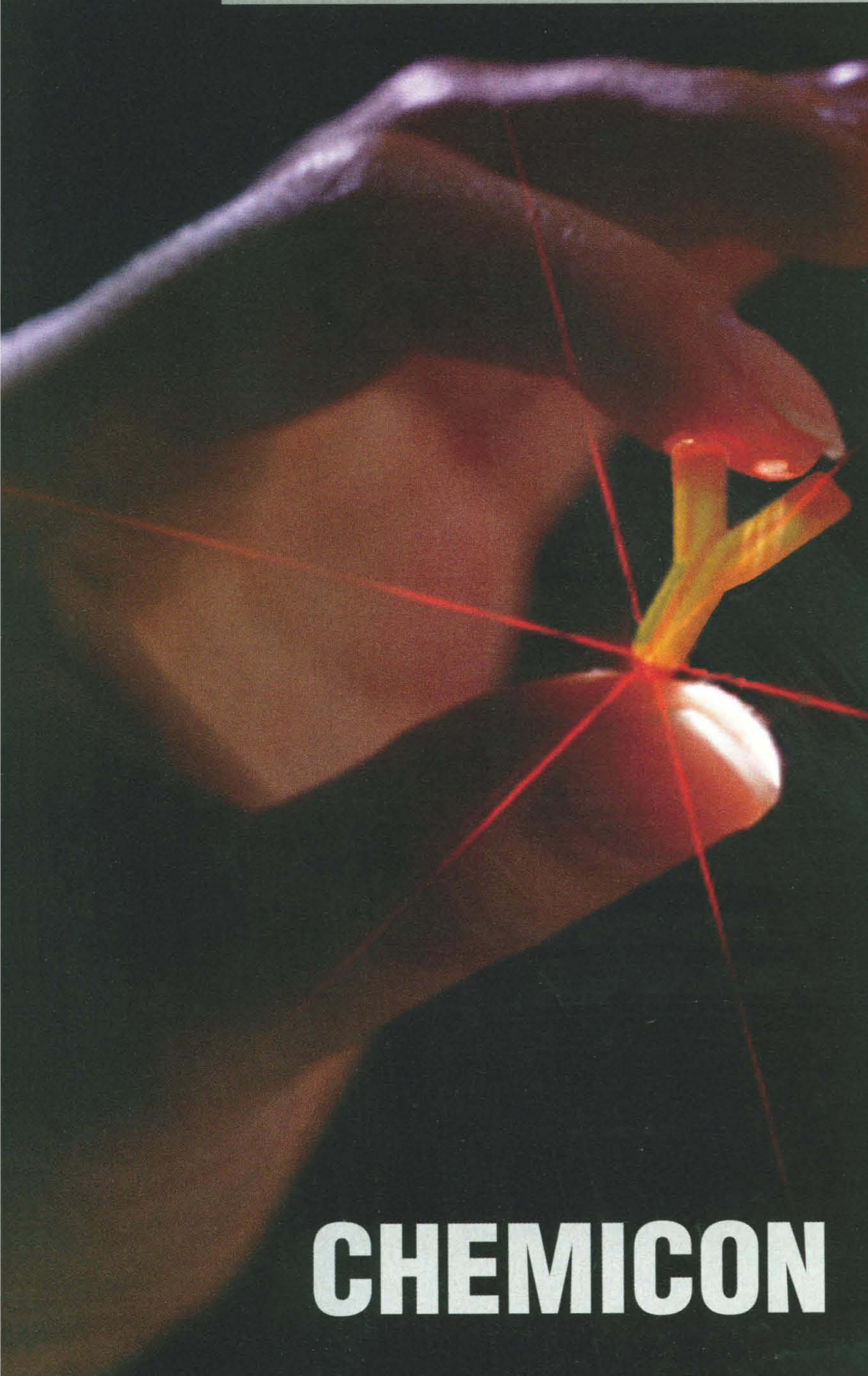
233 S. Wacker Dr., 11th Floor
Chicago, IL 60606-6307
312.651.3000; Fax: 312.651.3668

Call Today! (800) 345-4740

Try our FREE Demo versions:

www.spss.com/software/science

Drug Discovery Tools

- 
- Integrins
 - Functional Extracellular Matrix
 - Antibodies to Integrins, MMPs and TIMPs
 - Integrin purification gels

*Contact us for
our complete product
listing or for help
with a novel reagent
specific for your
needs.*

Circle No. 47 on Readers' Service Card

CHEMICON

CHEMICON International, Inc. • Phone: (909) 676-8080 • (800) 437-7500
Fax: (909) 676-9209 • www.chemicon.com • e-mail: custserv@chemicon.com

Announcing the first in a series of symposia...

THE JOURNAL OF PHYSIOLOGY

SYMPOSIUM

Secretion: Mechanisms and Regulation of Exocytosis

EXPERIMENTAL BIOLOGY 99

Saturday 17 April 1999, Washington DC

Keynote Lecture

James E Rothman

(Sloan-Kettering Institute, NY)

The minimal machinery for vesicle budding and fusion

Speakers include:

Julio Fernandez

(Mayo Clinic, Rochester, MN)

*The molecular mechanics of single proteins observed
by atomic force microscopy*

Joshua Zimmerberg

(NIH, Bethesda, MD)

*The fusion complex of exocytosis and
enveloped viral fusion*

Thomas C Südhof

(University of Texas, Dallas, TX)

Regulation of synaptic vesicle exocytosis

Pietro De Camilli

(Yale University, New Haven, CT)

Reformation of vesicles after exocytosis

George Augustine

(Duke University, Durham, NC)

*Molecular mechanisms of neurotransmitter release:
a functional view*

Jacopo Meldolesi

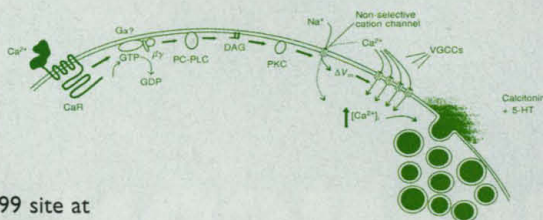
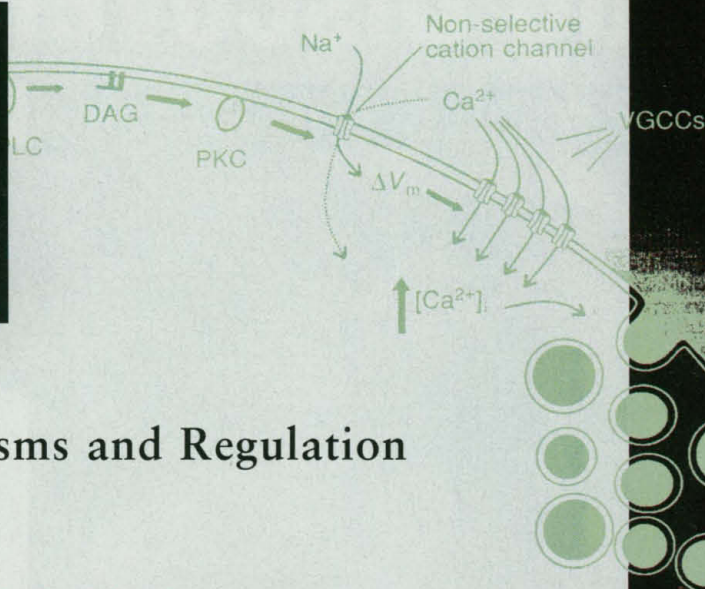
(Scientific Institute San Raffaele, Milan, Italy)

*Neurosecretion competence: an independently
regulated trait of the neurosecretory cell phenotype*

Bertil Hille

(University of Washington, Seattle, WA)

Stimulation of exocytosis without a calcium signal



Registration is via the Experimental Biology 99 site at
www.faseb.org/eb99 or for further information go to
<http://physiology.cup.cam.ac.uk/JPhysiol/symp.html>
E-mail: JPSymposium@physoc.org

Circle No. 24 on Readers' Service Card

The *Journal of Physiology* is published by Cambridge University Press on behalf of The Physiological Society in 24 fortnightly issues in eight volumes (514-521) plus Proceedings issues. The 1999 subscription price (which includes online access) is £1248/\$2134. ISSN 0022-3751. For further information go to www.journals.cup.org.

The *Journal of Physiology* has its own home page showing the latest contents and news items of interest to physiologists. Go to www.physiology.cup.cam.ac.uk/JPhysiol/ or www.cup.org and to *The Journal of Physiology* via the hot links.

CAMBRIDGE
UNIVERSITY PRESS

Purchase Your Biological and Chemical Reagents.

Faster. Easier. Online.

Search less to find the reagents you need
and discover more of what you're looking
for—at chemdex.com. Register for a free
password today and experience the future.

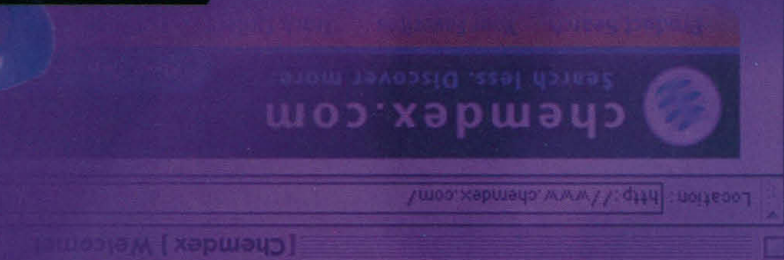
www.chemdex.com

chemdex.com
Search less.
Discover more.



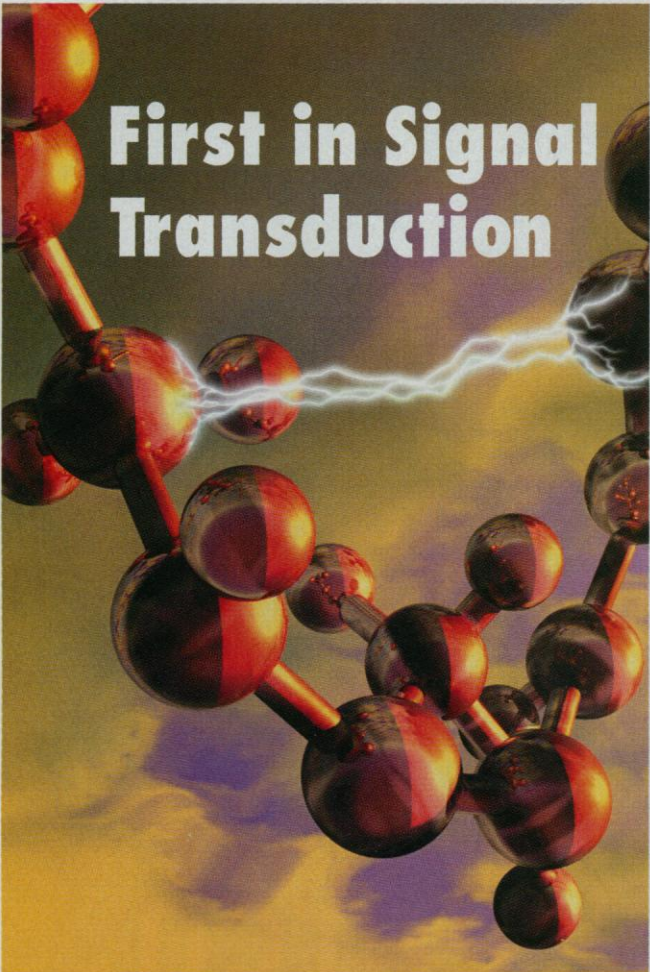
Search.
Less
With

Research—



© 1998 Chemdex Corporation.
Chemdex is a registered trademark of Chemdex Corporation.

Circle No. 11 on Readers' Service Card



First in Signal Transduction

Products for:

- Apoptosis
- Lipid signaling
- Protein kinases/phosphatases
- Gene regulation
- Proteasome and proteases

Call: 800-942-0430

Visit: www.biomol.com

BIOMOL®
Capture the Power

BIOMOL Research Laboratories, Inc.
5100 Campus Drive Plymouth Meeting, PA 19462-1123 USA
phone: 610-941-0430 fax: 610-941-9252
e-mail: info@biomol.com

Circle No. 28 on Readers' Service Card

Jobs Online.

Every ad placed in this issue of *Science* was posted on *Science* Professional Network's fully searchable online jobs database...last week.

- Get a jump on the competition.
- Find out about upcoming *Science* Career Fairs.
- Sign up for Job Alerts, our e-mail job notification service.
- Link directly to top organizations on Employer Profiles.

 www.scienceonline.org
click on "*Science* Careers"

Science
Real jobs. Right now.

DESIGNING AND IMPLEMENTING YOUR GENOMICS PLAN



...from gene cloning to identifying novel pharmaceutical targets

SYSTEMATIC gene function analysis and target validation by targeted gene modification.

COMPLETE transgenic programs including gene cloning, expression and phenotypic analysis.

CAPACITY to produce and screen transgenic rodents from hundreds of genes per year.

*Let us tailor our science to meet your genomics needs
through a collaborative approach.*

Call Chrysalis DNX Transgenic Sciences at
(609) 520-0300, or fax (609) 520-9864
or send e-mail to: genomics@chrysalisintl.com

DNX TRANSGENIC SCIENCES

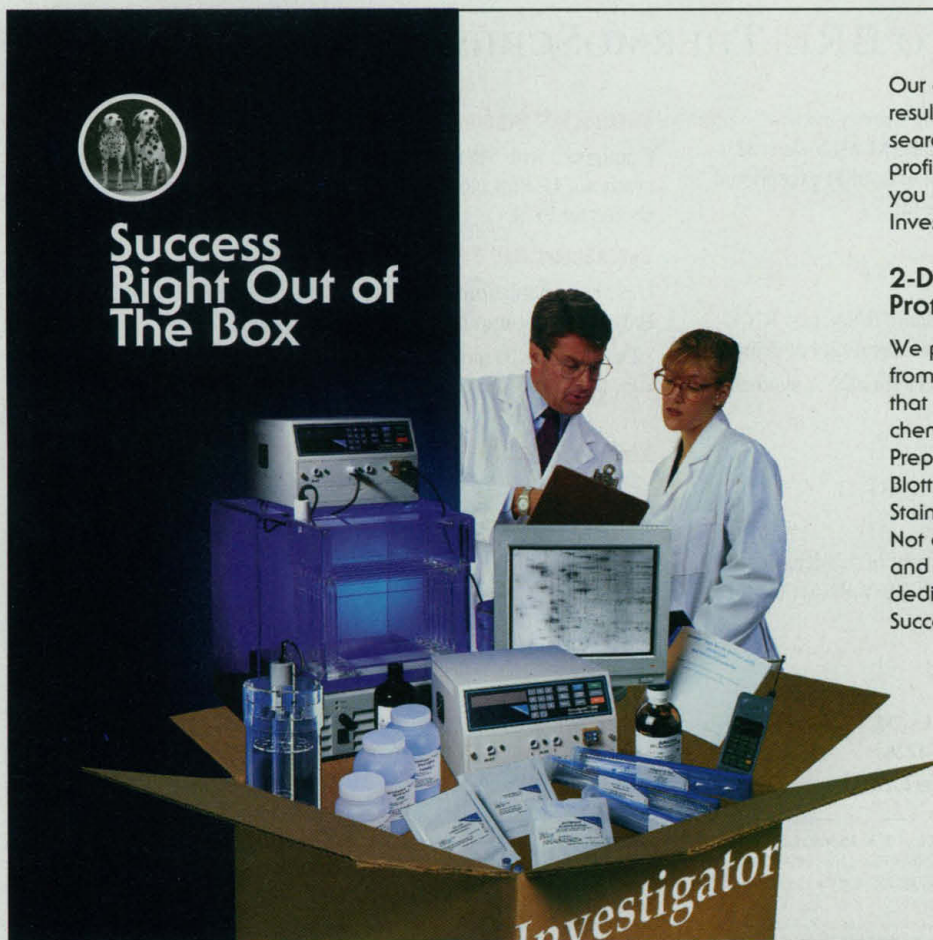
301 B College Road East, Princeton, NJ 08540
www.chrysalisintl.com/transgenic/

©1998 CHRYSALIS INTERNATIONAL CORP.

Circle No. 17 on Readers' Service Card



Success Right Out of The Box




Our attention to detail gives you results right out of the box. If you're searching for protein targets, mass profiling or deciphering the Proteome, you need the Genomic Solutions Investigator™ System.

2-D Gel Electrophoresis For Proteome Analysis.

We provide the complete package—from major components to the accessories that everyone else forgets. Ultra-pure chemicals. Pre-cast gels. Duracryl™. Preparative accessories. Image analysis. Blotting. Power supplies. Running devices. Stains. Standards. Sample prep. EVERYTHING. Not only that, but the technical expertise and support that comes only from being dedicated to 2-D electrophoresis. Success right out of the box.

Get your box now. Contact
Genomic Solutions at 800-848-5235.
or fax 734-975-4812.
Ask for our new catalog!

 **GENOMIC
SOLUTIONS**

22 Alpha Road, Chelmsford, MA 01824-4171 USA
Europe 01480 474 344
www.genomicsolutions.com

Circle No. 13 on Readers' Service Card

Transcribe longer.

Run hotter.

Expect more from less.

Do what hasn't been done before.

Introducing GIBCO BRL® THERMOSCRIPT RT-PCR Systems.

THERMOSCRIPT™ RT-PCR Systems, employing a novel *avian* RNase H⁻ reverse transcriptase, together with the M-MLV-derived SUPERSCRIPT™ II RNase H⁻ RT family of products, offer exceptional RT-PCR performance, no matter what your need.

THERMOSCRIPT RT-PCR Systems

Higher specificity

- Synthesize cDNA from high secondary structure RNA, rare RNA, and RNA with high GC content, and improve specificity of priming.
- Superior to RNase H⁺ AMV and M-MLV RTs for cDNA synthesis at temperatures up to 70°C.

Higher sensitivity

- 100-times better sensitivity than with AMV H⁺ RT.

Higher yield and longer transcripts

- Reduced RNase H activity for increased percent of full-length cDNA and higher cDNA yield than with AMV or M-MLV RNase H⁺ RTs.
- Amplify RT-PCR targets up to 12 kb.

SUPERSCRIPT Preamplification System

Configured with SUPERSCRIPT II RNase H⁻ RT for first-strand cDNA synthesis. Use for cloning or customize with amplification enzyme of choice for PCR.

SUPERSCRIPT ONE-STEP™ RT-PCR System

Unique combination of SUPERSCRIPT II RNase H⁻ RT and *Taq* DNA Polymerase to amplify up to 3.5 kb fragments.

- Detects 5 to 10 molecules of RNA template.
- Single tube reaction for reduced pipetting and risk of contamination.

Product	Cat. No.
THERMOSCRIPT RT-PCR System for First-Strand cDNA Synthesis	11146-016
with PLATINUM™ <i>Taq</i> DNA Polymerase	11146-032
with PLATINUM <i>Taq</i> DNA Polymerase High Fidelity	11146-040
SUPERSCRIPT Preamplification System	18089-011
SUPERSCRIPT ONE-STEP RT-PCR System	10928-026

U.S. Academic and Government Orders/TECH-LINE™: (800) 828-6686

U.S. Industrial Orders/TECH-LINE: (800) 874-4226

Internet Ordering and Information: www.lifetech.com

LIFE TECHNOLOGIES™

U.S. Academic & Government Fax Orders: (800) 331-2286 U.S. Industrial Fax Orders: (800) 352-1468

Latin America Orders: To Order/TECH-LINE: (301) 610-8709 • Fax: (301) 610-8724

Canada Orders: To Order: (800) 263-6236 • TECH-LINE: (800) 757-8257 • Fax: (800) 387-1007

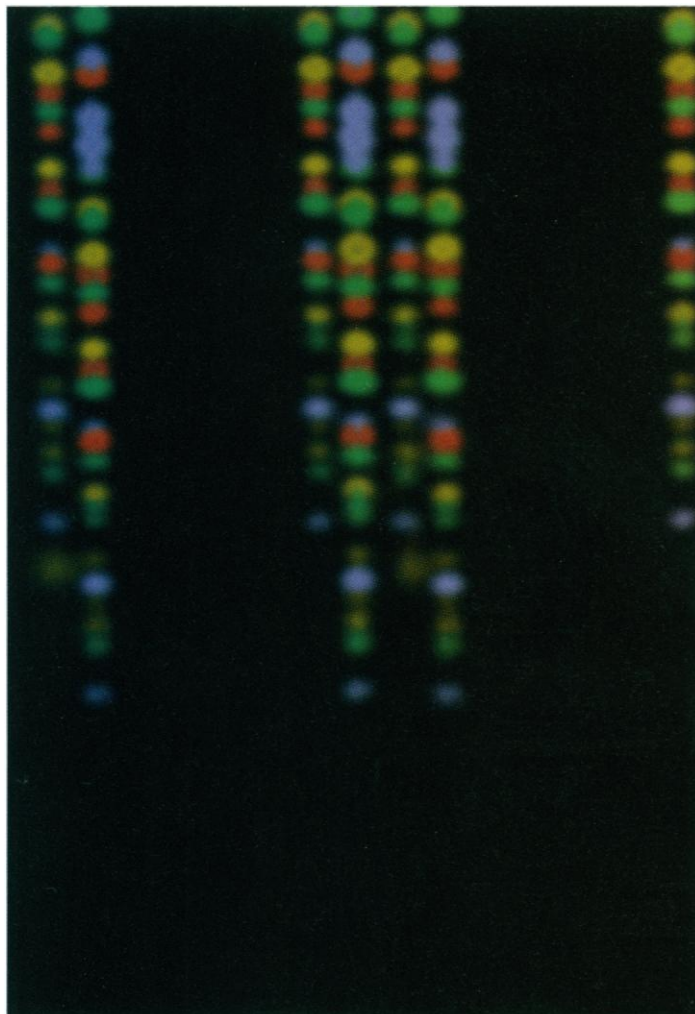
These products are for laboratory research use only and are not intended for human or animal diagnostic, therapeutic, or other clinical uses, unless otherwise stated. ©1999 Life Technologies, Inc. 98-97CRE

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

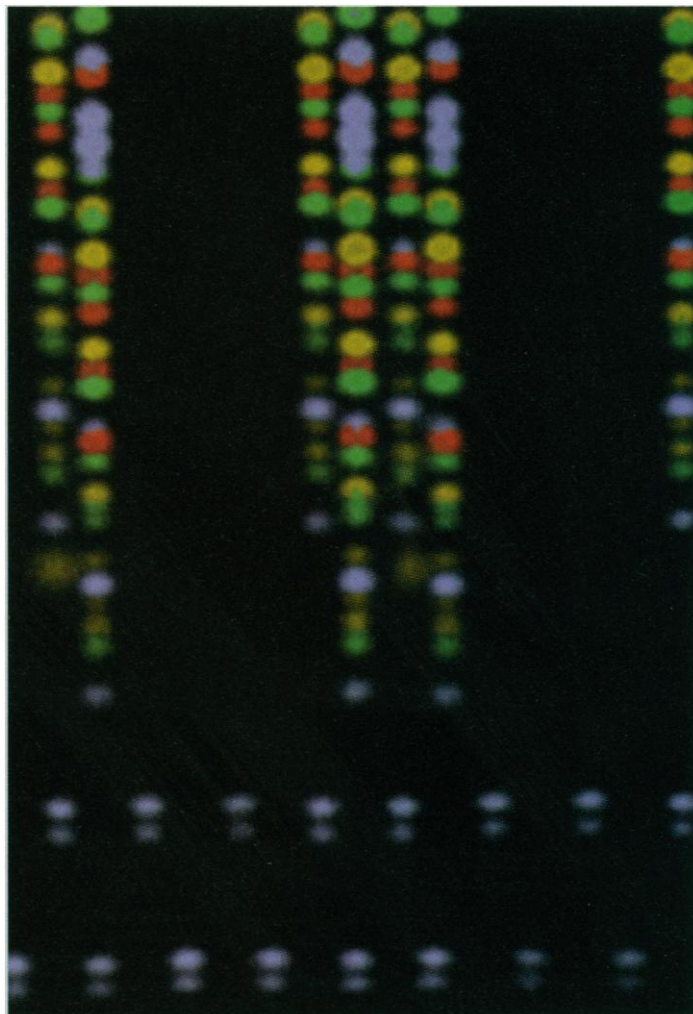
Circle No. 27 on Readers' Service Card

INTRODUCING ACCUTRAC™ FOR DNA SEQUENCING

NOW, COUNTING LANES IS AS EASY AS 1,2,3...



WITHOUT A TRACKING DYE, EMPTY LANES ARE DIFFICULT TO IDENTIFY.



WITH ACCUTRAC, THE NUMBER AND LOCATION OF EACH LANE IS APPARENT. INCORRECT ASSIGNMENTS ARE THUS ELIMINATED.



*ORDER YOUR FREE SAMPLE TODAY!

Put an end to inaccurate sample identification with AccuTrac™, the most accurate lane location technology available.

The AccuTrac™ process (patent pending) utilizes a fluorescent dye label that marks every lane, eliminating the need for manual review and lane assignment.

With AccuTrac™, **every** lane on a gel is identified, whether it contains data or not.

- AccuTrac™ has been used to monitor the results of tens of thousands of DNA sequencing reactions and has
- **reduced to zero** the incidence of mislabeled or skipped lanes. By using AccuTrac™ you will optimize not only data quality but also cost and time elements.

Order your FREE sample now.

Call Toll Free Fax On Demand 1-877-FAX-4CBI (329-4224) or visit at www.cbi-biotech.com.

* Offer available while supplies last. One sample per laboratory.



COMMONWEALTH
BIOTECHNOLOGIES, INC.

A key element for customized project support.

601 BIOTECH DRIVE • RICHMOND, VA 23235 • WWW.CBI-BIOTECH.COM

Circle No. 31 on Readers' Service Card

Circle No. 38 on Readers' Service Card

Takeda Chemical Industries, Ltd.

TAKEDA

According to the ancient Chinese philosophy of yin and yang, the universe is composed of opposing but interdependent forces. ■ Interestingly, this philosophy resembles the concept of homeostasis, the natural balance that occurs within living organisms, including the harmony between antagonists and agonists that regulate vital functions. Thus, an important factor in the search for new medicines is developing compounds that work together with the body's own restorative and regenerative abilities. ■ To lead healthy lives, we must seek balance with nature, with society, and within ourselves. As a leading pharmaceutical company, Takeda is striving to help people attain this balance.

In Perfect Balance

