

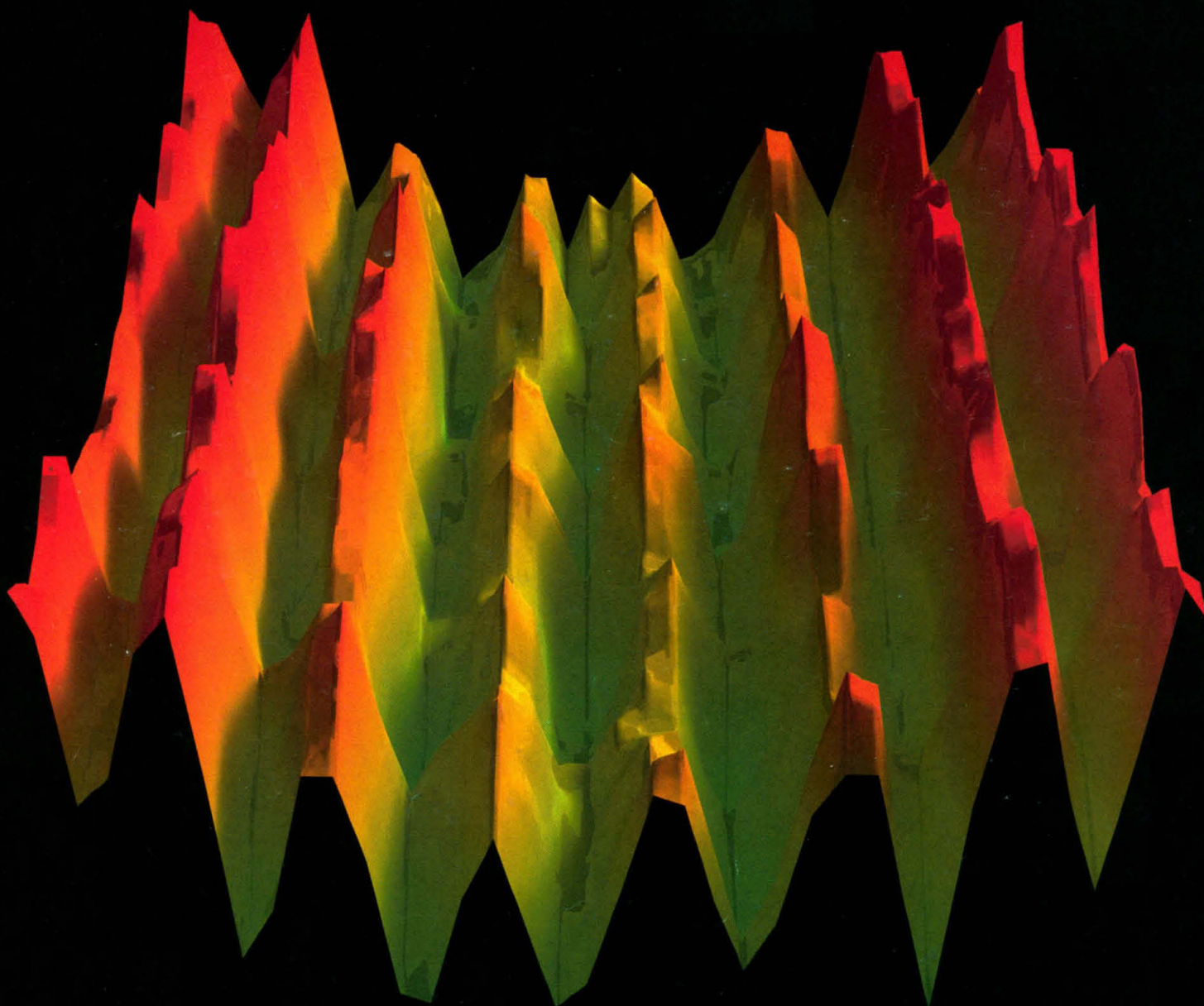


AMERICAN
ASSOCIATION FOR THE
ADVANCEMENT OF
SCIENCE

SCIENCE

31 JANUARY 1997
VOL. 275 • PAGES 589-720

\$7.00

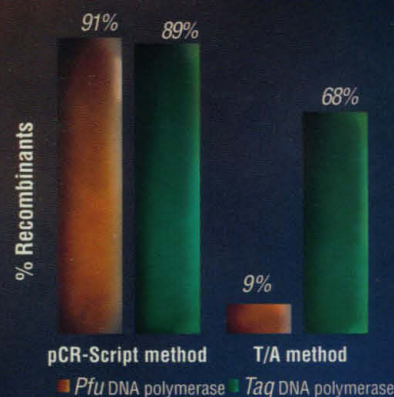


STRATAGENE

pCR-SCRIPT™ CLONING KITS

*With the T/A cloning method
you need a crystal ball
to foresee your results*

*...Eliminate the
guesswork with
pCR-Script cloning*



**pCR-Script Vectors
Eliminate the Inconsistency
of PCR Cloning**

♦ **pCR-Script cloning excels with high fidelity enzymes...**
T/A cloning method fails!

♦ **pCR-Script cloning works with all PCR enzymes...**
T/A cloning method does not!

♦ **pCR-Script performs consistently with Taq...**
T/A cloning method is variable!

Circle No. 18 on Readers' Service Card

*Another creative cloning solution
from Stratagene*



UNITED STATES:
Stratagene Headquarters
800-424-5444
INTERNET MAIL:
techservices@stratagene.com
AUSTRALIA: 1800-252-204
AUSTRIA: 1 5332666
BRAZIL: 11 530 7533
CANADA: 905 713 1201
DENMARK: 3 6101055
FRANCE: 1 34 60 2424
GERMANY:
Stratagene GmbH 0130-840911
HONG KONG: 5785839
ISRAEL: 3 7521687
ITALY: 258013409
JAPAN: (Furukoshi) 3 5684 1622
(Toyoko) 3 3660 4819 or 6 348 3785
KOREA: 2 5560311
MALAYSIA: 37031888
THE NETHERLANDS: 33 4950094
NEW ZEALAND: 9 443 5867
NORWAY: 22715090
PORTUGAL: 1-4581641
ROC: 2 694 0066 or 2 720 2215
SINGAPORE: 2730898
SPAIN: 1 729 03 33
SWEDEN: 8 680 0845
SWITZERLAND:
Stratagene GmbH 3641106
THAILAND: 23080611
UNITED KINGDOM:
Stratagene Ltd. 0800 585370

* Patent pending
† These products are optimized for use in the Polymerase Chain Reaction (PCR) process covered by patents owned by Hoffmann-La Roche. Purchase of these PCR-related products does not convey any rights under the PCR patents owned by Hoffmann-La Roche. A license to use the PCR process accompanies the purchase of certain reagents from Stratagene when used in conjunction with an Authorized Thermal Cycler.

The Importance of Choice

INTRODUCING 19 NEW HIGH-SENSITIVITY RENAISSANCE® LABELING KITS AND DETECTION SUBSTRATES

Specifically designed for nonradioactive detection of DNA and RNA using chemiluminescence and chromogenic methods, the Renaissance line of easy-to-use kits and substrates brings an unbeatable combination of sensitivity, reliability, and choice to your laboratory.

At NEN, we're committed to serving the life scientist as never before.

That's why we're expanding our already comprehensive Renaissance nonradioactive labeling and detection product offering by introducing 19 new high-sensitivity labeling kits and detection substrates.

Whether your labeling method of choice is Random Priming, Nick Translation, 3'-End Labeling, or RNA Transcription, there is a convenient kit for use with our chemiluminescent or chromogenic substrates. For ultimate flexibility, versions of all kits are available to make hybridization probes labeled with either fluorescein or biotin and include either alkaline phosphatase or horseradish peroxidase conjugates. Once your DNA or RNA probes are labeled, detection is quick and simple on GeneScreen membrane with either ready-to-use CDP-Star™ or Enhanced Luminol and Reflection™ film or 4CN Plus.

These new labeling kits give you everything you need to label probes in preparation for in situ hybridization (ISH) applications of Renaissance Tyramide Signal Amplification (TSA™) — the breakthrough technology that gives you unprecedented signal amplification that is up to 1000 times greater than conventional methods. And TSA can be used with both ISH or immunohistochemistry (IHC) techniques.

With Renaissance products, you get the the largest selection anywhere of nucleic acid labeling and detection products, allowing you the widest range of choice from a single source. And you get the assurance of knowing that product compatibility and system optimization are built in.

Call today to learn more about how Renaissance products provide the quality and choice you need for your lab. And when you do, ask about our expanding line of nonradioactive nucleotide analogs available in a wide range of fluorescein- and biotin-labeled deoxynucleotides, ribonucleotides, and dideoxynucleotides.

Renaissance is a registered trademark and NEN and Reflection are trademarks of NEN™ Life Science Products, E.I. du Pont de Nemours and Company. CDP-Star is a trademark of Tropix Inc., Bedford, Mass. Renaissance products are manufactured under an ISO 9002 Quality System registered by UL. © NEN™ Life Science Products, 1996.



See for Yourself — Superior Sensitivity in Short Exposure Time

Figure 1

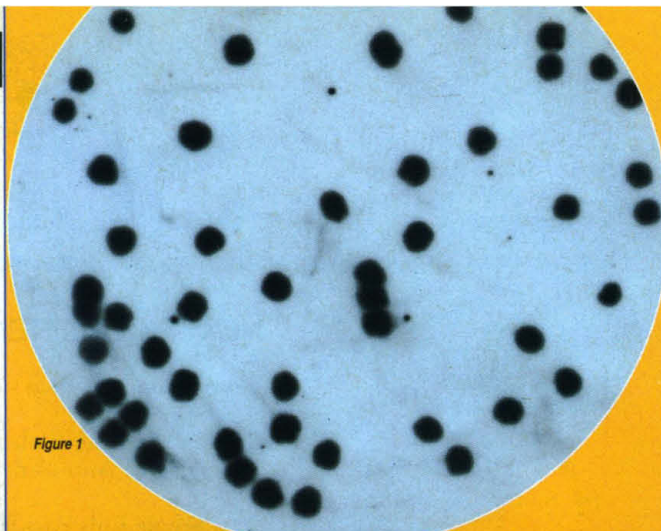


Figure 1. Colonies were screened for the TGF-β1 gene with a fluorescein-labeled oligonucleotide probe and Enhanced Luminol. This film demonstrates results obtained using the Renaissance 3'-End Labeling Fluorescein Kit with Antifluorescein-HRP (NEL823) and the detection substrate Enhanced Luminol (NEL201). Discs were exposed to Reflection film for 15 minutes.

Figure 2



Figure 2. Mouse β-actin was detected using a fluorescein-labeled ssRNA probe and ready-to-use CDP-Star. This film demonstrates results obtained using Renaissance RNA Fluorescein Labeling Kit with Antifluorescein-AP (NEL633) in conjunction with ready-to-use CDP-Star (NEL601). Blots were exposed to Reflection film for 5 minutes.

Figure 3

Figure 3. The v-Fos gene was detected in 125 ng of blotted mouse genomic DNA in less than 5 minutes using CDP-Star. This film demonstrates results obtained using the Renaissance Random Primer Biotin Labeling Kit with Streptavidin-AP (NEL604) in conjunction with ready-to-use CDP-Star (NEL601). Blots were exposed to Reflection film for 5 minutes.

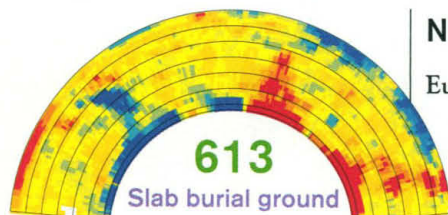


NEN™ Life Science Products

Boston, MA 02118-2512 USA
1-800-551-2121 • 617-482-9595
Fax: 617-482-1380
Web: <http://www.nenlifesci.com>
Email: NEN_TECH@WMVX.DNET.DUPONT.COM

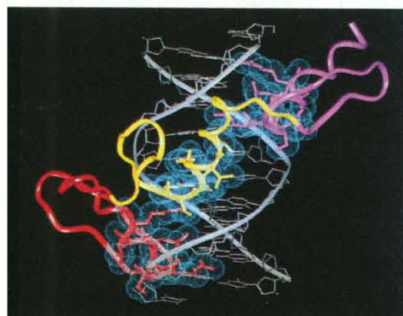
Australia (61) 2-923-7355 • Belgium (02) 7242716
France (01) 69825474 • Germany (06172) 872600
Italy (02) 25302-481/319 • Japan (81) 3-5421-1354
Netherlands (078) 6301092 • Switzerland (01) 8410330 • United Kingdom (01438) 73-40-27

Circle No. 23 on Readers' Service Card



613

Slab burial ground



657

Pointed fingers

NEWS & COMMENT

Europe Ponders Space Constraints 606

Switzerland: Biologists Mobilize
Against Anti-Genetics Referendum 607

Senate Bills Back Huge Increases 608

NSF Fits In New Projects Despite
Squeeze on Funding 609

France: Thrust and Parry Over
Nuclear Risks 610

\$1.6 Million Fraud Award Overturned 610

The Clearest View: Hubble Telescope
to Get an Upgrade 611

ITER Review Team Takes Bullish
Stance 612

RESEARCH NEWS

Deep-Sinking Slabs Stir the Mantle
20,000 Leagues Under the Earth 613
614

AIDS: Advances Painted in
Shades of Gray at a D.C. Conference 615

First Atom Laser Shoots Pulses of
Coherent Matter 617
A New Recipe for Atom Condensates 617

A "Master Control" Gene for Fly
Eyes Shares Its Power 618

Gas Clouds May Be Relics of Creation 619

Japanese Mission Stretches Limits
of Interferometry 620

Glaucoma Gene Provides Light at the
End of the Tunnel 621

PERSPECTIVES

Micro Lensing Sheds Light on Dark
Matter 626
P. Hewett and S. Warren

Searching a Quantum Phone Book 627
G. Brassard

Akt Signaling: Linking Membrane
Events to Life and Death Decisions 628
B. A. Hemmings

Alzheimer's Disease: Genotypes,
Phenotype, and Treatments 630
D. J. Selkoe

ARTICLE

How Cells Get the Right Chromosomes 632
R. B. Nicklas

DEPARTMENTS

THIS WEEK IN SCIENCE 595

EDITORIAL 599
Bright Star Among Billions
S. J. Gould

LETTERS 601
Human Genome Agreements: B. G. Lorimier; J. C.
Venter; N. A. Holtzman • Teaching Quality: S. C.
Trombulak • Cosmological Interpretations: H.-D.
Radecke

SCIENCESCOPE 605

RANDOM SAMPLES 623
The First Tool Kit • USC Suit Gains Supporters •
Money for Extremophiles

BOOK REVIEWS 624
Born to Rebel, reviewed by J. Modell • Browsing

AAAS NEWS & NOTES 685

PRODUCTS & MATERIALS 687

AAAS Board of Directors

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

Sheila Jasanoff
William A. Lester Jr.
Simon A. Levin
Marcia C. Linn
Michael J. Novacek
Anna C. Roosevelt
Jean E. Taylor
Nancy S. Wexler

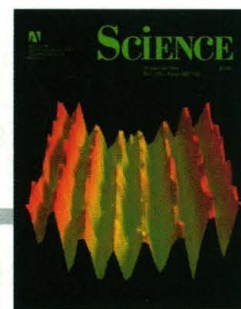
William T. Golden
Treasurer
Richard S. Nicholson
Executive Officer

■ 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. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 1997 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): \$105 (\$58 allocated to subscription). Domestic institutional subscription (51 issues): \$260. Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Printed in the U.S.A.

COVER

Matter wave interference of two freely expanding and overlapping Bose-Einstein condensates. The density of atomic sodium (vertical axis, in false color) is shown in an area of 0.1 millimeter by 0.4 millimeter containing about 50,000 atoms. The high-contrast interference

fringes demonstrate that Bose-Einstein condensates are "laser-like," made of atoms occupying a single controllable quantum state. See page 637 and the related News story on page 617. [Image: Dallin Durfee]



RESEARCH ARTICLE

Observation of Interference Between Two Bose Condensates 637

M. R. Andrews, C. G. Townsend, H.-J. Miesner, D. S. Durfee, D. M. Kurn, W. Ketterle

REPORTS

Photochemically Driven Collapse of Titan's Atmosphere 642

R. D. Lorenz, C. P. McKay, J. I. Lunine

Earth-Based Radio Tracking of the Galileo Probe for Jupiter Wind Estimation 644

W. M. Folkner, R. A. Preston, J. S. Border, J. Navarro, W. E. Wilson, M. Oestreich

Microscopic Growth Mechanisms for Carbon Nanotubes 646

J.-C. Charlier, A. De Vita, X. Blase, R. Car

A Silicon Single-Electron Transistor Memory Operating at Room Temperature 649

L. Guo, E. Leobandung, S. Y. Chou

Micropatterning Fluid Lipid Bilayers on Solid Supports 651

J. T. Groves, N. Ulman, S. G. Boxer

Magnetic Collapse in Transition Metal Oxides at High Pressure: Implications for the Earth 654

R. E. Cohen, I. I. Mazin, D. G. Isaak

A General Strategy for Selecting High-Affinity Zinc Finger Proteins for Diverse DNA Target Sites 657

H. A. Greisman and C. O. Pabo

Regulation of Neuronal Survival by the Serine-Threonine Protein Kinase Akt 661

H. Dudek, S. R. Datta, T. F. Franke, M. J. Birnbaum, R. Yao, G. M. Cooper, R. A. Segal, D. R. Kaplan, M. E. Greenberg

Direct Regulation of the Akt Proto-Oncogene Product by Phosphatidylinositol-3,4-bisphosphate 665

T. F. Franke, D. R. Kaplan, L. C. Cantley, A. Tokier

Identification of a Gene That Causes Primary Open Angle Glaucoma 668

E. M. Stone, J. H. Fingert, W. L. M. Alward, T. D. Nguyen, J. R. Polansky, S. L. F. Sunden, D. Nishimura, A. F. Clark, A. Nystuen, B. E. Nichols, D. A. Mackey, R. Ritch, J. W. Kalenak, E. R. Craven, V. C. Sheffield

Preattentive Filling-in of Visual Surfaces in Parietal Extinction 671

J. B. Mattingley, G. Davis, J. Driver

NMDA Channel Regulation by Channel-Associated Protein Tyrosine Kinase Src 674

X.-M. Yu, R. Askalan, G. J. Keil II, M. W. Salter

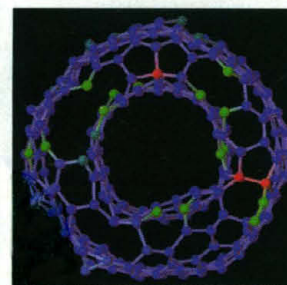
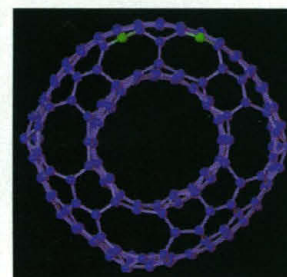
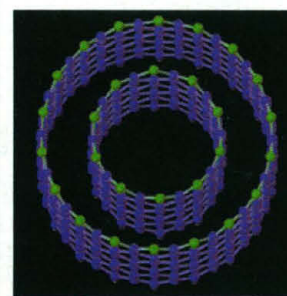
Positive Selection of T Cells Induced by Viral Delivery of Neopeptides to the Thymus 678

N. Nakano, R. Rooke, C. Benoist, D. Mathis

TECHNICAL COMMENTS

Comparative Rates of Development in *Monodelphis* and *Didelphis* 683

K. K. Smith and A. F. H. van Nievelt; Response: T. Rowe



646

Nanotube growth

■ 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.

On the Web **SCIENCE**^{NOW}

Get your daily news fix from *Science's* news team: <http://www.sciencenow.org/>

Immunological Services

Antigen Production and Purification

- Peptide Antigens
- Soluble Protein Antigens
- Cell Tissue Extracts
- Large-Scale Mammalian and Insect Cell Culture



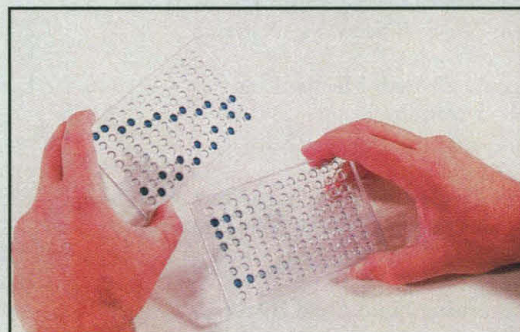
Bioreactor used for large scale production of Eukaryotic cells and cell products. (Fibroblasts, Monoclonals, Chinese hamster ovary, Baculovirus expression, etc.)

Assay and Kit Formatting

- ELISA
- Radioimmunoassay
- Immunofluorescence
- Flow Cytometry
- Immunohistochemistry

Antibody Testing and Characterization

- Immunoprecipitation
- Western Blotting
- ELISA
- Cell and Tissue Staining
- Peptide Mapping



Antibody Production and Purification

- Monoclonal and Polyclonal Development
- Large and Small Scale Monoclonal Production
- Affinity Purification
- Antibody Fragmentation
- Enzyme and Fluorescein Labeling
- Immobilization

Research Genetics, Inc.

2130 Memorial Pkwy, SW • Huntsville, AL • 35801

U.S. or Canada 800-533-4363 • U.K. 0-800-89-1393 • FAX 205-536-9016

Homepage <http://www.resgen.com>

Circle No. 22 on Readers' Service Card

THIS WEEK IN SCIENCE

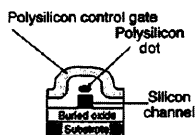
edited by PHIL SZUROMI

Ice ages on Titan?

Titan's nitrogen-rich atmosphere has been thought to need a steady supply of gases such as methane or hydrogen to help it maintain enough solar and thermal radiation to avoid condensation. However, there is no direct evidence that indicates that methane is maintained at a constant level. Lorenz *et al.* (p. 642) considered the effects of a depletion in methane on Titan with radiative-convective and radiative-saturated models. Without enough methane, Titan's atmosphere cools and nitrogen condenses. With continued methane-rich volcanism, the atmosphere could eventually warm up and lead to an atmospheric reinflation. This cycle could then repeat, which leads to the possibility of repeated "ice ages" on Titan that may be recorded in its surface morphology.

One electron at a time

A metal-oxide semiconductor transistor can represent information as charges stored on a floating gate that is built between the device channel and the control gate. One way to increase memory density is to reduce the amount of charge needed to change the state of



the device. Guo *et al.* (p. 649) have made a single-electron memory that incorporates a polysilicon dot (a few nanometers in dimension) as the floating gate. This device changed its output in steps corresponding to charging of the floating gate in single-electron increments at room temperature.

Eavesdropping on the Galileo probe

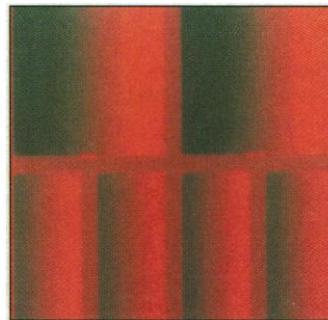
While the Galileo probe descended into Jupiter's atmosphere and returned measurements from all of its instruments to the orbiter above it, a group of scientists were listening in on this vital communication through two large arrays of radio telescopes on Earth. Folkner *et al.* (p. 644) describe how this radio signal was picked up and then used to estimate the wind speed along its trajectory. This probe-Earth measurement of wind speed was made in a different orientation because the Earth was nearly on the horizon of Jupiter during probe entry. These data not only confirmed the probe-orbiter wind speed measurements but did so at a different orientation, which will help in correcting and defining the winds of Jupiter in more than one dimension.

Nanotube growth

Depending on synthesis conditions, carbon nanotubes can form as single-walled or multiwalled structures. The growth of single-walled tubes generally requires metal catalysts to be present, but multiwalled tubes can be grown without them. Charlier *et al.* (p. 646) show through ab initio calculations that, for multiwalled tubes, a fluctuating-bond network between the edges of the sheets provides active sites for facile adsorption of carbon. For single-walled tubes, spontaneous dome closure is observed that makes uncatalyzed growth unfavorable.

Membrane corrals

Technologies normally used to make semiconductor devices have been harnessed to control the fluid bilayers of cell membranes. Groves *et al.* (p. 651) have patterned oxidized silicon wafers, which are hydrophilic, into corrals separated by barriers of gold, aluminum oxide, or photoresist. Fluid bilayers readily form within these corrals, and the concentrations of fluorescent probes within individual corrals could be altered by photobleaching or applying



an electric field. Such arrays are not only useful for fundamental studies, such as of diffusion in membranes, but may also find use in device patterning.

Biasing T cells

As T cells mature in the thymus, their receptors are biased against self-peptides (negative selection) but also toward nonself peptides. How does this latter positive-selection process prepare the T cell repertoire for encounters with the huge array of nonself sequences? Nakano *et al.* (p. 678) explored this question by studying mice that were injected in the thymus with an adenovirus vector expressing a nonself peptide along with an invariant chain (Ii) of the class II major histocompatibility complex. In this way, the peptide was expressed near its binding groove. Although the

T cells could respond to both closely related and unrelated peptide sequences, the particular repertoire changed with even slight changes to the original peptide sequence.

Glaucoma gene

Primary open angle glaucoma is one of leading causes of blindness but can often be successfully treated if caught before irreversible damage is done to the optic nerve. Stone *et al.* (p. 668; see the news story by Vogel, p. 621) used a genetic linkage and haplotype sharing analysis to identify a candidate gene, *TIGR*, for a juvenile onset form. Mutation screening showed that 13 of 330 unrelated patients carried mutations in this gene on chromosome 1. Genetic screening may help identify individuals at greater risk for this disease.

Akt actions

Two reports provide new insight into the biological regulation and function of the protein kinase Akt (also called PKB), the product of the Akt oncogene. Many growth factor receptors activate a phosphoinositide 3-kinase, and Franke *et al.* (p. 665) show that the product of this enzyme, phosphatidylinositol-3,4-bisphosphate, binds to and activates Akt. Dudek *et al.* (p. 661) explored the biological actions of activated Akt and found that Akt is required for insulin-like growth factor 1 to promote survival of primary cultures of cerebellar neurons. Implications of recent advances in understanding of Akt and its functions are discussed in a Perspective by Hemmings (p. 628).

NEW ENGLAND BIOLABS

Molecular Biology and PCR

Summer Workshops

WHEN:

Session 1: June 1-June 14, 1997
Session 2: June 22-July 5, 1997
Session 3: July 13-July 26, 1997

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. John R. McCarrey
Dept. of Genetics, Southwest
Foundation for Biomedical Research

Dr. Kathleen Fearon
College of Veterinary Medicine
Auburn University

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 twelfth annual New England Biolabs Molecular Biology Summer Workshops held at Clark Science Center, Smith College, Northampton, MA, USA. Over 1,000 research scientists have attended this intensive program in the past eleven 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 eight instructors, the student to teacher ratio is 6 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, 1997.

Notification of acceptance status will be mailed by March 12, 1997. Late applications will be accepted for our wait list. Payment in full will be due by April 10, 1997. 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.**



Start Your Day with inScight

Science and **Academic Press** invite you to start your day with **inScight**, the online information service devoted specifically to late-breaking science news.

Located at **www.apnet.com/inscight**, the site is a free service featuring daily topical news items of interest to researchers, practitioners, students, and anyone with an interest in current science issues. The experienced and preeminent

news team of the weekly **Science** compiles and provides **inScight** with the day's primary science news stories which are then formatted and maintained online through the Academic Press electronic production services department.

In addition to providing daily science news, **inScight** features a daily-updated network of links to related newsmakers, associations, and appropriate science subjects.

Stories are archived for easy searchable reference.

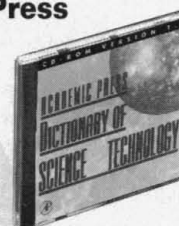
For key word descriptions, the service incorporates the **Academic Press Dictionary of Science and Technology**, a comprehensive reference of more than 130,000 entries.

Start your day off right, with inScight!

inScight—
www.apnet.com/inscight

Science—
www.sciencemag.org

Academic Press—
www.apnet.com/ or
www.europe.apnet.com/



MEMBERSHIP/CIRCULATION

Director: Michael Spinella
Deputy Director: Marlene Zendell
Member Services: Mary Curry, *Supervisor*; Pat Butler, Laurie Baker, Yvette Carter, Jonathan Keeler, *Representatives*
Marketing: Dee Valencia, *Manager*; Jane Pennington, *Europe Manager*; Hilary Baar, *Assistant Manager*; Lauri Sirois, *Coordinator*
Research: Renuka Chander, *Manager*
Business and Finance: Robert Smariga, *Manager*; Nina Araujo de Kobes, Kimberly Parker, *Coordinators*
Computer Specialist: Charles Munson

ADVERTISING AND FINANCE

Associate Publisher: Beth Rosner
Advertising Sales Manager: Susan A. Meredith
Recruitment Advertising Manager: Janis Crowley
Business Manager: Deborah Rivera-Wienhold
Finance: Randy Yi, *Senior Analyst*; Connie Dang, *Financial Analyst*
Marketing: John Meyers, *Manager*; Allison Pritchard, *Associate*
Electronic Media: David Gillikin, *Manager*; Mark Croatti, *Crystal Young, Production Associates*
Product Advertising: Carol Maddox, *Traffic Manager*; Natalie Britt, *Sales Associate*
Product Advertising Sales: **East Coast/E. Canada:** Richard Teeling, 201-904-9774, FAX 201-904-9701 • **Midwest/Southeast:** Elizabeth Mosko, 773-665-1150, FAX 773-665-2129 • **West Coast/W. Canada:** Neil Boylan, 415-673-9265, FAX 415-673-9267 • **UK, Scandinavia, France, Italy, Belgium, Netherlands:** Andrew Davies, (44) 1-457-871-073, FAX (44) 1-457-877-344 • **Germany/Switzerland/Austria:** Tracey Peers, (44) 1-260-297-530, FAX (44) 1-260-271-022 • **Japan:** Maschy Yoshikawa, (81) 3-3235-5961, FAX (81) 3-3235-5852
Recruitment Advertising: Terri Seiter Azie, *Sales and Production Operations Manager*; Celeste Miller, *Sales Supervisor*; Eric Banks, Troy Benitez, Bren Peters-Minnis, Bethany Ritchey, *Sales*; Debbie Cummings, *European Sales Manager*; Wendy Green, *Production Associate*; Nicole Robinson, *Advertising Assistant*
Recruitment Advertising Sales: **US:** Janis Crowley, 202-326-6532, FAX 202-289-6742 • **Europe:** Debbie Cummings, (44) 1223-302067, FAX (44) 1223-576208 • **Australia/New Zealand:** Keith Sandell, (61) 02-922-2977, FAX (61) 02-922-1100 • **Japan:** Maschy Yoshikawa, (81) 3-3235-5961, FAX (81) 3-3235-5852
Assistant to Associate Publisher: Nancy Hicks
Permissions: Lincoln Richman
 Send materials to *Science* Advertising, 1200 New York Avenue, NW, Washington, DC 20005.

SCIENCE EDITORIAL BOARD

Charles J. Arntzen
 David Baltimore
 J. Michael Bishop
 William F. Brinkman
 E. Margaret Burbidge
 Pierre-Gilles de Gennes
 Joseph L. Goldstein
 Mary L. Good
 Harry B. Gray
 John J. Hopfield
 F. Clark Howell
 Paul A. Marks
 Yasutomi Nishizuka
 Helen M. Ranney
 Bengt Samuelsson
 Robert M. Solow
 Edward C. Stone
 James D. Watson
 Richard N. Zare

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

■ The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objectives are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, to advance education in science, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

INFORMATION RESOURCES

SUBSCRIPTION SERVICES

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

REPRINTS & PERMISSION

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

INTERNET ADDRESSES

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

INFORMATION FOR CONTRIBUTORS

See pages 98–99 of the 3 January 1997 issue or

access <http://www.sciencemag.org/science/home/con-info.shtml>.

EDITORIAL & NEWS CONTACTS

North America

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

Europe

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

Asia

Japan Office: Carl Kay, Esaka-cho 5-chome 11-10, Suita-shi, Osaka 564 Japan; (81) 6-368-1925, FAX (81) 6-368-6905; science@magical.egg.or.jp • **News Bureau:** (81) 3-3335-9925, FAX (81) 3-3335-4898 • **China Office:** Hao Xin, (86)10-6255-9478; science@public3.bta.net.cn

BOARD OF REVIEWING EDITORS

Frederick W. Alt <i>Children's Hospital, Boston</i>	Paul T. Englund <i>Johns Hopkins Univ. School of Medicine</i>	Harvey F. Lodish <i>Whitehead Institute for Biomedical Research</i>	Gottfried Schatz <i>Biozentrum, Basel</i>
Don L. Anderson <i>California Institute of Technology</i>	G. Ertl <i>Max-Planck-Gesellschaft</i>	Richard Losick <i>Harvard Univ.</i>	Jozef Schell <i>Max-Planck-Institut für Zuchtungsforschung</i>
Michael Ashburner <i>Univ. of Cambridge</i>	Richard G. Fairbanks <i>Lamont-Doherty Earth Observatory</i>	Reinhard Lührmann <i>Institut für Molekularbiologie und Tumorforschung der Philipps-Universität</i>	Ronald H. Schwartz <i>National Institute of Allergy and Infectious Diseases, NIH</i>
Stephen J. Benkovic <i>Pennsylvania State Univ.</i>	Robert E. Fay <i>U.S. Bureau of the Census</i>	Ruth Lynden-Bell <i>Queen's Univ., Belfast</i>	Terrence J. Sejnowski <i>Salk Institute</i>
Alan Bernstein <i>Mount Sinai Hospital, Toronto</i>	Douglas T. Fearon <i>Univ. of Cambridge</i>	Seth Marder <i>California Institute of Technology</i>	Christopher R. Somerville <i>Carnegie Institute of Washington</i>
Seth Blair <i>Univ. of Wisconsin, Madison</i>	Harry A. Fozzard <i>The Univ. of Chicago</i>	Diane Mathis <i>Institut de Chimie Biologique, Strasbourg</i>	Thomas A. Steitz <i>Yale Univ.</i>
David E. Bloom <i>Harvard Institute for International Development</i>	Roger I. M. Glass <i>Centers for Disease Control</i>	Susan K. McConnell <i>Stanford Univ.</i>	Michael P. Stryker <i>Univ. of California, San Francisco</i>
Piet Borst <i>The Netherlands Cancer Institute</i>	Stephen P. Goff <i>Columbia Univ. College of Physicians & Surgeons</i>	Anthony R. Means <i>Duke Univ. Medical Center</i>	Cliff Tabin <i>Harvard Medical School</i>
Henry R. Bourne <i>Univ. of California, San Francisco</i>	Peter N. Goodfellow <i>SmithKline Beecham, UK</i>	Stanley Meisel <i>Univ. of California, Davis</i>	John Jen Tai <i>Academia Sinica, Taiwan</i>
Michael S. Brown <i>Univ. of Texas Southwestern Medical Center</i>	Peter Gruss <i>Max Planck Institute of Biophysical Chemistry</i>	Shigetada Nakanishi <i>Kyoto Univ.</i>	Tomoyuki Takahashi <i>Univ. of Tokyo</i>
James J. Bull <i>Univ. of Texas at Austin</i>	Philip C. Hanawalt <i>Stanford Univ.</i>	Kim Nasmyth <i>Research Institute of Molecular Pathology, Vienna</i>	Masatoshi Takeichi <i>Kyoto Univ.</i>
Kathryn Calame <i>Columbia Univ. College of Physicians & Surgeons</i>	Paul Harvey <i>Univ. of Oxford</i>	Roger A. Nicoll <i>Univ. of California, San Francisco</i>	Keiji Tanaka <i>RIKEN Institute</i>
Dennis W. Choi <i>Washington Univ. School of Medicine, St. Louis</i>	M. P. Hassell <i>Imperial College at Silwood Park</i>	Staffan Normark <i>Swedish Institute for Infectious Disease Control</i>	David Tilman <i>Univ. of Minnesota, St. Paul</i>
David Clapham <i>Mayo Foundation</i>	Nobutaka Hirokawa <i>Univ. of Tokyo</i>	Bert W. O'Malley <i>Baylor College of Medicine</i>	Robert T. N. Tjian <i>Univ. of California, Berkeley</i>
Adrienne E. Clarke <i>Univ. of Melbourne, Parkville</i>	Tomas Hökfelt <i>Karolinska Institutet</i>	Stuart L. Pimm <i>The Univ. of Tennessee, Knoxville</i>	Yoshinori Tokura <i>Univ. of Tokyo</i>
John M. Coffin <i>Tufts Univ. School of Medicine</i>	Tasuku Honjo <i>Kyoto Univ.</i>	Bert Vogelstein <i>Johns Hopkins Oncology Center</i>	Emil R. Unanue <i>Washington Univ. School of Medicine, St. Louis</i>
F. Fleming Crim <i>Univ. of Wisconsin, Madison</i>	Susan D. Iversen <i>Univ. of Oxford</i>	Derek van der Kooy <i>Univ. of Toronto</i>	Geerat J. Vermeij <i>Univ. of California, Davis</i>
Paul J. Crutzen <i>Max-Planck-Institut für Chemie</i>	Eric F. Johnson <i>The Scripps Research Institute</i>	Yeshayau Pocker <i>Univ. of Washington, Seattle</i>	Arthur Weiss <i>Univ. of California, San Francisco</i>
James E. Dahlberg <i>Univ. of Wisconsin Medical School, Madison</i>	Elliott Kieff <i>Harvard Univ.</i>	Ralph S. Quatrano <i>Univ. of North Carolina, Chapel Hill</i>	Zena Werb <i>Univ. of California, San Francisco</i>
Robert Desimone <i>National Institute of Mental Health, NIH</i>	Judith Kimble <i>Univ. of Wisconsin, Madison</i>	Martin Raff <i>Univ. College London</i>	George M. Whitesides <i>Harvard Univ.</i>
	Stephen M. Kosslyn <i>Harvard Univ.</i>	Douglas C. Rees <i>California Institute of Technology</i>	Owen N. Witte <i>Univ. of California, Los Angeles</i>
	Michael LaBarbera <i>The Univ. of Chicago</i>	T. M. Rice <i>ETH-Hönggerberg, Zürich</i>	
	Nicole Le Douarin <i>Institut d'Embryologie Cellulaire et Moléculaire du CNRS</i>	David C. Rubie <i>Universität Bayreuth</i>	
		Erkki Ruoslahti <i>The Burnham Institute, CA</i>	

LET US HELP YOU WITH YOUR INHIBITIONS.

Introducing 4 New Protease Inhibitor Cocktails From Sigma.

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

Our new protease inhibitor cocktails are packaged in smaller sizes for your

economy as well as convenience. You buy only what you need and use only what you need — saving time and money over preparing mixtures yourself.

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

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

SIGMA
BIOCHEMICALS AND REAGENTS
FOR LIFE SCIENCE RESEARCH

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

A Member of the Sigma-Aldrich Family.

Circle No. 6 on Readers' Service Card

We're proving that positive thinking can cure disease.

The first step in accomplishing anything is the belief that it can be done. We believe there are cures for today's "incurable" diseases and we're working fast to find them. At Pharmacia & Upjohn we share this belief with more than 30,000 colleagues worldwide.

Along the way, we're finding better treatments for diseases like cancer, AIDS, diabetes, Parkinson's, growth disorders and arthritis.

Believing there is a cure is the first step in finding it. By sharing that belief you too can join in the fight. That's the power of positive thinking. That's the power of Pharmacia & Upjohn.



**Pharmacia
& Upjohn**

Custom Peptides for Born Skeptics



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

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



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

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

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

Circle No. 17 on Readers' Service Card

* Offer valid while supplies last. © 1997 Genosys Biotechnologies, Inc. GBI 97006 USA

GENOSYS

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

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

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

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

Australia: AMRAD Pharmacio Biotech
Phone: 008-252-265
eMail: genosys@genosys.co.uk

New Zealand: AMRAD Pharmacio Biotech
Phone: 0800-733-893
eMail: genosys@genosys.co.uk

Taiwan: Cashmere Scientific Company/
Phone: 866-2-821-3004
eMail: genosys@genosys.co.uk