



# Science

11 January 2002

Vol. 295 No. 5553  
Pages 221-392 \$9



AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



# Choose the Right Tool for the Job.

Stratagene's wide selection of competent cells includes strains designed to solve your cloning and protein expression problems. Our extensive toolbox of competent cells includes solutions for transformation of large DNA with the unique Hte phenotype found in our XL10-Gold® cells.\* Our novel BL21-CodonPlus® strain\*\* removes codon bias, dramatically improving *E. coli* as a protein expression host. And our SURE® strain\*\*\* is exceptional for cloning unstable DNA.

Call today or visit [www.stratagene.com](http://www.stratagene.com) for more information about these and many other strains. Get the right tool for your cloning or protein expression project!



## The Right Competent Cell for the Job

- Easily clone large and ligated DNA
- Highest efficiencies for your most demanding cloning applications
- Successfully clone unstable DNA
- High-level expression of heterologous proteins
- Choice of packaging formats and genotypes for routine cloning
- And many more strains for your common and unusual challenges!

Widest selection guarantees  
the right tool for the job!

Competent Cells  
FROM STRATAGENE

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

**STRATAGENE EUROPE**  
Belgium, France, Germany,  
The Netherlands, Switzerland,  
United Kingdom

European Toll-Free Numbers  
ORDER: 00800 7000 7000  
TECHNICAL SERVICES: 00800 7400 7400

Austria  
0800 312 526  
\*U.S. Patent Nos. 5,512,468 and 5,707,841  
and patents pending  
\*\* Patents pending  
\*\*\* U.S. Patent Nos. 5,707,841, 5,552,314  
and 5,512,468 and patents pending

[www.stratagene.com](http://www.stratagene.com)

Please see [www.stratagene.com](http://www.stratagene.com)  
for a full listing of Competent Cells



**STRATAGENE®**



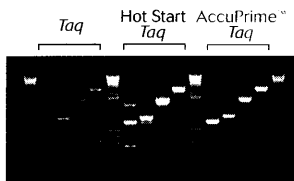
## AccuPrime™ *Taq*. Clean PCR, hot-start accuracy. Cycle after cycle after cycle.

Now you can amplify only the specific DNA targets you want, the first time, without amplifying any non-specific bands. Thanks

to the unmatched technology of AccuPrime™ *Taq* DNA Polymerase, you can prevent mispriming throughout each and every cycle of PCR.

**Advanced hot-start.** AccuPrime™ *Taq* combines Platinum® hot-start technology with a proprietary thermostable accessory protein that remains active throughout all PCR cycles and provides you with unprecedented control over mispriming. Unlike conventional DNA

polymerases, with AccuPrime™ *Taq* you get consistent extension results of targeted and specific PCR product.



Comparison of PCR specificity with various *Taq* Polymerases.

AccuPrime™ *Taq*. For information, call or visit our website today.

**Save valuable time.** AccuPrime™ *Taq* broadens your primer annealing temperatures with its robust performance between 55°C–65°C, overcoming your problems caused by sub-optimal primer sets. Stop wasting valuable time redesigning your primer sets. Turn to



**United States Headquarters:**  
Invitrogen Corporation  
1600 Faraday Avenue  
Carlsbad, California 92008  
Tel: 1 760 603 7200  
Tel (Toll Free): 1 800 955 6288  
Fax: 1 760 603 7229  
Email: tech\_service@invitrogen.com

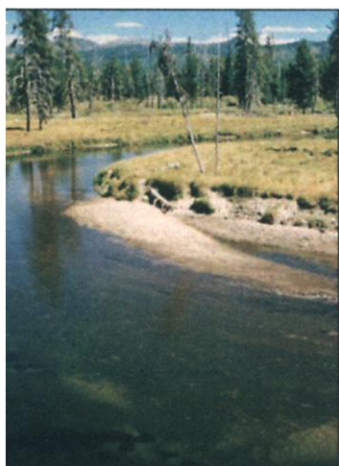
**European Headquarters:**  
Invitrogen Ltd  
3 Fountain Drive  
Inchinnan Business Park  
Paisley PA4 9RF, UK  
Tel (Free Phone Orders): 0800 269 210  
Tel (General Enquiries): 0800 5345 5345  
Fax: +44 (0) 141 814 6287  
Email: eurotech@invitrogen.com

**International Offices:**  
Argentina 5411 4556 0844  
Australia 1 800 331 627  
Austria 0800 20 1087  
Belgium 0800 14894  
Brazil 0800 11 0575  
Canada 800 263 6236  
China 10 6849 2578  
Denmark 80 30 17 40

France 0800 23 20 79  
Germany 0800 083 0902  
Hong Kong 2407 8450  
India 11 577 3282  
Italy 02 98 22 201  
Japan 03 3663 7974  
The Netherlands 0800 099 3310  
New Zealand 0800 600 200  
Norway 00800 5456 5456

Spain & Portugal 900 181 461  
Sweden 020 26 34 52  
Switzerland 0800 848 800  
Taiwan 2 2651 6156  
UK 0800 838 380  
Other countries see our website

## NEWS



256

Sands of time

### NEWS OF THE WEEK

- 246 CLINICAL TRIALS: Proposed Rules Aim to Curb Financial Conflicts of Interest
- 247 HIGH-ENERGY PHYSICS: Repairs Weakened Neutrino Detector
- ▼247  
227 OLDEST ART: From a Modern Human's Brow—or Doodling?
- ▼249  
316 EVOLUTIONARY BIOLOGY: Finches Adapt Rapidly to New Homes
- 249 SCIENCESCOPE
- 250 ENDANGERED SPECIES: Fur Flies Over Charges of Misconduct
- 251 CANCER RESEARCH: Will Bigger Mean Better for U.K. Charity?
- ▼253  
336  
338 ASTHMA RESEARCH: Missing Gene Takes Mice's Breath Away
- 253 STEM CELL RESEARCH: Stem Cells May Shore Up Transplanted Hearts
- 254 U.S. BUDGET: Spending Triples on Terrorism R&D

- 254 STEM CELL RESEARCH: Rat Brains Respond to Embryonic Stem Cells
- 255 OPTICS: Crystal Stops Light in Its Tracks

### NEWS FOCUS

- 256 GEOLOGY: Subtleties of Sand Reveal How Mountains Crumble
- 258 BIOENGINEERING: Plant Scientists See Big Potential in Tiny Plastids
- 260 AMERICAN GEOPHYSICAL UNION: Of Ocean Weather and Volcanoes
- 263 WOMEN IN SCIENCE: China Debates Big Drop in Women Physics Majors
- 264 BRAZIL: Tough Placebo Rules Leave Scientists Out in the Cold
- 265 SCIENCE EDUCATION: U.S. Programs Ask Faculty to Help Improve Schools
- 267 RANDOM SAMPLES

## SCIENCE'S COMPASS

### LETTERS

Closing of the National Tritium Labeling Facility W. W. Moses. Global Warming Continues J. Hansen, R. Ruedy, M. Sato, K. Lo. Minimizing Effects of CO<sub>2</sub> Storage in Oceans G. H. Rau, K. Caldeira. *Response* B. A. Seibel, P. J. Walsh. Taxonomists' Requiem? Y. Samyn, C. Massin. The Development of Electroporation R. Heller. Corrections and Clarifications

### POLICY FORUM

- 278 WOMEN IN SCIENCE: European Strategies for Promoting Women in Science N. Dewandre



278

Focusing attention on women in science

### BOOKS ET AL.

- 281 TECHNOLOGY: *Inviting Disaster* Lessons from the Edge of Technology J. R. Chiles, reviewed by L. J. Dumas
- 282 NEUROSCIENCE: *The Secret Life of the Brain* David Grubin Productions and Thirteen/WNET, and *The Secret Life of the Brain* R. Restak

### PERSPECTIVES

- 283 ASTRONOMY: Putting Galaxies on the Scale F. Bertola
- ▼284  
321 PROTEOMICS: Integrating Interactomes M. Gerstein, N. Lan, R. Jansen
- ▼287  
345 GENETICS: Do X Chromosomes Set Boundaries? I. Percec and M. S. Bartolomei
- ▼288  
308 CHEMISTRY: A New Oxidation State for Pd? R. H. Crabtree
- ▼289  
305 SYNTHETIC CHEMISTRY: The Key to Successful Organic Synthesis Is ... W. D. Jones
- ▼290  
325 CELL BIOLOGY: Slick Recruitment to the Golgi V. A. Bankaitis



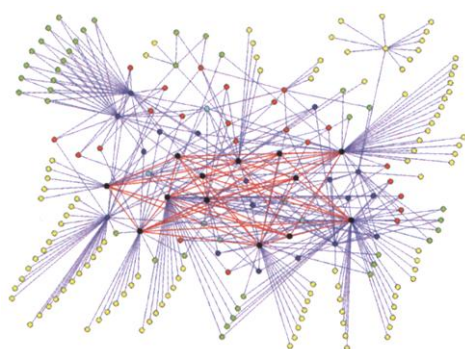
# RESEARCH

## BREVIA

- 297 **Faithful Expression of Imprinted Genes in Cloned Mice** K. Inoue, T. Kohda, J. Lee, N. Ogonuki, K. Mochida, Y. Noguchi, K. Tanemura, T. Kaneko-Ishino, F. Ishino, A. Ogura

## REPORTS

- 299 **Surface Stress and Thermodynamic Nanoscale Size Selection** J. B. Hannon, J. Tersoff, R. M. Tromp
- 301 **Continuous Wave Operation of a Mid-Infrared Semiconductor Laser at Room Temperature** M. Beck, D. Hofstetter, T. Aellen, J. Faist, U. Oesterle, M. Illegems, E. Gini, H. Melchior
- ▼305 **Remarkably Selective Iridium Catalysts for the Elaboration of Aromatic C-H Bonds** J.-Y. Cho, M. K. Tse, D. Holmes, R. E. Maleczka Jr., M. R. Smith III
- ▼308 **Synthesis and Structure of Formally Hexavalent Palladium Complexes** W. Chen, S. Shimada, M. Tanaka
- 310 **Direct Determination of the Timing of Sea Level Change During Termination II** C. D. Gallup, H. Cheng, F. W. Taylor, R. L. Edwards
- 313 **Iron-Silicon Alloy in Earth's Core?** J.-F. Lin, D. L. Heinz, A. J. Campbell, J. M. Devine, G. Shen
- ▼316 **Sex-Biased Hatching Order and Adaptive Population Divergence in a Passerine Bird** A. V. Badyaev, G. E. Hill, M. L. Beck, A. A. Dervan, R. A. Duckworth, K. J. McGraw, P. M. Nolan, L. A. Whittingham
- 319 **Unique and Redundant Connexin Contributions to Lens Development** T. W. White



▼321  
284

**A Combined Experimental and Computational Strategy to Define Protein Interaction Networks for Peptide Recognition Modules** A. H. Y. Tong, B. Drees, G. Nardelli, G. D. Bader, B. Brannetti, L. Castagnoli, M. Evangelista, S. Ferracuti, B. Nelson, S. Paoluzi, M. Quondam, A. Zucconi, C. W. V. Hogue, S. Fields, C. Boone, G. Cesareni

▼325  
290

**Role of Diacylglycerol in PKD Recruitment to the TGN and Protein Transport to the Plasma Membrane** C. L. Baron and V. Malhotra

328

**Identification of a Major Gene Regulating Complex Social Behavior** M. J. B. Krieger and K. G. Ross

332

**The Potential Size and Duration of an Epidemic of Bovine Spongiform Encephalopathy in British Sheep** R. R. Kao, M. B. Gravenor, M. Baylis, C. J. Bostock, C. M. Chihota, J. C. Evans, W. Goldmann, A. J. A. Smith, A. R. McLean

▼336  
253  
338

**Development of Spontaneous Airway Changes Consistent with Human Asthma in Mice Lacking T-bet** S. Finotto, M. F. Neurath, J. N. Glickman, S. Qin, H. A. Lehr, F. H. Y. Green, K. Ackerman, K. Haley, P. R. Galle, S. J. Szabo, J. M. Drazen, G. T. De Sanctis, L. H. Glimcher

▼338  
253  
336

**Distinct Effects of T-bet in  $T_H1$  Lineage Commitment and IFN- $\gamma$  Production in CD4 and CD8 T Cells** S. J. Szabo, B. M. Sullivan, C. Stemmann, A. R. Satoskar, B. P. Sleckman, L. H. Glimcher

342

**Stage-Specific Transcription of Distinct Repertoires of a Multigene Family During *Plasmodium* Life Cycle** P. R. Preiser, S. Khan, F. T. M. Costa, W. Jarra, E. Belnoue, S. Ogun, A. A. Holder, T. Voza, I. Landau, G. Snounou, L. Renia

▼345  
287

**CTCF, a Candidate *Trans*-Acting Factor for X-Inactivation Choice** W. Chao, K. D. Huynh, R. J. Spencer, L. S. Davidow, J. T. Lee

## 321

Predicted protein partners



## COVER 328

Execution of a fire ant (*Solenopsis invicta*) queen. Workers immobilize an unwanted queen by pulling on her legs and antennae, then they gradually bite and sting her to death. A single gene influences acceptance or rejection of queens, ultimately controlling the social organization of the colony. [Photo: John All]



## 316

Adaptive sex bias in bird broods

New on Science Express

The art of modern behavior



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 © 2002 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): \$120 (\$66 allocated to subscription). Domestic institutional subscription (51 issues): \$390; Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$85. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A.

Change of address: allow 4 weeks, giving old and new addresses and 8-digit account number. Postmaster: Send change of address to Science, P.O. Box 1811, Danbury, CT 06813-1811. Single copy sales: \$9.00 per issue prepaid includes surface postage; bulk rates on request. Authorization to photocopy material for internal or personal use under circumstances not falling within the fair use provisions of the Copyright Act is granted by AAAS to libraries and other users registered with the Copyright Clearance Center (CCC) Transactional Reporting Service, provided that \$8.00 per article is paid directly to CCC, 222 Rosewood Drive, Danvers, MA 01923. The identification code for Science is 0036-8075/83 \$8.00. Science is indexed in the Reader's Guide to Periodical Literature and in several specialized indexes.

A N Y T H I N G I S P O S S I B L E

384

GIVES  
YOU MORE

**Greater throughput + greater efficiencies = MegaBACE 4000.**

You'll get greater throughput with the new MegaBACE™ 4000 than you have ever achieved before. How much greater? Well, it processes 384 samples simultaneously. Put another way, it generates over 2.8 million bases per day. That's four times greater throughput than a 96-capillary instrument—which means you can sequence four times as many genomes in a week.

Receiving four times greater throughput from one system significantly boosts the efficiency of your operations. That means less labor, less space and less cost per base.

Time is money.

Go to **www.megabace.com** now for a special demonstration of the power of MegaBACE 4000.

 **Amersham**  
Biosciences

# Scienceonline

www.scienceonline.org

NOW!

Daily  
Full Text  
Access  
to  
Science  
Magazine  
and  
Science  
Express  
Articles  
and  
Reports  
on  
Science  
Direct

CONTENT HIGHLIGHTS AS OF 11 JANUARY 2002

## science magazine

www.sciencemag.org

### SCIENCE EXPRESS

www.sciencexpress.org

**Emergence of Modern Human Behavior: Middle Stone Age Engravings from South Africa** C. S. Henshilwood *et al.*

247 Geometric patterns engraved on 75,000-year-old ochre from South Africa indicate the early and gradual rise of modern human behavior.

**Chiral Amplification of Oligopeptides in Two-Dimensional Crystalline Self-Assemblies on Water** H. Zepik *et al.*

An enhanced distribution of chiral molecules in a series of polymerized oligopeptides shows that the stereochemistry is influenced by the organization of the molecules before their assembly.

**Germline Transmission and Tissue-Specific Expression of Transgenes Delivered by Lentiviral Vectors** C. Lois, E. J. Hong, S. Pease, E. J. Brown, D. Baltimore

Lentiviral vectors for gene delivery are a powerful alternative to other methods of producing transgenic animals.

## TECHNICAL COMMENTS

### Do Neurons Predict the Future?

Hasegawa *et al.* (Reports, 1 Dec. 2000, p. 1786), studying the relation between behavior and neuronal activity in the rhesus monkey prefrontal cortex, found that "neurons reflected past or predicted future performance, much more than they reflected current performance." Roelfsema comments that the analysis of Hasegawa *et al.* "is incomplete in at least three respects," and argues from numerical simulations that the findings of Hasegawa *et al.* are consistent with a dependence of neuronal activity on the subject animal's motivation for the current trial: The study, Roelfsema concludes, "did not show that prefrontal neurons track the monkey's past performance and predict its future performance." Hasegawa *et al.* respond that the behavioral model presented by Roelfsema rests on assumptions incompatible with the actual experimental data, and that their experiments did "indeed demonstrate that the background activity of prefrontal neurons reflects neuronal processes that track general aspects of behavior with significant time lags or leads."

The full text of these comments can be seen at  
www.sciencemag.org/cgi/content/full/295/5553/227a

## SPECIAL FEATURE

**Quarterly Author Index** www.sciencemag.org/feature/data/aindex.shl

## science's next wave

www.nextwave.org

career resources for scientists

**Singapore: The Experience of a Lifetime—Notes of an MIT Exchange Postdoc** M. L. Choong

In the second essay in our *Voices of Singaporean Scientists Working Abroad* series, we hear from a visitor to the prestigious Whitehead Institute for Biomedical Research.

**UK: Go East** K. Urquhart

European scientists tend to think first of the US when it comes to an overseas postdoc or collaboration. But they also should consider another emerging scientific powerhouse—Japan.

**Canada: Financial Planning for Scientists, Part 15—Building a Diversified Portfolio** C. Boulakia

In his concluding column, our financial guru pulls all the information in the series together into one comprehensive investment strategy.

**US: Not Your Dad's Academic Career** T. Kuther

The *Chicago Guide to Your Academic Career* is a fine example of how *not* to advise young academics.

## KNOWLEDGE ENVIRONMENTS

## science's sage ke

www.sageke.org

science of aging knowledge environment

**Single-Cell Analysis** M. B. Kelz *et al.*

Focusing with a molecular zoom lens?

**Cancer and Aging** J. Campisi

Yin, yang, and p53.

## science's stke

www.stke.org

signal transduction knowledge environment

**Perspective: Meeting at Mitosis—Cell Cycle-Specific Regulation of c-Src by RPTP $\alpha$**  T. Mustelin and T. Hunter

How the intricate activation of phosphatases and kinases regulates the onset of mitosis.

### GrantsNet

www.grantsnet.org

RESEARCH FUNDING DATABASE

### AIDScience

www.aidsience.com

HIV PREVENTION & VACCINE RESEARCH

### Members Only!

www.AAASMember.org

AAAS ONLINE COMMUNITY

### SCOPE

http://scope.educ.washington.edu

EXPLORING SCIENCE CONTROVERSIES

### Functional Genomics

www.sciencegenomics.org

NEWS, RESEARCH, RESOURCES

#### ONLINE STAFF

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

**SCIENCE'S NEXT WAVE** EDITORIAL: MANAGING EDITOR Crispin Taylor; EDITORS Eick von Ruschkowski (Germany), Kirstie Urquhart (UK) Ric Weibl (US); CONTRIBUTING EDITORS Lesley McCarney (Canada), Robert Metzke (The Netherlands), Jennie Wong (Singapore); PROJECT EDITORS Jim Austin, Sibrina Collins, Katie Cottingham, Laure Haak; PRODUCTION ASSOCIATE Lily Han; MARKETING: MARKETING MANAGERS Karen Horting (Global), Hazel Crocker (Europe); PROGRAM DIRECTOR Lisa Kozlowski; MARKETING ASSOCIATE Angela Walker; PROGRAM ASSOCIATES Shajuan Martin, Tammy Minor

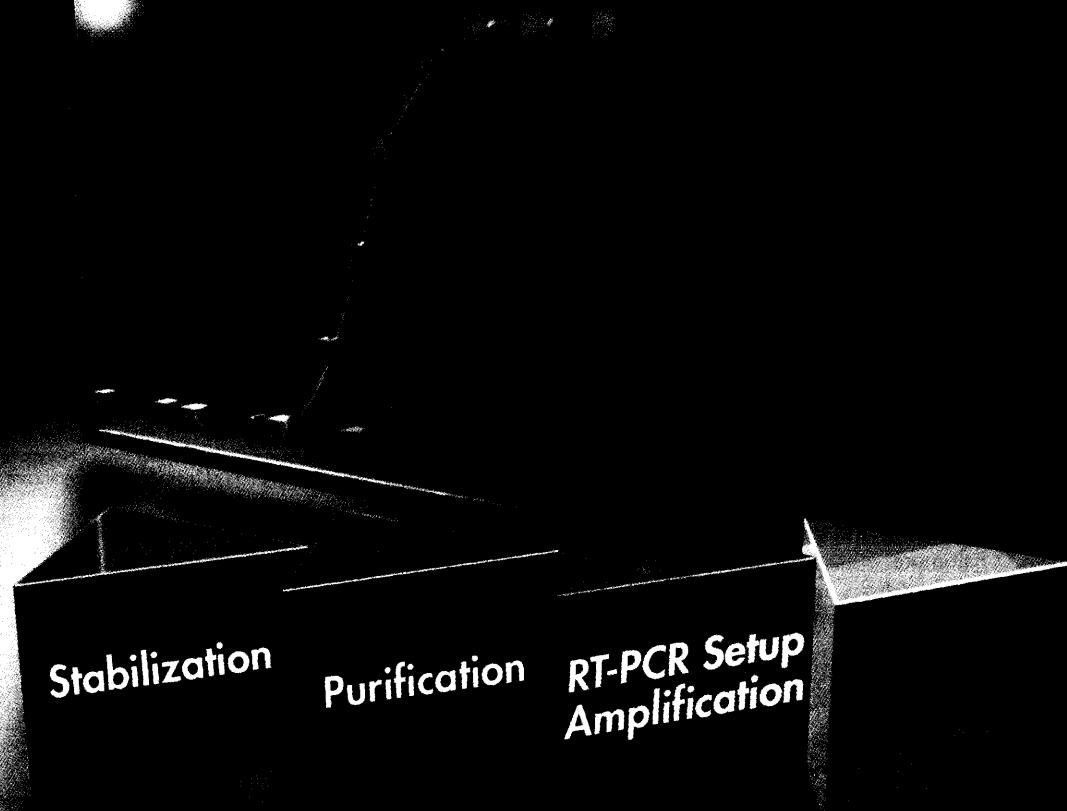
**AIDSCIENCE** SENIOR EDITOR Roberto Fernandez-Larsson; ASSOCIATE EDITOR Paula Werner

**SCIENCE'S STKE** EDITOR Bryan Ray; MANAGING EDITOR Nancy Gough; ASSOCIATE EDITORS Lisa Chong, John Nelson; PUBLICATIONS ASSISTANT Christopher Kenny

**SCIENCE'S SAGE KE** EDITORIAL DIRECTOR Kelly LaMarco; SENIOR NEWS EDITOR Evelyn Strauss; ASSOCIATE EDITOR R. John Davenport

**ELECTRONIC MEDIA** MANAGER Don Hemerway; INTERNET PRODUCTION MANAGER Betsy Hartman; ASSISTANT PRODUCTION MANAGER Wendy Stengel; SENIOR PRODUCTION ASSOCIATE Lisa Stanford; ASSOCIATES Carla Cathey, Steve Kusek, Darcee O'Donnell, Louis Williams; LEAD APPLICATIONS DEVELOPER Carl Saffell

# QIAGEN — All You Need for Success in Real-Time Gene Expression Analysis



## Need advanced solutions for real-time gene expression analysis?

QIAGEN has everything you need — from RNA stabilization to automated and manual RNA purification and PCR setup — plus primers, probes, enzymes, and complete kits for quantitative PCR and RT-PCR!

With QIAGEN's complete portfolio of products for real-time gene expression analysis, you can develop your assays faster and with less cost.

## Choose QIAGEN for success in real-time gene expression analysis!

Visit us at [www.qiagen.com](http://www.qiagen.com) and click

Trademarks: QIAGEN® (QIAGEN Group). QIAGEN products for PCR are sold under licensing arrangements with F. Hoffmann-La Roche Ltd, Roche Molecular Systems, Inc. and The Perkin-Elmer Corporation. The PCR process is covered by U.S. Patents 4,683,195 and 4,683,202 and foreign equivalents owned by Hoffmann-La Roche AG. © 2002 QIAGEN, all rights reserved.

#### QIAGEN:

##### Australia

Tel. 03-9489-3666  
Fax 03-9489-3888

##### Germany

Tel. 02103-29-12400  
Fax 02103-29-22022

##### Switzerland

Tel. 061-319-3031  
Fax 061-319-3033

##### Canada

Tel. 800-572-9613  
Fax 800-713-3951

##### Italy

Tel. 02-33430411  
Fax 02-33430426

##### UK and Ireland

Tel. 01293-422-999  
Fax 01293-422-922

##### France

Tel. 01-60-920-930  
Fax 01-60-920-925

##### Japan

Tel. 03-5547-0811  
Fax 03-5547-0818

##### USA

Tel. 800-426-8157  
Fax 800-718-2056

#### Distributors:

Argentina Tecnolab S.A. (011) 4555 0010 Austria/Slovenia Merck EuroLab GmbH (01) 576 00 0 Belgium/Luxemburg Westburg b.v. 0800-1-9815 Brazil Uniscience do Brasil 011 3622 2320 China Gene Company Limited (852) 2896-6283 Cyprus Scientonics Ltd (02) 765 416 Czech Republic BIOCONSUIT spol. s.r.o. (420) 2 417 29 792 Denmark Merck EuroLab A/S 43 86 87 88 Egypt Clinlab 52 57 212 Finland Merck EuroLab Oy (09) 804 551 Greece BioAnalytica S.A. (01) 640 03 18 India Genetix (011) 542 1714 or (011) 515 9346 Israel Westburg (Israel) Ltd. 08 6650813/4 or 1-800 20 22 20 Korea LRS Laboratories, Inc. (02) 924-86 97 Malaysia RESEARCH BIOLABS SDN. BHD. (603) 8070 3101 Mexico Quimica Valaner S.A. de C.V. (55) 55 25 57 25 The Netherlands Westburg b.v. (033) 4950094 New Zealand Biolab Scientific Ltd. (09) 980 6700 or 0800 933 966 Norway Merck EuroLab AS 22 90 00 00 Poland Syngen Biotech Sp. z o.o. (071) 551 41 06 or 0601 70 60 07 Portugal IZASA PORTUGAL, LDA (21) 424 7312 Singapore Research Biolabs Pte Ltd 7310866 Slovak Republic BIOCONSUIT Slovakia spol. s.r.o. (02) 5022 1336 South Africa Southern Cross Biotechnology (Pty) Ltd (021) 671 5166 Spain IZASA, S.A. (93) 902 20 30 90 Sweden Merck EuroLab AB (08) 621 34 00 Taiwan TAIGEN Bioscience Corporation (02) 2880 2913 Thailand Theera Trading Co. Ltd. (02) 412-5672 In other countries contact: QIAGEN, Germany



CRFAD2002SWW



# THIS WEEK IN Science

edited by Phil Szuromi

## Room-Temperature Mid-IR Lasers

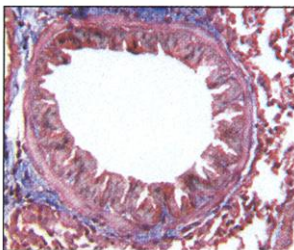
Semiconductor lasers offer portability, compactness, low power consumption, and low cost. For spectroscopic investigation in the mid-infrared (where many molecular species have excitation modes), the stability and sharp linewidth of continuous wave (CW) lasers is a must. However, light sources for this wavelength regime have been limited to low-temperature or pulsed-mode operation (or both). Beck *et al.* (p. 301; see the 21 December news story by Service) report on a technological advance in the design of semiconductor lasers that allows them to achieve CW operation at room temperature. A key feature of their design is to bury the active region to ensure good thermal dissipation of excited carriers. **X**

## Quicker Route to Reactants

Improved routes for the formation of carbon-carbon bonds, especially catalytic ones, are invariably of value. One approach for coupling carbon atoms of aromatic rings, the Miyaura-Suzuki reaction, uses a palladium (Pd) catalyst to couple an aryl boronic acid and an aryl halide. Cho *et al.* (p. 305; see the Perspective by Jones) report on iridium (Ir) catalysts that allow the direct synthesis of the needed arylboron compounds from aromatic hydrocarbons and boranes under "solventless" conditions. These Ir catalysts are highly selective and do not interfere with the subsequent Pd-catalyzed cross-coupling reactions. **X**

## Ascent on T Cell Control

The T-box family transcription factor, T-bet, has recently been identified as a possible master regulator in T helper 1 (T<sub>H</sub>1) immune responses through the transactivation of the gene for interferon- $\gamma$  (IFN- $\gamma$ ). Two studies now look at the effect of T-bet deficiencies (see the news story by Vogel). Szabo *et al.* (p. 338) found that the absence of T-bet expression in mice profoundly attenuated production of IFN- $\gamma$  by natural killer and CD4 T cells and also shifted the cytokine profile of CD4<sup>+</sup> T cells toward that of a T<sub>H</sub>2 phenotype. Surprisingly, IFN- $\gamma$  expression by CD8<sup>+</sup> T cells was not affected. Finotto *et al.* (p. 336) observed that T-bet-deficient mice develop spontaneous airway inflammation resembling acute and chronic forms of human asthma. T-bet expression is also reduced in airway tissue from asthmatic patients,



## 299 Temperature-Controlled Domain Sizes

Although many nanostructures are formed kinetically, theory predicts that at conditions near a surface-structure phase boundary, small domains may form at equilibrium whose size can be varied. Hannon *et al.* (p. 299) used low-energy electron microscopy to map out such a transformation in detail on the Si(111) surface between the complex (7 × 7) reconstructed surface and small triangular domains of the nearly disordered "1 × 1" phase. The size of the domains can be tuned simply by changing surface temperature.

## And In Brevia ...

Unlike mice cloned from embryonic stem cells, mice cloned from somatic cells by Inoue *et al.* (p. 297) appear quite normal, although their placentas are often enlarged.

which suggests that dysregulation of this transcription factor might contribute to airway hyper-responsiveness in humans.

## Evidence for Hexavalent Palladium

High oxidation states of the late transition metals are rarely seen for complexes with one metal center, and then only with highly electronegative ligands like fluorine. Chen *et al.* (p. 308; see the Perspective by Crabtree) now report that the synthesis and structure of a trimetallic Pd complex with organosilicon ligands in which two Pd atoms are in the 2+ state and one, which bonds to six Si atoms, appears

to be in the previously unobserved 6+ state for this element.

## Sea Level at Termination II

There has been considerable disagreement during the last decade concerning the validity of the Milankovitch theory, which contends that glacial cycling is mainly the result of changes in solar insolation at 65°N latitude. Newer evidence suggests that glacial ice volume began to decrease thousands of years before solar forcing in the Northern Hemisphere began to increase. Gallup *et al.* (p. 310) now report that sea level had risen to within 20% of its peak last interglacial value by 136,000 years ago, too soon for the corresponding amount of glacial ice melting to be consistent with Milankovitch theory. By radiometrically dating samples from uplifted coral terraces on Barbados, they determined that the penultimate glacial termination (Termination II), unlike the most recent termination, probably preceded the increase in mid-latitude Northern Hemisphere insolation that Milankovitch theory says should be its cause.

## Parental Guidance Suggested

Populations of organisms that become established in new locations frequently diverge morphologically and behaviorally; this process can give rise to new species. What processes drive the initial divergences? Badyaev *et al.* (p. 316; see the news story by Pennisi) report tests on reproductive behavior of two recently established populations of the house finch in different parts of the United States. Parental manipulation of the sex ratio and growth patterns of offspring significantly reduces offspring mortality, thus giving the populations a better chance of establishment and survival in the new habitats.

## SH3 Search Committee

Src-homology 3 domains (SH3 domains) are so named for their similarity to a region in the proto-oncogene protein kinase Src. SH3 domain family members bind to protein domains character-

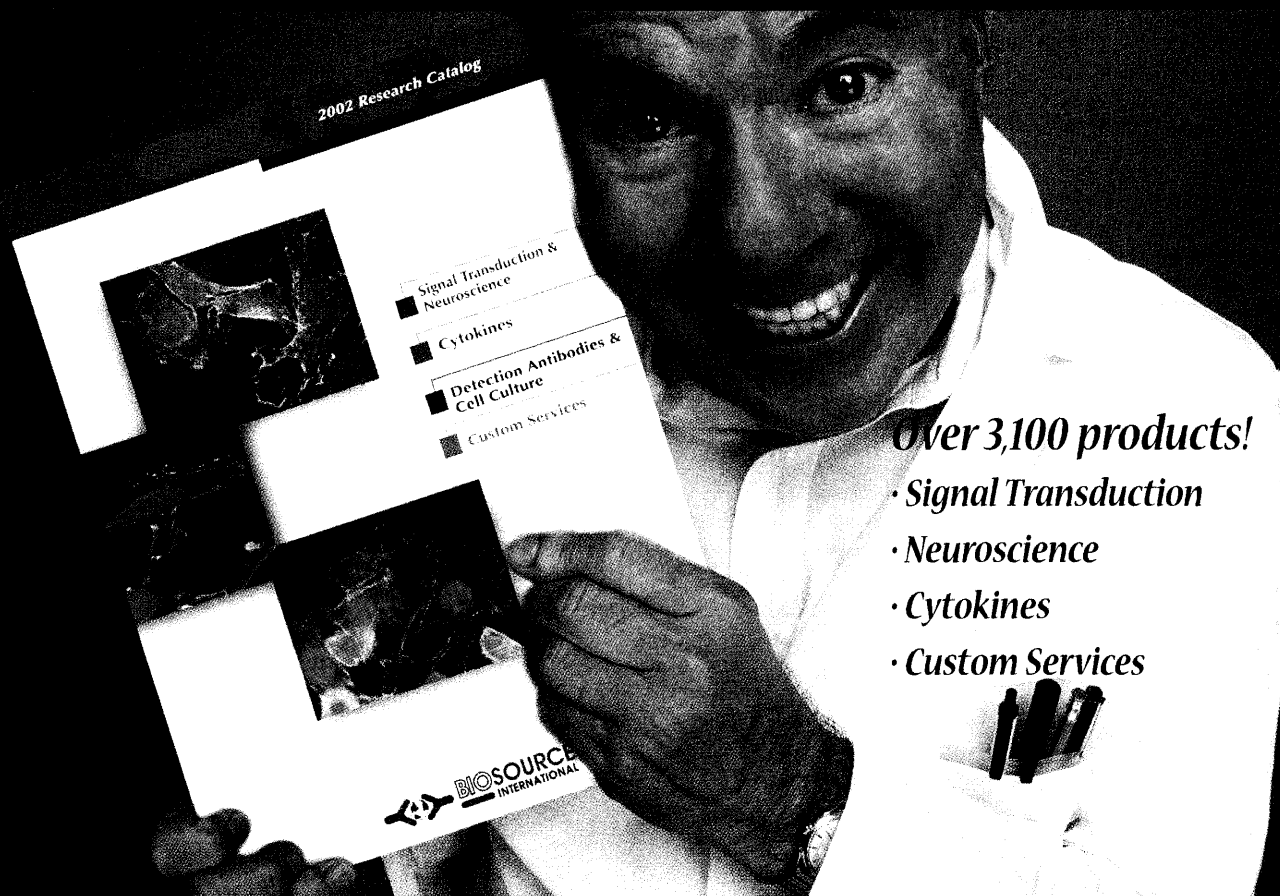
Signal Transduction

Neuroscience

Cytokines

Custom

# BioSource's 2002 Research Catalog is Here.



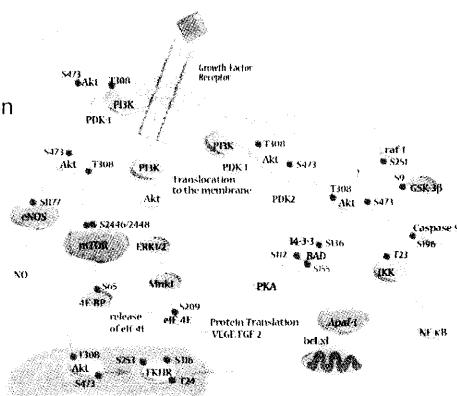
**Over 3,100 products!**

- Signal Transduction
- Neuroscience
- Cytokines
- Custom Services

**Order your FREE copy today!**

## BioSource International's 2002 Research Catalog Features:

- Sixteen color Signal Transduction Pathways
- Complete Glossary of Terms for molecules
- Protocols for Western/IP, Bioassays, IHC, Luminex™ and more!



Order catalog on-line!

**biosource.com**

## Over 300 New Products! Highlights include:

- ELISA Kits 30 New!
- Phospho-specific Antibodies 26 New!
- Luminex™ Multiplex Antibody Pairs 30 New!
- Pan Antibodies - 104 New!
- Signal Transduction, Cytokine and Chemokine
- Real Time PCR® Reagents 30 New!
- ELISpot Kits 14 New!
- Recombinant Proteins 35 New!
- CytoSet™ Antibody Pairs 19 New!

®The (PCR) process is covered by patents owned by Roche Molecular Systems, Inc. Use of the PCR process requires a license. A license may be obtained through the purchase and use of authorized reagents and the purchase and use of a thermocycler supplied by The Perkin Elmer Corporation or otherwise negotiating a license with Perkin Elmer.

For research use only.



**BIOSOURCE**  
INTERNATIONAL

**biosource.com**

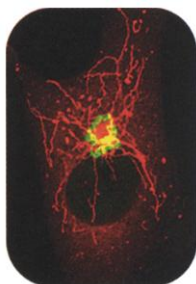
BioSource USA  
800.242.0607

BioSource Europe  
+32.67.88.99.99

ized by paired proline residues, and so mediate protein-protein interactions in cell signaling and cytoskeleton reorganization. Tong *et al.* (p. 321; see the Perspective by Gerstein *et al.*) used phage display to search peptide libraries of random sequences to identify preferred binding motifs for the various SH3 domains. They then searched the predicted proteome of *Saccharomyces cerevisiae* for potential binding partners, and also used a two-hybrid assay to identify proteins that interacted with the various SH3 domains when expressed in yeast. The common interactions from the networks predicted by each of these procedures were then assessed for likely biological significance. **X**

### Proteins for One or Many Queens

In the fire ant *Solenopsis invicta*, the social structure of the colony is determined in large part by alleles of the gene *Gp-9*. Colonies in the United States in which the workers bear the *B* allele have single queens, and those bearing the *b* allele have multiple queens. Krieger and Ross (p. 328; see the cover and the 30 November news story by Holden) now show that *Gp-9* encodes a putative pheromone binding protein, which indicates that the number of egg-laying queens is determined by worker recognition. A glutamic acid residue at position 151 of the *B* allele is changed to lysine in the *b* allele, which changes the protein's charge and accounts for their different electrophoretic mobilities of the two alleles. **X**



### Have Lipid, Will Travel

The serine-threonine kinase protein kinase D (PKD) binds to the trans-Golgi network (TGN) in mammalian cells and is involved in the release of transport vesicles destined for the plasma membrane. Baron and Malhotra (p. 325; see the Perspective by Bankaitis) now show that in order for PKD to bind to the TGN, it must specifically bind to the lipid diacylglycerol. When concentrations of this lipid were reduced in cells, both PKD recruitment to the TGN and transport out of the TGN were inhibited. **X**

### Sheep Likely Free of BSE

Given that sheep in the United Kingdom were fed the same animal protein concentrate that caused the epidemic of bovine spongiform encephalopathy (BSE) in British cattle, has there been similar cross-species infection of sheep? The question is difficult to answer because a similar prion disease, scrapie, has been endemic in British sheep for 200 years or so and is clinically indistinguishable from BSE. Unlike BSE, there is no evidence that human beings can acquire scrapie. Despite the large number of assumptions that have to be made, as few data are available, Kao *et al.* (p. 332) argue, after examining a wide range of possible scenarios, that few sheep have acquired BSE. **X**

### Malaria Stage Specificity

The *Plasmodium* parasites that cause malaria invade host cells with the assistance of proteins secreted from their rhoptry organelles. Some of these proteins are members of a multigene family (>35 genes) called Py235. Preiser *et al.* (p. 342) have discovered that different subsets of the Py235 family are transcribed at each of three invasive *Plasmodium* life-cycle stages. The expression of each subset of Py235 is apparently reset by conditions in the host-cell as the parasite transits from one stage to another and from one host-cell type to another, and may be a component in life-cycle changes in the parasite's preference for host cell type.

### Factor of Choice

X-linked genes in mammals should be expressed at similar levels in males and females, and so one of the two X chromosomes in females must be inactivated. The choice of which X is inactivated is thought to be governed by a trans-acting factor that binds to the so-called "X-inactivation center" on the X chromosome. Chao *et al.* (p. 345; see the Perspective by Percec and Bartolomei) present evidence that the trans-acting factor is CTCF, a transcription regulator previously shown to block enhancer function at imprinted genes. As was true in the context of imprinting, binding to the X chromosome was sensitive to the methylation status of its target DNA. These results raise the intriguing possibility that there may be mechanistic parallels between X inactivation and imprinting. **X**

CREDIT: BARON AND MALHOTRA

You've Got  
Some  
Nerve...



And we'll help you test it.

Wako BioProducts strives to provide new and unique laboratory reagents to scientists in all fields of study. Following eight decades of tradition, we supply high quality, high purity reagents for your life's research.

#### Antibodies:

Anti Rat Synaptobrevin 2  
Anti Rat Synaptotagmin 1  
Anti Rat Syntaxin  
Anti Rat SNAP-25  
Anti Substance P  
Anti sGC  
Anti Rat iNOS  
Anti Rat nNOS

#### Reagents:

All Natural Kainic Acid  
L-012  
Follistatin  
Activin A  
Activin B  
Activin AB

#### Neurotoxins:

Botulinum Toxins A-F  
Tetrodotoxin  
Joro Spider Toxin JSTX-3

Toll Free (in the USA only): 877-714-1920  
Telephone: 804-714-1920

Wako

www.wakousa.com



Drug Discovery

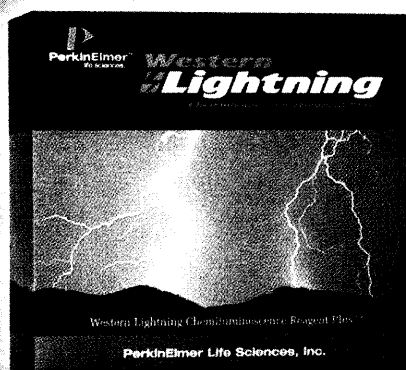
Research

Clinical Screening

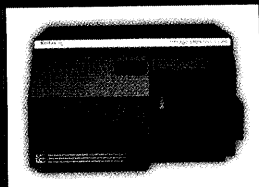
Chemiluminescence Imaging

# ***Lightning***

**Chemiluminescence Reagent Plus**



## **KODAK™ Image Station**



A versatile, compact benchtop imaging system with superior sensitivity and accuracy for all your imaging needs.

Products You Trust



**PerkinElmer™**  
life sciences.

## **See the difference in western blot imaging.**

A start-to-finish system from a single trusted source. Western Lightning—a reliable NEN brand product from PerkinElmer Life Sciences—taps the full power of chemiluminescence detection with sensitivity as much as 4 times greater than other brands.

PerkinElmer has everything you need for western blot imaging—including reagents, instrumentation and applications expertise! PerkinElmer is the single trusted source for western blotting.

*Also try our new DNA Thunder Chemiluminescence Reagent Plus for Nucleic Acid Detection.*

**Mention promotion code JM123101 to receive a 50% discount off your first order of *Western Lightning*.**  
*(Offer good through December 31, 2001.)*

**Worldwide Headquarters:** PerkinElmer Life Sciences, 549 Albany Street, Boston, MA 02118-2512 USA (800) 551-2121  
**European Headquarters:** PerkinElmer Life Sciences, Imperiastraat 8, BE-1930 Zaventem Belgium +32 2 717 7911

Kodak is a trademark of Eastman Kodak Company, Rochester, NY

© 2001 PerkinElmer Life Sciences

**[www.perkinelmer.com/lifesciences](http://www.perkinelmer.com/lifesciences)**

SORVALL®



6 liters. 9 minutes.  
0 kidding.

## Introducing the SORVALL® Evolution™ RC Superspeed.

One instrument now does it all – from large-volume cell pelleting to isolation of sub-cellular particles. And it does it all faster, with:

- Unequaled accel/decel across the board
- Simple, intelligent operation
- Industry's widest choice of rotors
- Vacuum-free DuraFlex™ drive system

Superspeed centrifugation will never be the same again. It's going to be a whole lot better. Contact Kendro today.

Kendro

Quality Products - Lifetime Care

Offices worldwide. In the U.S., call 1-800-522-7746, Fax 203-270-2166.

In Europe, 49 (1805) 536 376, Fax 49 (1805) 112 114.

In Asia Pacific, (852) 2711-3910, Fax (852) 2711-3858.

Or contact your local Kendro Representative.

[info@kendro.com](mailto:info@kendro.com)

Visit our website  
[www.kendro.com](http://www.kendro.com)

# Amplify your Message

Do for your RNA what electricity did for the guitar.

## The new MessageAmp™ aRNA Kit

can amplify your  
mRNAs 1000X

in a single reaction. This  
means you can get that valu-  
able array data from your limiting

RNA samples. Each step of the  
MessageAmp procedure has been optimized  
for high efficiency and high yields, and the kit  
is compatible with both biotin and Cy™ dye  
labeling. The procedure can be completed in less  
than one day.

MessageAmp contains reagents for first-strand cDNA  
synthesis, RNase H digestion, second-strand synthe-  
sis, cDNA purification, in vitro transcription (using  
MEGAscript™ technology) and aRNA purification.

For more information about the MessageAmp Kit visit:  
**[www.ambion.com/messageamp](http://www.ambion.com/messageamp)**

Cy™ is a trademark of Amersham Pharmacia Biotech

**Ambion®**

**THE RNA COMPANY®**  
2130 Woodward • Austin, TX 78744

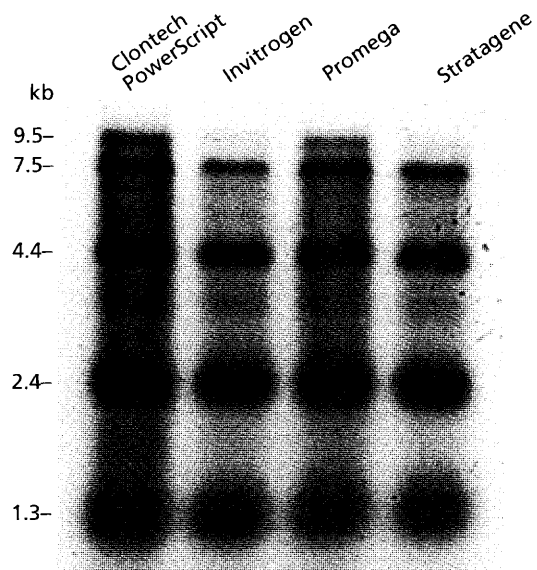
**US: 800-888-8804 CANADA: 800-445-1161**  
tel(512)651-0200 • fax(512)651-0201 • email: [moinfo@ambion.com](mailto:moinfo@ambion.com)  
For a complete list of distributors visit <http://www.ambion.com>



# PowerScript™ Reverse Transcriptase

Power through.

Illustration inspired by the art of Robert Indiana.



**Superior first strand cDNA synthesis from PowerScript™ RT.** A poly A<sup>+</sup> RNA ladder was incubated with equivalent amounts of different RNase H<sup>-</sup> RTs using the conditions suggested by each manufacturer. PowerScript generated the largest amounts of the 9.5 kb fragment.

Get the power of longer cDNAs for less money with **PowerScript™ Reverse Transcriptase (RT)**. PowerScript is a superior point mutant of the Moloney murine leukemia virus RT that lacks RNase H activity but retains wild-type polymerase ability—this means you get cDNAs consistently longer than 3 kb. PowerScript is cleaner than other commercially available RTs. In fact, we guarantee each preparation to be free of DNase and RNase. And as it costs less, PowerScript RT is clearly the most economical and best choice for cDNA library construction, RT-PCR, labeling probes, or any application requiring robust reverse transcription.

Call and order today!

## **BD Biosciences**

Clontech  
Discovery Labware  
Immunocytometry Systems  
Pharmingen

### **BD Biosciences Clontech**

Visit [www.clontech.com](http://www.clontech.com). In the U.S., call 800.662.2566 to order.

For research use only. Not for use in diagnostic or therapeutic procedures. Not For Resale.  
BD, BD Logo and all other trademarks are the property of Becton, Dickinson and Company. ©2001 BD (AD1Z689)





**It's not Voodoo.**

# It's serum-free Cell Culture.

Admit it.

You've always been a bit superstitious about your cell cultures.

After all, it's not easy to concoct the perfect potion. Particularly for cells that may ultimately be used in genomic, biopharmaceutical, therapeutic or diagnostic applications.

Hybridomas. CHO cells. HEK (293) cells. Insect cells. Neurons. Blood and bone marrow cells. Keratinocytes. ES cells. Hepatocytes. Endothelial cells. Mammalian cells for virus production.

No matter what your cell type, we can make a serum-free, protein-free or chemically-defined GIBCO™ medium optimized for its culture.

What's more, we make it in a format to suit your system: dry powder, 1X liquid, concentrates, and new Advanced Granulation Technology™.

Want to minimize adaptation time, improve control, enhance yield and simplify scale-up?

Turning to the most trusted name in cell culture always works like a charm.



For product data, go to  
[www.invitrogen.com/gibco/sfm](http://www.invitrogen.com/gibco/sfm)



**Better Cell Culture Through Innovation**

**United States Headquarters:**  
Invitrogen Corporation  
1600 Faraday Avenue  
Carlsbad, California 92008  
Tel: 1 760 603 7200  
Tel (Toll Free): 1 800 955 6288  
Fax: 1 760 603 7229  
Email: [tech\\_service@invitrogen.com](mailto:tech_service@invitrogen.com)

**European Headquarters:**  
Invitrogen Ltd  
3 Fountain Drive  
Inchinnan Business Park  
Paisley PA4 9RF, UK  
Tel (Free Phone Orders): 0800 269 210  
Tel (General Enquiries): 0800 5345 5345  
Fax: +44 (0) 141 814 6287  
Email: [eurotech@invitrogen.com](mailto:eurotech@invitrogen.com)

**International Offices:**  
Argentina 5411 4556 0844  
Australia 1 800 331 627  
Austria 0800 20 1087  
Belgium 0800 14894  
Brazil 0800 11 0575  
Canada 800 263 6236  
China 10 6849 2578  
Denmark 80 30 17 40

France 0800 23 20 79  
Germany 0800 083 0902  
Hong Kong 2407 8450  
India 11 577 3282  
Italy 02 98 22 201  
Japan 03 3663 7974  
The Netherlands 0800 099 3310  
New Zealand 0800 600 200  
Norway 0800 5456 5456

Spain & Portugal 900 181 461  
Sweden 020 26 34 52  
Switzerland 0800 848 800  
Taiwan 2 2651 6156  
UK 0800 838 380  
Other countries, see our website.

[www.invitrogen.com](http://www.invitrogen.com)

These products are for research use, and where appropriate, as raw material components in further cell culture manufacturing applications. They are not intended for human or animal diagnostic, therapeutic, or other clinical uses, unless otherwise stated.  
© 2001 Invitrogen Corporation PAS01-119MS



1200 New York Avenue, NW  
Washington, DC 20005

Editorial: 202-326-6550, FAX 202-289-7562

News: 202-326-6500, FAX 202-371-9227

Permissions: 202-326-7074, FAX 202-682-0816

Subscriptions: 800-731-4939 or 202-326-6417, FAX 202-842-1065

Bateman House, 82-88 Hills Road  
Cambridge, UK CB2 1LQ

(44) 1223-326500, FAX (44) 1223-326501

EDITOR-IN-CHIEF **Donald Kennedy**

EDITOR **Ellis Rubinstein**

MANAGING EDITOR **Monica M. Bradford**

DEPUTY MANAGING EDITORS

R. Brooks Hanson Katrina L. Kelnor

NEWS EDITOR

Colin Norman

**EDITORIAL/COMPASS** SUPERVISORY SENIOR EDITORS Barbara Jasny, Guy Riddihough, Phillip D. Szuroni; SENIOR EDITOR/PERSPECTIVES Orla Smith; SENIOR EDITORS Gilbert J. Chin, Pamela J. Hines, Paula A. Kiberstis (Boston), L. Bryan Ray, Linda R. Rowan; ASSOCIATE EDITORS Lisa D. Chong, Marc S. Lavine, Beverly A. Purnell, H. Jesse Smith, Valda

PUBLISHER **Alan I. Leshner**

ASSOCIATE PUBLISHER **Beth Rosner**

MEMBERSHIP/CIRCULATION DIR. **Michael Spinella**

**MEMBERSHIP/CIRCULATION** (membership@aaas.org) DEPUTY DIRECTOR Marlene Zentell; MEMBER SERVICES MANAGER Michael Lung; SENIOR SPECIALIST Mary Curry; COORDINATOR Jantell Stone; SPECIALISTS Laurie Baker, Pat Butler, Elizabeth Early, Katrina Smith; MARKETING MANAGER Gregory Urquhart; PRODUCTION MANAGER Lauri Sirois; SENIOR ASSOCIATE Deborah Stromberg; INTERNATIONAL MARKETING MANAGER Ruth Hall; SENIOR EXECUTIVE Martin Paine; RESEARCH MANAGER Renuka Chander; BUSINESS AND FINANCE MANAGER Teresa Ellis; ADMINISTRATIVE SUPPORT Zadia McKinnon; COMPUTER SPECIALIST John Williams

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

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

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

**FINANCE AND ADVERTISING** BUSINESS MANAGER Deborah Rivera-Wienhold; SENIOR ANALYST Randy Yi; FINANCIAL ANALYSTS Lisa Donovan, Jessica Tierney-Rubin; RIGHTS AND PERMISSIONS: ASSOCIATE Emilie David; ASSISTANT Karen Lentz; MARKETING: DIRECTOR John Meyers; RECRUITMENT MARKETING

Vinson; EDITOR, SCIENCE ONLINE Stewart Wills; ASSOCIATE BOOK REVIEW EDITOR Sherman J. Suter; ASSOCIATE LETTERS EDITOR Christine M. Pearce; INFORMATION SPECIALIST Janet Kegg; CONTRIBUTING EDITOR Kevin Ahern; EDITORIAL MANAGER Cara Tate; SENIOR COPY EDITORS Jeffrey E. Cook, Harry Jach, Etta Kavanagh, Barbara P. Ordway; COPY EDITORS Lauren Beben, Joshua Marcy, Monique Martineau; EDITORIAL COORDINATORS Carolyn Kyle, Ellen E. Murphy, Beverly Shields; PUBLICATION ASSISTANTS Chris Filiatreau, Joi S. Granger, Jeffrey Hearn, Elise Laffman, Gail Murphy, Brian White, Anita Wynn; EDITORIAL ASSISTANTS Yolanda Matthews, Patricia M. Moore, Tunisia L. Riley; EXECUTIVE ASSISTANT Sylvia S. Kihara; ADMINISTRATIVE SUPPORT Patricia F. Fisher

science\_editors@aaas.org (for general editorial queries)  
science\_letters@aaas.org (for letters to the editor)  
science\_reviews@aaas.org (for returning manuscript reviews)  
science\_bookrevs@aaas.org (for book review queries)

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

Francisco, CA: 415-778-2000, FAX 415-778-2001; MANAGER Allison Pritchard; ASSOCIATES Mary Ellen Crowley, Amanda Donath; ELECTRONIC MEDIA: MANAGER Don Hemertway; INTERNET PRODUCTION MANAGER Lizabeth Hartman; ASSISTANT PRODUCTION MANAGER Wendy Stengel; SENIOR PRODUCTION ASSOCIATE Lisa Stanford; PRODUCTION ASSOCIATES Carla Cathey, Steve Kusek, Darcey O'Donnell, Louis Williams; LEAD APPLICATIONS DEVELOPER Carl Saffell; ADMINISTRATIVE SUPPORT Joyce Scott

**PRODUCT ADVERTISING** (science\_advertising@aaas.org) NATIONAL SALES MANAGER Richard Teeling: 973-694-9173, FAX 973-694-9193 • NORTH-EAST AND E. CANADA Elizabeth Pointek: 978-969-1542, FAX 413-480-0008 • MIDWEST Rick Bongiovanni: 330-405-7080, FAX 330-405-7081 • WEST COAST/ CANADA B. Neil Boylan: 415-458-1630, FAX 415-458-1631 • MID-ATLANTIC AND SOUTHEAST SALES Christopher Breslin: 443-512-0330, FAX 443-512-0331 • UK/SCANDINAVIA/FRANCE/ITALY/BELGIUM/NETHERLANDS Andrew Davies: 44 (0)1-782-750-111, FAX 44 (0)1-782-751-999 • GERMANY/SWITZERLAND/AUSTRIA Tracey Peers: (44) 1-782-752-530, FAX (44) 1-782-752-531 JAPAN Masahiko Yoshikawa: (81) 3-3235-5961, FAX (81) 3-3235-5852 • TRAFFIC MANAGER Carol Maddox; TRAFFIC ASSOCIATE Halimah S. Whitby; SENIOR SALES ASSOCIATE Sheila Myers

**RECRUITMENT ADVERTISING** (science\_classifieds@aaas.org); PRODUCTION MANAGER Jennifer Rankin; ASSISTANT PRODUCTION MANAGER Deborah Tompkins; U.S. SALES MANAGER Gabrielle Boguslawski: 718-491-1607, FAX 202-289-6742; WEST COAST SALES MANAGER Kristine von Zedlitz; EAST COAST SALES MANAGER Jill Steinberg; INTERNET SALES MANAGER Beth Dwyer; ASSISTANT SALES MANAGER Daryl Anderson; SENIOR SALES COORDINATOR Erika Bryant; SALES COORDINATORS Rohan Edmonson, Caroline Gallina, Shirley Young; SALES REPRESENTATIVES Kathleen Clark, Jody Fenty, Christina Geiger, Bren Peters-Minnis; ASSISTANTS Sussy Castilla, Emmet Testafay; ASSOCIATES Christine Hall, Dina Freeman, Greta Springett; PUBLICATIONS ASSISTANTS Robert Buck, Jane Vaughn; U.K./EUROPE SALES MANAGER

Diego, CA: 760-942-3252, FAX 760-942-4979, Pacific North-west: 503-963-1940

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

**PREFLIGHT OPERATIONS** DIRECTOR David M. Tompkins

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

## SCIENCE INTERNATIONAL

**EUROPE** (science@science-int.co.uk) EDITORIAL SUPERVISORY SENIOR EDITOR Andrew M. Sugden; SENIOR EDITOR/PERSPECTIVES Julia Uppenbrink; SENIOR EDITORS Caroline Ash, Stella M. Hurlley; ASSOCIATE EDITORS Ian S. Osborne, Stephen J. Simpson, Peter Stern; EDITORIAL SUPPORT Jenny Parker, Sarah Parker; ADMINISTRATIVE SUPPORT Janet Mumford, Lara Crowe, Viv Hogarth; NEWS: EUROPEAN NEWS EDITOR Richard Stone; DEPUTY NEWS EDITOR Daniel Clery; CORRESPONDENTS Michael Balter (Paris: (33) 1-49-29-09-01, FAX (33) 1-49-29-09-00), Gretchen Vogel (Berlin: (49) 30-2809-3902, FAX (49) 30-2809-8365) Adam Bostanci (intern)

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

Debbie Harris; PROMOTIONS COORDINATOR Richard Walters; INTERNET SALES EXECUTIVE Tracy Holmes; AUSTRALIA/NEW ZEALAND: Keith Sandell: (61) 02-9922-2977, FAX (61) 02-9922-1100 JAPAN: Masahiko Yoshikawa: (81) 3-3235-5961, FAX (81) 3-3235-5852

**AAAS BOARD OF DIRECTORS** RETIRING PRESIDENT, CHAIR Mary L. Good; PRESIDENT Peter H. Raven; PRESIDENT-ELECT Floyd E. Bloom; TREASURER David E. Shaw; EXECUTIVE OFFICER Richard S. Nicholson; BOARD LEWIS M. Branscomb; Nina V. Fedoroff; Karen A. Holbrook; Sally Gregory Kohlstedt; Richard A. Meserve; Robert C. Richardson; Neena B. Schwartz; Lydia Villa-Komaroff

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

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

## INFORMATION FOR CONTRIBUTORS

See pages 151 and 152 of the 4 January 2002 issue or access [www.sciencemag.org/feature/contribinfo/home.shtml](http://www.sciencemag.org/feature/contribinfo/home.shtml)

## BOARD OF REVIEWING EDITORS

Frederick W. Alt  
*Children's Hospital,  
Boston*  
Edouard Bard  
*Univ. d'Aix-Marseille III*  
Frank S. Bates  
*Univ. of Minnesota*  
Ray H. Baughman  
*Univ. of Texas, Dallas*  
Stephen J. Benkovic  
*Pennsylvania St. Univ.*  
Michael J. Bevan  
*Univ. of Washington*

Ton Bisseling  
*Wageningen University*  
Henry R. Bourne  
*Univ. of California, SF*  
Lewis M. Branscomb  
*Harvard Univ.*  
Joseph A. Burns  
*Cornell Univ.*  
Dennis W. Choi  
*Washington Univ. School  
of Medicine, St. Louis*  
Joanne Chory  
*The Salk Institute*

David Clapham  
*Children's Hospital, Boston*  
J. M. Claverie  
*CNRS, Marseille*  
Jonathan D. Cohen  
*Princeton Univ.*  
F. Fleming Crim  
*Univ. of Wisconsin*  
Robert Desimone  
*NIMH, NIH*  
Julian Downward  
*Imperial Cancer Research  
Fund*  
Denis Duboule  
*Univ. of Geneva*  
Richard Ellis  
*California Inst. of  
Technology*  
Gerhard Ertl  
*Fritz-Haber-Institut, Berlin*  
Paul G. Falkowski  
*Rutgers Univ.*  
Douglas T. Fearon  
*Univ. of Cambridge*  
Tom Fenchel  
*Univ. of Copenhagen*  
Jeffrey S. Flier  
*Harvard Medical School*  
Richard Fortey  
*The Natural History  
Museum, London*  
Yves Frégnac  
*CNRS, Gif-sur-Yvette*  
Chris D. Frith  
*Univ. College London*

Don Ganem  
*Univ. of California, SF*  
James Gimzewski  
*Univ. of California, LA*  
Alex Halliday  
*ETH Zentrum, Zürich*  
Paul Harvey  
*Univ. of Oxford*  
Martin Heimann  
*Max Planck Institute  
of Biogeochemistry, Jena*  
Tasuku Honjo  
*Kyoto Univ.*  
Evelyn L. Hu  
*Univ. of California, SB*  
Herbert Jäkle  
*Max Planck Institute for  
Biophysical Chemistry,  
Göttingen*  
Meyer B. Jackson  
*Univ. of Wisconsin  
Medical School*  
Stephen Jackson  
*Univ. of Cambridge*  
Bernhard Keimer  
*Max Planck Inst. Stuttgart*  
Christian Körner  
*Botanisches Institut, Basel*  
Alan B. Krueger  
*Princeton Univ.*  
Angus I. Lamond  
*Univ. of Dundee*  
Antonio Lanzavecchia  
*Inst. of Res. in  
Biomedicine, Bellinzona*

Anthony J. Leggett  
*Univ. of Illinois, Urbana-  
Champaign*  
Norman L. Letvin  
*Beth Israel Deaconess  
Medical Center, Boston*  
Richard Losick  
*Harvard Univ.*  
Raul Madariaga  
*École Normale  
Supérieure, Paris*  
Rick Maizels  
*Univ. of Edinburgh*  
George M. Martin  
*Univ. of Washington*  
Diane Mathis  
*Harvard Medical School*  
Andrew Murray  
*Harvard Univ.*  
Elizabeth G. Nabel  
*NHLBI, NIH*  
James Nelson  
*Stanford Univ. School of  
Medicine*  
Roger Nicoll  
*Univ. of California, SF*  
Malcolm Parker  
*Imperial College*  
Roy R. Parker  
*Univ. of Arizona*  
Michele Parrinello  
*Centro Svizzero di Calcolo  
Scientifico*  
Linda Partridge  
*Univ. College London*

Suzanne Pfeffer  
*Stanford School of Medicine*  
Philippe Poulin  
*CNRS*  
Danny Reinberg  
*Univ. of Medicine and  
Dentistry-New Jersey*  
Janet Rossant  
*Univ. of Toronto*  
Erkki Ruoslahti  
*The Burnham Institute*  
David G. Russell  
*Cornell Univ.*  
Dan Schrag  
*Harvard Univ.*  
Georg Schulz  
*Albert-Ludwigs-Universität  
Freiburg*  
Terrence J. Sejnowski  
*The Salk Institute*  
Kazuo Shinzaki  
*RIKEN*  
Manfred Siggert  
*ETH Höngerberg, Zürich*  
Susan Solomon  
*NOAA*  
Christopher R. Somerville  
*Carnegie Institution of  
Washington, Stanford*  
Will J. Stewart  
*Marconi Caswell,  
Towcester*  
Edward I. Stiefel  
*Princeton*  
Bruce Stillman  
*Cold Spring Harbor Lab.*

Thomas Stocker  
*Univ. of Bern*  
Tomoyuki Takahashi  
*Univ. of Tokyo*  
Marc Tessier-Lavigne  
*Stanford Univ.*  
Joan S. Valentine  
*Univ. of California, LA*  
Michiel van der Klis  
*Astronomical Inst. of  
Amsterdam*  
Derek van der Kooy  
*Univ. of Toronto*  
Bert Vogelstein  
*Johns Hopkins*  
Christopher Walsh  
*Harvard Medical School*  
Julia R. Weertman  
*Northwestern Univ.*  
Arthur Weiss  
*Univ. of California, SF*  
R. Sanders Williams  
*Duke University*  
Ian A. Wilson  
*The Scripps Res. Inst.*  
Richard A. Young  
*The Whitehead Inst.*  
Martin Zatz  
*NIMH, NIH*  
Walter Ziegglänsberger  
*Max Planck Institute, Munich*  
Huda Zoghbi  
*Baylor College of Medicine*  
Maria Zuber  
*MIT*

## SENIOR EDITORIAL BOARD

John I. Brauman, Chair, *Stanford Univ.*  
Philip H. Abelson, *AAAS*  
Joseph L. Goldstein, *Univ. of Texas Southwestern Med. Ctr.*  
Richard Losick, *Harvard Univ.*  
Robert May, *Univ. of Oxford*  
Marcia McNutt, *Monterey Bay Aquarium Research Inst.*  
Vera C. Rubin, *Carnegie Institution of Washington*  
Christopher R. Somerville, *Carnegie Institution of  
Washington, Stanford*  
Yoshinori Tokura, *Univ. of Tokyo*  
Gerhard Wegner, *Max Planck Inst. of Polymer Research, Mainz*

## BOOK REVIEW BOARD

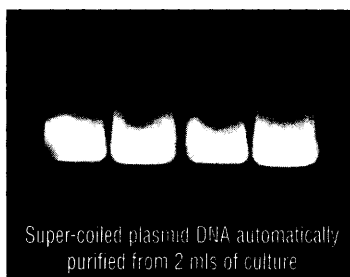
David Bloom, *Harvard Univ.*  
Londa Schiebinger, *Pennsylvania State Univ.*  
Richard Shweder, *Univ. of Chicago*  
Robert Solow, *MIT*  
David Voss, *Science*  
Ed Wasserman, *DuPont*  
Lewis Wolpert, *Univ. College, London*

# Pure & Simple...

The Mini Prep-48 Automated Instrument Produces  
Pure Plasmid DNA and Simplifies Your Life...  
and That's No Gibberish.

## Pure

- Produces plasmid DNA suitable for fluorescent automated sequencing, straight from the MP-48
- Improved yields (3-6 ug of DNA per lane)
- Up to 48 preps in just over one hour



## Simple

- Cost effective for plasmid isolation (<\$10K instrument and < \$.95 per prep)
- Starts with liquid culture, with walkaway automation
- No centrifugation step



The perfect new addition to your lab.

**1-800-466-7949**

6195 Cornerstone Court East • San Diego, CA 92121

**MacCONNELL**  
RESEARCH

Phone: (858) 452-2603 Fax (858) 452-6753  
[www.macconnell.com](http://www.macconnell.com)

You've just got to find the  
order in the chaos.



> If you work in proteomics,  
you know complexity firsthand.



Sample Prep and Fractionation

Labeling and Quantitation

Protein Separation

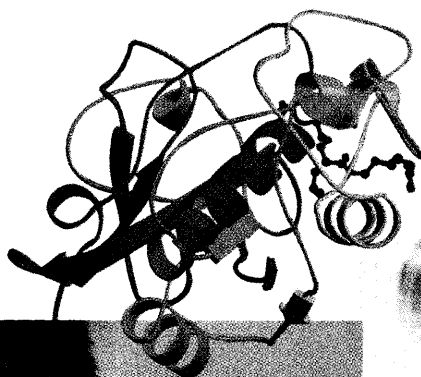
Sample Processing

### Your next proteomics discovery awaits.

Applied Biosystems, the company that enabled the sequencing of the human genome, is pioneering new proteomics workflows with perform protein ID, quantitation, and characterization at new levels of productivity. With technology breakthroughs like the Applied the innovations to get you to your next discovery moment. **1.650.638.5800** or **[www.appliedbiosystems.com/proteomics1](http://www.appliedbiosystems.com/proteomics1)**



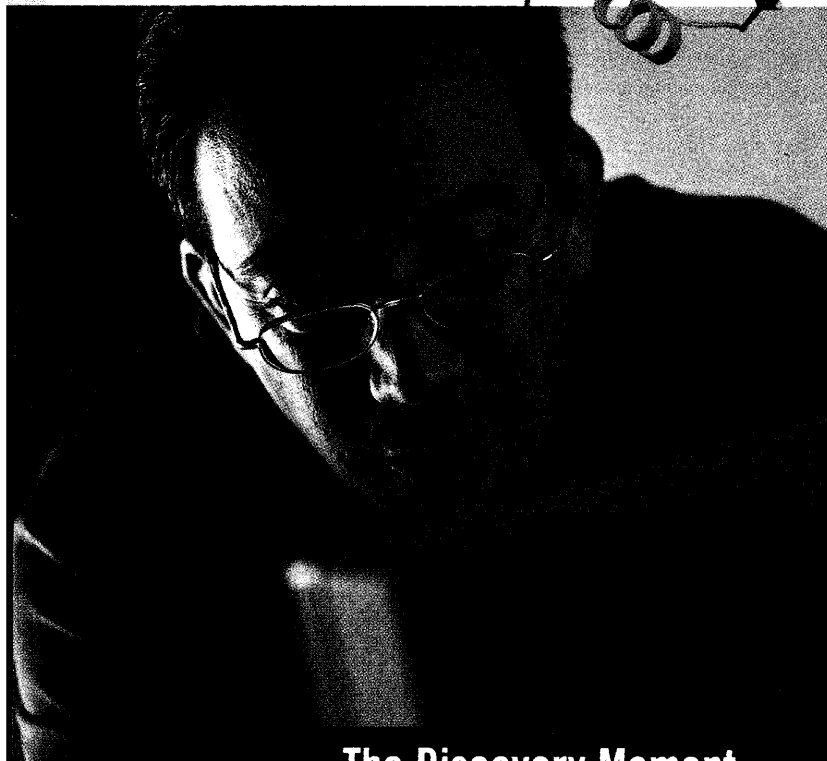
Maybe you do it by unlocking  
an insight about your research  
when you least expect it.



So your work starts to  
take on a new direction.  
Toward a discovery.



A new drug target or pathway.  
Even a cure.



## The Discovery Moment

Identification

Characterization

Functional Assays

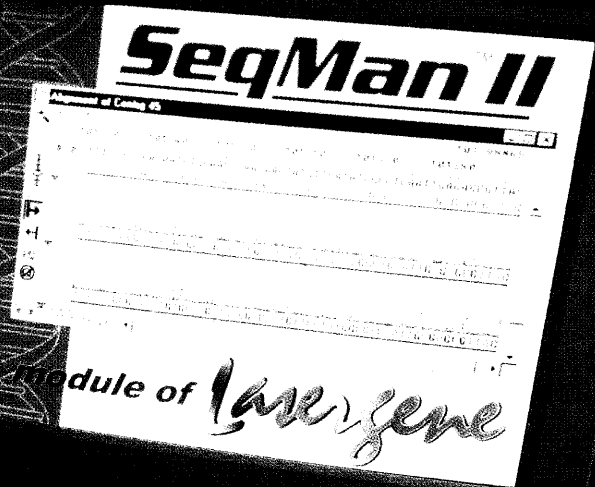
Bioinformatics

next-generation systems. Now you can look deeper into the proteome and Biosystems 4700 Proteomics Analyzer and ICAT™ reagents, we deliver

**AB** Applied  
Biosystems  
Data. Decision. Discovery.

# Defining Sequence Assembly

*Customer Service Award Winner*



**SeqManII** (sēk-man-ī-tū) n. 1. sequence assembly software for exacting researchers 2. easy-to-use, powerful, accurate sequence assembler 3. sequence quality evaluator, also removes vector and poor quality data 4. trace viewer, alignment editor see Lasergene n. 5. Try a Demo-  
[www.dnastar.com](http://www.dnastar.com)

© DNASTAR, Inc.

DNASTAR, Inc. 1228 S. Park St., Madison, WI 53715 USA [www.dnastar.com](http://www.dnastar.com)  
Tel: 608•258•7420 Fax: 608•258•7439 e-mail: [info@dnastar.com](mailto:info@dnastar.com)

GATC Biotech AG, Jakob-Stadler-Platz 7, 78467 Konstanz, Germany [www.gatc-biotech.com](http://www.gatc-biotech.com)  
Tel: +49 (0) 7531 81 60 0 Fax: +49 (0) 7531 81 60 81 e-mail: [bioinformatics@gatc-biotech.com](mailto:bioinformatics@gatc-biotech.com)

FROST & SULLIVAN

Market Engineering Award Recipient

Customer Service Leadership

2001

**DNASTAR**  
DNASTAR, Inc



## Synergy!

When the whole amounts to significantly more than the sum of its parts, scientists talk of “**synergy**”.

A perfect example: **the Multipipette® pro**, the high-precision manual dispenser and the **Eppendorf® PCR MasterMix**, two partners, whose interaction could hardly be improved.

Electronic dispensing with utterly consistent precision makes the processing of large series and microtiter plates child's play. Particularly when analyzing samples using PCR technology, pipetting and concentration errors can lead to fatal deviations. The “ready to use” **Eppendorf® PCR MasterMix** will drastically minimize these errors.

Multipipette® pro and Eppendorf® PCR MasterMix: an unbeatable intelligent team for reproducible experiments in the PCR field.

### **Multipipette® pro:**

- Electronic manual dispenser (positive-displacement principle)
- Dispensing and pipetting uneven volumes (e.g. 13.4 µl)
- Rapid, fatigue-free dispensing (spray-free, even in free jet)
- Electronic action for highest precision
- Large volume range from 1 µl to 50 ml

### **MasterMix:**

- “Ready-to-use” mix for maximum reproducibility
- High PCR yields
- Reliable and reproducible results
- Ideal for automating PCR

**Application Hotline:**  
+49 180-3 666 789

**eppendorf**  
*In touch with life*

Eppendorf AG · 22331 Hamburg · Germany · Phone +49 40-538 01-0 · Fax +49 40-538 01-556

e-mail: [eppendorf@eppendorf.com](mailto:eppendorf@eppendorf.com) · Internet: [www.eppendorf.com](http://www.eppendorf.com)

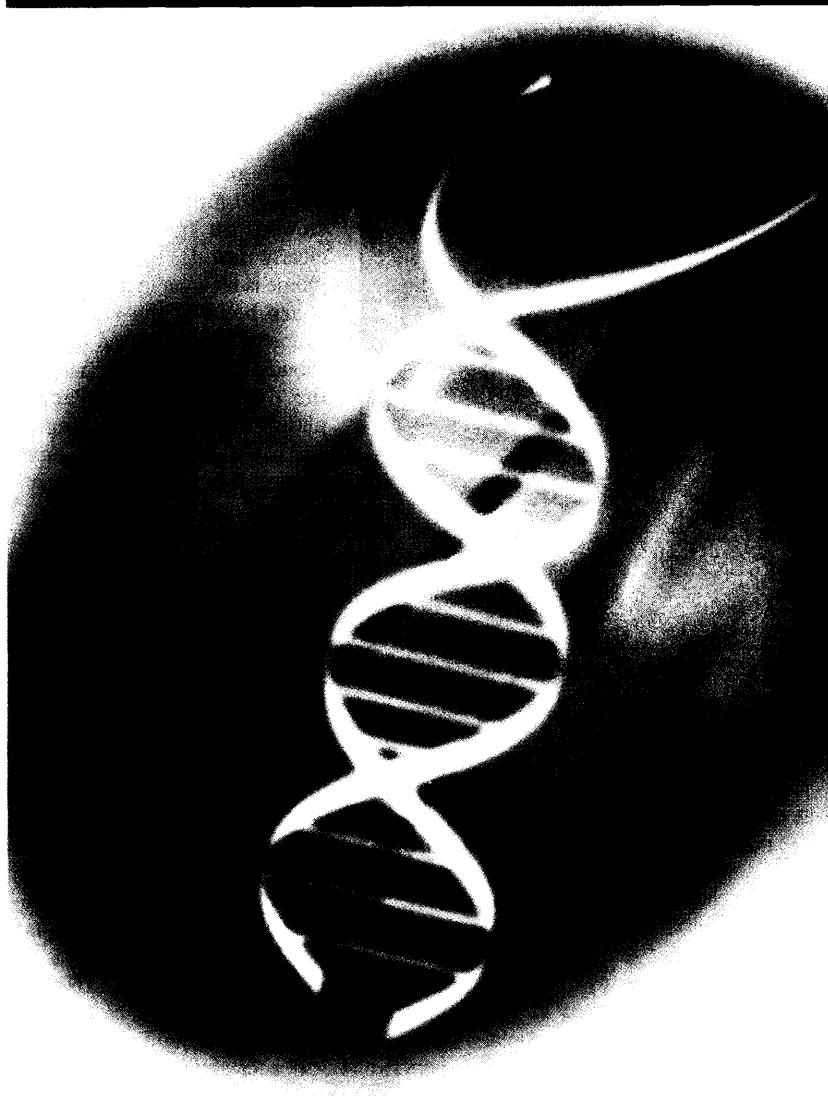
Brinkmann Instruments, Inc. · One Cantiague Rd. · Westbury, NY 11590-0207 · Phone 800-645-3050 or 516-334-7500 · Fax 516-334-7506

e-mail: [info@brinkmann.com](mailto:info@brinkmann.com) · website: [www.brinkmann.com](http://www.brinkmann.com)



**Unwind...**

**...we have the thermal solution**



US 1.800.926.3000  
Canada 1.800.387.2216

[www.varianinc.com](http://www.varianinc.com)



**VARIAN**

# Non-viral transfection of primary cells:

Impossible - you think?

**e.g. 90% efficiency**

Unbelievable?

**in human dermal fibroblasts**

At first that's what Peter thought too:

a m a  a  
gene transfer begins here

Dr. Peter Buttgereit, Technical Service Scientist - joined amaxa in April 2001. "During the last year of my Ph.D. at the University of Bonn I was one of the first to test the Nucleofector™\* technology. Unlike any other non-viral transfection technology, the DNA is directly transferred into the nucleus. With optimized combinations of electrical parameters and cell-type specific solutions it works for a multitude of primary cells, even non-proliferating cells. This novel technology was so convincing that my decision was clear: I joined amaxa right after finishing my Ph.D."



Not yet convinced?

Well, call Peter for further referrals

**+49 (0)221 99199-400**

or check our website

**www.amaxa.com**

\*Nucleofector™ is a trademark of amaxa



A detailed technical line drawing of a Nikon Cr60 Eclipse microscope. The drawing shows the main body, eyepieces, objective lenses, and various adjustment knobs. The drawing is oriented vertically, with the eyepieces at the top and the base at the bottom. The drawing is a technical sketch, showing the internal components and the overall structure of the microscope. The drawing is a technical sketch, showing the internal components and the overall structure of the microscope.

# DRAWN FROM EXPERIENCE.

STRAY LIGHT  
"NOISE TERMINATOR"  
FOR HIGH S/N RATIOS

EXTENDIBLE INFINITY DESIGN PERMITS  
EASY ADDITION OF ILLUMINATION  
SOURCES/ATTACH-ADJUSTS

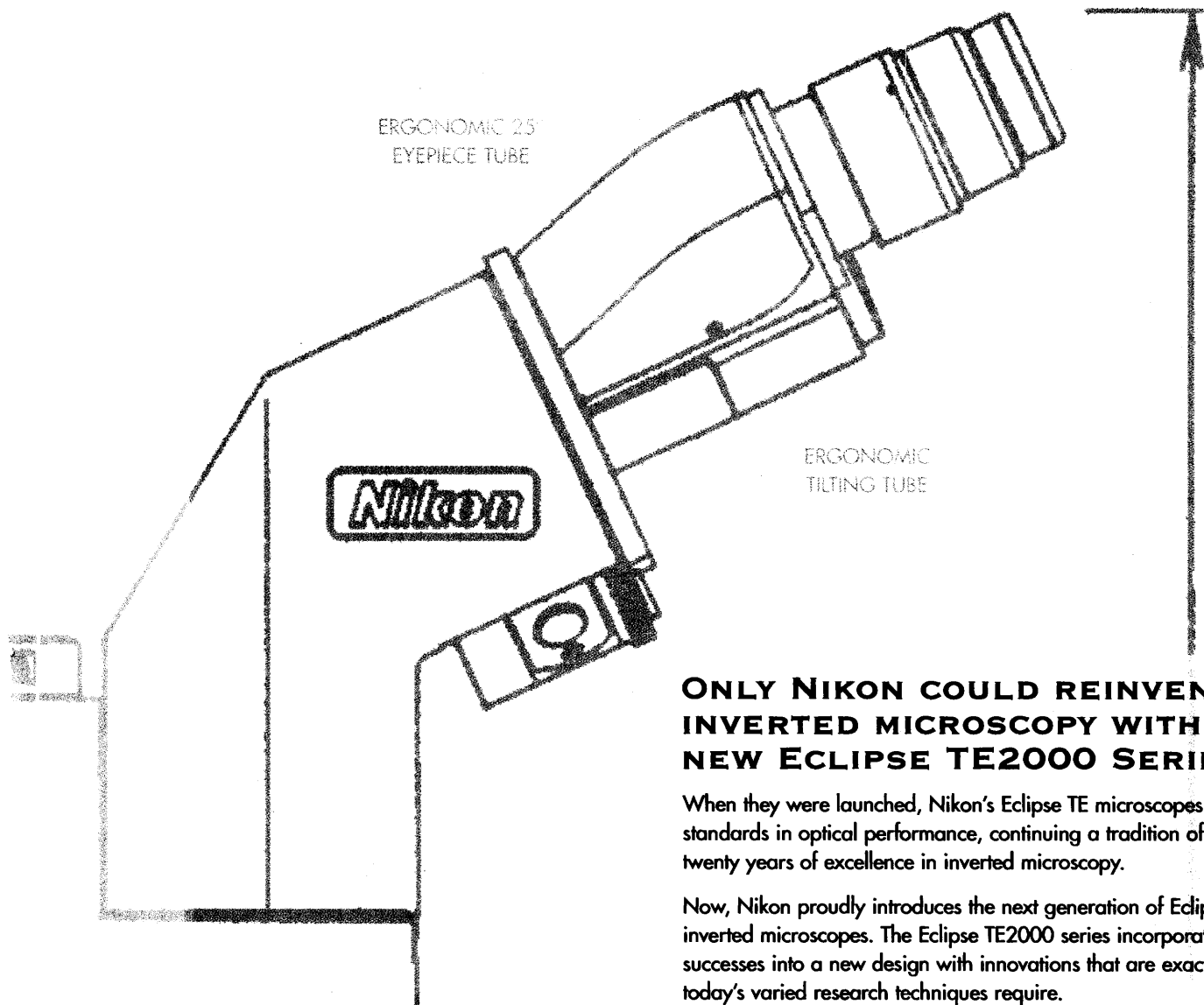
NEW HIGH  
STRENGTH ALLOY  
RESISTS VIBRATION  
AND TEMPERATURE  
VARIATIONS

SEXY POSITION FLUORESCENCE  
FILTER CUBE (UEP81)

NANOPRECISION LINEAR  
ENCODED Z-AXIS  
MOTORIZED FOCUS

MULTIPLE IMAGE PORTS  
(FRONT, BOTH SIDES,  
TOP AND BOTTOM)

# INVERTED MICROSCOPES



## ONLY NIKON COULD REINVENT INVERTED MICROSCOPY WITH THE NEW ECLIPSE TE2000 SERIES.

When they were launched, Nikon's Eclipse TE microscopes set new standards in optical performance, continuing a tradition of over twenty years of excellence in inverted microscopy.

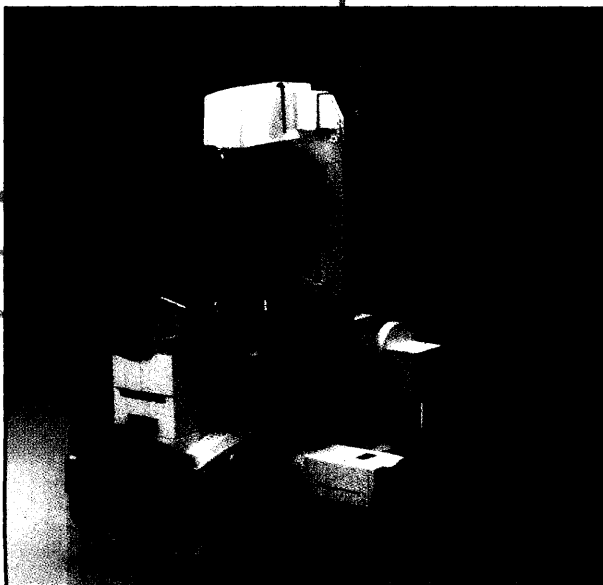
Now, Nikon proudly introduces the next generation of Eclipse research inverted microscopes. The Eclipse TE2000 series incorporates past successes into a new design with innovations that are exactly what today's varied research techniques require.

Here are just some of the special features built into this extraordinary microscope:

- Multi-port design permitting addition of optional illumination sources and other attachments without modifying the microscope.
- Unique "Noise Terminator" thoroughly eliminates stray light for greater S/N ratio in fluorescence imaging.
- Super-nanoprecision Z-access control and increased stability for superior 3D imaging.
- Modular motorized components for automated control.
- Exclusive CF160™ infinity optical system for excellent resolution with high numerical apertures and longer working distances.

The Eclipse TE2000 is available in three models, each configured to meet your research needs. Draw on Nikon's experience. For more information, call 1-800-52-NIKON, ext. 392 or visit [www.nikonusa.com](http://www.nikonusa.com)

Visit MicroscopyU at [www.nikonusa.com](http://www.nikonusa.com) to learn more about inverted microscopy.





How can I read the latest ground-breaking research first?


**Scienceexpress**

Where can my paper get worldwide attention within days of acceptance?

**Scienceexpress**

What's another great reason to join AAAS today?

**Scienceexpress**



Each week the editors of **Science** select several of the most important and cutting-edge research papers to publish online in *Science Express*. Within days of acceptance the paper is available to download on your own computer. All this happens weeks before the final version appears in the print version of **Science**. Papers in *Science Express* are available free to individual AAAS members and for a nominal fee to non-members.

 **AAAS**  
*Advancing Science Worldwide*

Get it first with  
[www.scienceexpress.org](http://www.scienceexpress.org)

**Science**  
*Discover the Future*

# IS THERE AN EASIER WAY

to Get All Your Cell Signaling  
and Neuroscience Products?

## Yes! Sigma-RBI

Why search around for cell signaling and neuroscience products? Sigma-RBI has them all — from standard biochemical reagents to the latest cutting-edge research products, including key signal transduction enzymes, phosphospecific antibodies, novel receptor ligands, selective enzyme inhibitors and much, much more.

Sigma-RBI is committed to bringing you the widest array of new, exciting and innovative research products.

With over 5,000 cell signaling and neuroscience products to select from, Sigma-RBI provides the right research tools right when you need them.

Plus, all products are available in one easy-to-use catalog conveniently arranged by scientific areas of interest — with over 600 new products added every year.

All products are backed by our world-renowned customer service and technical support, and can be researched using our award winning Web site.

**Subscribe now** to receive our new product updates and our newest Cell Signaling & Neuroscience Catalog by returning the attached card, or by calling 1-800-282-1298 and requesting literature code (079), or visit our Web site at [www.sigma-aldrich.com/cellsignaling](http://www.sigma-aldrich.com/cellsignaling).

availability, ordering & tracking

[www.sigma-aldrich.com](http://www.sigma-aldrich.com)

scientific tools, products & information

LEADERSHIP IN LIFE SCIENCE, HIGH TECHNOLOGY AND SERVICE  
SIGMA-ALDRICH CORPORATION • BOX 14508 • ST. LOUIS • MISSOURI 63178 • USA

**SIGMA**  
**RBI**

Stephen A. Callahan  
4900 1st Teachers Ln  
Baltimore, MD 21209  
(410) 555-7712 (home)  
(410) 555-7713 (work)  
scallahan@aol.com

#### EDUCATION

1986 Ph.D. Graduate Thesis: *Use of the*  
*Department of Immunology*

1982 Bachelor of Science, *Department of Biochemistry*

#### AWARDS AND HONORS

1988 present Research Fellowship

1988 Major Grant Award

1987 Postdoctoral Fellowship

1986 John G. Thompson Fellowship Award

#### PUBLICATIONS

1. Stephen Callahan, George H. Lee, and James H. Brown, *Journal of Biological Chemistry* 261: 11517-11521 (1986).
2. Stephen Callahan and James H. Brown, *Journal of Biological Chemistry* 261: 11517-11521 (1986).

#### RESEARCH EXPERIENCE

1. 1984 - 1986: Callahan, George H. Lee, and James H. Brown, *Journal of Biological Chemistry* 261: 11517-11521 (1986).
2. 1986 - 1987: Callahan, George H. Lee, and James H. Brown, *Journal of Biological Chemistry* 261: 11517-11521 (1986).

#### REFERENCES

Available upon request

Or

[www.sciencecareers.org](http://www.sciencecareers.org)

If you're in the life sciences, there's a better way to put yourself in the market for a new job. Go to ScienceCareers.org. Every week you'll find hundreds of job postings, employer profiles, a resume/CV database and an e-mail alert service that will bring jobs directly to you. With ScienceCareers.org you'll have all the tools you need to pound the pavement without ever hitting the street.

**Science @**  
CAREERS

[www.sciencecareers.org](http://www.sciencecareers.org)

# BIOCHEMISTRY AND MOLECULAR BIOLOGY EDUCATION

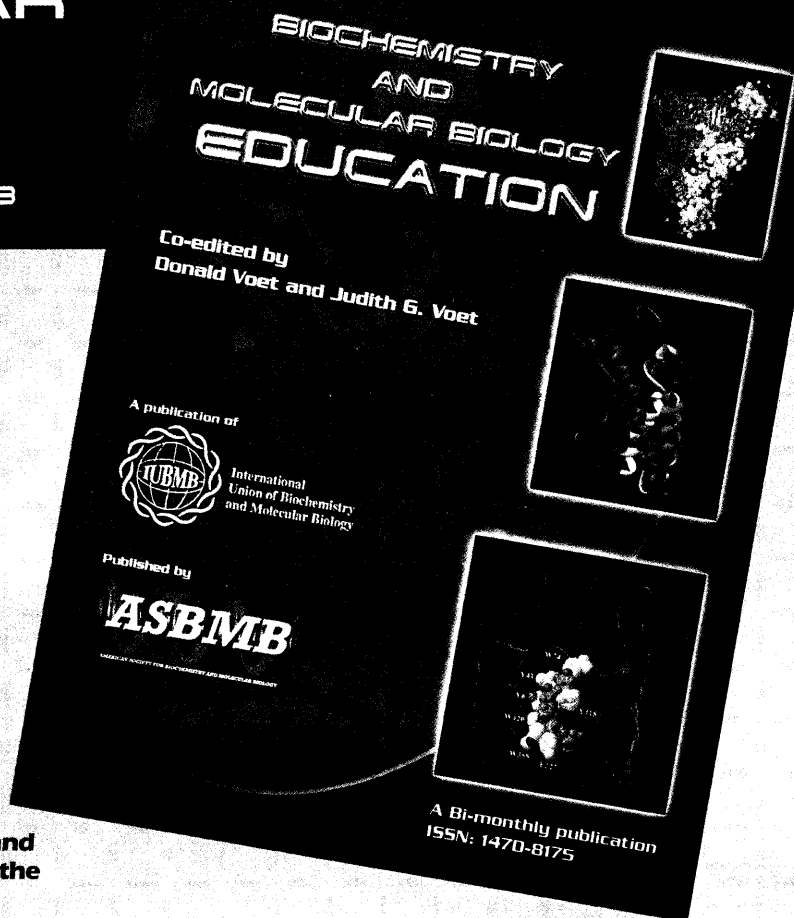
A JOINT PUBLICATION OF IUBMB/ASBMB

**BAMBED is a publication aimed at promoting quality biochemistry and molecular biology education, and education in related fields such as microbiology and cell biology, worldwide. BAMBED includes articles on**

- Teaching techniques and practices
- Methods of assessment of the effectiveness of new educational approaches
- Research in biochemistry and molecular biology education
- Short reviews on key areas of biochemical knowledge from workers, active in the field and intended to provide background material for the preparation of lectures, seminars, student presentations, dissertations, etc.
- Details of simple, tried and tested, laboratory experiments.

Articles submitted to BAMBED will be reviewed and turned around within six weeks. Manuscripts (three copies on 8.5x11 inch or A4 paper) containing new ideas concerning any aspect of interest to biochemistry and/or molecular biology educators, including laboratory class experiments, are welcomed and should be sent to the editorial office at the following address:

Professor Donald Voet  
Department of Chemistry  
University of Pennsylvania  
231 South 34th Street  
Philadelphia, PA 19104



## FIND OUT THE LATEST!

- Book Reviews
- Websites
- Videotapes
- Slide Sets
- Software

**Editors-in-Chief**  
Donald Voet  
University of Pennsylvania,  
Philadelphia, PA

Judith G. Voet  
Swarthmore College,  
Swarthmore, PA

## INTERACTIVE WEBSITE!

- Full Text Access
- Contents
- Abstracts
- Multimedia
- Searchable

**Feature Editors**  
**Biotechnology Education**  
A. Stephen Dahms, San Diego  
State University, San Diego, CA

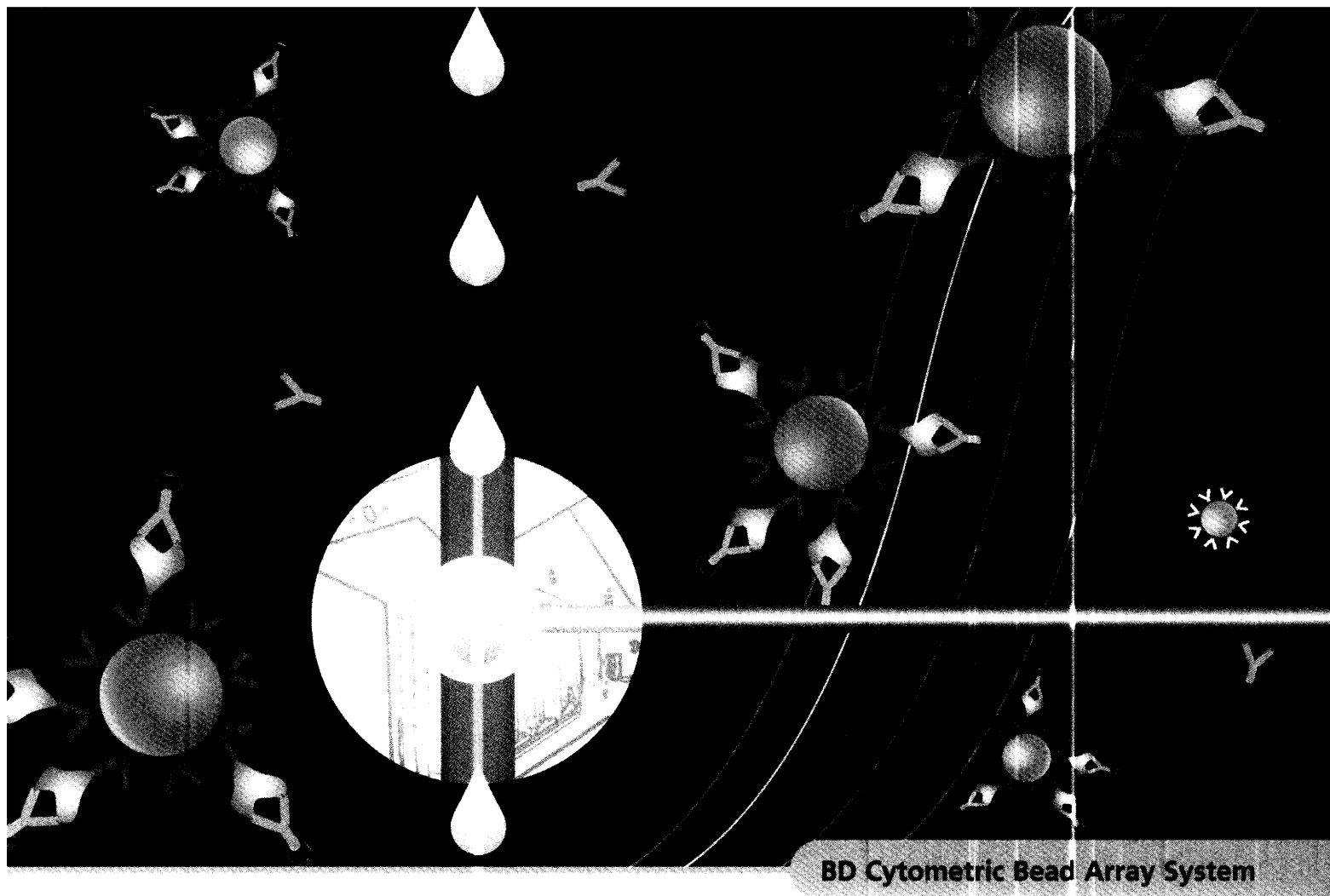
**Multimedia in Biochemistry and  
Molecular Biology Education**  
Graham R. Parslow, University of  
Melbourne, Australia

**Problem-based Learning**  
Harold B. White, University of  
Delaware, Newark, DE

**For submission requirements and further information  
visit [www.bambled.org](http://www.bambled.org)**

Published by American Society for Biochemistry and Molecular Biology  
9650 Rockville Pike • Bethesda, Maryland 20814-3996  
301-530-7145 • [bambled@asbmb.faseb.org](mailto:bambled@asbmb.faseb.org)  
A Joint Publication of IUBMB/ASBMB





## BD Cytometric Bead Array System

# A Multiplex Bead System You Can Count On

BD Biosciences Pharmingen has added a new twist to counting with beads. We recognize the value of small, precious samples and data reproducibility so we've developed a technology to ensure just those things.

The innovative Cytometric Bead Array (CBA) technology allows for quantitative detection of multiple analytes. Choose from Human Th1/Th2 Cytokine (two formats), Mouse Th1/Th2 Cytokine, Human Inflammation, and Mouse Ig Isotyping kits. Anaphylatoxin and Active Caspase-3 kits coming soon.

The BD CBA system provides reproducible data and reliable performance you can count on.

- get more results from a single small volume sample
- run one standard curve for all your analytes
- avoid artifacts associated with enzyme dependent signal generation
- achieve quantitative results with less time and labor
- use a complete system with ready-to-use kits and analysis software

## **BD Biosciences**

Clontech  
Discovery Labware  
Immunocytometry Systems  
Pharmingen

### **BD Biosciences Pharmingen**

Visit [www.bdbiosciences.com](http://www.bdbiosciences.com). Call 877.232.8995 (in the US) to order.

For Research Use Only. Not for use in diagnostic or therapeutic procedures. Not for resale.  
BD, BD Logo and all other trademarks are the property of Becton, Dickinson and Company. ©2001 BD  
01-81009-19H



LONG OLIGOS

# You **LONG** for the best... We deliver

## **Excellence in long oligo synthesis**

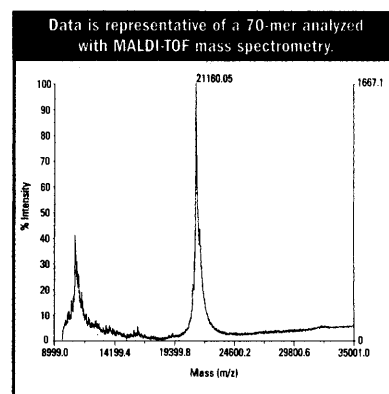
When you need long oligos for applications such as expression profiling and oligo arrays, call Sigma-Genosys — the leader in oligo synthesis. The superior coupling efficiency of our synthesis platforms enables us to routinely achieve full-length product for oligos as long as 130 bases. Our experience with gene construction and macroarray development provides us with insight into potential difficulties of long-mer synthesis. Our chemists work continuously to improve techniques for both synthesis and QC of long oligos. Unlike other suppliers, additional charges do not apply for synthesis of long oligos. Call us at 800-234-5362 to discuss how we can help your research.

### **Our long-mer oligo service includes:**

- Modified or non-modified oligos
- Shipment in tubes or microwell plates
- Statistical MALDI-TOF mass spectrometry
- Quality control by PAGE
- Oligo design

*"I need an oligo supplier that provides superior quality long oligos in the correct 96 well format. I trust Sigma-Genosys with my research."*

Kevin Arnold, Manager-DNA Production, Genaissance Pharmaceuticals



We can analyze and interpret mass spectrometry data for oligos up to 100 bases. Every synthesis lot is quality checked by statistical MALDI-TOF mass spectrometry.

[www.genosys.com](http://www.genosys.com)

LEADERSHIP IN LIFE SCIENCE, HIGH TECHNOLOGY AND SERVICE

1442 LAKE FRONT CIRCLE • THE WOODLANDS, TX 77380-3600  
800-234-5362 • FAX: 281-363-2212 • EMAIL: [GINFORMATION@SIAL.COM](mailto:GINFORMATION@SIAL.COM) • A Member of the Sigma-Aldrich Family

**SIGMA**  
GENOSYS

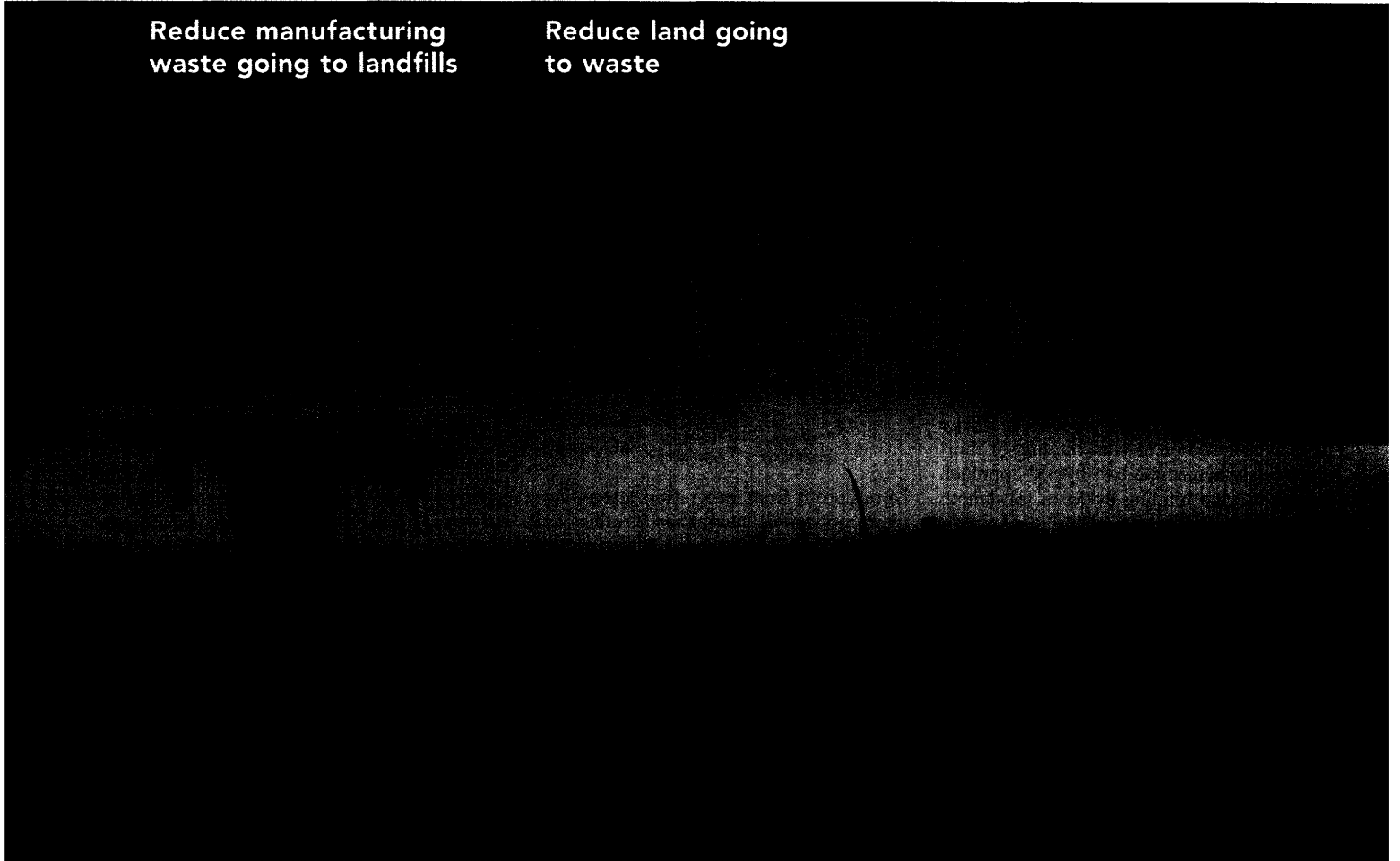
## TODAY

Reduce manufacturing  
waste going to landfills

## TOMORROW

Reduce land going  
to waste

## TOYOTA



Each year Toyota builds more than one million vehicles in North America. This means that we use a lot of resources — steel, aluminum, and plastics, for instance. But at Toyota, large scale manufacturing doesn't mean large scale waste.

In 1992 we introduced our Global Earth Charter to promote environmental responsibility throughout our operations. And in North America it is already reaping significant benefits. We recycle 376 million pounds of steel annually, and aggressive recycling programs keep 18 million pounds of other scrap materials from landfills.

Of course, no one ever said that looking after the Earth's resources is easy. But as we continue to strive for greener ways to do business, there's one thing we're definitely not wasting. And that's time.

[www.toyota.com/tomorrow](http://www.toyota.com/tomorrow)



**"Bringing scientists together for progress and peace"**

## **2002 - GRANT OPPORTUNITIES AND CALENDAR OF MEETINGS - 2002**

The NATO Science Programme offers support for collaboration in civil science between scientists of countries of the Euro-Atlantic Partnership Council. The purpose of the Programme is to stimulate the cooperation which is essential to progress in science, to create enduring links between researchers, and to help sustain the scientific communities in transition in NATO's "Partner" countries (*see countries below*).

The Programme is structured in four sub-programmes, encompassing a variety of collaborative support mechanisms to achieve different objectives:

**Science Fellowships** to train young scientists

**Cooperative Science & Technology** to initiate cooperation and create enduring links

**Research Infrastructure Support** to provide basic infrastructure and guide organization of research

**Science for Peace** to strengthen industrial R&D

Scientists from NATO's Mediterranean Dialogue countries are also eligible to participate in the support activities of the Cooperative Science & Technology sub-programme.

### **Grant Opportunities**

Joint applications in all fields of science are invited from researchers in participating countries for Collaborative Linkage Grants or Expert Visits, or to organize Advanced Study Institutes or Advanced Research Workshops.

Application forms and information on how to apply for these and the other grants available - i.e. Science Fellowships, Networking Infrastructure Grants, Science Policy grants, "Science for Peace" grants - may be found at our web site.

The web site will be continuously updated in 2002 with new information on grant possibilities and should be consulted frequently for the latest information.

### **Calendar of Meetings**

Overleaf is a Calendar of Advanced Study Institutes, and Advanced Research Workshops which will take place in 2002. Locations and dates may change. Further information on any meeting, as well as requests to attend, should be addressed to the co-directors listed for the individual meetings. Some grants are available from the meeting directors for participation of Partner-country or NATO-country scientists.

Further meetings will be selected for support during the year, and the Calendar appearing on the web site will be updated continuously.

#### **Countries participating in the NATO Science Programme**

##### **NATO countries:**

Belgium, Canada, Czech Republic, Denmark, France, Germany, Greece, Hungary, Iceland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Spain, Turkey, United Kingdom, United States.

##### **EAPC Partner countries eligible for support:**

Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Croatia, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Romania, Russian Federation, Slovak Republic, Slovenia, Tajikistan, the former Yugoslav Republic of Macedonia<sup>1</sup>, Turkmenistan, Ukraine, Uzbekistan

##### **Other EAPC countries:**

Austria, Finland, Ireland, Sweden, Switzerland

##### **Mediterranean Dialogue countries:**

Algeria, Egypt, Israel, Jordan, Mauritania, Morocco, Tunisia

<sup>1</sup> Turkey recognises the Republic of Macedonia with its constitutional name.

**NATO Scientific and Environmental Affairs Division  
Boulevard Leopold III  
B-1110 Brussels, Belgium**

**<http://www.nato.int/science>**



# 2002 ADVANCED STUDY INSTITUTES

Advanced Study Institutes (ASIs) are high-level tutorial courses of two weeks' duration where a subject is treated in depth by lecturers of international standing. Presentations are made to about 100 scientists or research students already specialised in the field, or who have an advanced general scientific background. Suitably qualified scientists wishing to attend an ASI should apply to the Co-Directors of the particular ASI.

## LIFE SCIENCES

### Frontiers in Autoimmunity : Fundamental Aspects and Clinical Perspectives

15 Jun 2002 - 25 Jun 2002 : *Pushino, Russia*

**Co-Directors:** Dr. Moncef Zouali, Hôpital Broussais, Immunopathologie Humaine, Paris, France

(Fax: 33 1 45847962 E-mail: moncef.zouali@wanadoo.fr)

Prof. Alexander Gabibov, Russian Academy of Sciences, Moscow, Russia

(E-mail: gabibov@ibch.siocb.ras.ru)

LST.977840

### Dynamics of Speech Production and Perception

23 Jun 2002 - 7 Jul 2002 : *Il Ciocco, Italy*

**Co-Directors:** Dr. P.L. Divenyi, Veterans Affairs Medical Center, Martinez, California, USA

(Fax: 1 925 228 5738 E-mail: pdivenyi@ebire.org)

Dr. Klara Vicsi, Budapest University of Techn. and Economics, Hungary

(E-mail: vicsi@alpha.ttt.bme.hu)

LST.978275

## MATHEMATICS, PHYSICS AND ASTRONOMY

### Synchronization: Theory and Application

19 May 2002 - 1 Jun 2002 : *Yalta, Crimea, Ukraine*

**Co-Directors:** Prof. Arkady Pikovsky, Potsdam University, Germany

(Fax: 49 331 9771767 E-mail: Pikovsky@stat.physik.uni-potsdam.de)

Dr. Yuri Maistrenko, National Academy of Sciences of Ukraine, Kyiv, Ukraine

(E-mail: maistrenko@imath.kiev.ua)

PST.978047

### Progress in String, Field and Particle Theory

27 May 2002 - 8 Jun 2002 : *Cargese, Corsica, France*

**Co-Directors:** Dr. Laurent Baulieu, Université Pierre & Marie Curie Paris VI, France

(Fax: 33 1 44 277393 E-mail: baulieu@ipthe.jussieu.fr)

Prof. Eliezer Rabinovici, Hebrew University, Jerusalem, Israel

(E-mail: eliezer@vms.huji.ac.il)

PST.978517

### Quantum Communication and Information Technologies

3 Jun 2002 - 14 Jun 2002 : *Ankara Turkey*

**Co-Directors:** Prof. Alexander Shumovsky, Bilkent University, Turkey

(Fax: 90 312 266 4579 E-mail: shumov@fen.bilkent.edu.tr)

Prof. Valeriy Rupasov, Russian Academy of Sciences, Moscow, Russia

(E-mail: rupasov@cpd.landau.ac.ru)

PST.978043

### Wave Scattering in Complex Media : From Theory to Applications

10 Jun 2002 - 22 Jun 2002 : *Cargese, Corsica, France*

**Co-Directors:** Dr. Bart Van Tiggelen, Université Joseph Fourier, Grenoble, France

(Fax: 33 4 76887981 E-mail: tiggelen@belledonne.polycnrs-gre.fr)

Dr. Sergey Skipetrov, Moscow State University, Russia (E-mail: skipetrov@mail.ru)

URL: <http://lpm2c.polycnrs-gre.fr/Themes/tiggelen/cargese/index.html>

PST.977598

### Virtual Nonlinear Multibody Systems

23 Jun 2002 - 3 Jul 2002 : *Prague, Czech Republic*

**Co-Directors:** Prof. Werner Schiehlen, University of Stuttgart, Germany

(Fax: 49 (0)711 685 6400 E-mail: wos@mechb.uni-stuttgart.de)

Prof. Michael Valasek, Czech Technical University, Prague, Czech Republic

(E-mail: valasek@fsik.cvut.cz) URL: [http://mechatronika.fsik.cvut.cz/ASI\\_NATO/](http://mechatronika.fsik.cvut.cz/ASI_NATO/)

PST.977399

### Molecular Electronics: Bio-sensor and Bio-computer

24 Jun 2002 - 4 Jul 2002 : *Pisa, Italy*

**Co-Directors:** Prof. Paolo Gualtieri, Istituto di Biofisica C.N.R., Pisa, Italy

(Fax: 39 050 2760 E-mail: paolo.gualtieri@ibp.pi.cnr.it)

Prof. Itamar Willner, The Hebrew University of Jerusalem, Israel

(E-mail: willner@vms.huji.ac.il) URL: [http://www.ibp.cnr.it/natoasi\\_biosensor/](http://www.ibp.cnr.it/natoasi_biosensor/)

PST.978073

### Slow Relaxations and Nonequilibrium Dynamics in Condensed Matter

1 Jul 2002 - 26 Jul 2002 : *Les Houches, France*

**Co-Directors:** Prof. Jean-Louis Barrat, Université de Lyon I, Villeurbanne, France

(Fax: 33 472 432648 E-mail: jean-louis.barrat@dpm.univ-lyon1.fr)

Prof. M. Feigelman, Landau Institute for Theoretical Physics, Moscow, Russia

(E-mail: feigel@landau.ac.ru)

URL: [http://dpm.univ-lyon1.fr/houches\\_ete](http://dpm.univ-lyon1.fr/houches_ete)

PST.978104

### Normal forms, Bifurcations and Finiteness Problems in Differential Equations

8 Jul 2002 - 19 Jul 2002 : *Montreal, Canada*

**Co-Directors:** Prof. Christiane Rousseau, Université de Montreal, Canada

(Fax: 514 343 5700 E-mail: Rousseau@dms.umontreal.ca)

Prof. Yulij Ilyashenko, Moscow State University, Russia

(E-mail: yulij@msu.ru) URL: <http://www.dms.umontreal.ca/sms>

PST.978134

### New Directions in Mesoscopes Physics (Towards Nanoscience)

20 Jul 2002 - 1 Aug 2002 : *Erice, Sicily, Italy*

**Co-Directors:** Prof. Rosario Fazio, Università di Catania, Italy

(Fax: 39 095 333231 E-mail: fazio@dmfci.unict.it)

Prof. V. Gantmakher, Russian Academy of Sciences, Chernogolovka, Russia

(E-mail: gantm@issp.ac.ru)

PST.978102

### Accretion Disks, Jets and High Energy Phenomena in Astrophysics

29 Jul 2002 - 23 Aug 2002 : *Les Houches, France*

**Co-Directors:** Prof. G. Pelletier, Observatoire de Grenoble, France

(Fax: 33 47644 8821 E-mail: Guy.Pelletier@obs.ujf-grenoble.fr)

Prof. V. Beskin, Lebedev Physical Institute, Russia

(E-mail: beskin@lpi.ru)

PST.978132

### Ultrafast Photonics

1 Sep 2002 - 14 Sep 2002 : *St Andrews, UK*

**Co-Directors:** Prof. Alan Miller, University of St Andrews, UK

(Fax: 44 1334 463104 E-mail: am8@st-and.ac.uk)

Prof. Aleksei Zheltikov, Lomonosov Moscow State University, Russia

(E-mail: zheltikov@top.phys.msu.ru)

PST.978548

### The Early Universe and the Cosmic Microwave Background : Theory and Observations

7 Sep 2002 - 20 Sep 2002 : *Palermo, Sicily, Italy*

**Co-Directors:** Prof. Norma Sanchez, Ministère de l'Education Nationale et de la Recherche, France

(Fax: 33 1 4051 2002 E-mail: Norma.Sanchez@obspm.fr)

Prof. Yuri Parijskij, Russian Academy of Sciences, Niznij Arkyz, Russia

(E-mail: par@sao.ru)

PST.978507

### Computer Simulations of Surfaces and Interfaces

8 Sep 2002 - 18 Sep 2002 : *Varna, Bulgaria*

**Co-Directors:** Prof. D.P. Landau, University of Georgia, Athens, USA

(Fax: 1 706 542 2492 E-mail: landau@hal.physast.uga.edu)

Prof. A. Milchev, Bulgarian Academy of Sciences, Sofia, Bulgaria

(E-mail: milchev@ipchp.ipc.bas.bg)

PST.978063

### Axiomatic, Enriched and Motivic Homotopy Theory

9 Sep 2002 - 20 Sep 2002 : *Cambridge, UK*

**Co-Directors:** Prof. J.P.C. Greenlees, University of Sheffield, UK

(Fax: 0114 222 3769 E-mail: j.greenlees@sheffield.ac.uk)

Prof. Igor Zhukov, University of St.Petersburg, Russia

(E-mail: igor@zhukov.pdmi.ras.ru)

PST.978445

### Patterns of Symmetry Breaking

15 Sep 2002 - 29 Sep 2002 : *Cracow, Poland*

**Co-Directors:** Dr. W.H. Zurek, Los Alamos National Laboratory, USA

(Fax: 505 665 3003 E-mail: whz@lanl.gov)

Prof. Henryk Arodz, Jagiellonian University, Cracow, Poland

(E-mail: ufarodz@th.if.uj.edu.pl)

PST.978545

## CHEMISTRY AND MATERIALS SCIENCE

### Synthesis, Functional Properties and Applications of Nanostructures

26 Jul 2002 - 4 Aug 2002 : *Crete, Greece*

**Co-Directors:** Prof. Thomas Tsakalakos, College of Engineering Rutgers University, USA

(Fax: 732 445 3229 E-mail: tsakalak@rci.rutgers.edu)

Dr. Ilya Ovid'ko, Russian Academy of Sciences, St. Petersburg, Russia

(E-mail: ovidko@def.ipme.ru)

PST.977752

### Chemical Probes in Biology

18 Aug 2002 - 30 Aug 2002 : *Island of Spetses, Greece*

**Co-Directors:** Prof. M.P. Schneider, Bergische Universität Wuppertal, Germany

(Fax: 0049 202 439 2535 E-mail: schneid@uni-wuppertal.de)

Dr. V. Kren, Academy of Sciences of the Czech Republic, Prague, Czech Republic

(E-mail: kren@biomed.cas.cz)

PST.978171

### Metal-Ligand Interactions in Molecular-, Nano-, Micro-, and Macro-Systems in Complex Environments

1 Sep 2002 - 12 Sep 2002 : *Cetraro, Italy*

**Co-Directors:** Prof. Nino Russo, Università della Calabria, Arcavacata di Rende, Italy

(Fax: 39-0984 492044 E-mail: nrusso@unical.it)

Prof. Malgorzata Witko, Polish Academy of Sciences, Cracow, Poland

(E-mail: ncwitko@cyf-kr.edu.pl)

PST.978460

### Thermodynamics, Microstructures and Plasticity

2 Sep 2002 - 13 Sep 2002 : *Frejus, France*

**Co-Directors:** Dr. Alphonse Finel, LEM, ONERA, Chatillon, France

(Fax: 00331 46734155 E-mail: alphonse.finel@onera.fr)

Dr. Alexander Olemskoi, Sumy State University, Ukraine

(E-mail: olemskoi@ssu.sumy.ua)

PST.978494

### Novel Approaches to the Structure and Dynamics of Liquids:

#### Experiments, Theories, Simulations

6 Sep 2002 - 15 Sep 2002 : *Rhodes, Greece*

**Co-Directors:** Prof. Jannis Samios, University of Athens, Greece

(Fax: 3010 7274752 E-mail: isamios@cc.uoa.gr)

Prof. Vladimir Durov, Lomonosov Moscow State University, Russia

(E-mail: durov@gol.ru)

PST.978550

### Scanning Probe Microscopy : Characterization, Nanofabrication and

#### Device Application of Functional Materials

1 Oct 2002 - 13 Oct 2002 : *Algarve, Portugal*

**Co-Directors:** Prof. Paula Vilarinho, University of Aveiro, Portugal

(Fax: 351 234 25300 E-mail: paulas@cv.ua.pt)

Prof. Yossi Rosenwaks, Tel Aviv University, Israel

(E-mail: yossir@eng.tau.ac.il)

PST.978539

## EARTH SCIENCES

### Data Assimilation for the Earth System

19 May 2002 - 1 Jun 2002 : *Maratea, Italy*

**Co-Directors:** Dr. Richard Swinbank, Meteorological Office, Bracknell, UK

(Fax: 44 1344 854046 E-mail: richard.swinbank@metoffice.com)

Prof. Victor Shutyaev, Russian Academy of Sciences, Moscow, Russia

(E-mail: shutyaev@imn.ras.ru) URL: <http://darc.nerc.ac.uk/asi/>

EST.978293

### Hydrogeophysics : Improved Subsurface Characterization

#### Using Integrated Hydrogeological and Geophysical Data

24 Jun 2002 - 3 Jul 2002 : *Liblice, Czech Republic*

**Co-Directors:** Prof. Yoram Rubin, University of California at Berkeley, USA

(Fax: 510 642 7476 E-mail: rubin@ce.berkeley.edu)

Dr. Mark Goldman, Geophysical Institute of Israel, Lod, Israel

(E-mail: mark@gil.co.il)

EST.978617

## ADVANCED STUDY INSTITUTES - *continued*

### Ocean Carbon Cycle and Climate

5 Aug 2002 - 16 Aug 2002 : *Ankara, Turkey*

**Co-Directors:** Prof. Temel Oguz, Middle East Technical University, Erdemli-Icel, Turkey  
(Fax: 90 324 521 2327 E-mail: oguz@ims.metu.edu.tr)

Dr. Gennady Korotaev, Ukrainian Academy of Sciences, Sevastopol, Ukraine

(E-mail: ipdop@fossil.ukrcom.sebastopol.ua)

EST.978610

### ENVIRONMENTAL SCIENCES

#### Phytoremediation of Metal-Contaminated soils

26 Aug 2002 - 6 Sep 2002 : *Kostolac, Czech Rep.*

**Co-Directors:** Prof. Jean Louis Morel, Laboratoire Sols et Environnement, ENSAIA-INPL Nancy, France  
(Fax: 33 3 8359 5791 E-mail: morel@ensaia.inpl-nancy.fr)

Prof. Sulejman Sulce, Agricultural University of Tirana, Albania

(E-mail: mbusekp@icc-al.org)

EST.978633

### APPLIED SCIENCES AND ENGINEERING

#### Learning Theory and Practice

8 Jul 2002 - 19 Jul 2002 : *Leuven, Belgium*

**Co-Directors:** Prof. Johan Suykens, Katholieke Universiteit Leuven, Belgium

(Fax: 016 321970 E-mail: johan.suykens@esat.kuleuven.ac.be)

Dr. G. Horvath, Technical University of Budapest (DMIS, TUB), Hungary

(E-mail: horvath@mit.bme.hu)

PST.978547

#### Models, Algebras and Logic of Engineering Software

30 Jul 2002 - 11 Aug 2002 : *Marktobderdorf, Germany*

**Co-Directors:** Prof. Manfred Broy, Technische Universität München, Germany

(Fax: 49-89 289 28183 E-mail: broy@in.tum.de)

Prof. Amir Pnueli, the Weizmann Institute of Science, Rehovot, Israel

(E-mail: amir@wisdom.weizmann.ac.il)

URL: <http://www4.informatik.tu-muenchen.de/div/summerschool/>

PST.978130

## 2002 ADVANCED RESEARCH WORKSHOPS

Advanced Research Workshops (ARWs) are working meetings of about four days' duration, where scientists and engineers researching at the frontiers of a subject are able to engage in an intense but informal exchange of views, aiming at a critical assessment of existing knowledge and identification of directions for future action. Attendance at ARWs is mainly by invitation, but a few places are available for particularly well-qualified scientists upon application to the Co-Directors of the relevant ARW.

### LIFE SCIENCES

#### Biology and Biotechnology of the Plant Hormone Ethylene

23 Apr 2002 - 27 Apr 2002 : *Murcia, Spain*

**Co-Directors:** Dr. Miguel Vendrell, Instituto de Biología Molecular, CSIC-CID, Barcelona, Spain

(Fax: 34 93 2045904 E-mail: mvmagr@cid.csic.es)

Prof. Marian Saniewski, Research Institute of Pomology and Floriculture, Skierniewice, Poland

(E-mail: msaniew@insad.isk.skierniewice.pl)

LST.978620

#### Science-Based Management in Thoracic Oncology

13 May 2002 - 15 May 2002 : *Krasnodar, Russia*

**Co-Directors:** Prof. Gilbert Massard, Hôpitaux Universitaires de Strasbourg, France

(Fax: 33 3 88 11 60 77 E-mail: Gilbert.Massard@chru-strasbourg.fr)

Prof. Vladimir Porhanov, Regional Center for Thoracic Surgery, Krasnodar, Russia

(E-mail: t\_m\_popovchuk@yahoo.com)

LST.978599

#### Perspectives of Epidemiological Research on Non-Hodgkin's Lymphoma:

##### The InterLymph Collaborative Project

15 May 2002 - 17 May 2002 : *Lyon, France*

**Co-Directors:** Dr. Paolo Boffetta, International Agency for Research on Cancer, Lyon, France

(Fax: 33 4 727 38320 E-mail: boffetta@iarc.fr)

Dr. Jose Iscovich, International Fertility Institute, Raanana, Israel

(E-mail: iscovich@netvision.net.il)

LST.978627

#### Artemia Biodiversity in the Newly Independent States:

##### Current Global Resources and their Sustainable Exploitation

5 Jun 2002 - 9 Jun 2002 : *Moscow, Russia*

**Co-Directors:** Dr. P. Sorgeloos, Lab Aquaculture & Artemia Reference Ctr, Gent, Belgium

(Fax: 32 92 264 4193 E-mail: patrick.sorgeloos@rug.ac.be)

Prof. Aleksandr Litvinenko, Tyumen State Agricultural Academy, Russia

(E-mail: lotsman@sibtel.ru)

LST.978264

#### Bridging Basic with Clinical Epileptology

21 Jul 2002 - 25 Jul 2002 : *San Servolo, Venezia, Italy*

**Co-Directors:** Prof. Giuliano Avanzini, Istituto Nazionale Neurologico "Carlo Besta", Milano, Italy

(Fax: 39 02 70600775 E-mail: avanzini@istituto-besta.it)

Prof. Amel Mrabet, EPS Charles Nicolle, Tunis, Tunisia

(E-mail: amel.mrabet@rns.tn)

LST.978574

#### Psychiatric Neuroimaging

28 Sep 2002 - 1 Oct 2002 : *Villa La Palma, Italy*

**Co-Directors:** Dr. S.C.R. Williams, Institute of Psychiatry, London, UK

(Fax: 44 20 7848 0055 E-mail: s.williams@iop.kcl.ac.uk)

Dr. Talma Hendler, Tel-Aviv Sourasky Medical Center, Israel

(E-mail: talma@tasmc.health.gov.il)

LST.978608

#### Toxicogenomics and Proteomics

16 Oct 2002 - 20 Oct 2002 : *Prague, Czech Republic*

**Co-Directors:** Dr. James Valdes, U.S. Army SBCCOM, Aberdeen Proving Ground, Maryland, USA

(Fax: 410 436 3191 E-mail: james.valdes@sbccom.apgea.army.mil)

Dr. Jaroslav J. Spizek, Czech Academy of Sciences, Prague, Czech Republic

(E-mail: spizek@biomed.cas.cz)

SST.978578

### MATHEMATICS, PHYSICS AND ASTRONOMY

#### New Trends in Phase Transformations and Their Applications to Smart Structures

Date to be arranged : *Metz, France*

**Co-Directors:** Prof. Etienne Patoor, Ecole Nationale Supérieure d'Arts et Métiers, Metz, France

(Fax: 03 87 315366 E-mail: etienne.patoor@metz.ensam.fr)

Dr. Alexander Volkov, St.Petersburg State University, Russia

(E-mail: volkov@smel.niimm.spb.su)

PST.977762

#### Confinement, Topology and Other Non-perturbative Aspects of QCD

21 Jan 2002 - 27 Jan 2002 : *Stara Lesna, Slovakia*

**Co-Directors:** Prof. Jeffrey Greensite, San Francisco State University, California, USA

(Fax: 415 338 2178 E-mail: greensit@stars.sfsu.edu)

Dr. Stefan Olejnik, Slovak Academy of Sciences, Bratislava, Slovak Republic

(E-mail: fyziolej@savba.sk)

PST.978127

#### Liquids Under Negative Pressure

23 Feb 2002 - 25 Feb 2002 : *Budapest, Hungary*

**Co-Directors:** Prof. P.R. Williams, University of Wales, Swansea, UK

(Fax: 44 179 229 5701 E-mail: p.r.williams@swansea.ac.uk)

Dr. Attila Imre, KFKI Atomic Energy Research Institute, Budapest, Hungary

(E-mail: imre@sunserv.kfki.hu)

URL: <http://www.kfki.hu/~pressure/meeting.html>

PST.978478

#### Recent Trends in Theory of Physical Phenomena in High Magnetic Fields

25 Feb 2002 - 1 Mar 2002 : *Grenoble, France*

**Co-Directors:** Prof. Peter Wyder, CNRS Grenoble, France

(Fax: 33 (0)4 76 85 56 10 E-mail: wyder@labs.poly.cnrs-gre.fr)

Prof. Israel Vagner, Rupin Institute for Higher Education, Emek Hefer, Israel

(E-mail: vagner@labs.poly.cnrs-gre.fr)

PST.978119

#### Bianisotropics 2002 - 9th International Conference on Electromagnetics of Complex Media

8 May 2002 - 11 May 2002 : *Marrakech, Morocco*

**Co-Directors:** Prof. Said Zouhdi, University Pierre et Marie Curie, Paris, France

(Fax: 33 1 44 27 43 82 E-mail: sz@ccr.jussieu.fr)

Dr. Mohamed Arsalane, University Cadi Ayyad, Marrakech, Morocco

(E-mail: doyen@fstg-marrakech.ac.ma)

PST.978498

#### The Nature of Time : Geometry, Physics and Perception

21 May 2002 - 24 May 2002 : *Tatranska Lomnica, Slovakia*

**Co-Directors:** Dr. R. Buccheri, Istituto di Fisica Cosmica del CNR, Palermo, Italy

(Fax: 39 0916809616 E-mail: buccheri@area.pa.cnr.it)

Dr. Metod Saniga, The Slovak Academy of Sciences, Tatranska Lomnica, Slovak Republic

(E-mail: msaniga@auriga.ta3.sk)

URL: [http://www.astro.sk/~msaniga/nato\\_arw/index.html](http://www.astro.sk/~msaniga/nato_arw/index.html)

PST.978142

#### Quantum Noise in Mesoscopic Physics

6 Jun 2002 - 8 Jun 2002 : *Delft, The Netherlands*

**Co-Directors:** Dr. Y. Nazarov, Technische Universiteit Delft, Netherlands

(Fax: 31 15 278 1203 E-mail: Y.V.Nazarov@tn.tudelft.nl)

Prof. M. Reznikov, Solid State Institute, Haifa, Israel (E-mail: ssmisha@tx.technion.ac.il)

PST.978474

#### White Dwarfs

17 Jun 2002 - 21 Jun 2002 : *Naples, Italy*

**Co-Directors:** Dr. Domitilla de Martino, Astronomical Observatory of Capodimonte, Naples, Italy

(Fax: 39 081 456710 E-mail: demartino@na.astro.it)

Dr. Kalytis Romualdas, Vilnius University, Lithuania

(E-mail: romualdas.kalytis@tf.vu.lt)

PST.978479

#### Optical Properties of 2D Systems with Interacting Electrons

23 Jun 2002 - 26 Jun 2002 : *St.Petersburg, Russia*

**Co-Directors:** Prof. Wolfgang Ossau, University of Würzburg, Germany

(Fax: 49 931 8885142 E-mail: ossau@physik.uni-wuerzburg.de)

Prof. R. Suris, Russian Academy of Sciences, St.Petersburg, Russia

(E-mail: suris@theory.ioffe.rssi.ru)

PST.978459

#### Emerging Applications of Vacuum-Arc-Produced Plasma, Ion and Electron Beams

24 Jun 2002 - 27 Jun 2002 : *Lake Balka, Russia*

**Co-Directors:** Dr. I.G. Brown, University of California, Berkeley, USA

(Fax: 1 510 486 4374 E-mail: IGBrown@LBL.Gov)

Prof. E. Oks, Russian Academy of Sciences, Tomsk, Russia

(E-mail: oks@opee.hcei.tsc.ru)

PST.977788

#### Stochastic Systems : From Randomness to Complexity

21 Jul 2002 - 27 Jul 2002 : *Erice, Sicily, Italy*

**Co-Directors:** Prof. Fabio Marchesoni, University of Camerino, Italy

(Fax: 075 44666 E-mail: marchesoni@pg.infn.it)

Prof. Jerzy Luczka, University of Silesia, Katowice, Poland

(E-mail: luczka@us.edu.pl)

PST.978125

#### Space, Time and Life

26 Aug 2002 - 30 Aug 2002 : *Brijuni Island, Croatia*

**Co-Directors:** Professor Sir Harold Kroto, University of Sussex, Brighton, UK

(Fax: 44 1273 677 196 E-mail: kroto@sussex.ac.uk)

Prof. Slobodan Bosanac, R. Boskovic Institute, Zagreb, Croatia

(E-mail: dbosanac@faust.irb.hr)

PST.978573

# ADVANCED RESEARCH WORKSHOPS - continued

## Interpretation of the New Diffractive Phenomena in Quantum Chromodynamics and in the S-Matrix Theory

31 Aug 2002 - 6 Sep 2002 : *Alushta, Crimea, Ukraine*

**Co-Directors:** Prof. Roberto Fiore, Università della Calabria, Rende, Italy

(Fax: 39 0984 493187 E-mail: fiore@cs.infn.it)

Prof. L. Jenkovszky, National Academy of Sciences of Ukraine, Kyiv, Ukraine

(E-mail: jenk@gluk.org)

PST.977335

## Bilinear Integrable Systems : from Classical to Quantum, Continuous to Discrete

15 Sep 2002 - 19 Sep 2002 : *Elba, Italy*

**Co-Directors:** Prof. P.L.J. Van Moerbeke, Université Catholique de Louvain, Louvain-la Neuve, Belgium

(Fax: 010/47 25 30 E-mail: vanm@mail.math.ucl.ac.be)

Dr. Ludvig Faddeev, Steklov Mathematical Institute, St. Petersburg, Russia

(E-mail: faddeev@pdmi.ras.ru)

PST.978503

## Concepts in Electron Correlation

28 Sep 2002 - 2 Oct 2002 : *Hvar, Croatia*

**Co-Directors:** Dr. Alex Hewson, Imperial College, London, UK

(Fax: 020 7594 8517 E-mail: a.hewson@ic.ac.uk)

Dr. Veljko Zlatić, Institute of Physics, Zagreb, Croatia (E-mail: zlati@ifs.hr)

PST.978406

## CHEMISTRY AND MATERIALS SCIENCE

### Molecular and Structural Archaeology : Cosmetic and Therapeutic Chemicals

23 May 2002 - 27 May 2002 : *Erice, Sicily, Italy*

**Co-Directors:** Prof. Georges Tsoucaris, Laboratoire de Recherche des Musées de France, Paris, France

(Fax: 33 01 47033246 E-mail: Georges.Tsoucaris@cep.u-psud.fr)

Prof. J.S. Lipkowsky, Polish Academy of Science, Warszawa, Poland

(E-mail: KLATRA@ichf.edu.pl)

PST.978091

### Material Research in Atomic Scale by Mossbauer Spectroscopy

1 Jun 2002 - 6 Jun 2002 : *Smolenice, Slovak Republic*

**Co-Directors:** Prof. M. Mashlan, Palacky University Olomouc, Czech Republic

(Fax: 420 68 5225737 E-mail: mashlan@isc.upol.cz)

Prof. M. Miglierini, Slovak University of Technology, Bratislava, Slovak Republic

(E-mail: bruno@elf.stuba.sk)

PST.978437

### Extended Defects in Wide Band Gap Materials: Electrical and Optical Properties

1 Jun 2002 - 4 Jun 2002 : *Bologna, Italy*

**Co-Directors:** Prof. A. Cavallini, University of Bologna, Italy

(Fax: 39 051 2095153 E-mail: cavallini@bo.infn.it)

Prof. Vitaly Kveder, Russian Academy of Sciences, Chernogolovka, Russia

(E-mail: kveder@issp.ac.ru)

PST.978456

### Continuum Models and Discrete Systems

17 Jun 2002 - 21 Jun 2002 : *Shoreish, Israel*

**Co-Directors:** Prof. E. Inan, Istanbul Technical University, Maslak-Istanbul, Turkey

(Fax: 90 212 285 6386 E-mail: inan@itu.edu.tr)

Prof. David Bergman, Tel Aviv University, Israel (E-mail: bergman@post.tau.ac.il)

PST.978461

### Nonlinear Homogenization and its Applications to Composites, Polycrystals and Smart Materials

25 Jun 2002 - 28 Jun 2002 : *Warsaw, Poland*

**Co-Directors:** Prof. Pedro Ponte Castaneda, University of Pennsylvania, Philadelphia, USA

(E-mail: ponte@sol1.jrsm.upenn.edu)

Prof. Jozef Telega, Polish Academy of Sciences, Warszawa, Poland

(E-mail: jtelega@ippt.gov.pl)

PST.978499

### Nanostructured Materials and Coatings for Biomedical and Sensor Applications

4 Aug 2002 - 8 Aug 2002 : *Kyiv, Ukraine*

**Co-Directors:** Prof. Yuri Gogotsi, Drexel University, Philadelphia, USA

(Fax: 1 215 895 6760 E-mail: gogotsi@drexel.edu)

Prof. I. Uvarova, Institute for Problems of Materials Science, Kyiv, Ukraine

(E-mail: uvarova@materials.kiev.ua)

PST.978526

### Low Temperature Quantum Effects: Dynamic Interactions in Technical Applications

29 Aug 2002 - 1 Sep 2002 : *Sudety, Poland*

**Co-Directors:** Prof. Philip Wigen, The Ohio State University Columbus, USA

(Fax: 1 614 292 7557 E-mail: wigen@mps.ohio-state.edu)

Prof. H. Szymczak, Polish Academy of Sciences, Warszawa, Poland

(E-mail: szymh@ifpan.edu.pl)

PST.978444

## EARTH SCIENCES

### North African Cretaceous Rudist and Coral Formations and their Contributions to Carbonate Platform Development

12 May 2002 - 16 May 2002 : *Tunis, Tunisia*

**Co-Directors:** Prof. E. Gili, Universitat Autònoma de Barcelona, Spain

(Fax: 34 935 811 263 E-mail: igpaa@blues.uab.es)

Dr. M. Negra, Université 7 Novembre de Carthage, Bizerte, Tunisia

(E-mail: hedi.negra@fsb.rnu.tn)

EST.978196

### Natural Marine Hydrocarbon Seepage in World Oceans with Applications to the Caspian Sea Region

9 Oct 2002 - 12 Oct 2002 : *Baku, Azerbaijan*

**Co-Directors:** Prof. J.C. Moore, University of California at Santa Cruz, USA

(E-mail: casey@es.ucsc.edu)

Prof. Ibragim Guliev, Azerbaijan Academy of Sciences, Baku, Azerbaijan

(E-mail: iguliev@azeurotel.com)

EST.977889

## ENVIRONMENTAL SCIENCES

### The Invasions of the Black, Mediterranean and Caspian Seas by the American Ctenophore, *Mnemiopsis leidyi*: A Multidisciplinary Perspective

Date to be arranged : *Baku, Azerbaijan*

**Co-Directors:** Dr. Richard Harbison, Woods Hole Oceanographic Institution, Massachusetts, USA

(Fax: 1 508 457 2169 E-mail: gharbison@whoi.edu)

Dr. T. Shiganova, Russian Academy of Sciences, Moscow, Russia

(E-mail: shiganov@chip.sio.rssi.ru)

EST.977923

### Hybrid Solar-Wind Systems: Effective Implementation Conditions

Date to be arranged : *Tashkent, Uzbekistan*

**Co-Directors:** Prof. Didier Mayer, Centre d'Energetique, Sophia Antipolis, France

(Fax: 33 4 93957535 E-mail: didier.mayer@cenerg.cma.fr)

Prof. Djura Abdullaev, SEMRC, Uzbekistan

(E-mail: ftmtm@uzpak.uz)

EST.977881

### Risk Assessment (as Applied to Human Health and Environmental Concerns) as a Tool for Environmental Decision Making in Central Asia

Date to be arranged : *Almaty, Kazakhstan*

**Co-Directors:** Dr. Christopher Teaf, Inst. for International Cooperative Environmental Research,

Tallahassee, Florida, USA (Fax: 850 574 6704 E-mail: cteaf@res.fsu.edu)

Dr. Bulat Yessekin, Regional Environmental Centre for Central Asia, Almaty, Kazakhstan

(E-mail: bulat@itte.kz)

EST.978362

### Environmental Challenges in the Mediterranean (2000-2050)

6 Mar 2002 - 10 Mar 2002 : *Valencia, Spain*

**Co-Directors:** Prof. Antonio Marquina, Faculty of Political Science, Madrid, Spain

(Fax: 34 91 3942655 E-mail: marioant@cps.ucm.es)

Prof. Bechir Chourou, University of Tunis I, Tunisia

(E-mail: bechir.chourou@planet.tn)

EST.977911

### Weakly Interacting Molecular Pairs: Unconventional Absorbers of Radiation in the Atmosphere

25 Mar 2002 - 28 Mar 2002 : *Abbaye de Fontevraud, France*

**Co-Directors:** Dr. Claude Camy-Peyret, Université Pierre et Marie Curie, Paris, France

(Fax: 33 0 1442 77033 E-mail: camy@ccr.jussieu.fr)

Dr. A. Viganin, Russian Academy of Sciences, Moscow, Russia

(E-mail: viganin@omega.ifaran.ru)

EST.978277

### Ecological Standardization and Equidosemetry for Radioecology and Environmental Ecology

14 Apr 2002 - 19 Apr 2002 : *Kyiv, Ukraine*

**Co-Directors:** Dr. Gilbert Desmet, International Union of Radioecologists, Zemst, Belgium

(Fax: 32 15 621830 E-mail: gilbert.desmet@skynet.be)

Prof. Yuriy Kutlakmedov, National Kyiv University, Ukraine

(E-mail: ecoetic@mail.kar.net)

EST.978258

### Comparative Risk Assessment and Environmental Decision Making

21 Apr 2002 - 25 Apr 2002 : *Cairo, Egypt*

**Co-Directors:** Dr. Igor Linkov, Arthur D. Little Inc., Cambridge, Massachusetts, USA

(Fax: 617 498 7019 E-mail: linkov.igor@adlittle.com)

Dr. Abou Ramadan, Atomic Energy Authority, Cairo, Egypt

(E-mail: ramadan58@yahoo.com)

EST.978625

### Methodologies in Evaluation of Socio-Economic and Environmental Consequences of Mining and Energy Production in the Arctic and Sub-Arctic

8 May 2002 - 12 May 2002 : *Apatity, Russia*

**Co-Directors:** Prof. Rasmus Rasmussen, Roskilde University, Denmark

(Fax: 45 4674 3031 E-mail: rasmus@ruc.dk)

Dr. Natalia Koroleva, Kola Science Centre of RAS, Russia

(E-mail: n\_koroleva@aprec.ru)

EST.977832

### Air Pollution Processes in Regional Scale

13 Jun 2002 - 15 Jun 2002 : *Kallithea, Halkidiki, Greece*

**Co-Directors:** Dr. D. Melas, Aristotle University of Thessaloniki, Greece

(Fax: 30 31 283752 E-mail: melas@auth.gr)

Prof. Dimitar Syrakov, National Institute of Meteorology & Hydrology, BAS, Sofia, Bulgaria

(E-mail: dimitar.syrakov@meteo.bg / dsyrak@eagle.cu.bas.bg)

EST.977875

## APPLIED SCIENCES AND ENGINEERING

### Surface Waves in Anisotropic and Laminated Bodies and Defects Detection

7 Feb 2002 - 9 Feb 2002 : *Moscow, Russia*

**Co-Directors:** Prof. G.A. Maugin, Université Pierre et Marie Curie (Paris VI), Jussieu, France

(Fax: 33 1 44 27 52 59 E-mail: gam@ccr.jussieu.fr)

Mr. R. Goldstein, Russian Academy of Sciences, Moscow, Russia

(E-mail: goldst@ipmnet.ru)

PST.978081

## SOCIAL AND BEHAVIOURAL SCIENCES

### Operator Functional Status and Impaired Performance in Complex Work Environments

3 Apr 2002 - 7 Apr 2002 : *Il Ciocco, Italy*

**Co-Directors:** Prof. Glyn Hockey, University of Leeds, UK

(Fax: 44 113 233 5749 E-mail: bobh@psychology.leeds.ac.uk)

Dr. Oleksandr Burrov, Ukrainian Inst. for Scient., Techn. & Econ. Inform, Kyiv, Ukraine

(E-mail: burrov@intei.kiev.ua) URL: <http://ignatz.pwp.blueyonder.co.uk/arw/arw>

LST.977821

## SECURITY-RELATED CIVIL SCIENCE

### Scientific Fundamentals for the Lifetime Extension of Reactor Pressure Vessels

22 Apr 2002 - 25 Apr 2002 : *Kyiv, Ukraine*

**Co-Directors:** Dr. Hans-Werner Viehrig, Forschungszentrum Rossendorf e.V., Dresden, Germany

(Fax: 0351 260 2205 E-mail: h.w.viehrig@fz-rossendorf.de)

Prof. Vladimir Pokrovsky, National Academy of Sciences of Ukraine, Kyiv, Ukraine

(E-mail: pokr@ipp.adam.kiev.ua)

SST.978338

### Unresolved Issues Remaining in the Decommissioning of Nuclear Powered Vessels and in the Environmental Remediation of their Supporting Infrastructure

22 Apr 2002 - 24 Apr 2002 : *Moscow, Russia*

**Co-Directors:** Dr. Leo Lesage, Argonne National Laboratory, USA

(Fax: 1 708 252 53 18 E-mail: xl\_lesage@anl.gov)

Prof. A.A. Sarkisov, Russian Academy of Sciences, Moscow, Russia

(E-mail: sarkisov@ibrae.ac.ru)

SST.978664

## SCIENCE AND TECHNOLOGY POLICY

### Science Education: Talent Recruitment and Public Understanding

18 Apr 2002 - 20 Apr 2002 : *Budapest, Hungary*

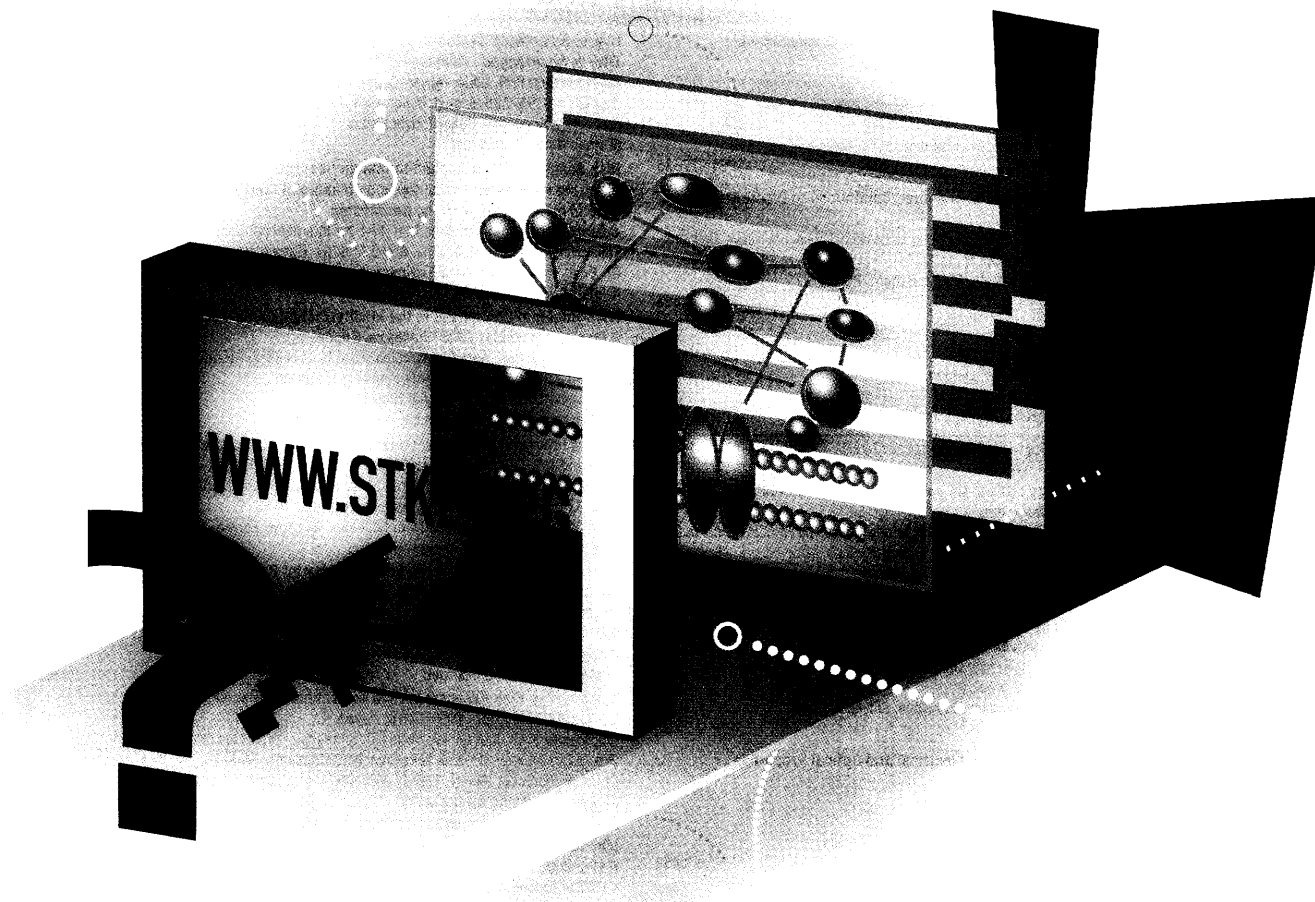
**Co-Directors:** Prof. Leon Lederman, Illinois Math. Science Academy, Aurora, Illinois, USA

(Fax: 1 630 907 5013 E-mail: lederman@fnul.gov)

Prof. Peter Cserehely, Semmelweis University, Budapest, Hungary

(E-mail: cserehely@puskin.sote.hu)

STP.977925



# STKE PUTS YOU ON THE RIGHT PATH

**U**pdated weekly, *Science's* *Signal Transduction Knowledge Environment* (STKE) provides the perfect combination of quick summaries and full text access to

research papers from over 40 respected scientific journals, plus original *Reviews*, *Protocols*, and *Perspectives*.

You'll also find a Connections Map database of signaling molecules, plus an extended list

of helpful e-tools like *personalization options* and *interactive letters*, all at [www.stke.org](http://www.stke.org).

To subscribe to *STKE*, or for more information, visit *STKE* at [www.stke.org](http://www.stke.org) and click *subscriptions*, or contact

AAAS at (202) 326-6417 or [membership2@aaas.org](mailto:membership2@aaas.org).

No one can know where new insights in signal transduction might lead you, but *STKE* will help you find the right path.

Science's  
**stke**

You're on the right path™

**SIGNAL TRANSDUCTION KNOWLEDGE ENVIRONMENT**

a product of *Science* and Stanford University Libraries

[www.stke.org](http://www.stke.org)

Cellomics™

ABBOTT  
LABORATORIES  
Quality Health Care Worldwide





## HUMAN FRONTIER SCIENCE PROGRAM (HFSP)

Bureaux Europe, 20 place des Halles, 67080 STRASBOURG Cedex, FRANCE

E-mail: [info@hfsp.org](mailto:info@hfsp.org)

Web site: <http://www.hfsp.org>

### NEW UNIFIED PROGRAM OF RESEARCH SUPPORT

The Human Frontier Science Program (HFSP) supports basic research with emphasis placed on **novel, innovative and interdisciplinary** approaches to basic research which involve scientific exchanges across national boundaries. HFSP previously supported 2 scientific programs focused on neuroscience and molecular biology. With the dissolving of boundaries separating traditional biological fields, and the need to involve disciplines outside biology in life sciences research, these separate programs have been unified into a **single program on complex mechanisms of living organisms** by the HFSP Board of Trustees. Henceforth, a single committee will review all grant applications, while a second committee will review all long-term fellowship applications. Both committees are composed of internationally-leading scientists.

### CALL FOR LETTERS OF INTENT TO APPLY FOR A RESEARCH GRANT FOR AWARD YEAR 2003

The new HFSP research grant program places special emphasis on the involvement of other disciplines such as chemistry, physics, mathematics, computer science and engineering in projects within the general areas of neuroscience and molecular approaches to biological functions. Significant new ideas, techniques and discoveries often arise at the boundaries between traditional disciplines. To stimulate novel, daring ideas and innovative approaches, preliminary results are not required in research grant applications. Applicants are expected to develop new lines of research through the collaboration; projects must be distinct from applicants' other research funded by other sources. HFSP supports only international, collaborative teams, with an emphasis on encouraging scientists early in their careers.

**International teams of scientists interested in submitting applications for support must first submit a letter of intent online via the HFSP web site. The guidelines for potential applicants and further instructions are available on the HFSP web site ([www.hfsp.org](http://www.hfsp.org)).**

Research grants provide support for basic research (*up to 3 years*) carried out jointly by research teams in different countries. The principal applicant must be from one of the member countries\* but co-investigators may be from any country. Preference is given to intercontinental teams. The size of the team should normally be 2 – 4 members with not more than one member from any one country.

#### TWO TYPES OF GRANT ARE AVAILABLE:

**Young Investigators' Grants** are for teams of scientists who are all within 5 years of establishing an independent laboratory and within 10 years of obtaining their PhDs. Successful teams will receive a standard amount of \$250,000 per year for the whole team.

**Program Grants** may be applied for by independent scientists at all stages of their careers, although the participation of younger scientists is especially encouraged. Up to \$500,000 may be applied for per year for the whole team, including approximately \$100,000 per team member per year plus some additional funds for essential equipment related to the collaboration.

**Deadline for Letters of Intent: 3 APRIL 2002**

#### LONG-TERM FELLOWSHIPS

Long-Term Fellowships provide 3 years of support for postdoctoral research abroad in a laboratory of the fellow's choice. Applicants are expected to explore a **new area of research** since frontier life science research in the 21<sup>st</sup> century will require investigators able to span more than one traditional scientific discipline. More information is available on the HFSP web site. **The next deadline for Long-term Fellowships is 2 September 2002.**

#### SHORT TERM FELLOWSHIPS

Provide up to three months of support to learn new techniques or establish new collaborations in another country. Applications are accepted throughout the year. **Guidelines and application forms** are available on the HFSP web site ([www.hfsp.org](http://www.hfsp.org))

*\*Current member countries include Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Japan, Luxembourg, the Netherlands, Portugal, the Republic of Ireland, Spain, Sweden, Switzerland, UK and USA*