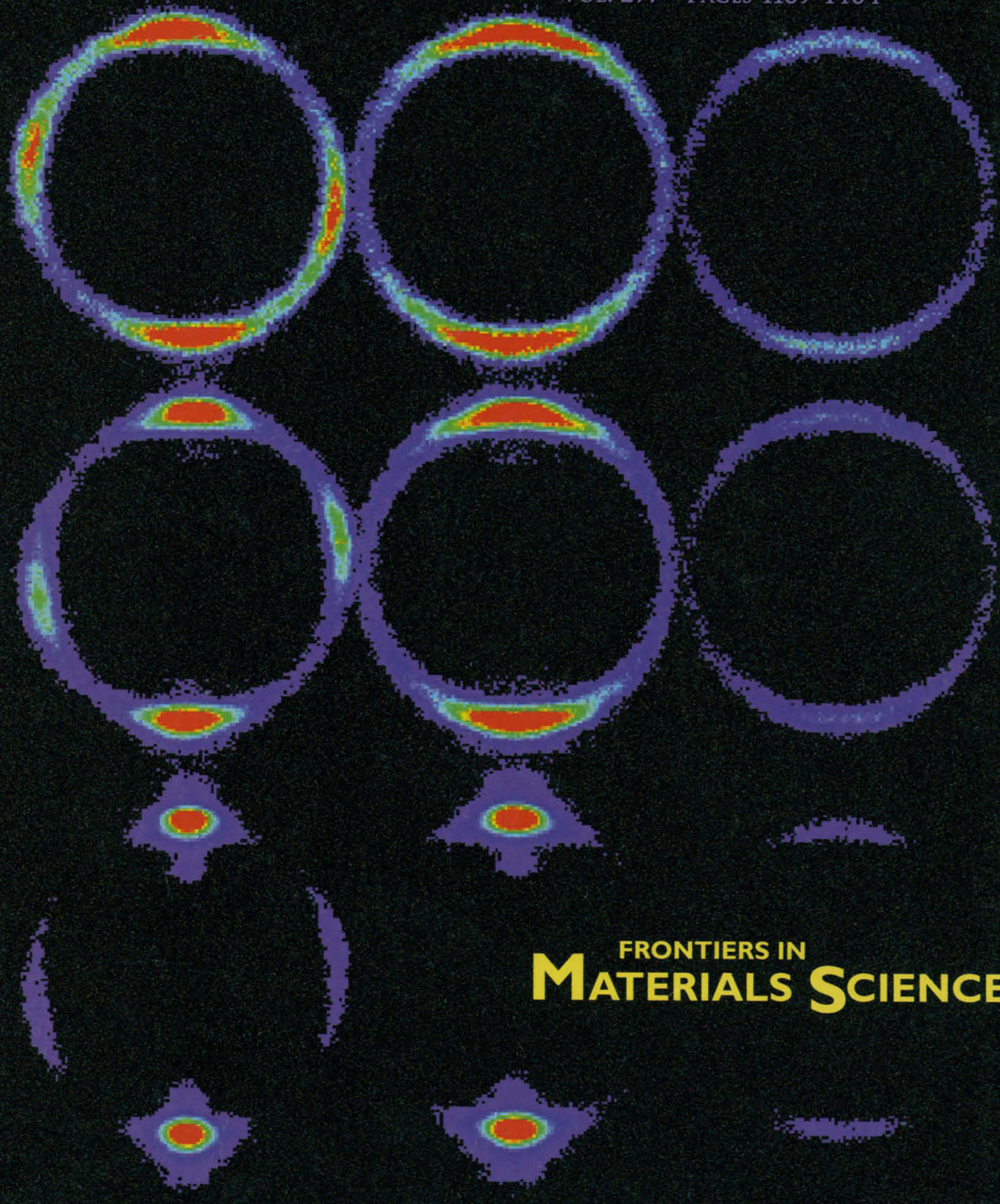
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

29 AUGUST 1997
VOL. 277 • PAGES 1169–1404
$7.00



FRONTIERS IN MATERIALS SCIENCE

After 10 years, the future looks even brighter

...and cooler. Because the combination of DIG* labeling and chemiluminescent detection delivers results without the *"heat"* of radioactivity. Since 1987, we've collected the citations and customers to attest to its superior sensitivity, reliability, and consistency.

But our glowing past is just the beginning. DIG's tenth anniversary coincides with the introduction of the Lumi-Imager™—a precision instrument that can visualize, quantify, and analyze chemiluminescent signals to assure you of improved productivity and results in a variety of blotting, and microtiter plate assays.

Why settle for isotopes when DIG is preferred by thousands worldwide? DIG and the new Lumi-Imager—there's nothing brighter . . . or cooler.

BOEHRINGER MANNHEIM

mannheim boehringer

Internet http://biochem.boehringer-mannheim.com

* The DIG System; formerly sold in North America as the Genius System.

Circle No. 27 on Readers' Service Card

Light Years Ahead...

LIBRARIES THEN.

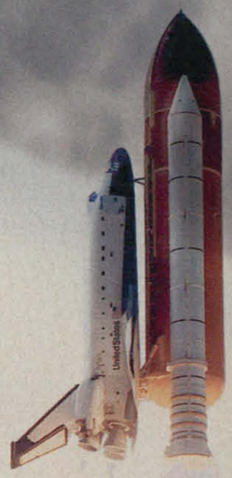
Historically, plasmid libraries were not the best tool for gene discovery. Plasmid vectors gave you smaller primary library sizes than lambda vectors. As the size of ligated DNA increased, transformation efficiency decreased, reducing your chances of finding full-length cDNA clones. And larger plasmids, such as two-hybrid and eukaryotic expression vectors, made this size bias worse.

LIBRARIES NOW!

Now, XL10-Gold™ ultracompetent cells* take plasmid libraries to a new level of potential discovery. XL10-Gold cells provide the absolute highest transformation efficiencies of ligated DNA. They make plasmid libraries larger and more complex, approaching the quality of lambda libraries. Stratagene offers plasmid library kits for prokaryotic cloning, for high-level eukaryotic expression and for yeast two-hybrid screening.**

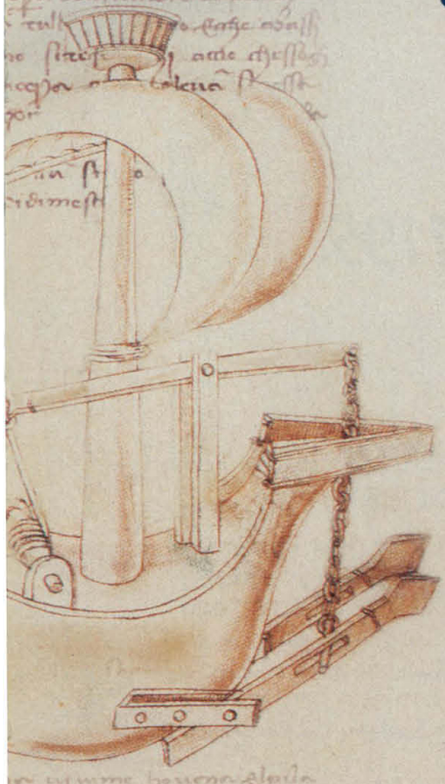
XL10-GOLD

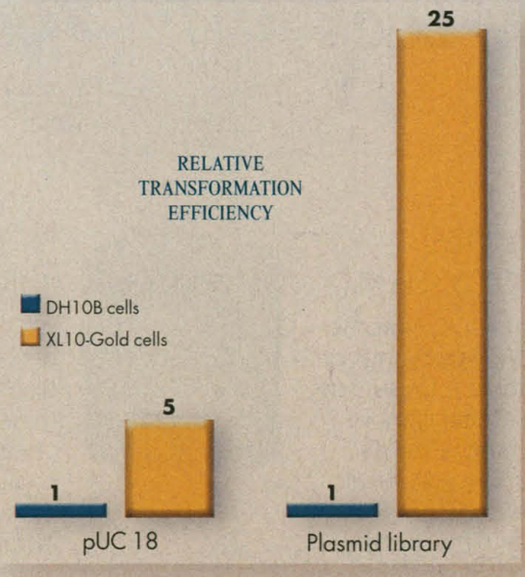
ULTRACOMPETENT CELLS



COMPETENT CELLS FOR THE REAL WORLD

- *Increase transformation efficiency of large constructs*
- *Produce larger plasmid libraries*
- *Generate libraries with more full-length clones*
- *Kits available for prokaryotic, eukaryotic and two-hybrid libraries*





Equal amounts of pUC DNA or a cDNA ligation mixture were transformed into DH10B or XL10-Gold competent cells according to manufacturer's instructions. Efficiency (cfu/µg DNA) was calculated. Relative transformation efficiency for pUC and the cDNA ligation were determined separately.

The Gold Standard of Plasmid Libraries

Circle No. 45 on Readers' Service Card

UNITED STATES:
Stratagene Cloning Systems
(800) 424-5444
INTERNET MAIL:
techservices@stratagene.com

AUSTRALIA: (02) 9417 7866
AUSTRIA: (0222) 3 68 99 51
BRAZIL: 11 5561-1771
CANADA: 800-661-4556
DENMARK: 86 10 10 55
FRANCE: (01) 34 60 24 24
GERMANY: (0130) 84 09 11
HONG KONG: 2578-5839
INDIA: 3325677
ISRAEL: 03-5761520
ITALY: 02-58.01.34.09
JAPAN: (Funakoshi) (03)5684-1622
(Toyobo) (03)3660-4819
KOREA: (02)-556-0311
MALAYSIA: 3-7031888
NETHERLANDS: 033 495 00 94
NEW ZEALAND: 9 443-5867
NORWAY: 22 20 01 37
PORTUGAL: 01-441 06 84
SINGAPORE: 2730898
SPAIN: 1 729 03 33
SWEDEN: (8) 6800845
SWITZERLAND: (061) 6 93 05 40
THAILAND: (662) 308-0611
UNITED KINGDOM: 0800 585370

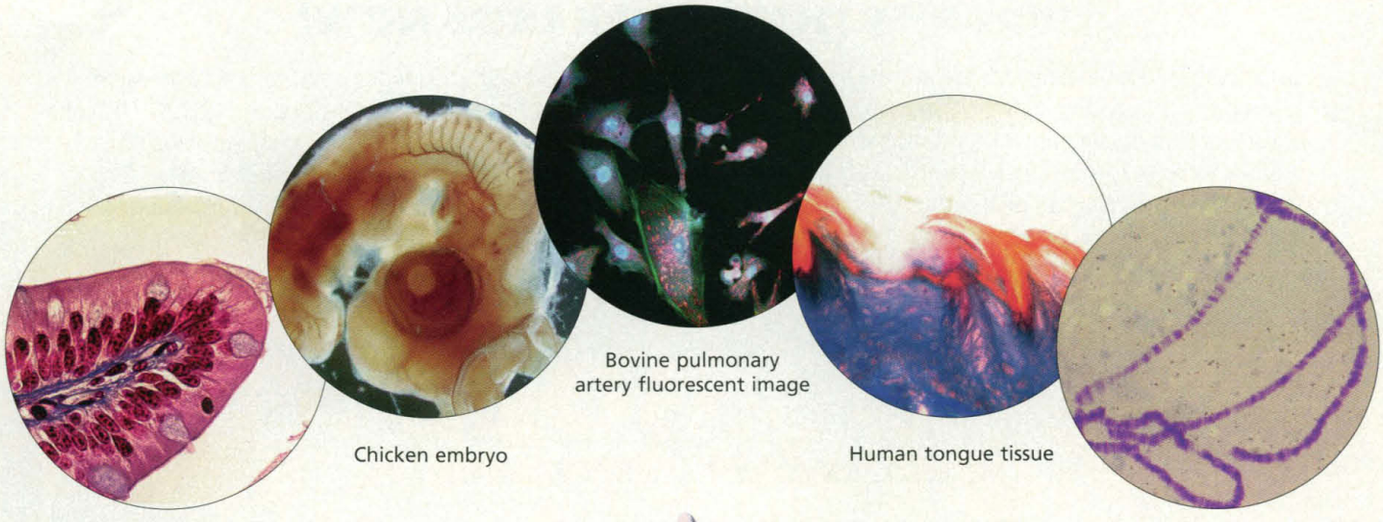
OTHER COUNTRIES CALL
STRATAGENE USA: (619) 535-5400

XL10-Gold™ Ultracompetent Cells (5 x 100 µl) #200314
XL10-Gold™ Ultracompetent Cells (10 x 100 µl) #200315
pBluescript® II XR Library Construction Kit #200455
pCMV-Script™ XR Library Construction Kit #200465
pAD-GAL4-2.1 XR Library Construction Kit #200460

*Patent pending
**U.S. Patent nos. 5,283,173 and 5,468,614

STRATAGENE®

LOOK AT THESE IMAGES.



Human intestinal tissue

Chicken embryo

Bovine pulmonary artery fluorescent image

Human tongue tissue

Polytene chromosomes of Drosophila

NOW, LOOK AT THE PRICE: $1195.

THE 1-MILLION-PIXEL DIGITAL CAMERA SYSTEM.

No matter what your photomicroscopy application, you cannot get better image quality at a lower price than with a Pixera digital camera system. In fact, to match Pixera's million-pixel resolution, you would have to spend at least 10 times as much. And Pixera gives you everything you need – including a full suite of application software so you can visualize, create and communicate.

NOW – THE PERFECT TOOL FOR TELEMEDICINE.

You can capture two- or three-dimensional still or moving images directly to your PC, Mac, or laptop and then manipulate, organize, archive, and communicate those images via video conferencing or e-mail. A new PCI card makes the system unbelievably easy to install and to use.

For more information, visit our web site at www.pixera.com or call toll-free 1-888-4 PIXERA.

All images were captured at 1280 x 1024 pixels with a Pixera Professional Digital Camera mounted on a microscope with a standard C-mount adapter.

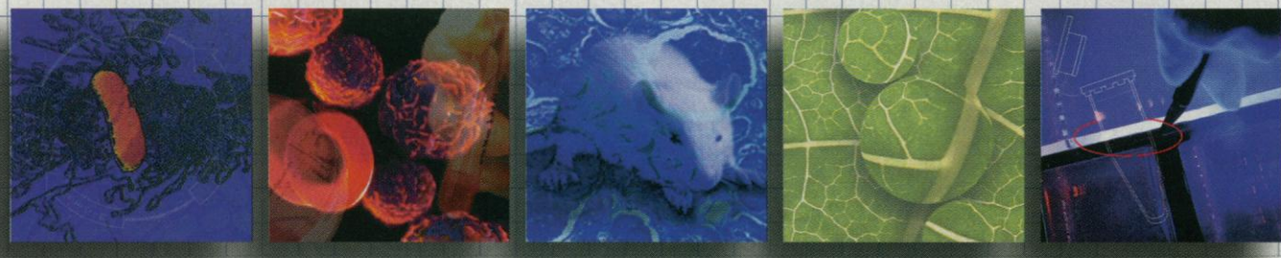
pixera

140 Knowles Drive, Los Gatos, CA 95030
www.pixera.com

Circle No. 37 on Readers' Service Card

nucleon

DNA extraction and purification products



- **Bacterial/yeast mini-maxi preps**
- **Blood and cultured cells**
- **Animal tissue and paraffin sections**
- **Plant tissue**
- **PCR clean-up and DNA recovery from gels**

Dedicated Kits, Specific Applications, Excellent Results

Now available from Amersham™, the Nucleon™ range of extraction and purification kits, provide robust, user friendly protocols for a wide range of applications and sample types. The high quality of the DNA recovered by these kits makes it suitable for use in a variety of downstream processes, such as RFLP, sequencing and PCR.

You can now extract, purify, label and detect nucleic acids using products from one supplier.

- Innovative resin-based extraction systems
- Fully optimized kits dedicated for specific applications
- Economical scale-up for larger sample sizes
- High quality DNA and increased yields
- Easy to use

Amersham LIFE SCIENCE

FOR MORE INFORMATION, CONTACT YOUR LOCAL OFFICE

http://www.amersham.co.uk/life

http://www.amersham.com/life

EUROPE	+44 (0)1494 544550
USA	1 800 323 9750
JAPAN	(03) 59 92 2828

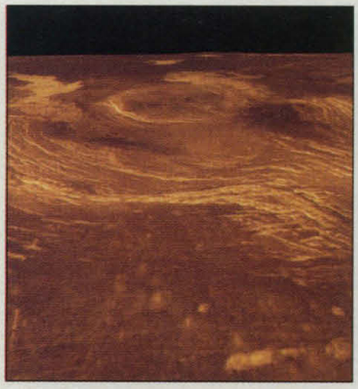
MNUC

ISSN 0036-8075
29 AUGUST 1997
VOLUME 277
NUMBER 5330

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

1192
Patchwork school reform



1289
Venus upwellings

NEWS & COMMENT

The Calculus of School Reform 1192
The Special Needs of Science 1193
California Spars Over Math Reform 1194

Bipartisan Mood in Congress Opens Door for Pork 1195

Korea: In Land of Industrial Giants, Universities Nurture Start-Ups 1196

French Research: Government Restores Funding Cuts 1197

Japan: Merger Plan for Rival Science Agencies 1198

NASA Boosts Earth Science Grants 1198

RESEARCH NEWS

Drug Delivery Takes a Deep Breath 1199

No Hidden Starstuff in Nearby Universe 1201

New Kind of Cancer Mutation Found 1201

Conjuring Matter From Light 1202

Ice Age Communities May Be Earliest Known Net Hunters 1203

How Humans and Nature Influence Ecosystems 1204

FRONTIERS IN MATERIALS SCIENCE

NEWS

Shining a Bright Light on Materials 1213

X-rays Find New Ways to Shine 1214

X-rays Go Where Neutrons Fear to Tread 1216

Brightness Speeds Search for Structures Great and Small 1217

New Synchrotrons Light Up Microstructure of Earth 1220

ARTICLES

Structure Determination of Mg_5Si_6 Particles in Al by Dynamic Electron Diffraction Studies 1221
H. W. Zandbergen, S. J. Andersen, J. Jansen

PERSPECTIVES

Gamma Ray Bursts 1257
C. Kouveliotou

Closer to Coherence Control 1258
L. J. Sham

Yeast as a Model Organism 1259
D. Botstein, S. A. Chervitz, J. M. Cherry

DEPARTMENTS

THIS WEEK IN *SCIENCE* 1177

EDITORIAL 1183
Microstructural Engineering of Materials

LETTERS 1185
Science, Technology, and Foreign Policy: T. E. Wirth; I. A. Lerch; P. A. Cohen • Economics and Informed Passions: R. B. Norgaard • Critical Habitats on Private Land: R. D. Applegate; S. Shaw; *Response*: F. Shilling • A U3-Like Small Nucleolar RNA in Archaea: Retraction: A. G. Russell, M. Moniz de Sa, P. P. Dennis • Corrections and Clarifications

SCIENCESCOPE 1191

RANDOM SAMPLES 1207
Anteing Up for a World War on Malaria • Buckyballs Save Nerves • Prions Up Close and Personal • Brazil's New Monkey

BOOK REVIEWS 1254
A Tale of Two Continents, reviewed by D. Gross • *Selection* and *The Basics of Selection*, J. A. Endler • Vignettes • Books Received

AAAS NEWS & NOTES 1317

TECH.SIGHT: PRODUCTS 1320

■ **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. Domestic individual membership and subscription (51 issues): $105 ($58 allocated to subscription). Domestic institutional subscription (51 issues): $260. Foreign postage extra: Mexico, Caribbean (surface mail) $55; other countries (air assist delivery) $90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. IPM #1069624. **Printed in the U.S.A.**

COVER

Polymers that join two regions with different chemical compositions can separate into phases on a nanometer scale. This particular layered material responded to shear flow in a dynamic manner; it became well aligned (its x-ray scattering pattern is shown at the bottom) but only after proceeding through a transient of mutually perpendicular domains (four-spot pattern, upper left). See page 1248 and the special section on Materials Science beginning on page 1213. [Image: Z.-R. Chen and J. A. Kornfield]

Competing Interactions and Levels of Ordering in Self-Organizing Polymeric Material 1225
M. Muthukumar, C. K. Ober, E. L. Thomas

Fuzzy Nanoassemblies: Toward Layered Polymeric Multicomposites 1232
G. Decher

Computational Design of Hierarchically Structured Materials 1237
G. B. Olson

Molecular Manipulation of Microstructures: Biomaterials, Ceramics, and Semiconductors 1242
S. I. Stupp and P. V. Braun

Pathways to Macroscale Order in Nanostructured Block Copolymers 1248
Z.-R. Chen, J. A. Kornfield, S. D. Smith, J. T. Grothaus, M. M. Satkowski

Biodiversity and Ecosystem Function: The Debate Deepens 1260
J. P. Grime

RESEARCH ARTICLES

A Conformational Switch in *Escherichia coli* 16S Ribosomal RNA During Decoding of Messenger RNA 1262
J. S. Lodmell and A. E. Dahlberg

The Motion and Boundary Between the Capricorn and Australian Plates 1268
J.-Y. Royer and R. G. Gordon

REPORTS

A Test Case of Correlation Metric Construction of a Reaction Pathway from Measurements 1275
A. Arkin, P. Shen, J. Ross

$^{40}Ar/^{39}Ar$ Dating into the Historical Realm: Calibration Against Pliny the Younger 1279
P. R. Renne, W. D. Sharp, A. L. Deino, G. Orsi, L. Civetta

s-Process Zirconium in Presolar Silicon Carbide Grains 1281
G. K. Nicolussi, A. M. Davis, M. J. Pellin, R. S. Lewis, R. N. Clayton, S. Amari

Room-Temperature Spin Memory in Two-Dimensional Electron Gases 1284
J. M. Kikkawa, I. P. Smorchkova, N. Samarth, D. D. Awschalom

Synthesis of Gallium Nitride Nanorods Through a Carbon Nanotube–Confined Reaction 1287
W. Han, S. Fan, Q. Li, Y. Hu

Corona Formation and Heat Loss on Venus by Coupled Upwelling and Delamination 1289
S. E. Smrekar and E. R. Stofan

Bipolar Changes in Atmospheric Circulation During the Little Ice Age 1294
K. J. Kreutz, P. A. Mayewski, L. D. Meeker, M. S. Twickler, S. I. Whitlow, I. I. Pittalwala

The Influence of Island Area on Ecosystem Properties 1296
D. A. Wardle, O. Zackrisson, G. Hörnberg, C. Gallet

The Influence of Functional Diversity and Composition on Ecosystem Processes 1300
D. Tilman, J. Knops, D. Wedin, P. Reich, M. Ritchie, E. Siemann

The Effects of Plant Composition and Diversity on Ecosystem Processes 1302
D. U. Hooper and P. M. Vitousek

A Critical Role for Tapasin in the Assembly and Function of Multimeric MHC Class I–TAP Complexes 1306
B. Ortmann, J. Copeman, P. J. Lehner, B. Sadasivan, J. A. Herberg, A. G. Grandea, S. R. Riddell, R. Tampé, T. Spies, J. Trowsdale, P. Cresswell

Induced α Helix in the VP16 Activation Domain upon Binding to a Human TAF 1310
M. Uesugi, O. Nyanguile, H. Lu, A. J. Levine, G. L. Verdine

Accelerated Aging and Nucleolar Fragmentation in Yeast *sgs1* Mutants 1313
D. A. Sinclair, K. Mills, L. Guarente

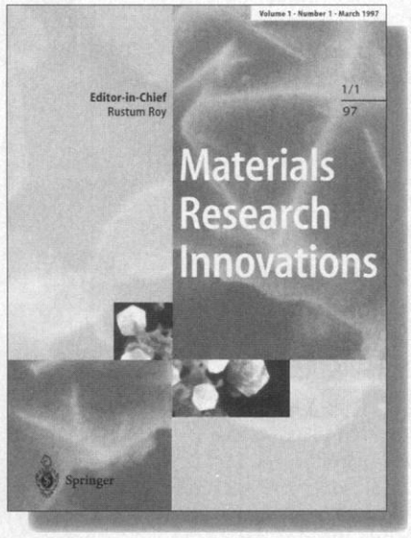
1260, 1296, 1300 & 1302

Biodiversity and ecosystem properties

◩ **Indicates accompanying feature**

Change of address: allow 4 weeks, giving old and new addresses and 8-digit account number. **Postmaster:** Send change of address to *Science*, P.O. Box 1811, Danbury, CT 06813–1811. **Single copy sales:** $7.00 per issue prepaid includes surface postage; bulk rates on request.

New journal in 1997



Materials Research Innovations will accept papers which are new, unexpected, and innovative in all core areas of materials research: metals polymers, ceramics, composites, electronic materials, and biomaterials. They may be of an experimental or theoretical nature and report on:

- synthesis of new phases or composites
- new processes of making new phases faster, cheaper, "greener"
- new characterization tools and their applications
- new devices based on new materials

The journal will publish original papers of various lengths, conference announcements, and a section "New Developments of Materials" giving the latest news on sophisticated research and engineering results.

http://
link.springer.de

Springer
Print Journals
Go Electronic

Materials Research Innovations

ISSN 1432-8917 Title No. 10019

Editor-in-Chief:
R. Roy, University Park/PA

Subscription information 1997:
Volume 1, 4 issues: DM 450,–*

Materials Research Innovations is included in the programme **"LINK – Springer Print Journals Go Electronic".**
ISSN electronic edition: ISSN 1433-075X

For more information, please visit us on **http://link.springer.de** or by fax: **+49-6221-487-288.**
In 1997, access to the electronic edition is **free for subscribers** to the printed journal.

Please order from
Springer-Verlag Berlin
Fax: + 49 / 30 / 8 27 87- 448
e-mail: subscriptions@springer.de
or through your bookseller

* suggested list price, plus carriage charges. In EU countries the local VAT is effective.

Springer

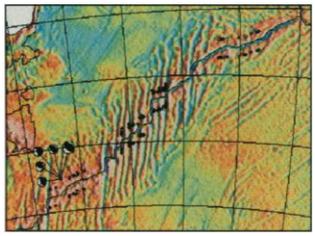
Circle No. 30 on Readers' Service Card

THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Earth's extra plates

Reconstruction of plate tectonic boundaries is more difficult than fitting together the pieces of a puzzle because geologists do not know the location of all of the boundaries. Perhaps one of the more difficult boundaries to reconstruct is in the Indian Ocean. Royer and Gordon (p. 1268) used



magnetic seafloor anomalies and seismic data to determine that the Indo-Australian plate is not one plate, but three plates with diffuse boundaries. The definition of these additional plates will help refine the deformational history of this region, including the collision of India with Eurasia to produce the Himalayas.

■

Long-lived spin states

Electron spins in a solid can be aligned with a magnetic field, but usually this alignment is rapidly lost even at very low temperatures. Kikkawa *et al.* (p. 1284; see the Perspective by Sham, p. 1258) measured electron spin precession with femtosecond time resolution by monitoring the Kerr rotation of light induced by the spins. In a negatively doped semiconductor heterostructure that confined a two-dimensional electron gas, they found spin precession times on the order of nanoseconds, far greater than the carrier lifetimes of the electron and holes or of spins in insulating samples. Long lifetimes were observed even at room temperature and appear to arise from inefficient electron-hole scattering of the spins. Such spin coherence may find application in ultrafast magneto-optical devices.

Diversity versus composition

What are the relative roles of species diversity and composition in ecosystem function? Three reports, one based on measurements in natural ecosystems and two on experimental manipulation, address the question (see the Perspective by Grime, p. 1260). Wardle *et al.* (p. 1296) analyzed the ecosystem properties of 50 relatively pristine islands of varying size in an archipelago in northern Sweden. Plant diversity actually decreased with increasing island size, most likely because of the increased risk of lightning-induced fire disturbance with increasing size, yet ecosystem process rates were highest on larger islands. Hooper and Vitousek (p. 1302) and Tilman *et al.* (p. 1300) seeded experimental plots with different combinations of species and functional groups; they assessed how richness and composition of plant functional groups affected a range of ecosystem functions, including productivity and nutrient retention. The studies from natural and experimental systems concur: The characteristics of the dominant plants and the functional composition of the ecosystems are determining features, while diversity per se is not.

Overcoming kinetic complexity

Reaction kinetics are usually determined by identifying individual steps and measuring their rates, an approach that becomes more difficult for complex pathways that involve several steps and are regulated by feedbacks (such as enzymatic syntheses). Recently a theoretical approach was developed for determining the component processes by following perturbations to the reaction at steady state. Arkin *et al.* (p. 1275) show that this approach, when applied to initial steps of glycolysis, does indeed capture the underlying kinetics.

■

Tube replacement

Gallium nitride nanostructures are of high technological interest because of their semiconducting and optical properties. Han *et al.* (p. 1287) show that by using carbon nanotubes as templates, gallium nitride nanorods can be made from oxide and ammonia precursors. The nanorods closely maintain the morphology and dimensions of the original carbon nanotubes. Similar results were obtained for silicon nitride, indicating that a wider range of compounds may be accessible through this route.

A date with history

Accurate radiometric dating of young rocks is critical for many fields and for Holocene samples the primary method has been radiocarbon dating. Renne *et al.* (p. 1279) show that the argon-40/argon-39 method can be used to date even into the historical realm. They dated the famous ash flow produced by the 79 A.D. eruption of Mount Vesuvius.

■

Tectonic activity remaining on Venus?

Venus is comparable to Earth in size but its tectonic history and activity seems to have been quite different. For example, Venus exhibits circular collections of faults and ridges that range up to 2600 kilometers across, known as coronae. Smrekar and Stofan (p. 1289) present a model in which these features are formed by upwelling associated with plumes and suggest that some may still be active.

■

Ribosomal switch

As the ribosome translates nucleic acid sequences into proteins, it is thought to undergo large conformational changes. Lodmell and Dahlberg (p. 1262) constructed mutations in the 912 region of the central domain of 16S ribosomal RNA (rRNA) that led to increases or decreases in the fidelity of translation similar to those seen for mutants of the ribosomal proteins S12 and S5. Sequences were identified that engage in a conformational switch in rRNA. This switch is facilitated by S5 and S12 and appears to affect the codon-anticodon arrangement and the selection of the correct transfer RNA at the ribosomal A site.

■

Binds and winds

Although it is known that transcription activators stimulate transcription, the structural basis for this regulation has been elusive. Uesugi *et al.* (p. 1310) describe the secondary structure that is induced in the activation domain of the herpes simplex virus VP16 protein when complexed to its target protein, $hTAF_{II}31$ (a subunit of the human general transcription factor TFIID). Upon binding, VP16 undergoes an induced transition from random coil to α-helix. Sequence similarities in the acidic activation domains of VP16 and other proteins suggest a general recognition element of acidic activation domains for $hTAF_{II}31$.

■

Signs of age

A helicase gene, *WRN*, is defective in the human disease, Werner's syndrome, a disease that exhibits some of the same features as normal aging. A similar gene in yeast, *SGS*, also codes for a helicase. Sinclair *et al.* (p. 1313; see the Perspective by Botstein *et al.*, p. 1259) show that the absence of *SGS* causes yeast cells to show signs of premature aging: a shorter average lifetime, sterility, and nucleolar fragmentation. Further elucidation of the functions of *SGS* may shed light on the process of normal aging.

F A S T

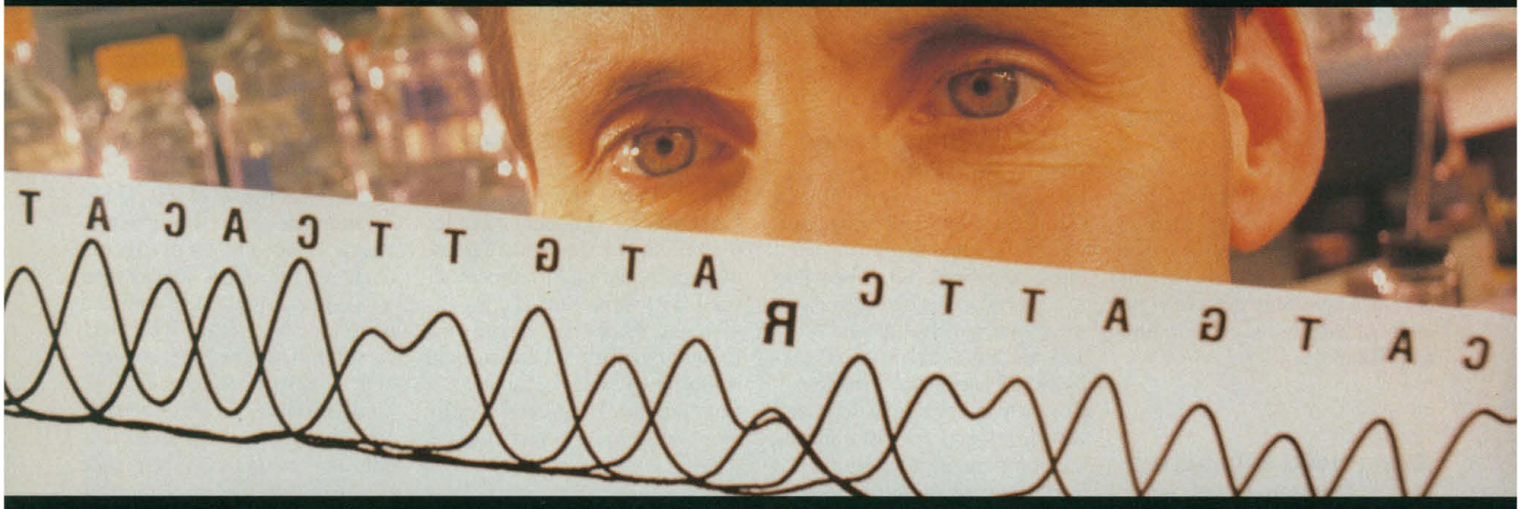
300 bases in 30 minutes.

E A S Y

Gels cast and polymerized in less than 5 minutes.

A F F O R D A B L E

$35,000.*



Automated DNA sequencing system for the clinical laboratory.

How good can an automated DNA sequencing system be that sells for $35,000? Very good indeed!

And that's what the **OpenGene™** system by Visible Genetics is: Remarkably fast. Surprisingly small. Exceptionally easy to use. And ingeniously designed.

Sure, the **OpenGene** system may sound unbelievable. Especially when you consider that it's specifically designed to perform in the clinical lab.

But we think that once you see it in operation, you'll be convinced. So phone us now at **1-888-463-6844 (INFO-VGI).** And we'll prove that some things are not too good to be true.

The OpenGene system by Visible Genetics. Very fast. Very easy. Very smart.

VISIBLE GENETICS INC.

E-mail: infovgi@visgen.com • web site: http://www.visgen.com
Tel.: (1) 416-813-3240 • Fax: (1) 416-813-3262

OpenGene is a trademark of Visible Genetics Inc. *Computer workstation not included.

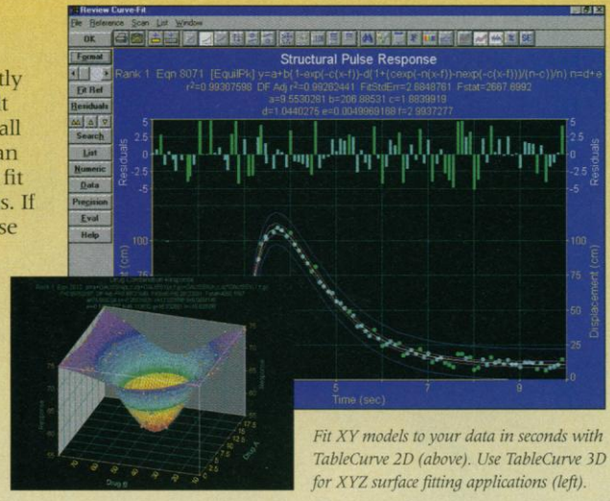
Circle No. 6 on Readers' Service Card

Fit *thousands* of equations to your data in seconds

NEW 3D VERSION 3.0

FIND THE BEST MODEL FOR YOUR DATA IN SECONDS

TableCurve 2D has 3,665 equations frequently encountered in science and engineering built right in. With a single mouse click, fit them all or just the ones you need – instantly! You can even enter your own specialty models to be fit and ranked along with the built-in equations. If no single function describes your data, choose from the three powerful non-parametric estimation features – Local Regression Estimation, Spline Fitting and Smooth Spline Estimation. TableCurve saves you precious time because it takes the endless trial and error out of data fitting.



Fit XY models to your data in seconds with TableCurve 2D (above). Use TableCurve 3D for XYZ surface fitting applications (left).

VISUALLY DISCOVER THE BEST EQUATION TO MODEL YOUR DATA

Once the fit is complete, TableCurve automatically displays the fitted equations and the corresponding graphs sorted by the statistical criteria you select. Graphically review the fitted results as you scroll through the equation list to discover the model that meets your requirements for the ideal fit.

Solve complex science and engineering problems faster

- Optimize product and process performance
- Quickly calibrate sensors
- Understand complex chemical kinetics
- Reduce empirical data to a simple equation
- Stabilize systems with dynamic feedback
- Any general curve fitting application!

"I was able to turn a two-week semi-accurate task into a two-hour precision task the minute I installed TableCurve."

Scott Slavick
Engineer and Researcher

Call now at 1-800-345-4740

TABLE Curve®

To order:
SPSS Inc., 444 N. Michigan Avenue, Chicago, IL, 60611
+312.329.2400; fax: +312.329.3668
Distributors worldwide: http://www.spss.com/order/

A4740

Circle No. 46 on Readers' Service Card

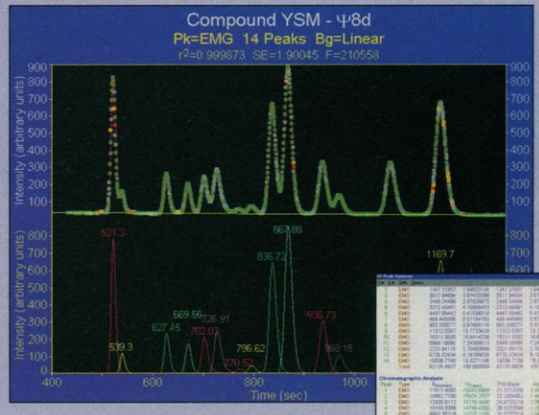
PeakFit separates the most complex peaks...automatically

THE AUTOMATIC CHOICE FOR SPECTROSCOPY, CHROMATOGRAPHY AND ELECTROPHORESIS

"We know of no other comparable program that offers such sophisticated data analysis..."

Journal of the American Chemical Society
Vol. 114, No. 20

State-of-the-art nonlinear curve-fitting techniques separate overlapping peaks standard instrumentation misses. Easily separate, locate and measure up to 100 peaks and access 82 built-in nonlinear equations and up to 15 user-defined functions to fit virtually all data. PeakFit calculates the amplitude (intensity), area, center and width data for each peak.



The graphics engine allows you to show any characteristic of each peak.

From data input to data output, this analysis of 14 asymmetric and overlapping peaks was completed in five minutes by a novice PeakFit user.

PEAK FINDING AND FITTING IS FULLY AUTOMATED

PeakFit has three procedures to characterize normal and hidden peaks. Choose between residuals, second derivative or deconvolution procedures depending on your data set. And PeakFit has highly advanced data smoothing and manipulation techniques to accurately process noisy data. Sophisticated artificial intelligence experts are placed at all key points to help you pick out the best values for smoothing and filtering levels. PeakFit's graphical placement options handle even the most complex peaks as smoothly as Gaussians. PeakFit far surpasses any other peak analysis package made.

Call now at 1-800-345-4740

To order:
SPSS Inc., 444 N. Michigan Avenue, Chicago, IL, 60611
+312.329.2400; Fax: +312.329.3668
Toll-free: 1.800.621.1393; Fax: 1.800.841.0064
http://www.spss.com/software/science/peakfit

SPSS ASC GmbH, Schimmelbuschstrasse 25
40699 Erkrath, Germany
+49.2104.9540; Fax: +49.2104.95410
France: +0800.90.37.55, UK: +0880.894982
Distributors worldwide: http://www.spss.com/order/

SPSS science™

A4740

Circle No. 41 on Readers' Service Card

About every 9 seconds, new information is added to the CAS databases. We're dedicated to bringing you the most up-to-date, comprehensive scientific information available. It's what we do every day.

(There, we just updated again.)

Our databases contain records on 17 million substances with information collected from 8,000 journals. And extensive, up-to-date patent information gathered from 31 international patent offices — very handy considering the fastest growing source of new organic substances is patents.

(There, we just updated again.)

So, when your job depends on having the latest information, rest assured, you can always depend on CAS.

FOR MORE INFORMATION CALL:
1-800-753-4227 OR **614-447-3700**

CAS®

A division of the American Chemical Society®

OR VISIT OUR WEB SITE:
http://www.cas.org

Circle No. 20 on Readers' Service Card

www.sciencemag.org

SCIENCE

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

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

INFORMATION RESOURCES

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

MEMBER BENEFIT CONTACTS
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.

REPRINTS & PERMISSION
Reprints: Ordering/Billing/Status, 800-407-9190; Corrections, 202-326-6501 • **Permissions:** 202-326-7074, FAX 202-682-0816

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

INFORMATION FOR CONTRIBUTORS
See pages 98–99 of the 3 January 1997 issue or access www.sciencemag.org/misc/con-info.shtml.

EDITORIAL & NEWS CONTACTS

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

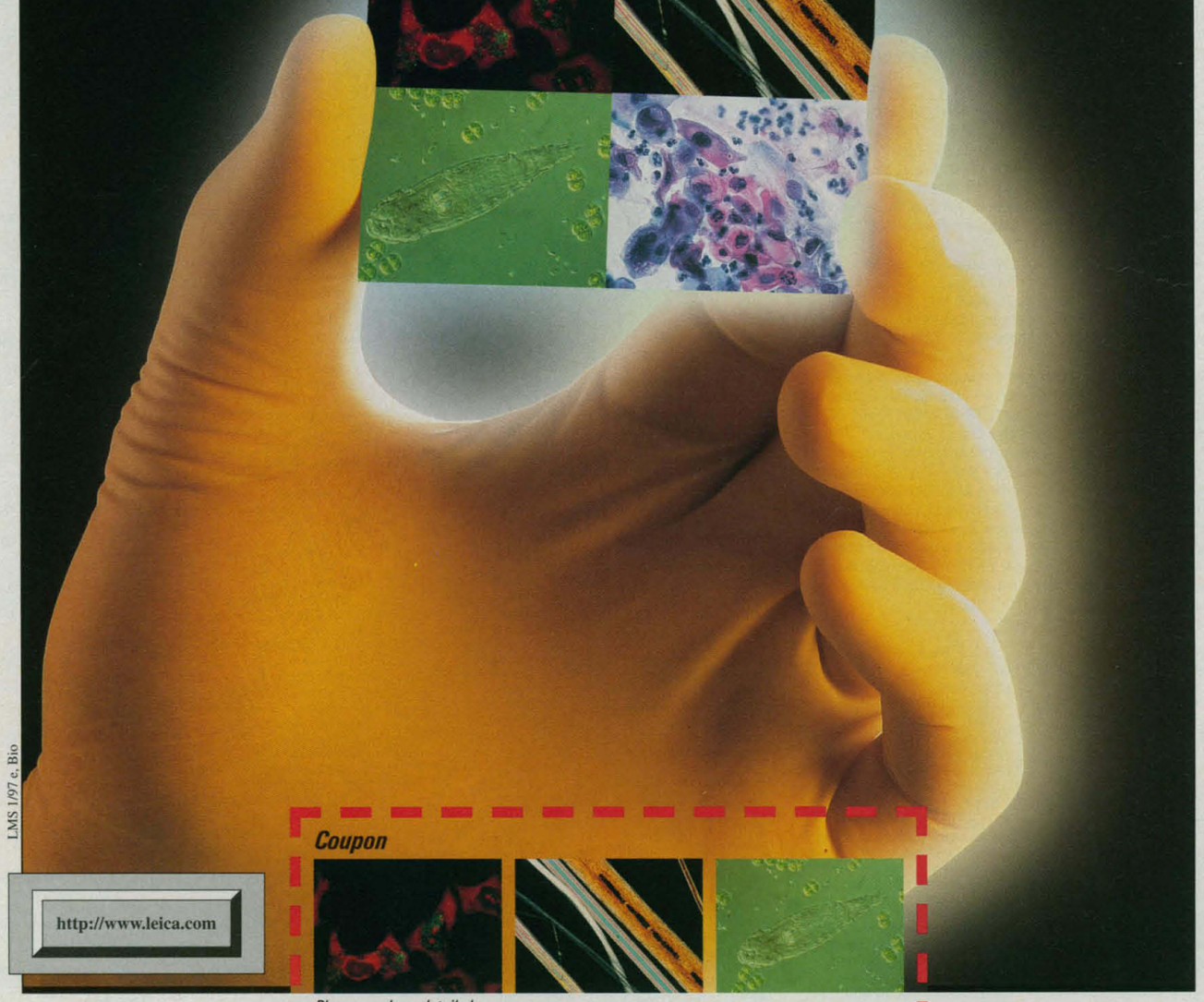
Europe
Headquarters: 14 George IV Street, Cambridge, UK CB2 1HH; (44) 1223-302067, FAX (44) 1223-302068
Paris Correspondent: (33) 1-49-29-09-01, FAX (33) 1-49-29-09-00

Asia
News Bureau: Dennis Normile, (81) 3-3335-9925, FAX (81) 3-3335-4898; dnormile@twics.com
• **Japan Office:** Carl Kay, Esaka 1-chome 16-10-305, Suita-shi, Osaka-fu 564 Japan; (81) 6-387-5483, FAX (81) 6-337-6809; science@japanese.co.jp
• **China Office:** Hao Xin, (86)10-6255-9478; science@public3.bta.net.cn

Leica. An Eye for Discovery

The demand for innovative system solutions in life sciences is growing all the time.
Leica can provide you with just the solution you need.
So why not benefit from the experience of an international technology group?
Sales organizations in over 20 countries guarantee optimum support and service.
Leica offers a wide range of products for life science applications to suit all requirements from routine to research.

For further details, fill in the coupon and return it to us or contact us on the Internet.



LMS 1/97 e. Bio

http://www.leica.com

Coupon

Please send me detailed information about:

Company:

Department:

Street: *Post-zip code/City:*

Leica AG
CH-9435 Heerbrugg (Switzerland)
Telephone +41 71 727 31 31
Fax +41 71 727 46 76

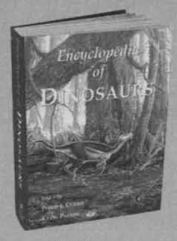
Circle No. 18 on Readers' Service Card

Leica

Titles Covering the Full Spectrum of Science

from Academic Press

Includes Foreword by Michael Crichton



Encyclopedia of Dinosaurs

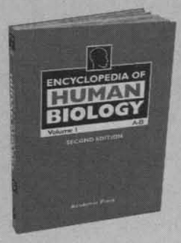
Edited By
Philip J. Currie and Kevin Padian

*"The **Encyclopedia of Dinosaurs** is quite possibly the most valuable and comprehensive volume ever published on dinosaurs, and it is sure to become the reference work in the field. Edited by two of the world's foremost dinosaur experts, it includes hundreds of contributions from virtually every luminary in the field."*

—DOUGLAS PRESTON, Author of **Dinosaurs in the Attic** and **Relic**

September 1997, c. 848 pp., $99.95/£70.00 (tentative)
ISBN: 0-12-226810-5

Encyclopedia of Human Biology



SECOND EDITION

Editor-in-Chief
Renato Dulbecco

Praise for the First Edition

"The format and illustrations are excellent and encourage browsing; and the whole series has clearly been assembled with great labour and dedication."

—NATURE

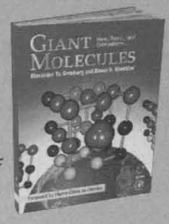
The **Encyclopedia of Human Biology, Second Edition** provides complete coverage of the vast subject area of human biology—no other reference work available offers such a detailed and comprehensive treatment of the subject. Including more than 670 articles in 37 different biological fields, this fully revised edition features one of the most renowned editorial Advisory Boards ever assembled. The **Second Edition** offers more than 75% new, updated, and revised content including approximately 150 new articles.

Nine-Volume Set
Prepublication Price: $1799.00/£1399.00* (tentative)
September 1997, c. 7000 pp.,
$2100.00/£1600.00 (tentative)/ISBN: 0-12-226970-5
*Prepublication price expires on December 31, 1997.

Includes a Foreword Written by Nobel Laureate Pierre-Gilles de Gennes

Giant Molecules

Here, There, and Everywhere



Alexander Yu. Grosberg and Alexei R. Khokhlov

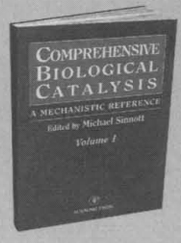
"Giant molecules is one of the hottest topics in science today. This book, written by two brilliant physicists, will guide readers through this new frontier of polymer science while they master the modern concepts behind it."

—TOYOICHI TANAKA, Massachusetts Institute of Technology, Cambridge

May 1997, 244 pp., $39.95/£24.95/ISBN: 0-12-304130-9
Includes one CD-ROM.

Four-Volume Set!

Comprehensive Biological Catalysis



A Mechanistic Reference

Edited by
Michael Sinnott

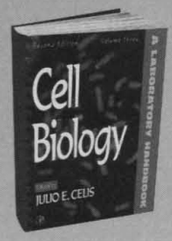
"Having the underlying chemistry and the enzymic work alongside one another and at the most advanced level is going to be very attractive."

—D. BETHELL, University of Liverpool, U.K.

Comprehensive Biological Catalysis: A Mechanistic Reference offers a comprehensive review of enzyme catalysis from a chemical perspective. This multi-volume work thoroughly covers background chemistry.

Four-Volume Set
Prepublication Price: $750.00/£XXX.XX* (tentative)
October 1997, c. 1200 pp., $899.00 (tentative)
£575.00 (tentative)/ISBN: 0-12-646860-5
*Prepublication price expires on December 31, 1997.

Cell Biology



A Laboratory Handbook

SECOND EDITION

Edited by
Julio Celis

KEY FEATURES

- Contains more than 60% new material
- Provides cell biologists and other life scientists with the most up-to-date instructions for basic and advanced cell biological techniques, including those at the interface between cell and molecular biology
- Contains information appropriate for a large, diverse, and constantly growing international audience of cell, developmental, and molecular biologists, plus others who need these methods in their laboratory research
- Includes color plates throughout the set for easy reference
- Designed as the essential lab guide and research reference for the field

Four-Volume, Comb Bound Set
Prepublication Price: $149.95/£95.00*

November 1997, c. 1800 pp., $199.95 (tentative)
£129.95 (tentative)/ISBN: 0-12-164725-0
*Prepublication price expires last day of month of publication.

Handbook of Neurolinguistics

Brigitte Stemmer and Harry A. Whitaker

The **Handbook of Neurolinguistics** is a state-of-the-art reference and resource book; it describes current research and theory in the many subfields of neurolinguistics and its clinical application. Thorough and clearly written, the **Handbook** provides an excellent overview of the field of neurolinguistics and its development.

Prepublication Price: $125.00 (tentative)
£75.00 (tentative)*

October 1997, c. 816 pp., $149.95 (tentative)
£110.00 (tentative)/ISBN: 0-12-666055-7
*Prepublication price expires on October 31, 1997.

Order from your local bookseller or directly from:

Academic Press
Order Fulfillment Dept. **DM**27098
6277 Sea Harbor Drive, Orlando, FL 32887
24-28 Oval Road, London NW1 7DX, U.K.

In the U.S. and Canada
CALL TOLL FREE: **1-800-321-5068**
FAX: **1-800-874-6418**
E-MAIL: **ap@acad.com**
In Europe, CALL: **0181-300-3322**

FIND US ON THE WEB!
AP NET
Academic Press
www.apnet.com

Circle No. 43 on Readers' Service Card

do it yourself library screening

800. 430. 0030

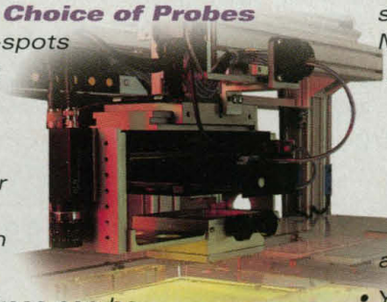
get 85–100 kb or 120+ kb P1, PAC, or BAC clones by performing your own library screening with "down-to-the-well"™ PCR'able DNA pools or by using high-density colony filters from genome systems.

PAC/BAC PCRable DNA Pools

Genome Systems provides its PAC, BAC libraries in convenient DNA pools for screening by PCR. Depending upon your choice of kits, enough DNA is provided for 25 or 50 screens.

Our High Density Filters Can Be Hybridized with Your Choice of Probes

Genome Systems double-spots colonies on 22cm x 22cm filters, (36,864 spots per filter). Double-spotting makes it easy to identify true positive colonies over the background noise generated by hybridization probes.



In addition, the clone address can be easily determined by the position of the two hybridization signals created by double spotting.

From a single copy gene, a multi-gene family, or an entire YAC clone, you can identify the cognate clones, or let Genome Systems isolate P1, PAC, or BAC clones in a matter of days.

Our services include:

- P1 (85kb insert) genomic library screening service (Human, Mouse ES for knockouts, Mouse RIII, Rat and Drosophila)
- PAC (120kb+ insert) genomic library screening service (Human, Fugu Fish and Zebra Fish)
- BAC (120+kb insert) genomic library screening service (Human, Mouse ES 129/SvJ, Mouse C57BL/6, Fugu Fish, Mosquito, Zebra Fish, Corn, Halo Bacteria, and Ustilago)
- YAC (0.5 to 1Mb insert) genomic library screening service (Human, Mouse and Zebra Fish)
- Fosmid (40kb insert) genomic library screening service (C. elegans and C. briggsae)
- IMAGE human, and mouse cDNA clones
- EST sequencing
- Custom robotic picking and spotting

Other P1, PAC, or BAC services include:

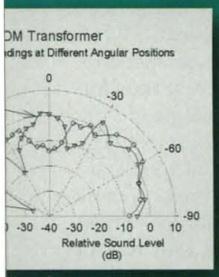
- DNA Preparation
- DNA Insert End Sequencing
- DNA Insert Orientation
- DNA Subcloning

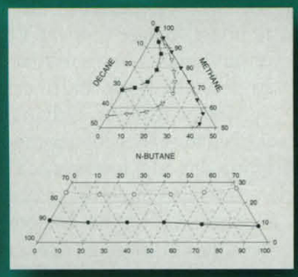
GenomeSystemsInc™
8620 Pennell Drive
St. Louis, Missouri 63114-9823
Voice: 800. 430. 0030 or 314. 692. 0033
FAX: 314. 692. 0044
email: Genome@genomesystems.com
World Wide Web:
http://www.genomesystems.com
France: Appel gratuit, 0590. 2104
Germany: Rufen sie uns an zum ortstarif, 0130. 81. 9081
UK: Call us free on, 0800. 89. 3733

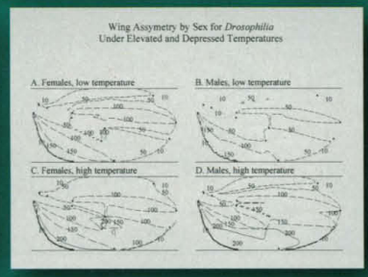
1. The PCR process is covered by patents owned by Hoffman-La Roche.

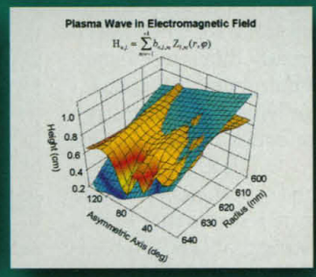
Exact Graphs for Exact Science

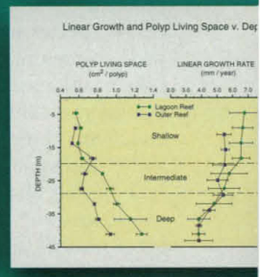
NEW! SIGMAPLOT 4.0

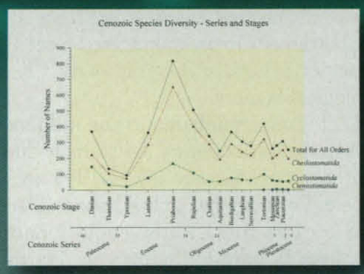


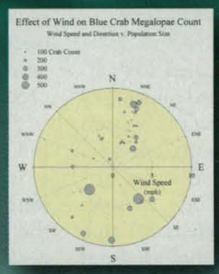


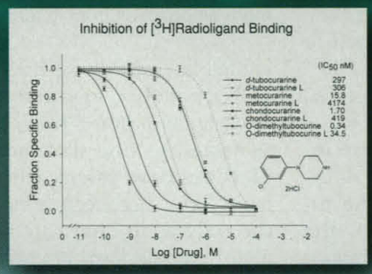


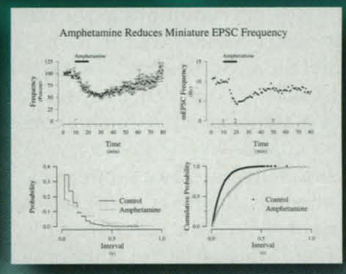


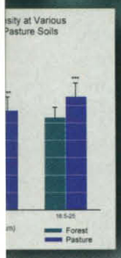


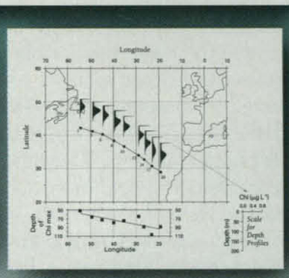


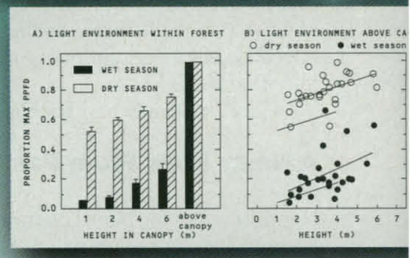












"When it comes to choosing the program that will best meet the needs of the bulk of scientific and engineering users; it isn't close: it's SigmaPlot by a mile."

Dr. Barry Simon, Ph.D.
Review of eleven competitive products
Desktop Engineering Magazine,
September 1996

You've spent months gathering and analyzing data. Now you need to show off your work-clearly and precisely. Sure, you can use a spreadsheet or a data analysis program to make a graph. Many scientists have tried this route. Then they saw that they could not create the exact graph that best represented their data. Scientists like you designed the solution: SigmaPlot.

SHOW OFF YOUR RESULTS

Add your SigmaPlot graphs to lab notebooks, reports, slides, presentations and publications. Place your SigmaPlot graphs in other applications using cut and paste, OLE 2, or exports to EPS, TIFF, JPEG and other graphic file formats.

DESIGNED WITH THE FLEXIBILITY YOU NEED

Customize every detail to create the exact SigmaPlot graph you want. Just a few mouse clicks is all it takes to see one of over 100 curve fits added to your graph using the new SigmaPlot 4.0 Regression Wizard. Choose the error bar direction for every data point. Lay out multiple graphs on a page to see the trends in your data. All this and more with amazing ease.

THE PROOF IS IN THE PLOTTING

Over 100,000 of your colleagues have already seen how SigmaPlot can help them create compelling graphs-like the ones shown here. Researchers, Technicians, Professors, and Engineers have all come to rely on SigmaPlot when they need exact graphs for exact science.

AVAILABLE FOR MACINTOSH

Designed for Microsoft® Windows NT™ Windows 95

Call today at 1-800-345-4740

SPSS Inc., 444 N. Michigan Avenue, Chicago, IL 60611
+312.329.2400; Fax: +312.329.3668
Toll-free: 1.800.621.1393; Fax: 1.800.841.0064
http://www.spss.com/software/science/sigmaplot

SPSS ASC GmbH, Schimmelbuschstrasse 25
40699 Erkrath, Germany
+49.2104.9540; fax: +49.2104.95410
France: +0800.90.37.55, UK: +0880.894982
Distributors worldwide: http://www.spss.com/order/

SIGMAPLOT
Exact Graphs for Exact Science

YSP4SCI-0897

A4740

Circle No. 39 on Readers' Service Card

A TEST OF **Brilliance**

Pharmaceutical Screening
Assay Development Service

Only one of these little piggies is headed to market.

It's a difference so subtle you could miss it at first pass.
Just as subtle hits could be slipping by your current screening assays.

If you're not screening with ultrasensitive luminescent assays from Tropix, you could be missing critical data.

The experts at Tropix work with you to design tests of brilliance: assays perfectly suited to the parameters of your research and the realities of HTS. Of course, Tropix pioneered chemiluminescence – the most sensitive detection method available.

Bank on it. Delegating your assay development to Tropix can significantly reduce capital expenditures, discovery timelines, human resource costs and ultimately shrink your time to market.

Put Tropix to the test. Call 800-542-2369.

TROPIX

PE Applied Biosystems

TROPIX
47 Wiggins Avenue
Bedford, Massachusetts 01730
USA
Tel: 617-271-0045
800-542-2369
Fax: 617-275-8581
E-mail: info@tropix.com

PE APPLIED BIOSYSTEMS

USA
Foster City, CA
Tel: 800-345-5224
415-570-6667
Fax: 415-572-2743

Europe
Langen, Germany
Tel: 49 6103 708 301
Fax: 49 6103 708 310

Canada
Mississauga, Ontario
Tel: 800-668-6913
905-821-8183
Fax: 905-821-8246

Japan
Chiba
Tel: (0473) 80-8500
Fax: (0473) 80-8505

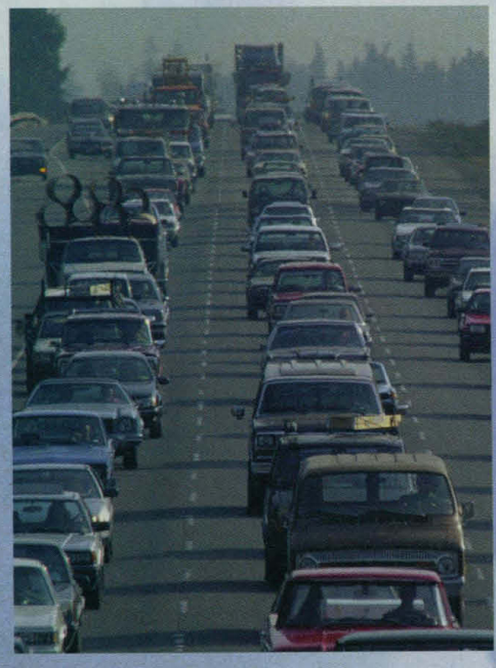
Latin America
Mexico City, Mexico
Tel: 52-5-651-7077
Fax: 52-5-593-6223

Australia
Victoria
Tel: (03) 9212-8585
Fax: (03) 9212-8502

Circle No. 32 on Readers' Service Card

Reformulated Gasoline

Driving to Cleaner Air



Cleaner Burning Fuels Mean Healthier Air

Smog, which is ground level ozone pollution, is a serious local and regional air quality concern because it causes respiratory problems. Right now, 127 million Americans live in areas with poor air quality, according to the EPA. A proven way to reduce ozone pollution is by using cleaner burning gasolines, often called reformulated gasoline (RFG).

Cleaner Burning Fuels Reduce Cancer, Heart and Lung Diseases

Using cleaner burning fuels (RFG) has reduced carcinogens in gasoline emissions by 20 to 40%. Other diseases caused, at least in part, by air pollution include asthma, emphysema, heart disease and osteoporosis.

Cleaner Burning Fuels Reduce Dependence On Foreign Oil

Cleaner burning fuels use oxygenates that are made from domestic natural gas and corn. These oxygenates **(MTBE and ethanol)** displace a certain percentage of gasoline, actually as much as 12%. This means we are using less foreign oil.

Cleaner Burning Fuels Are Cost Effective and High Performers

Ford, General Motors and Chrysler recommend using reformulated gasolines so you can be sure these fuels will perform well in your vehicle. They are easy to use because you fill your car's tank as you always have. And the cost is only 2 to 4 cents more per gallon, a small price to pay for cleaner, healthier air.

Cleaner Burning Fuels Exceed Expectations

Beyond taking the equivalent of 7.5 million cars off America's roads each year, cleaner burning fuels also reduced toxic emissions by 20%.

For more information on this important issue including legislative, health, product safety, research studies, auto performance or environmental (air/water) issues, call 1-800-975-7827.

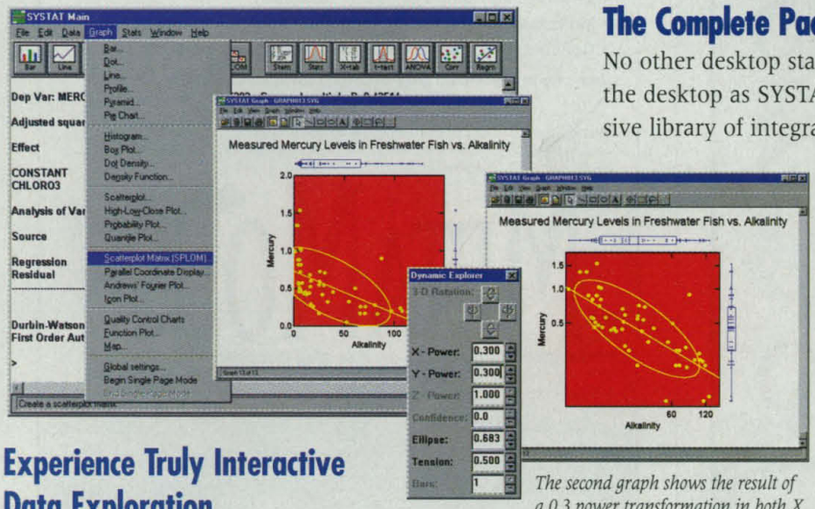
Support cleaner burning fuels in your region, because what is at stake is breathtaking.

Sponsored by: Oxygenated Fuels Association and American Methanol Institute

Circle No. 19 on Readers' Service Card

Unparalleled Research Quality Statistics and Graphics

Biggest Update Ever! 13 New Procedures



The Complete Package for Serious Research

No other desktop statistics package delivers as much power on the desktop as SYSTAT® 7.0 for Windows.® With SYSTAT's extensive library of integrated statistics and graphics, you'll never have to worry about finding the right statistic or perfect graphic for the specific needs of your research data. Designed by statisticians, SYSTAT's algorithms give reliable, accurate results – even when your data are extreme. SYSTAT supports your research from data to discovery.

Experience Truly Interactive Data Exploration

SYSTAT's intuitive Windows user interface delivers immense statistical computing power at the click of a mouse. Discover hidden patterns in your data with SYSTAT's interactive graphic tools including data brushing and realistic 3D rotation. Visually determine the perfect power or log transformation for your data using the Dynamic Explorer.

The second graph shows the result of a 0.3 power transformation in both X and Y variables. SYSTAT's Dynamic Explorer updated the scatterplot, regression line, confidence ellipse and univariate border densities in real time.

Get Meaningful Results

SYSTAT provides statistics with the depth you need to develop rock solid conclusions, and an inexhaustible supply of precise, publication-quality graphics to create clear, convincing presentations of your results.

" SYSTAT 7.0 remains the most capable and nimble Windows statistics and analytical graphics package currently available."
***Alan Fridlund,* Infoworld**

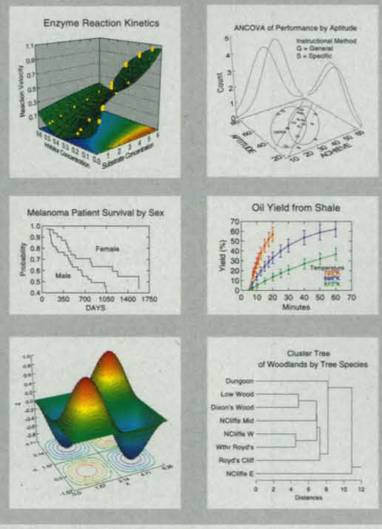
You Can Rely on SYSTAT from Data to Discovery

An Immense Library of Statistics

- ANOVA/MANOVA
- Bootstrapping*
- Canonical and Set Correlations*
- Classification and Regression Trees*
- Cluster Analysis
- Conjoint Analysis*
- Correspondence Analysis*
- Crosstabs
- Descriptive Statistics
- Design of Experiments
- Discriminant Analysis
- Factor Analysis
- General Linear Model
- Linear Regression
- Logistic Regression*
- Loglinear Models
- Multidimensional Scaling
- Nonlinear Regression
- Nonparametric Tests
- Partially Ordered Scales*
- Path Analysis
- Perceptual Mapping*
- Principal Components
- Probit*
- Repeated Measures
- Signal Detection*
- Survival Analysis*
- Test Item Analysis*
- Time Series
- t-tests
- Two Stage Least Squares*
- 13 Probability Densities and Random Number Generators

*New in SYSTAT 7.0! – Upgrade now!

More Scientific Graph Choices



PC Magazine Editors' Choice · PC Week Corporate Top Rated Satisfaction Score · Info World Reader's Choice

Available for Windows 3.1, 95 and NT

Call today

1-800-345-4740

Or fax 1-800-841-0064

http://www.spss.com/Software/Science/SYSTAT

SYSTAT®

A4740
YSYSSCI-0797

SPSS Inc., 444 N. Michigan Avenue
Chicago, IL 60611, +312.329.2400 (3668 fax)
Distributors worldwide: http://www.spss.com/order/

SPSS ASC GmbH, Schimmelbuschstrasse 25
40699 Erkrath, Germany, +49.2104.9540 (95410 fax)
France +0800.90.37.55, UK +0800.894982

Circle No. 40 on Readers' Service Card