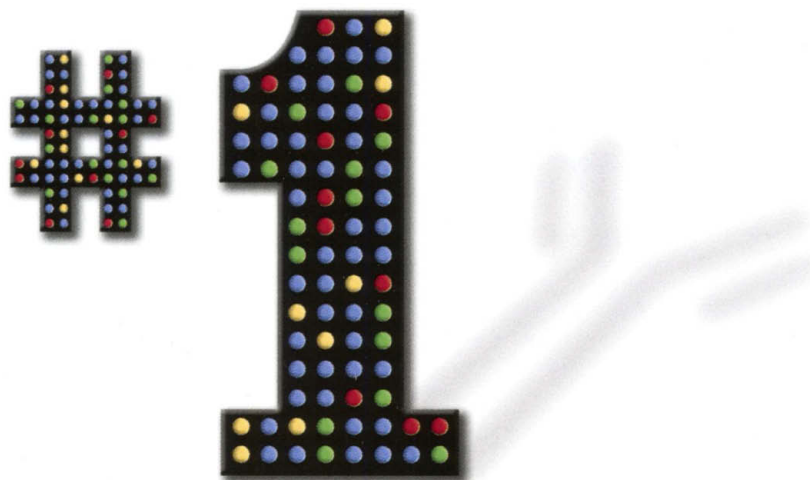


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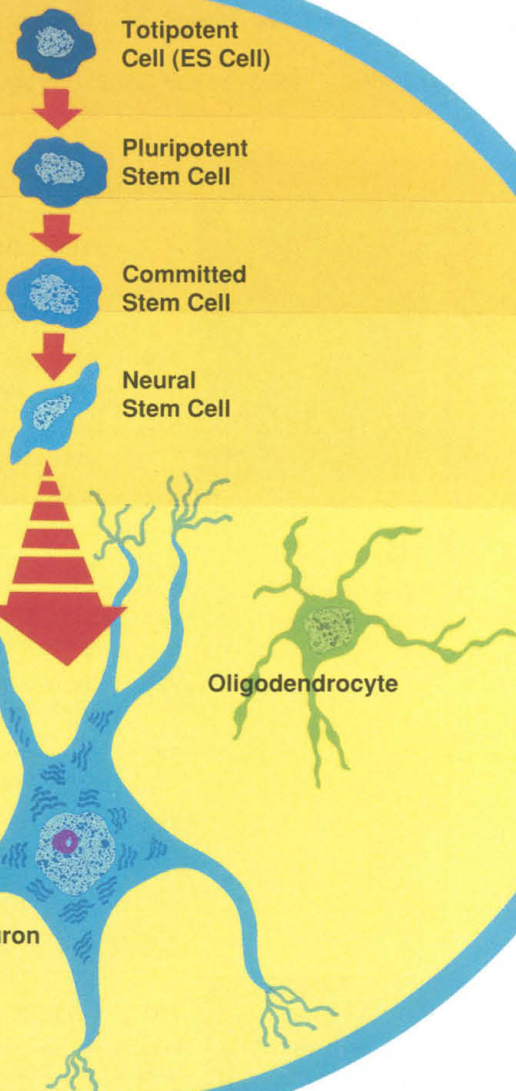
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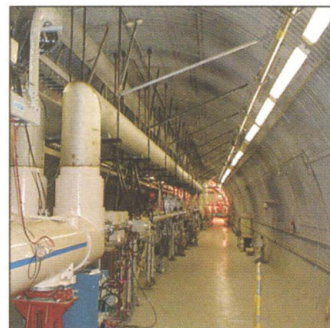
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Science

Volume 298 25 October 2002 Number 5594

697 **SCIENCE ONLINE**
699 **THIS WEEK IN SCIENCE**
703 **EDITORIAL**
D. Michaels, E. Bingham, L. Boden, R. Clapp,
L. R. Goldman, P. Hoppin, S. Krinsky, C.
Monforton, D. Ozonoff, A. Robbins
▼ **Advice Without Dissent**
732

705 **EDITORS' CHOICE**
709 **NETWATCH**
712 **CONTACT SCIENCE**
855 **AAAS NEWS & NOTES**
859 **NEW PRODUCTS**



718

Baffling results
from Brookhaven

NEWS

NEWS OF THE WEEK

- 718 **HIGH-ENERGY PHYSICS:** Wayward Particles Collide With Physicists' Expectations
- 719 **NATIONAL SCIENCE FOUNDATION:** White House Concerns Block Doubling Bill
- 719 **EVOLUTIONARY GENETICS:** Jumbled DNA Separates Chimps and Humans
- 721 **PROTECTING HUMAN SUBJECTS:** Koski Steps Down After Bumpy Ride
- 721 **SCIENCESCOPE**
- 722 **SEISMOLOGY:** Suit Ties Whale Deaths to Research Cruise
- ▼723 **ENDOCRINOLOGY:** Divorcing Estrogen's Bright and Dark Sides
843
- 724 **PALEONTOLOGY:** Cuts at Dino Monument Anger Researchers
- 724 **EUROPEAN RESEARCH:** Directive Could Give Postdocs Permanency

- 725 **LOW-DOSE RADIATION:** U.N. Faces Tough Sell on Chernobyl Research
- 725 **PUBLIC HEALTH:** Creeping Consensus on SV40 and Polio Vaccine
- 727 **ATTOPHYSICS:** X-ray Flashes Provide Peek Into Atom Core

NEWS FOCUS

- 728 **BACTERIOPHAGE THERAPY:** Stalin's Forgotten Cure
Food and Agriculture: Testing Grounds for Phage Therapy
- ▼732 **TOXICOLOGY:** Overhaul of CDC Panel Revives Lead Safety Debate
703
- 733 **INDIA:** Missing Generation Leaves Hole in Fabric of Research
- 735 **THE INSTITUTE FOR GENOMIC RESEARCH:** Gene Researchers Hunt Bargains, Fixer-Uppers
- 737 **BIOINFORMATICS:** The Human Genome in 3D, at Your Fingertips
- 739 **RANDOM SAMPLES**

SCIENCE'S COMPASS

747 LETTERS

Reforming Undergrad Biology Curriculum S. M. Smith; H. M. Lenhoff. **Discussing the Origin of Life** W. Borgeson, N. A. Matlin, G. Wächtershäuser. **Response** A. Lazcano and J. L. Bada. **Another Form of Bias in Conservation Research** J. N. Klironomos. **Response** J. A. Clark and R. M. May. **Revisiting an Archean Impact Layer** B. M. Simonson and S. W. Hassler. **Response** G. R. Byerly and D. R. Lowe. **Corrections and Clarifications**

POLICY FORUM

- 753 **PUBLIC HEALTH:** National Security and the Biological Research Community R. M. Atlas

BOOKS ET AL.

- 755 **MUSEUMS:** *Treasures on Earth* Museums, Collections and Paradoxes K. S. Thomson; *The Poetic Museum* Reviving Historic Collections J. Spaulding; *Making Museums Matter* S. E. Weil, reviewed by J. A. Sabloff
- 756 **NATURAL HISTORY:** *The Darwin Centre The Natural History Museum*, reviewed by L. S. Gramates
- 757 **HISTORY OF SCIENCE:** *Communicating Science The Scientific Article from the 17th Century to the Present* A. G. Gross, J. E. Harmon, M. Reidy; reviewed by L. Ceccarelli

PERSPECTIVES

- 759 **DENSITY FUNCTIONAL THEORY:** In Pursuit of the "Divine" Functional A. E. Mattsson
- 760 **QUANTUM MECHANICS:** To Condense or Not to Condense T. M. Rice
- 761 **CANCER BIOLOGY:** A Matter of Dosage R. Fodde and R. Smits
- ▼763 **SYSTEMS BIOLOGY:** Life's Complexity Pyramid Z. N. Oltvai and A.-L. Barabási
799
824
- ▼764 **ARCHAEOLOGY:** Climate and Human Migrations T. D. Dillehay
821

ESSAY

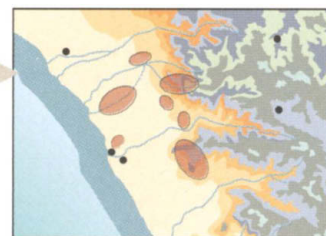
- 766 **EPPENDORF & SCIENCE PRIZE:** Making a Bigger Brain by Regulating Cell Cycle Exit A. Chenn
2002 Grand Prize Winner



755

Museums in
transformation

764
Paleoecology
and archeology
in Northern Peru



BREVIA

- 793 **PCR in a Rayleigh-Bénard Convection Cell**
M. Krishnan, V. M. Ugaz, M. A. Burns

RESEARCH ARTICLES

- 794 **Global Air Pollution Crossroads over the Mediterranean** J. Lelieveld *et al.*
- ▼799
763 **Transcriptional Regulatory Networks in *Saccharomyces cerevisiae*** T. I. Lee *et al.*
- REPORTS**
- 805 **Direct Observation of Percolation in a Manganite Thin Film** L. Zhang, C. Israel, A. Biswas, R. L. Greene, A. de Lozanne
- 807 **Ideal Pure Shear Strength of Aluminum and Copper** S. Ogata, J. Li, S. Yip
- 811 **The Effect of Size-Dependent Nanoparticle Energetics on Catalyst Sintering** C. T. Campbell, S. C. Parker, D. E. Starr
- 814 **Heterogeneous Atmospheric Aerosol Production by Acid-Catalyzed Particle-Phase Reactions** M. Jang, N. M. Czoschke, S. Lee, R. M. Kamens
- 817 **Robotic Observations of Dust Storm Enhancement of Carbon Biomass in the North Pacific** J. K. B. Bishop, R. E. Davis, J. T. Sherman
- ▼821
764 **Human Occupations and Climate Change in the Puna de Atacama, Chile** L. Núñez, M. Grosjean, I. Cartajena
- ▼824
763 **Network Motifs: Simple Building Blocks of Complex Networks** R. Milo, S. Shen-Orr, S. Itzkovitz, N. Kashtan, D. Chklovskii, U. Alon
- 827 **Progression of Vertebrate Limb Development Through SHH-Mediated Counteraction of GLI3** P. te Welscher, A. Zuniga, S. Kuijper, T. Drenth, H. J. Goedemans, F. Meijlink, R. Zeller
- 830 **Timing Requirements for Insulin/IGF-1 Signaling in *C. elegans*** A. Dillin, D. K. Crawford, C. Kenyon
- 834 **Targeting of Cyclic AMP Degradation to β_2 -Adrenergic Receptors by β -Arrestins** S. J. Perry, G. S. Baillie, T. A. Kohout, I. McPhee, M. M. Magiera, K. L. Ang, W. E. Miller, A. J. McLean, M. Conti, M. D. Houslay, R. J. Lefkowitz
- 837 **Role of *Toxoplasma gondii* Myosin A in Powering Parasite Gliding and Host Cell Invasion** M. Meissner, D. Schlüter, D. Soldati
- 840 **Oscillatory Expression of the bHLH Factor Hes1 Regulated by a Negative Feedback Loop** H. Hirata, S. Yoshiura, T. Ohtsuka, Y. Bessho, T. Harada, K. Yoshikawa, R. Kageyama

THE DYNAMIC SYNAPSE

- 769 **Neuroscience: A Vibrant Connection**

REVIEWS

- 770 **The Developing Synapse: Construction and Modulation of Synaptic Structures and Circuits** S. Cohen-Cory
- 776 **Postsynaptic Signaling and Plasticity Mechanisms** M. Sheng and M. J. Kim
- 781 **Emerging Roles of Presynaptic Proteins in Ca^{++} -Triggered Exocytosis** J. Rettig and E. Neher

VIEWPOINTS

- 785 **Neural and Immunological Synaptic Relations** M. L. Dustin and D. R. Colman
- 789 **Alzheimer's Disease Is a Synaptic Failure** D. J. Selkoe

See also Science's *STKE* on p. 697.



COVER 769

The synapses that connect neurons in the nervous system are dynamic entities. The special section in this issue focuses on aspects of synapse formation and development and the dynamic processes that occur at synaptic connections throughout the lifetime of an individual. [Image: Kosi Gramatikoff]

▼843
723

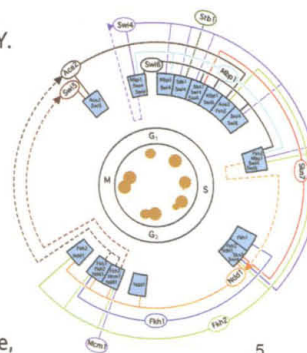
Reversal of Bone Loss in Mice by Nongenotropic Signaling of Sex Steroids

S. Kousteni, J.-R. Chen, T. Bellido, L. Han, A. A. Ali, C. A. O'Brien, L. Plotkin, Q. Fu, A. T. Mancino, Y. Wen, A. M. Vertino, C. C. Powers, S. A. Stewart, R. Ebert, A. M. Parfitt, R. S. Weinstein, R. L. Jilka, S. C. Manolagas

- 846 **Treatment of Ischemic Brain Damage by Perturbing NMDA Receptor-PSD-95 Protein Interactions** M. Aarts, Y. Liu, L. Liu, S. Besshoh, M. Arundine, J. W. Gurd, Y.-T. Wang, M. W. Salter, M. Tymianski

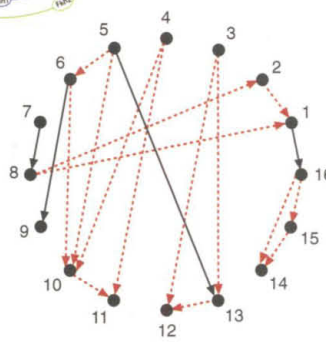
850 Cancer Regression and Autoimmunity in Patients After Clonal Repopulation with Antitumor Lymphocytes

M. E. Dudley, J. R. Wunderlich, P. F. Robbins, J. C. Yang, P. Hwu, D. J. Schwartzentruber, S. L. Topalian, R. Sherry, N. P. Restifo, A. M. Hübicki, M. R. Robinson, M. Raffeld, P. Duray, C. A. Seipp, L. Rogers-Freezer, K. E. Morton, S. A. Mavroukakis, D. E. White, S. A. Rosenberg



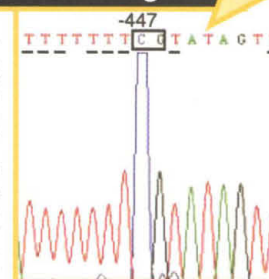
799 & 824

Finding structure in networks



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Methylation-dependent silencing of neuronal genes



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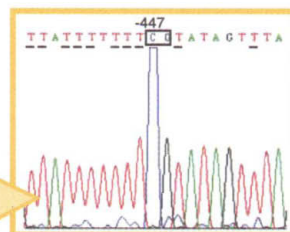
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SCIENCE EXPRESS

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Corepressor-Dependent Silencing of Chromosomal Regions Encoding Neuronal Genes V. V. Lunyak *et al.*

The transcription factor REST/NRSF uses two different mechanisms to repress neuron-specific genes.



Molecule Cascades A. J. Heinrich, C. P. Lutz, J. A. Gupta, D. M. Eigler

An STM tip can nudge patterns of CO molecules on a copper surface into "hopping," a movement that can be engineered to perform one-time computational logic functions.

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Exploring the options for postdocs looking to leave bench science.

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S. Steghaus-Kovac

How different are the facilities for researchers at Germany's private institutions?

CANADA: The Academic Consultant S. Cheung

Tools and tips for academics wishing to develop a complementary consulting business.

US: Coming Out in the Sciences—A Graduate Student's Perspective M. Hughes

For a gay student, the decision to come out to colleagues cannot be taken lightly.

SINGAPORE: BioMed-Singapore—A One-Stop Shop J. Wong

Singapore's national Web portal for the biomedical sciences is a great resource for students, scientists, and investors.

EUROPE: Serial Postdoc Killer? K. Urquhart

Does an EC directive mean the end of successive short-term contracts and the beginning of greater job security for academic researchers?

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NEWS FOCUS: The Drifter I. Chen

A sinuous pathway has led Gary Ruvkun to probe how *C. elegans* grows old.

GENETICALLY ALTERED MICE: Liver-Specific IGF-1-Deficient Mice

IGF-1 regulates growth and cell proliferation by inducing the phosphatidylinositol 3-kinase survival pathway.

NOTEWORTHY THIS WEEK: Boundary War M. Beckman

Opposing enzymes establish border between active and silent DNA.

NOTEWORTHY THIS WEEK: Deadly Giveaway R. J. Davenport

Protein linked to Parkinson's disease squanders clearance molecules.

science's stke

signal transduction knowledge environment

www.stke.org

PERSPECTIVE: AMPA Receptors Do the Electric Slide S. deSouza and E. B. Ziff

769 Dynamic palmitoylation of the synaptic-anchoring protein PSD-95 may regulate clustering of AMPA receptors in the synapse.

REVIEW: Glutamate Receptor Trafficking in Synaptic Plasticity

769 A. Contractor and S. F. Heinemann

Changing the glutamate receptor complement at the synapse contributes to long-term potentiation and long-term depression.

EDITORIAL GUIDE: The Dynamic Synapse—Neuronal Nexus for

769 Signaling L. D. Chong, N. R. Gough, L. B. Ray

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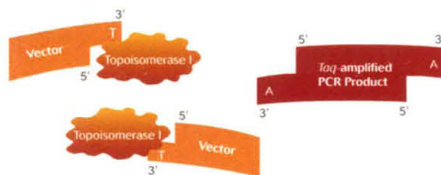


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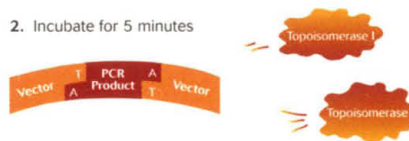
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THIS WEEK IN Science

edited by Phil Szuromi

Mediterranean Air Pollution

A large, international field measurement campaign—MINOS, the Mediterranean Intensive Oxidant Study—was conducted in 2001 to investigate anthropogenic contributions to environmental stresses affecting rainfall, ecosystems, agriculture, and drinking water supplies. Atmospheric chemistry–transport model simulations suggest that summertime tropospheric ozone is enhanced across the entire Mediterranean basin and contribute substantially to the radiative forcing of climate. Lelieveld *et al.* (p. 794) used a coastal station in north Crete and two aircraft to measure a wide range of gases, aerosols, radiation, and meteorological parameters. They conclude that European pollution of the Mediterranean lower troposphere has a strong impact on air quality and climate, particularly during summer, and that pollution in the free troposphere is largely determined by intercontinental transport, with upper tropospheric pollution from Asia by monsoons sometimes reaching into the stratosphere.

Magnetic Evolution in Manganites

The colossal magnetoresistance effect, in which the material's resistance drops rapidly in response to an applied magnetic field, is currently being developed for the applications in memory elements. Despite the complex phase diagram of such materials, a picture is developing based on the seeding, growth, and percolation of magnetic domains to explain the results. However, such an interpretation has so far relied on indirect experiments. Using magnetic force microscopy, Zhang *et al.* (p. 805) present direct evidence supporting the above scenario, but surprisingly find that the domains evolve at temperatures far away from the transition region. **X**



Second Time Around

Secondary organic aerosols particles form in the atmosphere through gas-phase reactions of volatile organic compounds associated with photochemical oxidant cycles. These aerosols have potentially negative health effects, contribute to the formation of visibility-reducing haze, and affect Earth's radiative balance. Jang *et al.* (p.

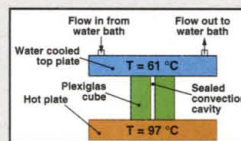
807

Shear Surprise

The elastic modulus of a material is a measure of how much tensile force is required to deform a sample and should generally be a good predictor of shear strength. However, first-principles calculations by Ogata *et al.* (p. 807) show that because of differences in atomic bonding, aluminum, which has a lower modulus than copper, can undergo larger strains before yielding and thus has the greater shear strength. External pressure is also shown to harden or soften the metals, depending on the crystal direction of the applied force, contrary to the common wisdom that such effects should be negligible.

And in Brevia ...

Continuous cycling in the polymerase chain reaction (PCR) amplification of DNA has been achieved by Krishnan *et al.* (p. 793) by using convection to shuttle the reaction volume through temperature zones associated with denaturation and annealing.



814) report that the formation of acidic surfaces on atmospheric organic aerosols can lead to large increases in secondary organic aerosol mass. Their experimental observations confirm that inorganic acids, such as sulfuric acid, catalyze particle-phase heterogeneous reactions of atmospheric organic carbonyl species. These reactions lead to a large increase in secondary organic aerosol mass and help stabilize the organic layers as the particles age. Climate models that do not take these reactions into account will likely underpredict radiative forcing caused by aerosols.

Robotic Eyes

Windblown dust may carry minerals such as iron that are often the limiting nutrient of

productivity in many areas of the world ocean. Bishop *et al.* (p. 817) describe results obtained with a new generation of robotic ocean sensors. They deployed 3000 autonomous profiling floats, which can function for years at a time, in the North Pacific just prior to the storms that swept dust from the Gobi desert across the Pacific Ocean in April and May 2001. They present observations of biomass variability between the surface and 1000 meters depth that show a likely biotic response to fertilization of high nutrient–low chlorophyll waters by iron and other micronutrients in the Asian dust.

High But Not Dry

The peopling of the New World after deglaciation appears to have followed patterns that reflect the response of early settlers to environmental conditions. Nuñez *et al.* (p. 821; see the Perspective by Dillehay) describe the discovery and survey of many new early sites in the Atacama Desert region of northern Chile at elevations exceeding 4000 meters. Most of the sites are concentrated in caves or around paleolakes. Settlement of the region about 13,000 years ago apparently coincided with a change from arid to humid conditions, and sites were abandoned starting about 9500 years ago when aridity returned.

Transcriptional Networks and Their Relatives

Living cells are the product of gene expression programs involving regulated transcription of thousands of genes. Lee *et al.* (p. 799) used immunoprecipitation and microarray studies to build a global analysis of transcriptional regulatory networks in *Saccharomyces cerevisiae*. Patterns observed were characterized as motifs that were then combined by an automatic process into a net-



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1994



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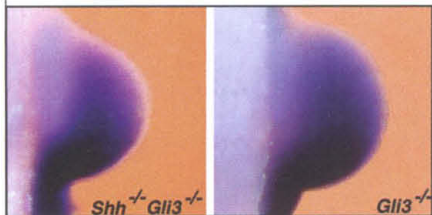


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work structure. Such transcriptional regulation represents a network of interactions, and similar networks underlie apparently unrelated systems such as food webs and electronic circuits. To examine their fundamental design features, Milo *et al.* (p. 824; see the Perspective by Oltvai and Barabási) looked at local organizing principles of networks, expressed as motifs of how different interactors are joined, that occurred at more than random frequencies. Motifs shared by food webs had features that were not shared by transcription networks from yeast and from *Escherichia coli* or by electronic circuits, although similarities were seen in information-processing circuits.

Digital Programming

Digit duplications (polydactyly) are seen in mice with defects in the transcription factor *Gli3*, and excess digits can be induced by ectopic expression of *Sonic Hedgehog* (*Shh*) in mouse limb buds. It was previously thought that the *Gli3* mutant phenotype was caused by ectopic *Shh* expression. Using mouse genetics and molecular analyses, te Welscher *et al.*



(p. 827) examine the relative mechanisms for *Shh* and *Gli3* in limb patterning. When *Shh* function was eliminated, the digits were severely truncated, whereas loss of *Gli3* function caused polydactyly. Mouse embryos lacking both *Shh* and *Gli3* were polydactylous. Digits can form by two completely different mechanisms, one of which is SHH dependent and another that is SHH independent (represented by the GLI3 mutation). Thus, a major function of SHH is to counteract the repressive action of GLI3. X

Live Long and Reproduce

Insulin and other insulin-like growth factors signal through a pathway that involved phosphatidylinositol 3-kinase and the forkhead transcription factors. This pathway is a critical regulator of life-span and reproduction in many organisms. Dillin *et al.* (p. 830) have now determined that in the nematode *Caenorhabditis elegans*, life-span can be regulated through this pathway only in the adult and reproduction only in the developmental phases. Thus, the long-standing notion that life-span can be lengthened only at the expense of reproductive fitness is almost certainly false.

Power Gliding

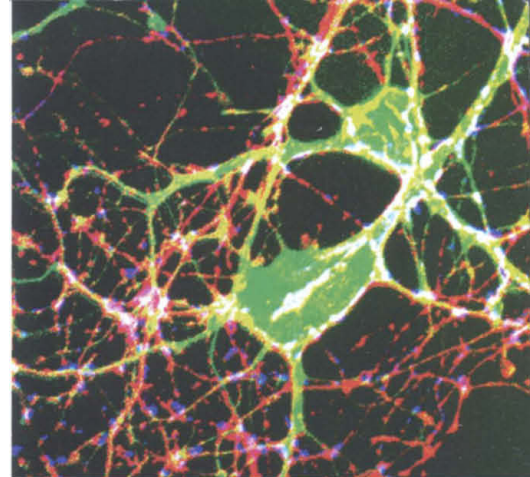
The role of the motor protein myosin A in the pathogenesis of *Toxoplasma gondii* has been examined by Meissner *et al.* (p. 837), who regulated the expression of a target protein to maintain the possibility of parasite propagation in the presence of a mutation of a gene required for invasion and parasite growth. They confirmed that myosin A is required to power the invasion of host cells and is a virulence factor in a mouse model system.

Strong Bones via Tailored Hormones

Interest in alternative preventive strategies against bone loss has intensified in light of the recent announcement of risks associated with hormone replacement therapy. Previous cell culture studies showed that estrogen and androgen protect bone through a mechanism distinct from the DNA-mediated mechanism underlying their effects on reproductive organs. Kousteni *et al.* (p. 843; see the news story by Miller) now show that a synthetic compound (estren) that mimics these "nongenotropic" effects can increase bone mass in estrogen- and androgen-deficient mice without adverse effects on reproductive organs.

A Gentler Treatment for Stroke

Although *N*-methyl-D-aspartate (NMDA) receptors play an important role in stroke, simply blocking them would lead to many unwanted side effects. Aarts *et al.* (p. 846) suggest a novel approach to treat ischemic brain injury without blocking NMDA receptors. They constructed peptides that bind to molecular domains governing the interaction of NMDA receptors with the postsynaptic density protein PSD-95. Normal synaptic activity and the subsequent postsynaptic calcium influx remain intact but deleterious downstream neurotoxic signaling events are inhibited.



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Figure shows primary dissociated mouse neurons of mixed glial cells nucleofected with eGFP. 48 hours post nucleofection, the cells were analyzed by light (A) and fluorescence microscopy (B). (Courtesy of Dr. A. Dityatev, Center for Molecular Neurobiology, Hamburg, Germany).

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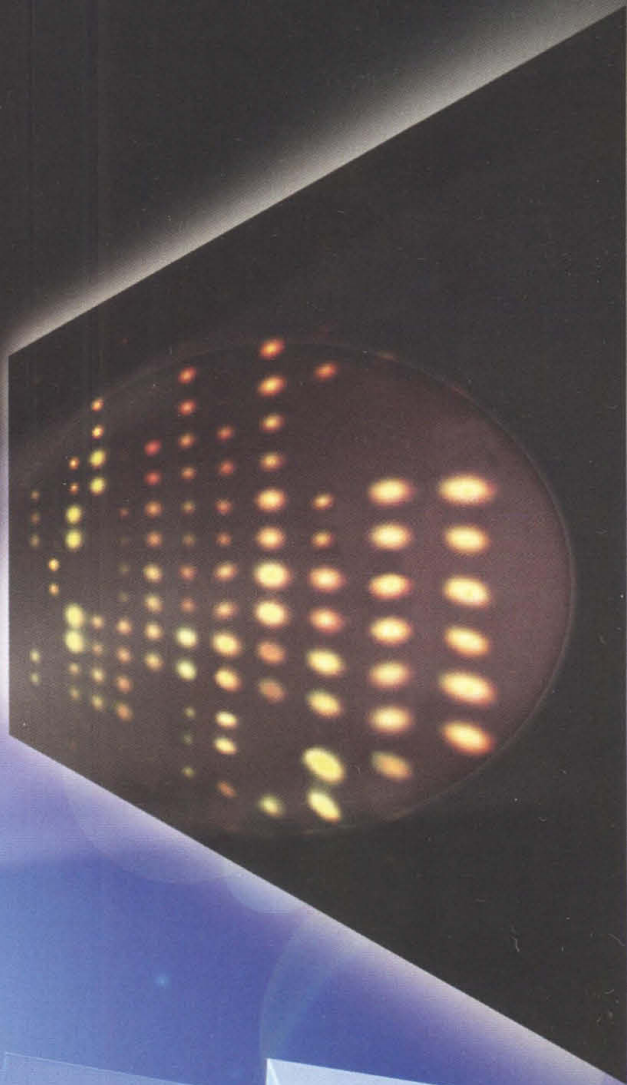
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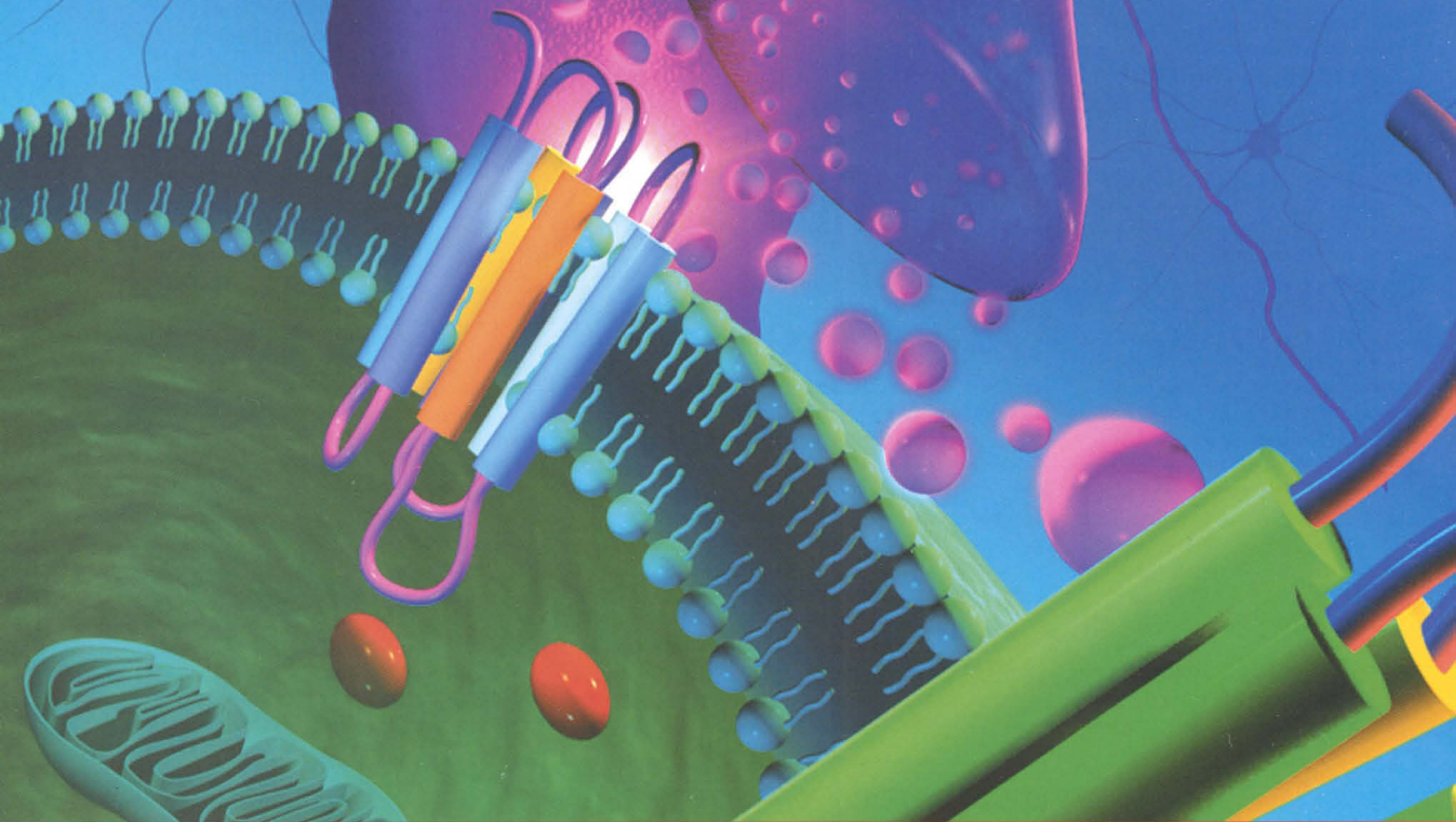
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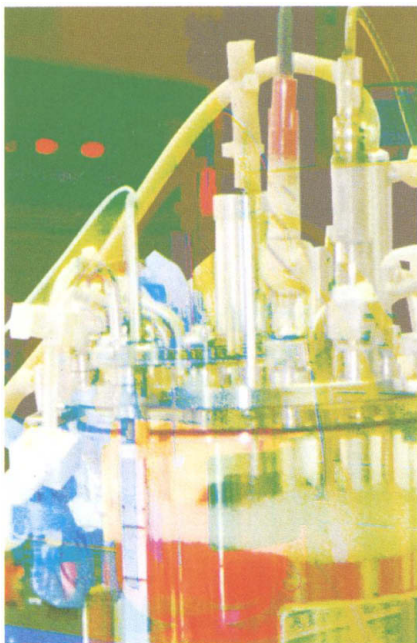
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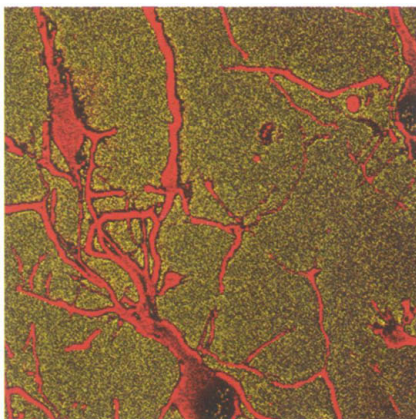


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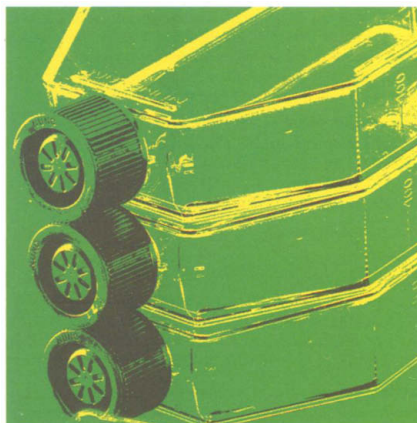


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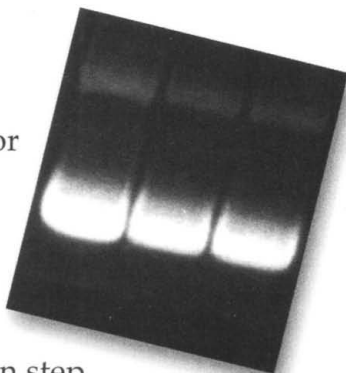
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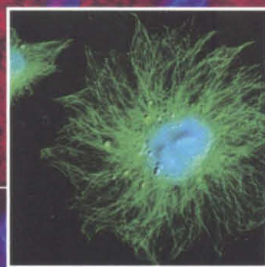
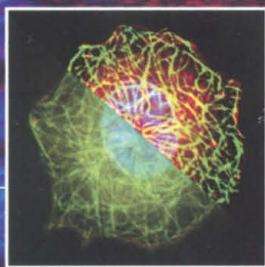
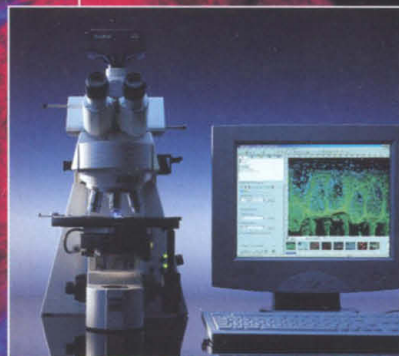
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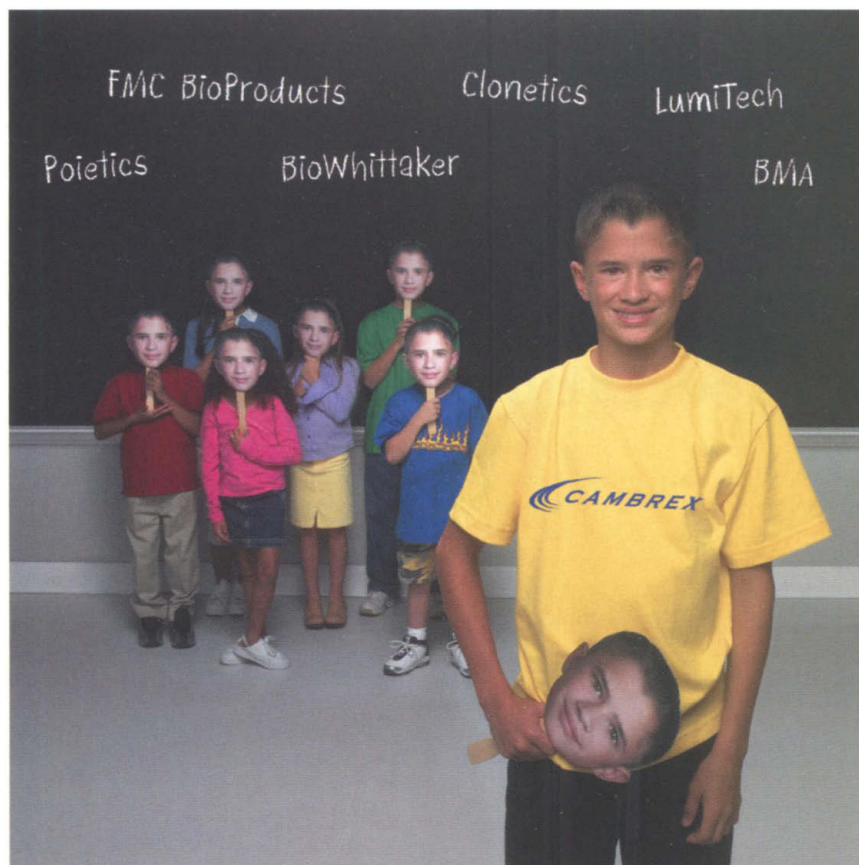
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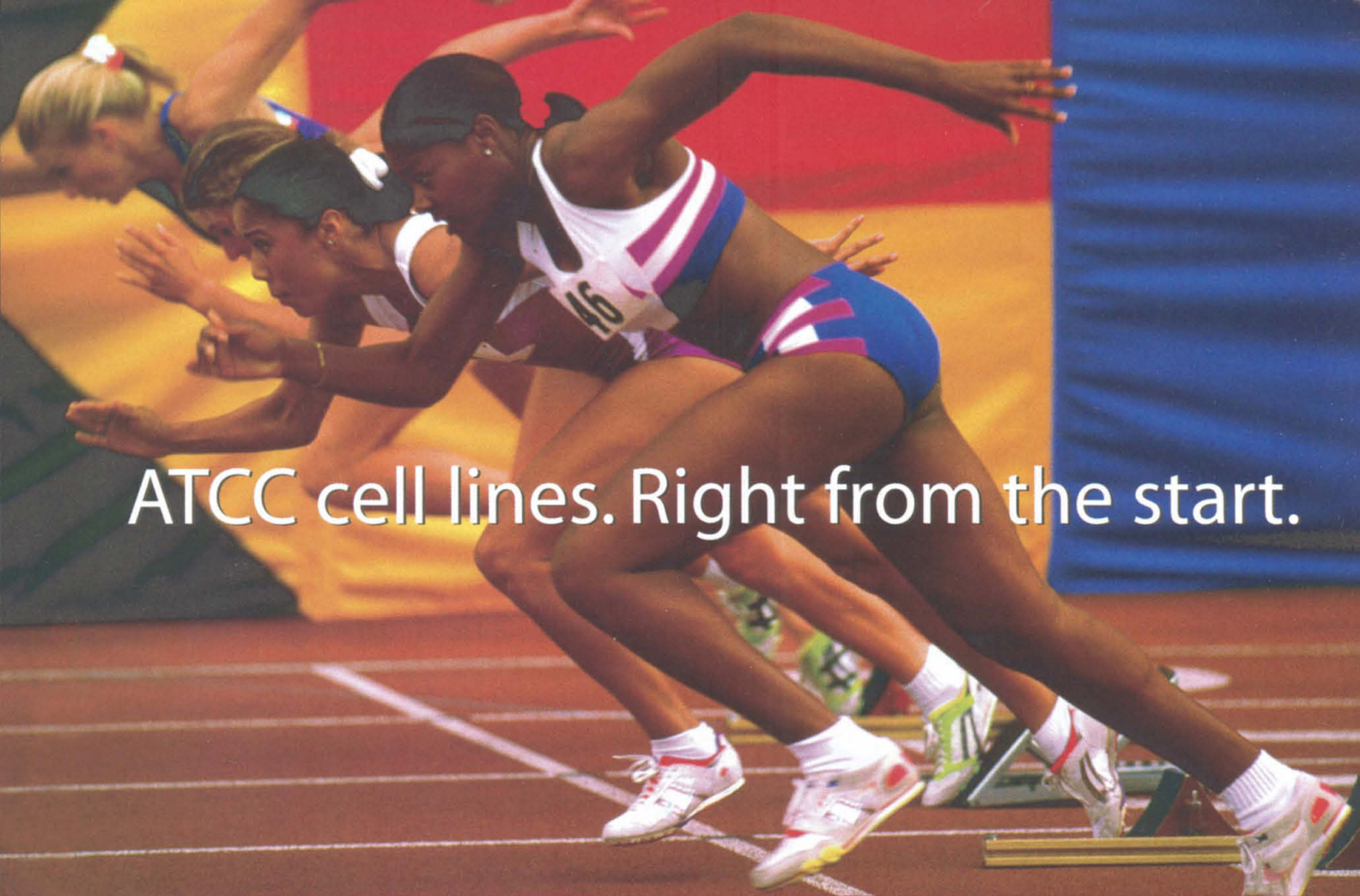
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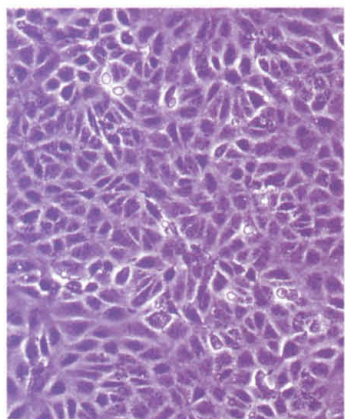
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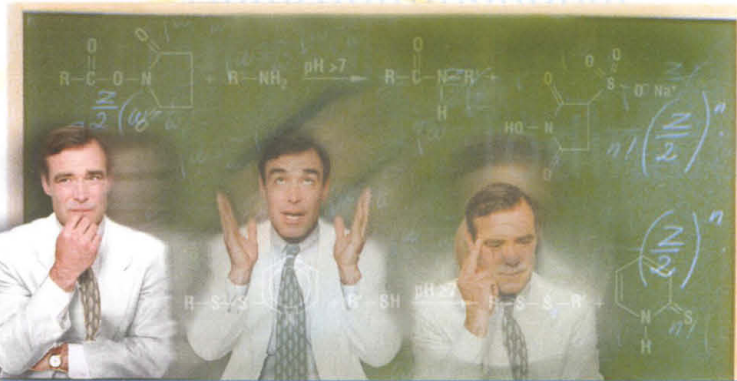
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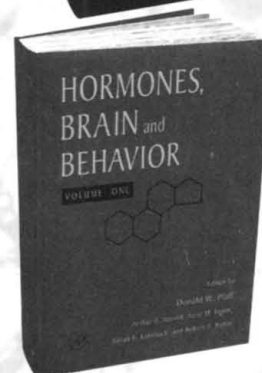
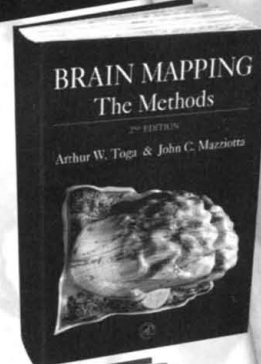
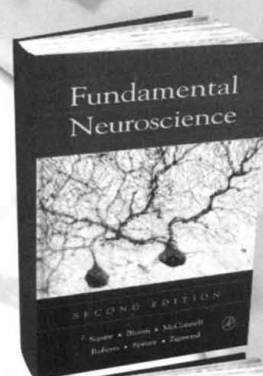
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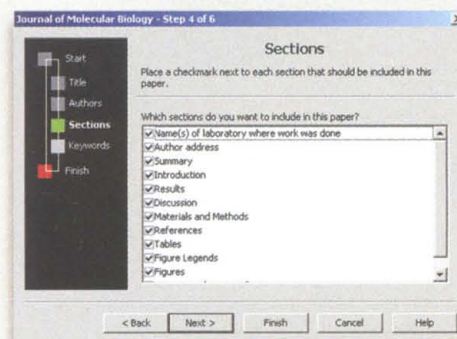
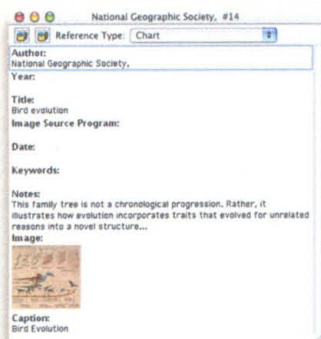
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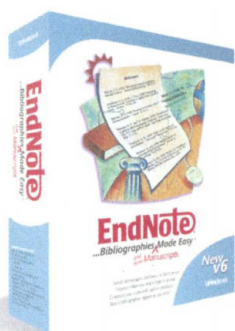
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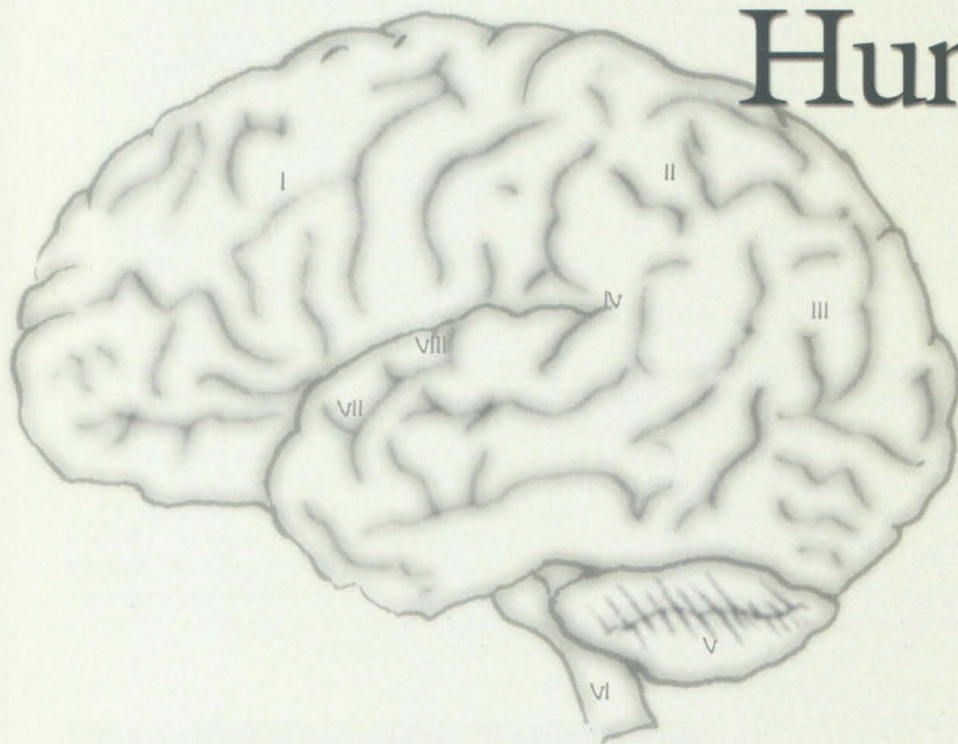
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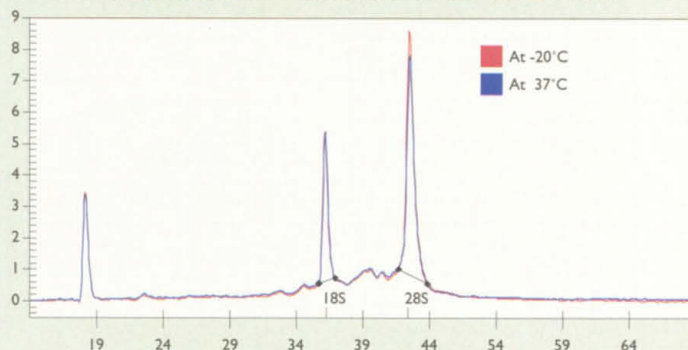
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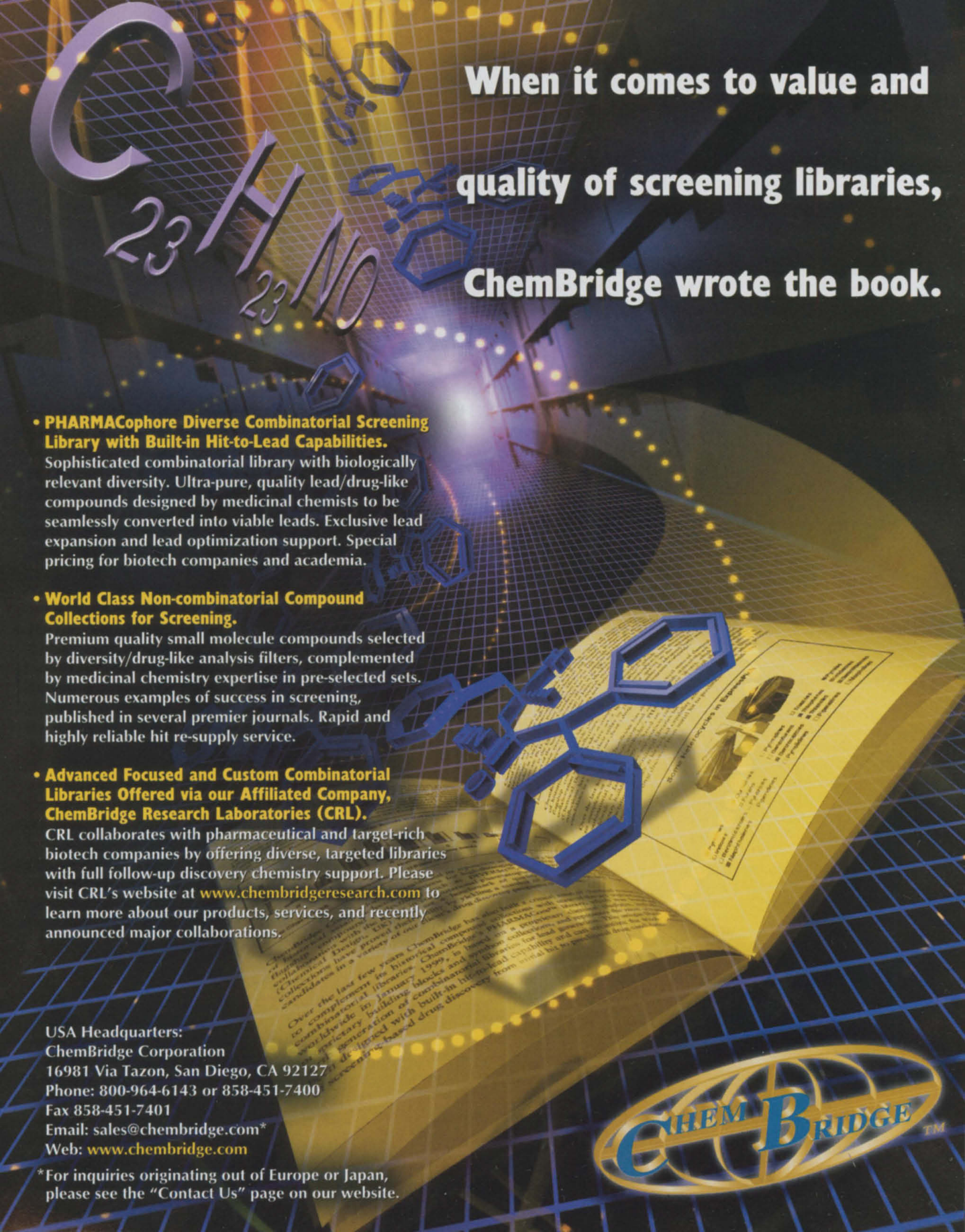
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