22 February 2002

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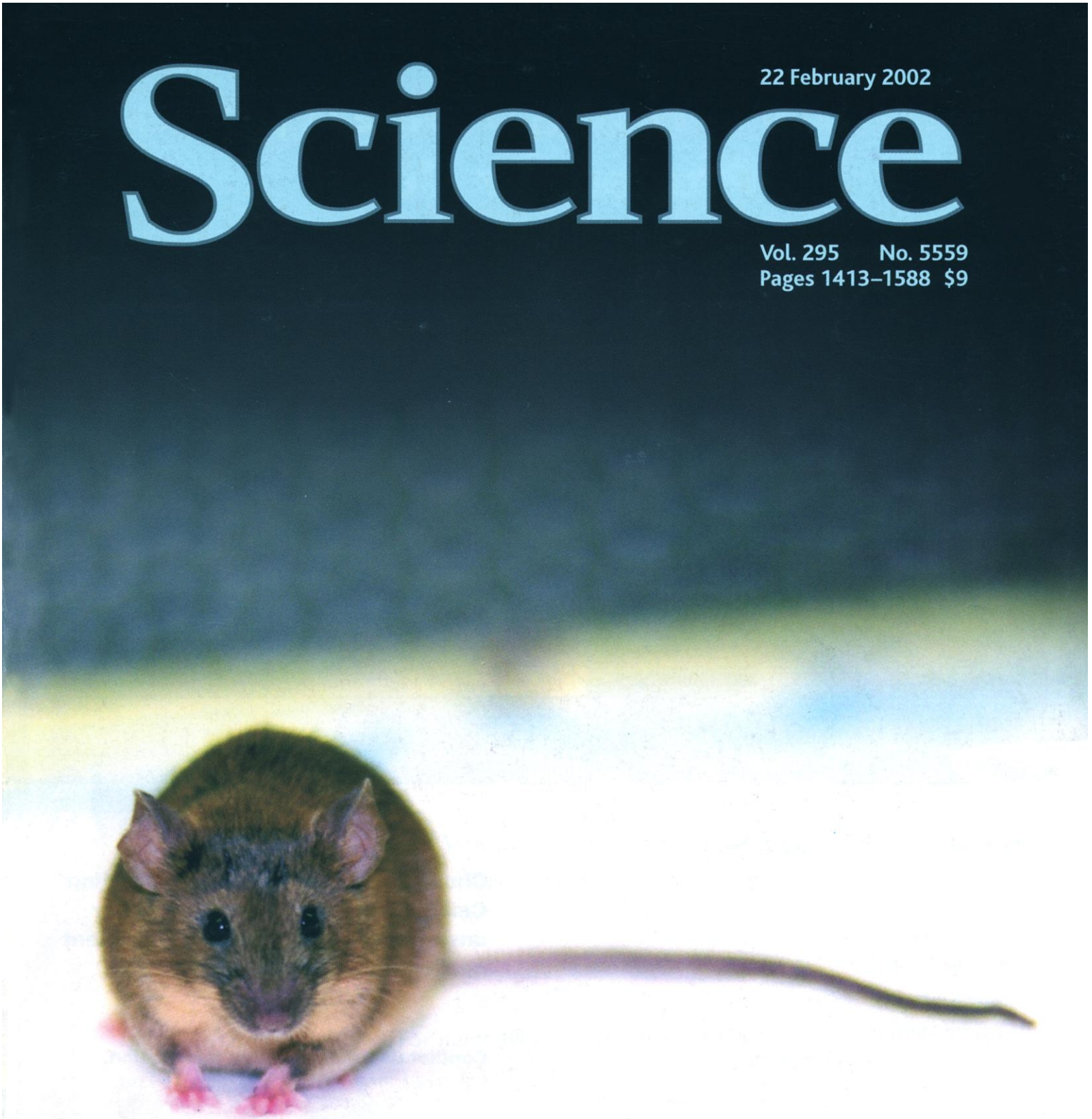

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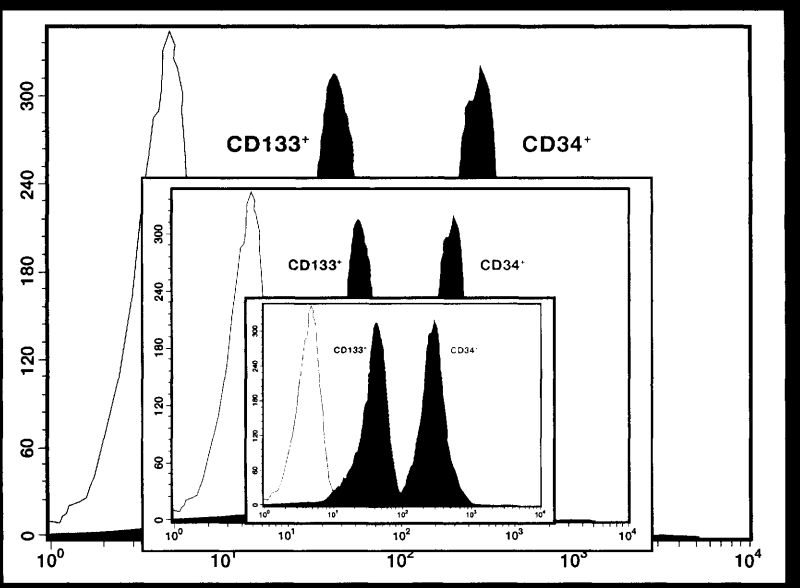

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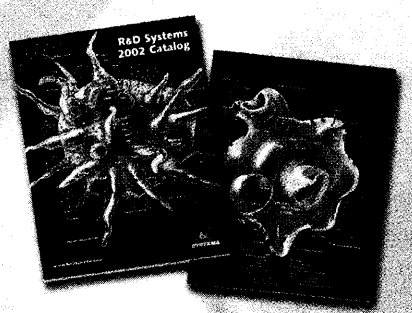

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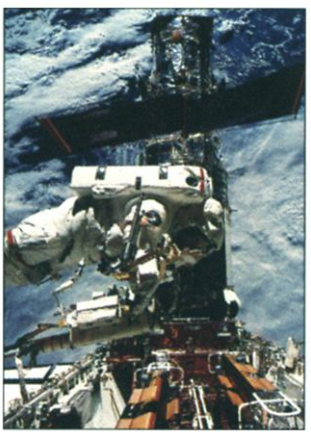

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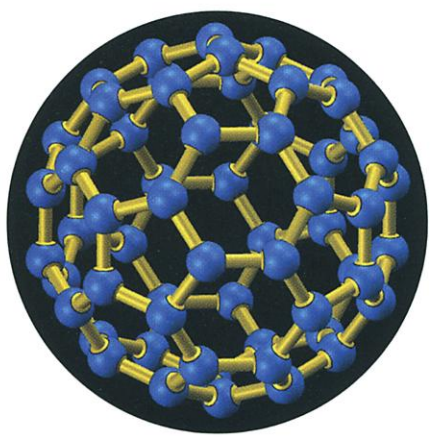
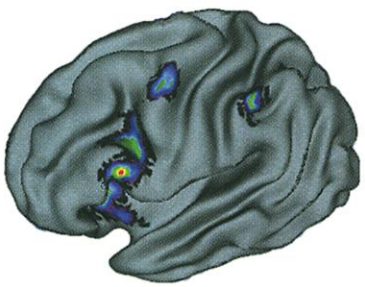


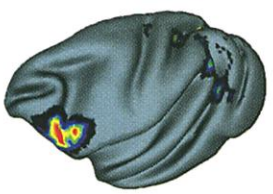
1500
Flash-pyrolysis route to C_{60}

REPORTS

COVER 1493

A genetically altered male mouse that seemingly cannot distinguish the sex of other mice, a task normally accomplished in rodents through the detection of sex-specific pheromones. Without TRP2, an ion channel necessary for activation of the vomeronasal organ by pheromones, such mice display unusual lack of aggression toward other male mice and initiate mating behavior with both males and females. [Image: C. Dulac]

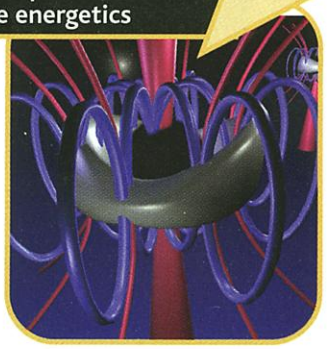




1532
High-level cognitive function in monkeys

New on *Science* Express

New spin on black hole energetics



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Detecting Energy Emissions from a Rotating Black Hole
M. H. P. M. van Putten and A. Levinson

The authors show that a rotating black hole with a plasma torus can release gamma-ray bursts, neutrinos, and gravitational waves.

Structure of HP1 Chromodomain Bound to a Lysine 9–Methylated Histone H3 Tail S. A. Jacobs and S. Khorasanizadeh

A structural study reveals how the HP1 chromodomain recognizes both the methylammonium group and the lysine 9 residue, and why some chromodomains do not interact with chromatin.

Structural Insights into Group II Intron Catalysis and Branch-Site Selection L. Zhang and J. A. Doudna

The catalytic core of the group II intron contains a two-nucleotide bulge.

TECHNICAL COMMENTS

The Problematic Rise of Archean Oxygen

Catling *et al.* (Reports, 3 Aug. 2001, p. 839) offered an explanation for why Earth's atmospheric oxygen suddenly increased between 2.4 and 2.2 billion years ago (Ga), hundreds of millions of years after the onset of bacterial photosynthesis: In the early, reducing atmosphere, hydrogen from photosynthetic splitting of water was first incorporated into methane (CH_4) as an intermediate product. Subsequent upper atmospheric photolytic decomposition of CH_4 into carbon and hydrogen, they suggested, allowed hydrogen to escape to space, and the permanent loss of that reductant led, over time, to irreversible oxidation of Earth. Towe comments that "the fate of the photosynthetic free oxygen produced each year . . . presents a serious problem for this proposal": One result of the rapid buildup of such oxygen, he suggests, would be oxidation of the methane itself, reducing the rate of atmospheric methane accumulation and, thus, hydrogen escape. Catling *et al.* respond that "kinetic losses of O_2 operated at a greater rate than [Towe] allows," sufficient to allow the buildup of CH_4 that they envisage—and that such a buildup "may help explain several major issues in Earth history."

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/295/5559/1419a

science's next wave www.nextwave.org

career resources for scientists

UK: Work and Play—A Lecturer's Life in a New University
A. Cunningham

Juggling teaching, administration, and research brings rewards as well as frustrations for those seduced by the lure of academia.

Canada: Rough Road Ahead for BC Universities L. McKarney

British Columbia's students and universities are facing their biggest challenge yet—the provincial government's controversial "make-over" strategy.

US: Educated Woman—Half-Life of a Graduate Student
M. P. DeWhyse

Social considerations likely did not figure prominently when you were thinking about where to go to grad school—so what should you do when you can no longer ignore your need for a life outside the department?

US: The CDC Toolkit Bellies Up to the Federal Trough

Soo–*ey*! The latest addition to the Career Development Center's toolkit offers the most comprehensive annotated guide to federal research funding anywhere. The slop is in the pail . . . come 'n get it!

Singapore: The Singapore Research Centre—Developing Cellular Therapeutics J. Wong

Explore the opportunities that will be created by one of Singapore's newest investments, intended to bring it to the frontier of global stem cell research.

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Perspective: The Dawn of the SPPARMs? S. M. Rangwala and M. A. Lazar

Advances in the identification of drugs for the treatment of type II diabetes.

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science of aging knowledge environment

Is Postmenopausal Life-Span a Gift of Modern Health or a Product of Natural Selection? D. J. Holmes

Views from endocrinology to anthropology.

Older and Stronger C. Seydel

Small molecule might help aged plants resist disease.

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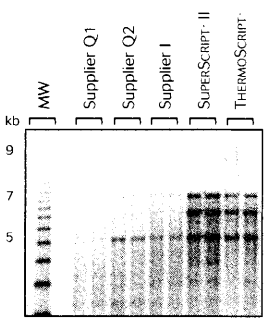

Comparison of yields of cDNA synthesis using various reverse transcriptases.

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THIS WEEK IN Science

edited by Phil Szuromi

Modeled Instability

During periods when the Northern Hemisphere continental ice sheets melted, the sudden addition of fresh water to the North Atlantic Ocean could have caused the slowing or cessation of North Atlantic deepwater formation and thermohaline circulation. Schmittner *et al.* (p. 1489) use a coupled model to examine interactions between the ocean, atmosphere, sea ice, and continental ice sheets during glacial periods. They find that the stability of the North Atlantic overturning was greatly reduced during glacial conditions, and that interactions between ice sheets, ice bergs, and ocean circulation could produce the rapid warming events of millennial duration known as interstadials.

1503

Electrical DNA Detection

One of the simplest ways to detect a molecule is devise an assay based on electrical conductivity. Park *et al.* (p. 1503; see the news story by Service) show that DNA can be detected electrically at concentrations as low as 500 femtomolar. Capture strands placed a substrate between two electrodes bind a longer target DNA strand. Probe strands capped with gold nanoparticles are then hybridized to the remainder of the target. When exposure to a silver solution, the nanoparticles nucleate silver deposition, and the time to develop a wire is inversely proportional to DNA concentration. Exposure to high salt concentration at room temperature provides a stringency wash that allows the elimination of thermal cycling.

And in Brevia ...

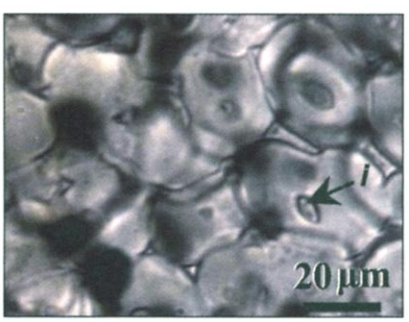
Extracellular DNA plays a critical role in the establishment of *Pseudomonas aeruginosa* biofilms, as demonstrated by Whitchurch *et al.* (p. 1487), who suggest that deoxyribonuclease I may be useful as a prophylactic against chronic *P. aeruginosa* infection.

An Ear to the Past

It is thought that El Niño–Southern Oscillation (ENSO) events were less frequent in a generally warmer Pacific basin during the mid-Holocene, but a lack of sea surface temperature (SST) data had made this assertion difficult to prove. Andrus *et al.* (p. 1508) studied sagittal otoliths (ear stones) from Peruvian sea catfish that lived in the shallow waters of coastal Peru approximately 6500 to 6000 years before the present. These ear structures precipitated aragonite ($CaCO_3$), and their oxygen isotopic compositions provide a record of ocean temperature. These high-resolution (sub-seasonal) measurements show that the eastern Pacific was indeed warmer during that interval than it is today, and that seasonal SST variability was greater then at 9°S latitude than at 5°S.

Pressure? What Pressure?

Two strains of bacteria can actually live at pressures above 1000 megapascals (Mpa), well beyond the currently known conditions for life on Earth (for example, the pressure in the deepest part of the ocean is about 100 MPa). Sharma *et al.* (p. 1514) conducted experiments observing such activity for *Shwanella oneidensis*, which is related to several other bacteria that live in deep, high-pressure environments. More surprisingly, even *Escherichia coli* can survive under these conditions. Bacteria were still viable under ambient conditions even after a stint in ice at 1200 to 1600 MPa.



CREDIT: SHARMA *ET AL.*

Sex, Mice, and Videotapes

The vomeronasal organ (VNO) is a sensory organ at the base of the nasal cavity that allows mice to detect and respond to pheromones, the chemical cues emitted by other mice which provide information about their social and sexual identity. To investigate the specific behavioral responses that are mediated by the VNO, Stowers *et al.* (p. 1493; see the cover and the 1 February news story by Beckman) produced mice genetically deficient in TRP2, a putative ion channel of the transient receptor potential family that is expressed selectively in the VNO. Sensory activation of VNO neurons was completely abolished in mice lacking TRP2. The results of videotaped behavioral assays revealed that male mice lacking TRP2 failed to display aggression toward other males, and, surprisingly, they initiated sexual behavior toward both males and females. VNO activity, which had been previously thought to be required for the initiation of male-female mating, may actually confer on mice the ability to distinguish males and females.

A Rational C_{60} Synthesis

Recently, it was shown that a polycyclic aromatic hydrocarbon, $C_{60}H_{30}$, can lose hydrogen under laser irradiation to form gas-phase C_{60}. Scott *et al.* (p. 1500) now show that a chlorinated derivative, $C_{60}H_{27}Cl_3$, can produce C_{60} through a flash-vacuum pyrolysis step in sufficient quantities to be isolated. Although not yet competitive with graphite vaporization synthesis, this approach might allow fullerenes to be synthesized that are not major products by that route.

The Plan for Partitioning Plant Parts

A general model can now predict how biomass is partitioned among plant organs both within and across seed plants. Enquist and Niklas (p. 1517; see the Perspective by Zens *et al.*) have quantified the scaling of stem, leaf, and root mass and show how different plants may differ in their allometric constants. These "general allocation rules" were then tested on a large global compilation of inter- and intraspecific patterns of leaf, stem, and root

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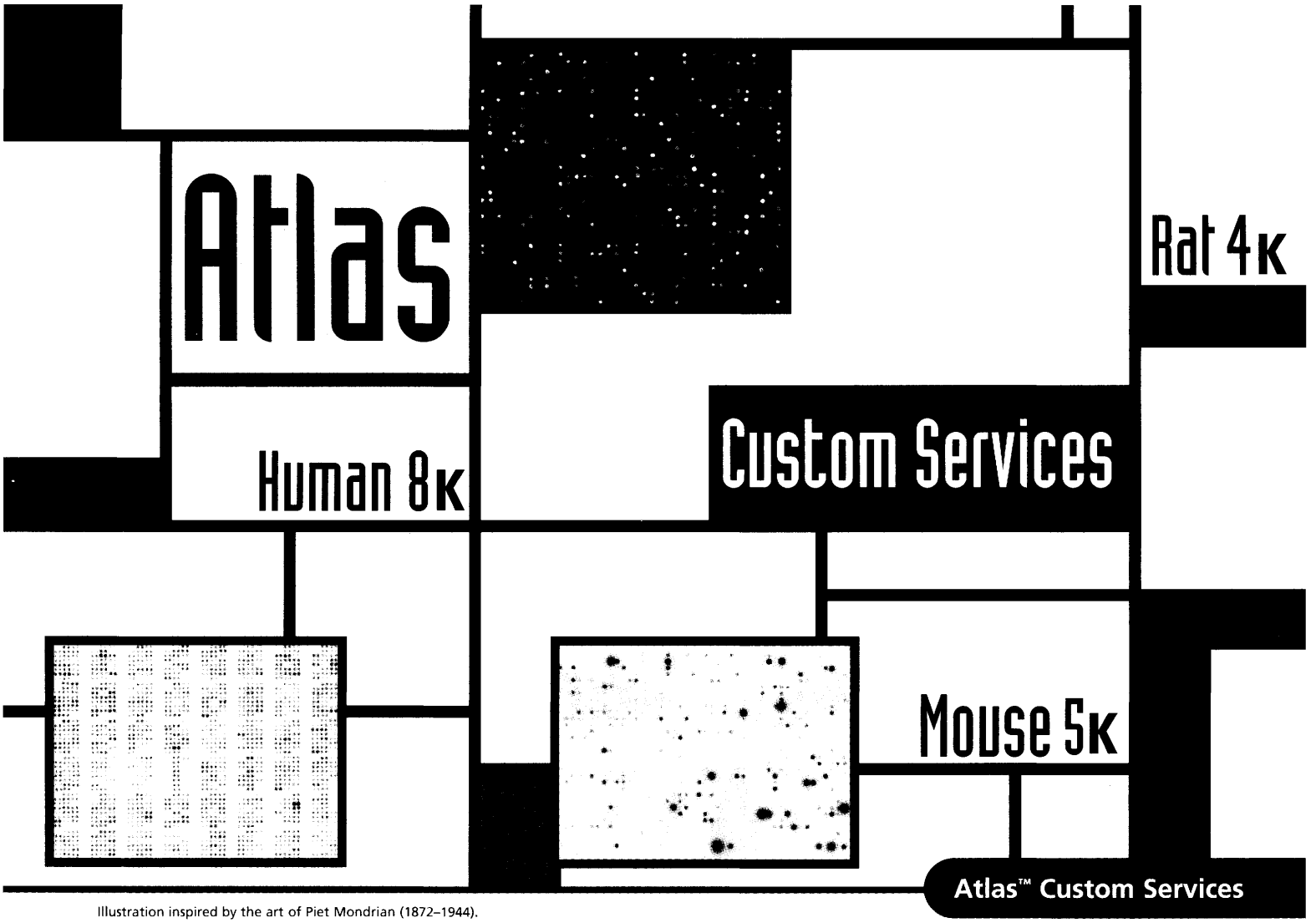

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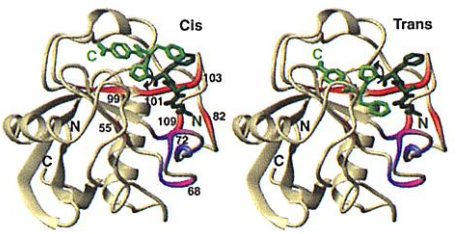
biomass that covered more than nine orders of magnitude in plant size. Statistical analysis provides robust support for the model predictions and shows broad generalities in the scaling of plant biomass across functionally diverse communities and ecosystems.

Two Steps Forward...

Most conventional cancer drugs gradually lose their effectiveness because tumor cells are genetically unstable and can readily acquire mutations that confer drug resistance. It had been hoped that drug resistance would not be a problem for angiogenesis inhibitors because these drugs target endothelial cells in the tumor vasculature, which are genetically stable. However, Yu *et al.* (p. 1526; see the news story by Marx), found that mice bearing human colorectal tumors deficient in the tumor suppressor protein p53 were less responsive to anti-angiogenic therapy than those bearing tumors with normal p53 function. The most likely explanation is that p53 loss confers an improved capacity to grow in low-oxygen conditions on the tumor cells. Because p53 is mutated in most human cancers, these results could have important implications for the design and interpretation of clinical trials testing anti-angiogenic drugs.

Moving in Concert



Dynamical effects can play a role in enzyme function and link the movement of amino acid residues with steps in the catalytic pathway. Eisenmesser *et al.* (p. 1520; see the Perspective by Falke) have now used nuclear magnetic resonance relaxation methods to characterize motions of the enzyme cyclophilin A as it isomerizes a proline residue of its substrate. Apart from detecting motion associated with substrate binding at nine residues, they identify one residue where the movement appears to be linked to transition-state rearrangement.

Interferon with Nuclear Export

A variety of proteins and RNAs are trafficked across the nuclear membrane via nuclear pores in a signal-mediated process. Enninga *et al.* (p. 1523) examined the control of messenger RNA (mRNA) export by the antiviral agents, interferons. Two of the protein constituents of the nuclear pore that are targeted by a viral protein and that lead to an inhibition of host-cell mRNA export were specifically up-regulated in the presence of interferons. These findings delineate an antiviral strategy that can reverse virally induced changes in host-cell gene expression.

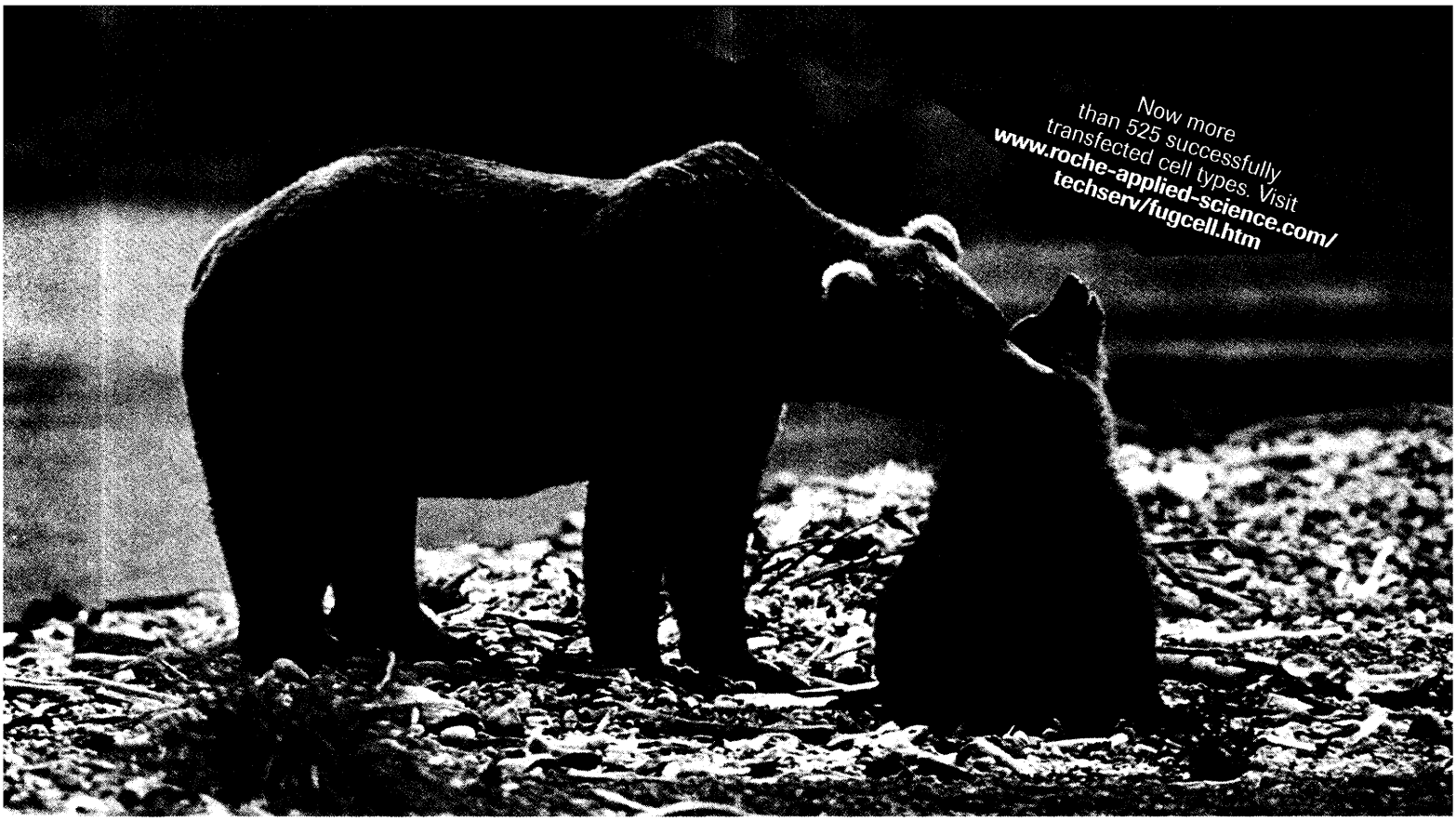
Neuron Survival Without Retrograde Transport

Some neurons depend on signals from their environment for their survival. In particular, sympathetic neurons are supported by nerve growth factor (NGF) that is secreted by their targets. Previous observations have indicated that NGF was internalized and transported back to the neuronal cell body. Using NGF anchored to beads, MacInnis and Campenot (p. 1536; see the Perspective by Miller and Kaplan) now show that although sympathetic rat neurons in compartmentalized culture do require NGF for survival, their survival does not require that NGF be internalized and transported.

After the Signal's Gone, What's Left?

T cells are stimulated into action when they associate with other immune cells that present them with specific antigens. An intercellular synapse facilitates this intimate encounter and a prolonged engagement is thought to be required for T cell activation. Lee *et al.* (p. 1539 see the Perspective by van der Merwe and Davis) in fact show that signaling through the T cell receptor has abated by the time a mature immunological synapse has formed. The center of the mature synapse may not function as a supramolecular signaling complex as previously thought, which raises new questions about the function of this specialized and dynamic structure.

CREDIT: EISENMESSER *ET AL.*



Grizzly bear (*Ursus arctos*)

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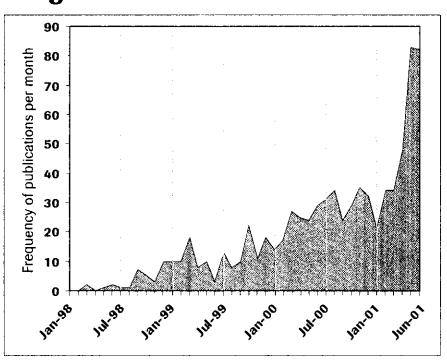

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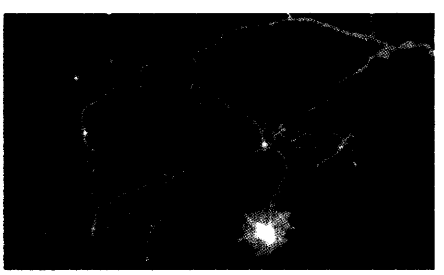

Rat hippocampal neuron expressing GFP 12 hours post transfection with FuGENE 6 Reagent. *Courtesy of the Vandongen Lab., Dept. of Pharmacology and Cancer Biology, Duke University.*

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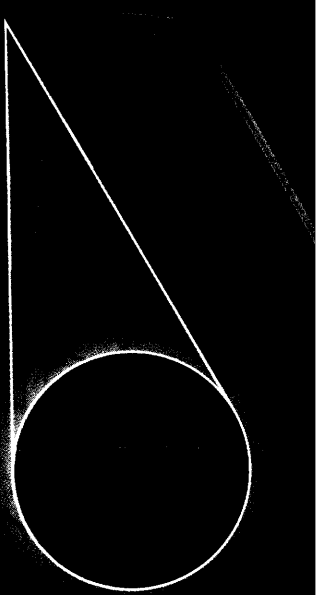

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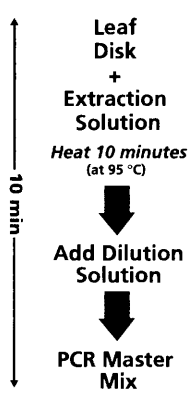

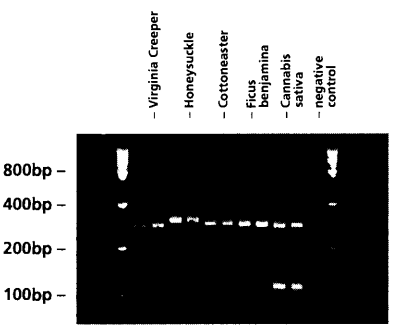

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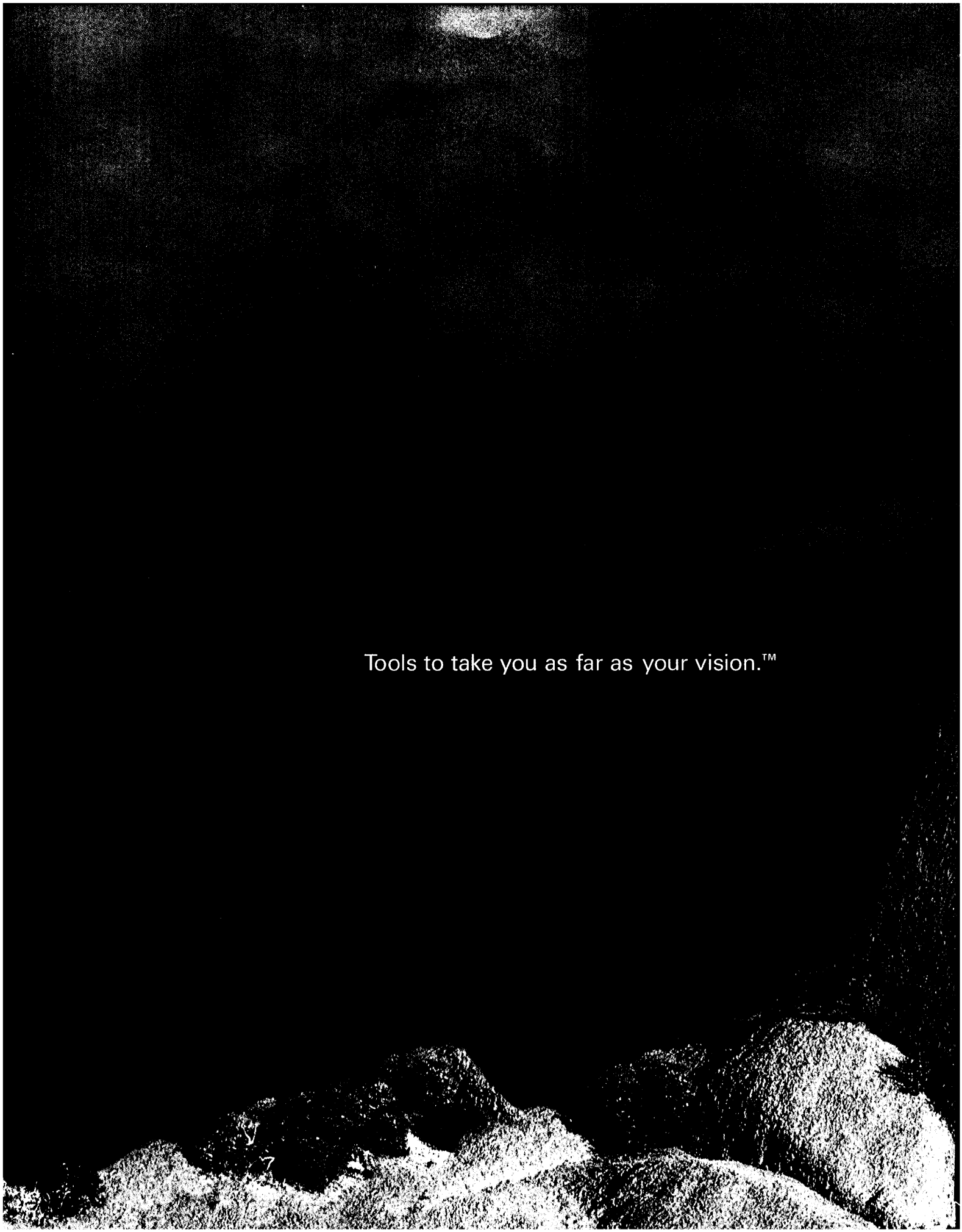
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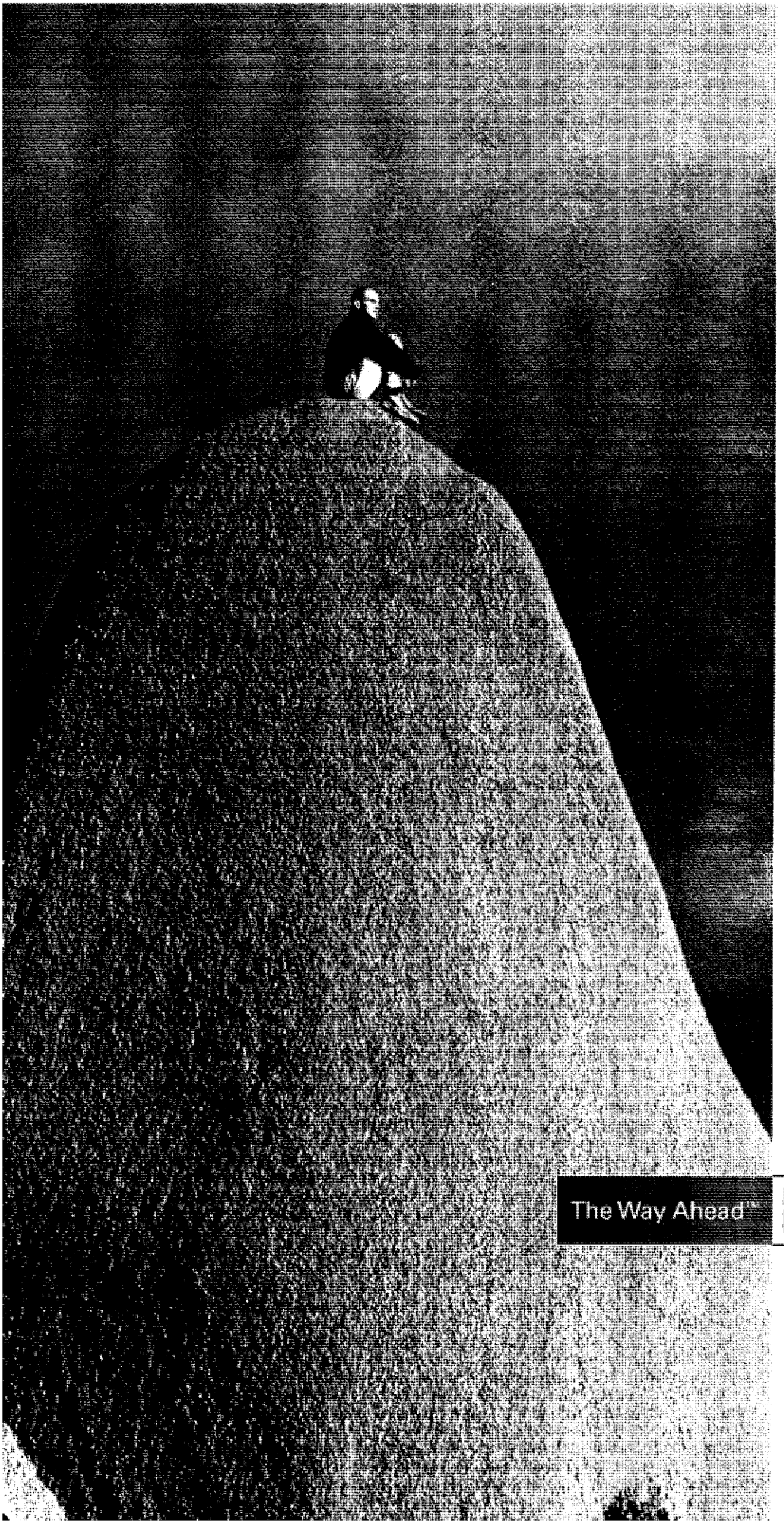

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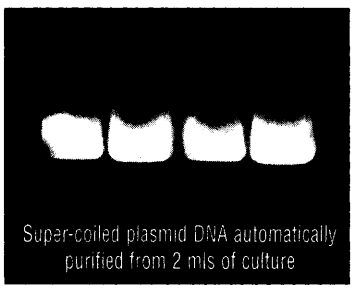

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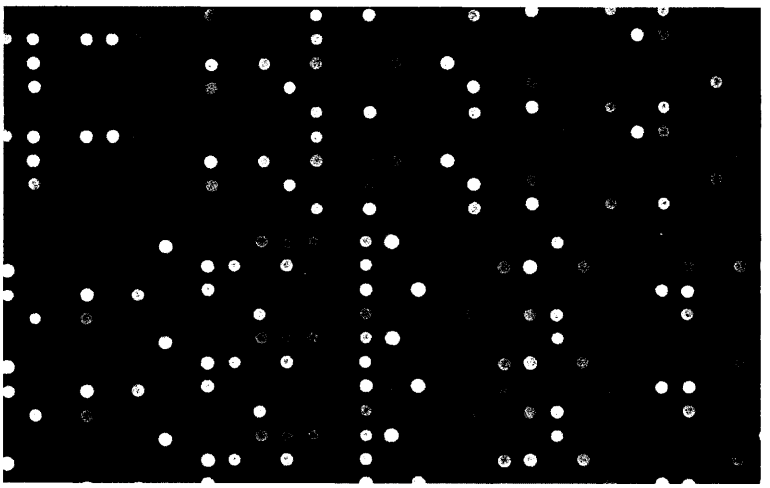

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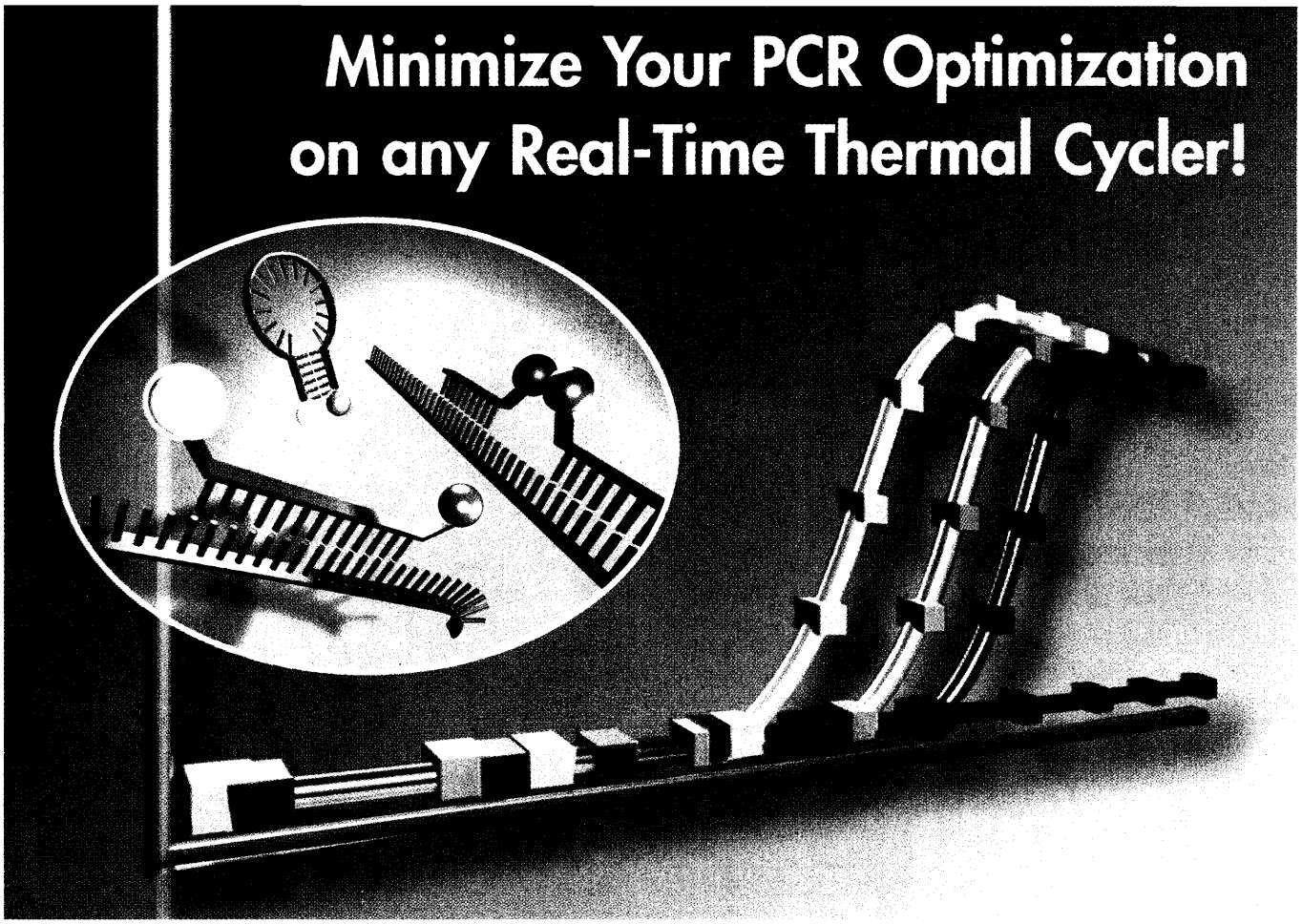

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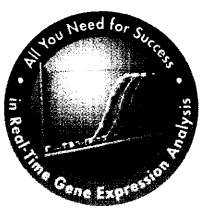

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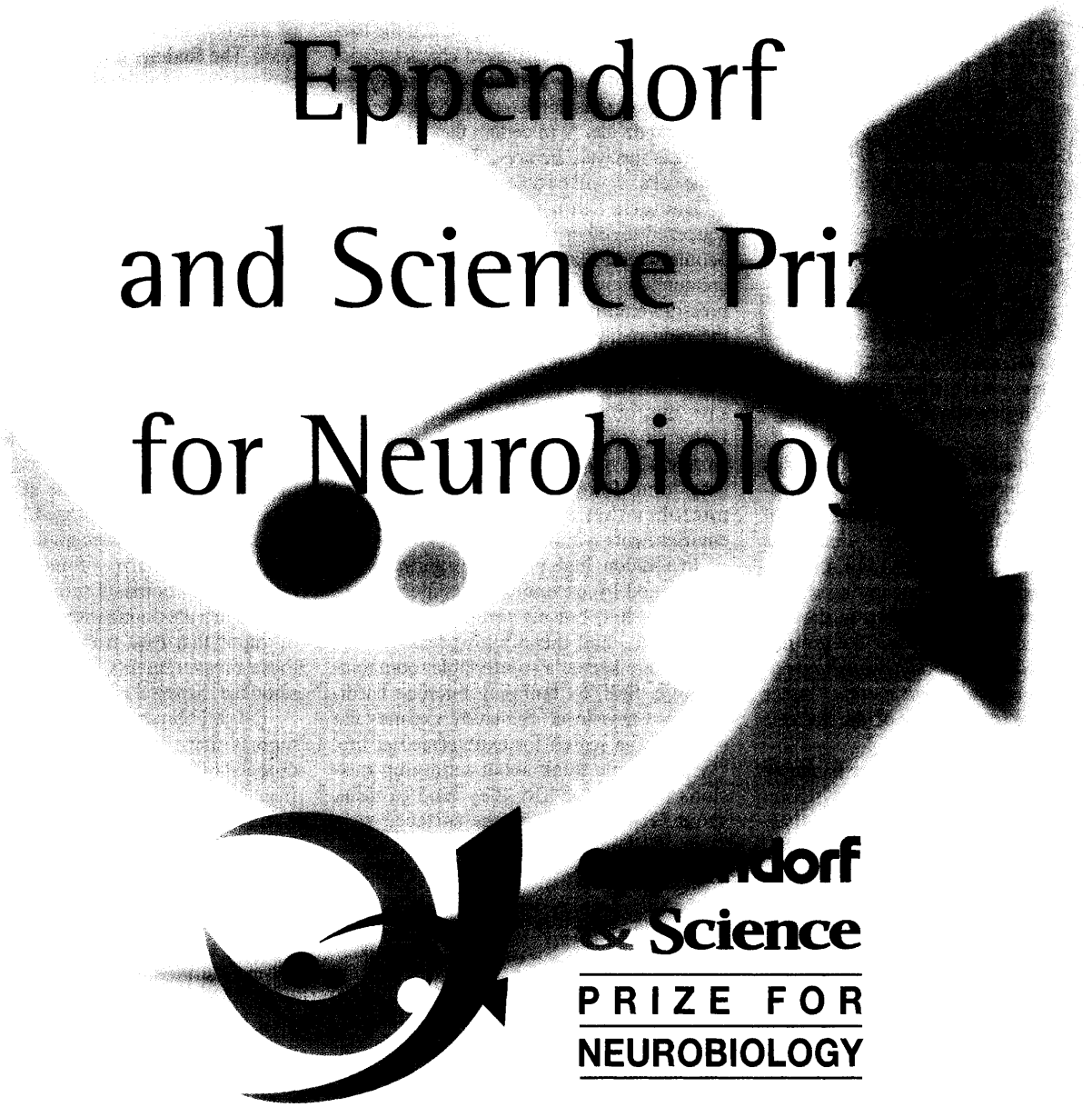

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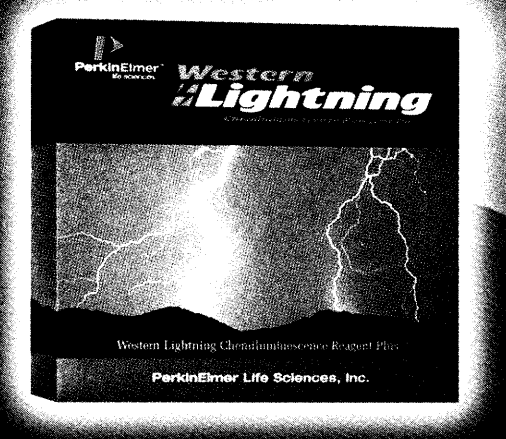

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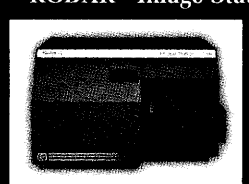

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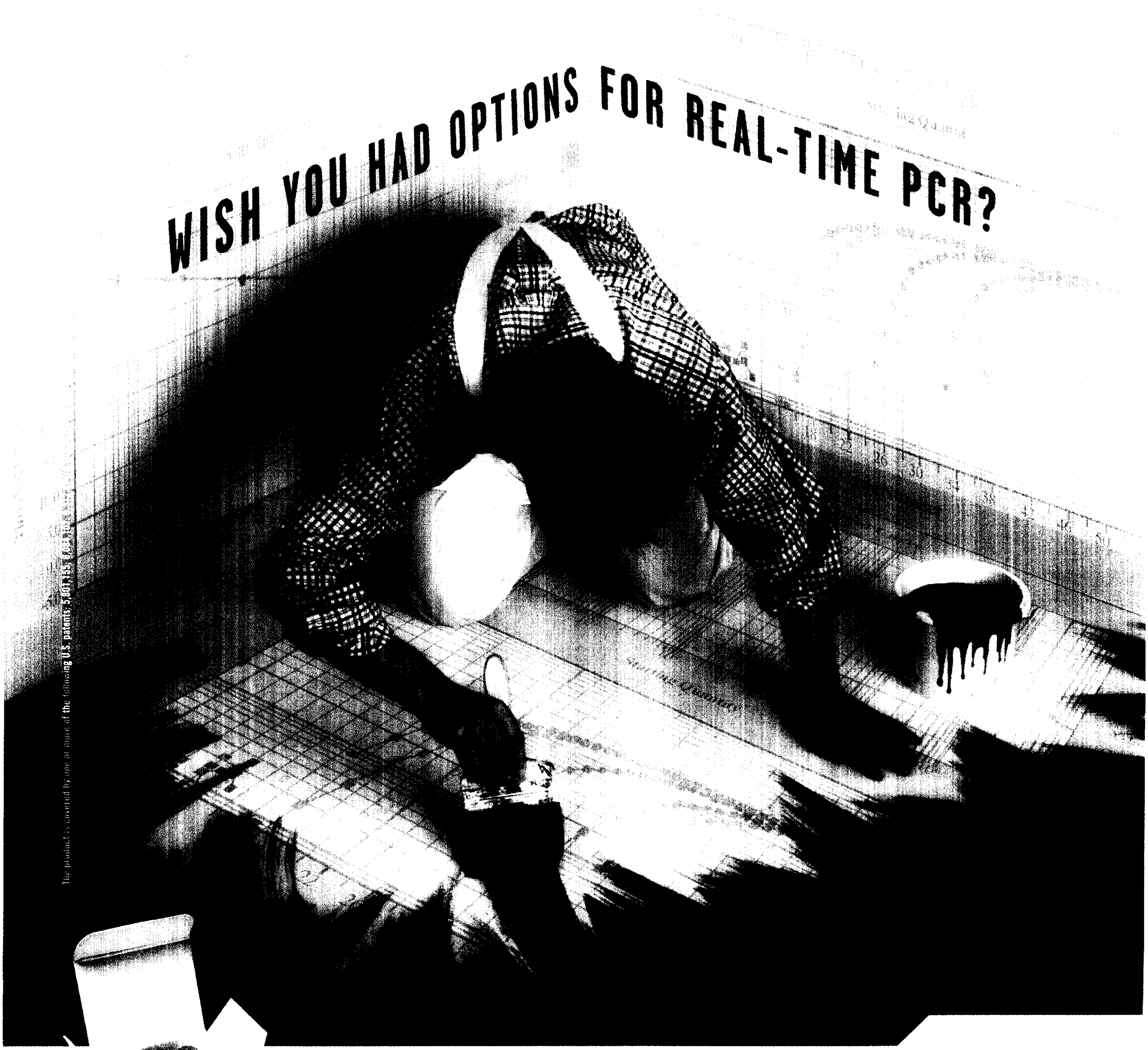

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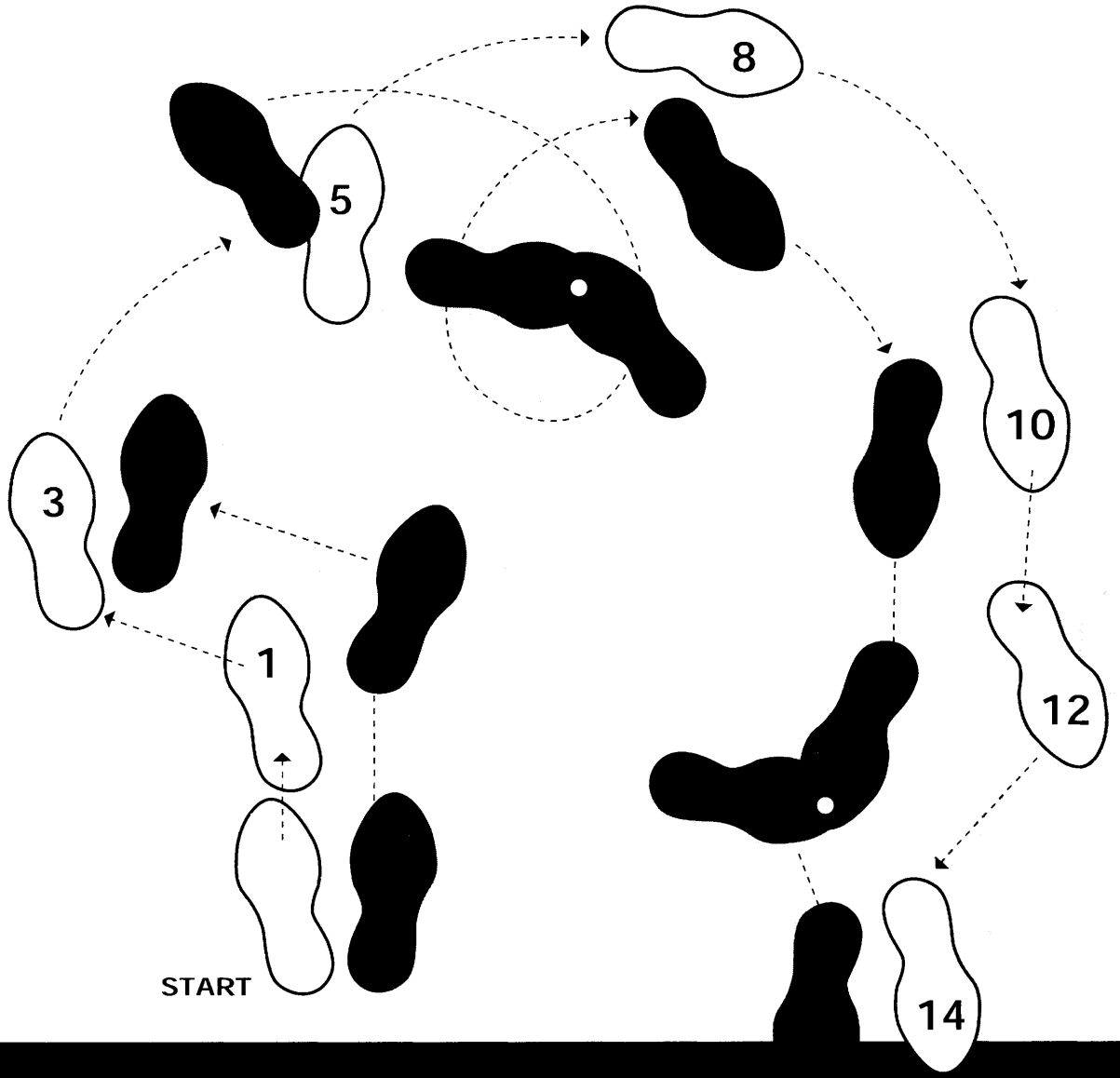

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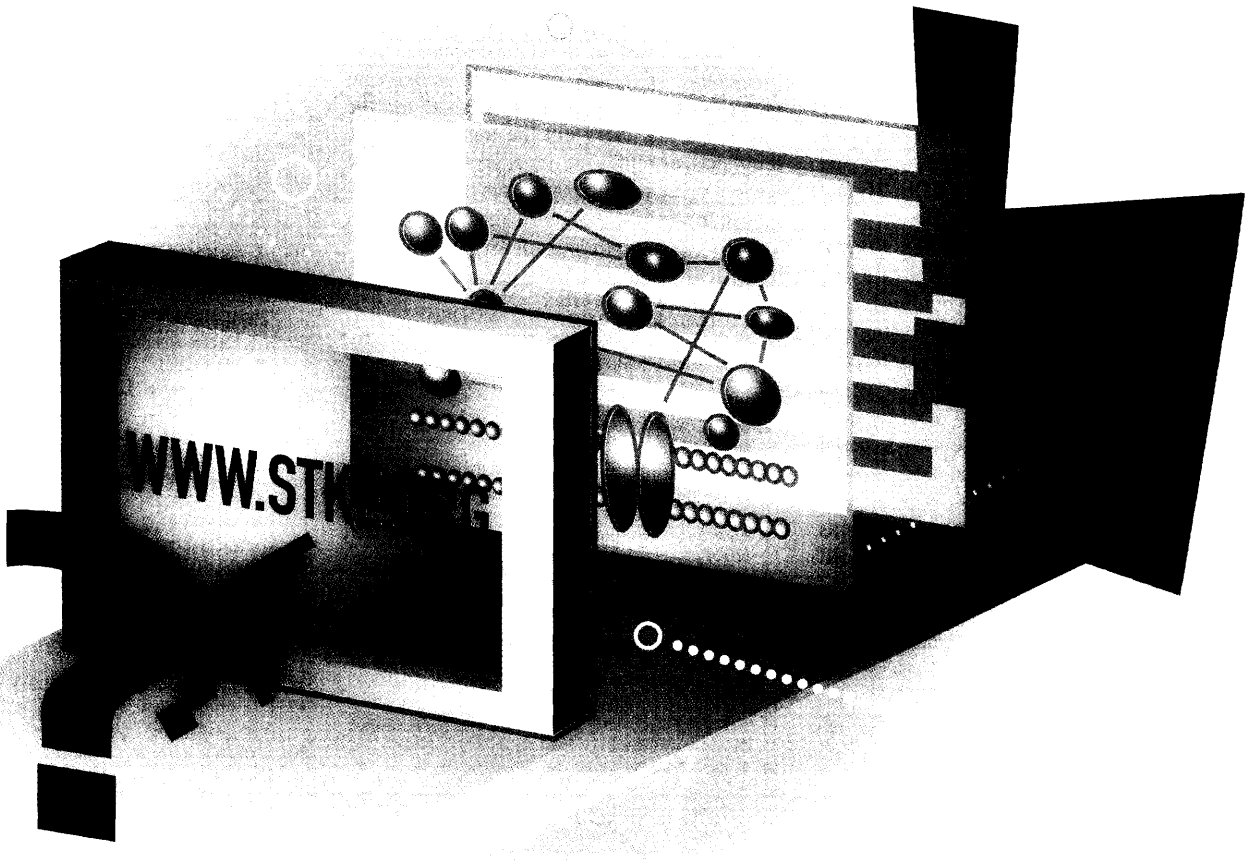

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Ordering Information

Product #	Description	Pkg. Size	U.S. Price
33500	UnBlot™ In-Gel Chemiluminescent Detection Kit – Rabbit*	Kit	$368
	Sufficient reagents to perform 10 mini-gel detections.		
	Includes: UnBlot™ Substrate	120 ml	
	Stabilized Goat anti-Rabbit-HRP	10 µl	
	Dilution Buffer	50 ml	
	BupH™ Pack PBS Buffer	17 packs	
	Tween®-20	5 x 10 ml vials	
	Hands-Off™ Incubation Colander	1 unit	
	Pre-cut Cellophane	10 sheets	
	CL-XPosure™ Film	25 sheets	

Product #	Description	Pkg. Size	U.S. Price
33505	UnBlot™ In-Gel Chemiluminescent Detection Kit – Mouse*	Kit	$368
	Sufficient reagents to perform 10 mini-gel detections. Includes same components as Product # 33500 except it contains Stabilized Goat anti-Mouse-HRP, 10 µl, instead of Stabilized Goat anti-Rabbit-HRP		

**Patent Pending*

NOTE: The UnBlot™ In-Gel Chemiluminescent Detection Kit (Product #s 33500 and 33505) has been tested successfully with homemade gels, Novex®, FMC, BioWhittaker and Bio-Rad® Criterion™ brand gels. The UnBlot™ In-Gel Chemiluminescent Detection Kit does not work as well with regular Bio-Rad®, iGels and Zaxis brand gels. Studies showed 25 times lower sensitivity and the gel may require individual optimization. The UnBlot™ In-Gel Chemiluminescent Detection Kit is recommended for well-separated proteins of any molecular weight. The recommended gel thickness for use with this kit is 0.75-1.5 mm.

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