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Science

Vol. 295 No. 5555
Pages 573–752 $9

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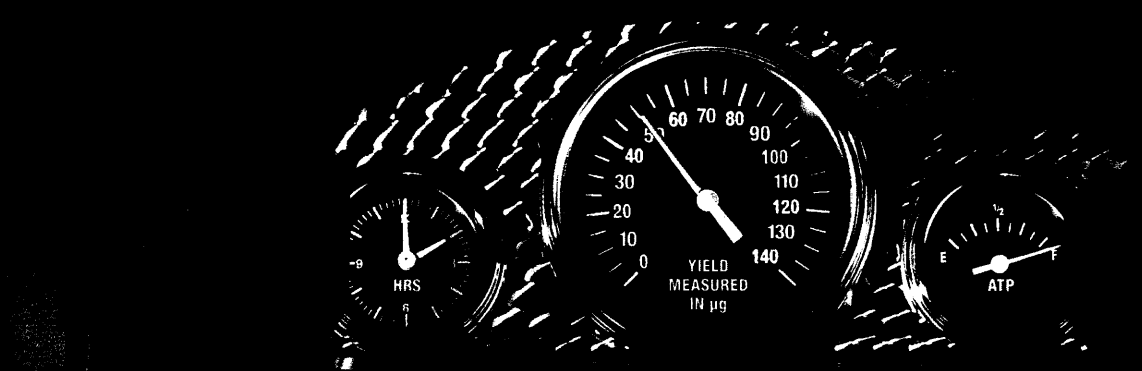

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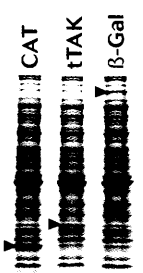

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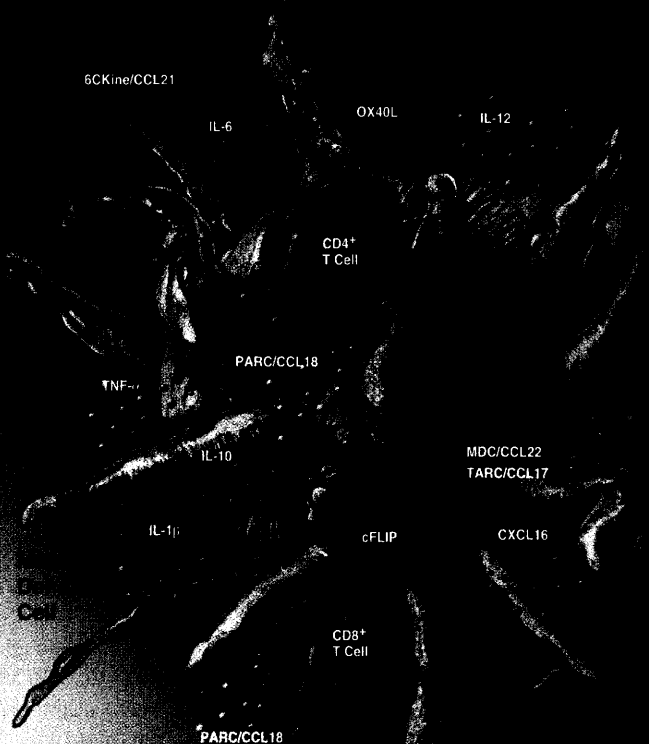

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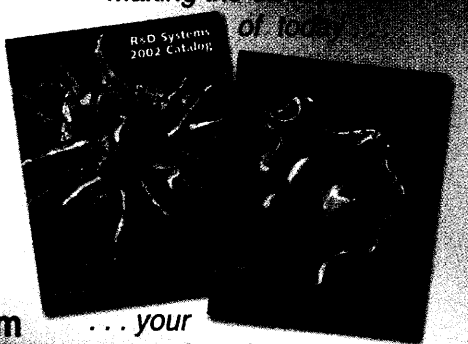

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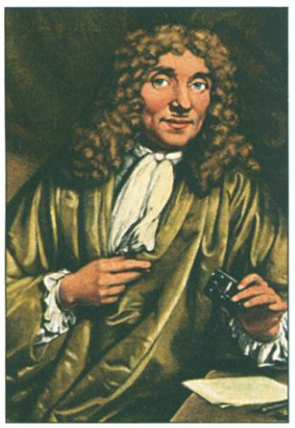

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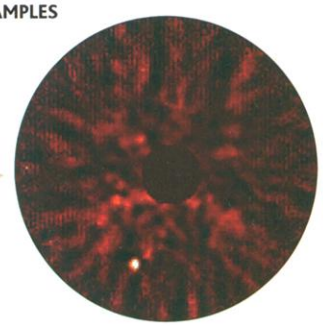
Cell movement comes into focus

NEWS



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Clear view from the ground

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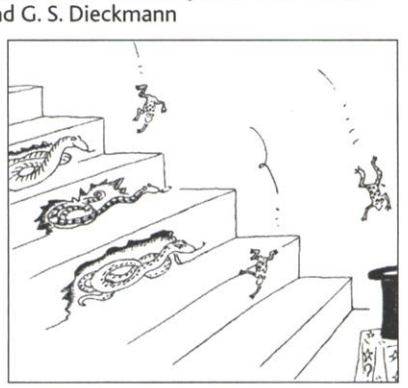
To the manor born



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Controlling nuclear reactions

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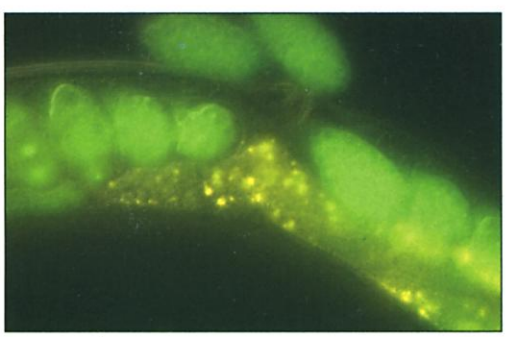

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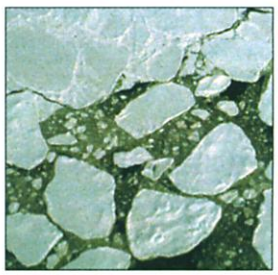
Antisense RNA gene silencing



COVER 641

In winter, a layer of frozen seawater with an area of more than 20 million km^2 surrounds the Antarctic continent. In spring, this frozen cover begins to break up and in summer, only 4 million km^2 of ice remain. The formation and melting of this huge ice mass drives climate, ocean circulation, and the ecosystem of the Southern Ocean. [Photo: D. N. Thomas]

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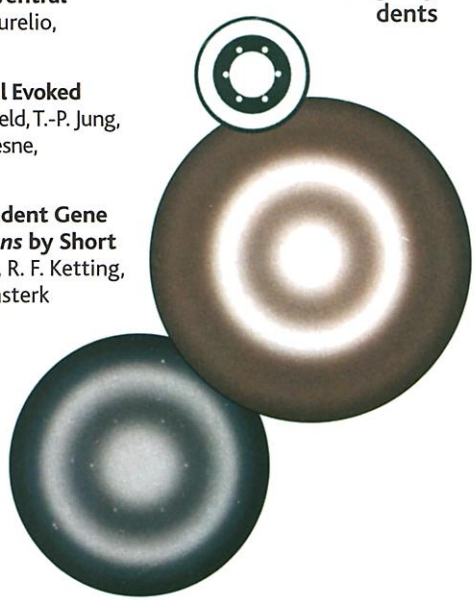
Making tiny dents



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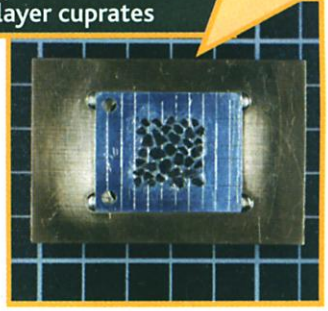

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CONTENT HIGHLIGHTS AS OF 25 JANUARY 2002

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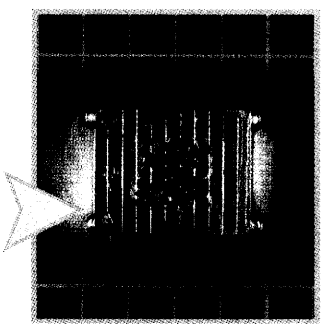
Magnetic Resonant Mode in the Single-Layer High-Temperature Superconductor $Tl_2Ba_2CuO_{6+\delta}$ H. He *et al.*

A long-sought-after magnetic resonance peak is observed in a single-layer higher temperature superconducting cuprate.



Extraction of Black Hole Rotational Energy by a Magnetic Field and the Formation of Relativistic Jets S. Koide, K. Shibata, T. Kudoh, D. L. Meier

Black holes eat everything, but in this study, a mechanism is simulated to extract energy from a rapidly spinning black hole.

Role of Nucleoporin Induction in Releasing an mRNA Nuclear Export Block J. Enninga, D. E. Levy, G. Blobel, B. M. A. Fontoura

Interferon-γ induces the expression of a set of nuclear pore proteins that reverse a virus-induced block in the export of mRNA.

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Canada: Tuition Fee Hikes and Budget Cuts—What's Next? J. Duff and J. Greener

Ontario's deregulation of tuition fees has created a crisis in higher education, according to the Canadian Federation of Students. Will the rest of Canada follow Ontario's divisive path?

US: Women Without Tenure, Part II—Science's Gender Sieve C. Trower

An in-depth assessment of the perforated scientific pipeline, which leaks women all the way from high school to the full professoriate.

US: Answers to Your Funding Questions The GrantDoctor

Nurturing the nurturers: money for minority nurses—especially men.

Singapore: Upbeat on Innovation? Take the Enterprise Challenge! J. Wong

Opportunities for innovative and enterprising individuals in Singapore to test their ideas without having to empty their savings.

UK: On the Record K. Urquhart

Completing the Postgraduate Skills Record each year of your Ph.D.—which ensures that you have a log of your achievements in hand when you need it—should take the pain out of CV writing and job application filing.

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science of aging knowledge environment

How a *clk* Ticks R. J. Davenport

A gene slated to act at chromosome ends might play a more clear-cut role in DNA repair.

Insulin Pathway Takes a Jog K. Miller

Workouts might benefit young and old by employing different molecular messengers.

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signal transduction knowledge environment

ST on the Web

New sites reviewed include the Rel/NF-κB Transcription Factor Web Site (in Signal Transduction Labs and People) and the Center for Biological Sequence Analysis (in Bioinformatics Databases and Tools).

Events

See where the meetings and conferences about signaling transduction are happening.

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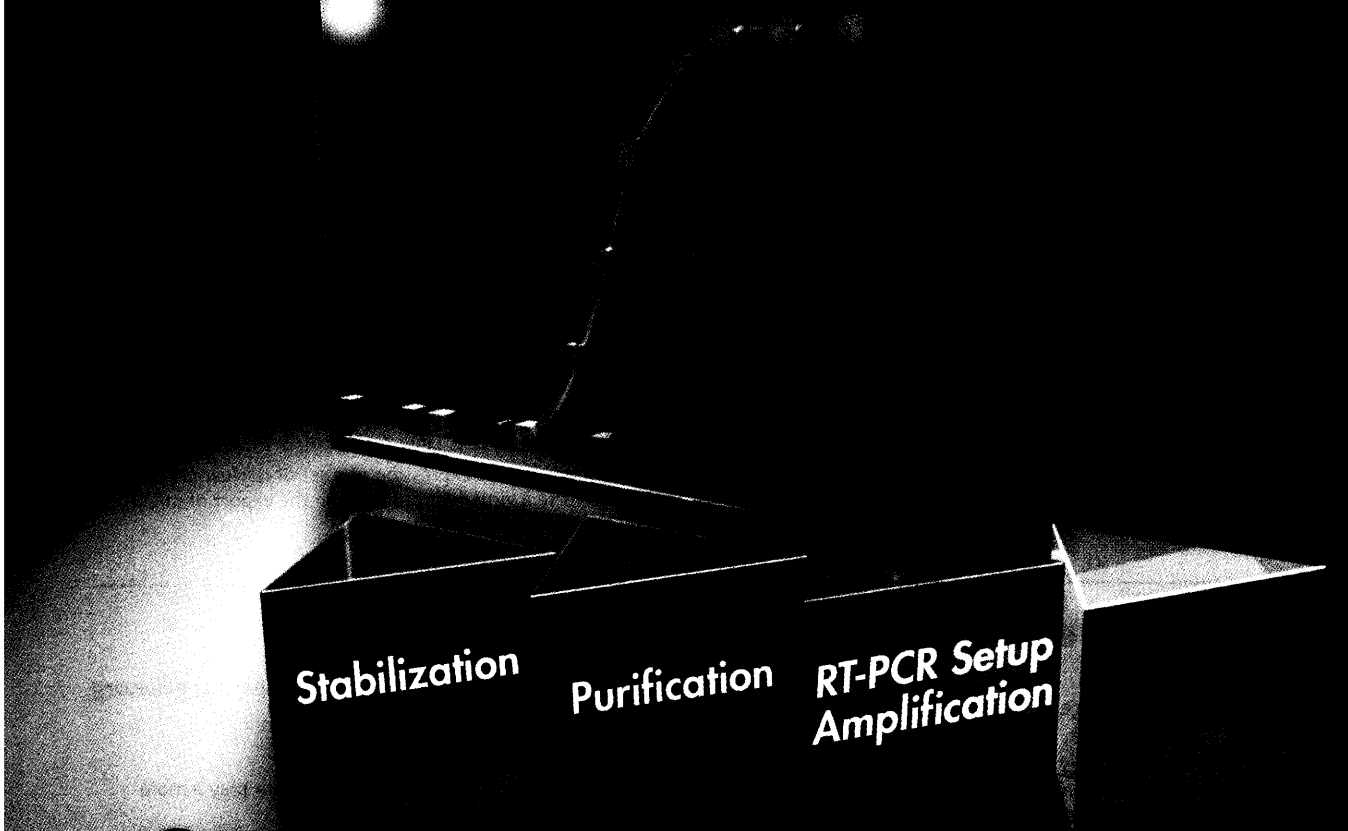

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THIS WEEK IN Science

edited by Phil Szuromi

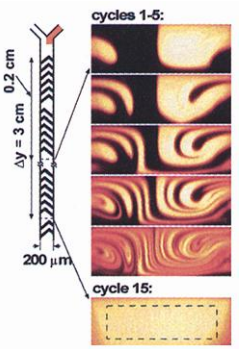
Organic Adsorption on Clays

Extensive beds of black, organic-rich shale were deposited at several times in the past, and particularly during the Mesozoic. These deposits have been interpreted as signifying periods when ocean circulation was restricted and reduced carbon was formed and preserved in a low-oxygen environment. Their presence has led to inferences of past ocean and climate conditions; these beds also are the source for much petroleum. Kennedy *et al.* (p. 657) suggest that their origin may in fact have been controlled by the clay mineralogy present (which may reflect continental weathering) rather than ocean conditions. They show that, like preservation of reduced carbon species in modern environments, organic carbon in a typical Mesozoic black shale is associated with smectite, a clay mineral that allows fixing of carbon species on interlayer sites, facilitating its capture and preservation.

Electrically Controlled Magnetism

For the developing field of spintronics in which the spin properties of the carriers are encoded with information, magnetic semiconductors need to be developed if spins are to be injected into adjacent semiconductors with high efficiency. Although magnetic semiconductors have been realized, they are not generally compatible with the group IV materials (Si, Ge, or C) that dominate microelectronics. Using molecular beam epitaxy, Park *et al.* (p. 651) prepared Mn-doped Ge with a ferromagnetic ordering temperature of 116 K. Their design includes a gate structure that allows the carrier density to be modified, thereby providing a mechanism for switching the magnetic behavior on and off.

Bespoke Microchannels



CREDIT: STROOCK *ET AL.*

One obstacle arising from the persistent shrinking of devices is the difficulty in mixing fluid streams, which prefer to adopt laminar flow patterns. External mixing devices do exist, but they require either moving parts or an external power source. Stroock *et al.* (p. 647) have tailored a microfluidic system with a series of asymmetric herringbones laid onto the floor of the channels. As the fluid passes over these ridges, backflow is initiated, causing two parallel inlet streams to mix chaotically. An additional benefit is that the fluid tends to flow as a plug, which usually is difficult to achieve in a microfluidic system where surface effects dominate and Poiseuille flow is the norm.

674 Improving Plants in China

The use of genetic engineering to improve crop plants has been the subject of intense debate. Although the technology offers potential for improving nutritional quality and growth traits of a variety of crops, public concern about the ecological impact of such engineered crops and about their value as foodstuffs has slowed their acceptance in some countries. Huang *et al.* (p. 674) have analyzed the state of affairs in China. Surveys from 1997 through 2000 indicate avid exploration of the potential of genetically modified crops, and their analysis indicates reduced costs and usage of pesticides for certain crops.

And in Brevia ...

The ice cover and ecology of the lakes on an Antarctic island have changed dramatically over the last 50 years in response to a 1°C rise in air temperature, according to data collected by Quayle *et al.* (p. 645).

Caught Between Love and Hate

When water is trapped between two hydrophilic surfaces, it wets both surfaces and shows well defined responses to dynamical shearing of the surfaces. When water is confined between two hydrophobic surfaces, if the separation distance becomes critically small, the water will spontaneously eject. So what happens when water is forced into a love-hate relationship? Using a surface force apparatus, Zhang *et al.* (p. 663) show that the interaction of the water with the hydrophobic surface is complex, with only glancing touches of the surface and with giant fluctuations in the shear moduli.

Tightening the Noose on Carbon Triple Bonds

The *sp* hybridization of the carbon atoms in a triple bond tends to force linear geometries on the triple bond and its substituents (C–C≡C–C) and to destabilize small rings containing triple bonds. Suzuki *et al.* (p. 660) report that a five-membered ring containing a triple bond was formed as part of a zirconium complex. The structure was determined by x-ray crystallography, and the presence of a triple bond was confirmed by nuclear magnetic resonance and reactivity studies.

Diversity at a Distance

Beta diversity is a measure of the pattern of species diversity at different scales and with distance and is a potentially powerful indicator of ecological processes. However, calculating it requires gathering large quantities of data, a tall challenge in tropical forests. Condit *et al.* (p. 666; see the Perspective by Duivenvoorden *et al.*) document patterns of beta diversity in three different parts of the American tropics, using data from more than 70 sites and 1000 species. They show higher species turnover in Central America than in Amazonia, correlating with greater habitat diversity in the isthmus. Limited seed dispersal, often thought to be a factor leading to patchy distributions and variation in community composition, appears not to be a critical determinant of beta diversity.

We Found It, You Can Relax Now

The hormone relaxin has long been recognized as important to mammalian reproductive processes (see the Perspective by Izell), and the

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Illustration inspired by the work of computer artist Rick Berry.

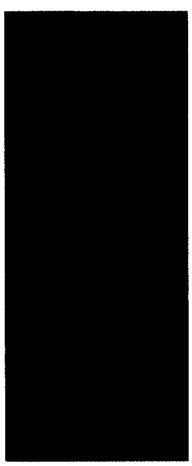

Figure 1. Atlas™ Glass Microarrays are designed for maximum specificity. A Cy5-labeled probe was prepared from a mixture of 5′-aminomodified antisense oligonucleotides corresponding to the genes that spell "Atlas" in the above Atlas™ Glass Human 1.0 Microarray (#7900-1). The probe was prepared using the Atlas Glass Fluorescent Labeling Kit (#K1037-1), omitting the reverse transcription steps, and then hybridized to an Atlas Glass Human 1.0 Microarray. Following hybridization, the microarray was scanned and analyzed using a GenePix-4000-1 scanner from Axon Instruments. The image clearly shows that hybridization occurs specifically to those spots corresponding to each antisense probe. Minimal cross-hybridization to nontarget spots is seen.

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development of therapeutics to treat preterm labor disorders and delivery problems has been stifled by the elusiveness of its cognate receptor. Hsu *et al.* (p. 671) have identified a G protein–coupled receptor that mediates the effects of relaxin. This is somewhat surprising because a structurally similar hormone, insulin, signals through a receptor-type tyrosine kinase.

Plasmodium in vitro

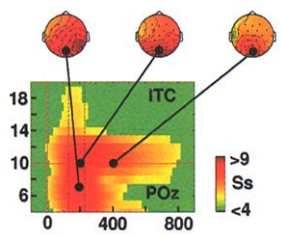
Malaria parasites have complex life cycles consisting of distinct stages, split between vertebrate and mosquito hosts. In contrast to the mosquito stages, techniques for replicating the vertebrate stages in vitro are well established. Al-Olayan *et al.* (p. 677) have succeeded in culturing mosquito stages of the malaria parasite *P. berghei* in vitro. This mouse parasite is a commonly used model for human malaria. Ookinetes developed from gametocytes in Schneider's insect medium; a large proportion of these developed into oocysts, from which mouse-infective sporozoites were obtained that were able to complete the cycle in mosquitoes.

Traffic Signaling

Legionella pneumophila invades host cells and takes up residence in a specialized intracellular vacuole. In order to change the characteristics of the phagocytic vacuole, *Legionella* have been predicted to inject proteins into the host cell cytoplasm through a secretion apparatus encoded by the *dot/icm* genes. Nagai *et al.* (p. 679) have identified a protein termed RalF that appears to be a substrate for secretion. Once in the host cell, RalF acts to recruit and activate a key protein in host membrane traffic, ARF1.

Cells Stabbed in the Gut

Helicobacter pylori is a prevalent human parasite (infecting half the world's population) and is linked to a variety of gut disorders, including severe gastritis and gastric carcinoma. Higashi *et al.* (p. 683) have elucidated the steps taken by the bacterial CagA protein that transform host cells. After CagA protein is injected by *H. pylori* into host cells, it is phosphorylated on tyrosine residues by host kinases. Phosphorylated CagA then binds to a host tyrosine phosphatase, SHP-2, which stimulates SHP-2 translocation to the cell surface where it displays its phosphatase activity. Active membrane–associated SHP-2 then stimulates morphological changes in the host cell that are the prelude to cellular transformation.



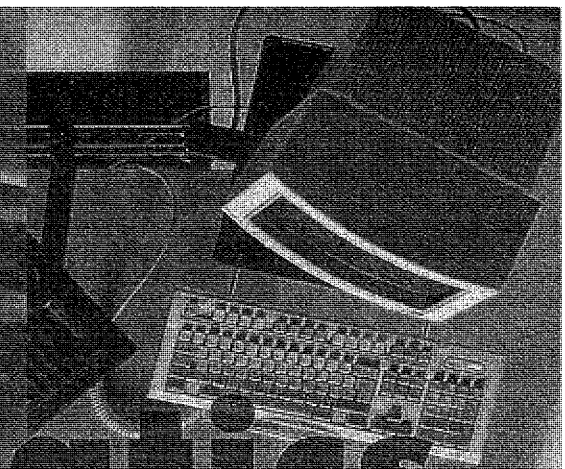
CREDIT: MAKEIG *ET AL.*

Decomposition of the Averages

Event-related potentials (ERPs) are widely used in electroencephalographic studies. It is usually assumed that ERPs evoked by brief stimuli reflect neural activity within discrete, functionally defined processing regions in the brain. The potentials recorded as the average of a large number of stimulus trials should thus be a simple combination of time-stationary neuronal population activity and otherwise asynchronous noise, which is presumed to average out. Makeig *et al.* (p. 690) used independent component analysis to decompose the ERP into different fractions arising from different brain areas. An incoming stimulus alters the phase relationship of synchronized activity in multiple brain regions, and these phase imbalances create the peaks in the ERP. Thus, in contrast to the traditional view, the recorded potential is very much affected by the ongoing rhythmic brain activity before the stimulus.

Staying Put

In the developing nervous system, axon pathfinding from the neuronal cell body to the synaptic target turns out to be only part of the story. Even after pathfinding has been accomplished, mechanical forces produced by movements of the organism or further developmental changes in tissue sizes and relationships can push those axons around. Aurelio *et al.* (p. 686; see the news story by Vogel) find that in *Caenorhabditis elegans*, additional cues are delivered to keep axons stabilized within the correct tracts in the ventral nerve cord. The cues derive from the PVT neuron, which is one of the first to establish the ventral nerve tract early in development. The steadying effect of the PVT neuron on later established axons is apparently mediated through the function of secreted zig proteins.



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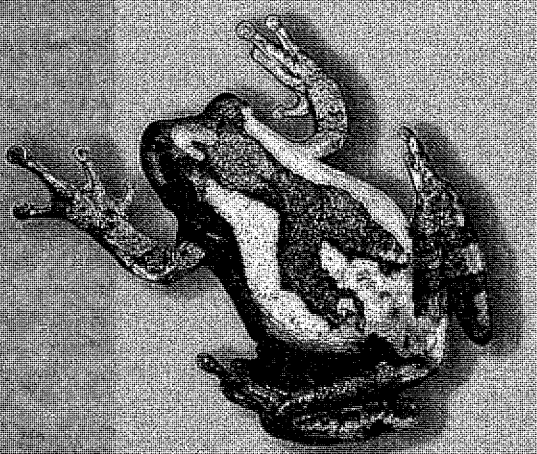

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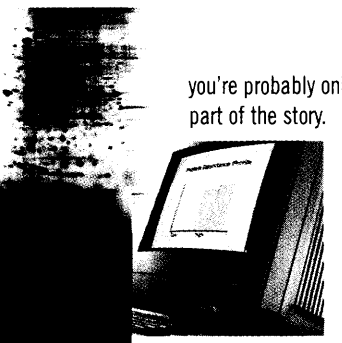

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January 28, 4:31 PM
Susan Kellerman, Ph.D.

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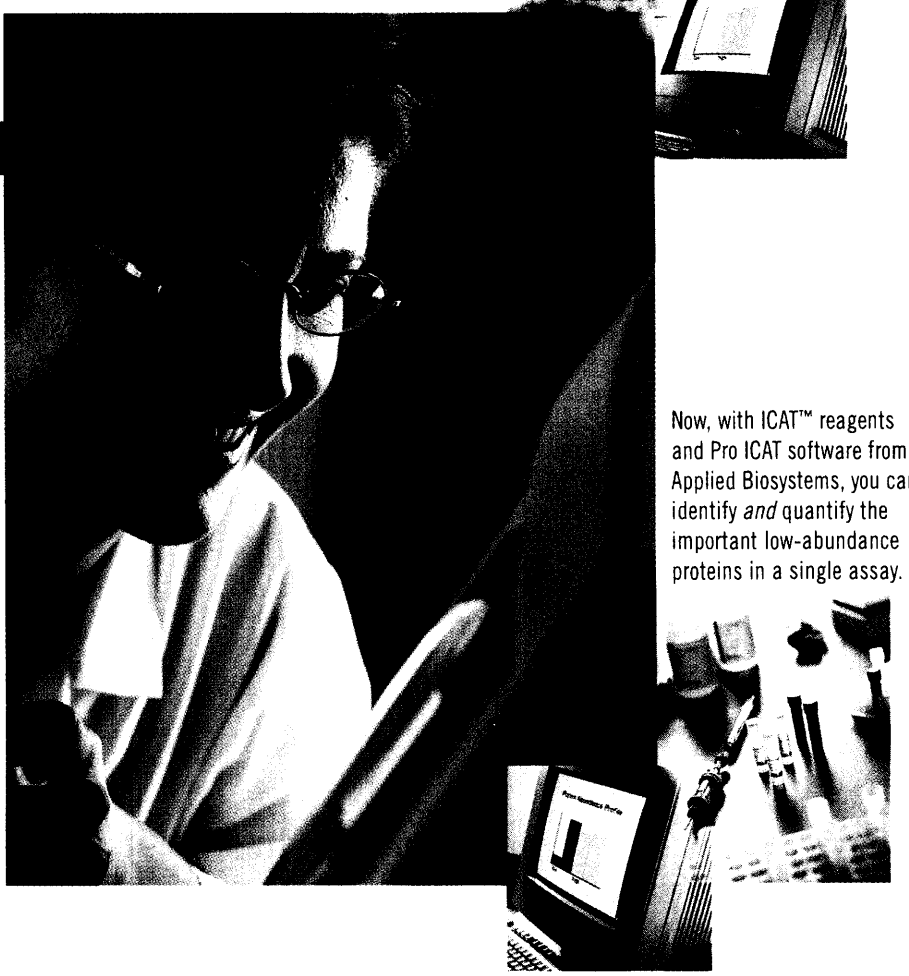

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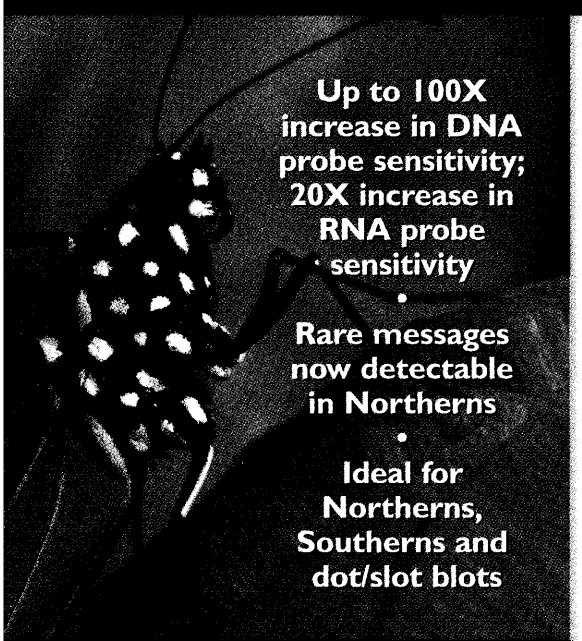

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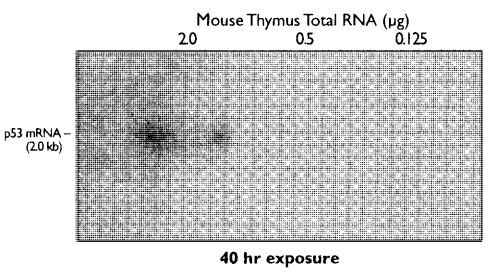

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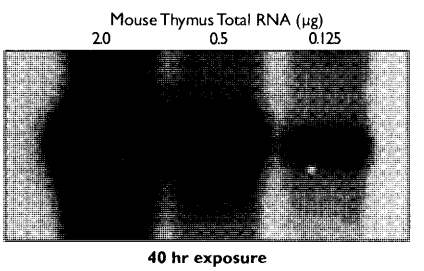

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1. *Molecular Cloning: A Laboratory Manual*, 1989. Sambrook, J. Fritsch, E.F., Maniatis, T. Cold Spring Harbor Laboratory Press.

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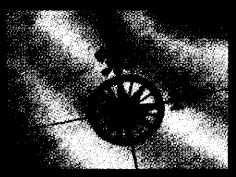

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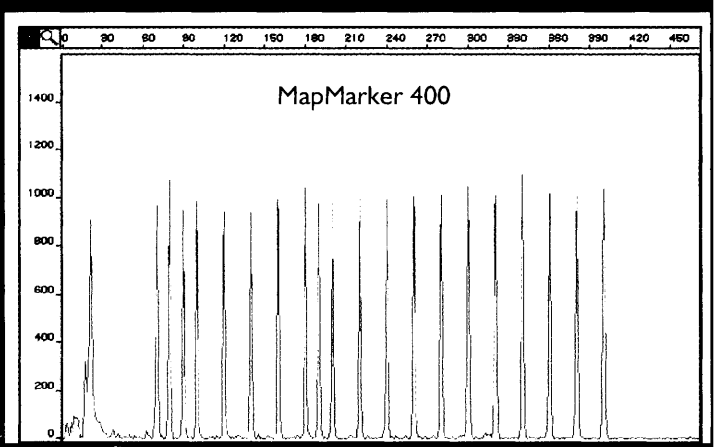

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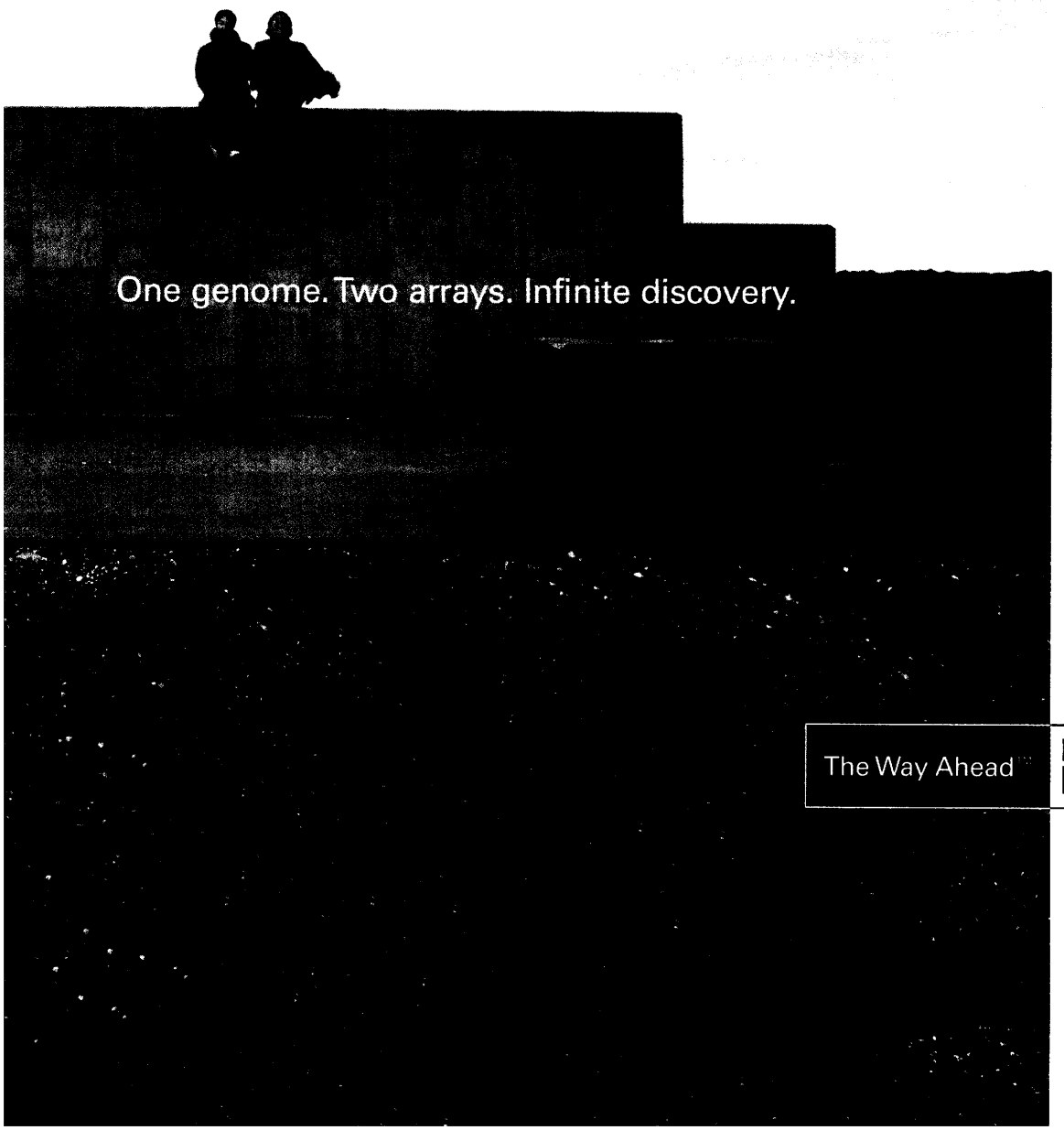

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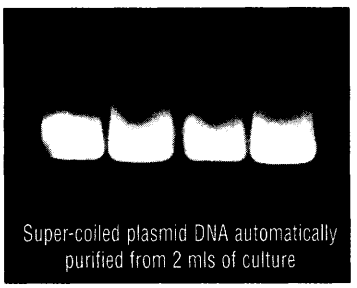

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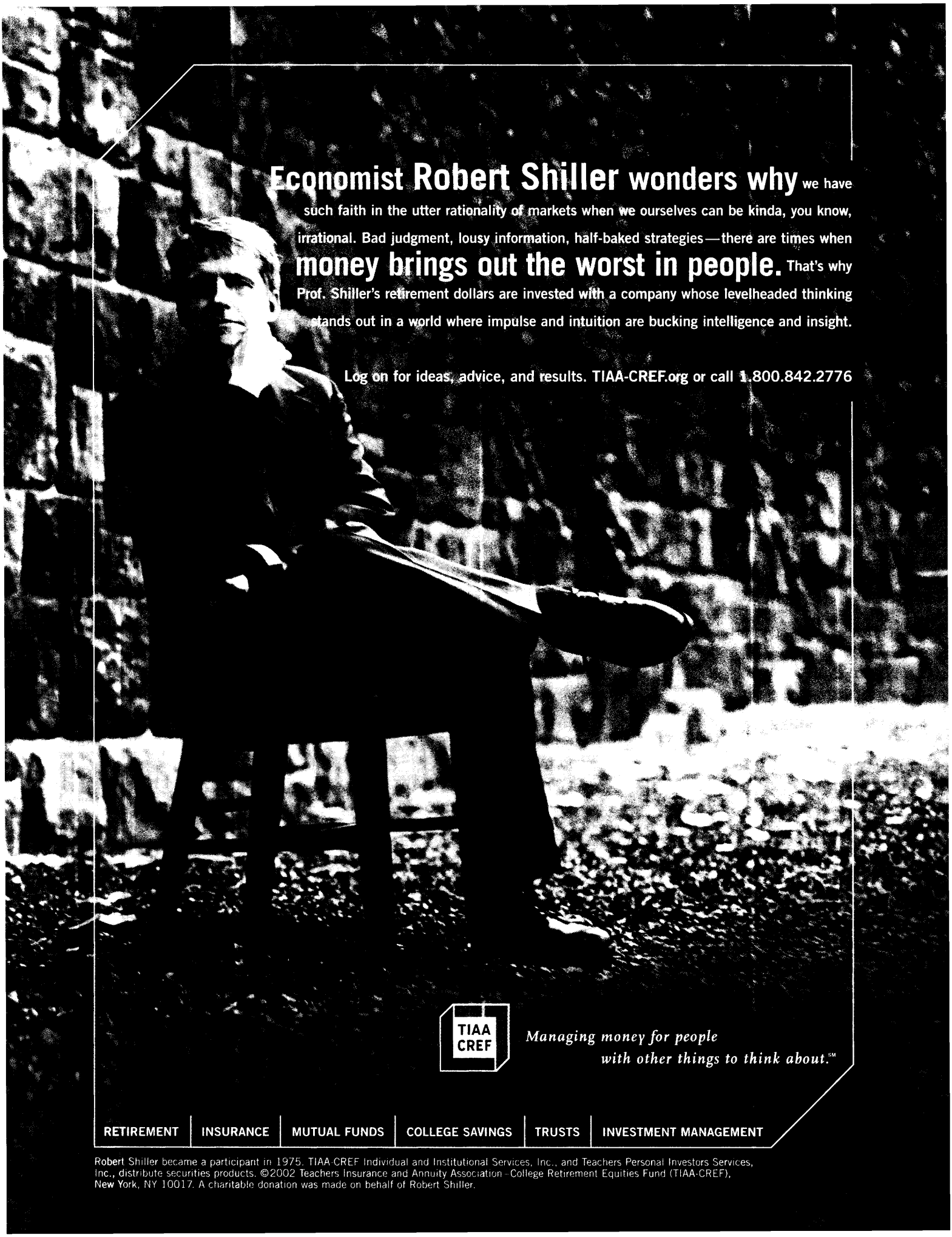

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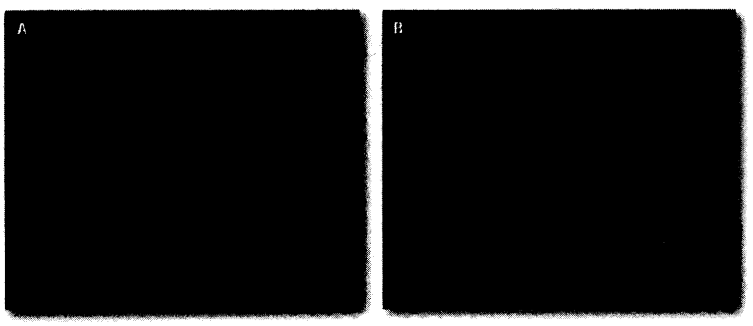

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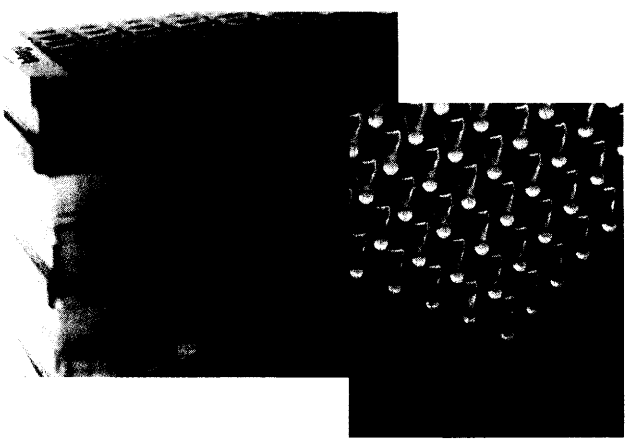

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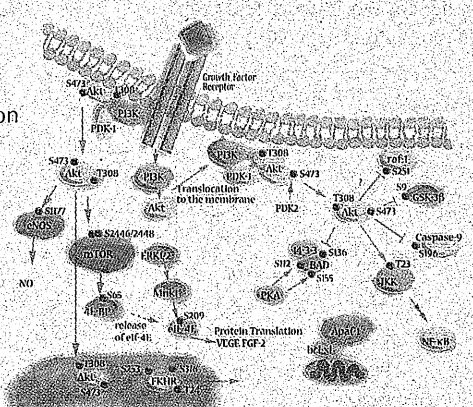

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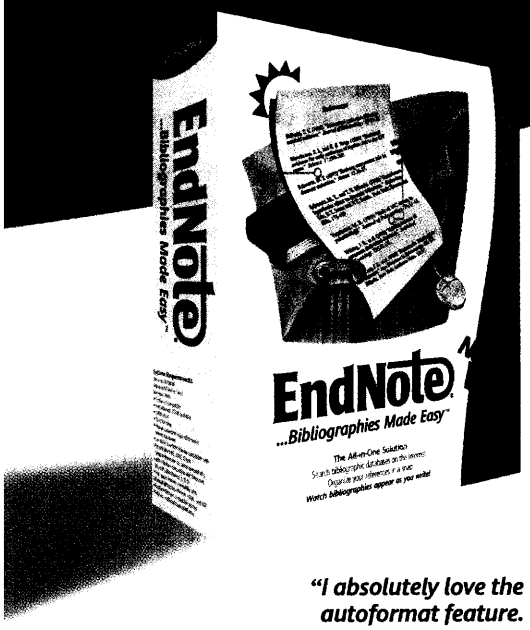

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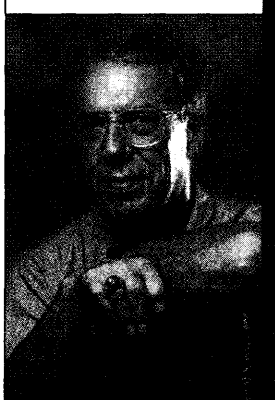

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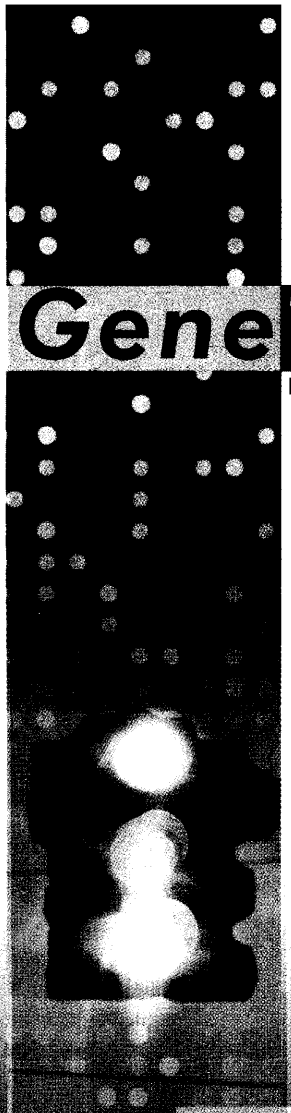

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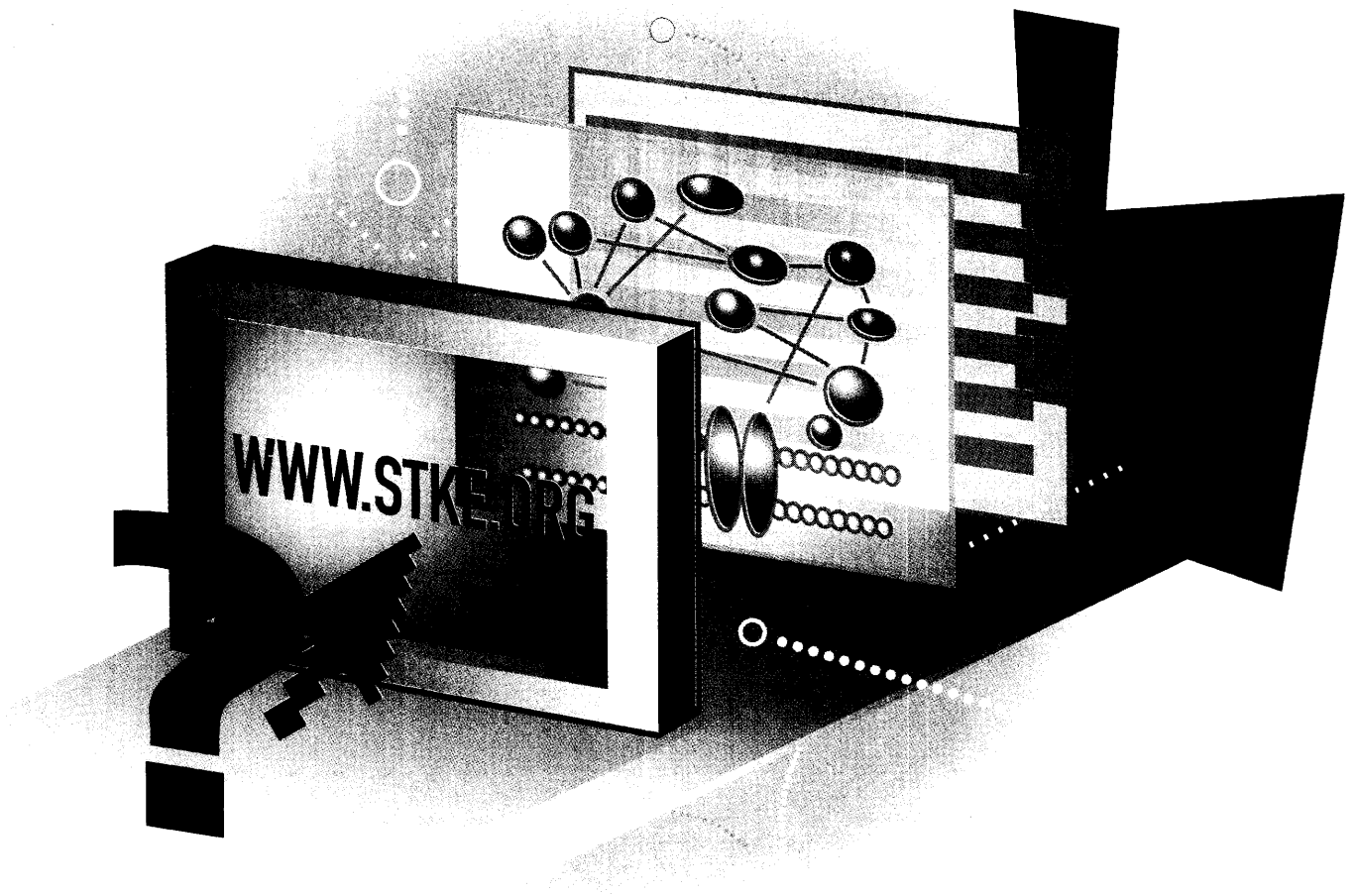

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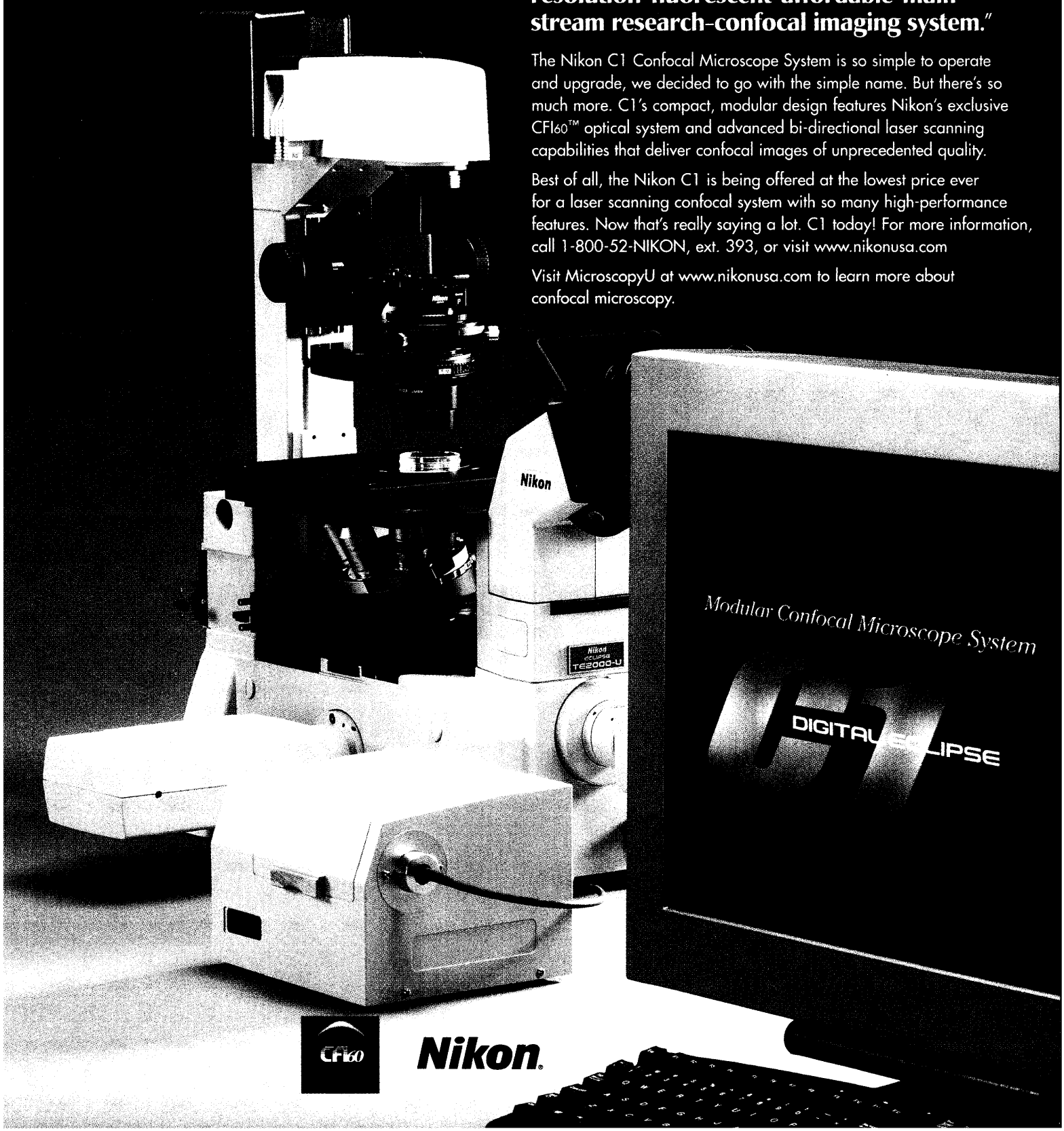

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