29 March 2002

Science

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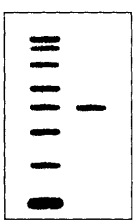

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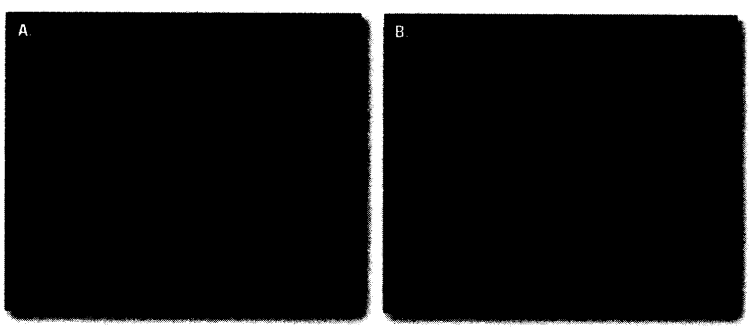

RNAi in *C. elegans*
Fluorescence microscopy of a *C. elegans* adult female with a transgenic GFP reporter gene (green) highly expressed in the pharynx (A). Double-stranded RNA corresponding to the GFP coding region was produced using the HiScribe RNAi Transcription Kit and injected into the syncytial gonad of transgenic adult worms. RNAi is demonstrated by the reduction of GFP expression in the progeny (B).

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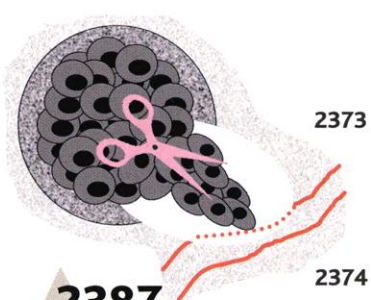

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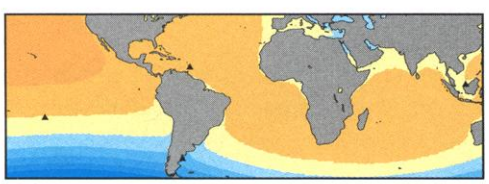

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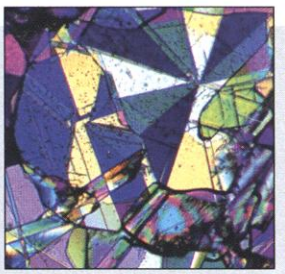

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Photomicrograph of an organic inclusion compound (crossed polarizers, λ plate) showing changes in interference colors for differently oriented domains. These domains, which are organized by host-guest hydrogen bonding, can be interconverted with external force, and their ferroelastic response can be modified with impurities. Such systems are featured in the special section on supramolecular chemistry and self-assembly in this issue. [Image: M. D. Hollingsworth and M. E. Brown]

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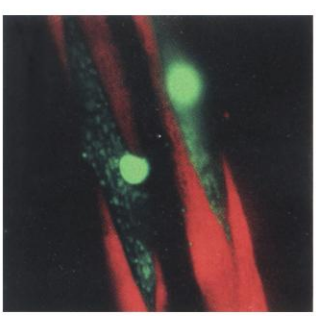

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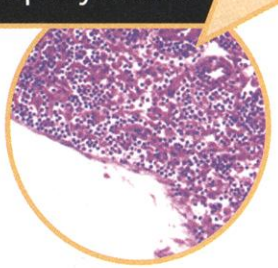
Spreading the RNAi message

New on *Science* Express Halting lymphocyte traffic



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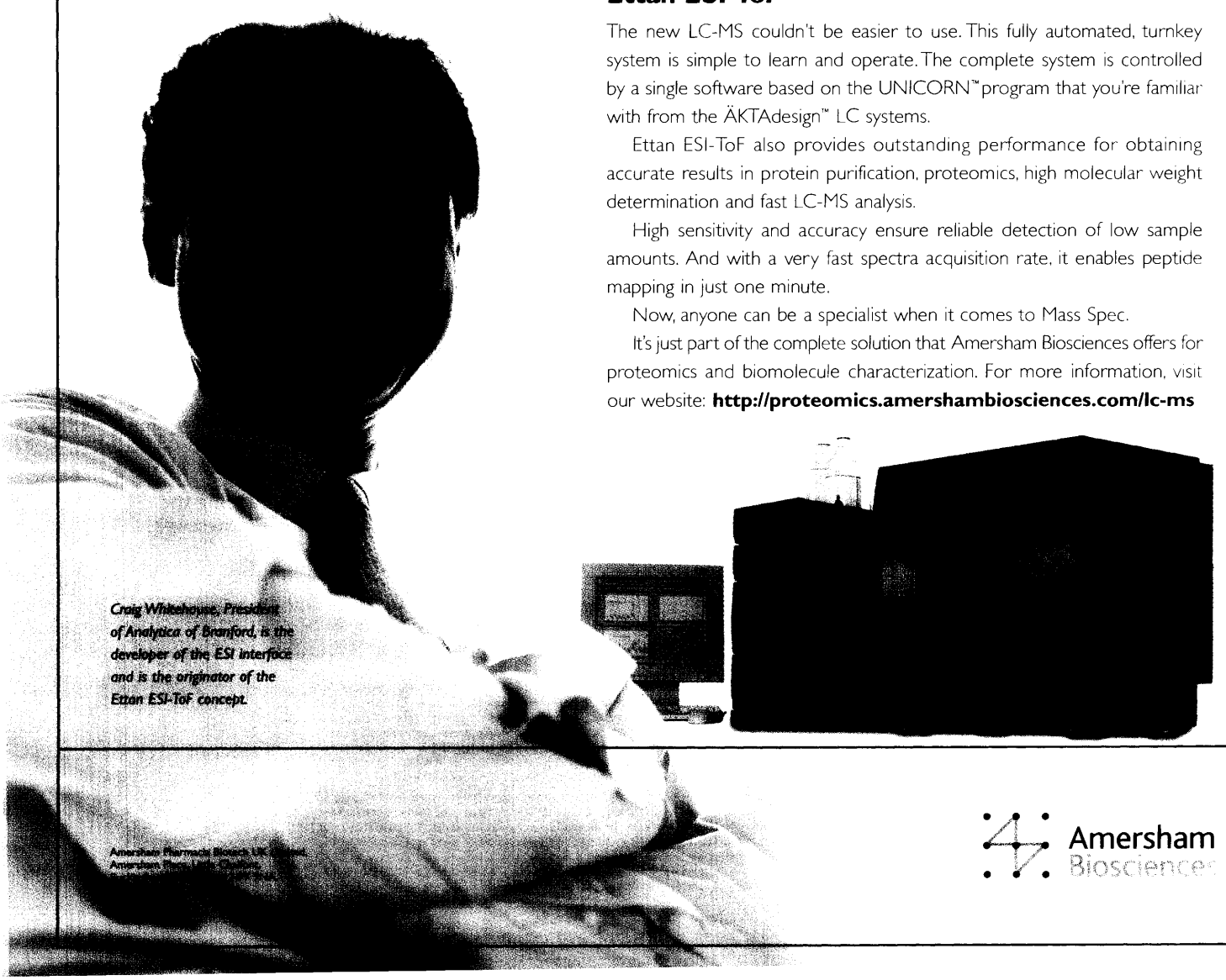

Craig Whitehouse, President of Analytica of Branford, is the developer of the ESI interface and is the originator of the Ettan ESI-ToF concept.

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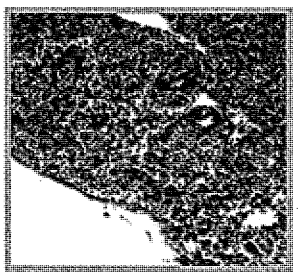
Alteration of Lymphocyte Trafficking by Sphingosine 1-Phosphate Receptor Agonists S. Mandala *et al.*

An immunosuppressive drug mimics a lipid in perturbing lymphocyte traffic.



Experimental Quantum Cloning of Single Photons A. Lamas-Linares, C. Simon, J. C. Howell, D. Bouwmeester

Cloning of quantum units, photons, is achieved close to the theoretical limit by spontaneous emission via a down-conversion process.

Genetic Dissection of Transcriptional Regulation in Budding Yeast R. B. Brem, G. Yvert, R. Clinton, L. Kruglyak

The genetic basis of control of gene expression levels is studied on a genome-wide scale.

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career resources for scientists

US: Mentoring Scientists—An Ethical Dilemma Edited by K. Cottingham

What is a mentor—and what are the obligations of mentors and protegés in academic science? Next Wave asked a panel of experts.

Canada: Stem Cell Research—Building a Canadian Network L. McKarney

Stem cell research in Canada is becoming more cohesive, with the recent creation of the Stem Cell Network and the Centre for Stem Cell and Gene Therapy.

Singapore: Research Scholarships and Fellowships J. Wong

A comprehensive list of scholarships and fellowships for research-based studies in Singapore and abroad.

UK: Science Writer in Residence M. Gross

A part-time passion became a full-time job for academic-turned-writer Michael Gross. A German living in the UK, he writes books and articles in two languages.

Germany: Book Review—Research Grants in Germany E. von Ruschkowski

A new book gives young researchers an overview of funding sources—from pre-Ph.D. through postdoc. (In German)

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A Game of Cellular Clue R. J. Davenport

SOD1, with oxidative damage, in the . . . mitochondria?

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signal transduction knowledge environment

Perspective: The Message and the Messenger—Delivering RNA in Neurons K. S. Kosik and A. M. Krichevsky

RNA granules control mRNA availability in neurons.

Connections Map: Fas Signaling Pathway in Cardiomyocytes Pathway Authority: H. Wajant

Beginning to dissect the pathway to cardiac hypertrophy.

Connections Map: *C. elegans* QL Neuroblast Migration Pathway Pathway Authority: B. Bowerman

A Wnt pathway sending neurons to the posterior.

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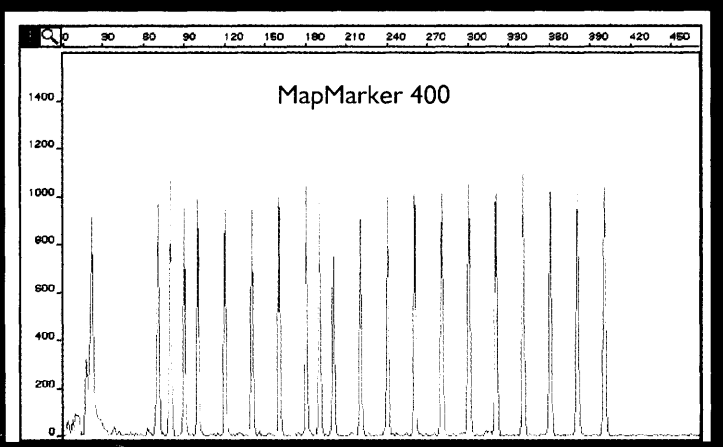

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THIS WEEK IN Science

edited by Phil Szuromi

Disinclined to Yield

When a metal is plastically deformed, networks of dislocations (translational defects in the atom positions) are created and make successive deformation processes more difficult. This "work hardening" is commonly used to make tough, fine-grained metals. However, disclinations, which are rotational defects, can also form. In a high-resolution transmission electron microscopy study of heavily deformed iron, Murayama *et al.* (p. 2433; see the Perspective by Ovid'ko) observed wedge-shaped regions of arrays of dislocations, which they believe make up a partial disclination dipole. They propose a mechanism for the formation of this dipole that helps explain how materials deform under severe plastic shear strain.

2425 Taking Nanorods to Solar Cells

Solar cells based on conducting polymers should be less expensive than inorganic devices because of lower processing costs, but inefficient transport of charge carriers within the polymers greatly limit their efficiency. Adding inorganic semiconducting particles such as CdSe should improve charge transfer because these particles are good electron acceptors and the polymers are good electron donors. Huynh *et al.* (p. 2425) show that when CdSe nanoparticles are formed as high–aspect ratio nanorods and are well dispersed in the polymer poly(3-hexylthiophene), thin-film photovoltaic devices show high external quantum efficiencies (~7% for illumination at 515 nanometers and 1.7% for simulated solar emission). Electron microscopy reveals that the rods tend to align such that they facilitate charge transport.

And in Brevia ...

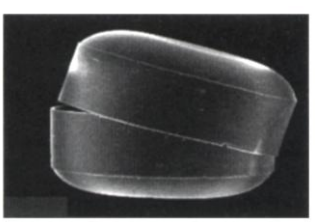
Silent earthquakes creep without producing measurable seismic shaking; Miller *et al.* (2423) show that eight such events have occurred since 1992 along the Juan de Fuca plate subduction zone in the Pacific Northwest and that a new creep event started on 7 February 2002.

Irregular Rise

One of the most dramatic events of the last deglaciation was a large (~20 meters) and rapid (<500 years) increase in sea level that occurred about 14,000 years ago. This event, called meltwater pulse IA (mwp-IA), was the result of the injection of fresh water from melting continental ice sheets into the ocean. Which ice sheets produced this water? Clark *et al.* (p. 2438; see the Perspective by Sabadini) used the highly nonuniform patterns of global sea level change to define the global sea level "fingerprints" for various melting scenarios. As a test of this method, they used estimates of sea level change at Barbados and Sunda Shelf to show that southern Laurentide ice could not have been the sole source of mwp-IA and that melting from the Antarctic is consistent with existing sea-level records.

Off the Walls

The amorphous silica walls of diatoms exhibit intricate species-specific patterns. Are these patterns the result of a complex and highly regulated assembly of cell organelles and vesicles or of physiochemical interactions? Sumper (p. 2430) presents evidence for the latter in the pattern formation in the diatom *Coscinodiscus*, in which he assumes that repeated phase-separation events during wall biogenesis produce self-similar patterns at smaller and smaller scales. High-resolution scanning electron microscopic images of three different *Coscinodiscus* species provide support for this model. Species-specific patterns would result from the constraints introduced by different wall-to-wall distances, which dictate the next level of pattern formation.



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Too Much TV

At what point does television viewing by young children have a harmful effect? Johnson *et al.* (p. 2468; see the Perspective by Anderson and Bushman) found that extensive television watching during adolescence and young adulthood is associated with subsequent aggressive behavior. To gather this data, 707 families with a child between the ages of 1 and 10 were interviewed and studied for 17 years. Increases in aggression were documented in 14-year-old boys who watched 1 to 3 hours of television per day in comparison to those who watched less than 1 hour per day.

Earth's Dynamo and Orbital Dynamics

Changes in the intensity of Earth's magnetic field are recorded in magnetic minerals trapped in layers of sedimentary rocks and provide clues to how the geodynamo works. Changes in Earth's orbit and climate have both been weakly correlated with magnetic field changes. Now, Yamazaki and Oda (p. 2435) have measured a 100,000-year periodicity in the inclination and intensity of the magnetic field in a 2.25-million-year section of a sedimentary marine core from the West Caroline Basin. The 100,000-year periodicity is correlated with orbital eccentricity, not climate, and the periodicity varies with the strength of the axial dipole field.

Genes for Systemic RNA Interference

One unusual aspect of RNA interference (RNAi)—the ability of short double-stranded RNA molecules to shut down expression of sequence-related messenger RNAs—is that it can be systemic, and thus spread from one cell or tissue to another. For example, in plants, RNAi is used to combat viral infection. Winston *et al.* (p. 2456) have isolated three genes in the nematode worm *Caenorhabditis elegans* that are required for the systemic RNAi effect. One of these loci, *sid1*, encodes a transmembrane protein, which is also present in mouse and humans, that may function as an act for a putative intercellular RNA signal.

At the Hub

Posttranslational modification of proteins is an important strategy used in controlling protein function during development. Dittmar *et*

Published online in *Science* Express

CONTINUED ON PAGE 2323

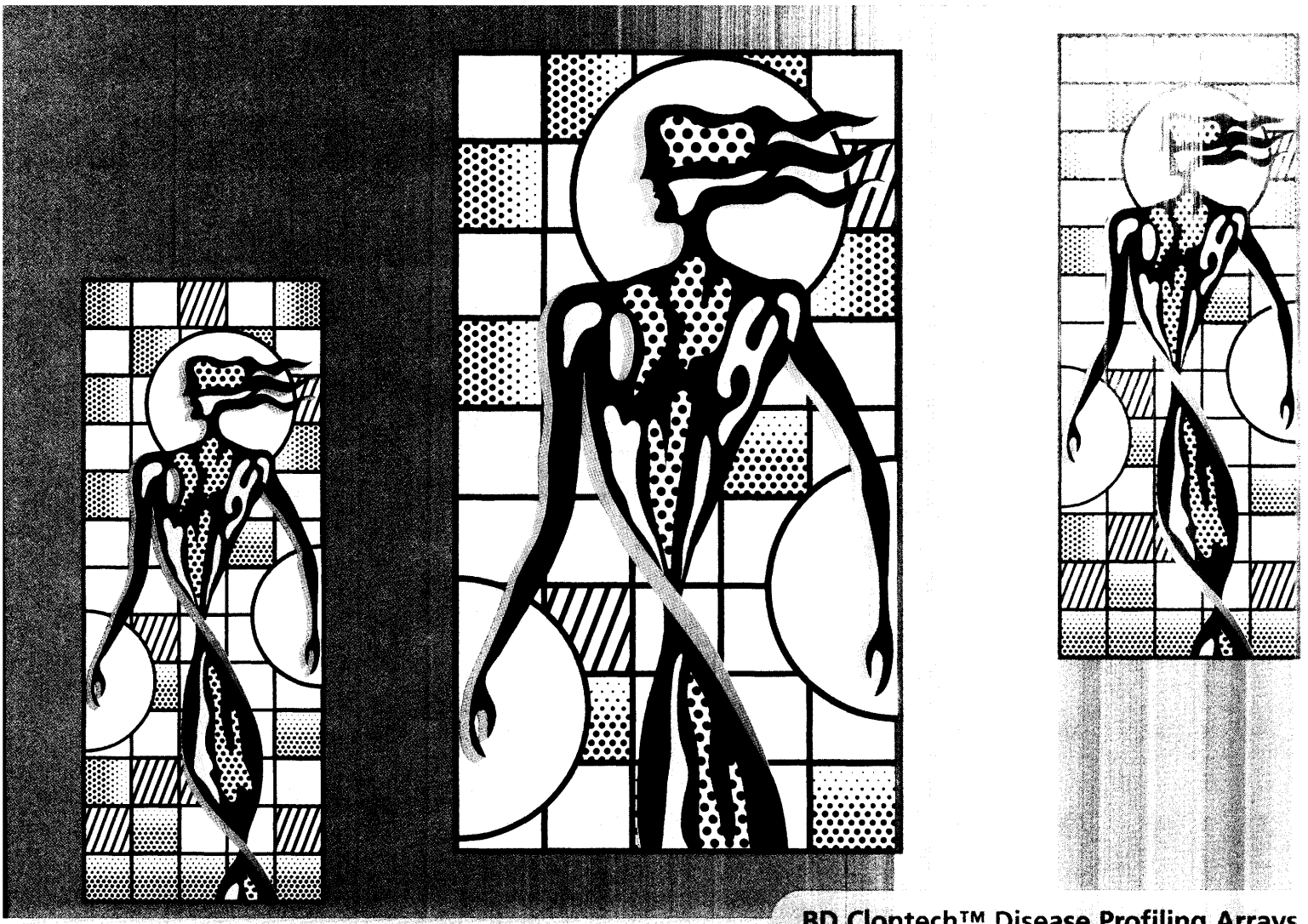

Illustration inspired by the art of Roy Lichtenstein (1923–1997).

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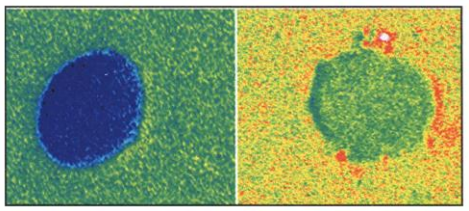
al. (p. 2442) discovered a modification termed Hub1 related to ubiquitination. The addition of Hub 1 to target proteins was found to be important in regulating polarized morphogenesis in yeast. Cells unable to link Hub1 to target proteins were defective in mating—a process that requires formation of a polarized mating projection, the shmoo.



CREDIT: KARLSEDER *ET AL.*

Protection from Senescence

Primary human cells can divide only so many times, and this state of growth arrest, or replicative senescence, is triggered by shortening of telomeres (the nucleoprotein complexes at the ends of chromosomes; see the news story by Marx). Karlseder *et al.* (p. 2446) show that senescence of primary human cells can be delayed by overexpression of a protein that protects chromosome ends, called telomere protection factor (TRF2). This result is incompatible with the long-standing view that senescence is triggered by the absence of telomeric DNA through a DNA-damage pathway.

On the Slopes

Understanding the balance between the assembly and disassembly of microtubules during the formation of the mitotic spindle requires a knowledge of the levels of a variety of assembly factors around the chromosomes. Kalab *et al.* (p. 2452) have directly visualized a concentration gradient of the small guanosine triphosphatase (GTPase) Ran in its GTP-bound conformation emanating from the chromosomes in mitotic extracts derived from *Xenopus* eggs. Such a gradient should promote the release of proteins from the chromosomes that could regulate microtubule dynamics.

Moving from A to B

Neurons in the medial superior temporal (MST) region participate in the encoding of various visual parameters. Some encode a location map of the environment and are called place cells, and others encode a direction of movement, derived from the expanding or contracting visual scene, and are called heading cells. Froehler and Duffy (p. 2462; see the Perspective by Bradley) describe a third kind of neuronal activity in the monkey MST that corresponds to an integration of heading and place, carried out by a path cell.

Neurons Switch Their Preferences

When we are awake, our eyes perform small rapid movements and jump from one fixation point to another. These saccades occur several times a second. Thiele *et al.* (p. 2460; see the news story by Barinaga) compared neuronal activity in two movement-specialized brain areas, area MT and area MST, during saccade-induced image motion and during passive viewing. Some cells suppress their response selectively during saccades while still being sensitive to such speed in passive conditions. More remarkably, they describe a neuron that shows an inversion of its direction preference during saccades. These changes in tuning, which seem to occur very rapidly, do not have a retinal origin but are mediated by an internal signal.

Undesirable Recruitment

Tamoxifen is a highly effective drug for the treatment and prevention of breast cancer, but concerns have been raised about its widespread use because it also appears to increase the risk of endometrial cancer. Tamoxifen acts by binding to the estrogen receptor and modulating its transcriptional activity; however, the mechanism underlying its anti-estrogenic activity in breast tissue and estrogenic activity in endometrial tissue is poorly understood. Cell culture studies by Shang and Brown (p. 2465; see the Perspective by Katzenellenbogen and Katzenellenbogen) reveal at least a partial explanation for the drug's tissue-specific effects. In endometrial cells—but not in mammary cells—tamoxifen stimulates the recruitment of a transcriptional coactivator protein (SRC-1) whose expression is necessary for the drug's estrogenic activity. This mechanistic insight will likely accelerate the development of better drugs for breast cancer, osteoporosis, and other diseases where estrogen plays a major role.

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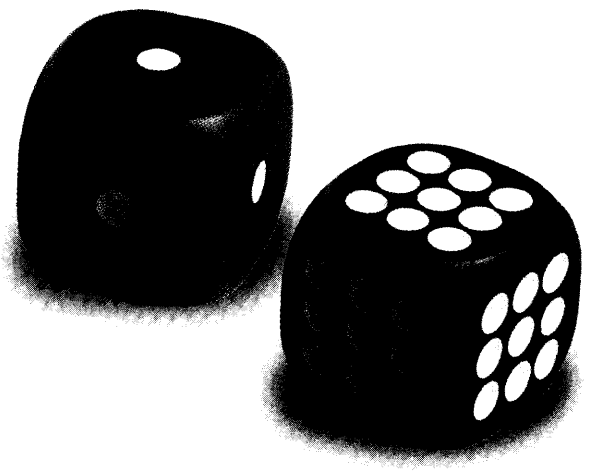

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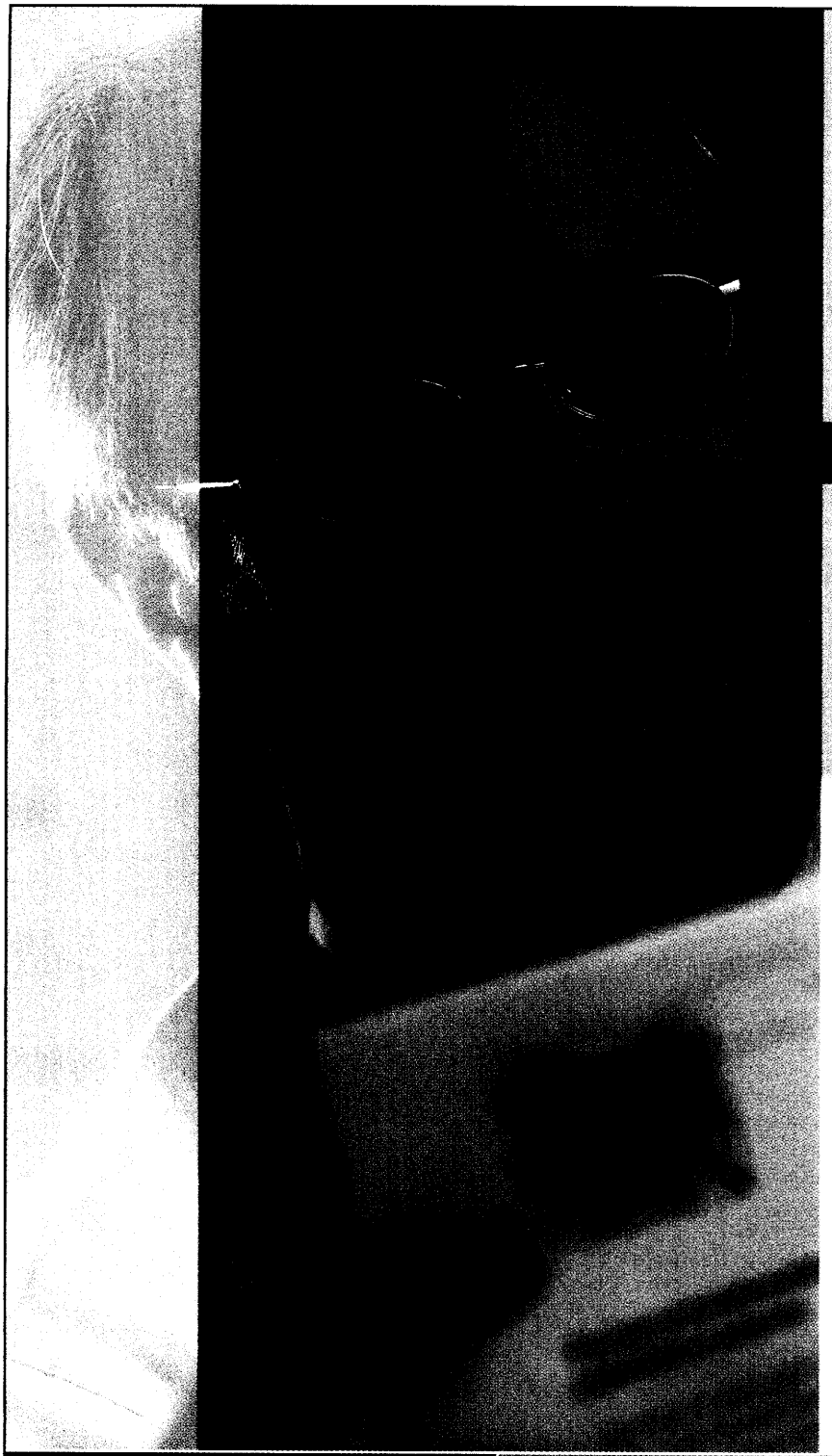

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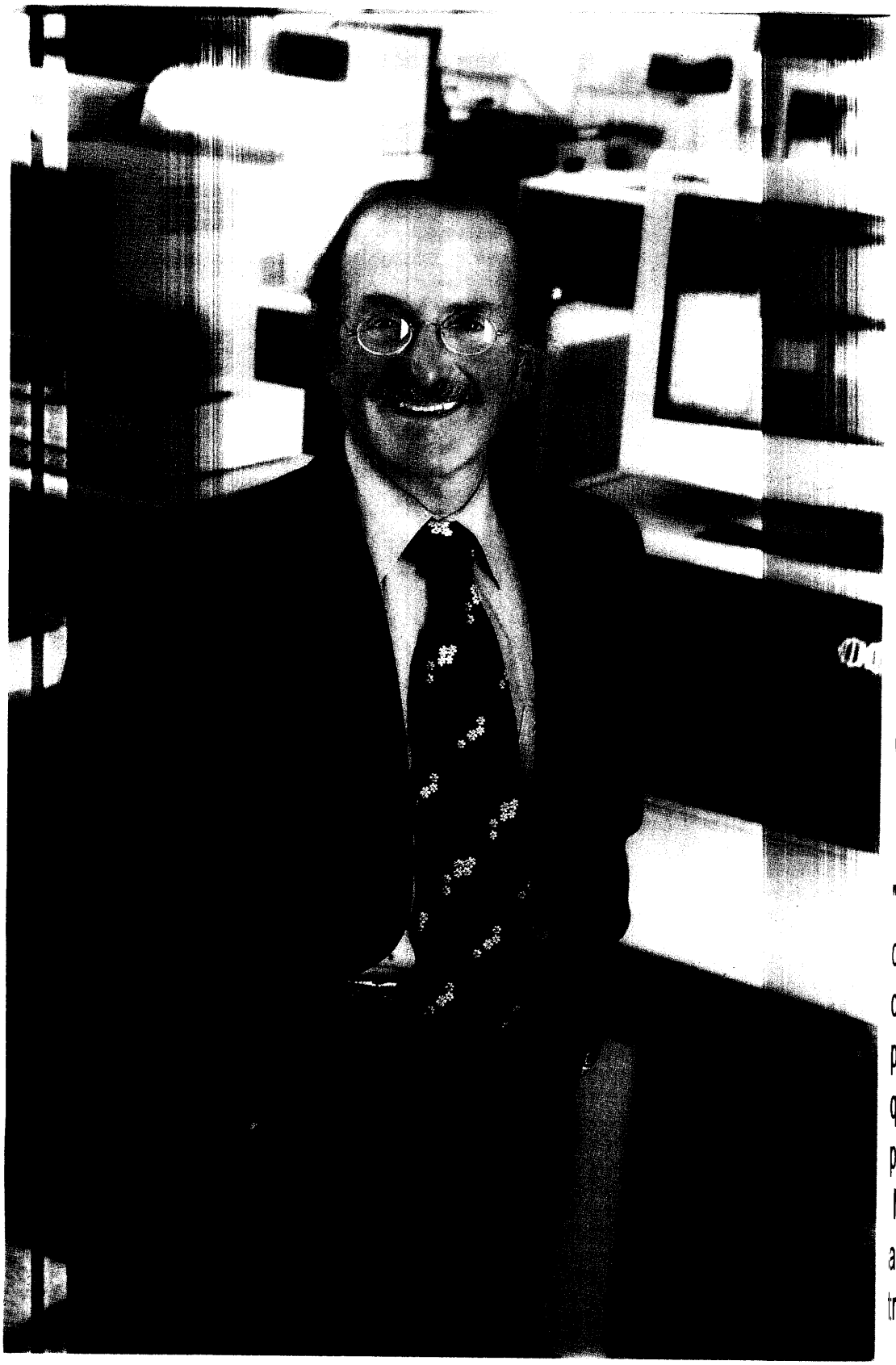

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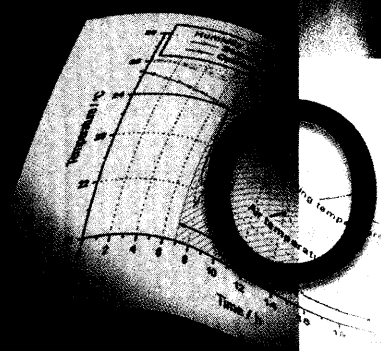

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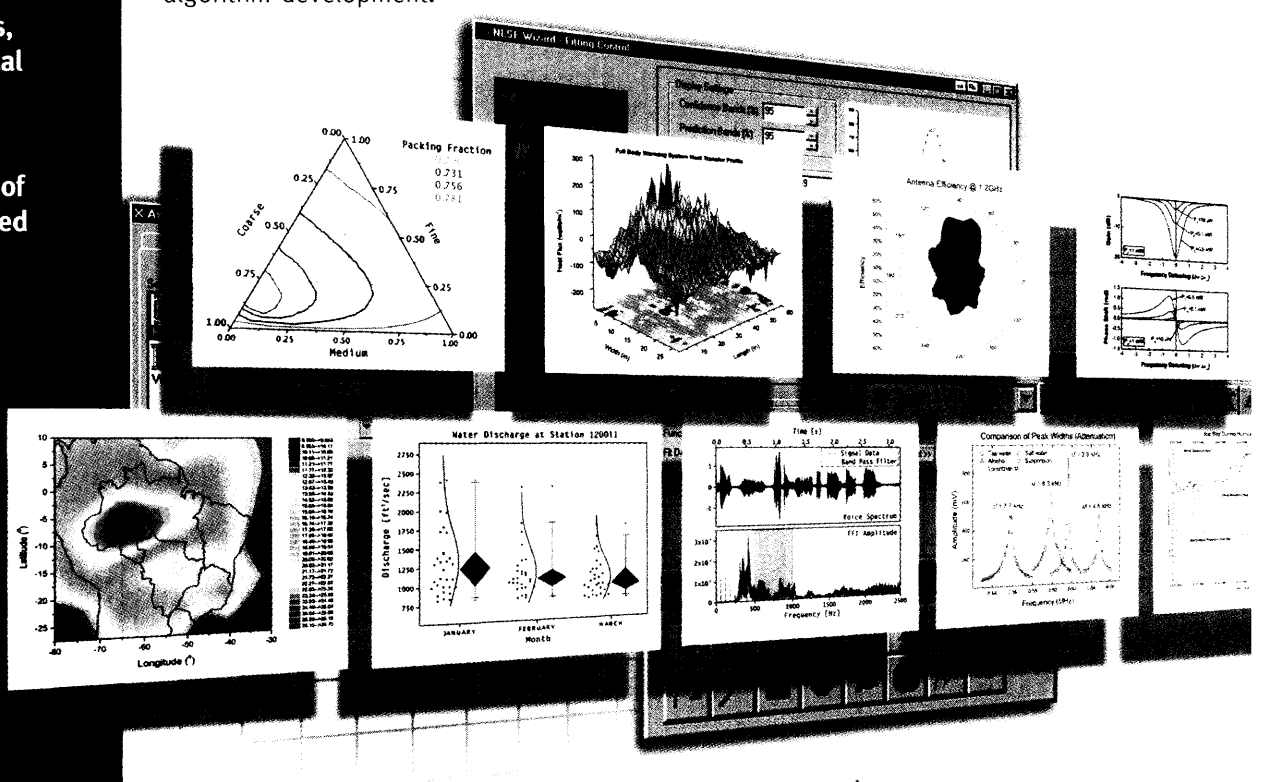

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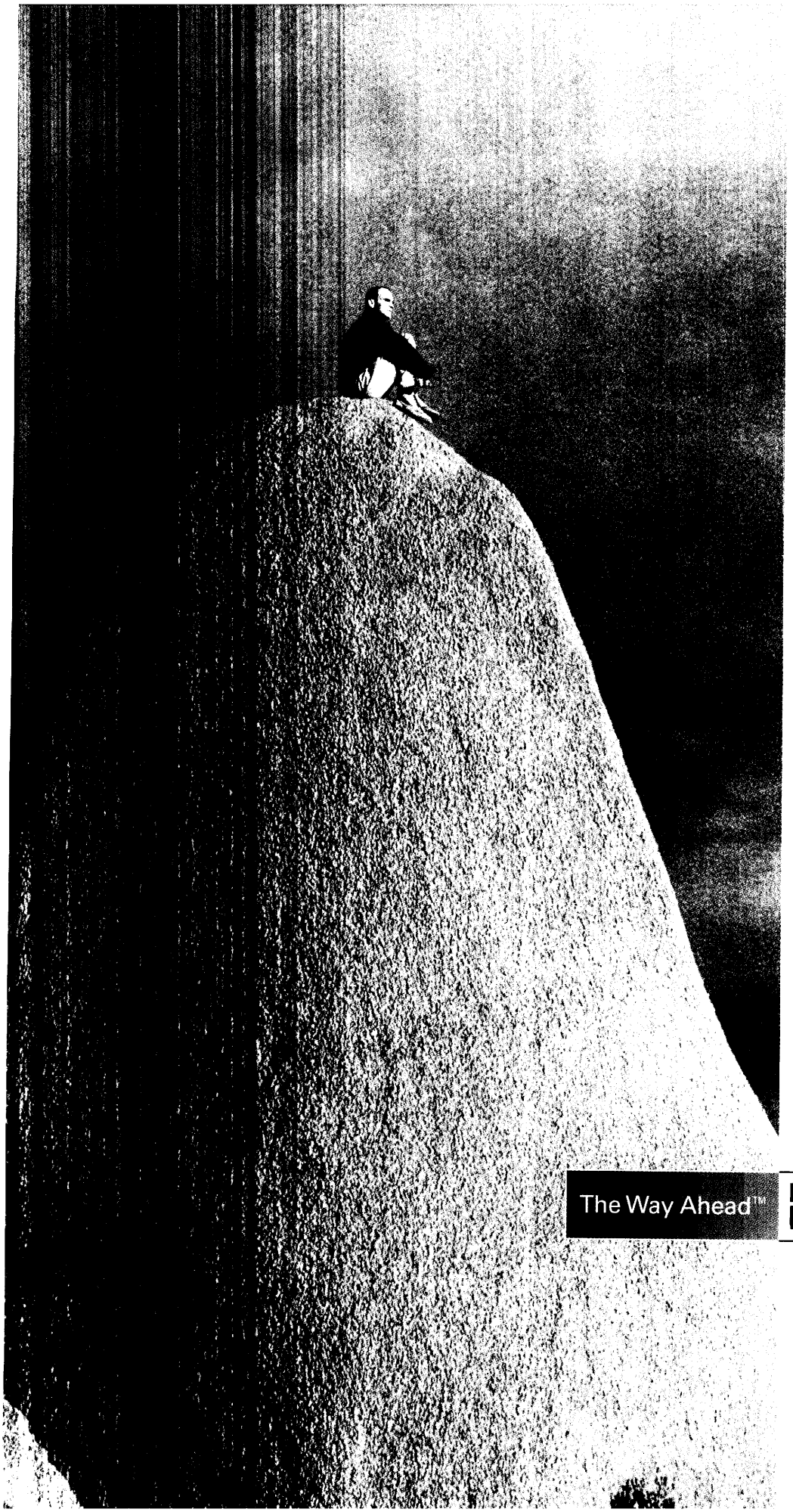

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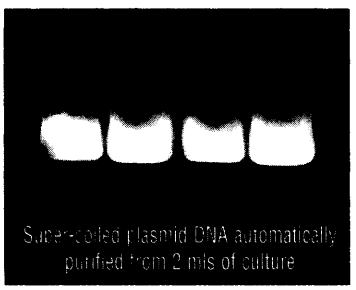

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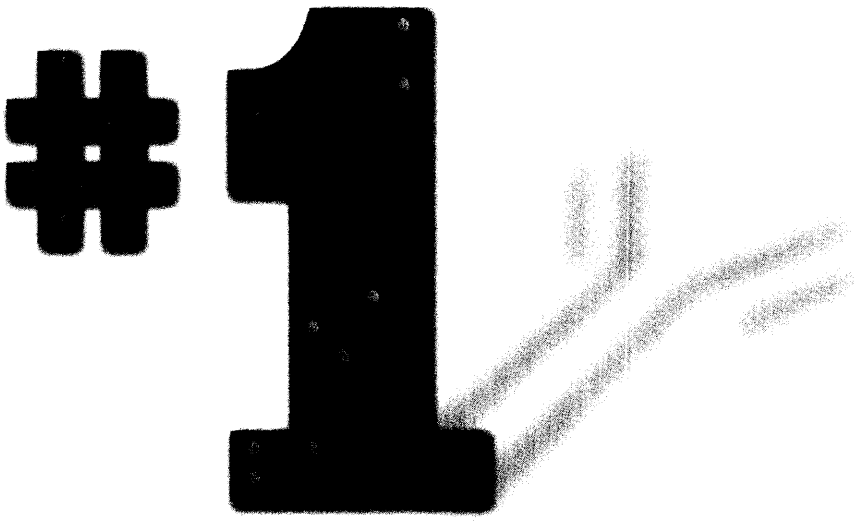

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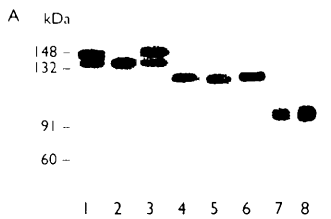
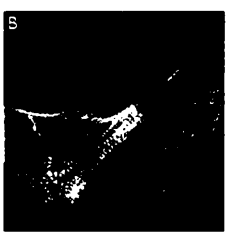
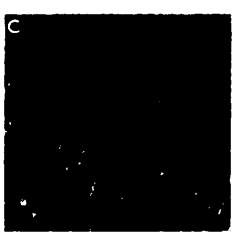


Lane:
1:c-Met [pY1003]
2:c-Met [pYpYpY1230/34/35]
3:c-Met [pY1365]
4:Integrin β [pTpT788/789]
5:Integrin β_3 [pY773]
6:Integrin β_3 [pY785]
7:IR [pY972]
8:IR/IGF1R [pYpYpY1158/62/63]





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cdc2	Integrin-β$_3$	Pyk2
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eIF-2α	JAK 1/2	Rb
eIF-4E	JNK	RON
ERK1/2	Lck	Src
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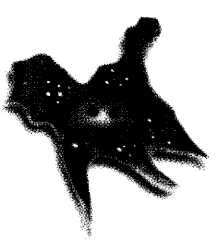

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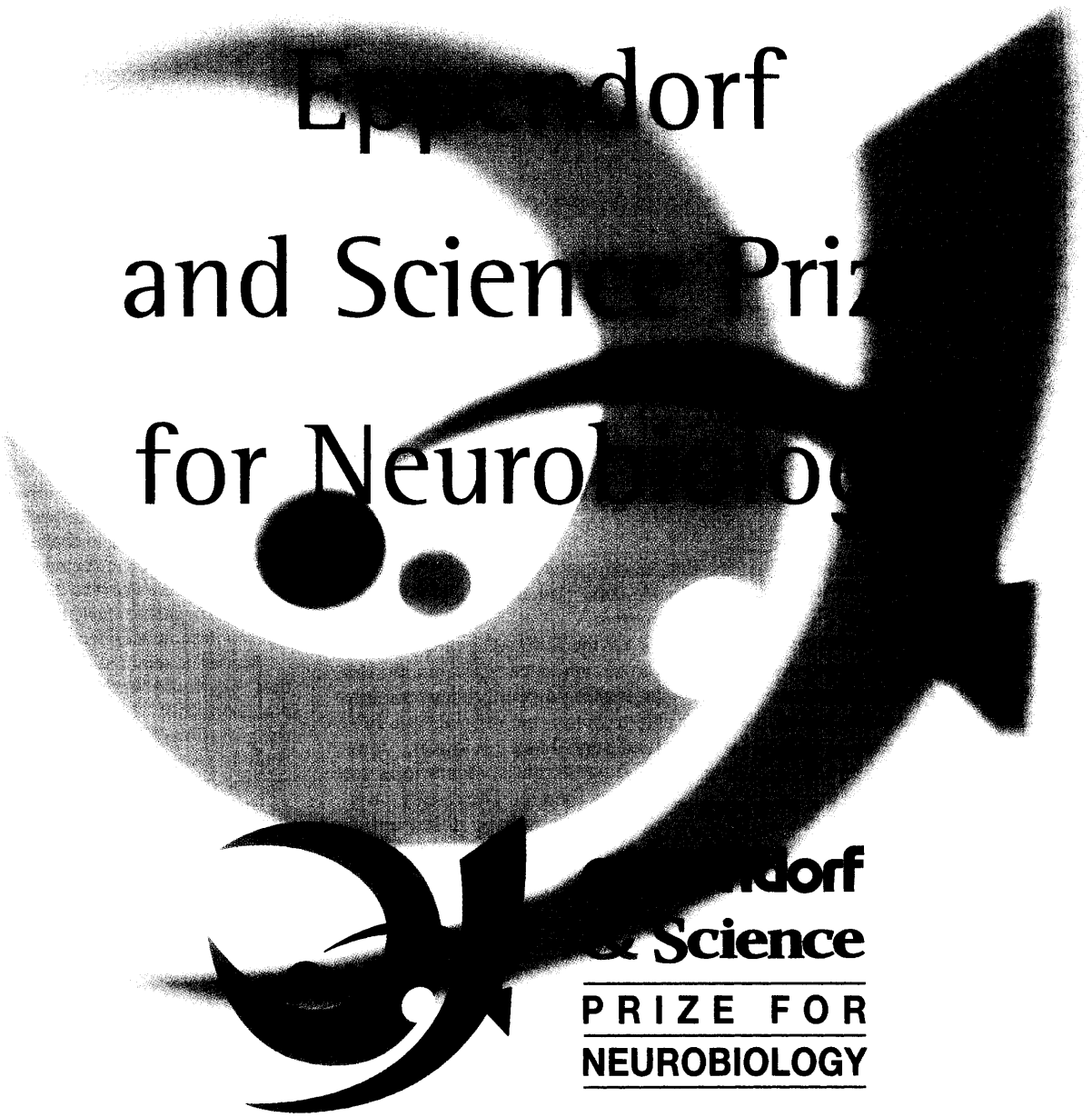

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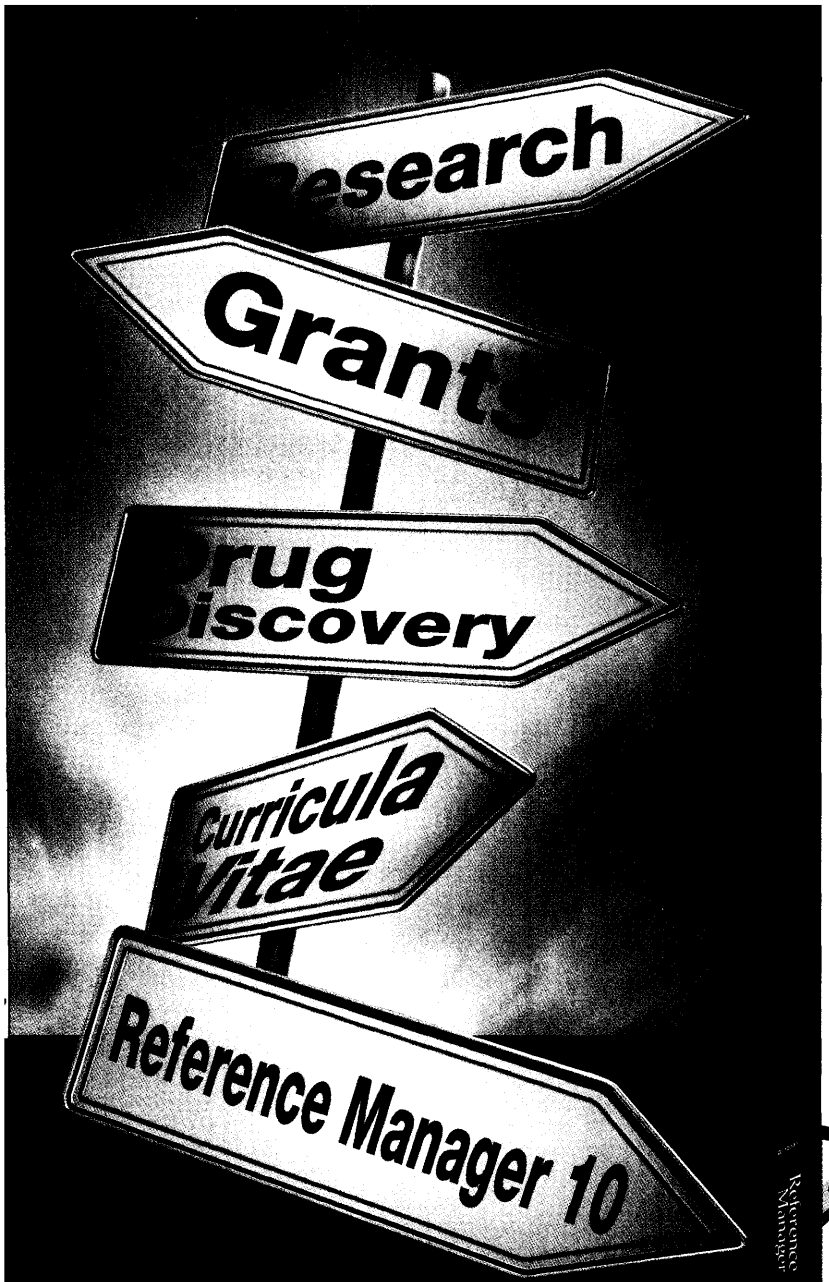

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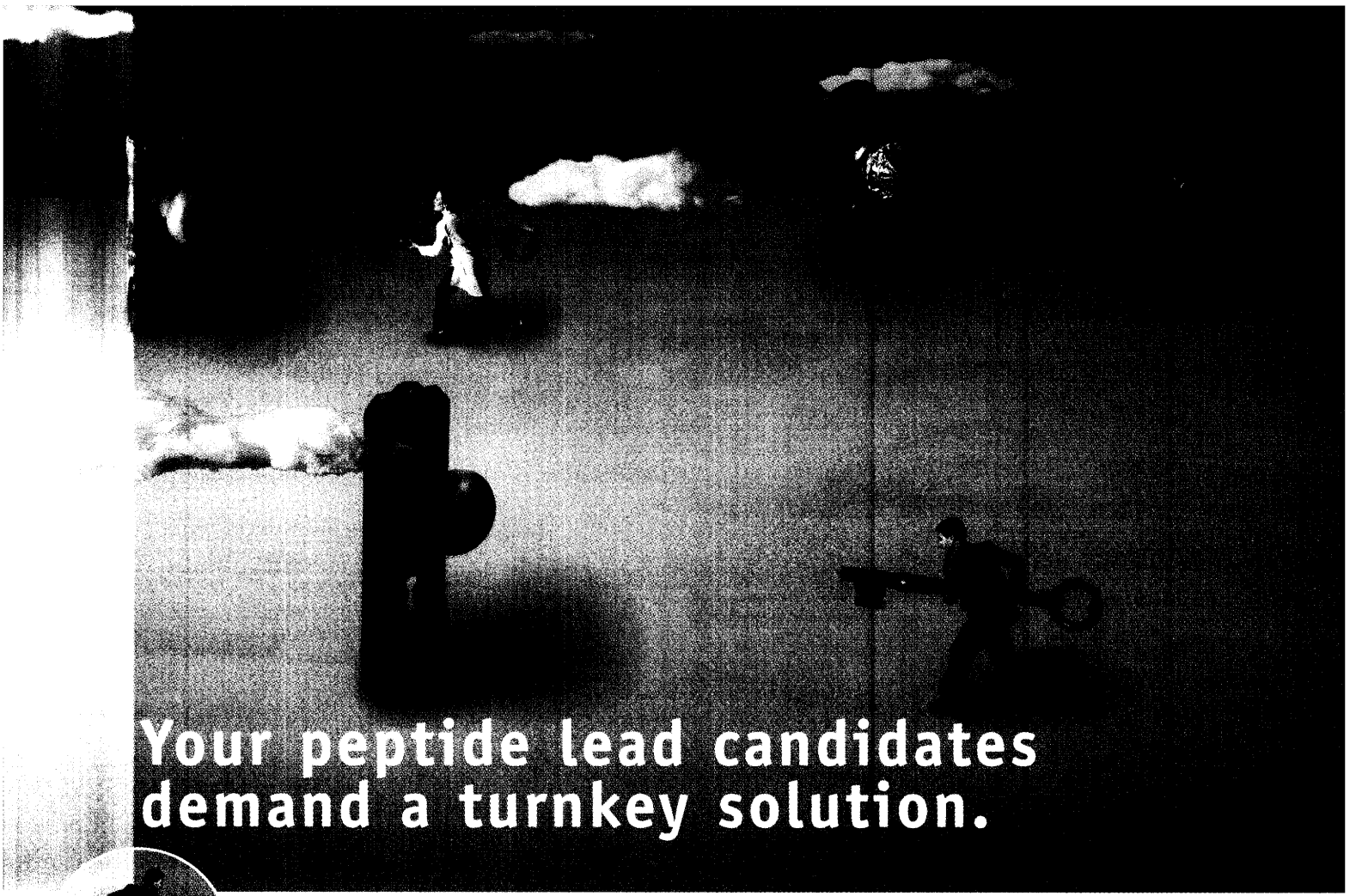

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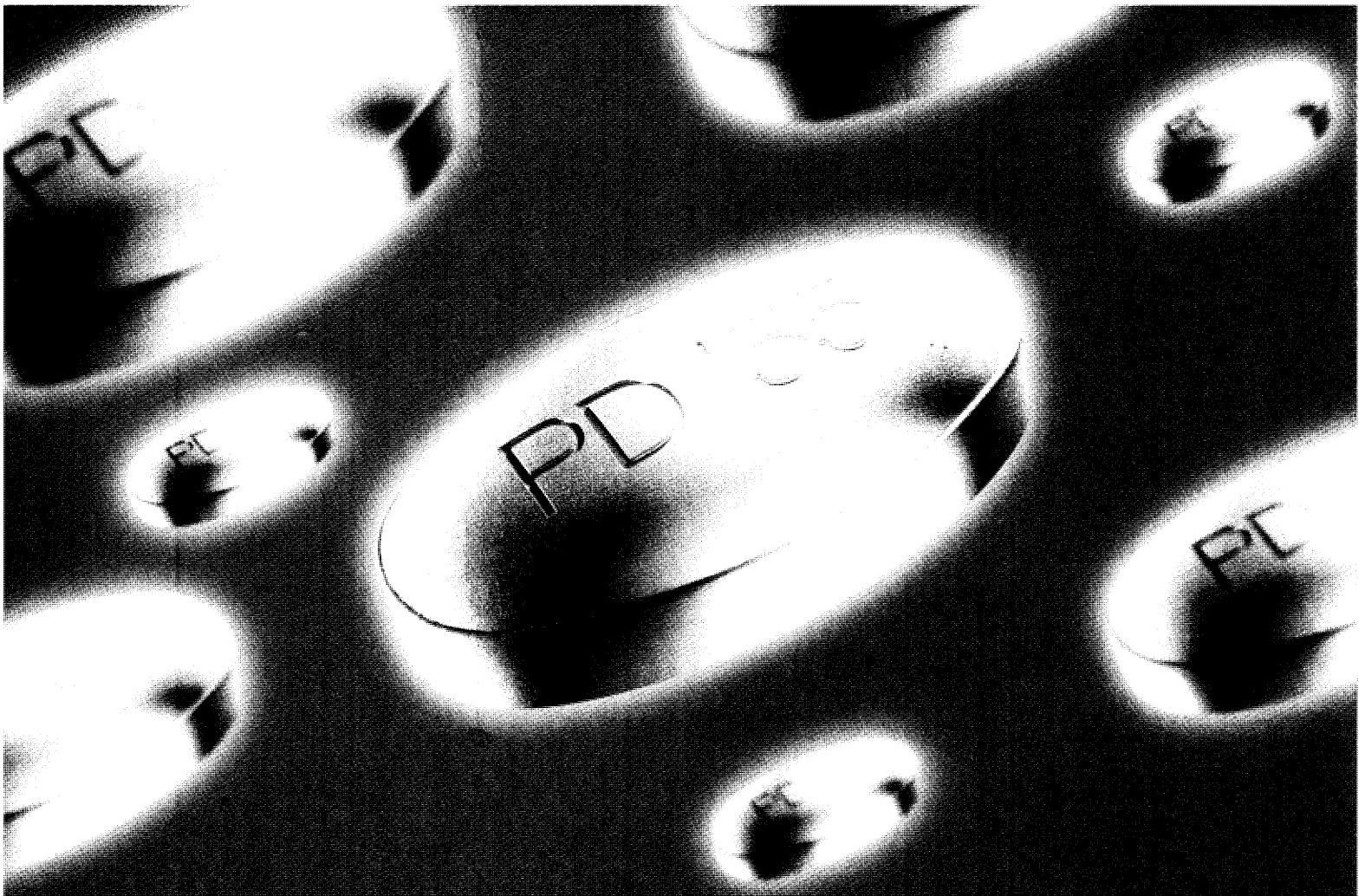

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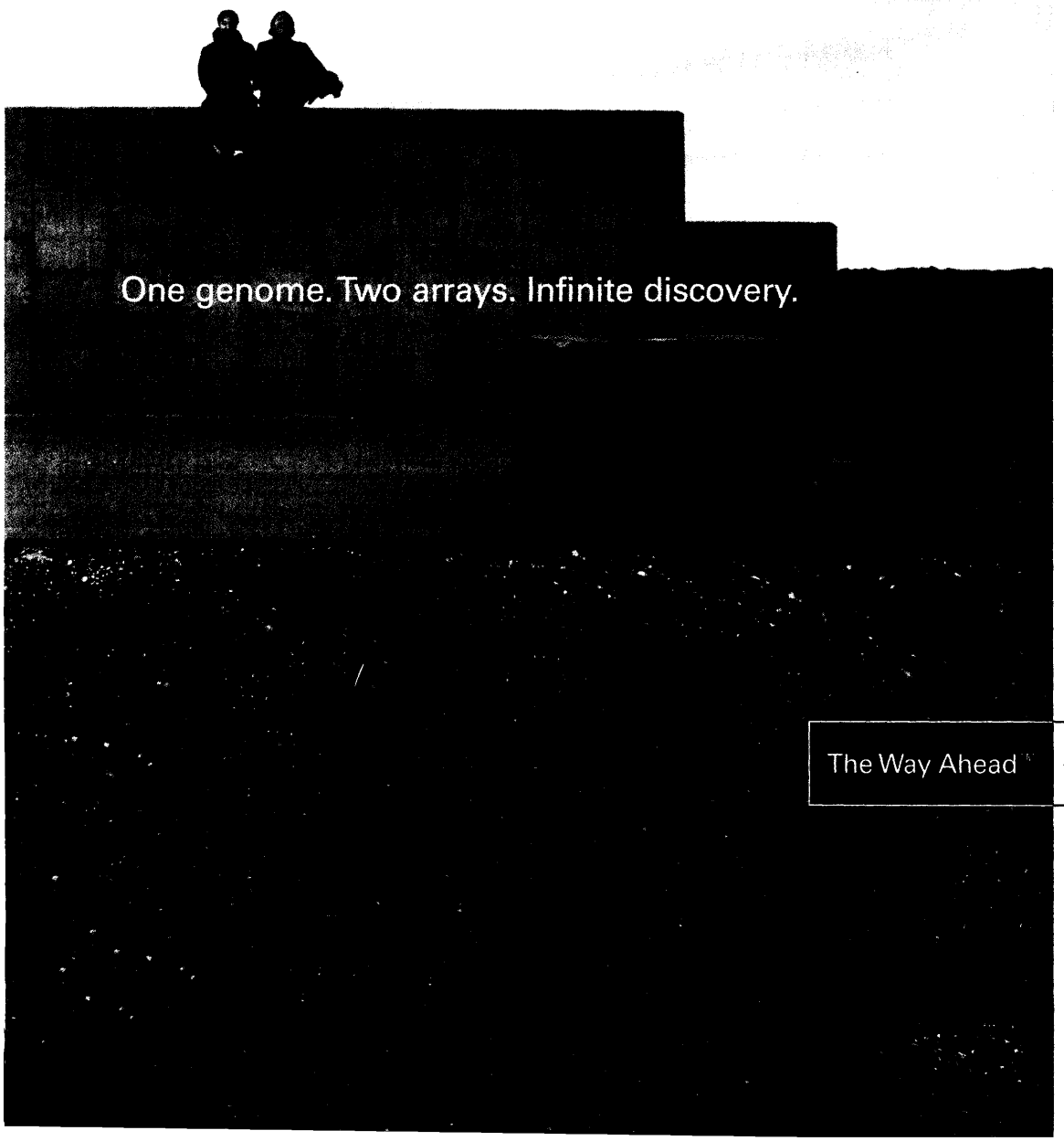

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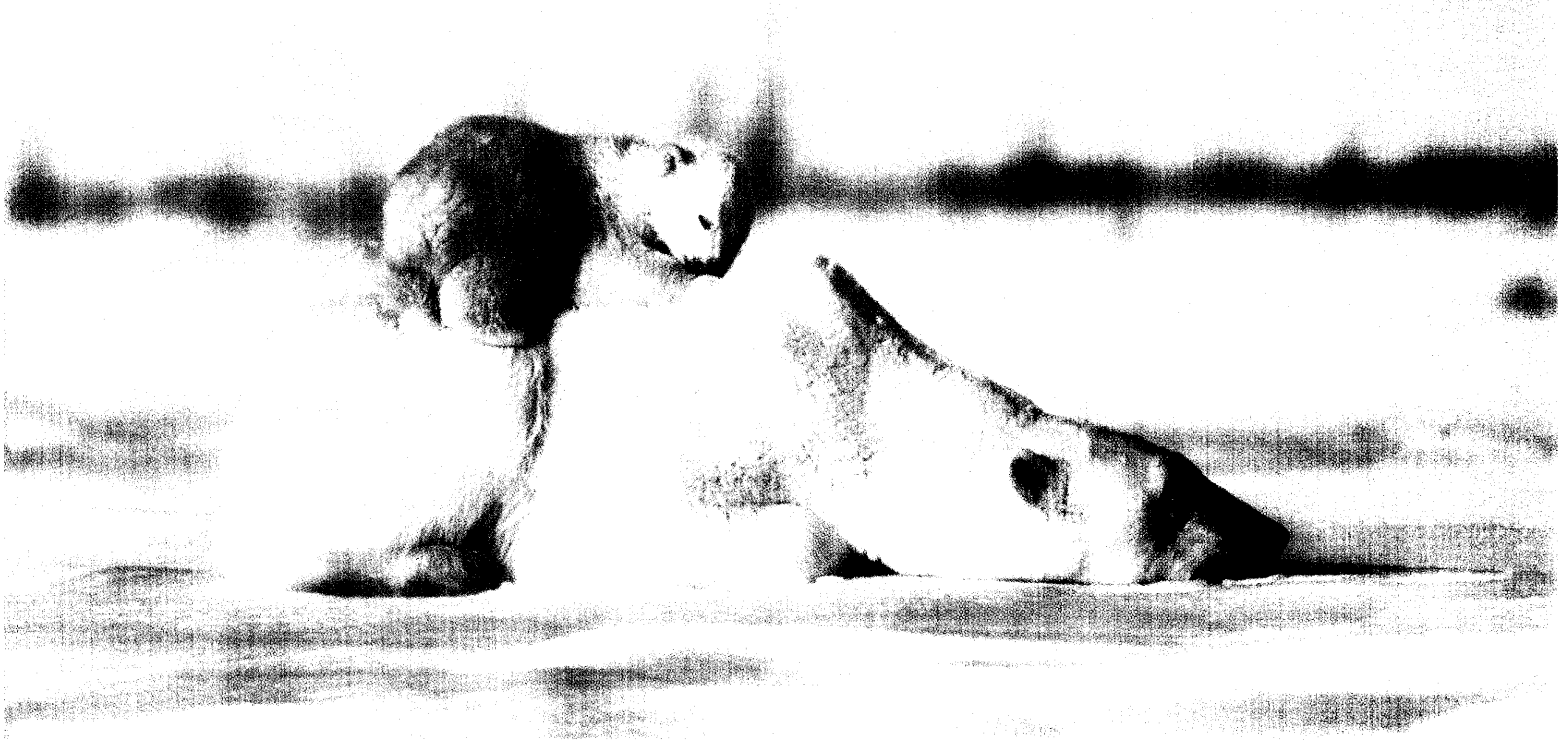

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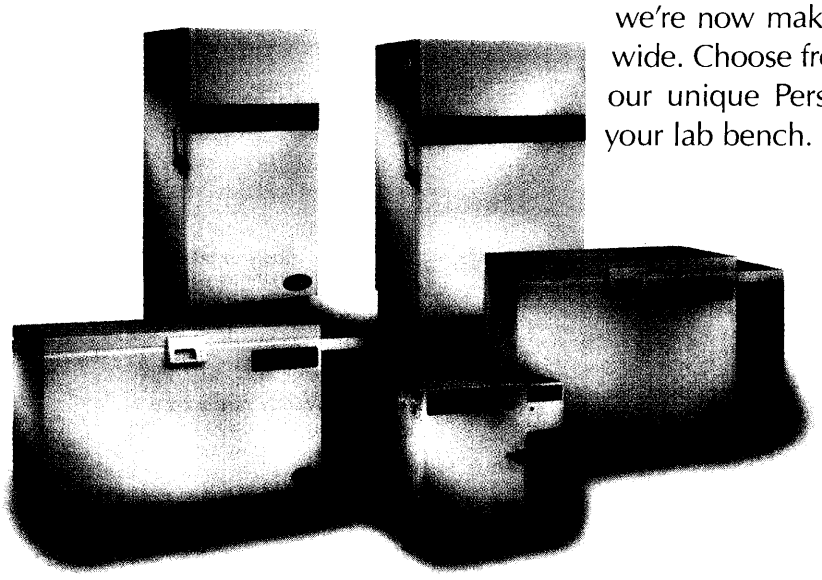

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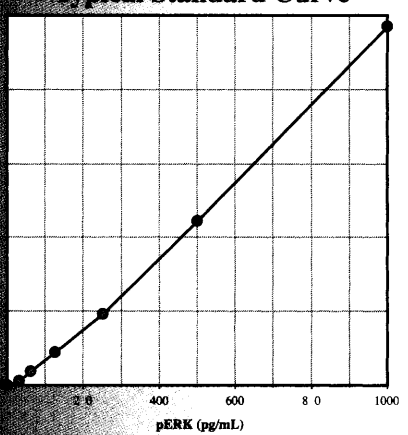

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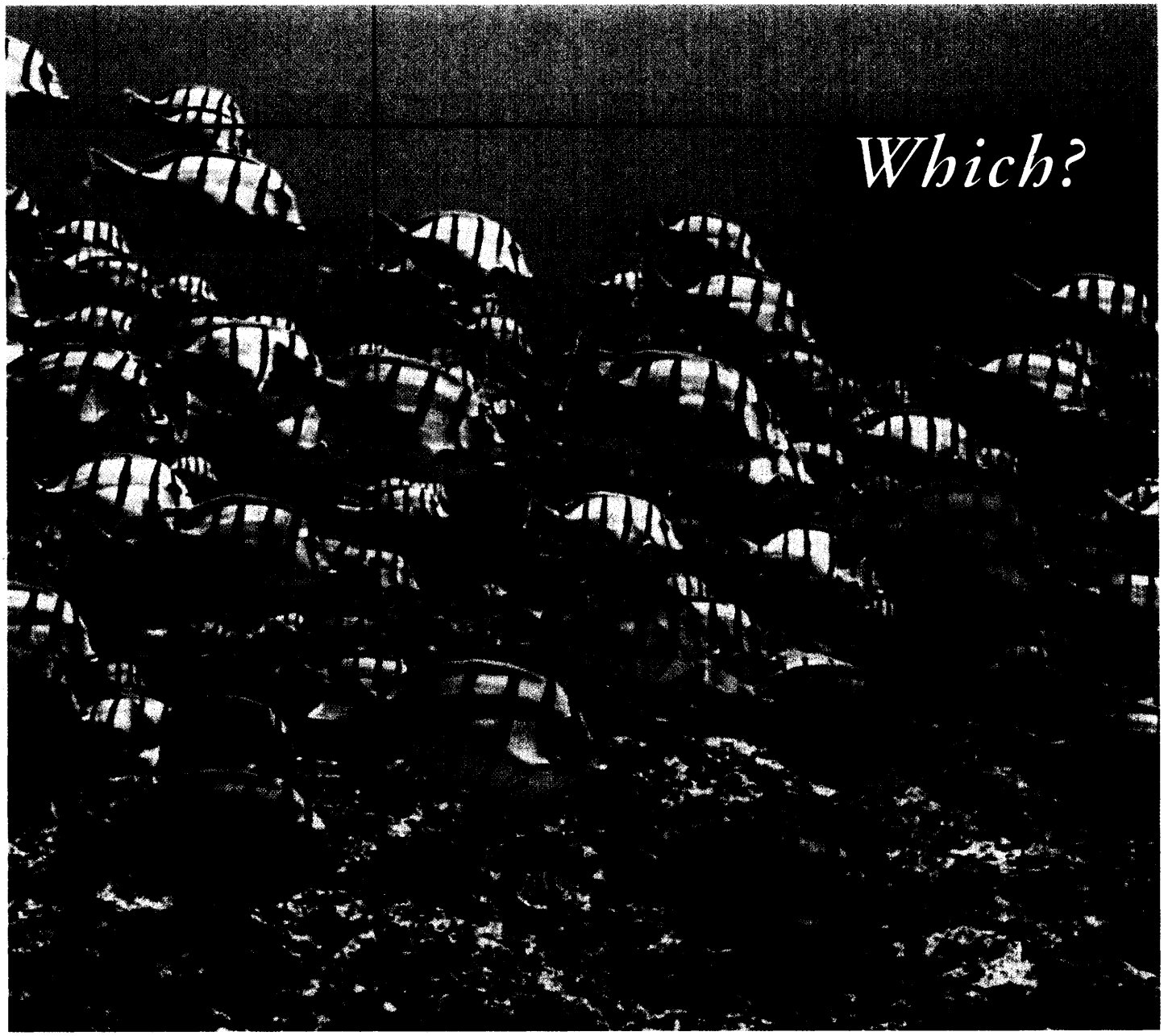

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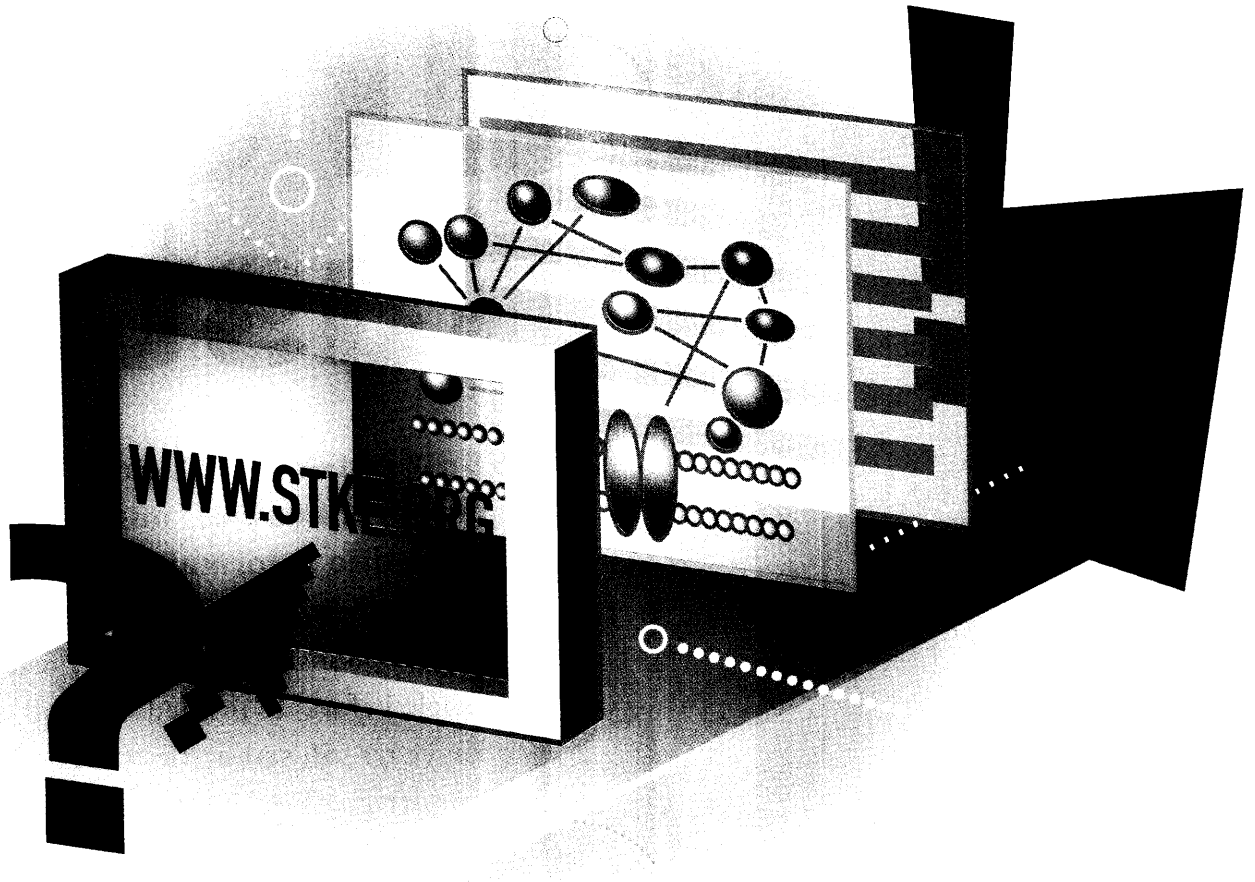

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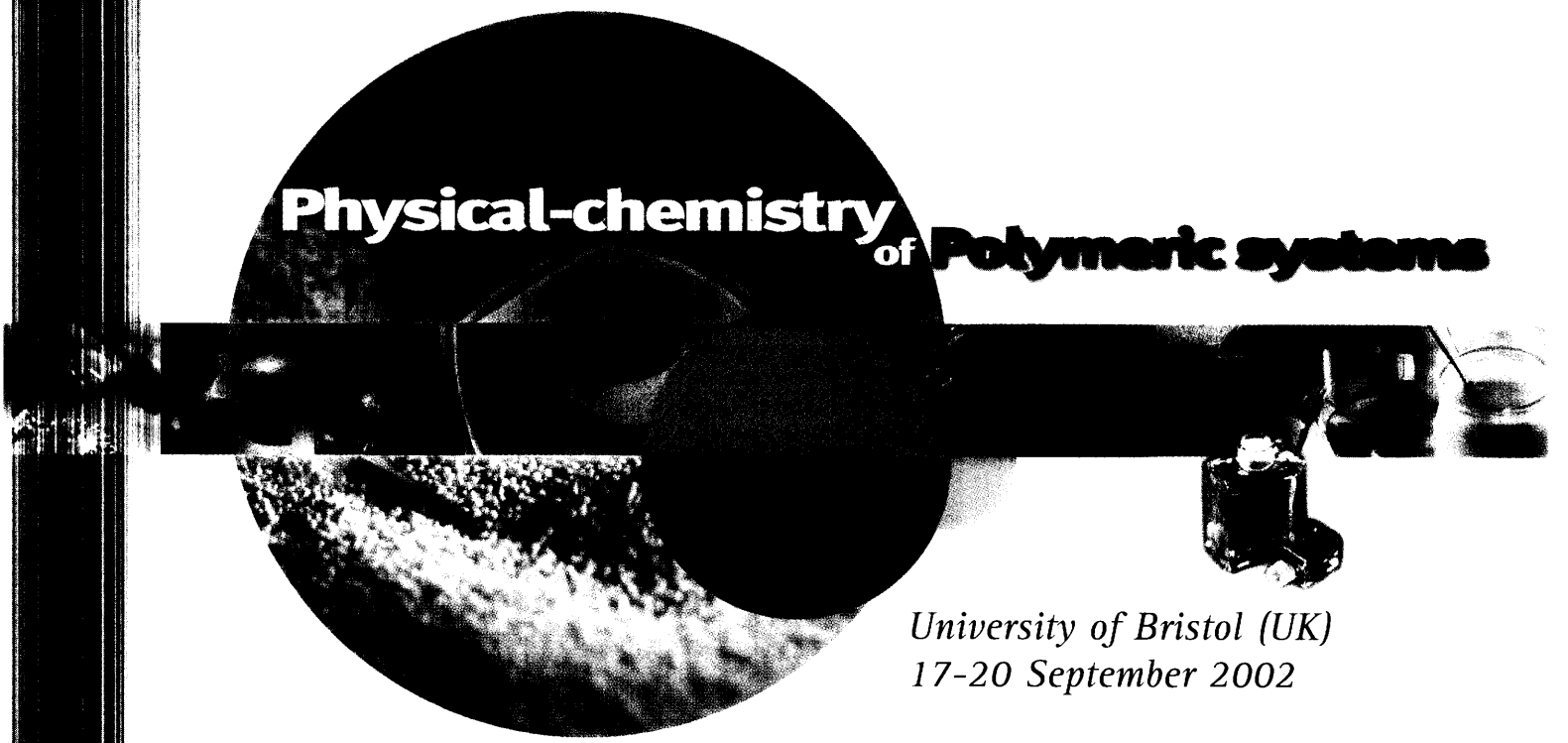

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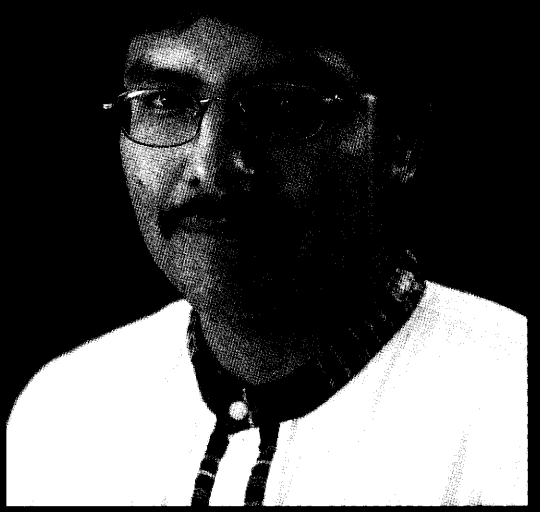

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Mathcad interfaces seamlessly with other applications, such as AutoCAD, Axum, Excel, and Visio. The data acquisition module allows one to acquire and send single-point data and waveform analog data in real time. The software allows a worksheet to be saved as an HTML file and also fully supports MathML (mathematics markup language).

The Mathcad 2001 professional version occupies 100 MB of hard disk space. The software comes with excellent documentation and provides comprehensive tutorials and overviews on the use of software. **—Krishna Pallavi, Satyam Priyadarshy**

K.P. is in the Department of Geology, Wright State University, Dayton, OH 45435, USA. E-mail: pallavi.2@wright.edu. S.P. is at Scope Labs, Inc., Reston, VA 20191, USA. E-mail: satyam@priyadarshy.com.

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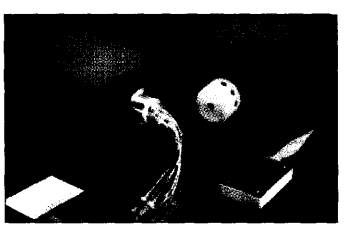

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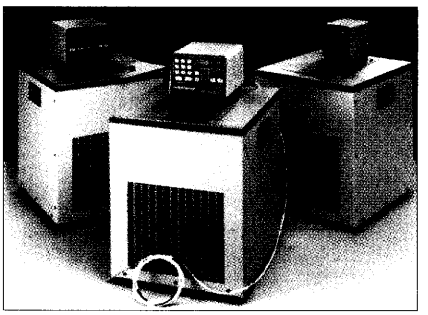

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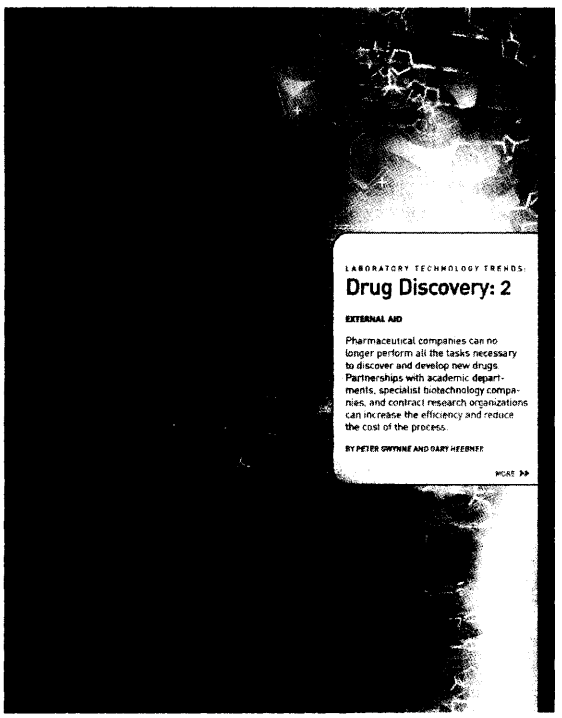

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