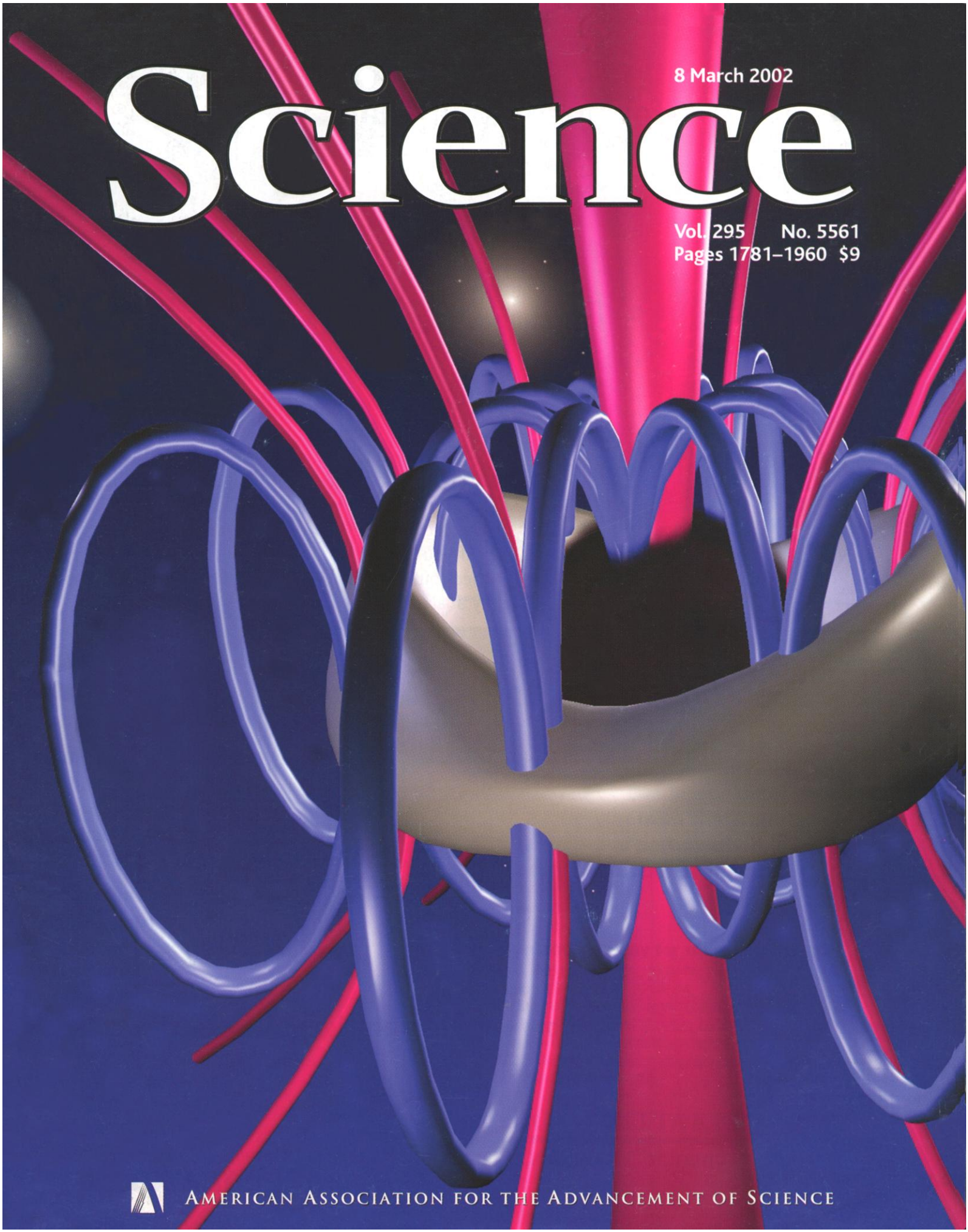
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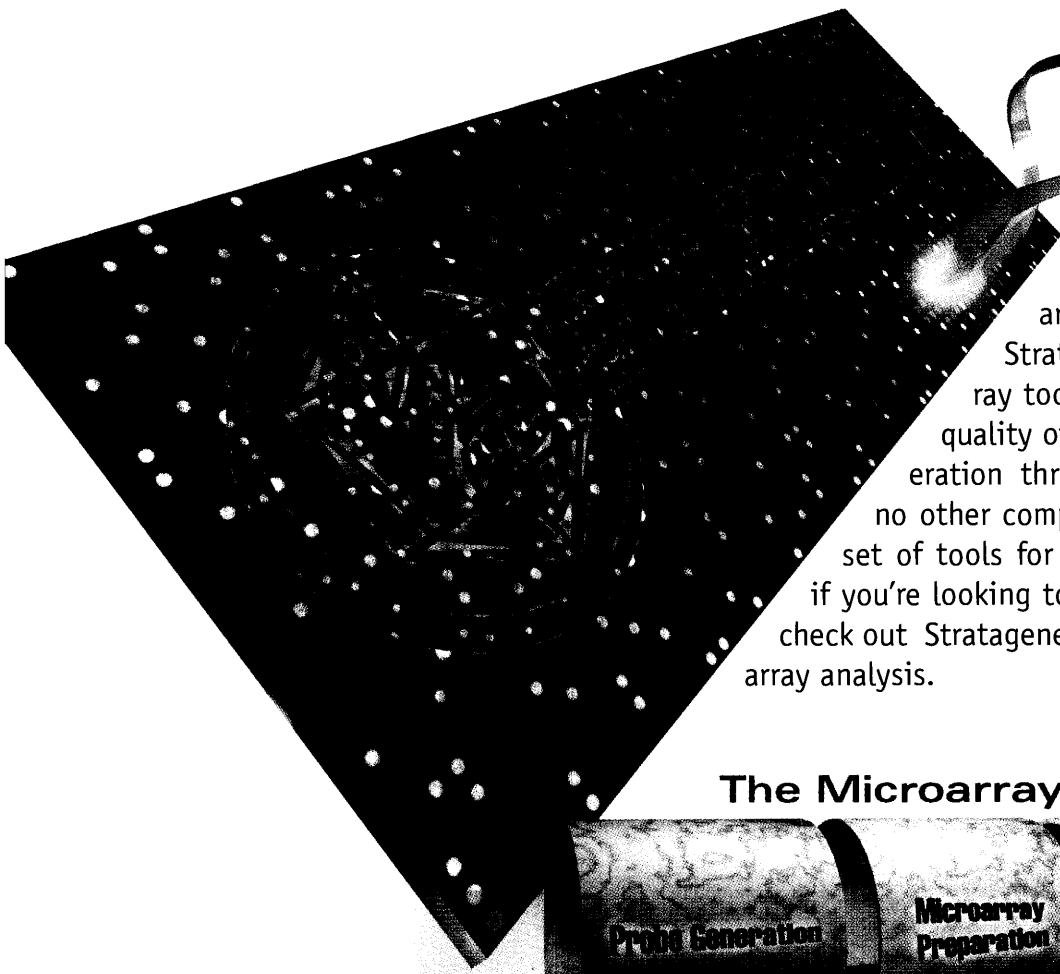

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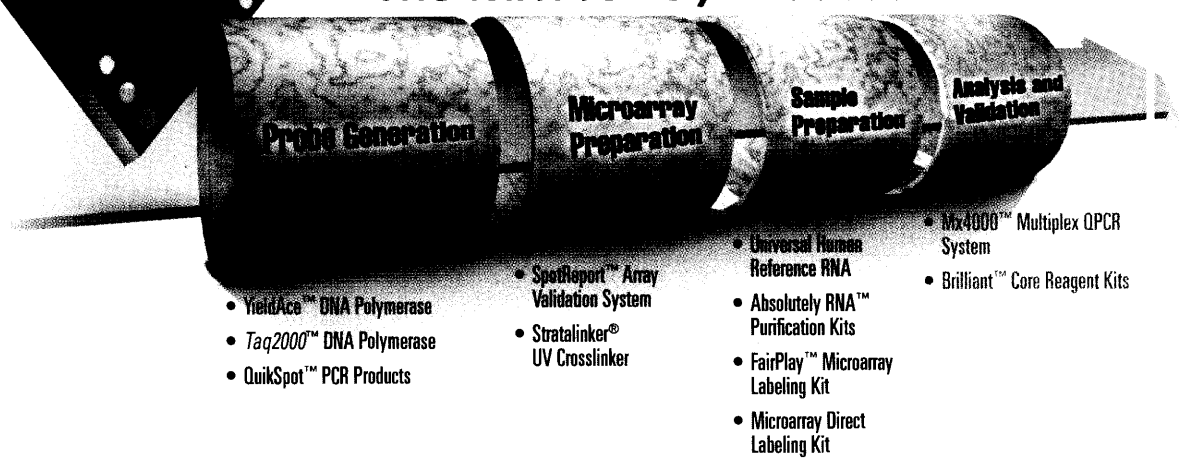

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NEWS

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Stem cell hotbed

1809
Bacteria blamed for blindness

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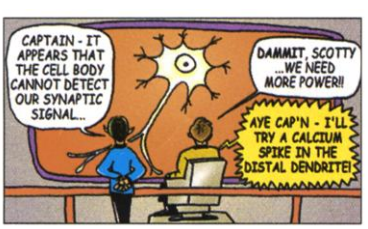

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Impulse power beats warp drive

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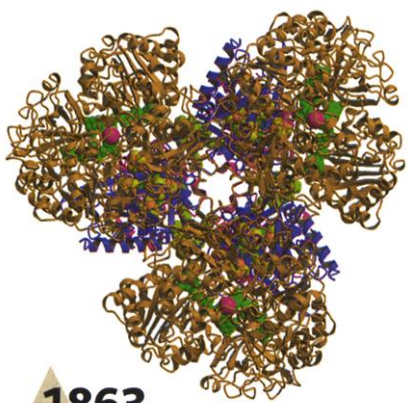
Controlled access to genomic DNA

RESEARCH



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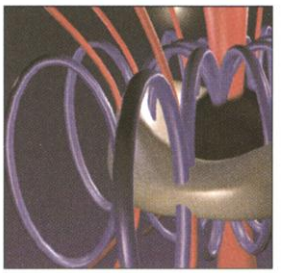
One-half of a redox loop

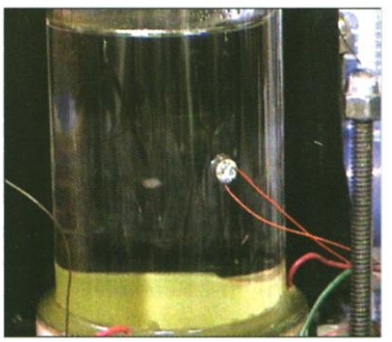


COVER 1874

Artist's impression of the hottest tango in the Universe: A torus formed from the debris of a star spins around a rotating black hole. The black hole feeds energy to the torus, which in turn radiates it away as unseen gravitational waves. At the same time, jets of energy are released along the black hole's axis of rotation as input to cosmological gamma-ray bursts. [Image: P. F. A. M. van Putten]

1868

A star in a jar



New on *Science* Express Coral skeleton thermometry probed

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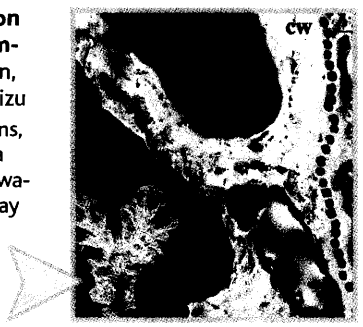
The Effect of Algal Symbionts on the Accuracy of Sr/Ca Paleotemperatures from Coral A. L. Cohen, K. E. Owens, G. D. Layne, N. Shimizu

The Sr/Ca ratio in coral skeletons, widely thought to function as a recording thermometer of the water in which the coral grows, may be affected more by algal symbionts than by temperature.



Redox Regulation of Forkhead Proteins Through a p66shc-Dependent Signaling Pathway S. Nemoto and T. Finkel

A functional link between intracellular oxidants, p66shc, and forkhead transcription factors reveals a possible signaling pathway that regulates aging in mammalian cells.

Crystal Structure of the Extracellular Segment of Integrin αVβ3 in Complex with an Arg-Gly-Asp Ligand J.-P. Xiong *et al.*

The structural consequences of an Arg-Gly-Asp ligand binding to an integrin are examined.

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US: Tooling Up—The Insider's Edge D. Bomzer

What are company recruiters looking for? Our new columnist offers an insider's point of view on resumes, interviews, and the value of follow-up telephone calls.

Singapore: Banking on Materials R&D to Give Singapore Added Edge E. H. Ng

A walk through the spectrum of interdisciplinary R&D activities at Singapore's Institute of Materials and Research Engineering.

UK: Who Wants to Be an Entrepreneur? K. Urquhart

Jonathan Milner transformed himself from postdoc to CEO, and just 4 years after his "entrepreneurial seizure" things are going great.

Germany: Optics See the Light E. von Ruschkowski

The research ministry has just launched a 5-year, €280 million research program on optical technologies; here's what you can expect.

Europe: Greek Doctoral Students—Facing an Uncertain Future E. Galanaki

In the latest installment of the Eurodoc Exchange, we hear about the problems faced by Ph.D. students in Greece, including inconsistent regulations and few funding opportunities.

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Perspective: Molecular BKology—The Study of Splicing and Dicing M. Fury, S. O. Marx, A. R. Marks

The presence or absence of phosphorylation sites can regulate which protein kinases activate BK channels.

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

Connections Map: Integrin Signaling Pathway Pathway Authorities: S. Boerner, C. Martin, T. Parsons

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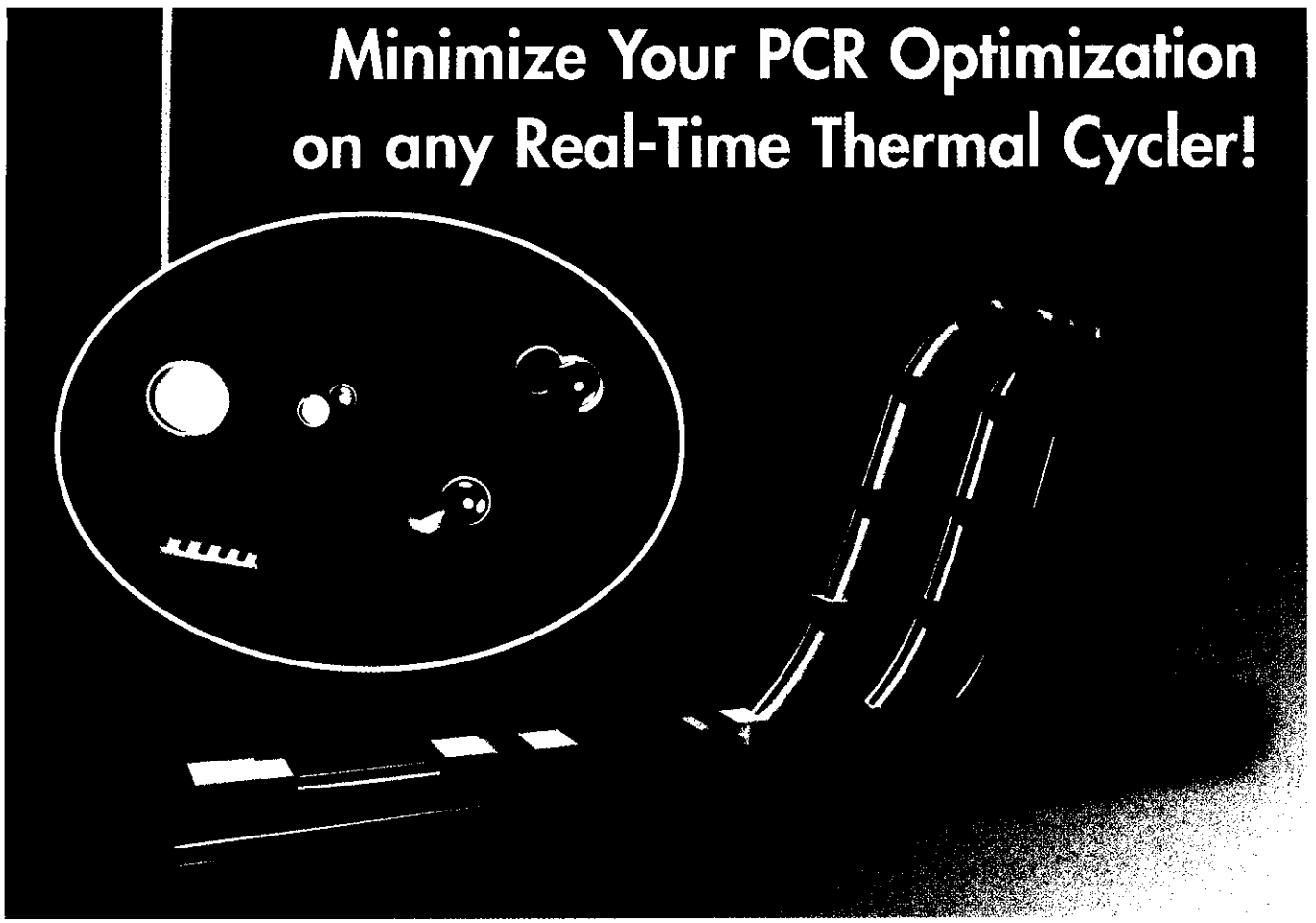

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THIS WEEK IN Science

edited by Phil Szuromi

Tritium via Sonoluminescence

Subjecting a liquid to an oscillating acoustic field can result in the observation of a flash of light. This sonoluminescence comes from a bubble that forms in the liquids, expands as the acoustic pressure decreases, and then dramatically collapses. Spectral analysis of the emitted light has shown that the bubbles are hot and effectively emit black body radiation. Recent experiments indicate that the smaller the starting bubble, the hotter it will get upon collapse. However, spontaneous bubble formation is typically restricted to a narrow regime of bubbles some tens of micrometers in diameter. Using a pulse of neutrons, Taleyarkhan *et al.* (p. 1868; see the Editorial, the news story by Seife, and the Perspective by Becchetti) can nucleate bubbles in deuterated acetone with diameters of only tens of nanometers that produce tritium during their collapse along with characteristic neutron emission. Tritium was not produced when normal acetone was used. Shock-code simulations indicate that the temperature inside the bubble is high enough (~10 million Kelvin) to induce production of tritium.

Energy from Rotating Black Holes

A rapidly rotating black hole, called a Kerr black hole, has been derived theoretically from general relativity, but has not yet been observed. Van Putten and Levinson (p. 1874; see the cover) have calculated the energy emitted from a black hole rotating within a magnetized torus of plasma. Some of the rotational energy is released in baryon-poor outflows that may be associated with gamma-ray bursts. Another fraction of the energy is released as gravitational radiation from the torus, and this radiation might be detectable by the new gravitational wave observatories. Thus, it may become possible to see Kerr black holes and to understand the physics behind energetic events like gamma-ray bursts.

Shaking Surprises

If you shake a can of mixed nuts, the much larger Brazil nuts migrate toward the top. Such size-dependent segregation through vibration arises from either the diffusion of the smaller nuts through the voids created between the larger ones, or through granular convection. Burtally *et al.* (p. 1877; see the Perspective by Mullin) now show that vibration can separate particles of the same size but different density if there is sufficient air pressure to drive the segregation. At low vibration rates, bronze particles formed a surface layer above the similarly sized lighter glass particles, with a sharp interface between them. At higher vibration frequencies, the bronze particles formed a middle layer surrounded by the glass beads.

1885

But Not a Drop to Drink

Although most of the Earth's surface is covered by oceans, much more water is bound up in mineral phases, and many hydrated minerals have been identified in the crust and upper mantle. Murukami *et al.* (p. 1885) have now synthesized hydrated lower mantle minerals under high-pressure and high-temperature conditions. Perovskite and magnesiowustite in the lower mantle can hold as much as five times more water than the oceans.

And in Brevia ...

A statistical analysis by Brookmeyer and Blades (p. 1861) of the 2001 anthrax outbreak in the United States indicates that the use of prophylactic antimicrobials likely halved the number of resulting infections.

Hydrides Nudge Their Way into Oxides

At first glance, the incorporation of hydrogen atoms directly into a transition metal oxide framework might appear to be a difficult route for synthesizing water. Hayward *et al.* (p. 1882; see the Perspective by Poeppelmeier) show that hydride (H^-), obtained from disproportionation of CaH_2 at elevated temperature, could replace oxide species in $LaSrCoO_4$ to form $LaSrCoO_3H_{0.7}$. The presence of hydride is revealed in the compound's unusual magnetic properties and neutron diffraction structure as well as by water evolution under more oxidizing conditions. This approach appears to be a general route to oxyhydrides.

How to Charge a Battery

Many microorganisms live under anaerobic conditions and must use other oxidizing agents, usually by coupling the reduction of one metabolite to the oxidation of another. In *Escherichia coli*, one such redox loop involves nitrate reductase, which reduces nitrate to nitrite, and formate dehydrogenase, which oxidizes formate to carbon dioxide. The flow of electrons is itself used to pump protons across the plasma membrane and creates an electrochemical gradient that is essentially equivalent to a battery. Jormakka *et al.* (p. 1863; see the Perspective by Richardson and Sawers) present the crystal structure of the membrane protein formate dehydrogenase at 1.6 angstroms and describe how the electrons travel along a 90-angstrom chain of carriers from one side of the membrane to the other.

Flipping Earth's Field

CREDIT: LI ET AL.

Earth's magnetic field can be approximated as a dipole, and every so often some process connected with the geodynamo somehow causes the dipole to reverse its polarity so that the field flips direction. Li *et al.* (p. 1887) have conducted a long-time scale, three-dimensional magnetohydrodynamic simulation of a reversing dipole in an idealized spherical dynamo. The field flipped only when the convection pattern became nonsymmetric, when the dynamo was in a high-energy state, and when the quadrupole mode was increasing.

The Nemesis Within Nematodes

Filarial nematodes can invade our bodies and cause river blindness, which targets the skin and eyes, or elephantiasis, which targets the

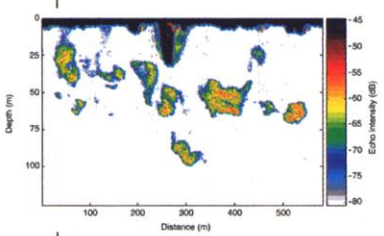
Published online in *Science* Express

CONTINUED ON PAGE 1791

lymphatic system. When the nematodes die, the host immune response may lead to inflammation, cell infiltration, and loss of vision or blockage of lymph vessels. Saint André *et al.* (p. 1892; see the news story by Pennisi), have discovered that symbiotic *Wolbachia* bacteria living within the nematodes, which possess immune reactive lipopolysaccharides, provoke the blinding inflammatory response in rodents, rather than the nematodes themselves. As the *Wolbachia* are critical for the development of the nematode worms and are also killed by antibiotics, this discovery may lead to new strategies for combating these diseases.

A Sense of Cell

The transcription factor CtBP associates with transcriptional repressors for the regulation of genes involved in development, cell cycle regulation, and transformation. Zhang *et al.* (p. 1895) show that the corepressor activity of CtBP can be regulated by the redox state of the cell. Mammalian CtBP is regulated by physiological concentrations of nuclear nicotinamide adenine dinucleotides (NADs). When the nuclear concentration of free NAD and NADH increases, CtBP increases its affinity to viral and cellular repressors and represses transcription. This regulatory mechanism suggests how protein interactions respond to metabolic balances for the regulation of transcription.



CREDIT: BRIERLEY *ET AL.*

Krill Under Ice

The reported feeding behavior of certain whale species suggests that Antarctic krill, *Euphausia superba*, are concentrated under the ice, at least at the ice pack margin. Using an autonomous subsurface vehicle traveling 15 to 20 kilometers under the sea ice, Brierley *et al.* (p. 1890) have found that krill abundance peaks within 1 to 13 kilometers of the ice margin. Here, the krill are safe from predators and have access to phytoplankton released from the undersurface of the ice.

Sugarcoated Dispatches

The signals for clearing circulating glycoproteins from the bloodstream are likely their carbohydrate tags, and it has long been proposed that membrane lectins perform this task. Lee *et al.* (p. 1898) examined the role of the mannose receptor (MR) in this process. A proteomic analysis of blood from mice that genetically lacked MR revealed elevated levels of proteins tagged with mannose and *N*-acetylglucosamine. All of these proteins are involved in the inflammatory response, which correlates with the down-regulation of MR in the early stages of inflammation.

Doing Transcription Backward

It is usually assumed that gene transcription in eukaryotes is initiated when sequence-specific activators bind their targets in DNA and recruit proteins that modify chromatin. The chromatin modifiers convert the normally repressive chromatin to a form that permits the assembly of the RNA polymerase II preinitiation complex. Soutoglou and Talianidis (p. 1901; see the Perspective by Fry and Peterson) now show that, for the differentiation-induced α_1-antitrypsin gene promoter, a complete preinitiation complex is assembled prior to chromatin modification and long before transcription is initiated. Instead, it is the reconfiguration of the chromatin to the permissive state by the chromatin modifier proteins that is the defining step in transcription initiation.

Location and Synapse Strength

When synaptic inputs occur far out in the dendritic tree, are they simply attenuated by the filtering effect of the neuronal membrane or are there compensatory mechanisms at work? Williams and Stuart (p. 1907; see the Perspective by Mel) used simultaneous triple patch-clamp recordings to explore the strength of spontaneous and artificially elicited excitatory postsynaptic potentials (EPSPs) along the length of dendrites in neocortical pyramidal neurons. Although they reconfirmed earlier findings that EPSP amplitude increases with distance from the soma, they also found that the somatic EPSP impact still decreases with distance. Thus, a single input has fairly little influence on somatic potential, but coincident inputs could still generate dendritic spikes and subsequent action potentials in the postsynaptic neuron.

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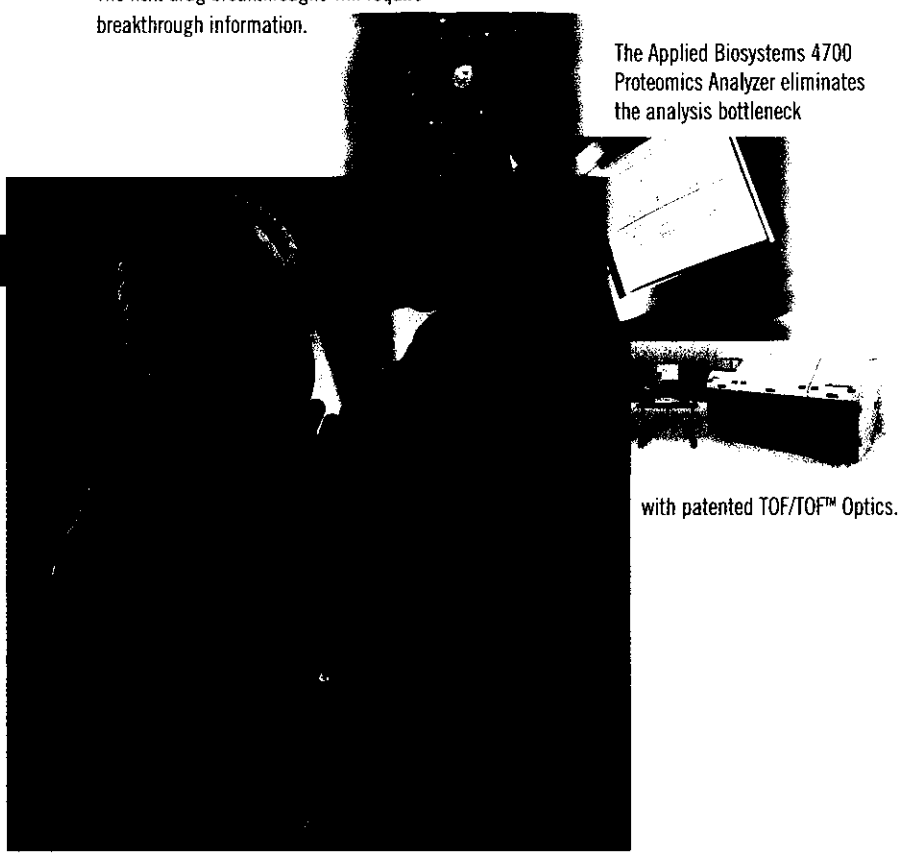

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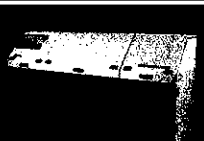

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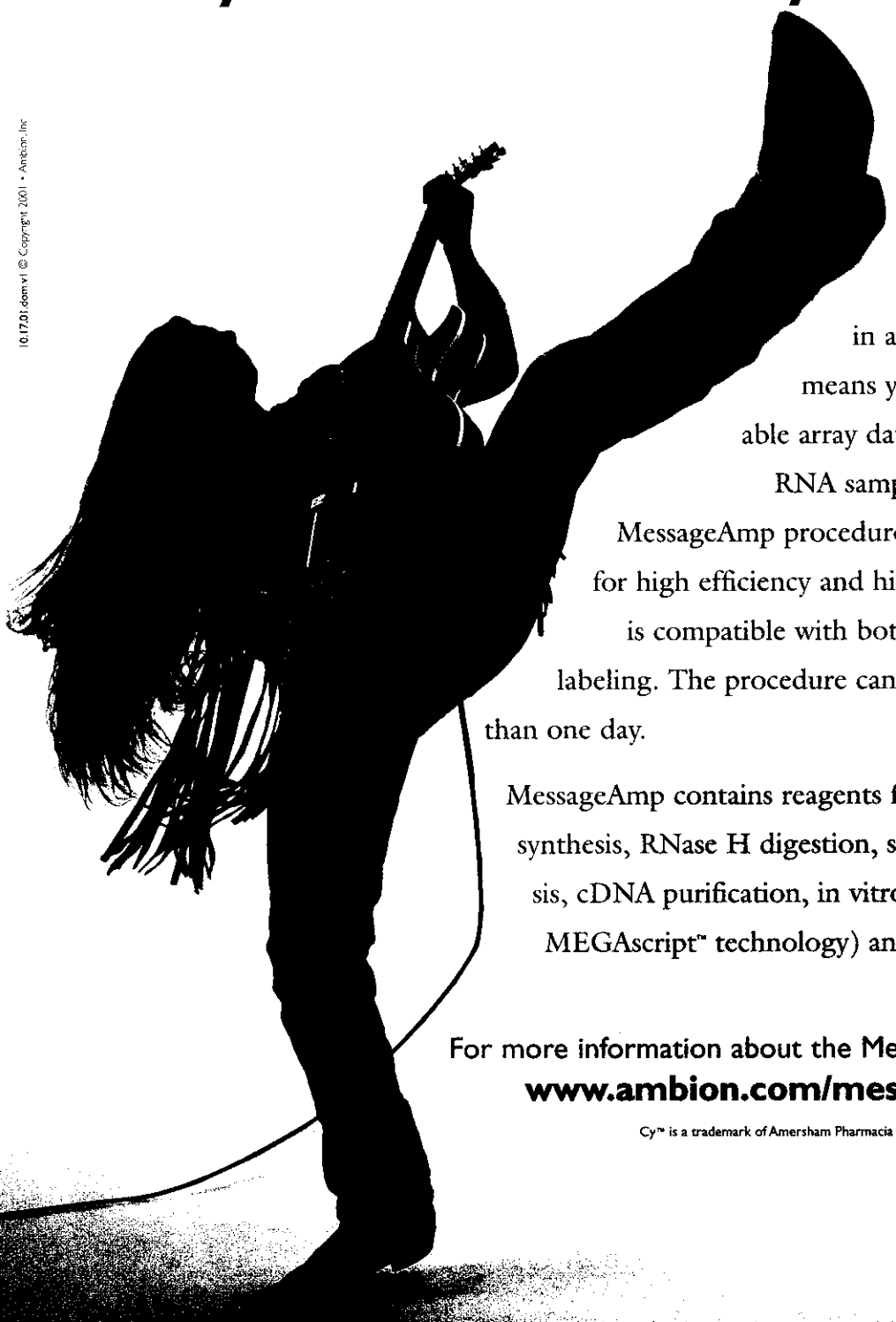

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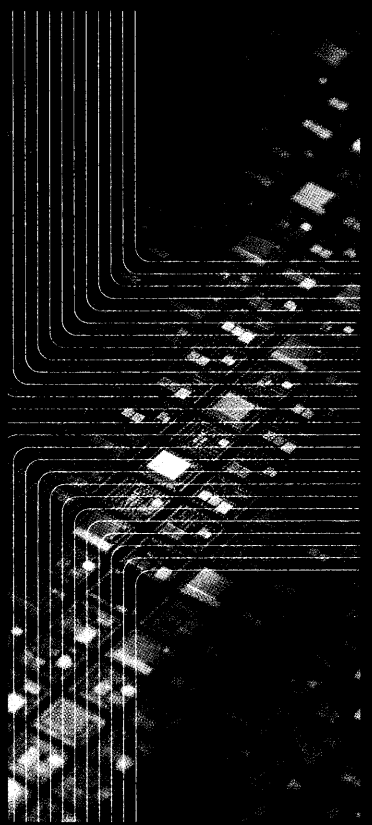

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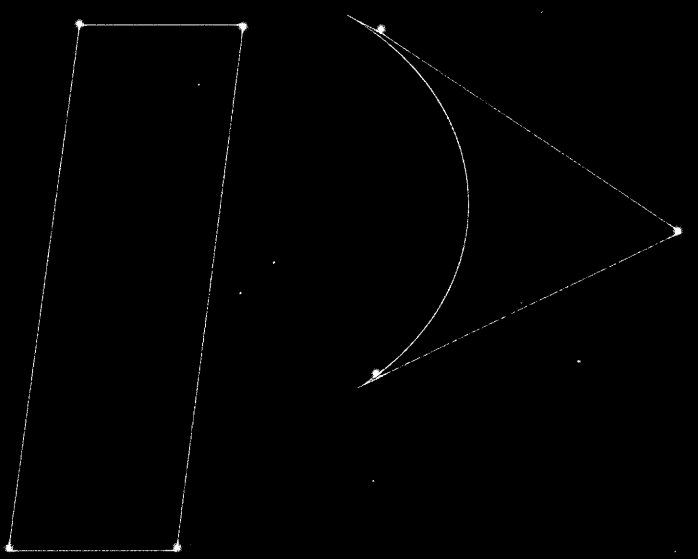

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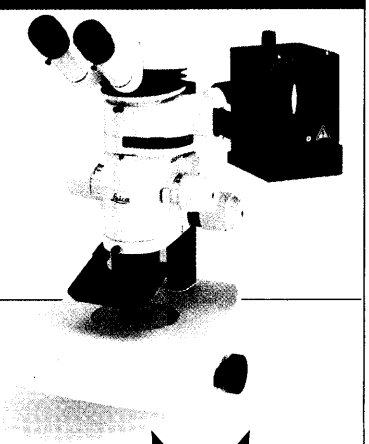

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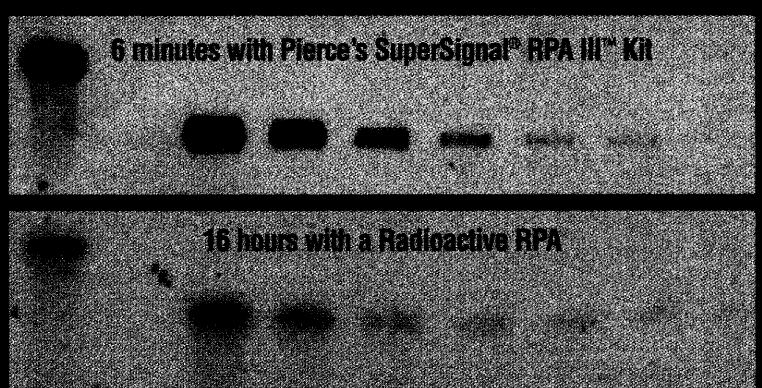

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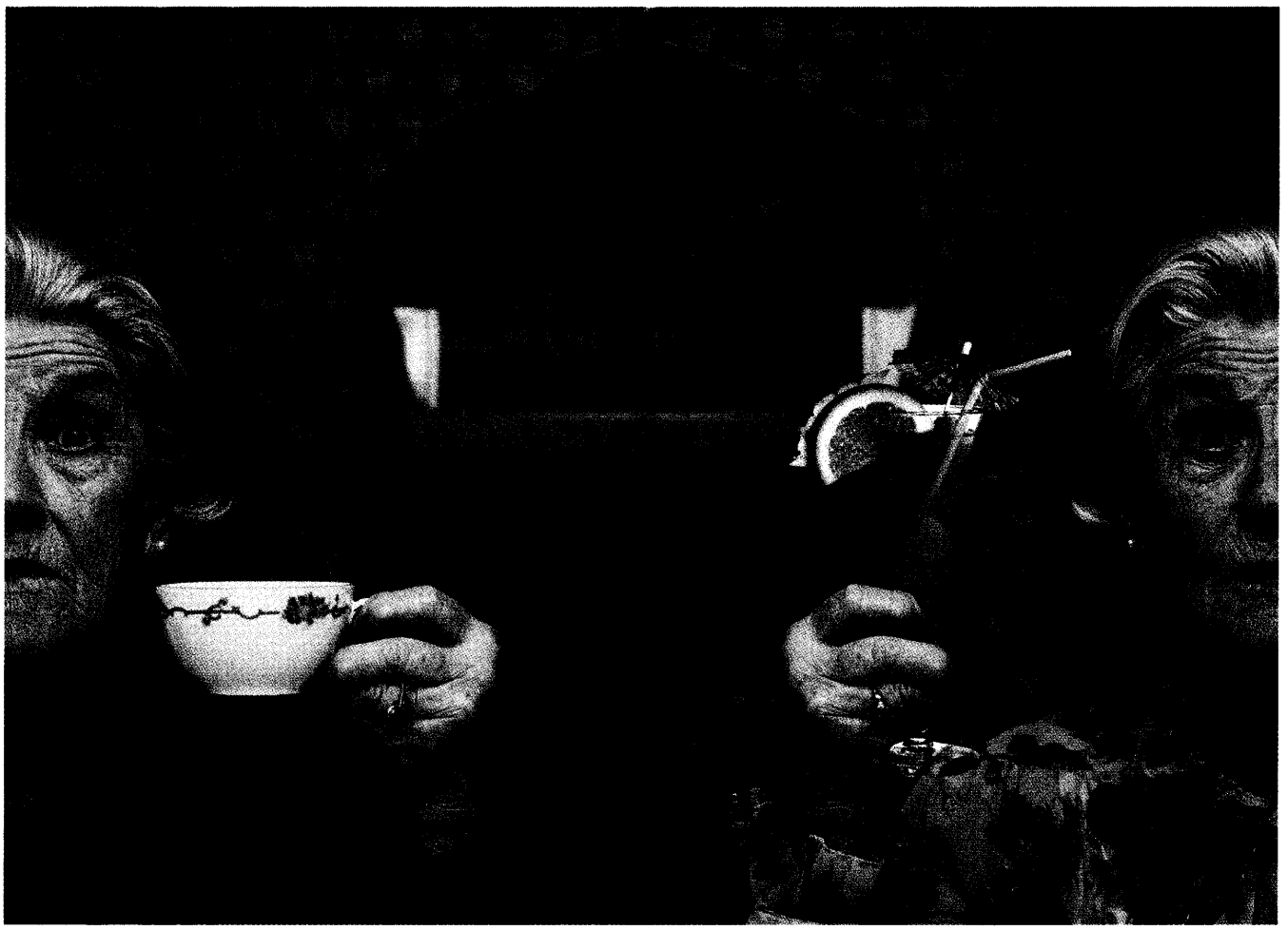

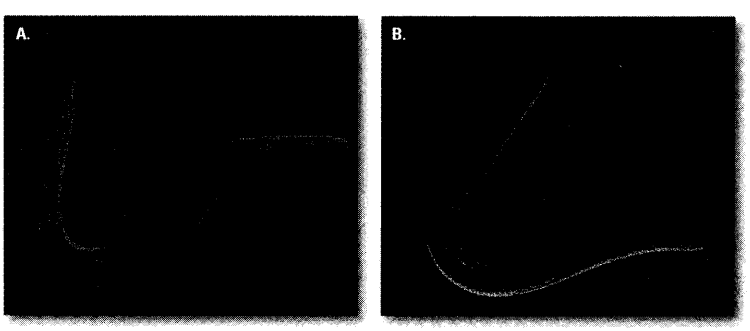

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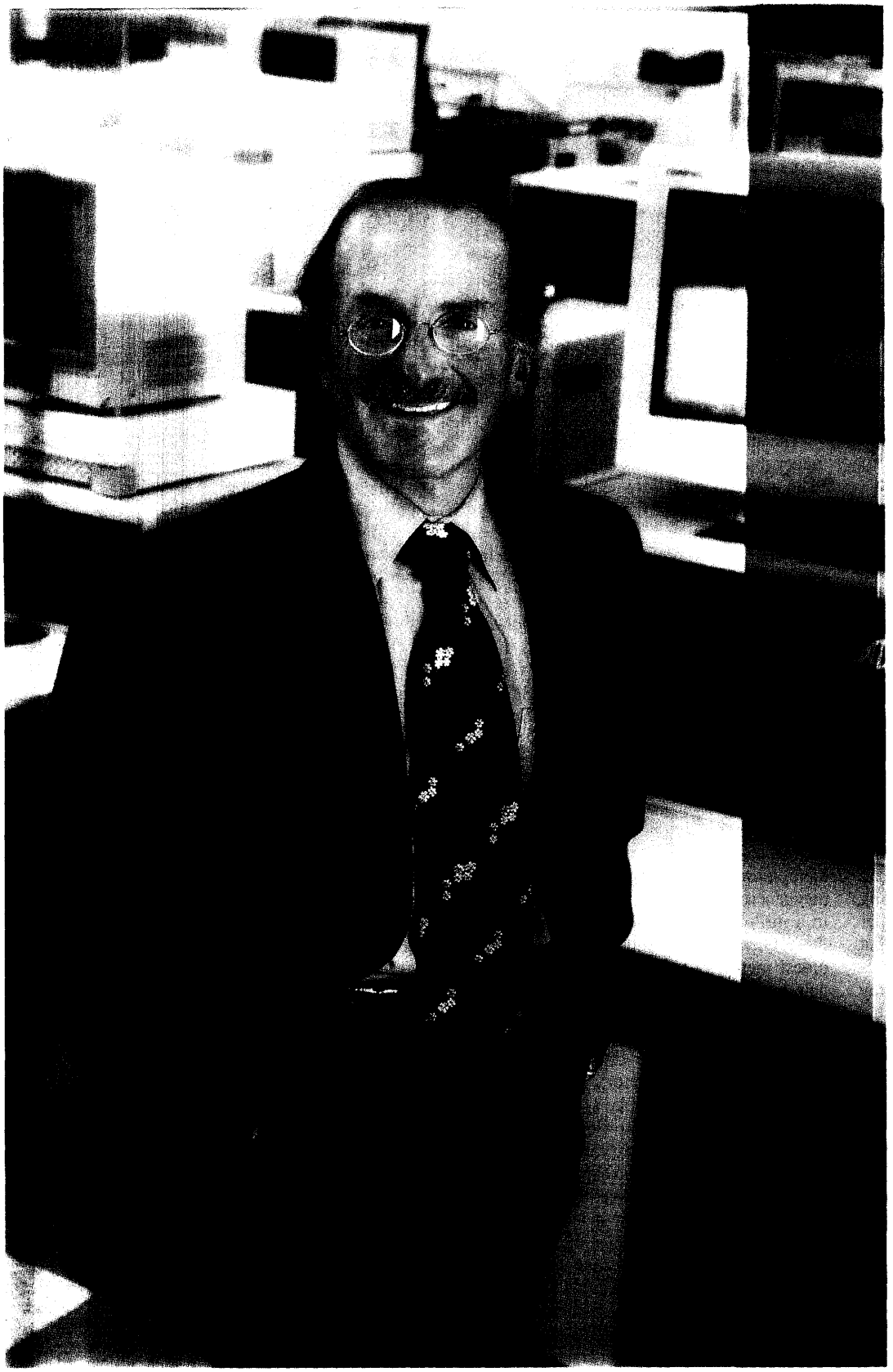

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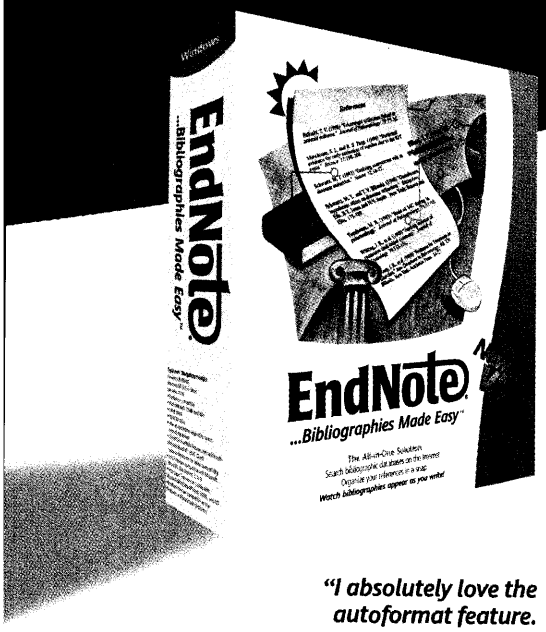

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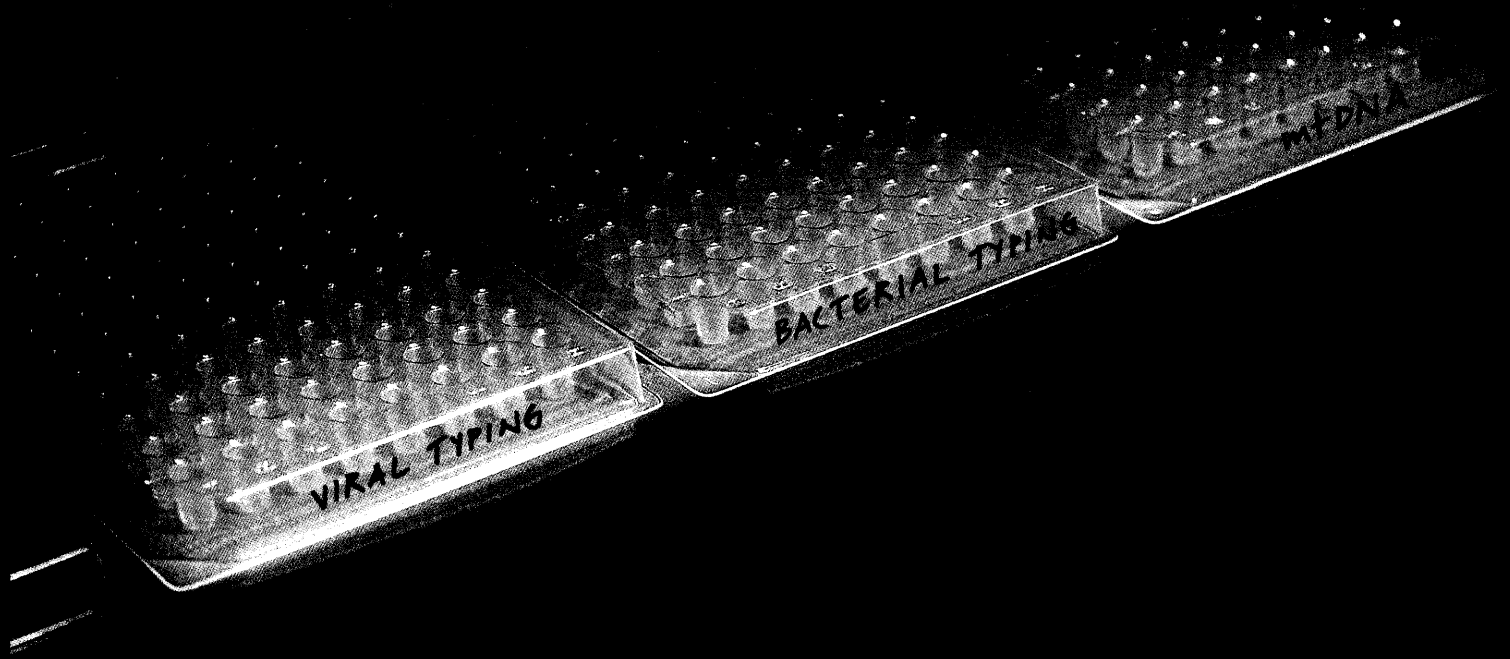

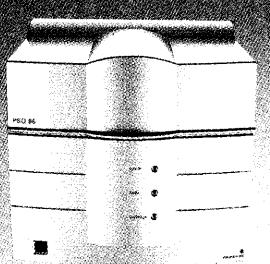

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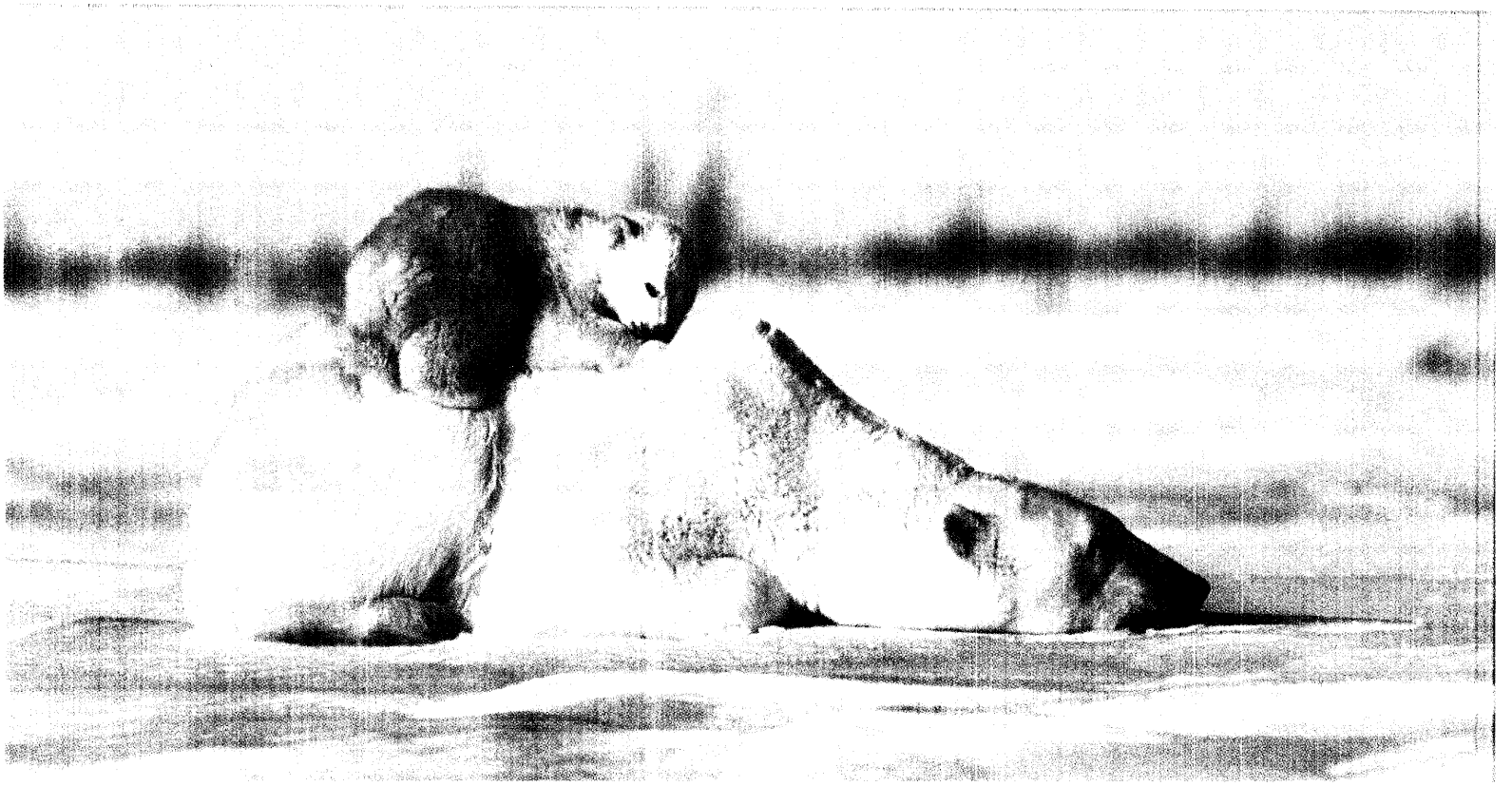

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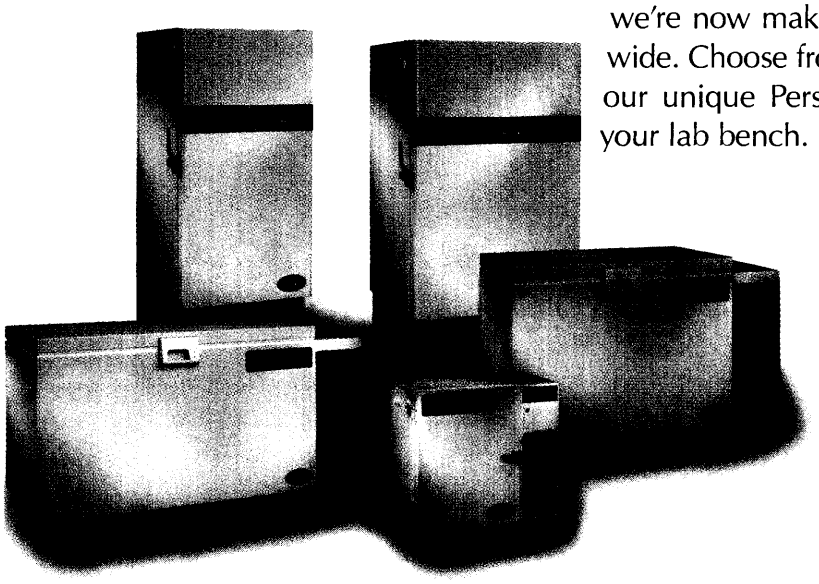

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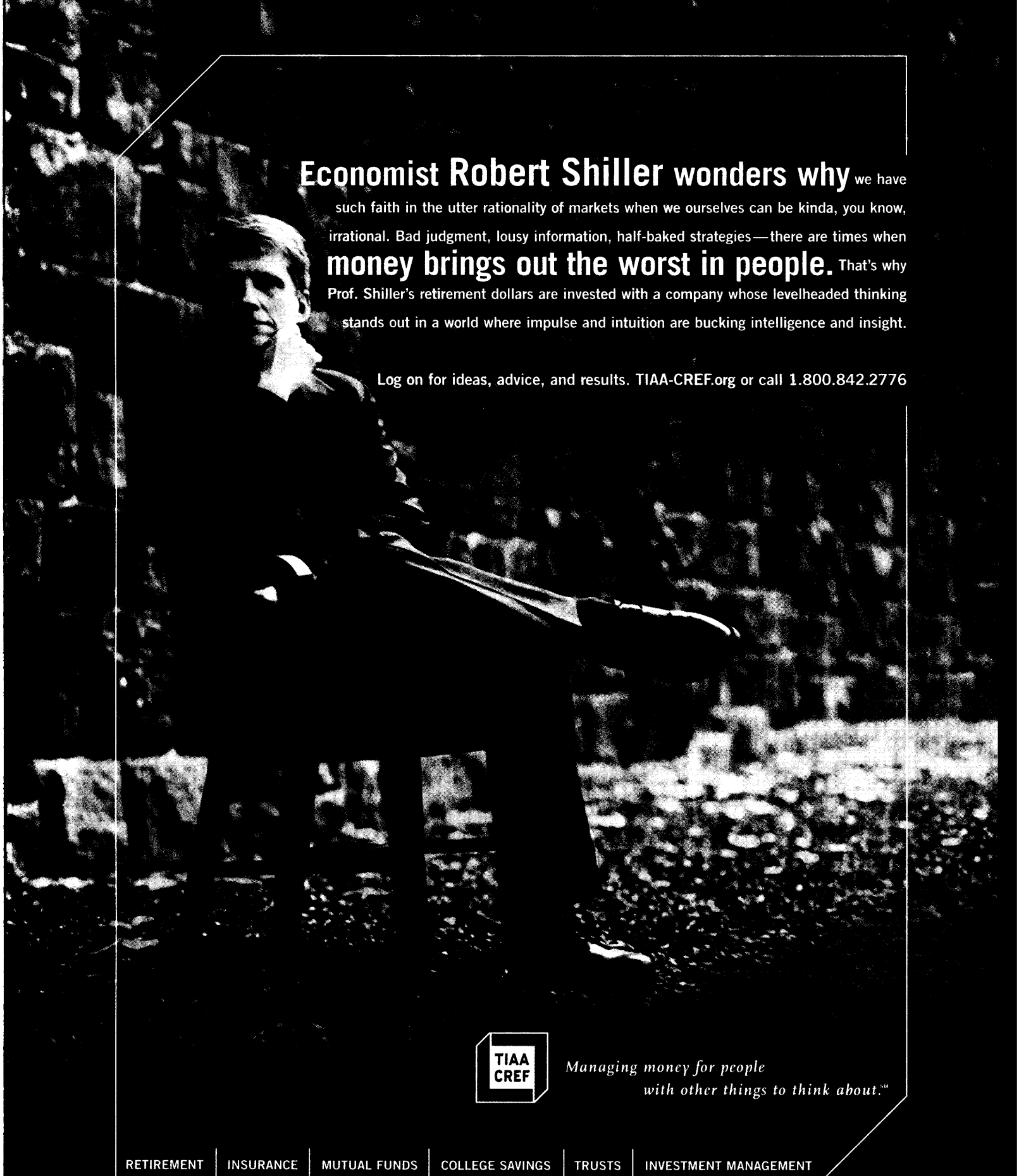

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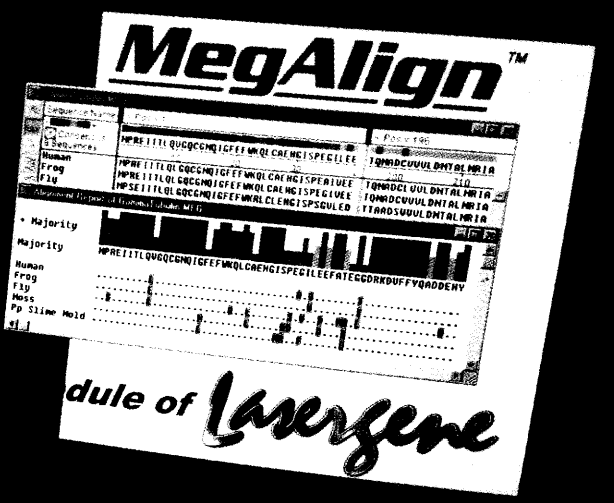

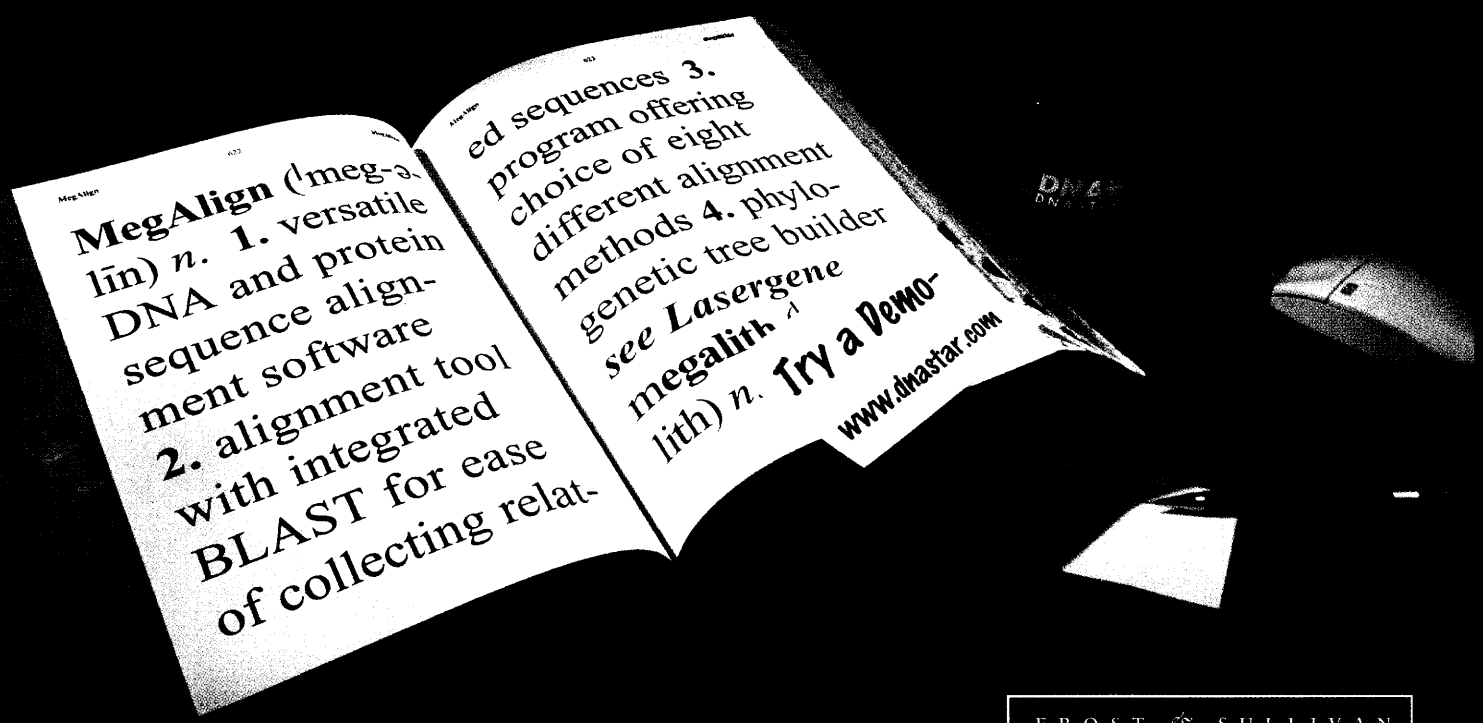

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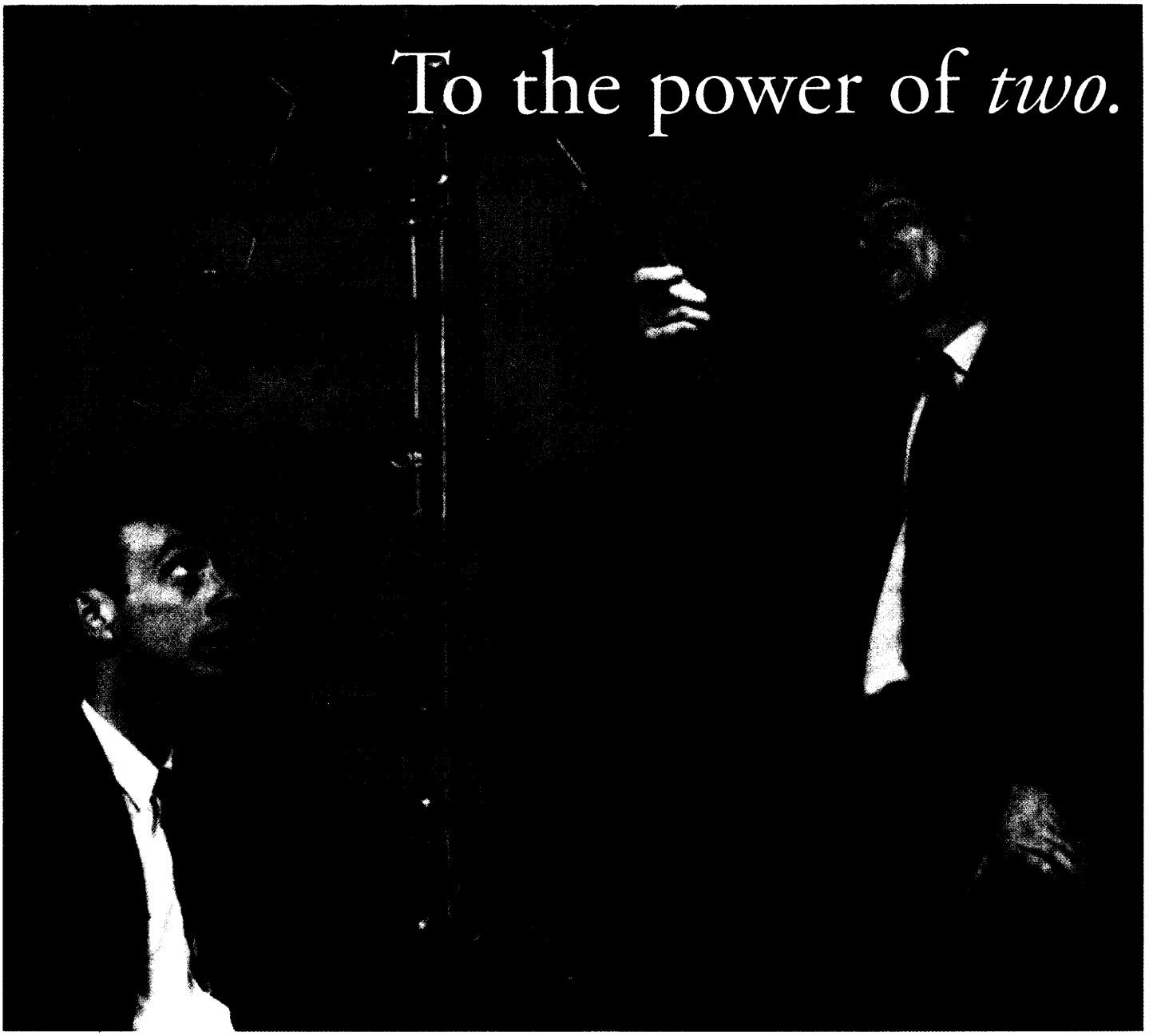

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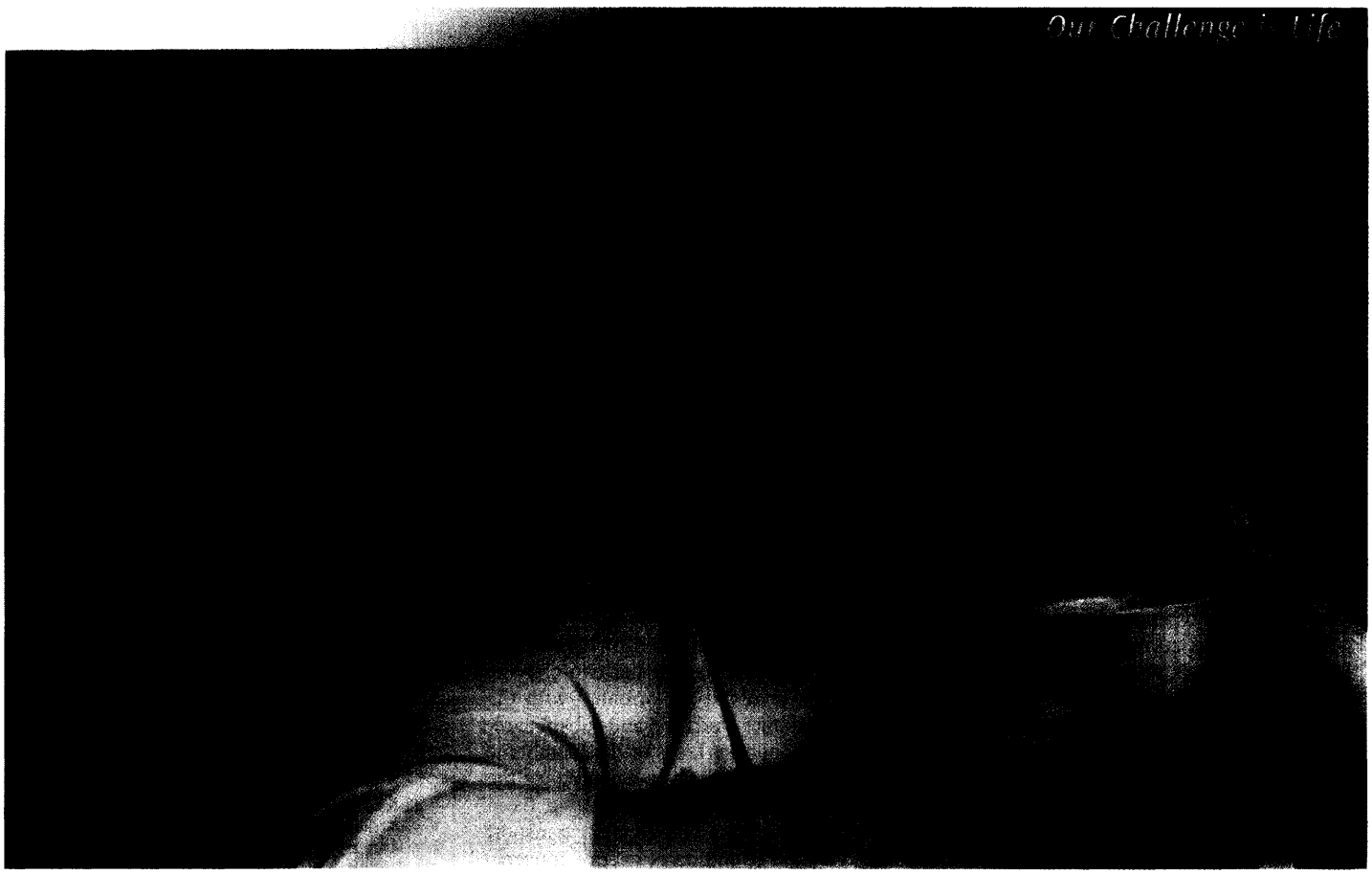

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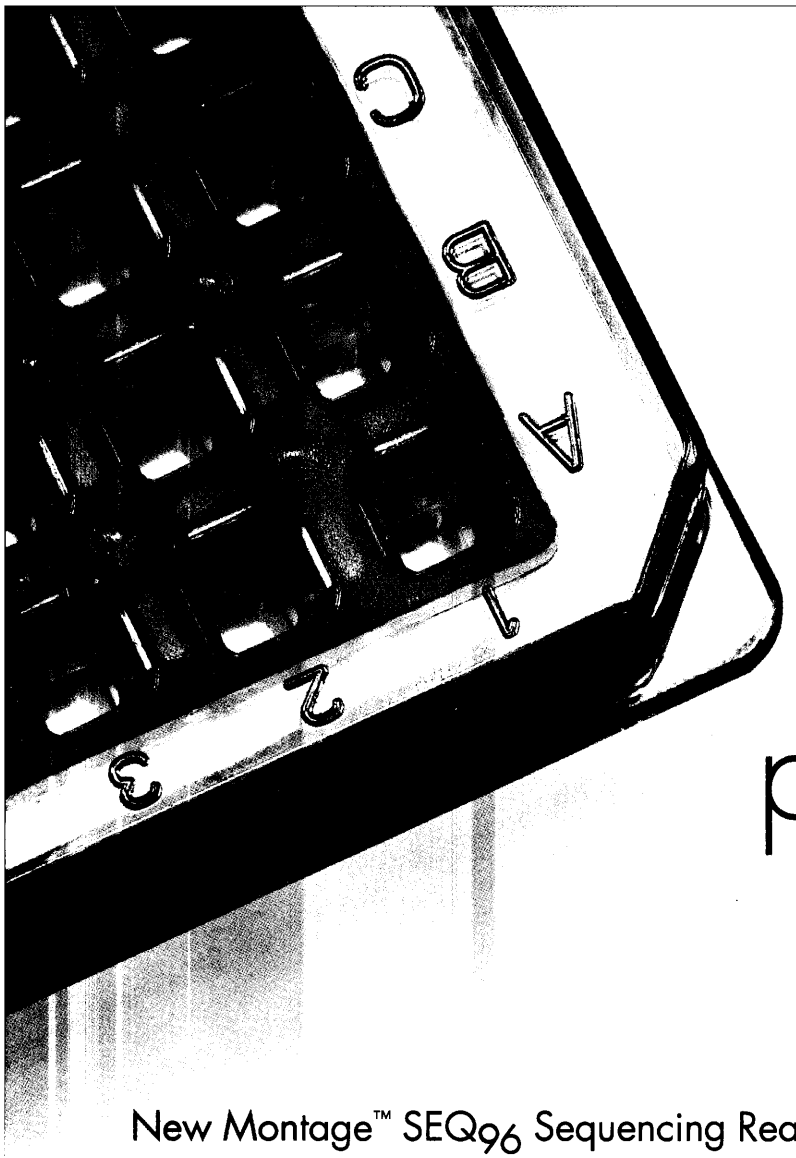

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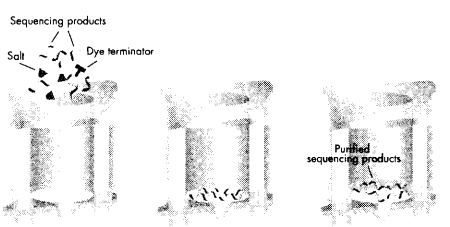

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