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1. Hogrefe, H., et al, (2002) *Proc Natl. Acad Sci.* USA 99, 596-601

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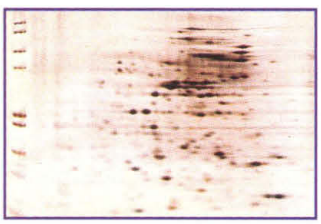

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Science

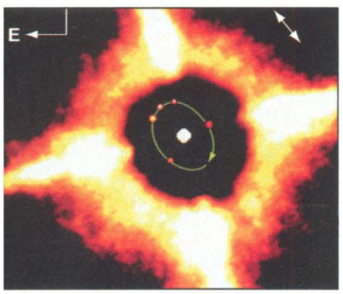
Volume 297 9 August 2002 Number 5583

NEWS

SUSTAINABLE DEVELOPMENT

In this issue, we examine how science can assist in constructing a sustainable world, in anticipation of the World Summit on Sustainable Development in South Africa on 26 August. Features include News articles that discuss sustainable agriculture on Amazonian soils and water availability; an Editorial, *Science and Sustainability*, by A. Leshner; a Book Review of *The New Economy of Nature*; the 2002 AAAS Presidential Address by P. Raven, *Science, Sustainability, and the Human Prospect*; a Review, *Economic Reasons for Conserving Wild Nature*, by A. Balmford; a Letter on conserving native plants in China; and News coverage of a Report in this issue (Achard *et al.*) on deforestation.

SCIENCE'S COMPASS



RESEARCH

BREVIA

RESEARCH ARTICLE

1013

Methane bubbles through microbial reefs

REPORTS

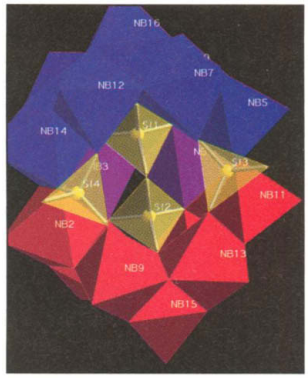
MATERIALS SCIENCE: SOFT SURFACES

NEWS

VIEWPOINTS AND REVIEWS

COVER 961

Polymer vesicles of varied morphology, about 5 to 20 μm across. The copolymers of these vesicle membranes include polyethyleneoxide–polylactic acid (PEO-PLA), which is biodegradable and enables the controlled release of fluorophores such as the anticancer drug doxorubicin. These vesicles are one example of the soft surfaces and interfaces highlighted in the special section in this issue. [Image: F. Ahmed, F. S. Bates, and D. E. Discher]



996

Hydrothermal route to heteropolyniobates

New on *Science* Express Photos without the silver

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CONTENT HIGHLIGHTS AS OF 9 AUGUST 2002

science magazine

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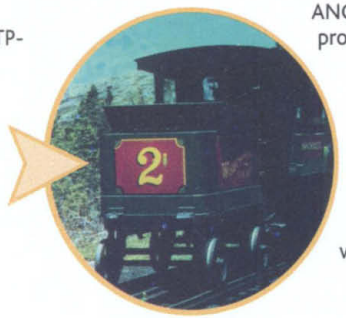
SCIENCE EXPRESS www.sciencexpress.org

Structure, Mechanism, and Regulation of the *Neurospora* Plasma Membrane H^+-ATPase W. Kühlbrandt, J. Zeelen, J. Dietrich

An atomic homology model reveals how ATP-driven proton pumping is regulated.

A Silver-Free, Single-Sheet Imaging Medium Based on Acid Amplification J. L. Marshall *et al.*

A single-sheet photographic medium for color imaging exploits photoacid generation and acid amplification to replace traditional silver halide exposure and development.



Role of ANC-1 in Tethering Nuclei to the Actin Cytoskeleton D. A. Starr and M. Han

ANC-1 is shown to interact with actin and the nuclear envelope protein UNC-84 to maintain the correct positioning of nuclei.

SPECIAL FEATURE www.sciencemag.org

A Sustainable Development Reader

A selection of articles from past *Science* issues on topics related to sustainable development.
www.sciencemag.org/feature/data/sust/index.shtml

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www.nextwave.org

career resources for scientists

NETHERLANDS: A New Tool for Networking R. Metzke

A research database is a great foundation for your professional network.

US: Morning in America A. Sreenivasan

A few institutions are waking up to alarm bells over the status of women in academia.

MISCINET: Making the Most of Opportunities T. Deans

Pursuing an undergraduate degree in nursing.

SINGAPORE: Alternative Medicine and Genetically Modified Organisms T. F. Chia

Transgenics represent new sources for potent neutraceuticals.

UK: Benchwork, Tattoos, and Family S. Morley

Bucking the prevailing academic stereotype is possible—if you want to.

EUROPE: Leading the Way K. Hallermalm

Sweden needs more postdocs if it wants to stay at the forefront of stem cell research.

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science of aging knowledge environment

REVIEW: Mitochondrial Bioenergetics, Aging, and Aging-Related Disease D. Nicholls

Cellular powerhouses take center stage in studies on aging.

NOTEWORTHY THIS WEEK: SHIPping Out Bone Breakers R. J. Davenport

Protein restrains osteoclasts.

NOTEWORTHY THIS WEEK: Dauer Power M. Leslie

Die-hard worms temporarily reverse aging.

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signal transduction knowledge environment

PERSPECTIVE: The Two Hats of SOS A. Nimnual and D. Bar-Sagi

How the guanosine exchange factor activity of SOS can be directed toward Ras or Rac.

ST on the Web

New sites reviewed include EMBL-EBI, BRC, The Eisen Lab, NetPhos, and Molecular Medicine.

GrantsNet	AIDScience	Members Only!	SCOPE	Functional Genomics
www.grantsnet.org	www.aidscience.com	www.AAASMember.org	http://scope.educ.washington.edu	www.sciencegenomics.org
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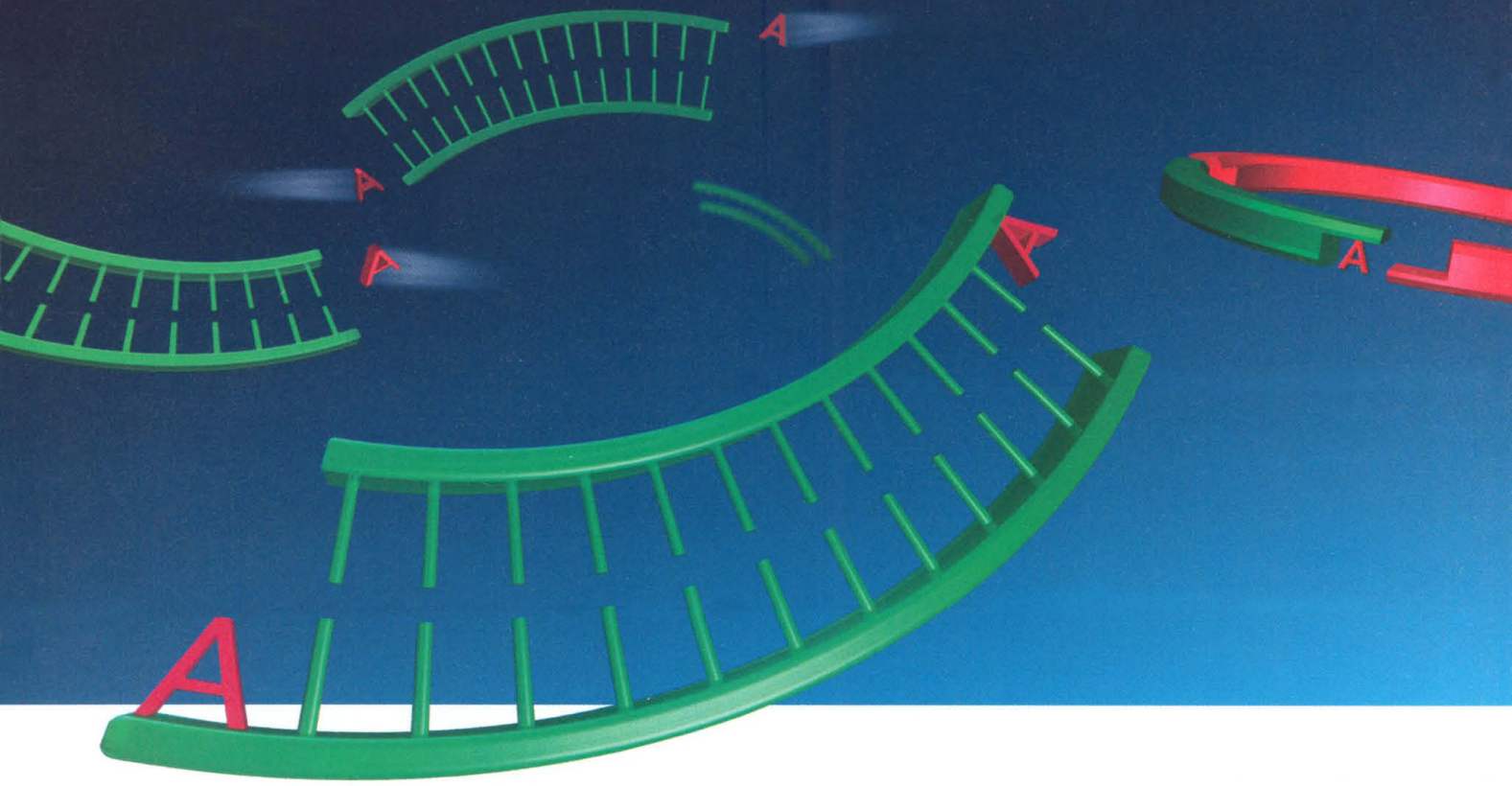

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THIS WEEK IN Science

edited by Phil Szuromi

Extended Actuator Lifetime

Conducting polymers have many electrochemical applications, such as batteries and light-emitting diodes, but their performance tends to degrade rather rapidly with repeated cycles of charging and discharging. The problem is often not the conducting polymer itself but the degradation of the electrolyte in which the polymer is immersed or embedded. Lu *et al.* (p. 983) show that the combined approach of improving the conducting polymer and using ionic liquids is an effective route for achieving stable electrochemical devices.

DNA Obstacle Course

For a polymer chain to move from one position to another, all of the segments need to shift position, either in a sequential or cooperative fashion, or some mixture of both. Confining the motion to two dimensions simplifies the picture somewhat because it limits the chains' ability to entangle and also allows for the direct visualization of individual chain motion. Nykypanchuk *et al.* (p. 987) used a colloidal templating process to create a series of spherical cavities interconnected via circular holes. Using a fluorescent dye, they were able to watch the motion of linear DNA as it jumped from cavity to cavity. Under these conditions, entropic barriers controlled the chain motion.

When Many Trees Fall in the Forest

The rate of tropical deforestation bears on issues in tropical ecology, biodiversity, and the sustainable use of the biosphere, and more reliable estimates of tropical deforestation rates are needed to complete models of the global carbon cycle and to determine the magnitude of the "missing" carbon sink. Achard *et al.* (p. 999; see the news story by Kaiser) have now determined rates of tropical deforestation from satellite imagery and improved statistical sampling strategy. They find that tropical humid forests are disappearing at a rate 23% lower than that of the best previous estimates. Despite this apparent bit of good news, the bad news is that humid tropical forests are disappearing at a rate of 5.8 million hectares (nearly twice the area of Belgium) a year, and an additional 2.3 million hectares per year are being degraded.

Duplicates Within the Human Genome

Compared to other sequenced animal genomes, the human genome is enriched for large, segmental duplications that arose less than 40 million years ago. By comparing the two versions of the human genome sequence available, Bailey *et al.* (p. 1003; see the Perspective by Lynch) identified regions that are overrepresented within a random set of fragments and thus are legitimate duplications within the genome. These duplications are distributed nonrandomly among human chromosomes. They identified 169 regions as possible hot spots of genomic rearrangement that provide a set of candidates for identification of human genetic diseases associated with unequal recombination between duplications as well as the genetic rearrangements associated with primate evolution. The study is also providing a valuable resource for generating a finished version of the human genome sequence.

993

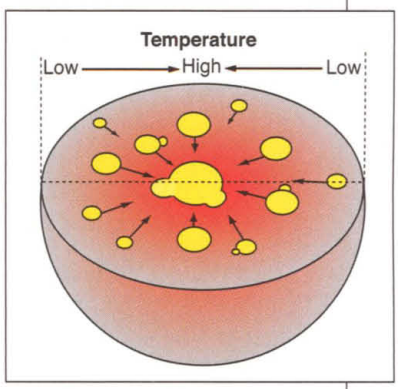
They've Got the Quantum Beat

The measurements of the dipole moment of molecules in high vibrational states might seem esoteric, but for water, these values are crucial for developing an accurate picture of the water absorption spectra crucial for atmospheric energy balances. Measurements of the Stark effect have been used previously to obtain ground-state and low-lying excited-state dipole moments. Callegari *et al.* (p. 993; see the Perspective by Bernath) now use three different lasers and a Stark field simultaneously to determine permanent and transition dipole moments through quantum beat spectroscopy of water molecules with 4, 5, or 8 quanta of excitation in their O–H stretching vibration. These values deviate systematically from the best theoretical estimates and will serve as benchmarks for future calculations of potential energy and dipole moment surfaces.

And In Brevia ...

A captive New Caledonian crow, observed by Weir *et al.* (p. 981), spontaneously and then repeatedly bent a piece of wire into a hook for use in a task requiring a hooked tool.

Not Just Space Eggs



Egg-type structures consisting of a core of one phase of an aluminum-indium alloy and an outer portion of the other phase have been produced in fine, rapidly solidified powders grown under microgravity conditions. Wang *et al.* (p. 990) now show that such materials can also be grown on Earth if there is a miscibility gap in the liquid state of the alloy phase diagram, in this case for iron-copper–based alloys. Even under rapid cooling, the difference in the temperature dependence of the interfacial energy causes Marangoni motion and causes the minor liquid component to form the core of the egg-type particles.

Black Sea Reef Builders

The recent discovery of large microbially generated reefs in the Black Sea associated with methane seeps along the Crimean peninsula has implications that may lead to a reassessment of the evolution of metabolism as well as the geochemical and atmospheric history of the early Earth. Michaelis *et al.* (p. 1013) show that the isotopically light carbonate reefs are built by consortia of anaerobic, methane-oxidizing microorganisms that

CREDIT: WANG *ET AL.*

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CONTINUED ON PAGE 895

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reach extremely high biomass and that contribute substantially to carbonate deposition under anoxic conditions. Previously, the isotopic signatures for methane oxidation have been interpreted as a sign of aerobic methanotrophy and an early oxygenation of the Earth's atmosphere. These new findings suggest that anaerobic conditions could have prevailed on the early Earth and that the anaerobic oxidation of methane by sulfate, accompanied by carbonate precipitation under alkaline conditions, could have occurred on a major scale.

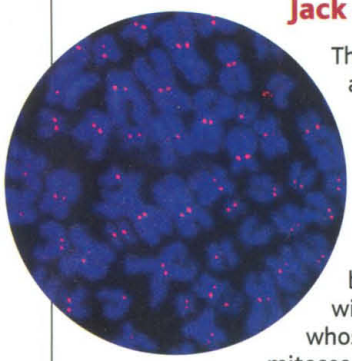
Holistic Cell Signaling

Mitogen-activated protein (MAP) kinases 1 and 2 are important regulators of many cellular processes. Not surprisingly then, they are subject to complicated regulatory circuits that both feed forward to favor activation of the kinases and feed back by stimulating enzymes that lead to inactivation of the MAP kinases. MAP kinase phosphatase (MKP), for example, dephosphorylates—and can thus inactivate—MAP kinases 1 and 2. However, MKP must be considered in the context of competing feedback loops and other inhibitory phosphatases. Bhalla *et al.* (p. 1018; see the Perspective by Ingolia and Murray) use a combination of experimental analysis with computational analysis and modeling to propose an unexpected role for MKP. Their studies indicate that MKP is not a major determinant of the acute activity of MAP kinases in growth factor–stimulated cells. Rather, increased activity of MKP seems to change the properties of the regulatory network such that strong stimuli that should have produced sustained activation of the MAP kinases only produces a short-term activation of those enzymes.

Controlling Telomerase on Telomeres

Telomeres are found at the tips of chromosomes, where they help solve the end-replication problem as well as prevent potentially lethal end-to-end fusion of chromosomes. Telomeric DNA consists of simple repeats, and telomere length is maintained by the telomerase enzyme, which is comprised of four components, Est1p, Est2p, and Est3p, and *TLC1* RNA. The enzyme complex has been thought to be recruited to the telomeres during S-phase by Cdc13p, a protein that binds single-stranded DNA. Working in yeast, Taggart *et al.* (p. 1023) now show that telomerase components are associated with the telomeres even in the presence of mutated, inactive Cdc13p, and thus recruitment cannot explain telomerase regulation. Rather, the core telomerase enzyme, Est2p–*TLC1* RNA, is associated with the telomeres prior to S-phase, and is then activated in late S-phase by the binding of Est1p.

Jack of All Cell Division



CREDIT: PRASANTH *ET AL.*

The highly conserved origin recognition complex (ORC) mediates initiation of replication of the genome in eukaryotes, but ORC functions in other cellular processes such as gene silencing and heterochromatin formation. Orc6, the smallest subunit in human cells, has previously been shown to bind to chromatin throughout the cell cycle. Prasanth *et al.* (p. 1026) now show that during mitosis, Orc6 is also found at the kinetochore, at the plane of cell division, and at the midbody of dividing cells. A diminution of Orc6 function produced with small intermediate RNAs resulted in a complex phenotype whose characteristics included increases in polyploidy, aberrant mitoses, cells with multipolar spindles, and the failure of chromosomes to align at the metaphase plate. Thus, Orc6 functions in a wide range of cell division activities, including replication, chromosome segregation, and cytokinesis.

Maintaining Immunity

Phosphoinositide 3-kinase activity regulates many cell processes across many cell types. There are three isoforms of its catalytic subunit p110, but their specificity has not been clear. Okkenhaug *et al.* (p. 1031) generated a mouse that expresses an inactive form of p110 and observed compromised B and T cell immune function. The study reveals a highly selective, nonredundant role for this isoform in lymphocyte antigen receptor signaling as well as a drug-development target.

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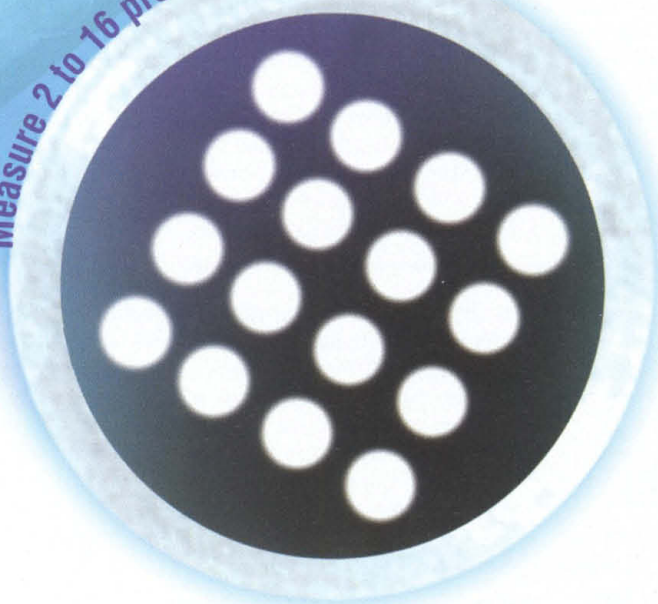

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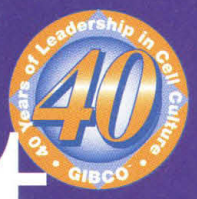

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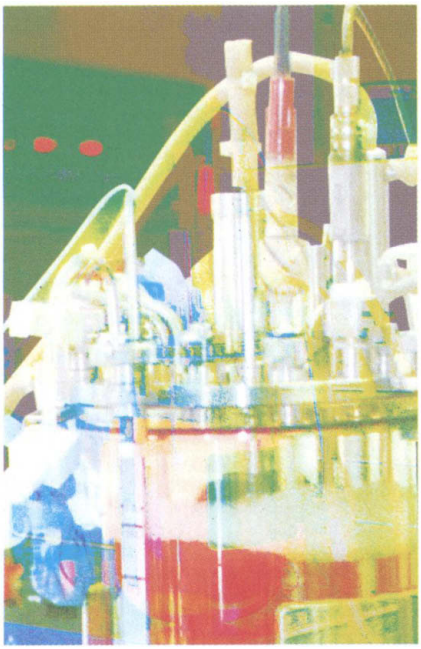

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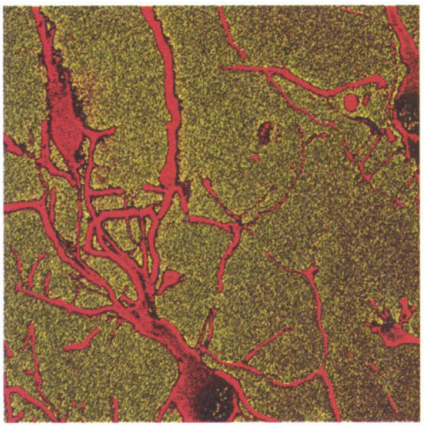

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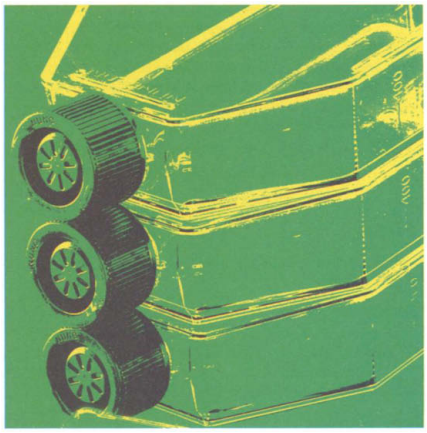

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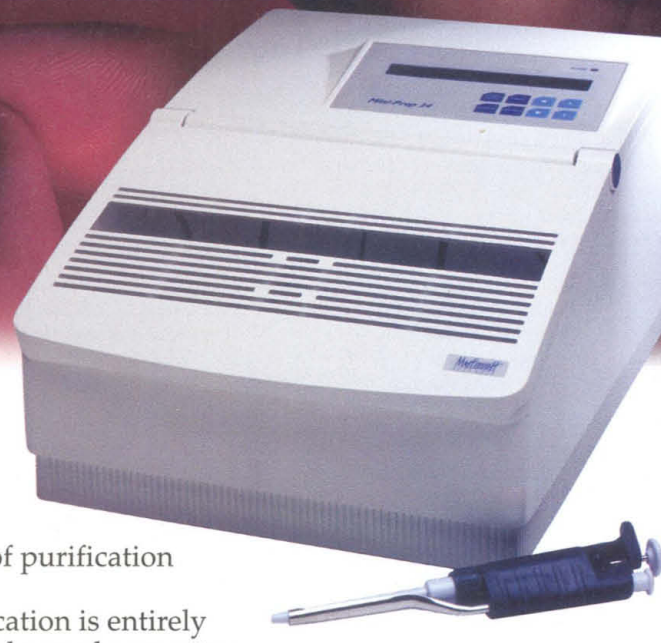

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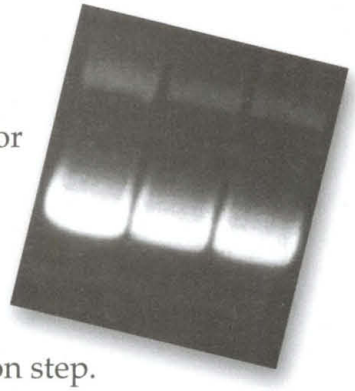

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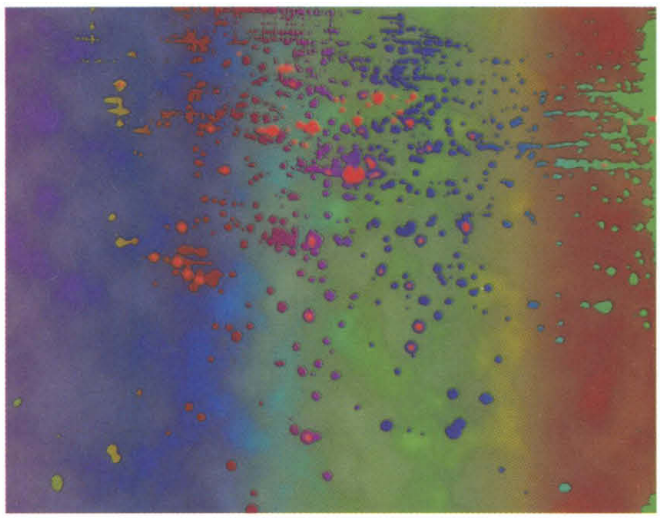

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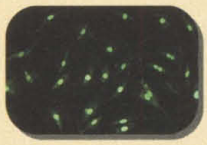

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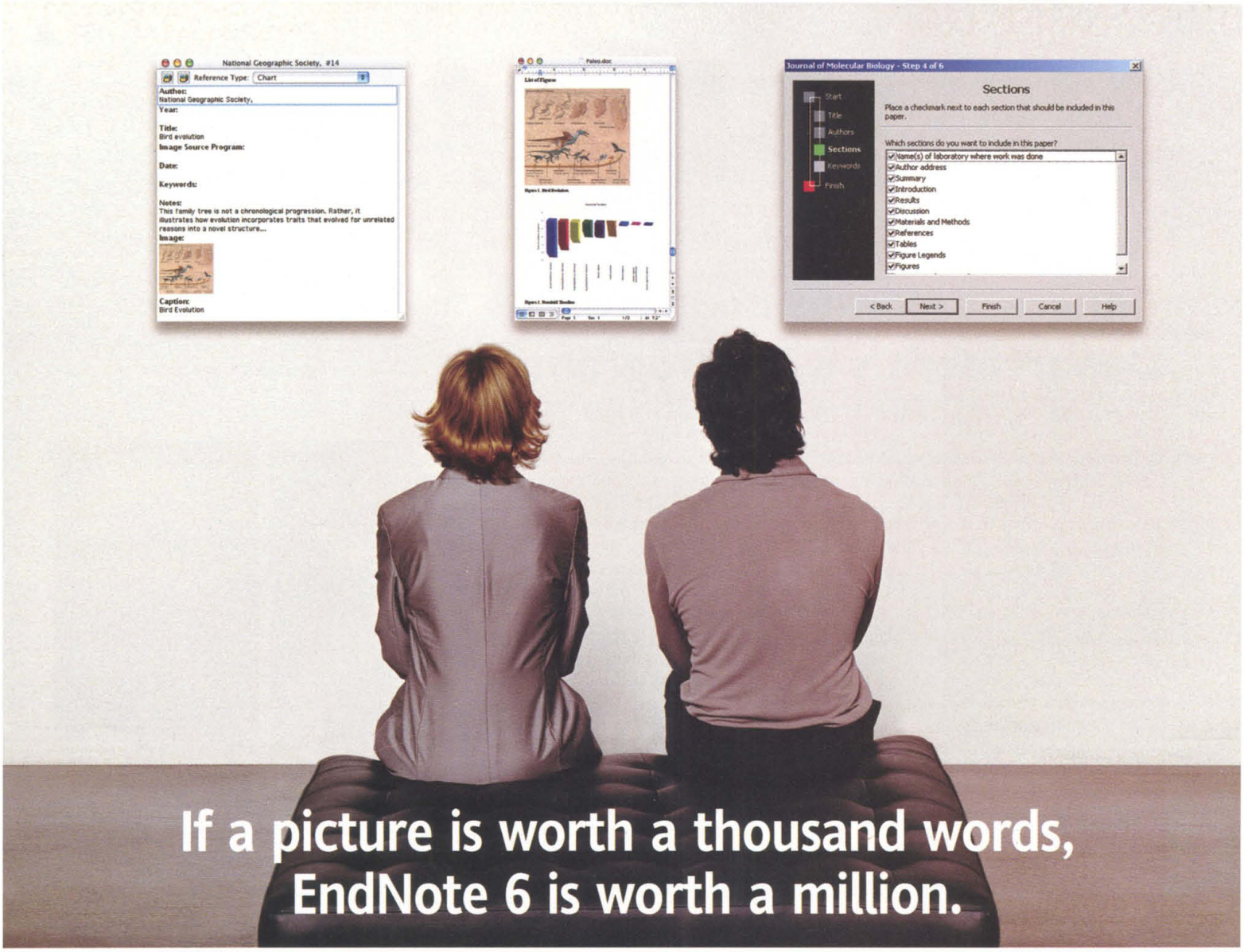

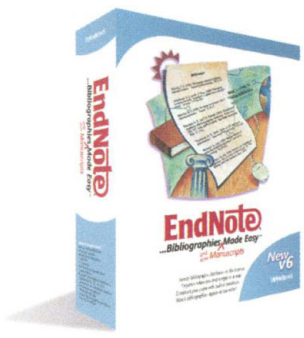

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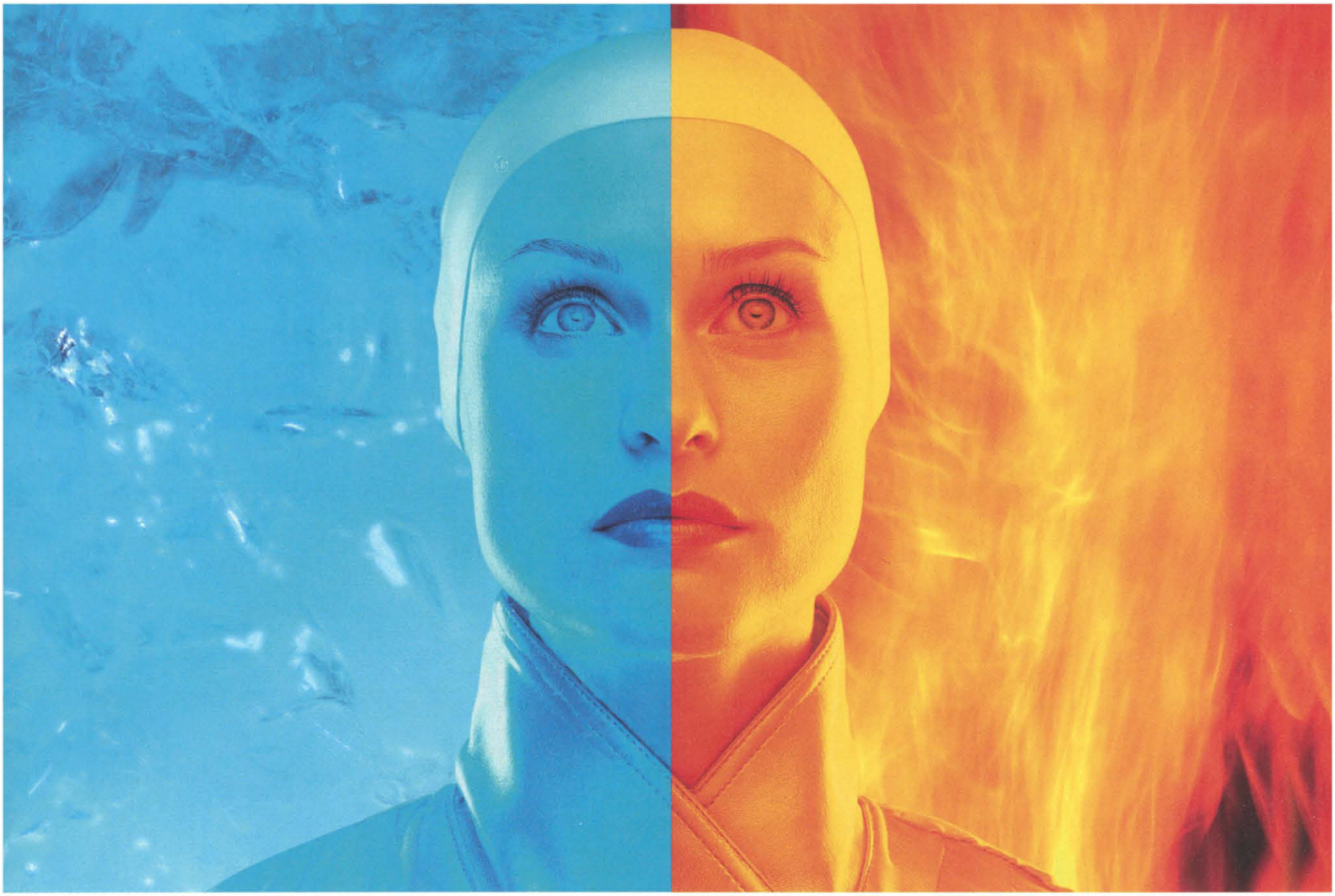

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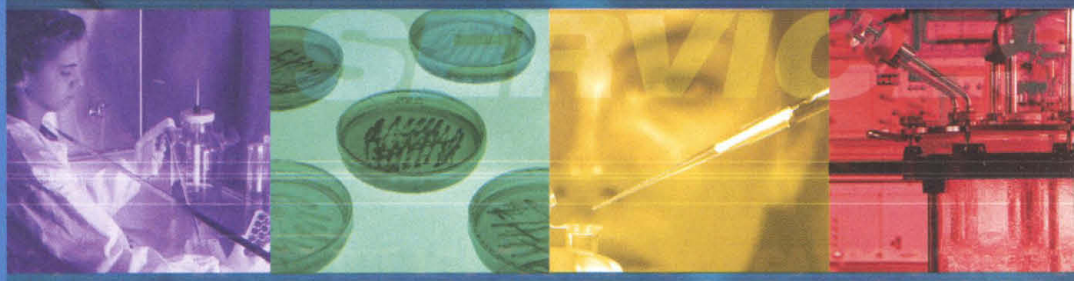

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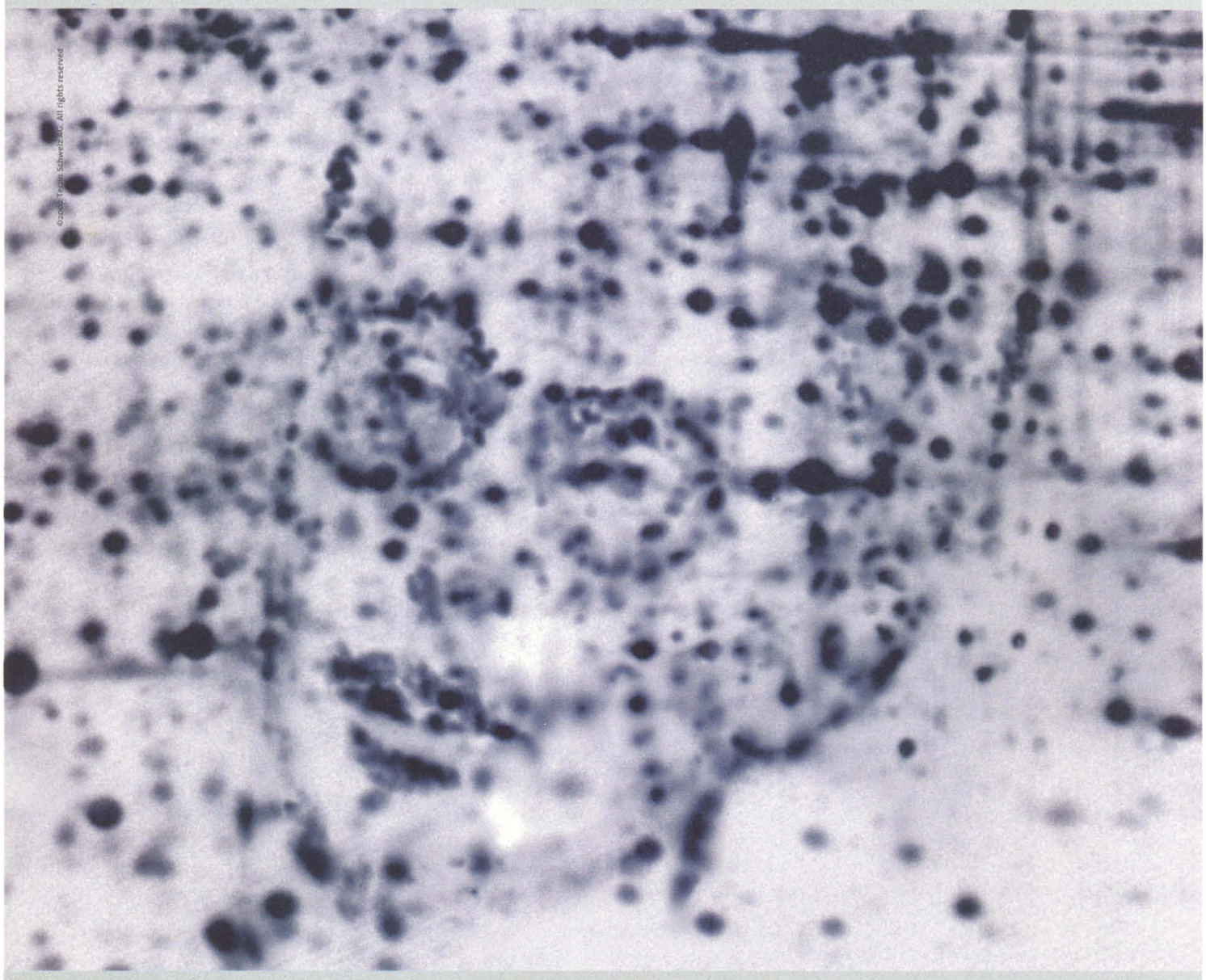

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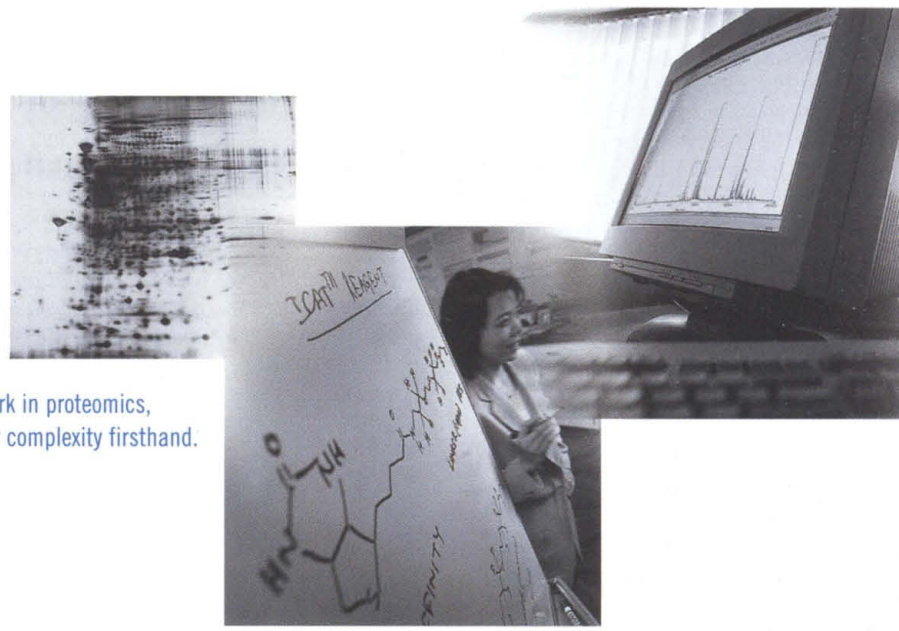

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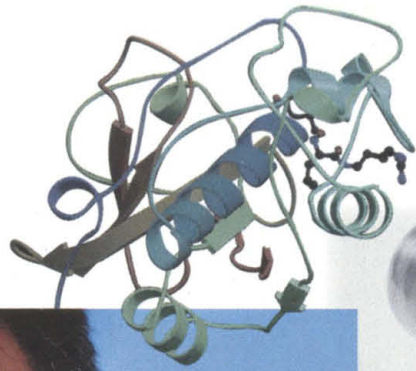

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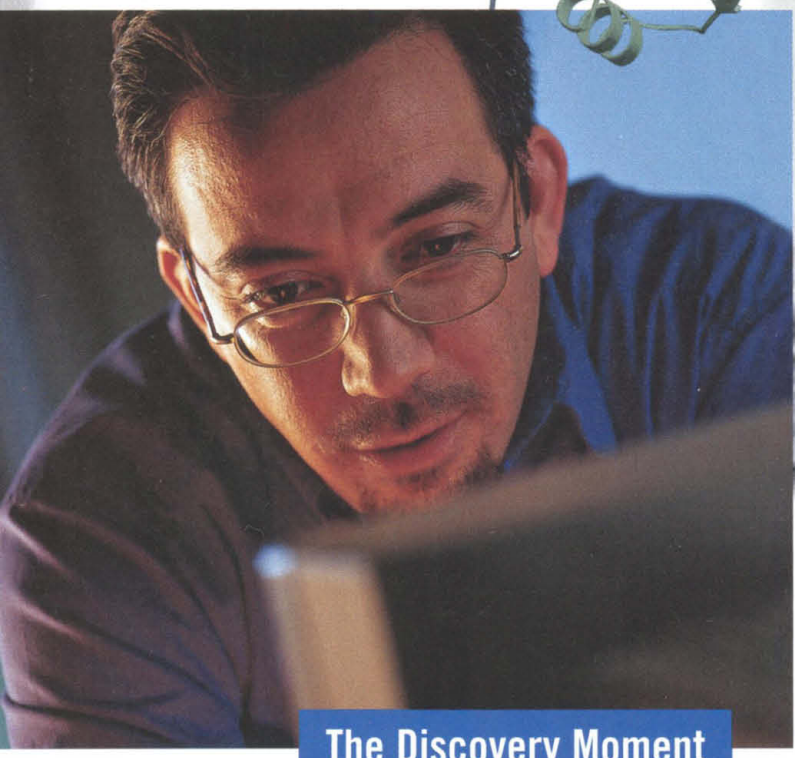

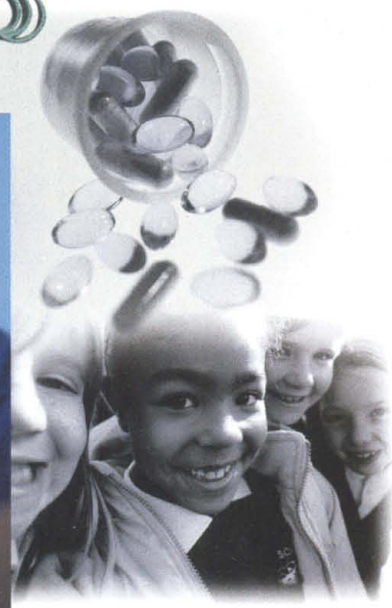

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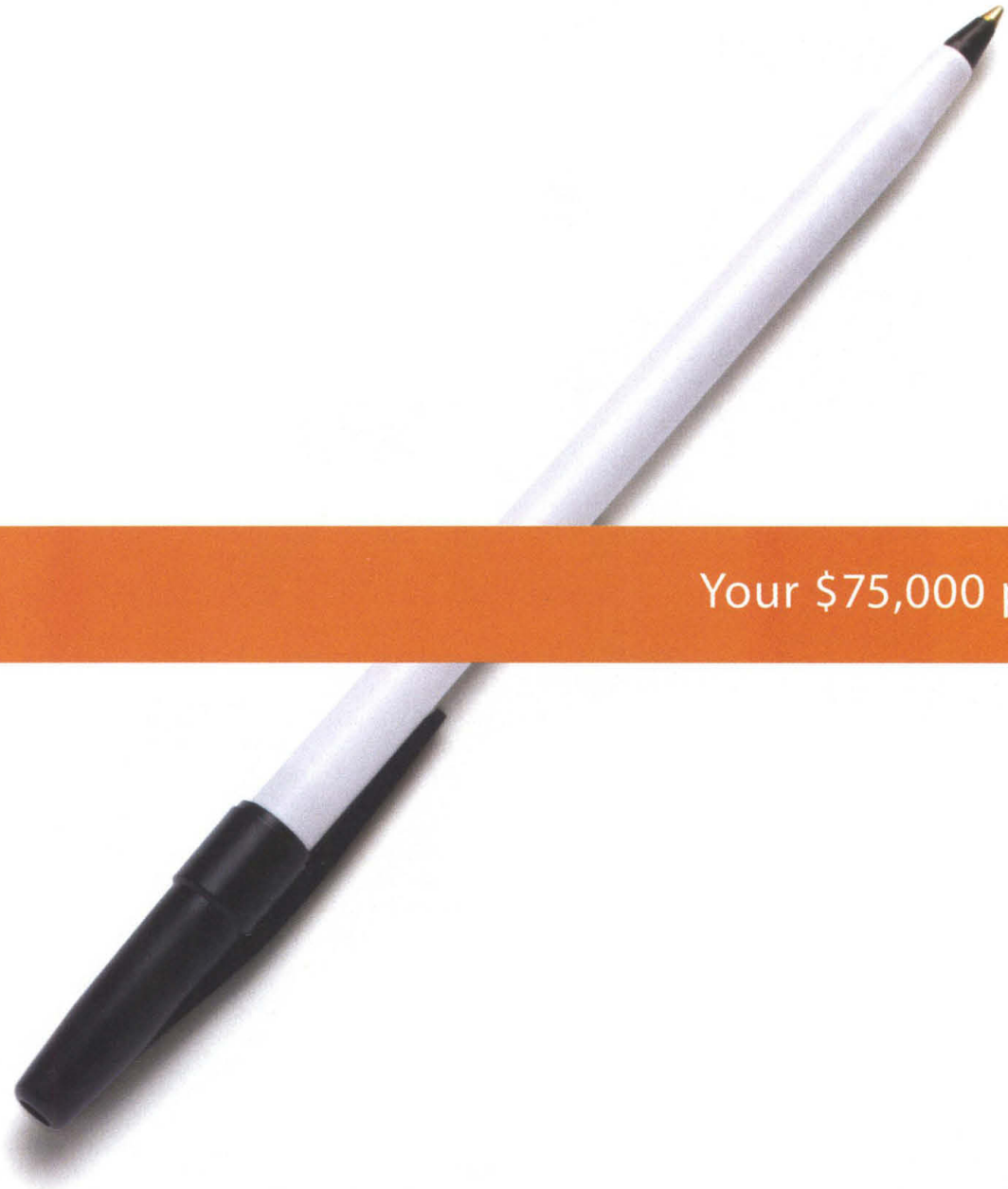

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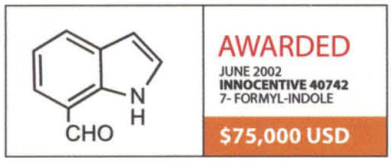

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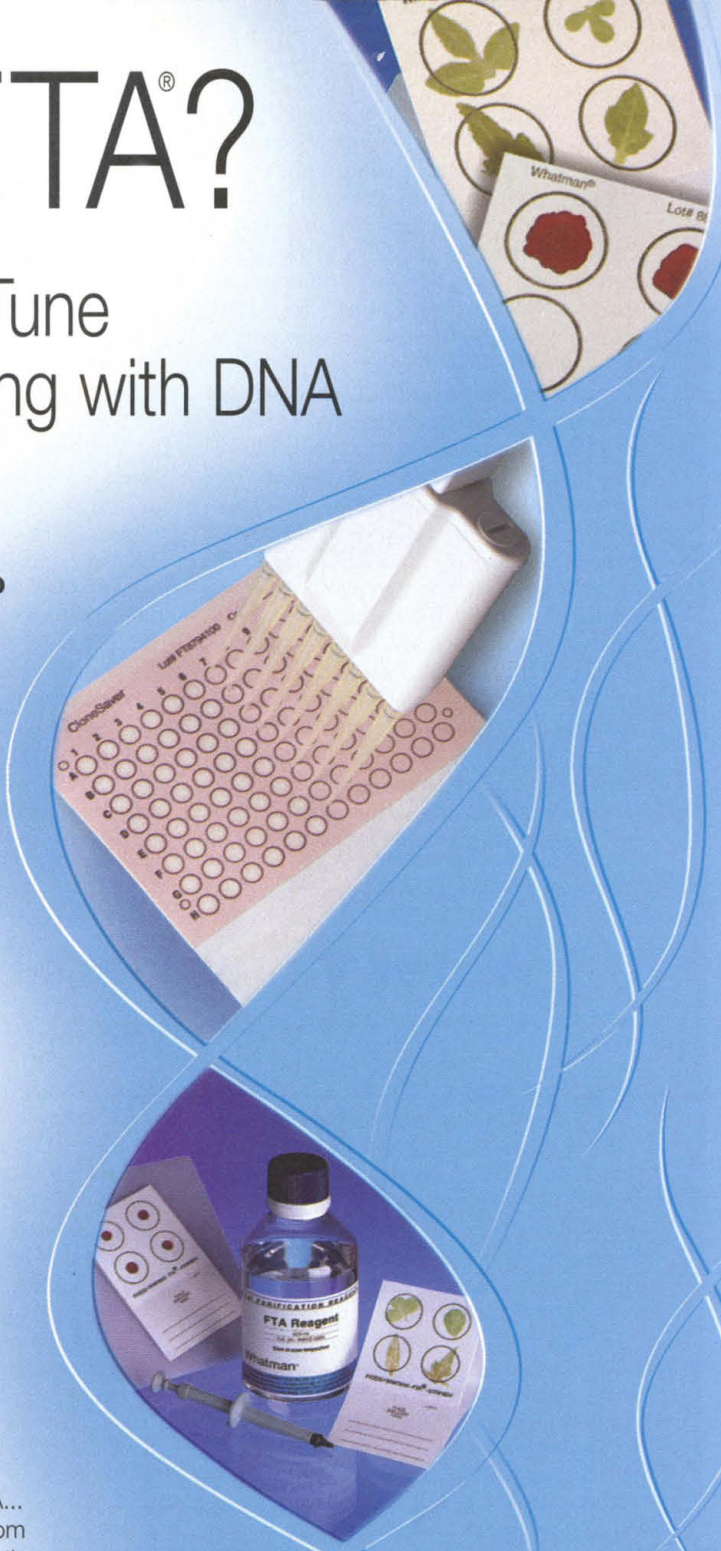

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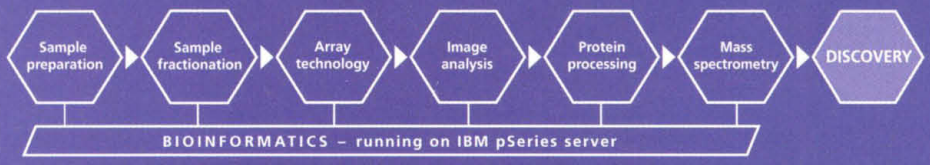

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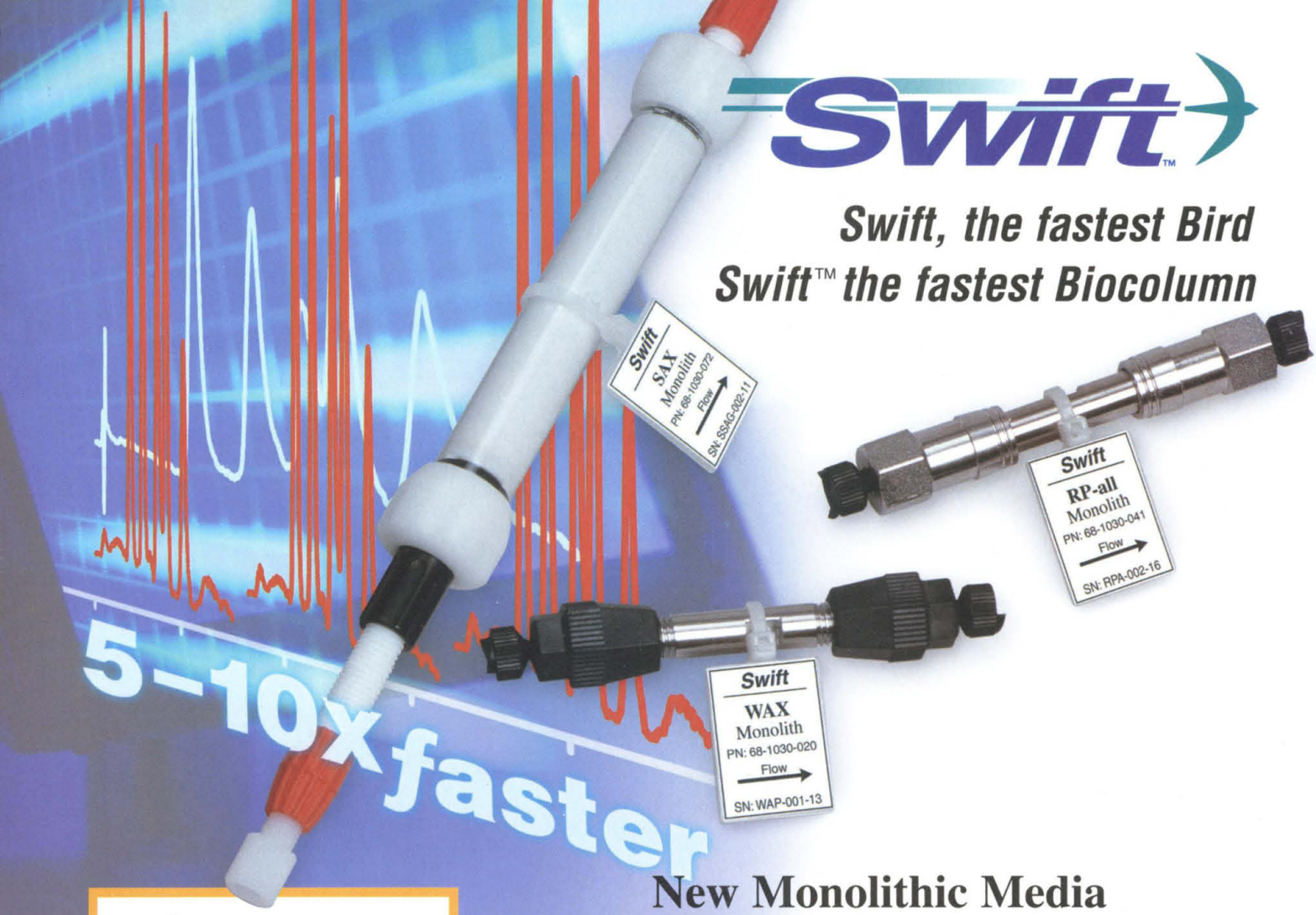

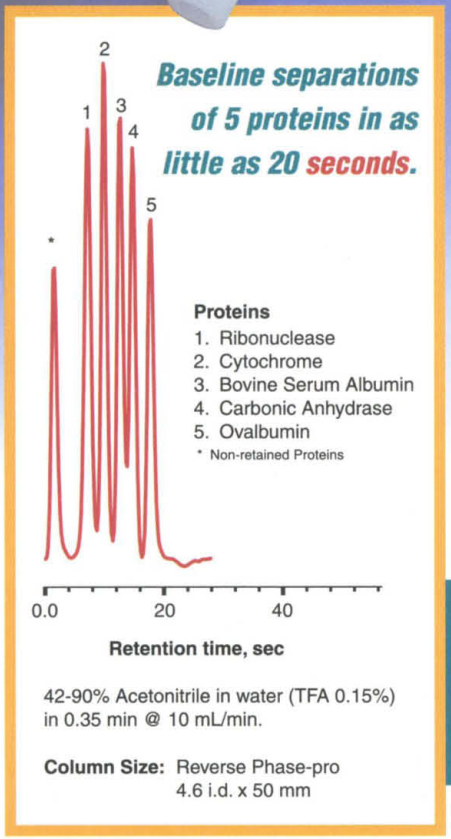

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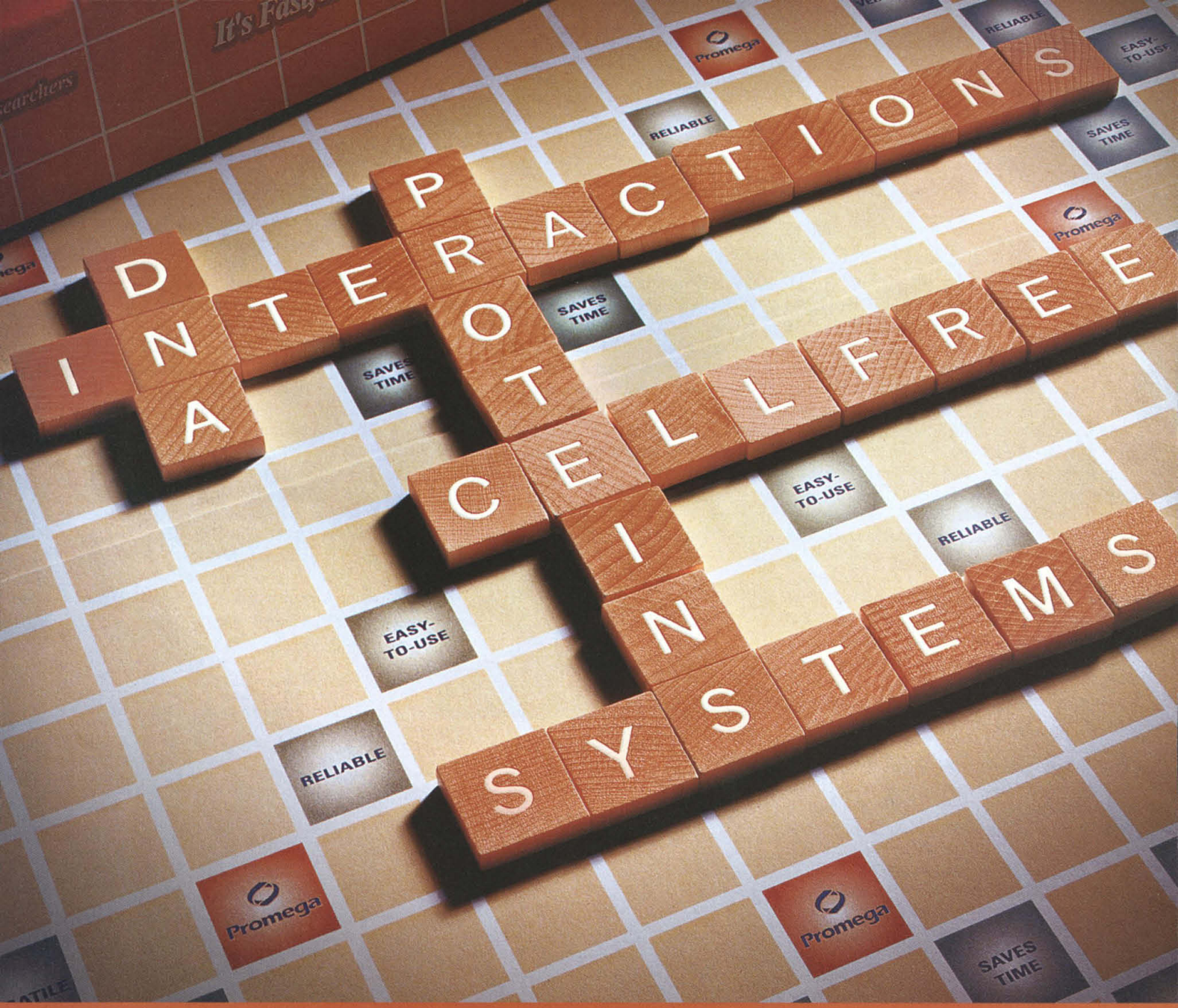

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