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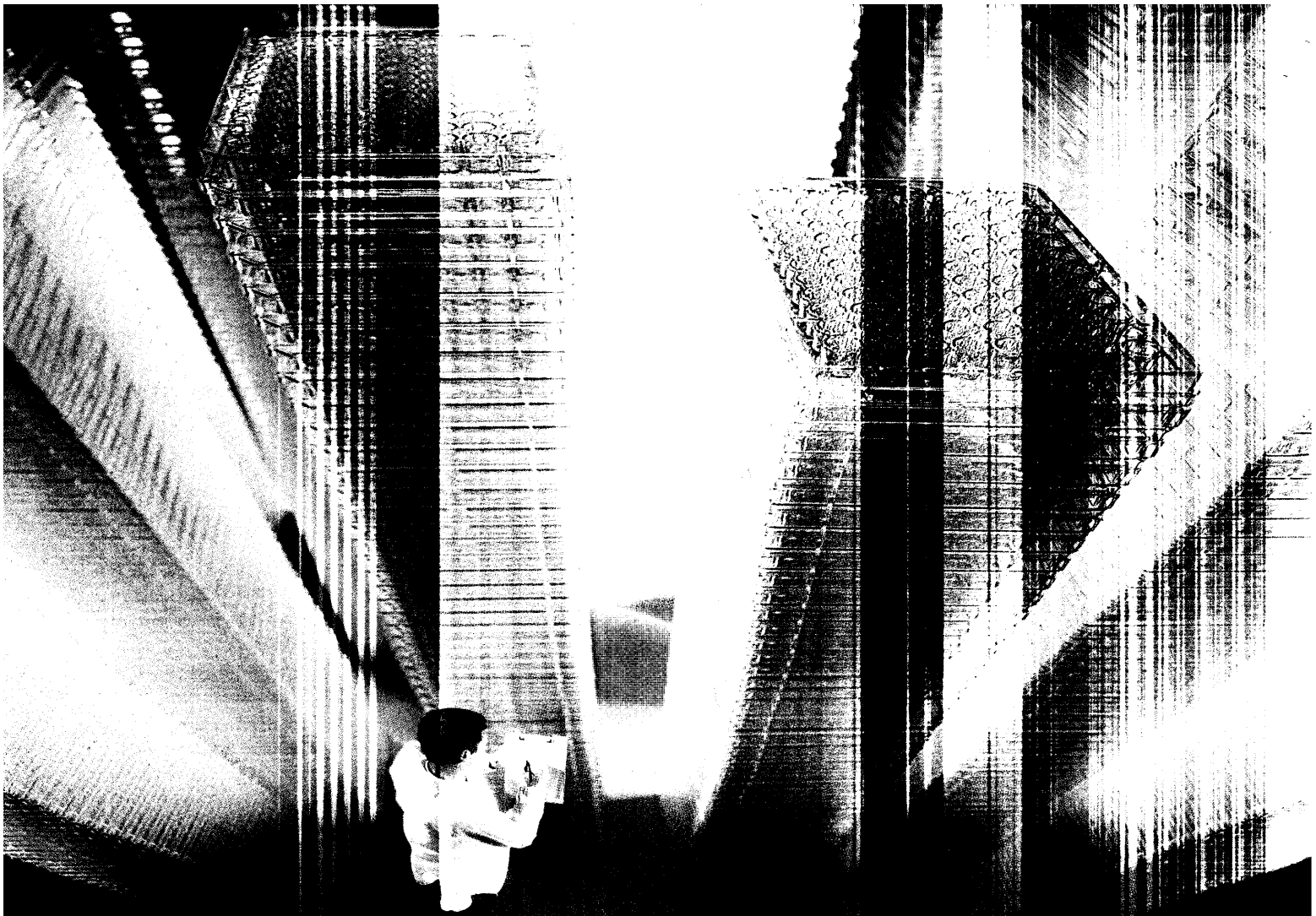

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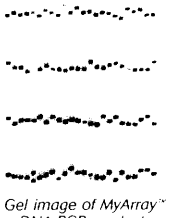

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Science

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1974
Microbes and chronic disease

NEWS

SCIENCE'S COMPASS

2002
Identifying flying organisms

COMPUTERS AND SCIENCE

See also NetWatch on p. 1959, Reports on p. 2059 and p. 2087, and www.sciencemag.org/feature/data/compsci/index.shtml

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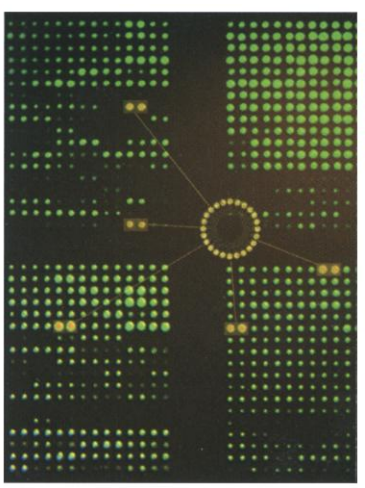
From a specialized workhorse serving the scientific elite, the computer has matured into a ubiquitous all-purpose tool for probing the universe and communicating the results. The special section in this issue examines some of its ever-expanding possibilities. [Photo: Ann Cutting; monitor images: A. S. Szalay]

RESEARCH

RESEARCH ARTICLE

REPORTS



2101

Chipping away at the proteome

New on *Science* Express Origins of deep-ocean vent organisms

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Deposition of Conformal Copper and Nickel Films from Supercritical Carbon Dioxide J. M. Blackburn, D. P. Long, A. Cabanas, J. J. Watkins

Processing of metal-organic precursor molecules in supercritical carbon dioxide allows thin copper and nickel films (such as wires) to be deposited uniformly on undulating surfaces.

***C. elegans* p53: Role in Apoptosis, Meiosis, and Stress Resistance** W. B. Derry, A. P. Putzke, J. H. Rothman

Discovery of a homolog of the p53 tumor suppressor gene in the nematode *C. elegans* opens up new possibilities for genetic dissection of p53 function.

Biogeography and Ecological Setting of Indian Ocean Hydrothermal Vents C. L. Van Dover *et al.*

Scaly-foot gastropods and swarms of swimming shrimp are among the intriguing invertebrates found at two hydrothermal vents along the Central Indian mid-ocean ridge, a new biogeographic province in an unusual ecologic setting.

TECHNICAL COMMENTS

Isotopic Variability of Nitrogen in Lunar Regolith

Measuring nitrogen isotope ratios in lunar soils as a function of depth, Hashizume *et al.* (Reports, 10 November 2000, p. 1142) found evidence for two N sources: a ^{15}N-depleted component associated with solar wind (SW) hydrogen, and a nonsolar, ^{15}N-enriched "planetary" component. Hashizume *et al.* argued that these patterns could not be explained by isotopic fractionation, but instead required "the contribution of ^{15}N-rich compounds," mostly of interstellar origin, "to the total nitrogen in planetary materials." Kerridge, in a comment, maintains that "rather simple arguments serve to illustrate the failure" of such a two-component model in explaining lunar regolith N isotope variability, and raises a number of other objections to the analysis of Hashizume *et al.* "The isotopic variability of lunar regolith N," Kerridge concludes, "... still lacks a viable explanation." Hashizume *et al.* respond by proposing a new model that relies on "variations in the flux ratio between the SW and micrometeorites" to explain the isotopic variation of lunar regolith N—a model that they hold is consistent with criteria cited by Kerridge for a hypothetical planetary component in lunar regolith N.

The full text of these comments can be found at www.sciencemag.org/cgi/content/full/293/5537/1947a.

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Perspective: Fat Hedgehogs, Slower or Richer? M. van den Heuvel

A step toward identifying the acyltransferases that palmitoylate Hedgehog, altering signaling output.

Review: Judging a Protein by More than Its Name—GSK-3 J. R. Woodgett

The many functions of GSK-3: development, apoptotic signal pathways, and neurological disorders.

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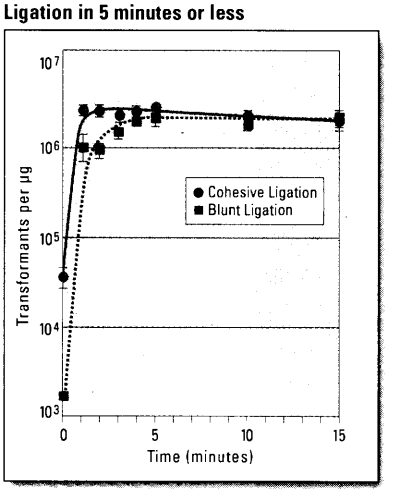

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THIS WEEK IN Science

edited by Phil Szuromi

Making Sense of Spinning Molecules

Numerous studies have been made of the scattering of crossed beams of molecules that have been prepared in well-defined electronic, vibrational, and rotational states. These scattering studies help test the theorist's potential energy surfaces that help describe these interactions. Lorenz *et al.* (p. 2063; see the Perspective by Crim) push these experiments even further by measuring the rotational sense imparted to NO molecules when they collided with a crossing beam of argon atoms. The use of circularly polarized light to excite the products and a full velocity mapping of the ions allowed the sense of the rotational vector to be determined. The strongest preference for a single preferred direction of rotation was exhibited by the states excited to the highest rotational levels.

2070 Rhine Graben Earthquakes

The Rhine graben is an active rift trending north to south through Germany and Switzerland. In order to assess the seismic hazard along this system, Meghraoui *et al.* (p. 2070; see the news story by Weiss) dug trenches along the Basel-Reinach fault to determine the number of earthquakes and the amount of slip along the fault. They identified three historic events that occurred between 610 AD to 6480 BC. The youngest event correlates with the 1356 Basel earthquake that destroyed the city and damaged about 40 castles along the Rhine graben south of the city. The identified events indicate a recurrence interval of 2500 years for a Basel-like event. The 1.8 meters of vertical displacement measured in the trenches indicate an average of 0.24 millimeters per year of slip along the Basel-Reinach fault.

More than Basal Transcription

The generality of function of the general transcription factors has been questioned since the observation that various TAFs [TATA-binding protein–associated factors] are expressed in a tissue-specific manner. Freiman *et al.* (p. 2084; see the Perspective by Verrijzer) eliminated the expression of one of the TAFs, $TAF_{II}105$, and show that the resultant "knockout" mice are viable but that the females are infertile. Examination of these females reveals that this $TAF_{II}105$ is necessary for folliculogenesis in the ovary. Hence, the basal transcription machinery contains a tissue-specific component that can act on a specific set of genes during female gametogenesis.

Out of Catastrophe Comes Order

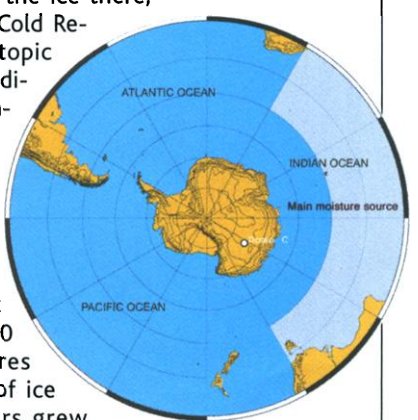
Chemical reactions can be described in terms of potential energy surfaces, which reflect the change in energy as molecules collide and reorganize from reactants into products. The shape of the potential energy surface—its landscape—determines the system's structure, dynamics, and thermodynamics. Wales (p. 2067; see Perspective by Leary) introduces a new analytical tool to the study of potential energy surfaces. He shows that universal functions derived from catastrophe theory provide a rationale for Hammond's postulate, an empirical rule which states that the transition state more closely resembles the higher in energy of the products and the reactants. The author also derives a quantitative law relating energy barriers, vibration frequencies, and path lengths.

A Different Trip for Making Trp

Prokaryotes such as *Escherichia coli* and *Bacillus subtilis* regulate the production of their own amino acids for protein synthesis. In the synthesis of tryptophan (Trp), both of these bacteria recognize Trp and its uncharged transfer RNA (tRNA) as regulatory signals. Valbuzzi and Yanofsky (p. 2057; see the Perspective by Losick and Sonenshein) show that these signals are not used in *B. subtilis* along the lines of the classic *E. coli* model. In *B. subtilis*, Trp activates the protein TRAP, which in turn binds to the *trp* leader RNA to promote the formation of a transcription termination structure, thereby limiting Trp production. The signal provided by uncharged $tRNA^{Trp}$ promotes the production of the protein AT, which binds directly to Trp-activated TRAP. TRAP is thus prevented from binding to RNA and is inactivated, which leads to antitermination and increases *trp* operon expression.

Paleoclimate at Lower Latitudes

Most data for long-term climate change (ice core and sediment records) are concentrated at the poles. Two reports extend the interpretation of such records to the determination of sea surface temperatures (SSTs) at midlatitude (see the Perspective by Steig). A reversal from warm to cold atmospheric temperatures occurred at both Northern and Southern high latitudes during the last deglaciation, but the Antarctic cooling preceded its Arctic analog by more than 1000 years. Stenni *et al.* (p. 2074) present a record of deuterium isotopes in ice from East Antarctica to show that a cooling event also occurred in the Indian Ocean, the main moisture source for the ice there, 800 years after the Antarctic Cold Reversal. Comparison of the isotopic record of precipitation with sodium concentrations in the ice indicates that the temperature gradient between the Antarctic and the Indian Ocean was linked strongly to the strength of atmospheric circulation. As Earth's climate slid into the depths of the Last Glacial Maximum about 21,000 years ago, ocean temperatures generally fell as the amount of ice frozen in continental glaciers grew. Sachs *et al.* (p. 2077) report that SSTs in the southeast Atlantic Ocean, off the southern tip of Africa, actually increased substantially between 41,000 and 25,000 years ago. Further analysis suggests that this warming was more than just a regional phenomenon.



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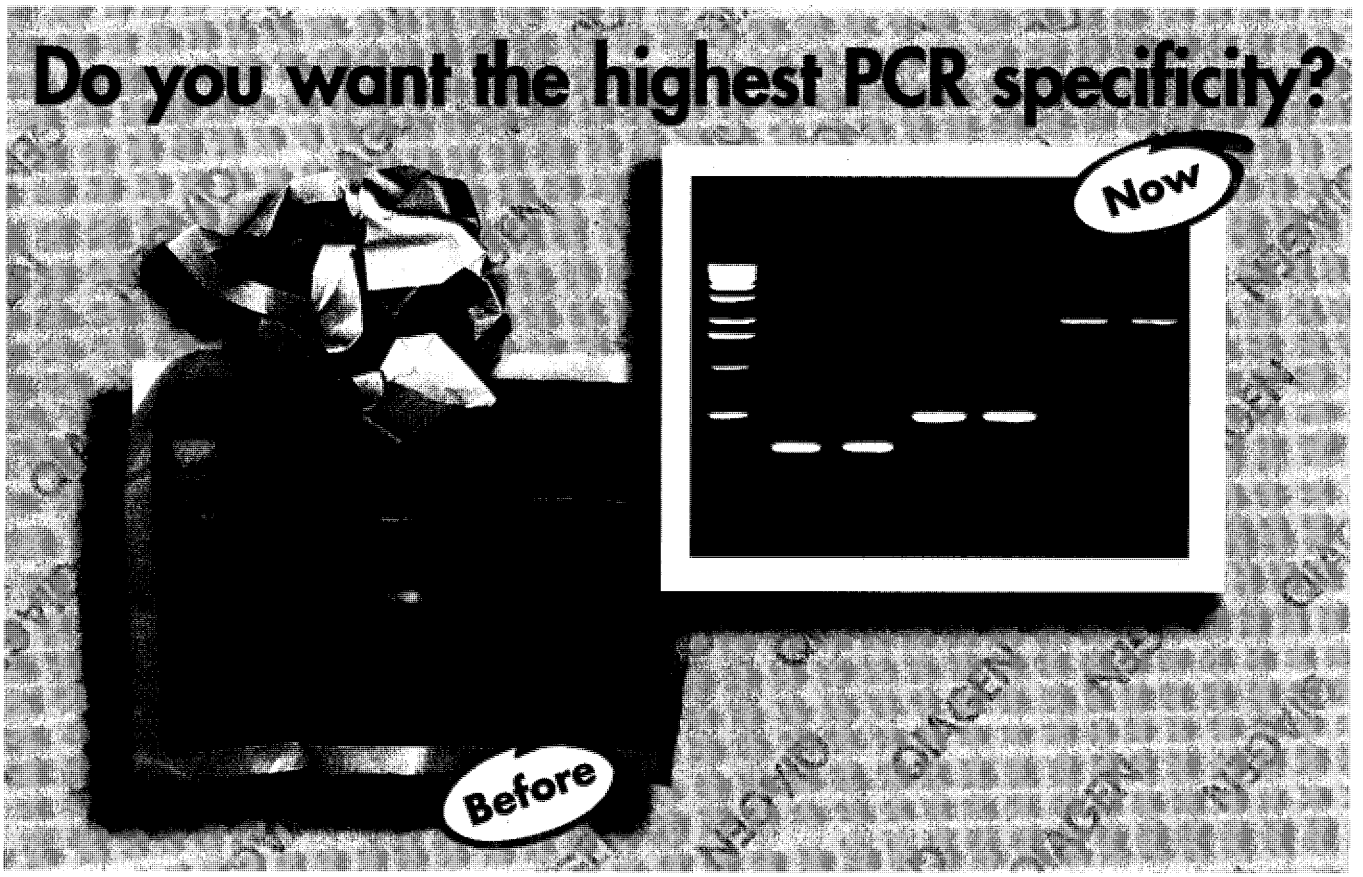

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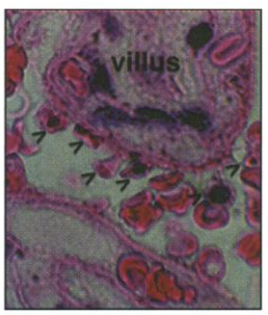
Yeast Protein Chips

Although gene identification is important and necessary, understanding gene function requires the analysis of proteins. Zhu *et al.* (p. 2101) have advanced this endeavor by creating microarrays on glass slides that display purified proteins (as fusions to glutathione *S*-transferase) for 80% of the open reading frames of the *Saccharomyces cerevisiae* genome. The microarrays were used to identify proteins that can bind to calmodulin or to phospholipids.

Comparative Genomics and Gene Evolution

Genome reduction has been thought to be a crucial element in the evolution of parasitic or intracellular bacteria. Ogata *et al.* (p. 2093; see the news story by Couzin) determined the sequence of *Rickettsia conorii* (which causes Mediterranean spotted fever in humans) and compared it to the previously sequenced genome *of R. prowazekii* (which causes "louse-borne" typhus). *R. conorii* contains 552 genes and has a high density of repeats that were not found in *R. prowazekii*. Colinearity of genes in the two organisms made it possible to observe several hallmarks of genome reduction, including "split" genes that are still transcribed, "split" genes in which only some of the segments are transcribed, fully decayed open reading frames, and complete disappearance of genes in *R. prowazekki*. Amplification of genomic DNA from other *Rickettsia* species indicates that gene degradation occurs frequently in *Rickettsia*.

Trojan Malaria



When malaria infects pregnant women, there is often a dramatic buildup of infected red blood cells in the placenta that can potentially lead to maternal morbidity and mortality, premature delivery, miscarriage, and low birth weight. Flick *et al.* (p. 2098; see the Perspective by Duffy and Fried) now describe how one of the malaria parasite surface proteins, PfEMP1, appears to bind to nonimmune immunoglobulins. The coated parasites can then adhere to placental cells via the placental immunoglobulin receptors.

Emotions and Moral Dilemmas

"Rational" or "objective" thinking often collides with "emotional" or "subjective" thinking when we are required to make difficult moral judgments. Two well-studied problems are the "trolley" dilemma and the "footbridge" dilemma, both of which involve taking some action to save five lives at the cost of one. Despite the lack of a consistent moral framework for analyzing these dilemmas, most people choose to save the five persons in the former but the one person in the latter. From behavioral and brain imaging analysis of human choices over a wide range of such dilemmas, Greene *et al.* (p. 2105; see the news story by Helmuth) conclude that the degree (for example, whether the cost is the result of an action or is passively incurred) to which emotional responses are evoked proportionately influences which moral judgments human reach and how they arrive at them.

BAFFling No More

A number of tumor necrosis factor (TNF)–related ligands and receptors have recently been identified that regulate B cell development and function. One of these is the B cell activating factor, BAFF, which interacts with two receptors [transmembrane activator and calcium-modulating cyclophilin ligand interacting protein (TACI) and B cell maturation antigen (BCMA)] to promote survival and proliferation of splenic B cells (see the Perspective by Waldschmidt and Noelle). Schiemann *et al.* (p. 2111) observed a profound defect in B cell development in mutant mice that lack expression of BAFF that was only partially reiterated in TACI- and BCMA-deficient animals. These results implicate the existence of another receptor for BAFF. Thompson *et al.* (p. 2108) describe a candidate receptor that binds BAFF but not any other of the identified TNF-like ligands. The A/WySnJ strain of mice harbors a truncation in the BAFF-R gene that leads to a B cell deficit similar to that observed in BAFF-deficient mice. Together, these studies suggest that the interaction of BAFF with BAFF-R mediates major effects on B cell development.

CREDIT: FLICK *ET AL.*

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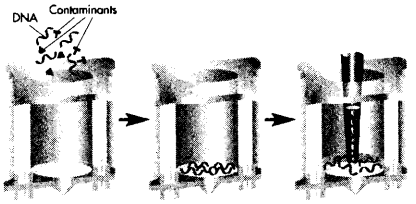

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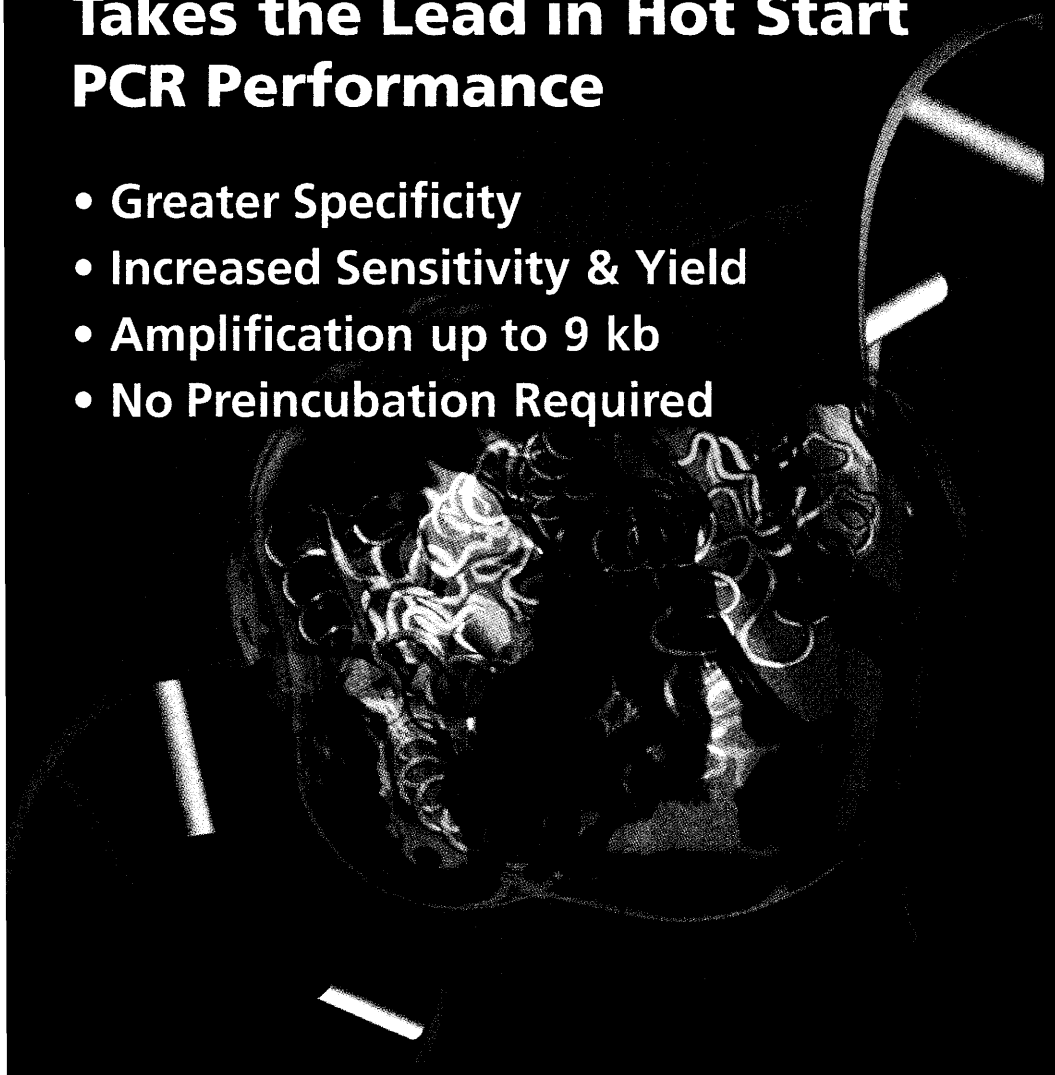
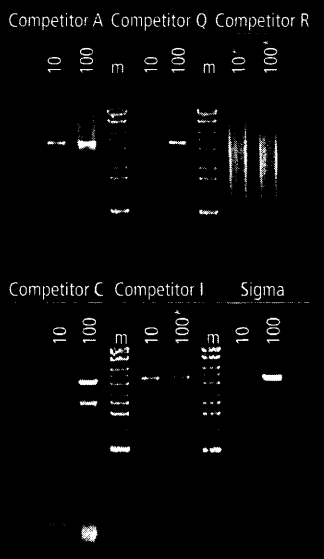


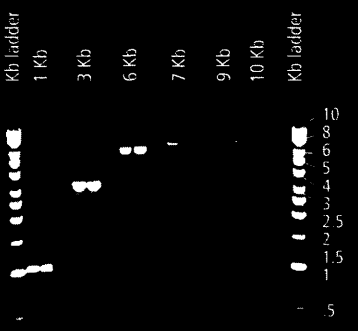
JumpStart Taq Delivers Increased Sensitivity and Yield



10 or 100 ng total human genomic DNA was amplified with primers targeted to a 5 kb section of β globin. Activation parameters and the number of cycles were altered to fit the supplier's recommendations.

* Samples were loaded at 40% other lanes to avoid signal overload from the non-specific product.

JumpStart Taq amplifies up to 9 kb



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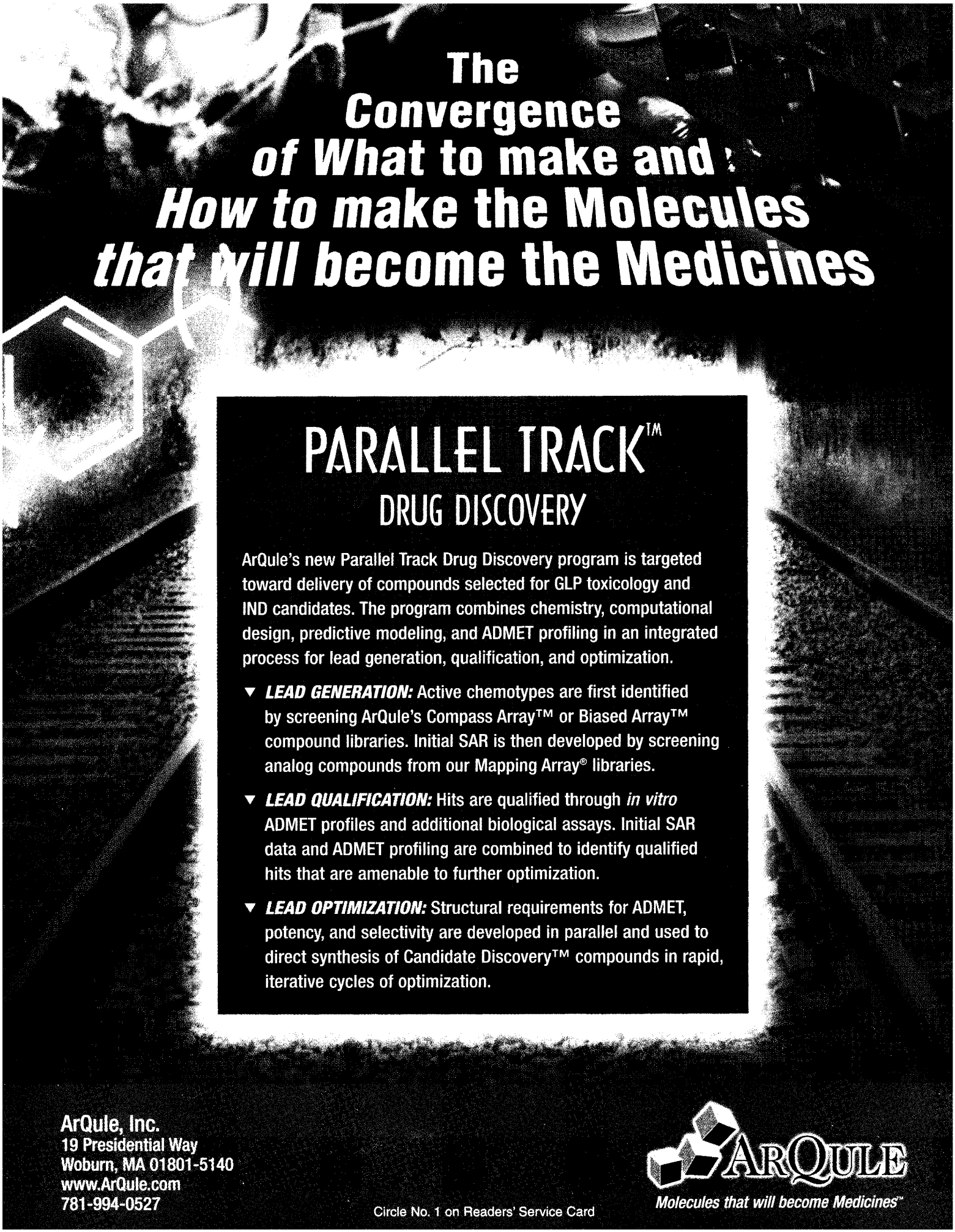
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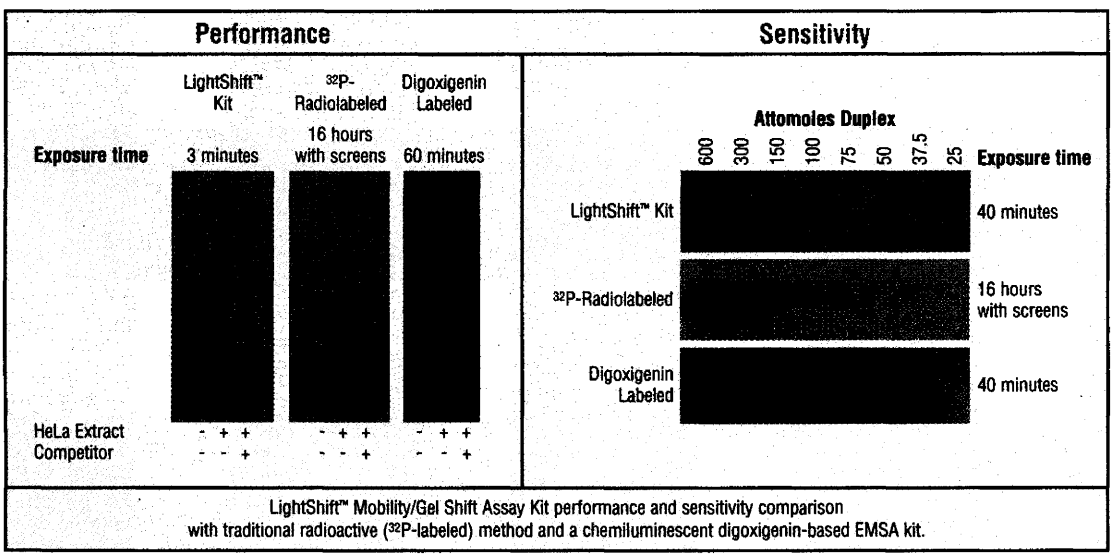

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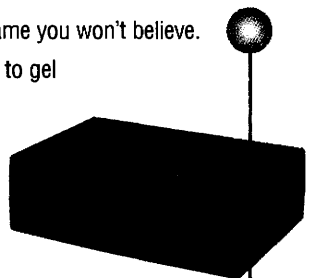

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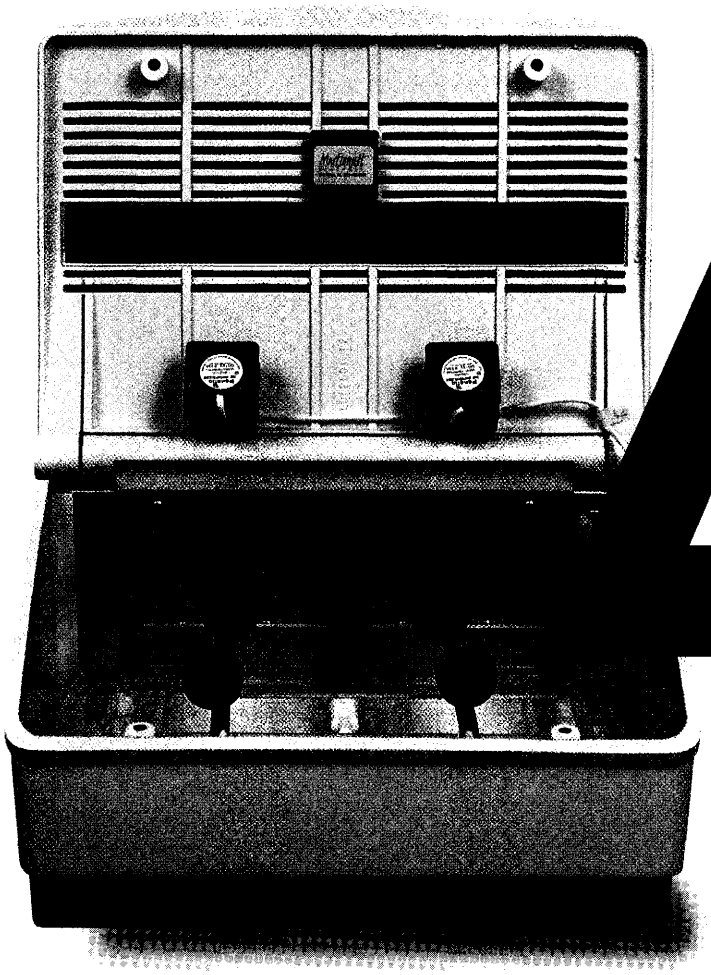

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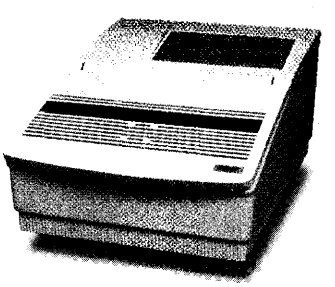

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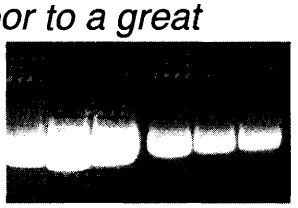

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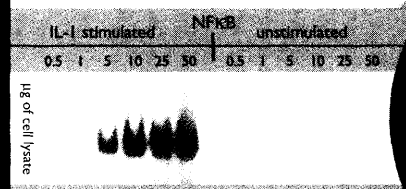

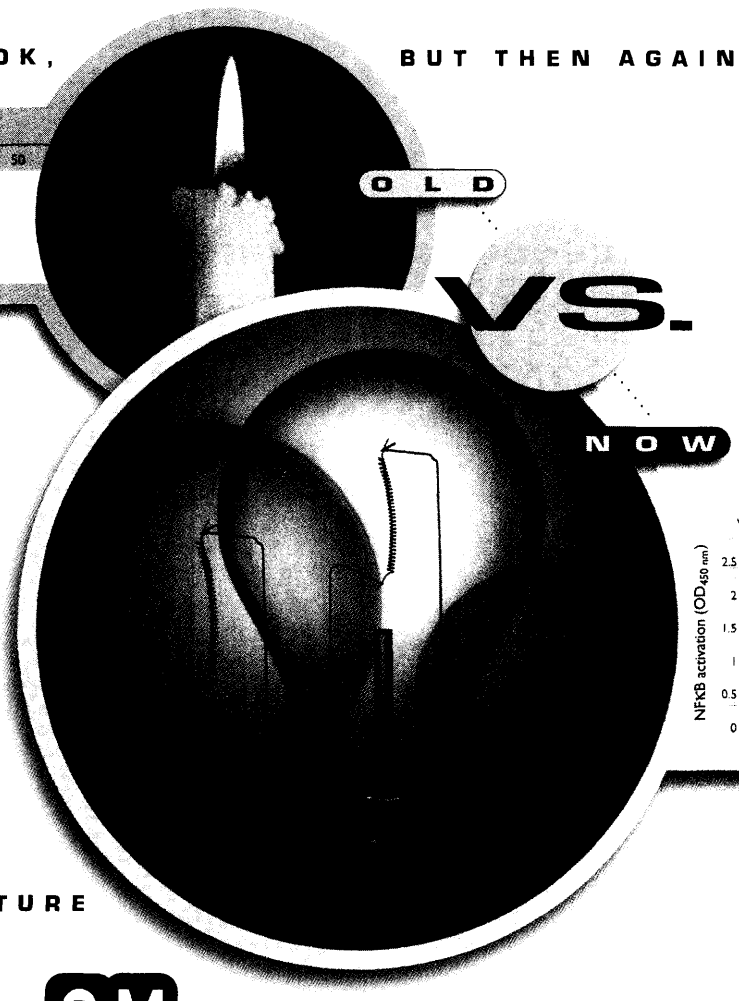

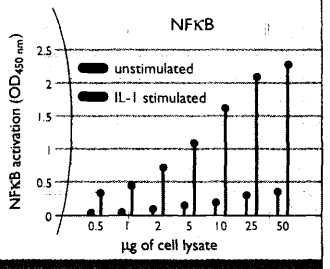

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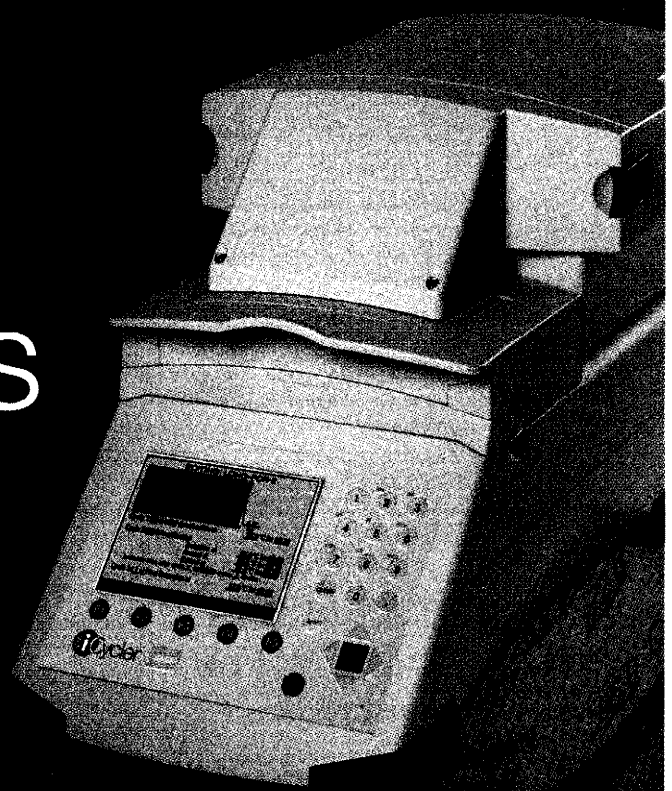

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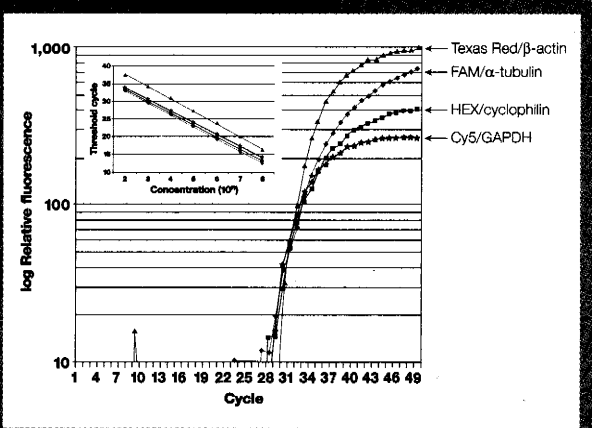

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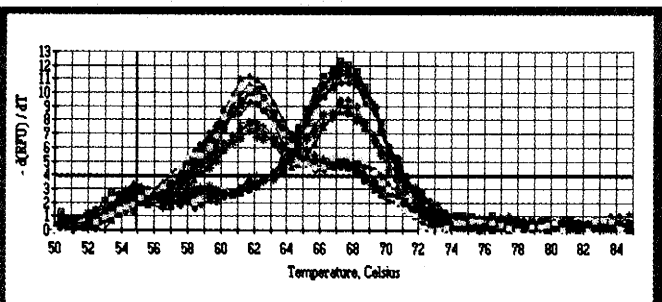

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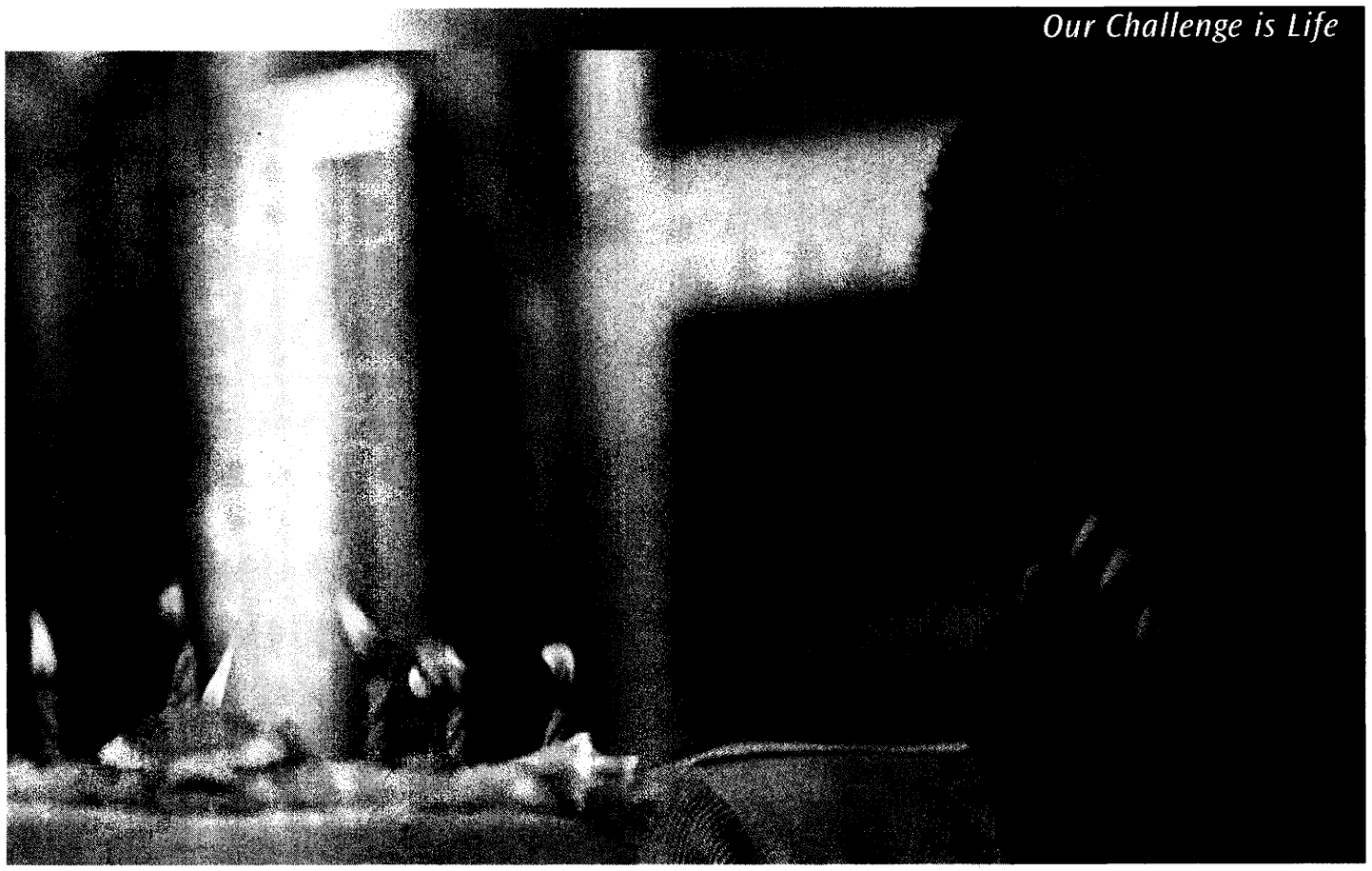

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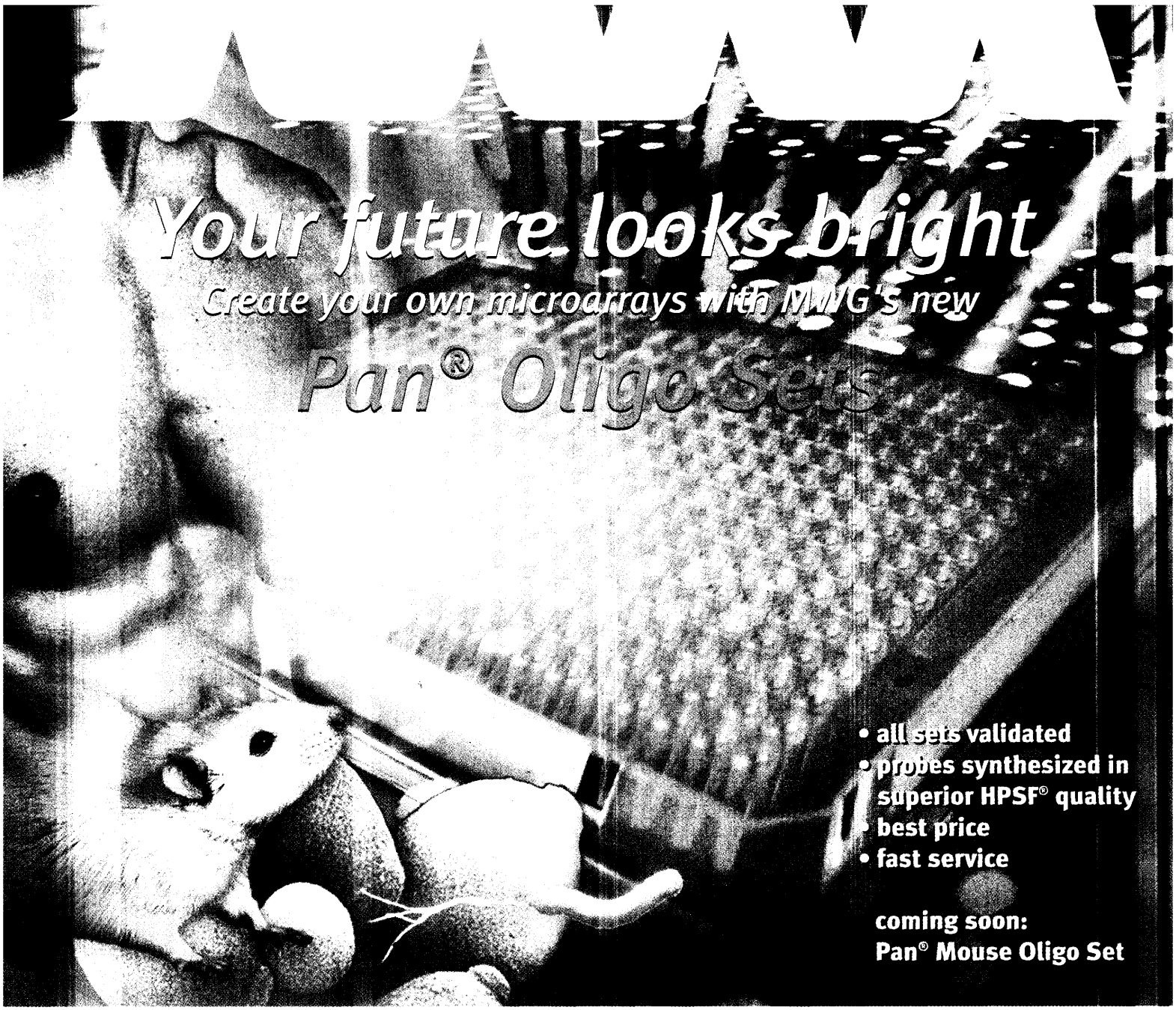

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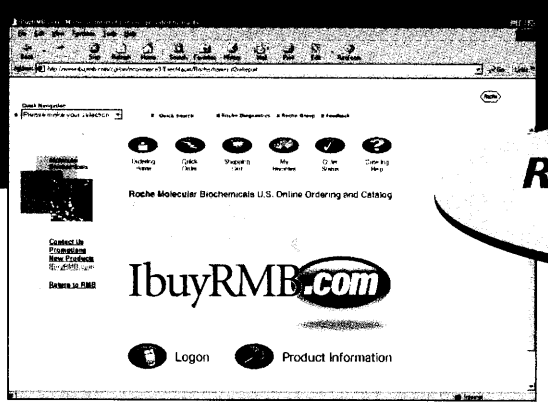

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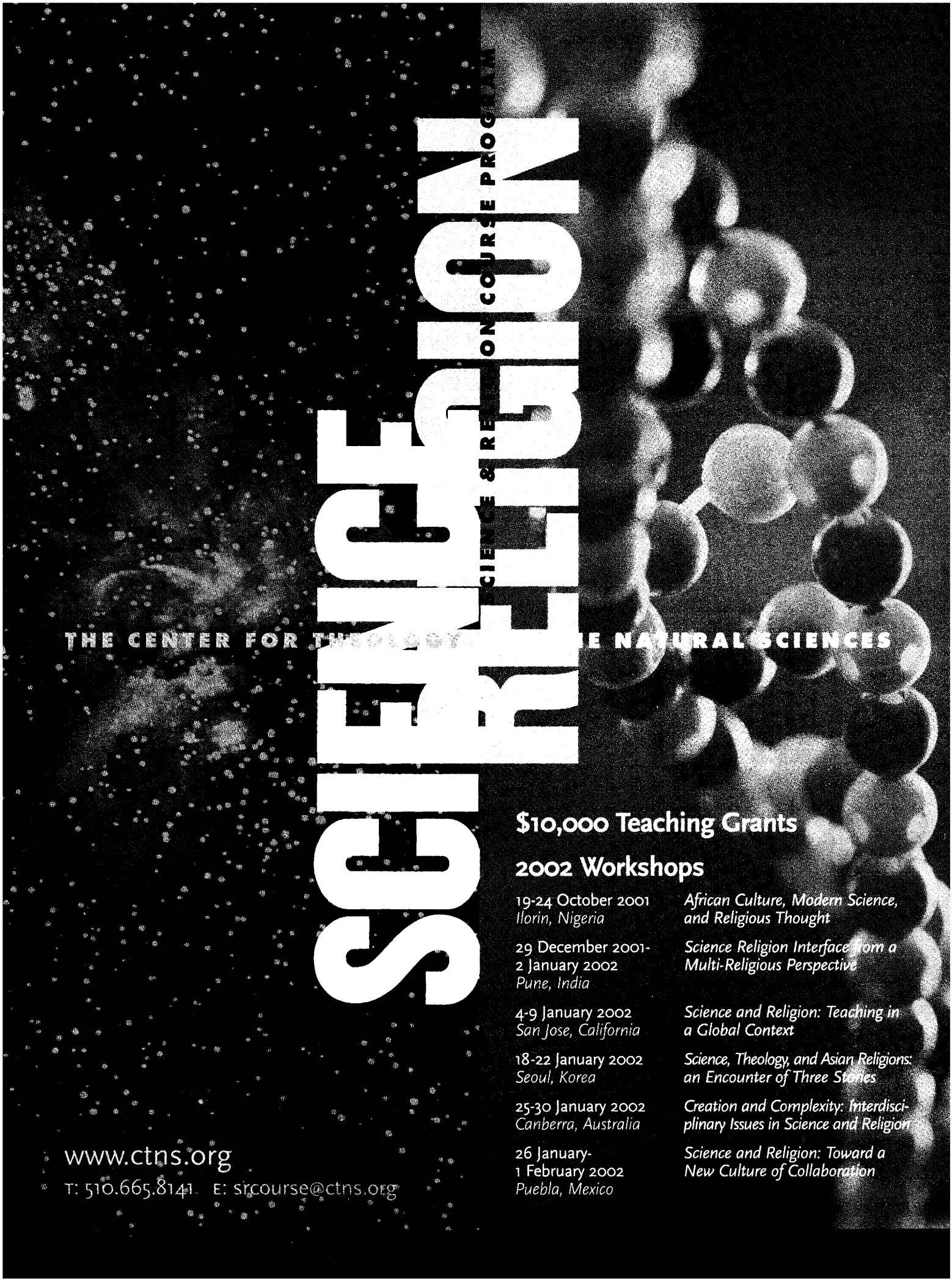
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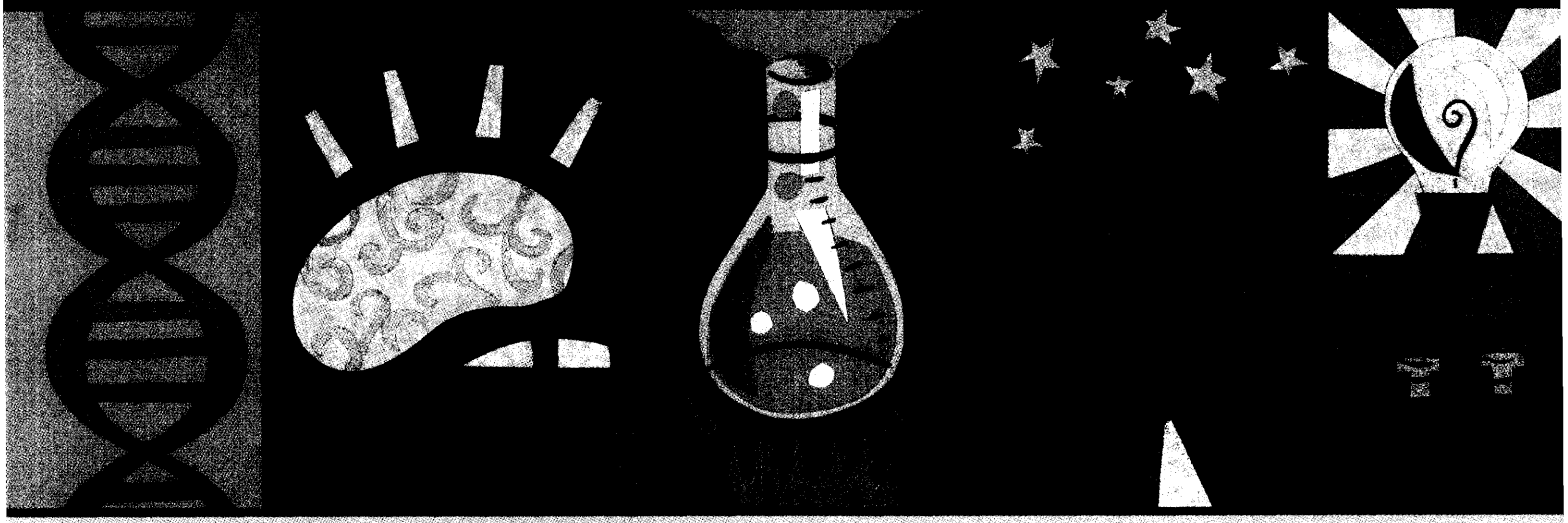

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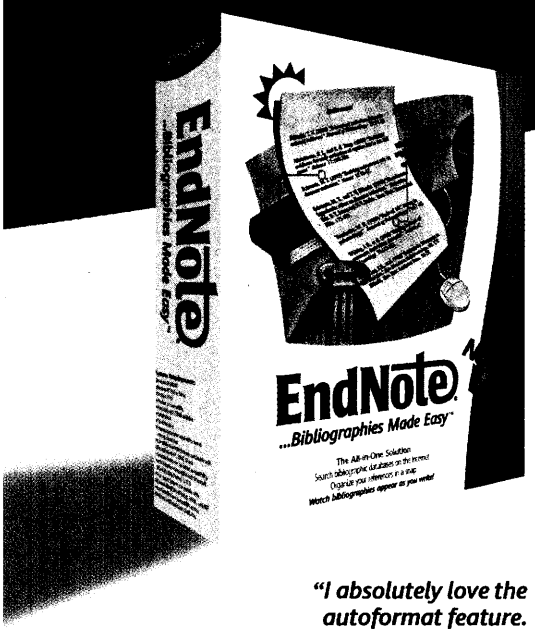

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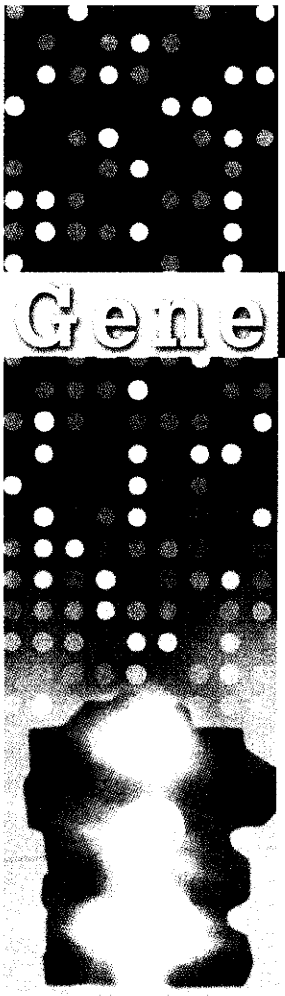

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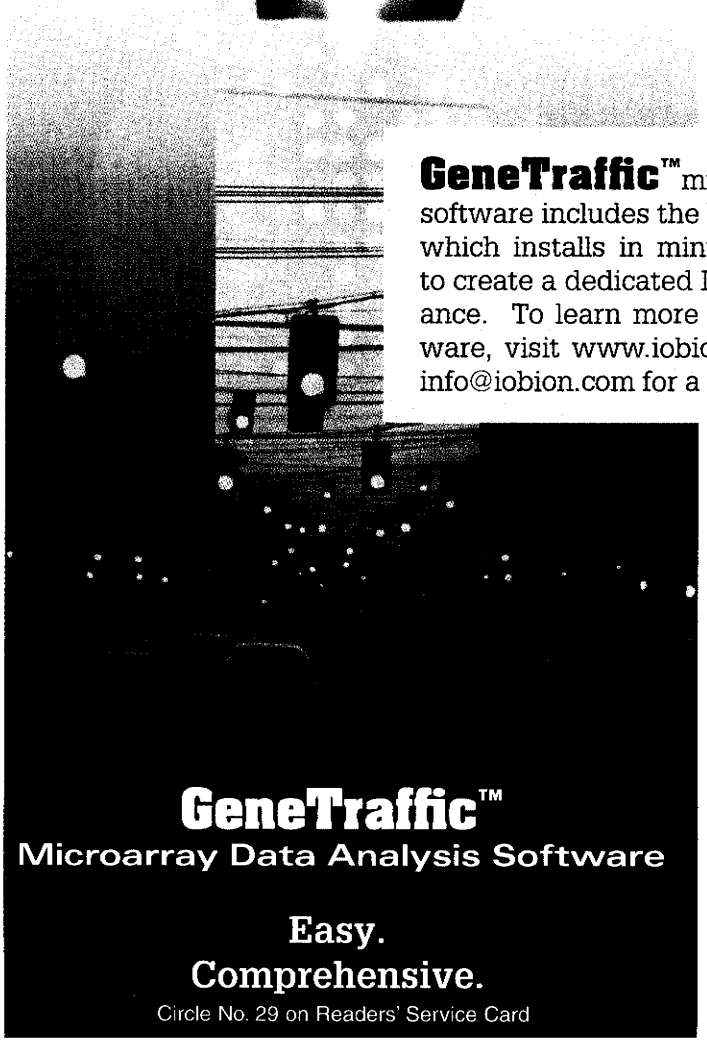

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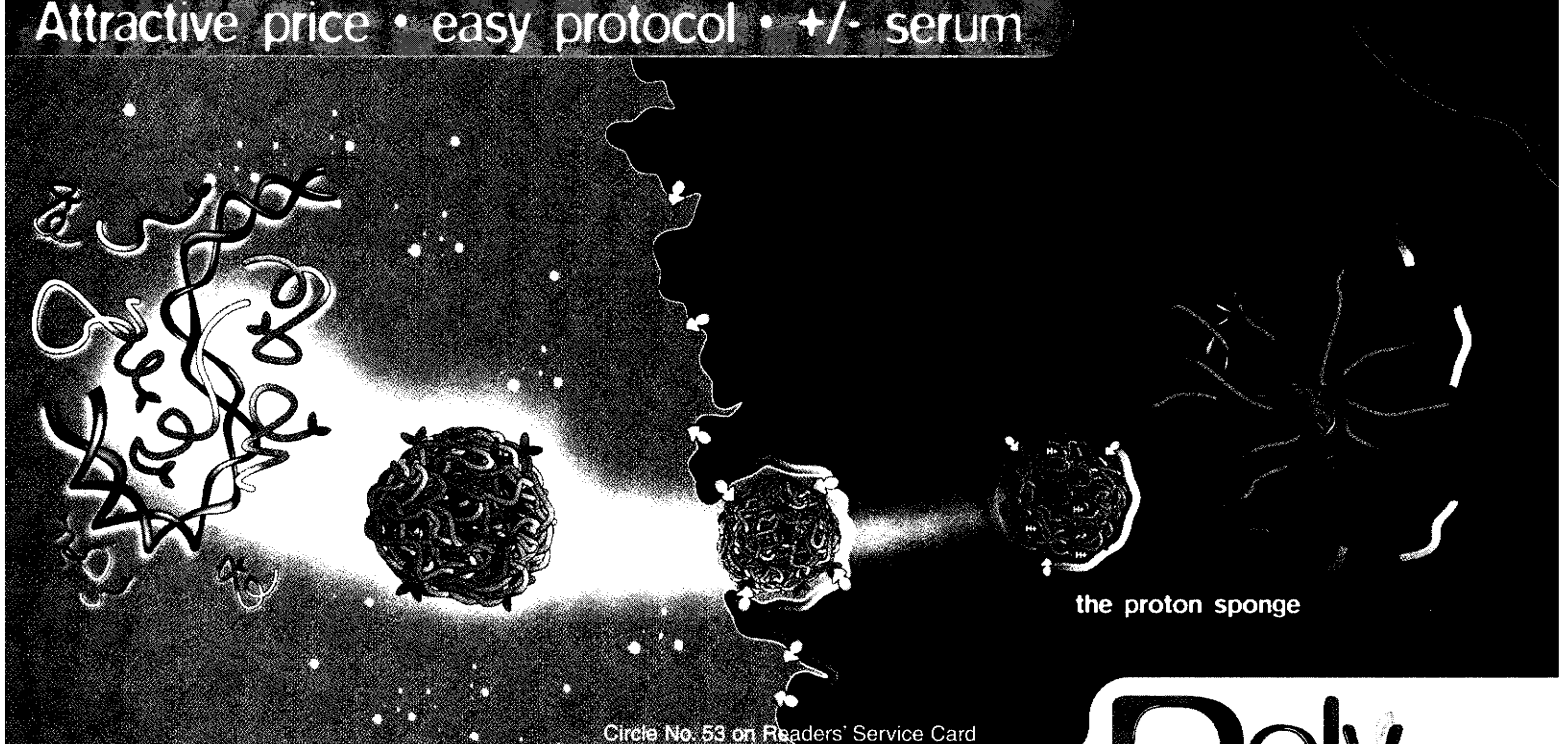

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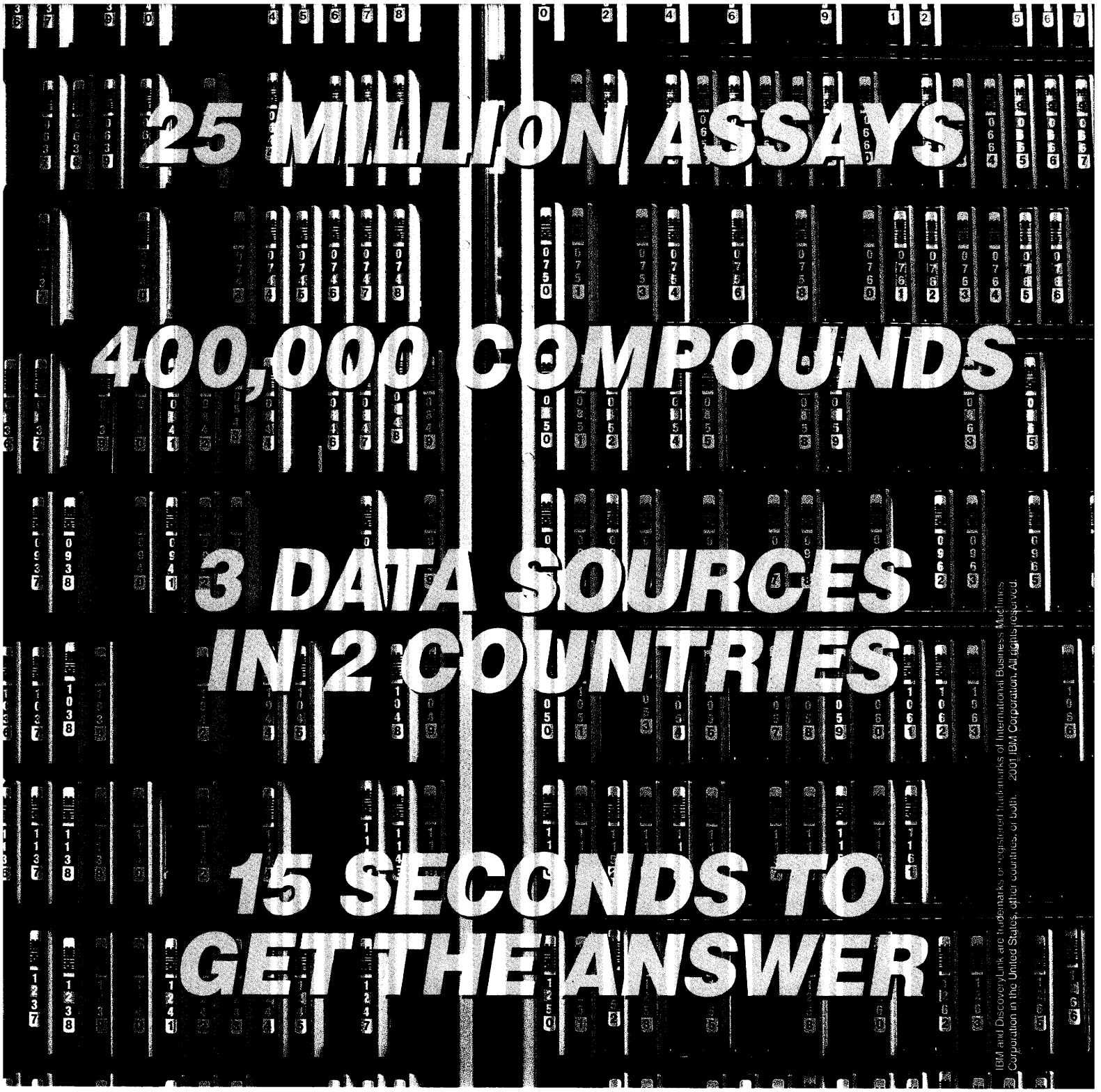

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