29 September 2000

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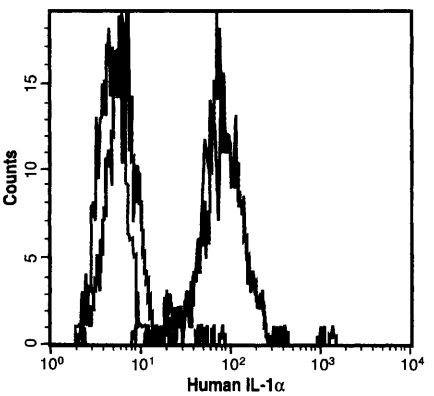

TF-1 cells stained with the human IL-1α Fluorokine Kit (pink, Cat # NFLA0) or with a negative staining control (green). Reaction specificity is demonstrated by effect that the blocking antibody (blue) and the negative blocking control (red) have on the staining reaction.

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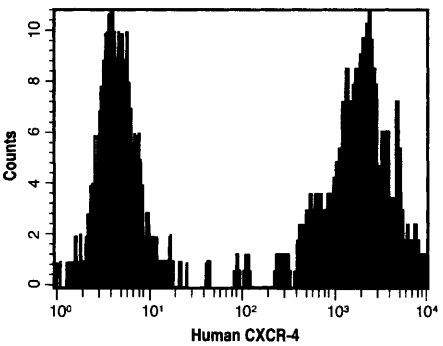
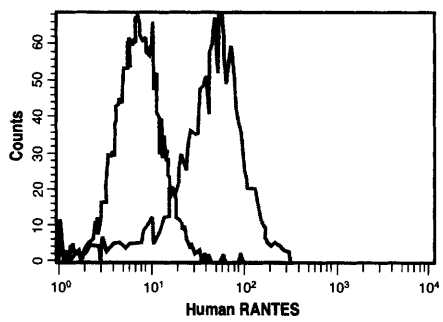


CXCR-4 transfected (red) and non-transfected NSO cells (green) stained with anti-human CXCR-4 monoclonal antibody (Cat # FAB173P) conjugated to phycoerythrin.

Intracellular Cytokine Staining



Permeabilized (green) vs. non-permeabilized (blue) staining of NSO cells transfected with human RANTES. Cells were stained with anti-human RANTES (Cat # IC278F) monoclonal antibody conjugated to fluorescein.

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VOLUME 289 29 SEPTEMBER 2000 NUMBER 5488

Science

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COVER Bioinformatics has begun to play a major role in facilitating biodiversity research, especially in the fields of taxonomy and systematics. Global databases are under construction for a wide range of groups of organisms, and the goal of a complete, digitized catalog of all named living organisms is in sight (although the number of unknown and unnamed species might still exceed this total). A special section on informatics in biodiversity begins on page 2305.

[PHOTO COLLAGE: C. FABER SMITH; IMAGES (TOP) CHRIS KNAPTON/DIGITAL VISION (BOTTOM) J. M. HORRILLO/AGE FOTOSTOCK AMERICA]

2260
Struck by statistics

NEWS

NEWS OF THE WEEK

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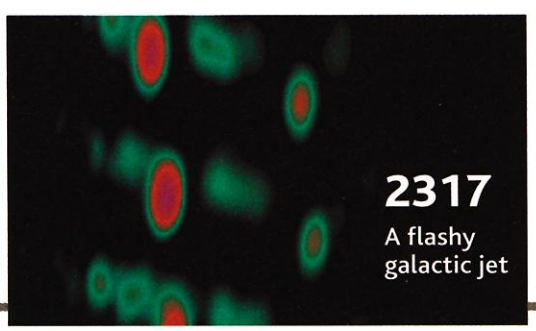
DEPARTMENTS

RESEARCH

REPORTS



BIOINFORMATICS FOR BIODIVERSITY

NEWS

VIEWPOINTS

See also Editorial on p. 2279.

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SCIENCE'S COMPASS

EDITORIAL

LETTERS

POLICY FORUM

2288
Forbidden mixtures

BOOKS *ET AL.*

PERSPECTIVES

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Image: A computer-generated rendering of Benoit Mandelbrot's infinite fractal formula.

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FLASHY JETS IN A RADIO GALAXY

Supermassive black holes may be detected by the relativistic jets created by the accretion process. Gómez *et al.* (p. 2317) observed the jets associated with the radio galaxy 3C120 for 16 months with the high-resolution Very Large Baseline Interferometer in order to better understand how these jets are created and how the local environment may alter their structure. They found knot structures in the jet that could not be readily explained by opacity or Faraday effects, but instead require the rotation of the magnetic field in the core of the galaxy. Other changes in the knots, such as flaring, accretion, and disappearance, can be related to denser molecular clouds in the surrounding medium.

SEPARATING THE ALMOST EQUAL

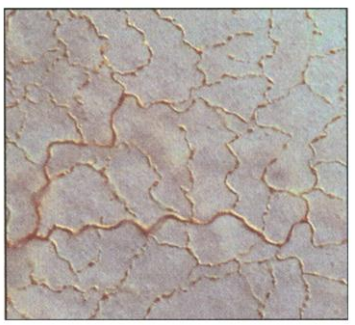
The rare earth elements exhibit similar chemical reactivity, which has made the separation of individual elements a difficult process that includes solvent extraction or ion exchange steps. The expense of the resulting pure rare earths limits some of their potential applications in electronic, magnetic, and optical materials. Uda *et al.* (p. 2326; see the Perspective by Fray) introduce a separation technique that takes advantage of the different redox potentials of rare earth elements for selective reduction and the differing vapor pressure of their chloride compounds for distillation. For the separation of samarium and neodymium, the separation factor was improved by nearly two orders of magnitude compared with conventional processes. Further improvements may result by replacing the chlorides with iodides.

HOW LOW IS LOW?

The New Madrid Seismic Zone is an intraplate region in the central United States that produced three large earthquakes between 1811 and 1812. Recent geodetic measurements suggested that strain accumulation rates are now low—but this finding may not mean that the probability of another large-magnitude event in the next few hundred years is also low. Kenner and Segall (p. 2329) modeled this intraplate region by incorporating a weak layer of lower crust that transfers stress to the overlying crust. Their calculated interseismic strain rates are consistent with past seismicity and geologic structure but are also so small that they may not be detected by geodetic measurements. They propose some long-term measurements that may be able to determine such small strain rates.

EYEING MOVEMENTS

When we watch a movie, we assume that we can easily watch and interpret all of the complex scenes and movements shown on the screen. However, many different levels of analysis must be performed in the visual system of our brain before a complex motion is perceived. An important step in the analysis of image movement is already performed in the eye. More than 35 years ago, Barlow and Levick characterized direction-selective neurons in the retina, ganglion cells that fire strongly only when an image moves in their preferred direction. Taylor *et al.* (p. 2347; see the news story by Barinaga) have now analyzed the cellular and synaptic mechanisms for the computation of direction selectivity in these cells. Their electrophysiological study shows that the critical asymmetric inhibition is caused by inhibitory cells impinging directly onto the dendrites of ganglion cells. Thus, processing in neuronal dendrites is a fundamental part of direction selectivity.



OBSERVING QUANTUM CONDUCTION CHANNELS

Electron flow through a restricted geometry on the nanometer scale leads to the now familiar observation of quantized conductance in which electrons flow through an integer number of channels, each of which has a fixed conductance described in terms of fundamental constants. A scanning probe microscopy study of conduction through a quantum point contact by Topinka *et al.* (p. 2323) now shows directly that the number of conduction channels increases as the size of the contact is increased. Their images also reveal the coherent transport of the electrons through the contact and the angular distribution of the conduction channels, in agreement with theoretical predictions.

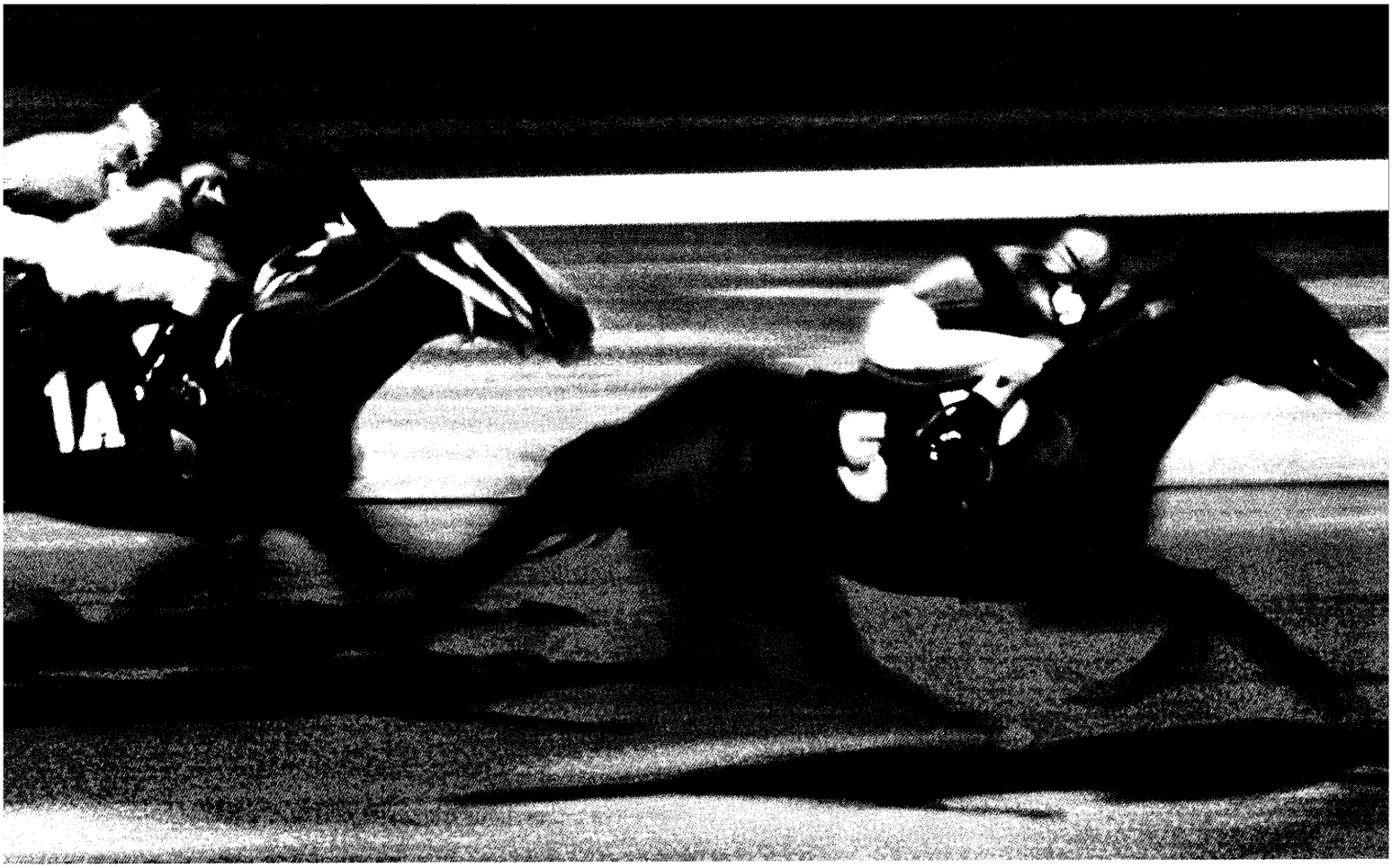
FROZEN FUEL

The largest known reservoir of hydrocarbons in Earth is not coal or oil, but the methane contained in submarine gas hydrates. Methane hydrates occur in the sediments of continental slopes as a thin layer roughly 200 to 500 meters below the sea floor where they are stable, but little has been known about how they actually form. Fehn *et al.* (p. 2332) used accelerator mass spectrometry measurements of cosmogenic iodine-129 to date the pore waters associated with gas hydrates from the western North Atlantic. The iodine in these pore waters dates to about 55 million years ago, far older than the surrounding sediments, and is likely produced from older and deeper organic sources. They suggest that these organic species are also the source of the methane, which migrated up through 1 to 3 kilometers of sediment before freezing in its present location.

CACHEXIA AND NF-κB

Patients with chronic diseases such as cancer and AIDS often develop cachexia, a life-threatening disorder characterized by extensive weight loss and degeneration of skeletal muscle. The cytokine tumor necrosis factor (TNF) is a critical mediator of the muscle wasting in cachexia, but little else is known about its molecular pathogenesis. Two reports discuss the role that the transcription factor NF-κB, a key component in the inflammatory response induced by TNF, plays in this disease. Guttridge *et al.* (p. 2363; see the Perspective by Tisdale) show that NF-κB in muscle cells suppresses the activity of MyoD, a transcription factor needed for muscle repair, by reducing the levels of MyoD messenger RNA. Lee *et al.* (p. 2350) describe the phenotype of knockout mice lacking the A20 protein, an inhibitor of signaling through NF-κB. The mice show severe inflammation and cachexia and die prematurely. The results suggest an inhibitory physiological role for A20 early in the signaling pathway leading from the TNF

CONTINUED ON PAGE 2239



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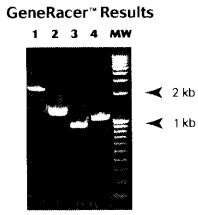

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THIS WEEK IN *SCIENCE*

CONTINUED FROM PAGE 2237

receptor to the activation of NF-κB. Paradoxically, A20 also appears to protect cells from programmed cell death.

SEPARATING THE SEXES

The evolution of separate sexes in plants (where hermaphroditism is the norm) has been widely studied. Gender dimorphism is a widespread evolutionary trend in plants and occurs in nearly half of the angiosperm families. Miller and Venable (p. 2335) propose a new pathway for the evolution of dimorphism, in which polyploidy is the factor that triggers gender specialization. Their main evidence comes from a single genus, but supporting data that come from 12 genera in seven different families indicate that polyploidy has broken down self-incompatibility, which would set the stage for gender dimorphism to evolve through an outcrossing mechanism.

AN OPEN OR SHUT CASE

Calcium waves, or oscillations, have been observed in various plant and animal cells. Allen *et al.* (p. 2338) have now made a connection in plants between cytoplasmic calcium oscillations and stomatal closure. Guard cells of mutant *Arabidopsis* plants showed calcium oscillations in response to some, but not all, of the physiological triggers and were unable to effect stomatal closure. When calcium oscillations were imposed by external treatments, however, stomata could close.

FOLLOW THE LEADER

The daily rhythms of our bodies, and those of other mammals, are thought to be coordinated by a "master" clock located in the hypothalamus of the brain, which in turn controls peripheral "slave" clocks in the other organs. Balsalobre *et al.* (p. 2344) identify glucocorticoid hormones as one of the signals that the master clock may use to coordinate the slaves. A synthetic glucocorticoid, dexamethasone, can transiently alter the phase of the rhythms in liver, kidney, and heart at any time of day or night. However, the master clock in the brain, which contains no glucocorticoid receptor and so is not affected by dexamethasone treatment, responds to entraining signals only at certain times in its cycle.

GOING AFTER THE TAG

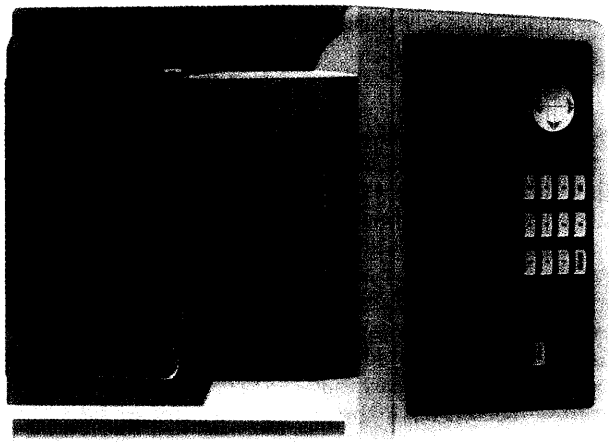
Bacteria possess a specialized machinery for degrading proteins whose synthesis has stalled for some reason, such as a lack of the appropriately charged aminoacyl transfer RNAs. They add an 11-residue peptide tag known as ssrA that marks newly synthesized but incomplete proteins for unfolding and degradation by the energy-dependent protease ClpXP. Levchenko *et al.* (p. 2354) describe a ribosome-associated protein, SspB, that stimulates degradation of proteins bearing the ssrA tag. Because SspB production is stimulated by starvation—which is likely also to increase the amount of ribosome stalling—the system could provide a means of efficiently recycling amino acids for synthesis of essential proteins during nutrient stress.

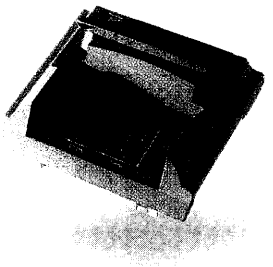
A DO-IT-YOURSELF APPROACH

The DNA of all eukaryotic genes is buried in chromatin, the major protein components of which are the histones, around which the DNA is wrapped. A critical step in the activation of a gene is the "freeing up" of the chromatin so that the general transcription factors have access to the DNA. Although much is known about the posttranslational modifications of histones that add acetyl and methyl groups to the proteins, a less well understood modification that is correlated with the activation of gene expression is the addition of ubiquitin to the histones. Pham and Sauer (p. 2357; see the Perspective by Mizzen and Allis) set out to identify the protein in cells responsible for this modification. It turns out that the culprit is none other than one of the components of the general transcription machinery itself, $TAF_{II}250$, a central subunit of transcription factor TFIID. A mutation in the portion of $TAF_{II}250$ thought to be responsible for adding ubiquitin to histones affected transcription and reduced the level of ubiquitination in the fruit fly *Drosophila*.

GOING BACKWARD

When animals are cloned by using cellular nuclei from somatic cells, rather than the germ cells that are normally responsible for propagation, the nucleus must be reprogrammed from a differentiated state in the reverse direction to a totipotent ground state. This process will lead to changes in the structure and the complement of regulatory proteins found within the nucleus. Kikyo *et al.* (p. 2360) have now analyzed an adenosine triphosphatase, ISWI, that contributes to the remodeling of chromatin in *Xenopus* cells. This enzyme helps release the TATA binding protein, a critical general transcription component, from the nuclear matrix.





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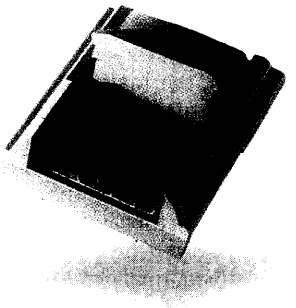

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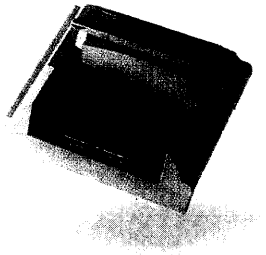

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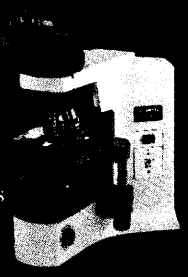

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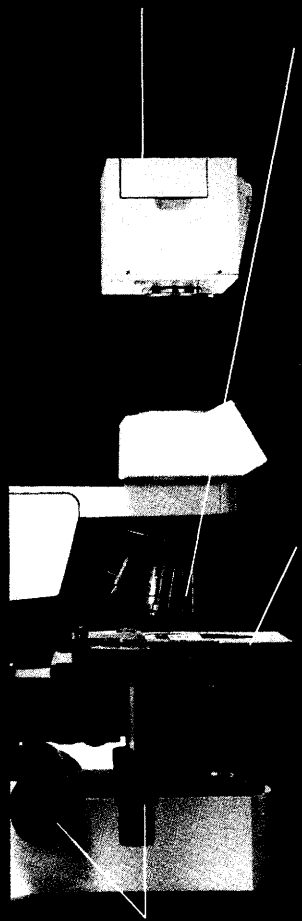

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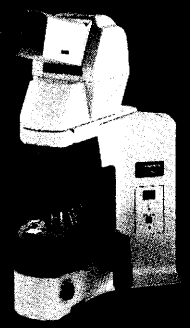

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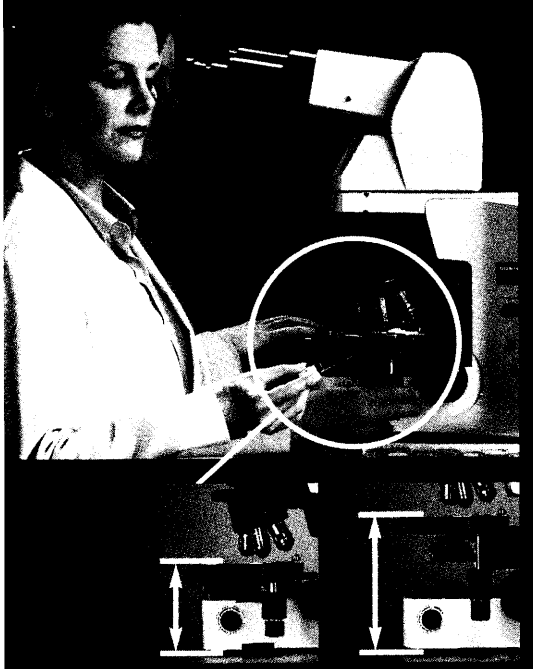

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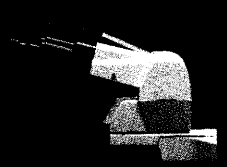

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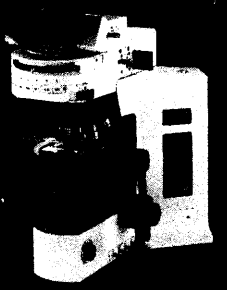

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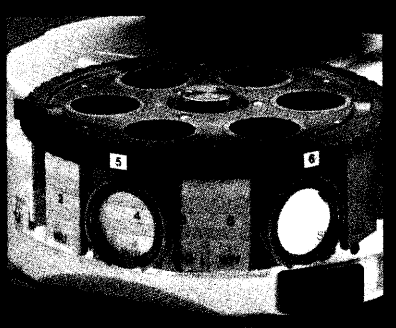

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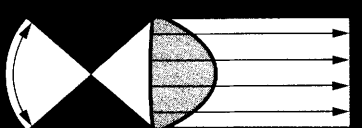

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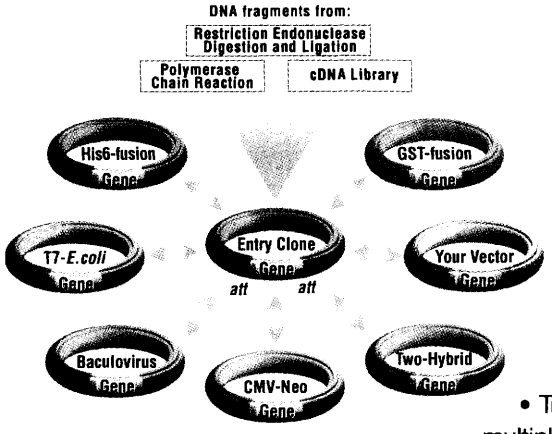

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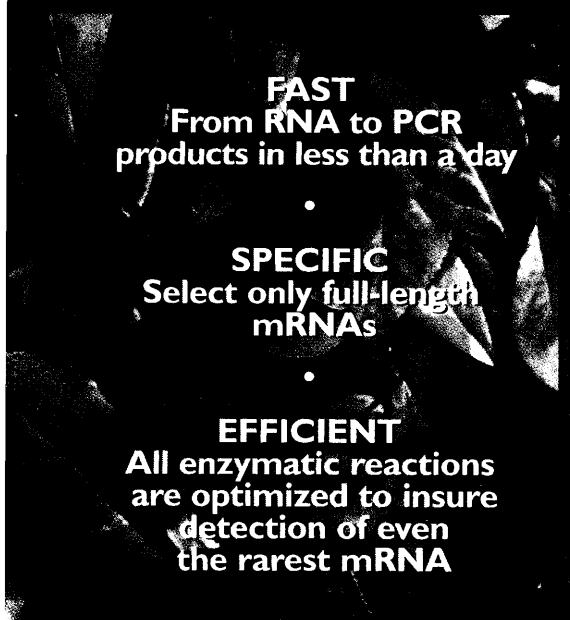

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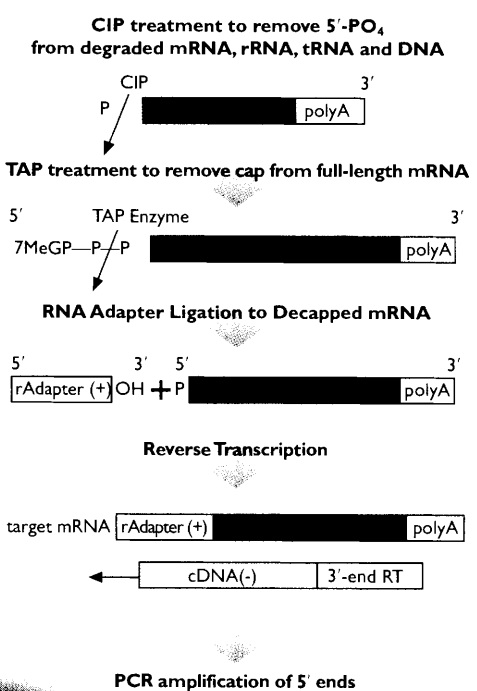

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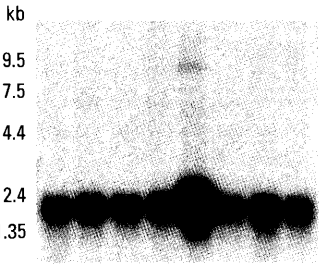

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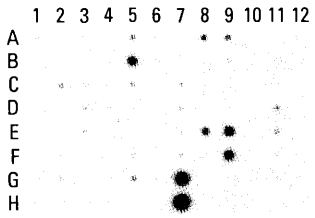

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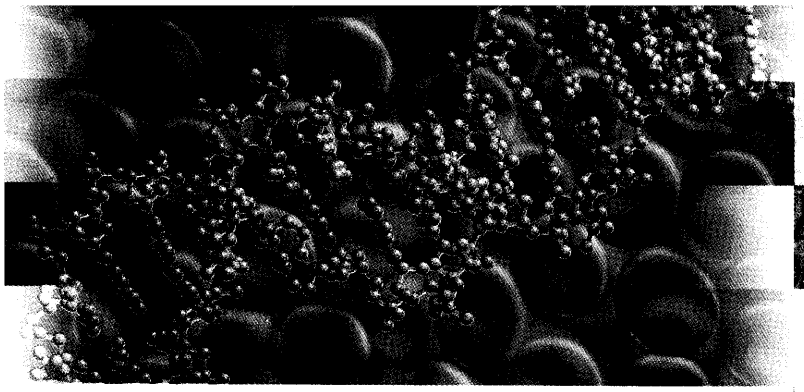

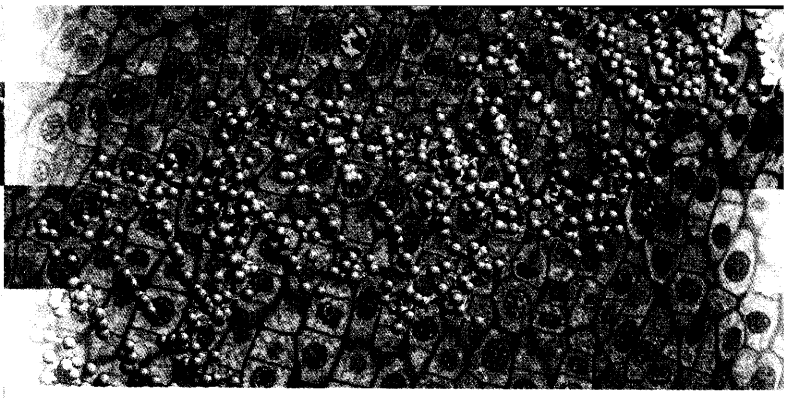

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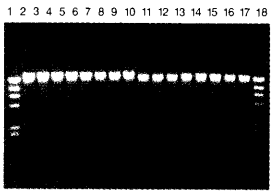

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Lanes 1 and 18: λ *Hind* III Marker
Lanes 2 to 9: Eppendorf gDNA Blood Kit
Lanes 10 to 17: Competing kit

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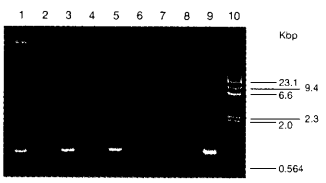
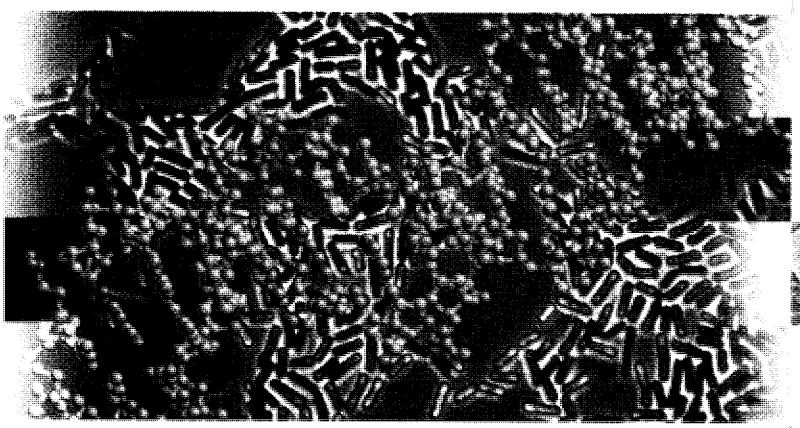
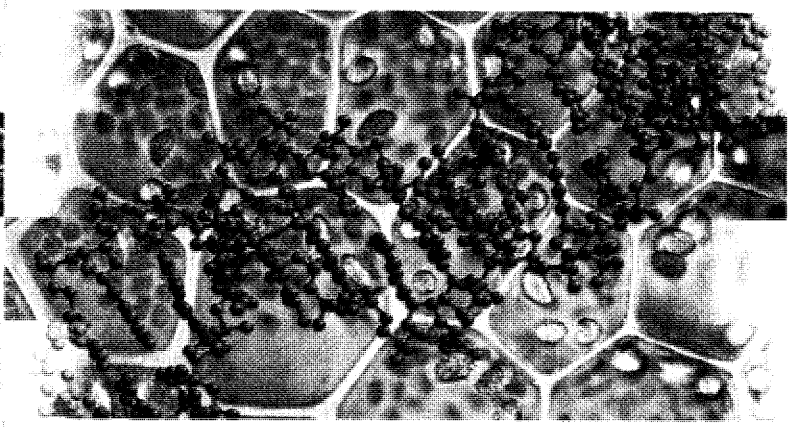


● RT-PCR analysis of total RNA isolated using the Eppendorf Perfect RNA Kits:
Lanes 1 and 2: Perfect RNA Kit (Mini Scale) total RNA
Lanes 3 and 4: Perfect RNA Kit (Midi Scale) total RNA
Lanes 5 and 6: Perfect RNA Kit (Maxi Scale) total RNA
Lane 7: No Reverse Transcriptase control.
Lane 8: Negative PCR control.
Lane 9: Positive control.
Lane 10: λ DNA-Hind III marker.





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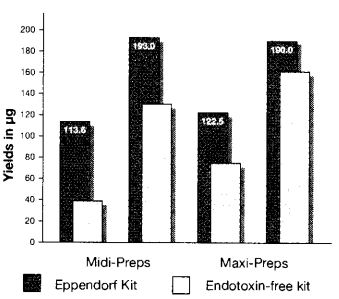

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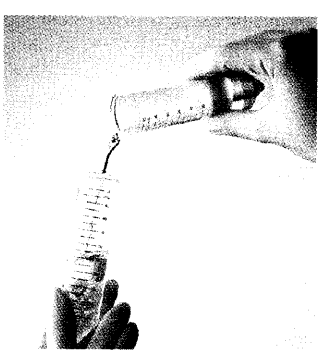

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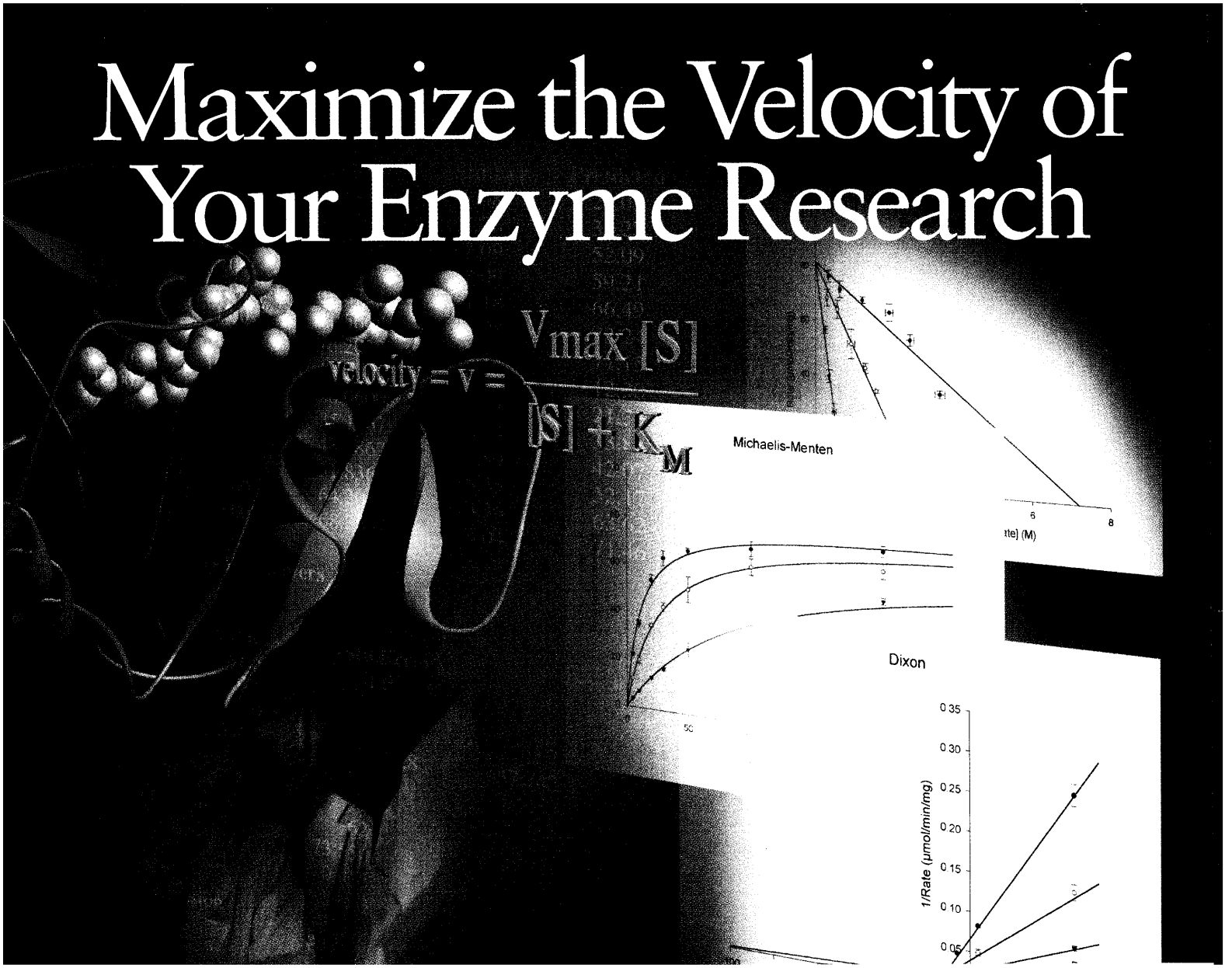

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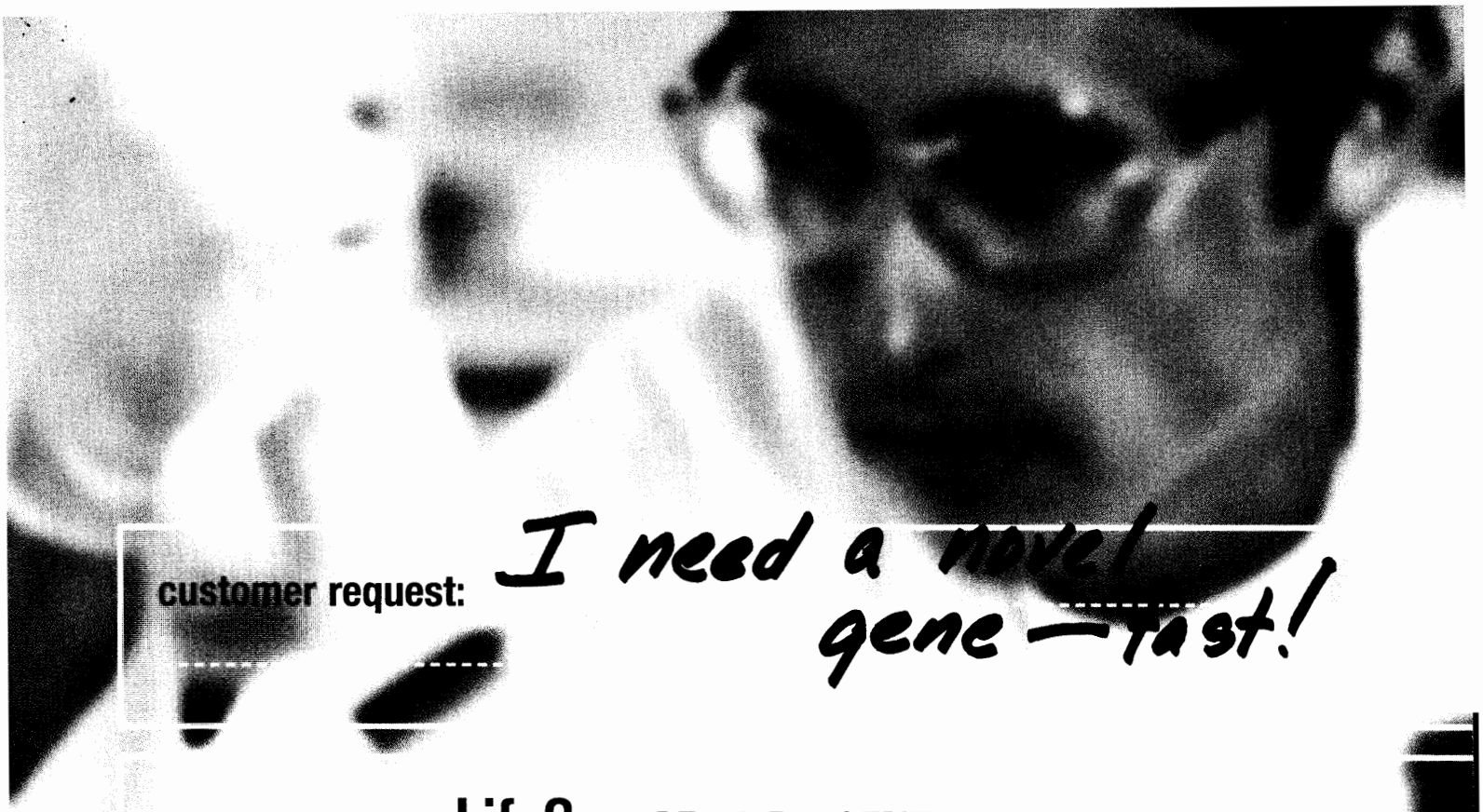

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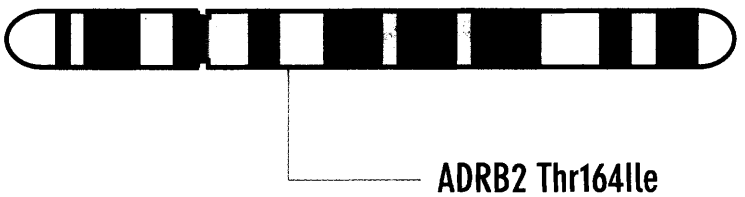

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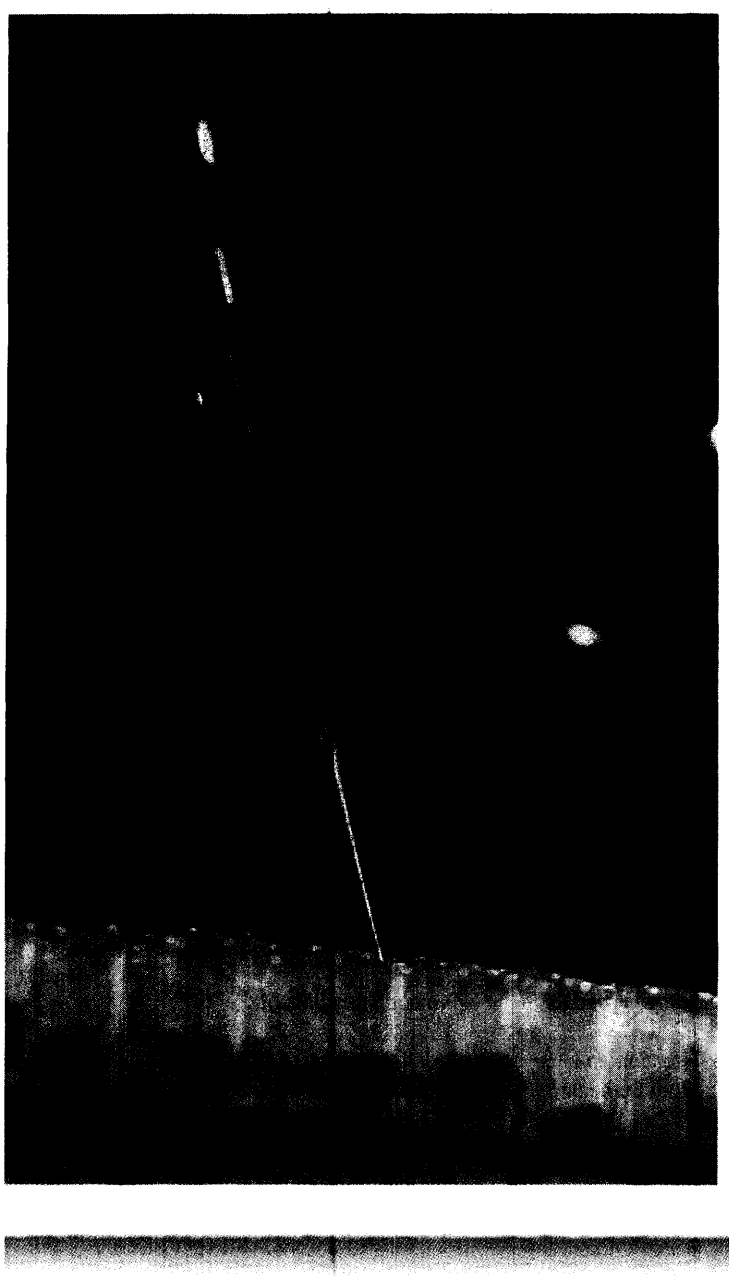

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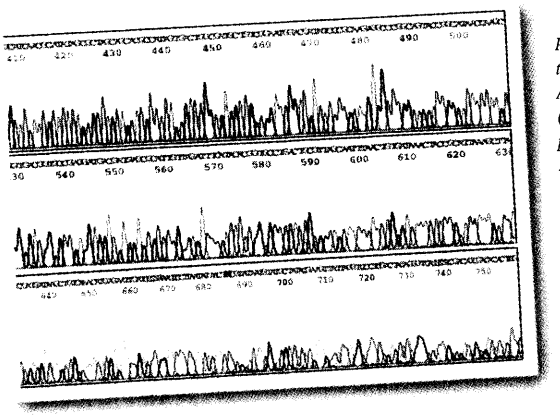

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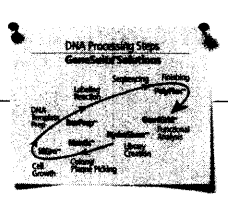

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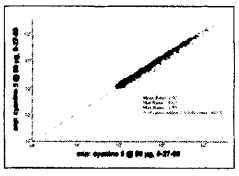

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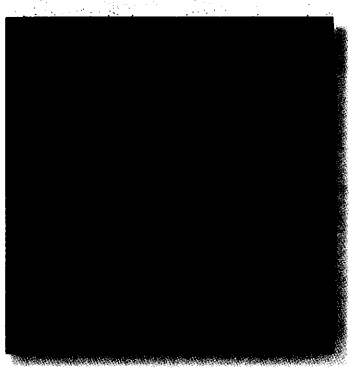

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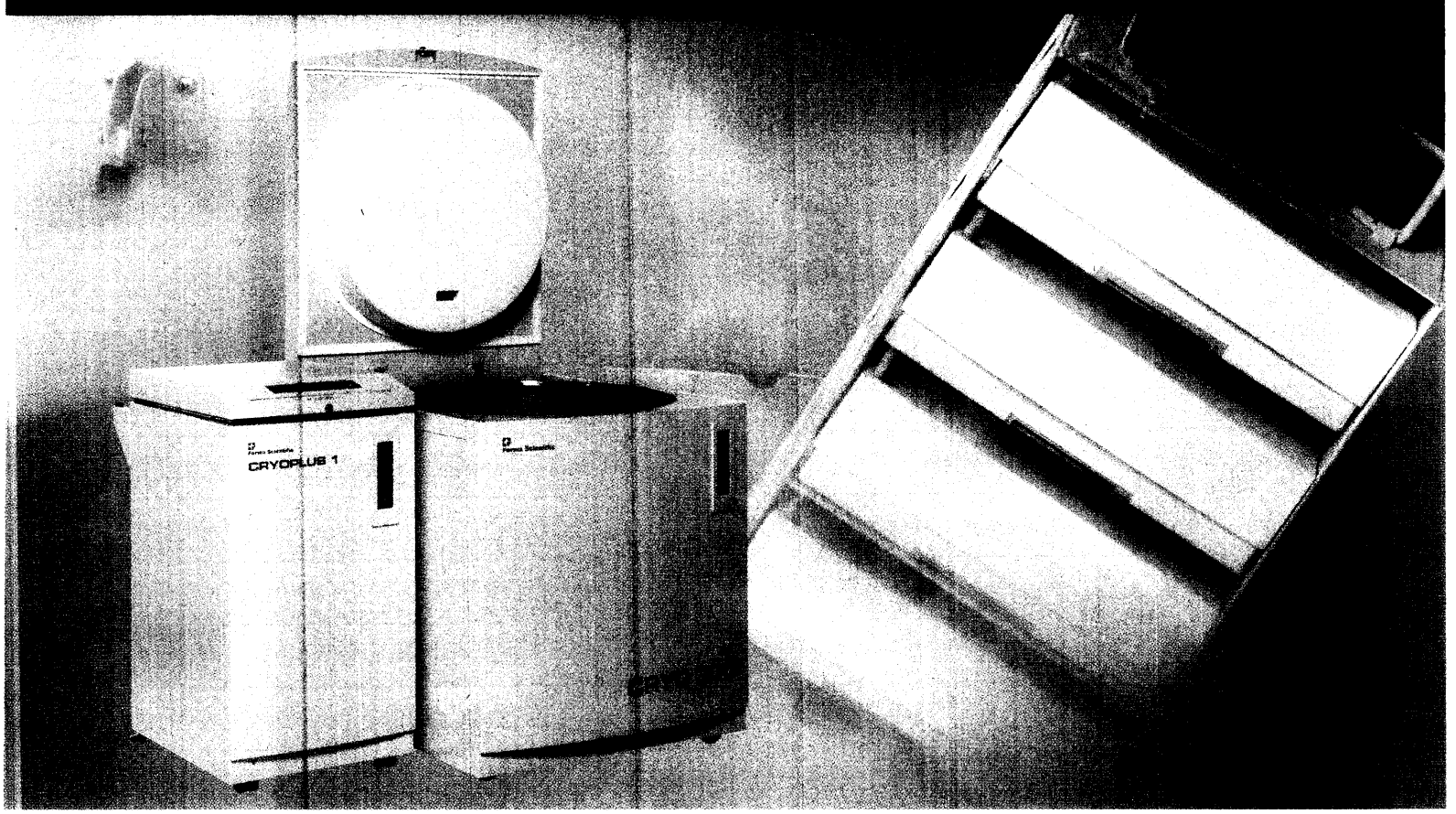

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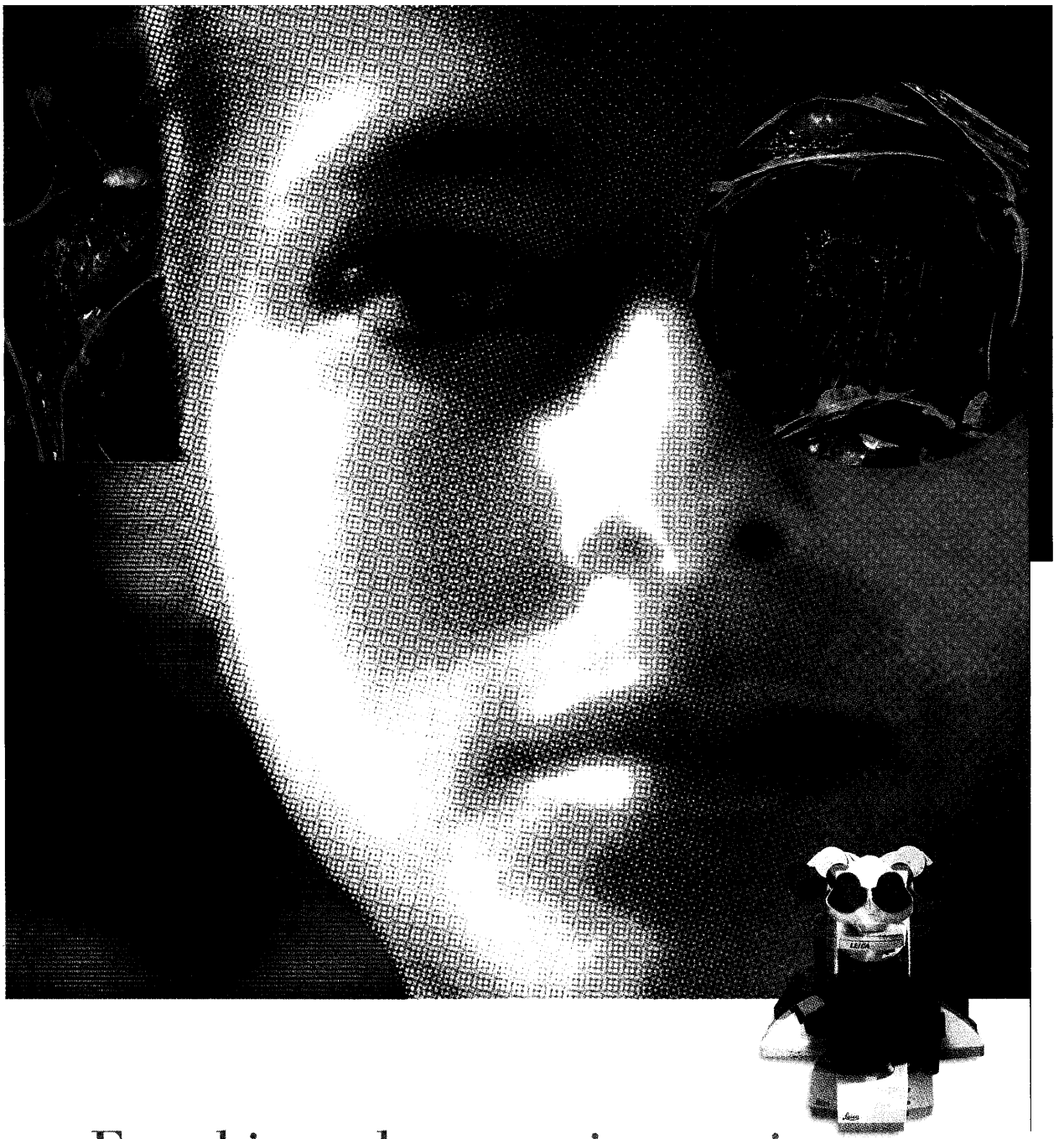

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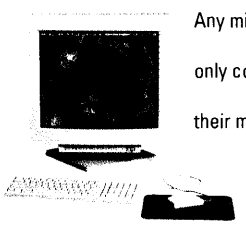

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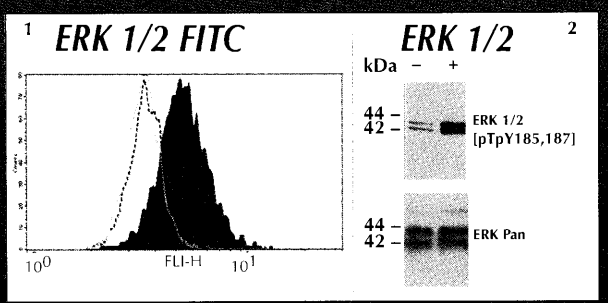
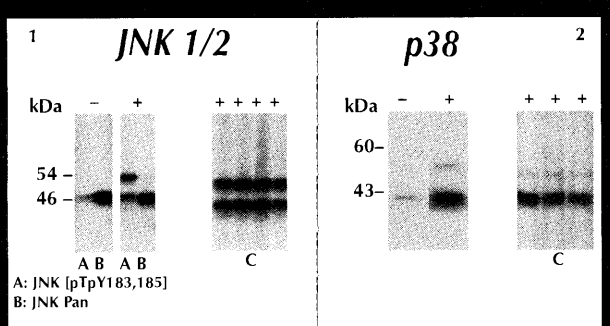


Show Me! (1) Flow Cytometry data show treated (red) and un-treated (green) Jurkat cells stained with (anti-ERK 1/2 [pTpY185/187] FITC conjugate (cat.#44-6808). The blue dotted line shows treated cells stained with FITC conjugate pre-incubated with blocking peptide. (2) Activation of MAP Kinase in PC12 cells treated with NGF is demonstrated by comparison to unstimulated control (anti-ERK 1/2 [pTpY185/187] (cat.#44-680).

MAP Kinase Superfamily



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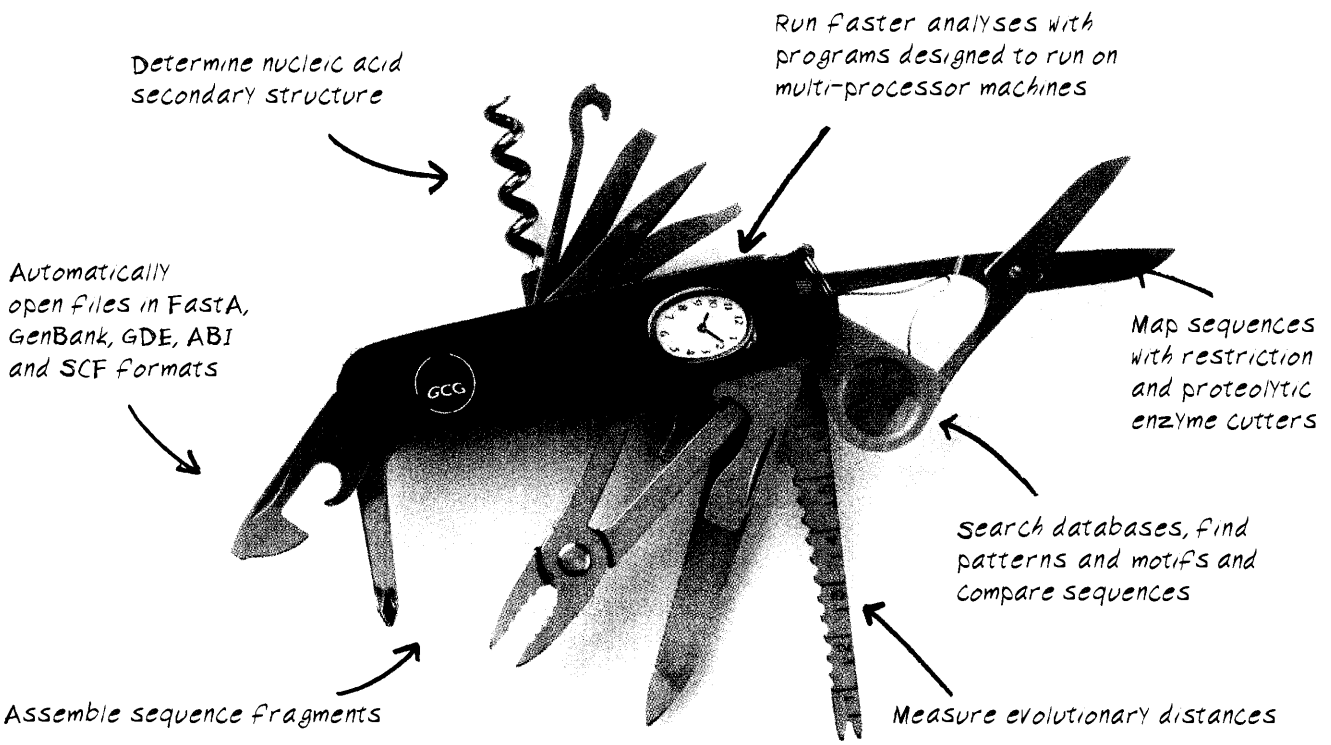

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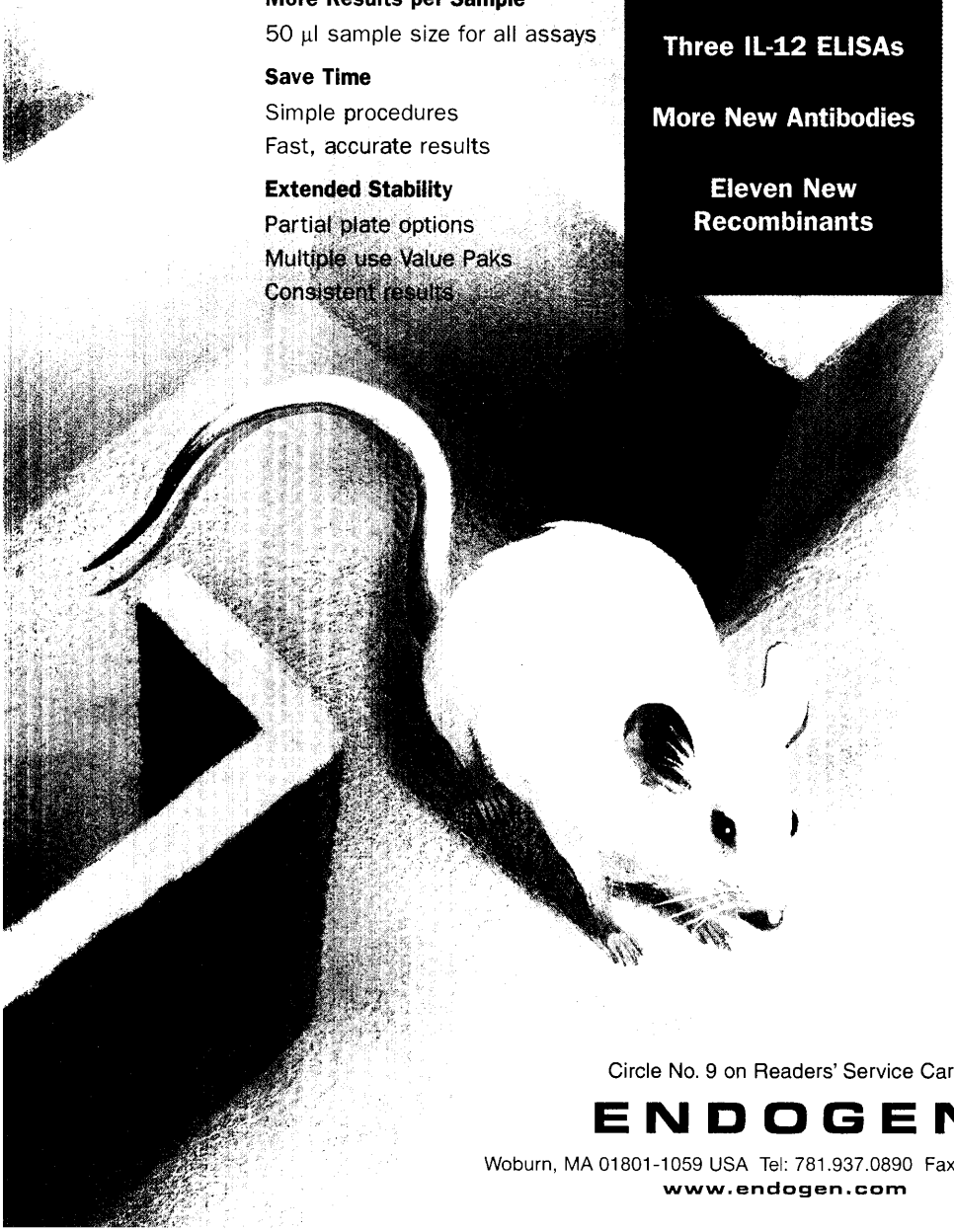

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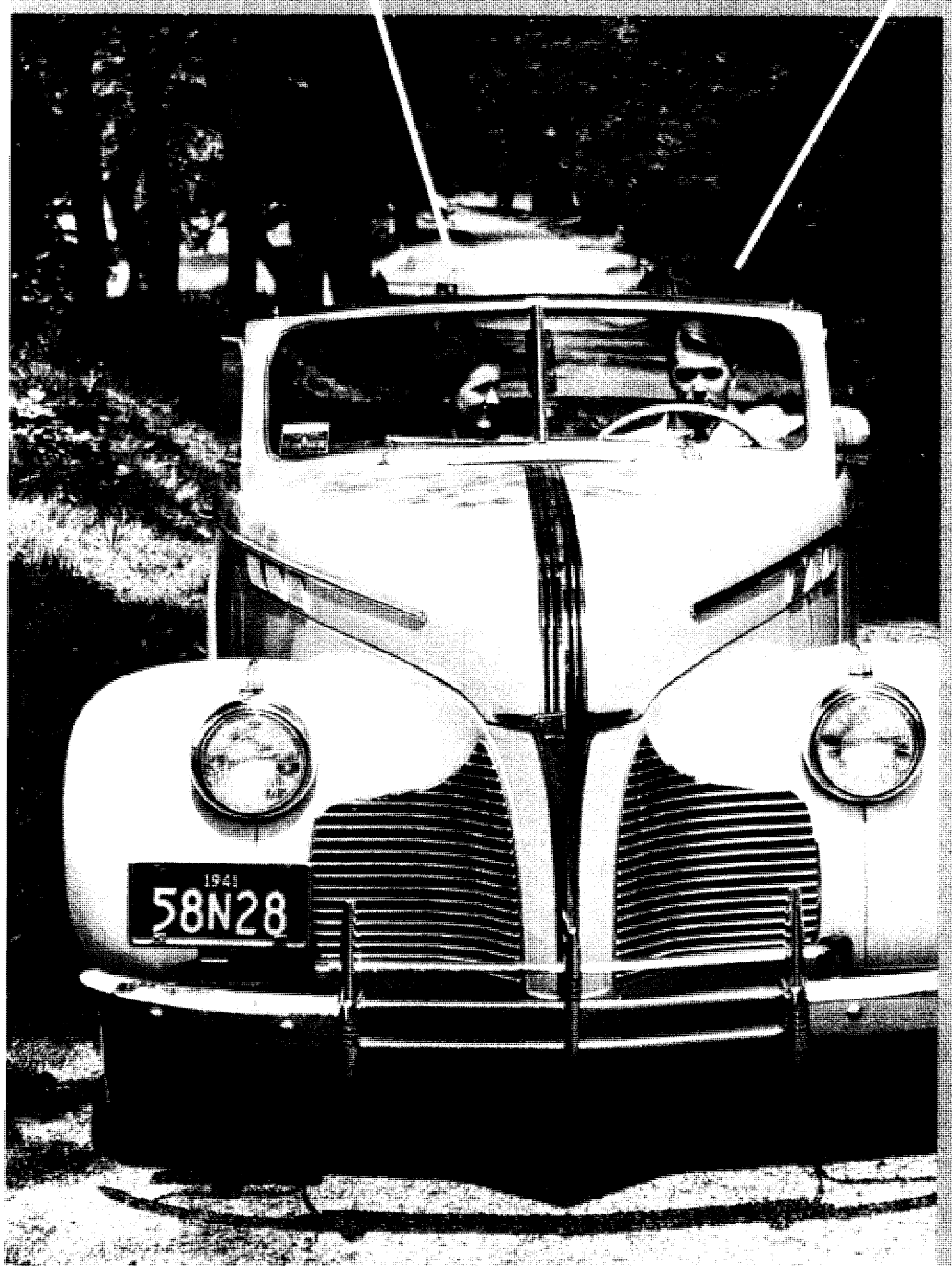

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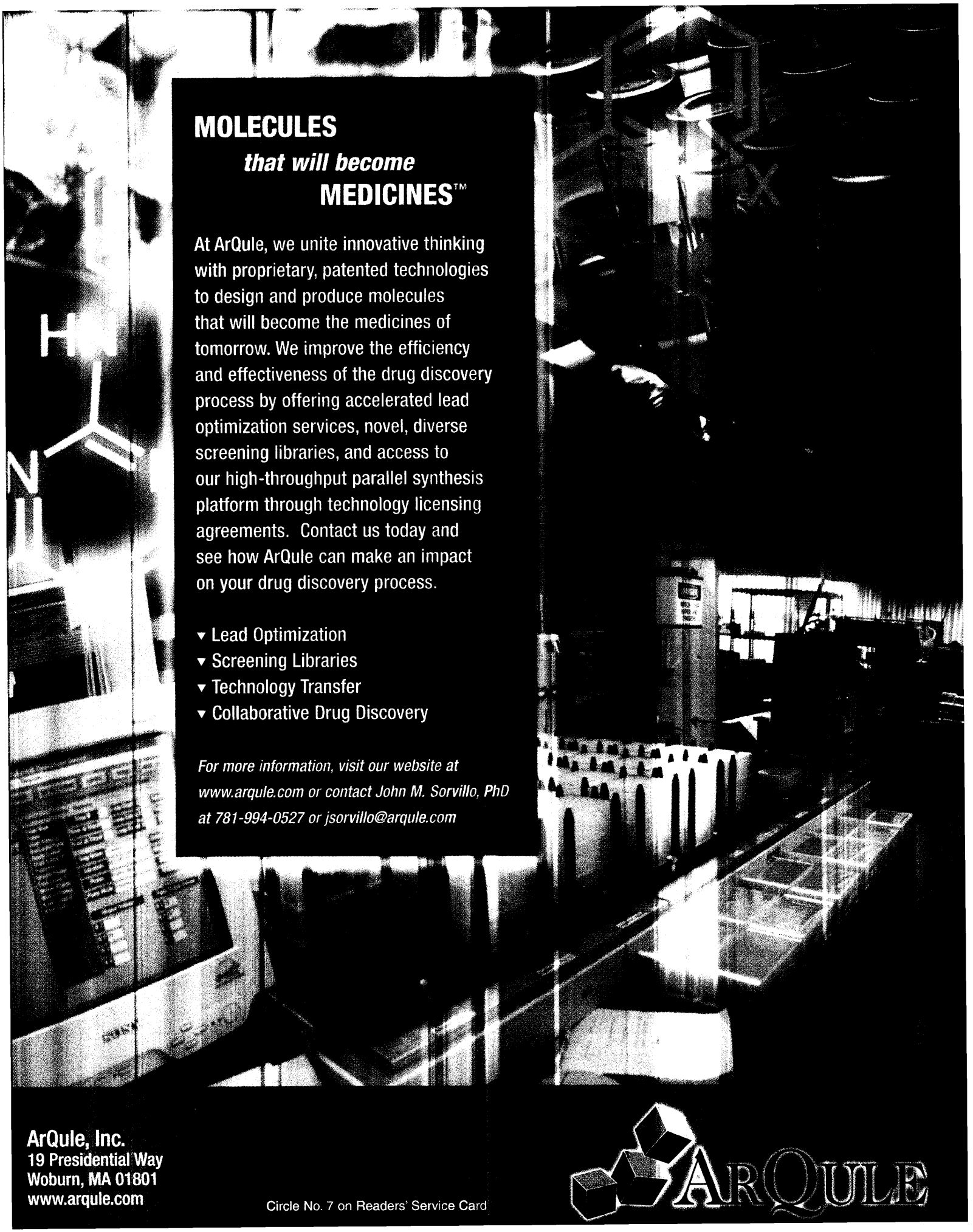

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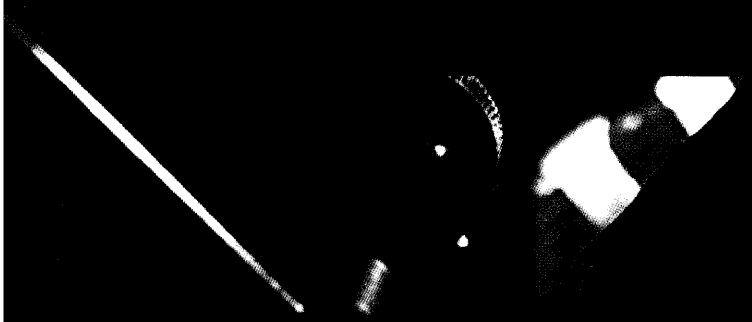

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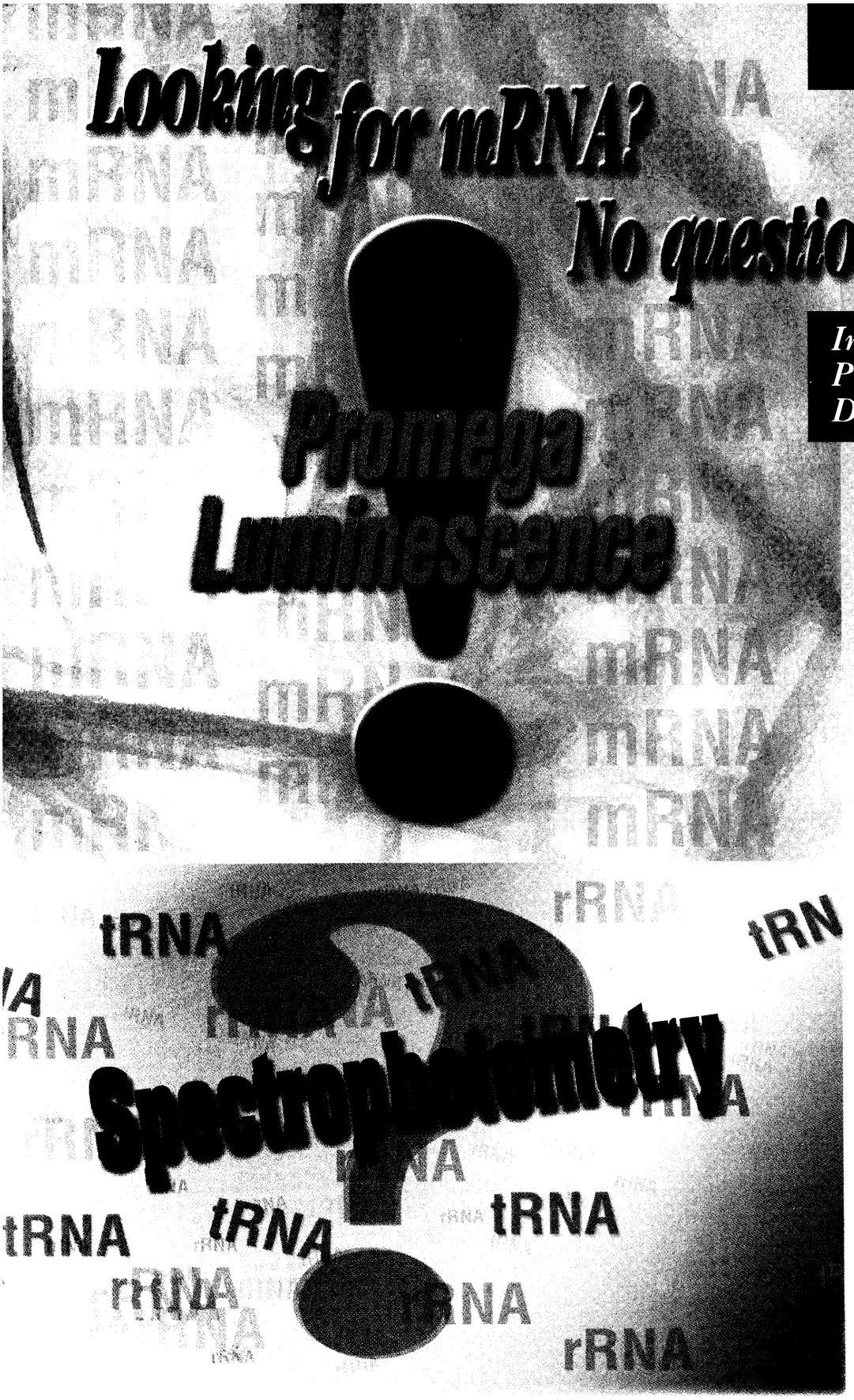

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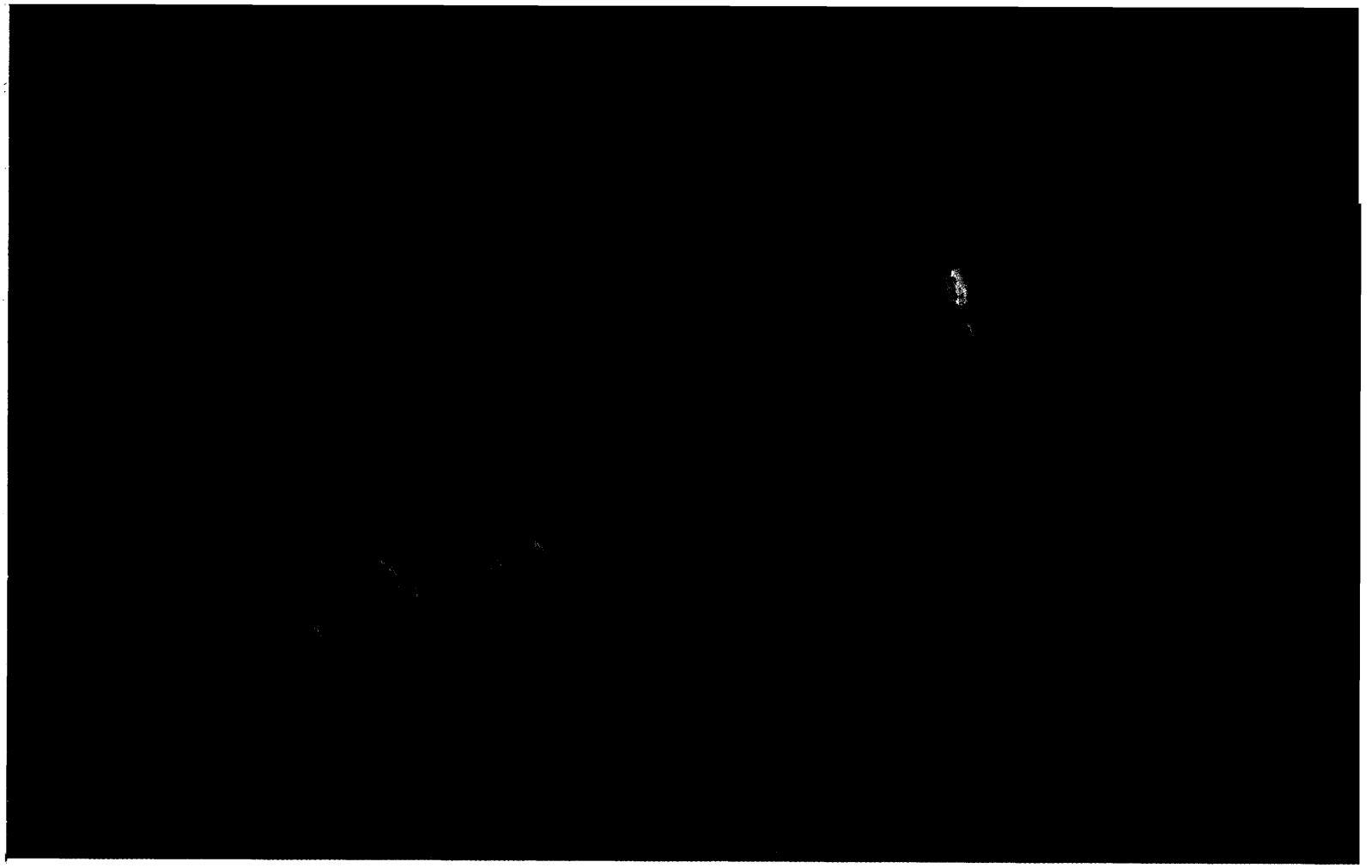

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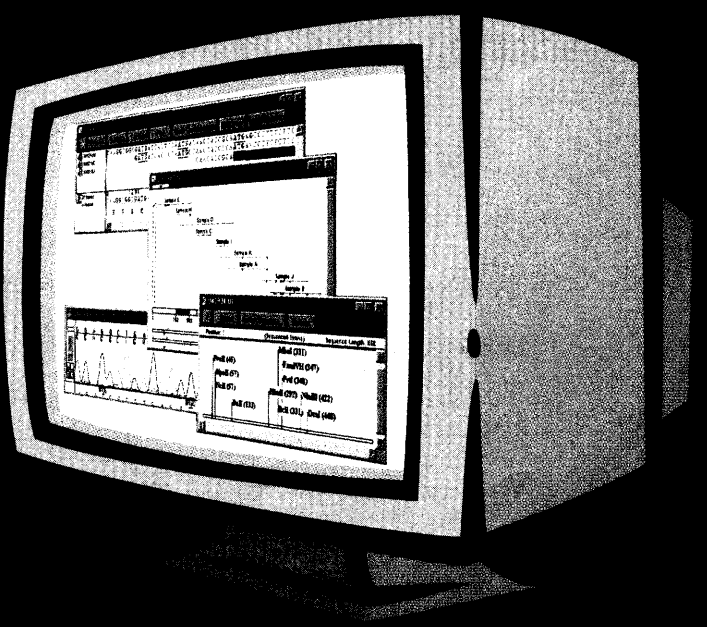

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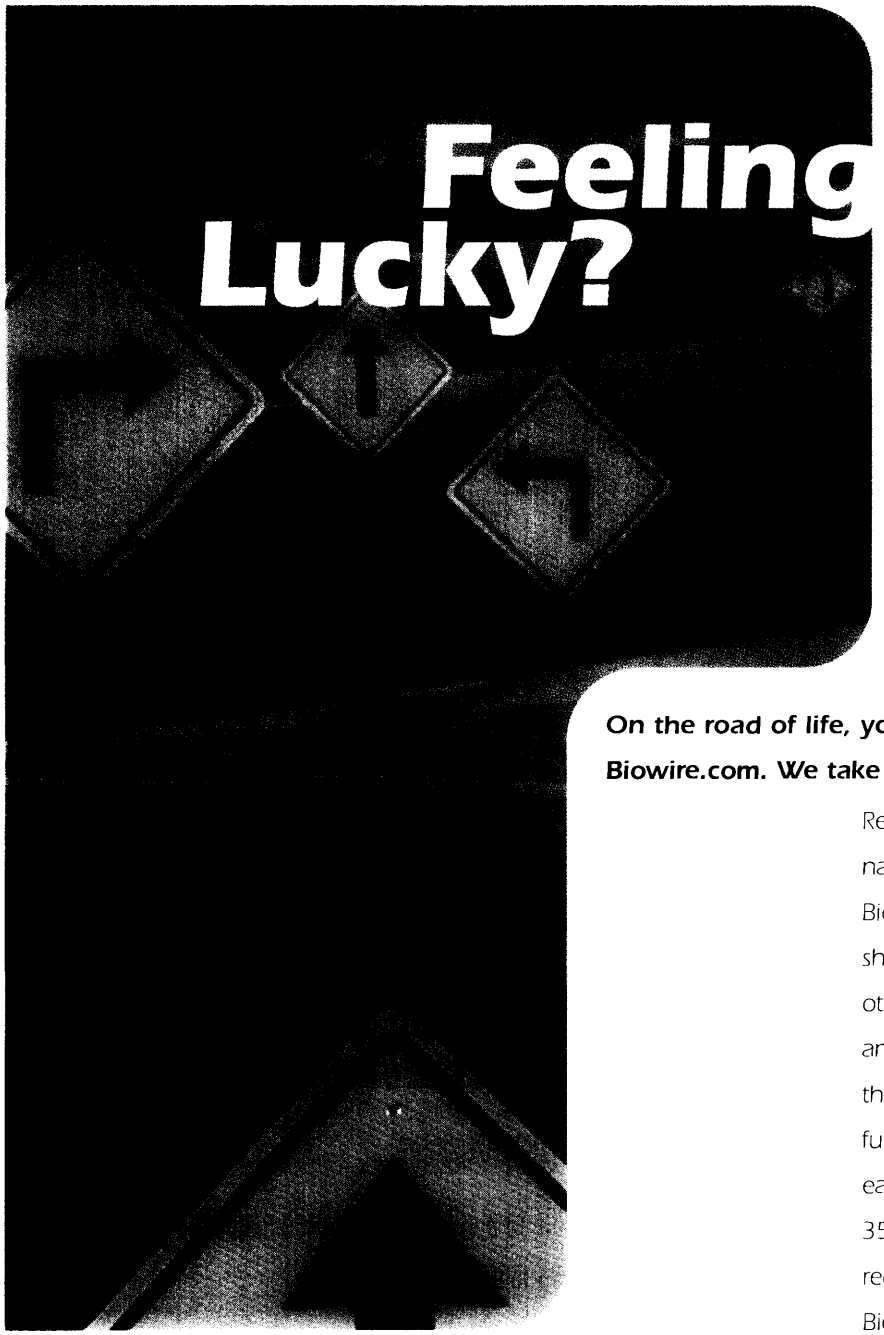

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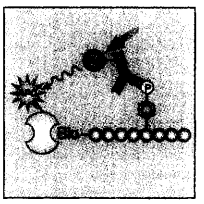

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