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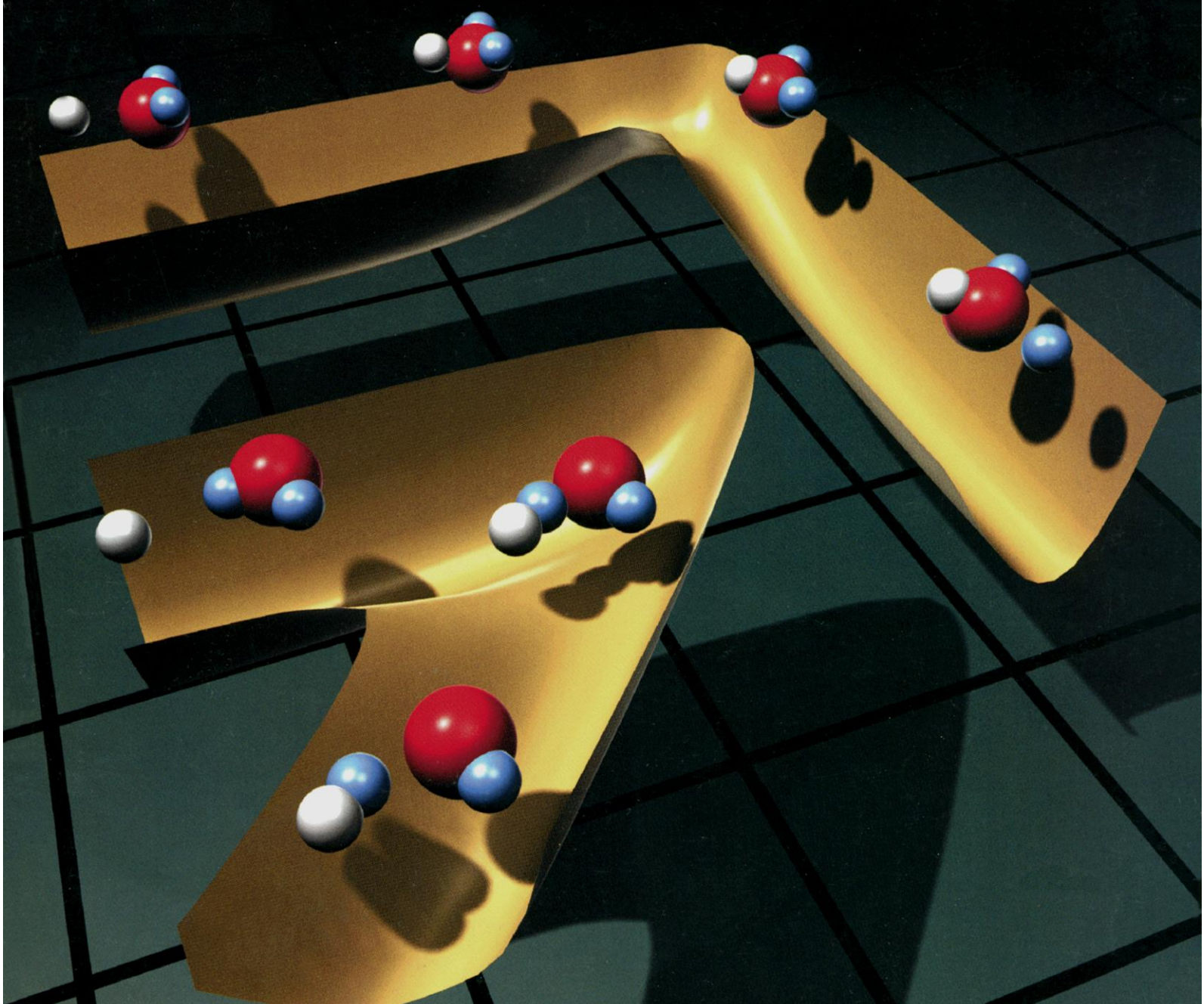

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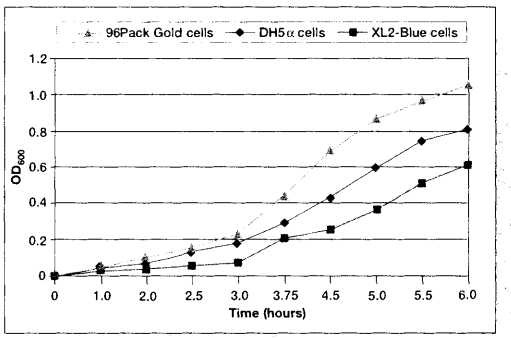

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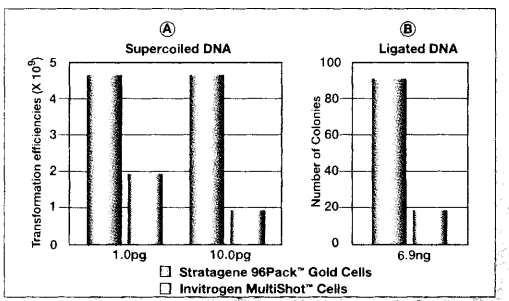

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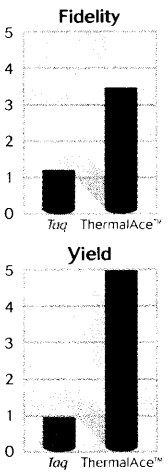

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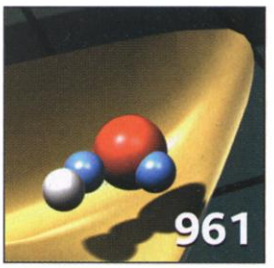
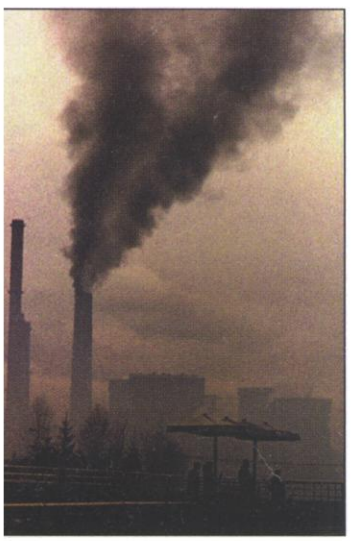


COVER A hydrogen atom (white) colliding with heavy water can replace (upper) a deuterium atom (blue), extract it (lower), or just bounce off. Exciting the water with a laser influences the outcome. Understanding how to influence chemical reactions requires accurate theory for the atomic motion on potential energy surfaces like those represented in yellow here. [Image: Visualization by Stuart Ramsden, Australian National University Supercomputer Facility Vizlab]



920

Haze over Kyoto treaty

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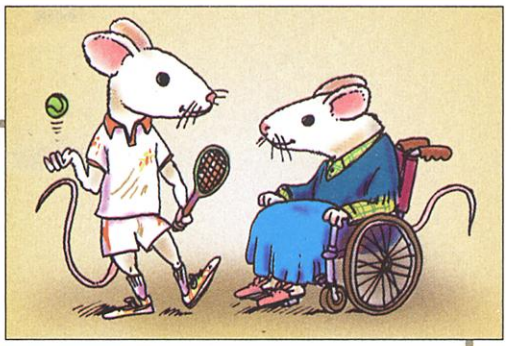

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Aging differently

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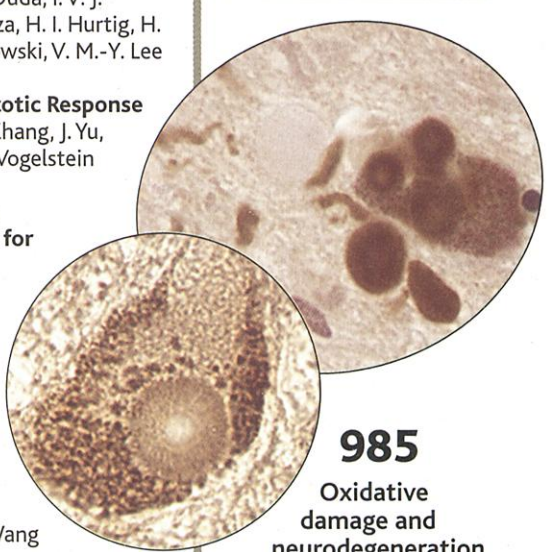

985
Oxidative damage and neurodegeneration

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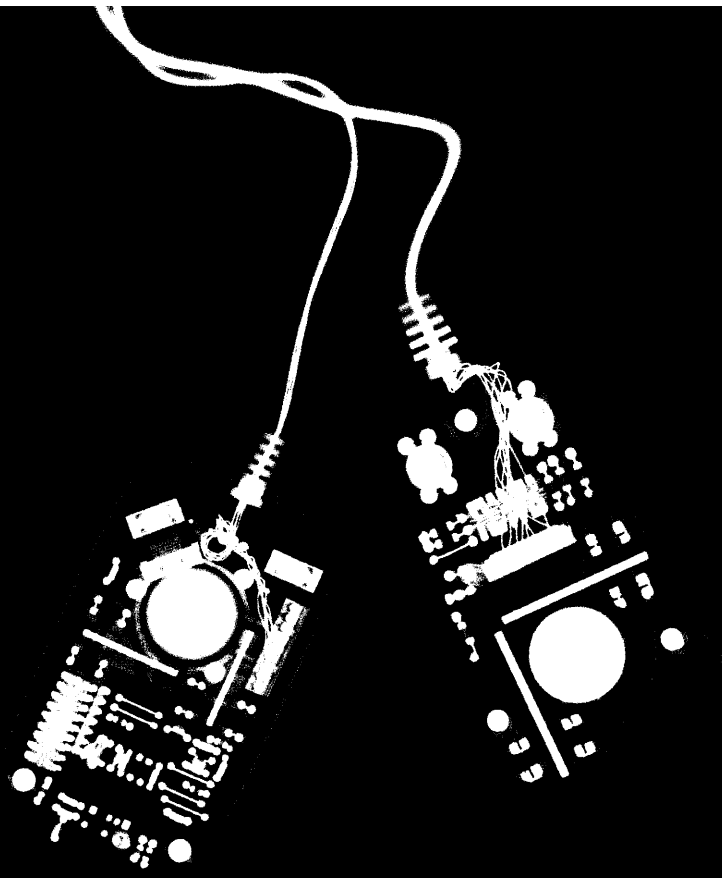

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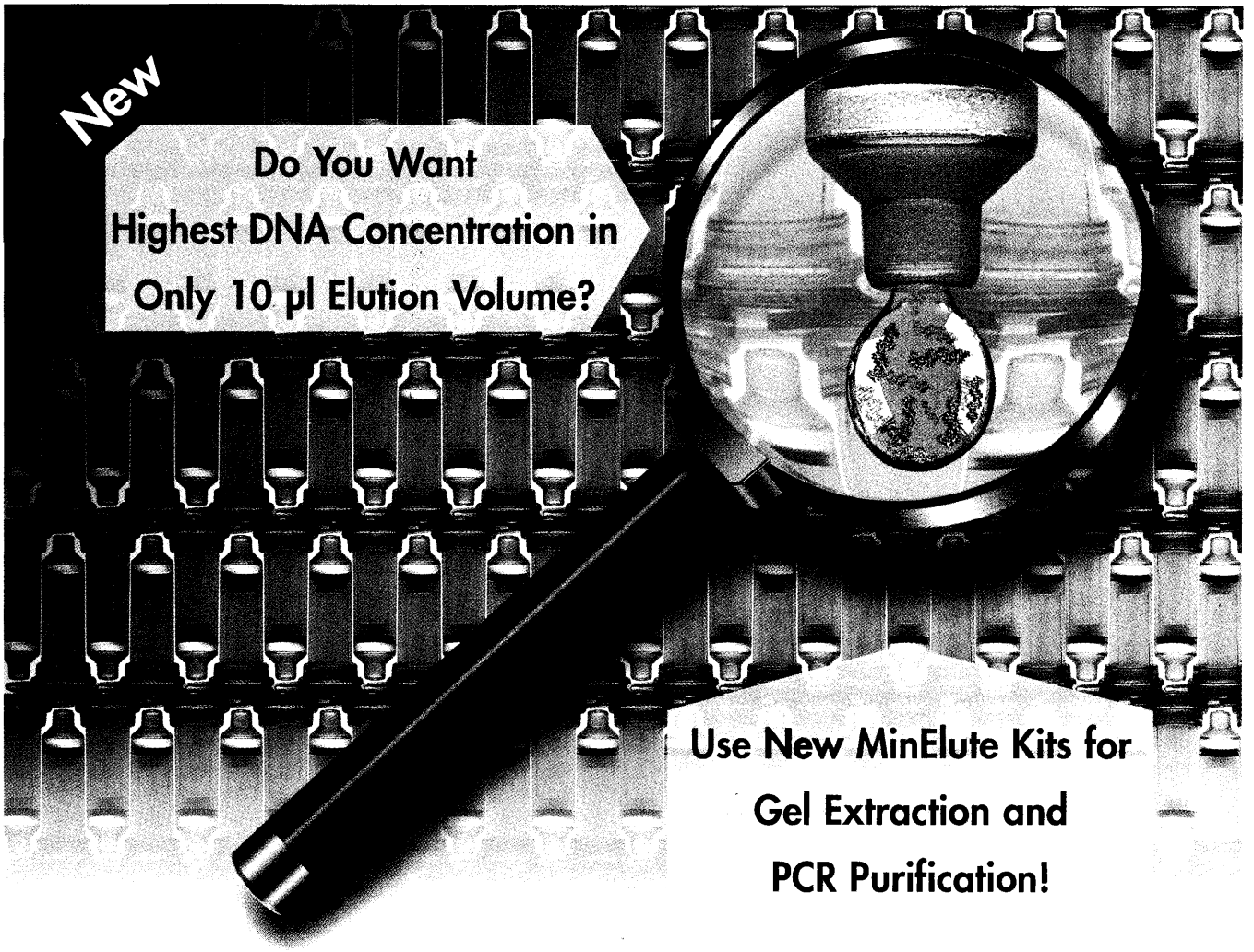

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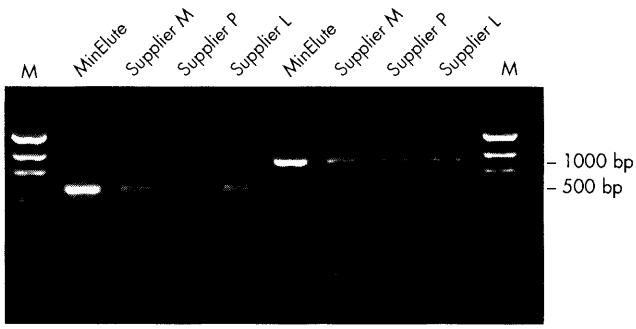

A 500 bp and a 1000 bp fragment purified using the MinElute Gel Extraction kit and 3 different silica-based DNA purification kits from the suppliers indicated. From each eluate 2 µl aliquots were loaded onto a 1.5% agarose gel. ***M****: markers*

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BURSTS FROM SUPERNOVAE

Gamma-ray bursts are high-energy flashes that last for seconds to minutes, that are then followed by a prolonged afterglow emitted at longer wavelengths that range from x-rays to radio waves. Piro *et al.* (p. 955) and Amati *et al.* (p. 953) studied the x-ray radiation, which decays for tens of hours after the burst, of afterglows from GRB990123, using the Chandra X-ray Observatory, and GRB991216, using the BeppoSAX satellite, respectively (see the news story by Schilling). X-ray spectra indicate that the GRBs ionized a dense local medium enriched in iron. These observations favor supernovae as the progenitors of the GRBs. These probable progenitors help resolve the long-standing mystery of what causes at least some of these daily flashes of high energy everywhere astronomers look.

LIGHT-EMITTING FIELD-EFFECT TRANSISTORS

Ambipolar transistors can operate in either an electron- or hole-channel mode depending on the bias applied to the gate electrode. Schön *et al.* (p. 963) show that for such transistors made from single-crystal α-sexithiophene, the electron and hole concentrations near the middle of the conduction channel can be adjusted to equal amounts by carefully controlling the bias applied to the gate and the bias between the source and drain contacts. The electrons and holes recombine in this region and emit nearly coherent light. The simple architecture introduced here should prove promising for integrated optoelectronics.

OF RICE AND MEN

Catalytic reactions involving chlorine and bromine are important pathways of polar stratospheric ozone loss, and halide radicals have significant impacts on tropospheric and mid-latitude stratospheric chemistry. As the anthropogenic production of halogen gases decreases in accordance with the terms of the Montreal Protocol, biogenic and other natural sources of atmospheric halogens will become relatively more important. Redeker *et al.* (p. 966) venture into this still largely unexplored territory by measuring methyl halide emissions from rice paddies. These data were then used to estimate global fluxes. These results also suggest that different enzymatic pathways synthesize methyl chloride and methyl iodide.

SMALL BUT TAKING A STAND

Bipedal locomotion has been thought to arise in the Early Triassic, about 240 million years ago in the archosaurs. This group that eventually gave rise to the dinosaurs, of which many of the predators were bipedal. Early reptiles, which arose more than 50 million years before the archosaurs, are thought to be mostly slow and sluggish tetrapods. Berman *et al.* (p. 969; see the news story by Stokstad) now describe a small (0.5 meters) reptile, which dates to about 290 million years ago, that likely ran rapidly on its two hind legs and was a herbivore. Phylogenetic analysis places this animal within the parareptilia, a group distinct from later biped archosaurs and dinosaurs.

EUKARYOTE PHYLOGENY

Our understanding of the phylogeny of the eukaryotes has rested largely on morphology and on RNA sequence data from the small subunit of the ribosome RNA (SSU rRNA). The interpretation of the ribosomal data has suggested that the eukaryotes diverged into kingdoms in a single "explosive" radiation, thus making it hard to assess relationships between these taxa. Baldauf *et al.* (p. 972) now present a new analysis using an entirely different set of molecular sequences. They reconstruct kingdom-level phylogenetic relationships using sequences from four proteins, and—in contrast to SSU rRNA data—uncover novel possibilities for teasing apart the early evolutionary divergences of eukaryote kingdoms.

DAMS AREN'T THE ONLY OBSTACLE

Modeling of population dynamics is a potentially powerful tool in conservation planning. Kareiva *et al.* (p. 977) apply a population dynamics approach to the vexing question of the future of chinook salmon in the Columbia River basin of northwestern North America. Dams have been instrumental in heavy declines in salmon numbers during the past 30 years, effects that have been only partly ameliorated by active management intervention to transport migrating salmon upstream. They show that the controversial projected removal of dams from the Snake River may not be sufficient to halt the decline of salmon populations toward extinction. Dam removal will be effective as a management tool only if efforts are made to understand and counteract other factors contributing to salmon mortality, especially during the stream, estuarine, and near-shore ocean phases of the life of juvenile salmon.

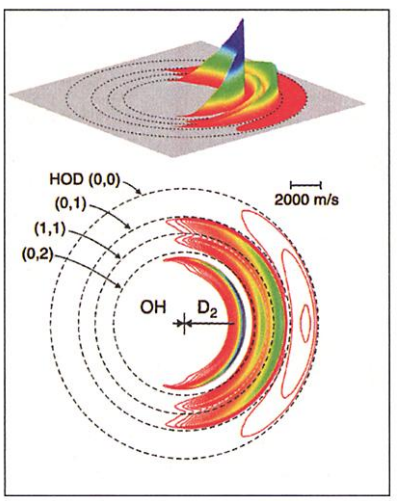
PROTEIN TRANSPORT SANS DNA

Type IV secretion systems function in a variety of pathogen-host interactions, including that of *Agrobacterium* and its host plant cells. Although known to transport nucleoprotein complexes, it has not been clear whether accessory proteins important in the infective process gain access to the host cell through the same

CONTINUED ON PAGE 899

TACKLING FOUR-ATOM REACTIONS

Fundamental studies of chemical reactions have normally focused on the simplest case of an atom reacting with a diatomic molecule. Building on that success, more complex four-atom reactions, which have more vibrational and rotational degrees of freedom, are now being studied, as demonstrated by D. H. Zhang *et al.* (p. 961; see the cover) and Strazisar *et al.* (p. 958). Both studies are concerned with the reaction of atomic hydrogen with water (see the Perspective by Schatz). Zhang *et al.* performed high-level ab initio calculations and obtained excellent agreement between theory and experiment for the exchange reaction, in which one hydrogen atom of water is exchanged. In contrast, they find significant disagreement for the abstraction reaction, which leads to the formation of molecular hydrogen and a hydroxyl radical. Strazisar *et al.* studied the reverse reaction experimentally and show that the energy deposited in the product is located preferentially in a specific vibrational mode. The same pattern of mode-specific reaction dynamics has been predicted by the most recent ab initio calculations for the reaction.



Cheetah *(Acinonyx jubatus)*

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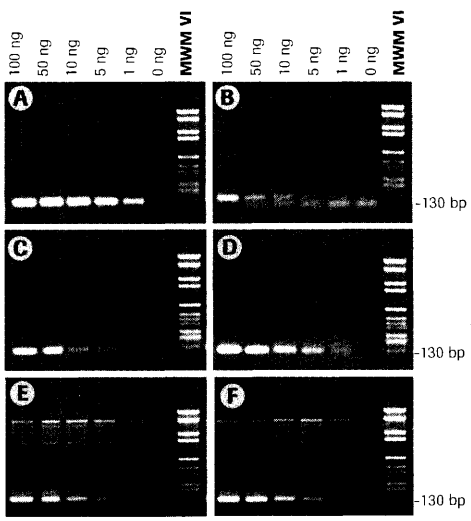

Figure 1: Specificity and sensitivity comparison in PCR using commercially available hot start systems.

Varying amounts of human genomic DNA were used for the amplification of a single 130 bp fragment from the tissue plasminogen activator (tPA) gene. Manufacturers' recommended initial product-activation times were used when applicable. The following cycling conditions were used in all reactions:

35 cycles at 95°C for 30 seconds
60°C for 30 seconds
72°C for 60 seconds
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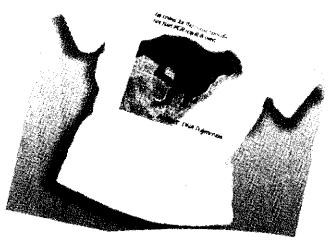

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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 897

transport system. Vergunst *et al.* (p. 979) now show that transport does not depend on presence of the nucleic acid. Analysis of a hybrid Vir-Cre protein showed that transport was directed by a portion of the Vir protein. Successful transfer was detected through the function of the Cre recombinase protein fused to it, and no nucleic acid was cotransported. Aside from clarifying the mechanisms of *Agrobacterium* infection, this approach offers a selectable system for transient introduction of proteins, without their cognate nucleic acids, into eukaryotic cells.

PROTEIN-PACKED DNA

When rod-shaped bacteria like *Bacillus subtilis* form spores, each developing spore must receive an intact chromosome. Bath *et al.* (p. 995) looked at how DNA is transferred to spores and found that a protein known as SpoIIIE appears to act as a sort of DNA pump that actively moves one of the replicated chromosomes into the spore. As many bacteria possess homologous proteins, such DNA motors may turn out to be ubiquitous.

BUILT-IN OBSOLESCENCE

When the pathogen *Listeria monocytogenes* invades host cells, it uses a toxin molecule to lyse the vacuole membrane in order to gain access to the cytosol where it will multiply. However, the same toxin molecule, listeriolysin, can lyse the cell plasma membrane and destroy the microorganisms' protected niche. Decatur and Portnoy (p. 992; see the news story by Pennisi) describe how the listeriolysin molecule contains a sequence that marks it for rapid degradation in the cytosol before the toxin has time to lyse the plasma membrane.

TURNING GENES ON AND OFF

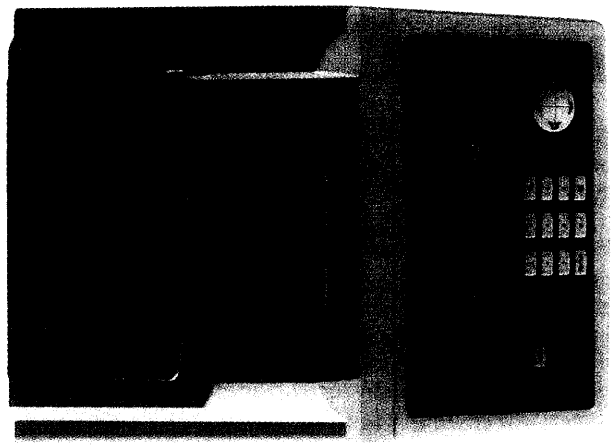
Regulating the production (or transcription) of RNA from a gene is the main control point for many cellular processes. This regulation is affected through a gene's promoter, a short sequence of DNA that has binding sites for a number of protein factors. The core promoter is sufficient to define the start sight of the RNA made from a gene. Elements of the core promoter of protein-coding genes include the TATA box, the initiator, and the recently discovered downstream promoter element (DPE). Willy *et al.* (p. 982) have isolated a factor required for the activation of transcription from promoters containing DPEs. Surprisingly, the factor turns out to have been previously characterized as a general repressor of transcription, NC2, an observation explained by its ability to repress TATA-box–containing promoters. The activation and repression functions of NC2 are separable.

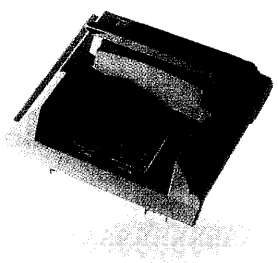
THE FACTS ON BAX

Many anticancer agents kill tumor cells by inducing apoptosis, and improvements in therapeutic strategies will depend on a clear understanding of the molecular mechanisms by which this occurs. To study the role of the BAX protein in drug-induced apoptosis, L. Zhang *et al.* (p. 961) used sophisticated genetic approaches to create derivatives of human colorectal cancer cells that were devoid of functional BAX genes. The cells without BAX retained a partial apoptotic response to the chemotherapeutic agent 5-fluorouracil, but were completely resistant to apoptosis induced by nonsteroidal anti-inflammatory drugs (NSAIDs), agents currently being used clinically for cancer chemoprevention. This striking requirement for BAX in the cellular response to NSAIDs may have important implications for future cancer chemoprevention strategies because it suggests that cells can easily develop resistance to this class of drugs.

A RADICAL WAY TO DAMAGE NEURONS

Reactive oxygen and nitrogen radicals that damage the protein, lipid, and nucleic acid components of cells have been implicated in the destruction of neurons associated with neurodegenerative diseases such as Parkinson's disease (PD). However, obtaining evidence of oxidative injury to the cellular components of brain neurons has been difficult. Giasson *et al.* (p. 985) decided to analyze α-synuclein, a protein known to be mutated in rare familial forms of PD, which is the principal component of inclusions called Lewy bodies that are associated with PD and many other types of neurodegenerative diseases. They raised antibodies to nitrated tyrosine residues in α-synuclein and used immunohistochemistry to show that Lewy bodies in postmortem brain tissue from patients with PD, Alzheimer's disease, and Lewy body dementia all contained nitrated α-synuclein. The authors propose that nitrative damage to α-synuclein (caused by interactions between reactive oxygen and nitrogen species) promotes aggregation of the protein and its deposition in Lewy bodies, thus contributing to the destruction of neurons and disease progression.





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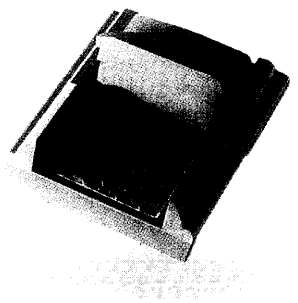

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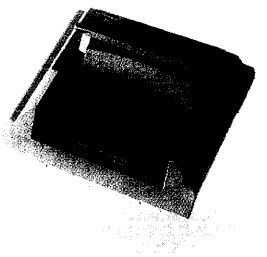

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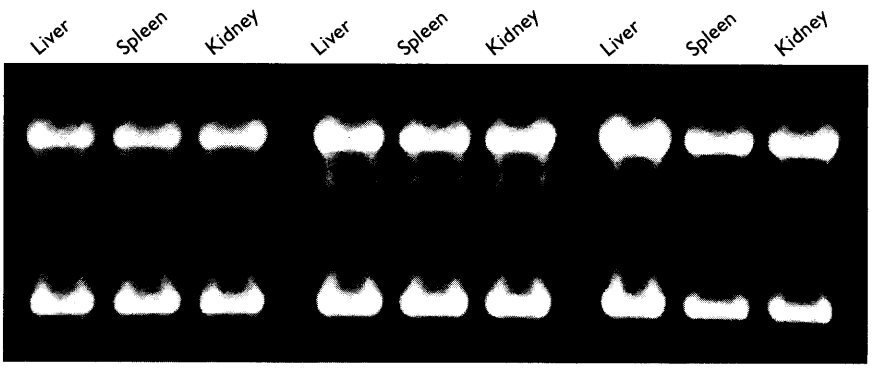

Figure 1a. Quality of RNA isolated from Tissue Stored in RNA*later*™ Solution. Fresh mouse tissues were dissected and stored in RNA*later*™ at 37°C for 1 day, room temperature for 1 week, or 4°C for 1 month. RNA was isolated using TRI Reagent® (MRC) and analyzed using denaturing agarose gel electrophoresis.

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Fig.1. Fluorescent sequencing results of a 100 bp pUC18 PCR fragment sequenced with a -20 Fwd primer using the DYEnamic ET Terminator Cycle Sequencing Kit (Amersham Pharmacia Biotech). Data generated for USB by Cleveland Genomics (clevelandgenomics.com), a research service company. PCR clean-up performed with: (a) ExoSAP-IT; (b) a column designed for PCR clean-up. Base miscalls in (b) are due to inherently low yields of short PCR products when using columns.

Fig. 2. Autoradiograms of a 20.7 kb Lambda PCR fragment sequenced with MBL202 Fwd primer using USB's Thermo Sequenase Radiolabeled Terminator Cycle Sequencing Kit. PCR clean-up performed with: (a) ExoSAP-IT; (b) a column designed for PCR clean-up.

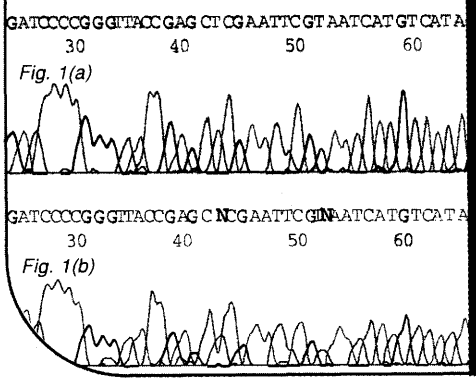


Fig. 1(a)

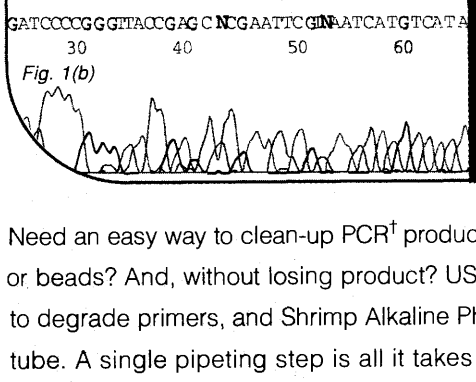
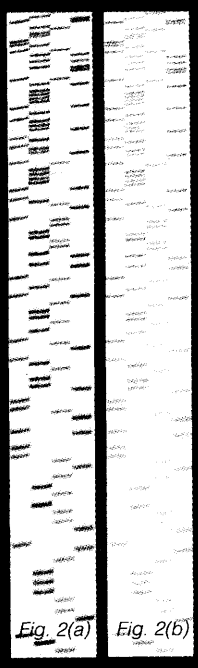


Fig. 1(b)



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B) Magnifying Glass is to Microscope
C) Abacus is to Calculator
D) Pony Express is to E-Mail
E) All of the Above

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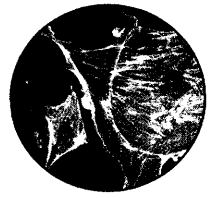

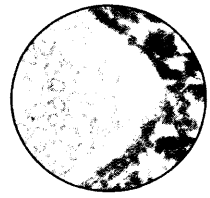

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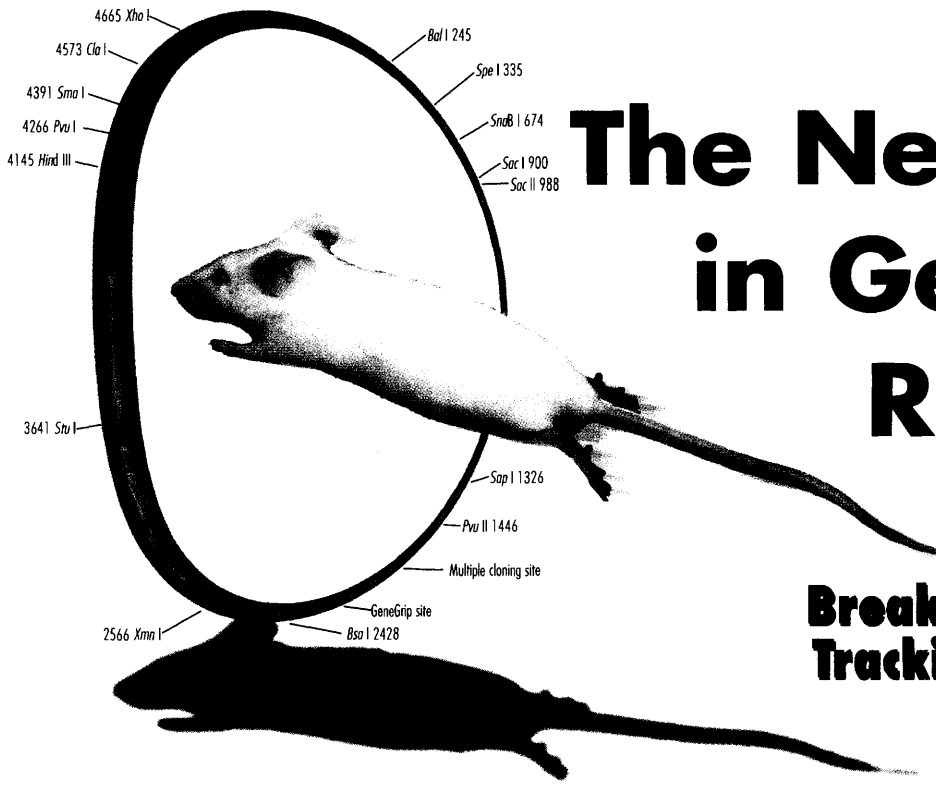

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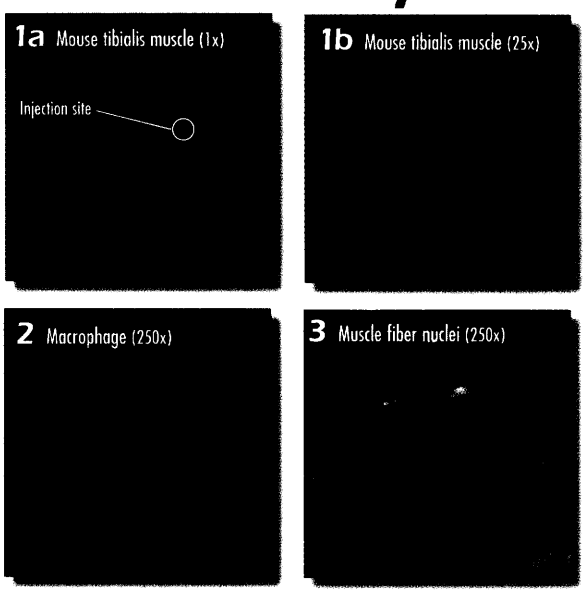

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[1]Dupuis, M., et al., *J. Immunol.* 2000, 165:2850–2858.

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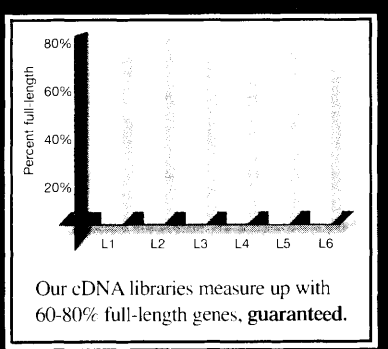

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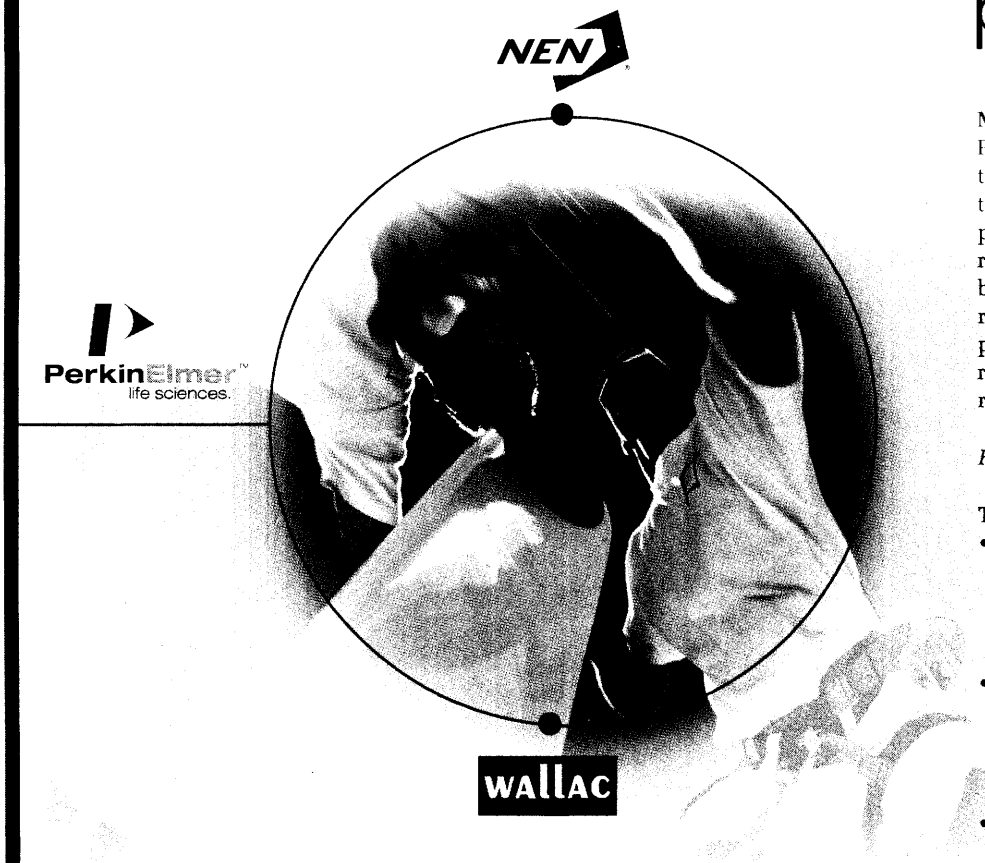

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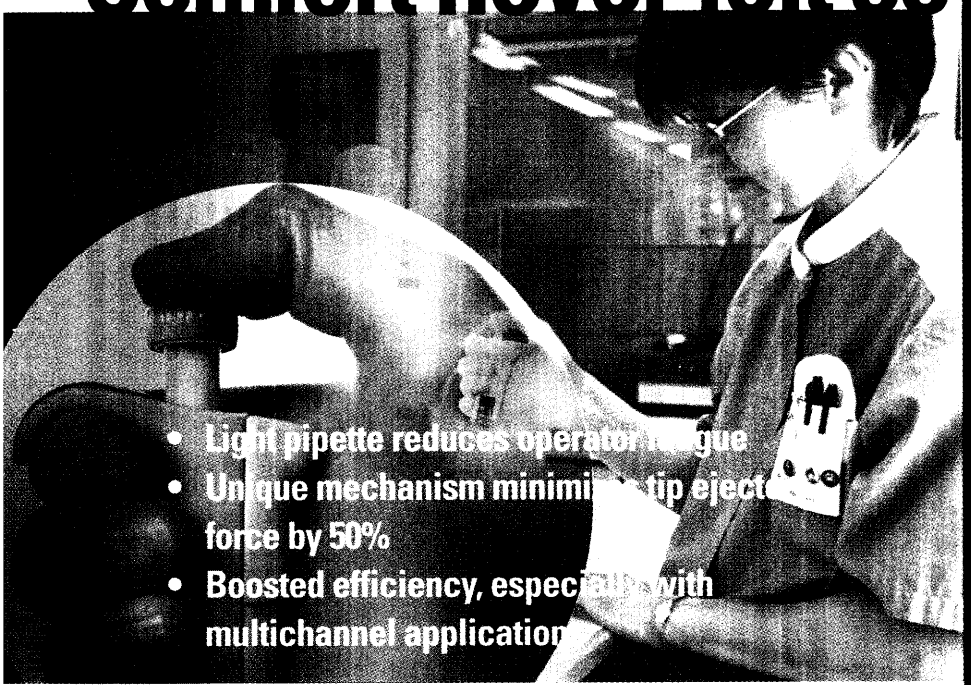

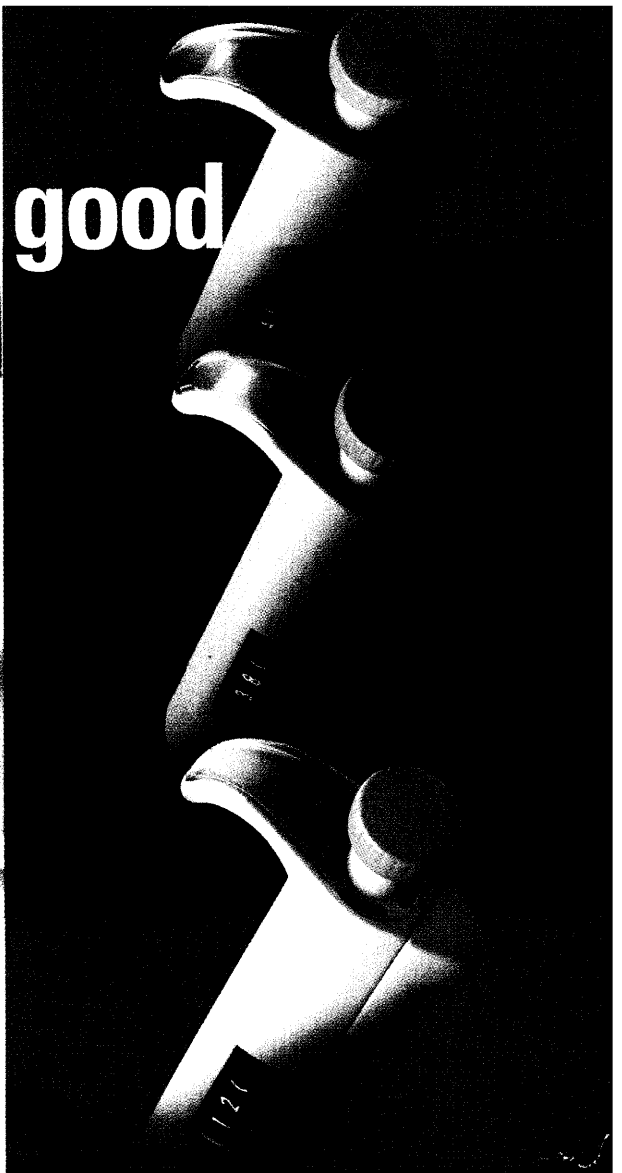

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  Tip ejector separated from the piston prevents accidental tip ejection.
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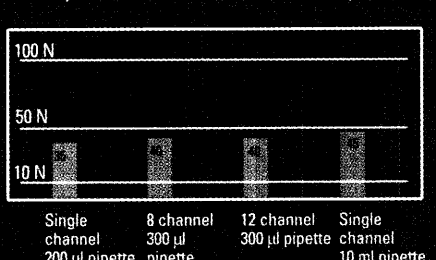
Ejection force needed with Finnpipette Digital pipettes

Ejection force needed with conventional tip ejection systems



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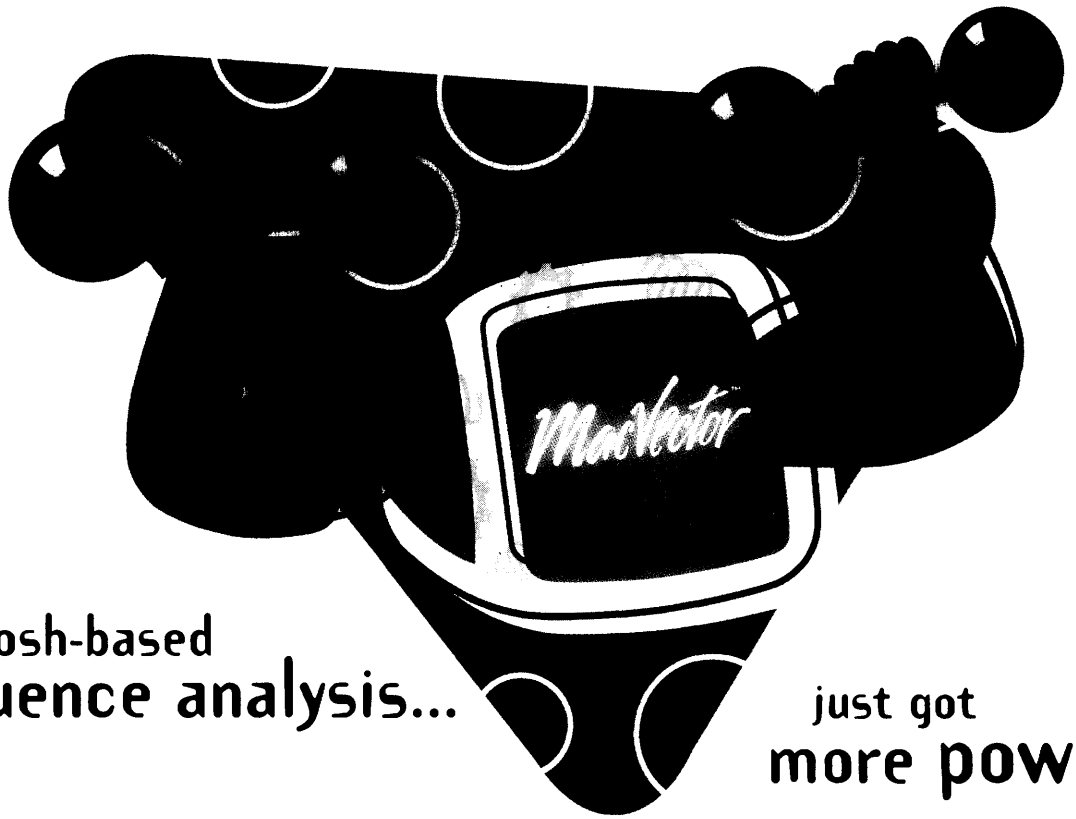

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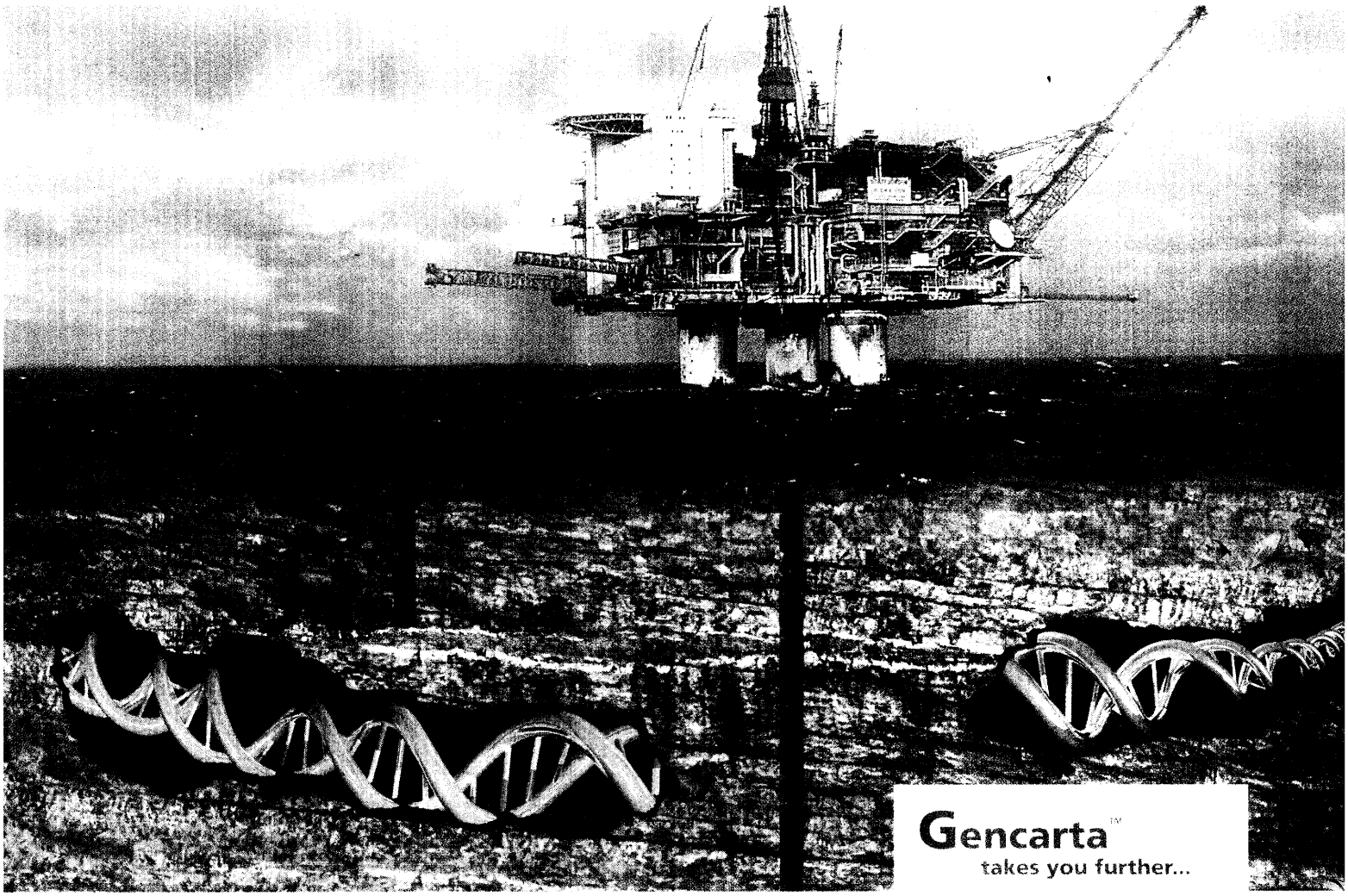

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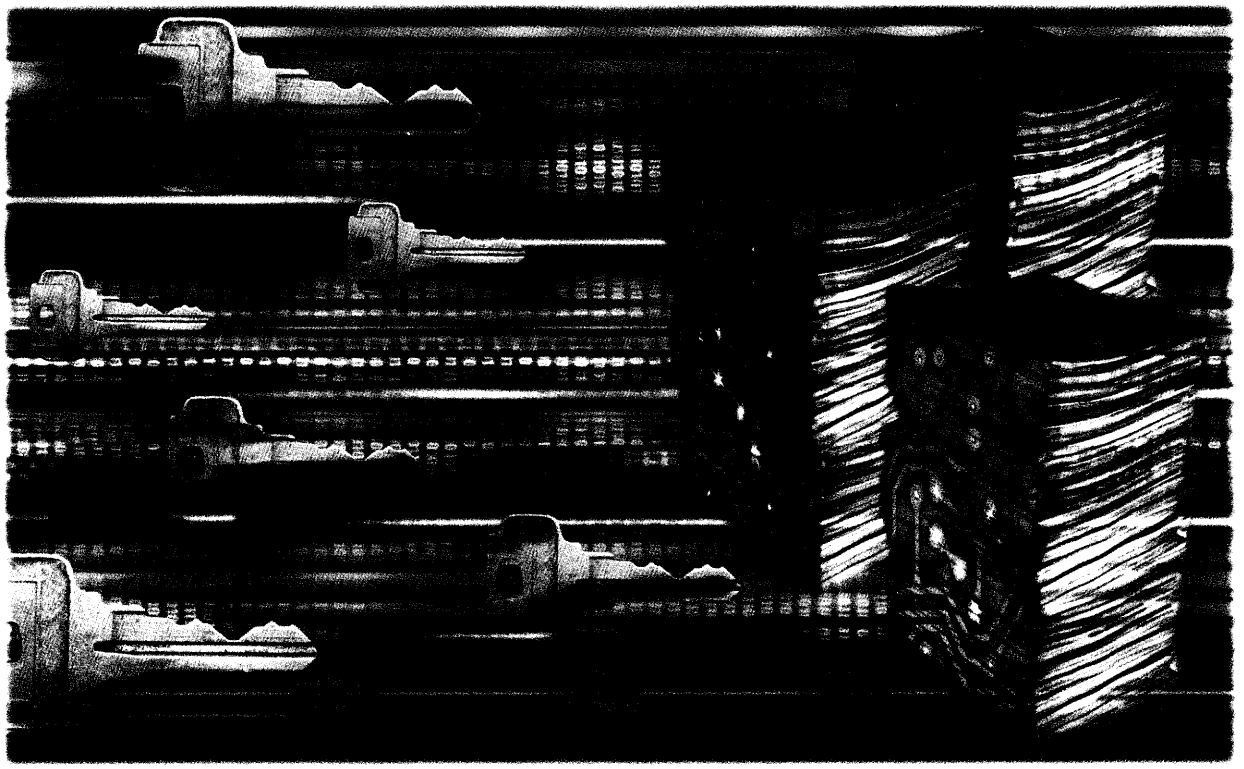

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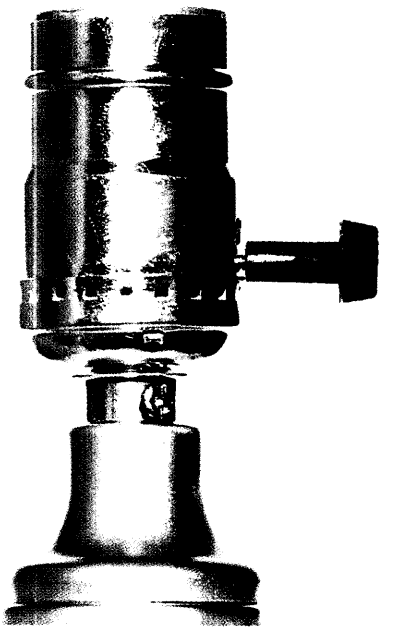

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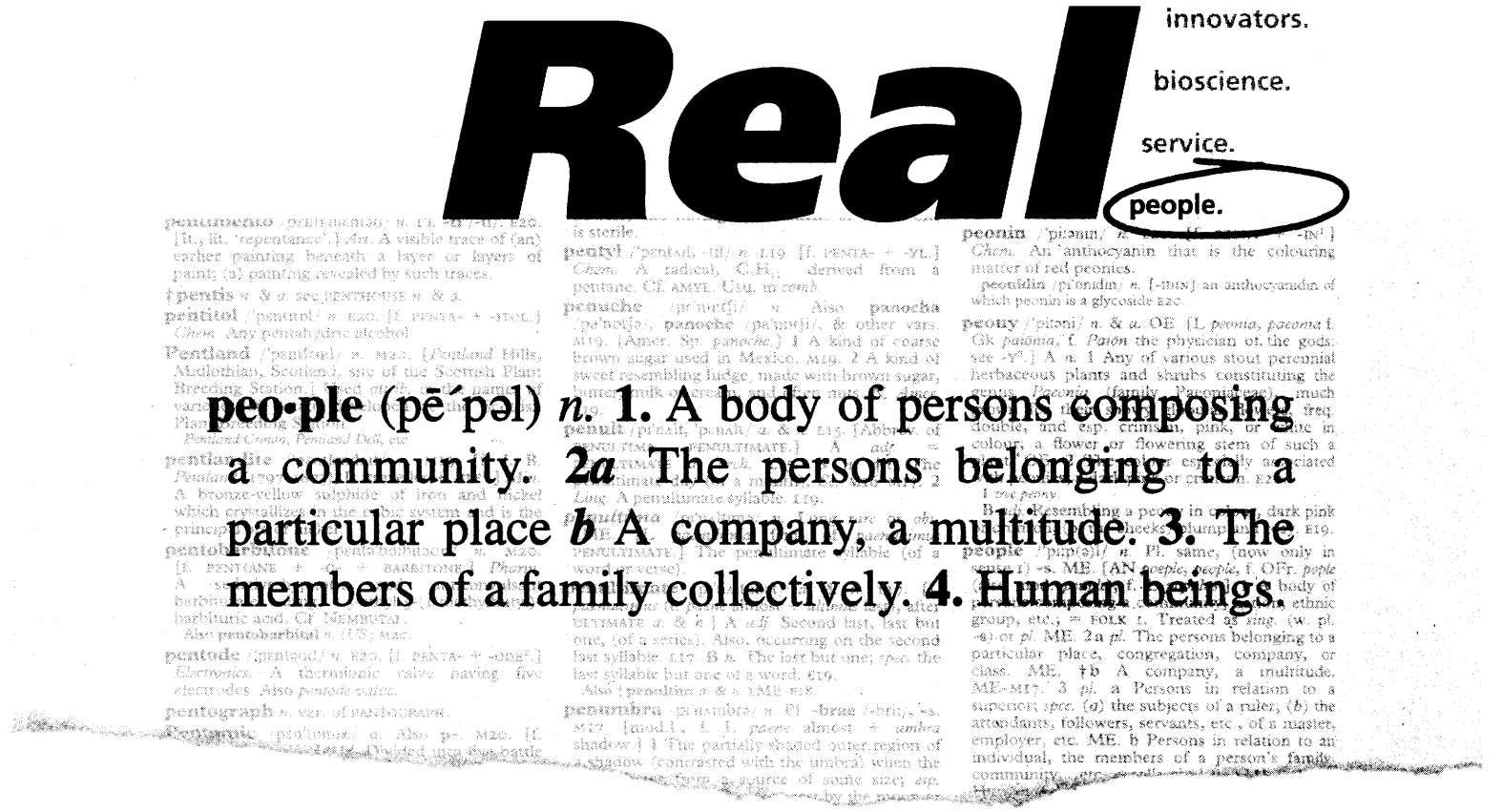

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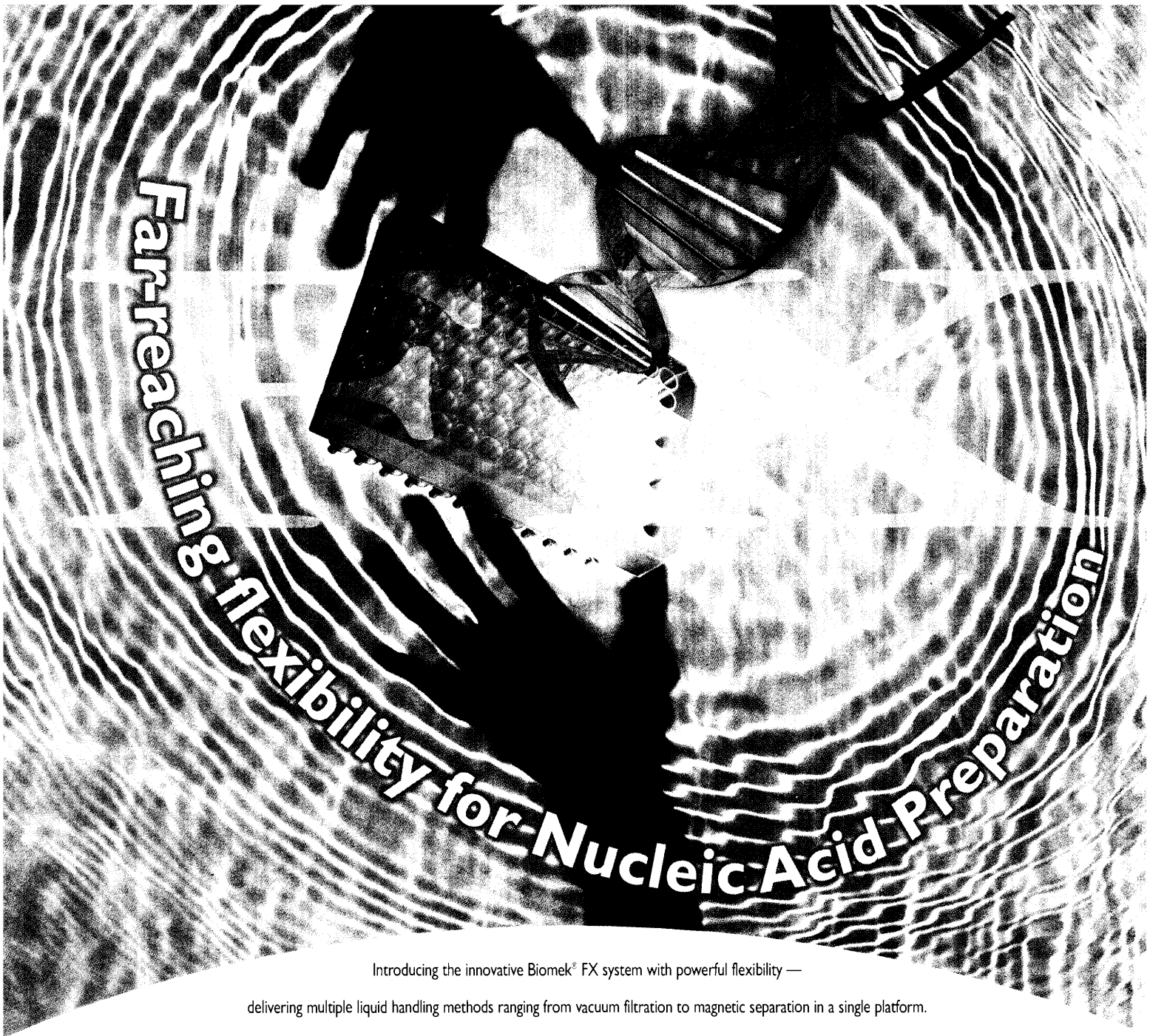

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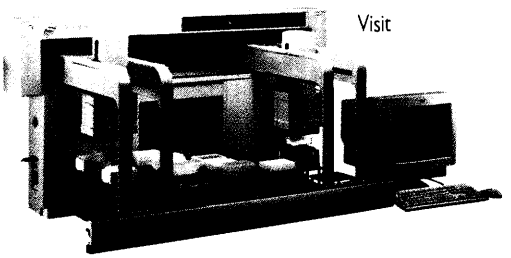

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