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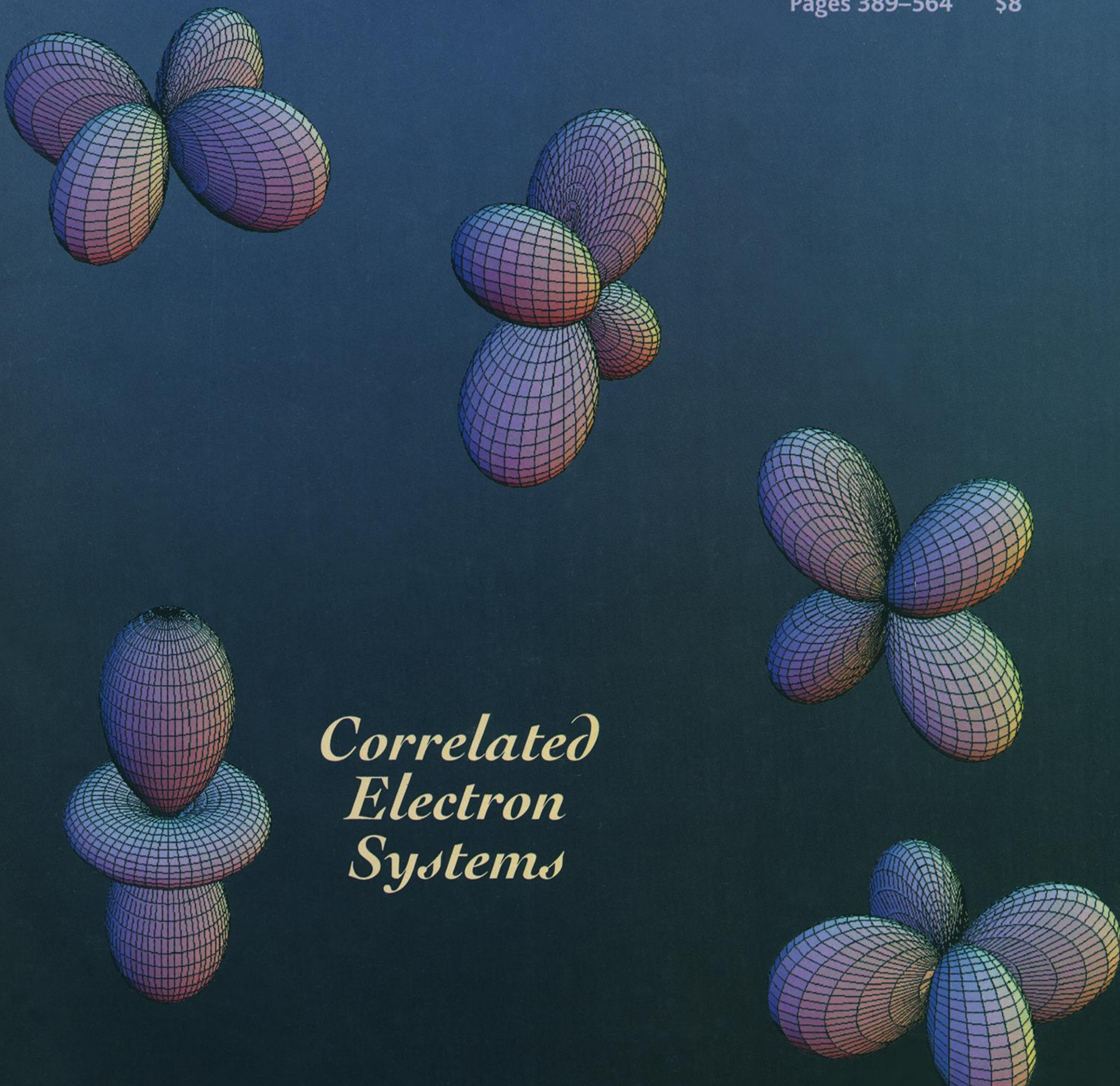

Correlated Electron Systems

American Association for the Advancement of Science

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Science

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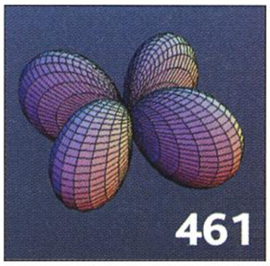
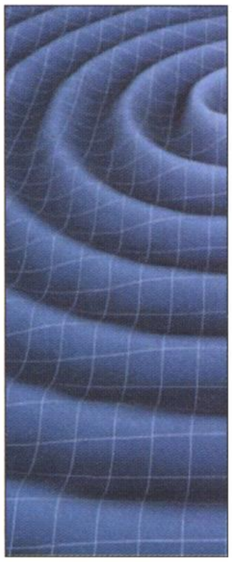


COVER The interactions and coupling between the charge, spin, orbital, and lattice degrees of freedom play an important role in determining the electronic and magnetic ordering of strongly correlated electron systems. The illustrations depict the available symmetries for the electron wave functions of the five d orbitals in the perovskite transition-metal oxides. A special section on correlated electron systems begins on page 461. [Images: Y. Tokura and N. Nagaosa]



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CORRELATED ELECTRON SYSTEMS

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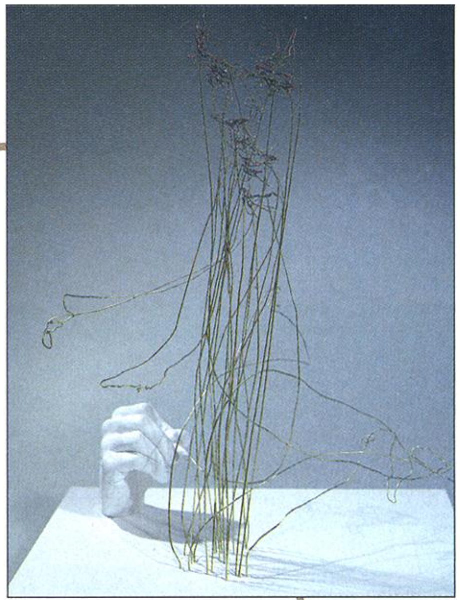

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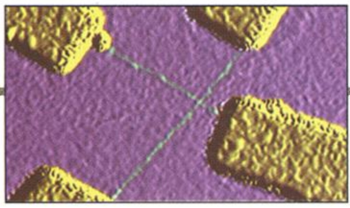

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Making contacts

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CLEARING THE AIR

The abundance and distribution of hydroxyl radicals (OH), a critical atmospheric oxidant, are hard to estimate, but the concentration of methyl chloroform (CH_3CCl_3), an anthropogenic pollutant oxidized by OH, is easily measured. Emissions of CH_3CCl_3 have decreased dramatically, however, in the past decade, and thus the relative abundance and distribution of OH can be estimated from the distribution of CH_3CCl_3. Montzka *et al.* (p. 500) measured CH_3CCl_3 concentrations from 10 remote locations across the globe from 1997 to 1999 and estimated the relative latitudinal distribution of OH, as well as developed a better CH_3CCl_3 budget.

THE HEARTBEAT OF EVOLUTION

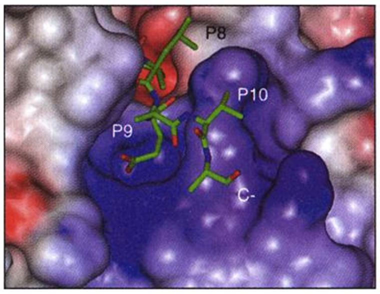
Spectacular recent fossils have provided a glimpse of some of the important soft tissues of dinosaurs. These findings allow improved inferences about dinosaur behavior and physiology and provide a more complete picture of evolutionary relations than that based on skeletal evidence alone. Fisher *et al.* (p. 503; see the news story by Morrell) have now used computerized tomography to identify the fossilized heart of an ornithischian dinosaur. The heart has four chambers and a single systemic arch, a similar arrangement to that in birds and mammals, but apparently distinct from those in most other reptiles. The presence of this heart structure in mammals, birds, and now dinosaurs may be related to higher metabolic rates.

NANOTUBE CONDUCTIVITY

Whether single-walled carbon nanotubes (SWNTs) are metallic (M) or semiconducting (S) depends on their diameter and chirality, as well as the presence of adsorbed species, and samples generally contain a mix of both types. Fuhrer *et al.* (p. 494) constructed junctions and measured the conductance of the three types of junctions that can form—M to M, S to S, and M to S—and performed three-terminal measurements that eliminate the effects of other contacts formed. The M to M and S to S junctions both show high conductances, which they attribute to strong contact forces between the nanotubes. The M to S junction forms a Schottky barrier, and the authors constructed a three-terminal rectifier controlled by the potential on the metallic nanotube. Tang *et al.* (p. 492) studied bundles of SWNTs with carbon-13 nuclear magnetic resonance and found that the nuclear spin lattice relaxation times were considerably shorter for the metallic nanotubes. These data were used to determine the density of states at the Fermi level for metallic nanotubes, which decreased with nanotube diameter.

STRUCTURAL CLUES IN AUTOIMMUNE DIABETES

Susceptibility to insulin-dependent diabetes mellitis (IDDM), an autoimmune disease, correlates with mutations in specific major histocompatibility complex class II alleles. Now Corper *et al.* (p. 505) have determined the structure of such a murine allele ($I\text{-}A^{g7}$) bound to an autoantigenic



peptide. The peptide binding groove is widened in the region of a mutation that is a key factor in disease susceptibility, and thus $I\text{-}A^{g7}$ is somewhat more promiscuous than other class II molecules. The authors suggest that autoimmune susceptibility likely correlates with the ability of $I\text{-}A^{g7}$ to bind a novel subset of peptides. Their results do not support an alternative theory that IDDM is linked to destabilization of $I\text{-}A^{g7}$.

GREATER HIMALAYAN ROCKS

When India collided with Eurasia, the rocks from the Indian continent were subducted beneath the rocks of the Eurasian continent to create a thick sequence of highly deformed rocks; the Greater Himalayan sequence, which are Indian metasedimentary rocks, are thrust onto the Lesser Himalayan sequence. DeCelles *et al.* (p. 497) measured uranium-lead ages for zircon grains from both sequences and determined that the Greater Himalayan sequence is older and the rocks were elevated before the collision. These results indicate that a greater extent of the Indian continent was subducted or underthrust beneath the Tibetan Plateau and that revisions to tectonic reconstructions of this major collision will be required.

EYES ABOUT

In 1977, a tomb was discovered in Vergina, Greece, that was initially thought to be of King Philip II of Macedonia, the father of Alexander the Great. A proper identification of the skeleton would help date and place in context many of the artifacts found in the tomb. Bartsiokas (p. 511; see the news story by Koenig) have re-examined particularly the eye orbit of the skeleton and find little evidence of a prominent injury that Philip II suffered some 18 years before his death. Thus, the skeleton is not that of Philip II but more likely of King Philip III Arrhidaeus, the half-brother of Alexander.

A GENE WHOSE TIME HAS COME

In 1988, a Syrian hamster with a genetically altered circadian period was shown to carry a semidominant mutation, called *tau*, that helped open the genetic understanding of circadian rhythms. Further work has relied mainly on mice, but new genomic methods are now allowing this mutation to be studied in detail in hamsters. Lowrey *et al.* (p. 483; see the Perspective by Young) have found that the hamster *tau* gene expresses casein kinase 1 epsilon (CKIε). They show how the single nucleotide substitution leads to altered kinase activity and explain the resulting shorter circadian period. A homolog of CKIε in *Drosophila*, *double-time*, is known to be an integral part of the clock.

CAPTURING A MUTATOR CELL

The conversion of normal cells into cancer cells is thought to involve the acquisition of a hypermutable phenotype, in which the cells begin to accumulate mutations at a high frequency. Whether this hypermutability can occur in normal cells prior to malignant transformation has been unclear. Finette *et al.* (p. 514) studied mutation frequencies in non-neoplastic T cells from patients with acute lymphocytic leukemia who had been treated with standard chemotherapeutic drugs. Chemotherapy caused a striking increase in mutation rate in these T cells, and cells with this hypermutable phenotype appeared to be selectively enriched over

CONTINUED ON PAGE 399

CONTINUED FROM PAGE 397

time. Although not themselves malignant, these hypermutable cells may prove to be important tools for studying the early events that lead to accumulation of cancer-causing mutations.

Ribosomal Processing

In eukaryotes, methylation of ribosomal RNA (rRNA) is usually guided by small nucleolar RNAs (snoRNAs) that pair with the targeted rRNA in the nucleolus. Omer *et al.* (p. 517) now show that homologs of snoRNAs are present in organisms representing both branches of the archaea, and which like bacteria lack a nucleolus. The archeon *Sulfolobus solfataricus* is known to contain methylated rRNA, and the authors used this sequence information to clone sno-like RNAs from *S. acidocaldarius*. Evidence for sno-like RNAs in other archaea was obtained by searching genomic databases. These results suggest that this type of rRNA processing predated the branching of archaea and eukaryotes.

Sorting Out Antigen Processing

Dendritic cells are specialized to process and present antigens to T cells via the class II major histocompatibility complex (MHC II) proteins. Antigens enter immature dendritic cells and travel to lysosomal MIIC compartments, but they can sometimes be found in nonlysosomal compartments called CIIVs whose functional role has been unclear. Turley *et al.* (p. 522) now report that when dendritic cells received a signal that initiates maturation and movement to lymph nodes, peptide–MHC II complexes were transferred from the MIICs to CIIVs. Other proteins that are ligands for costimulatory receptors on T cells were retained, yet soluble proteins and lysosomal markers remained behind. This highly specific sorting function allows preassemblage of antigen and costimulating molecule microdomains on the dendritic cell surface. This process may facilitate immunological synapse formation between the antigen-presenting cell and the T cell, an initial step in T cell activation.

Tongue-Tied?

The mapping between the sounds of words and their meanings is arbitrary. MacNeilage and Davis (p. 527; see the Perspective by Locke) have carried out an analysis of a large body of data, across different languages and many different subject groups, and find a nonuniform distribution of intrasyllabic consonant-vowel combinations. They offer a "frame-content" explanation based on biomechanical constraints and then extend their analysis to intersyllabic combinations. Here, the higher-than-expected frequency of labial-coronal consonant usage connects to a corpus of proto-words that have been postulated to represent the residual sign of an ancestral language.

Inconsistency in Reasoning

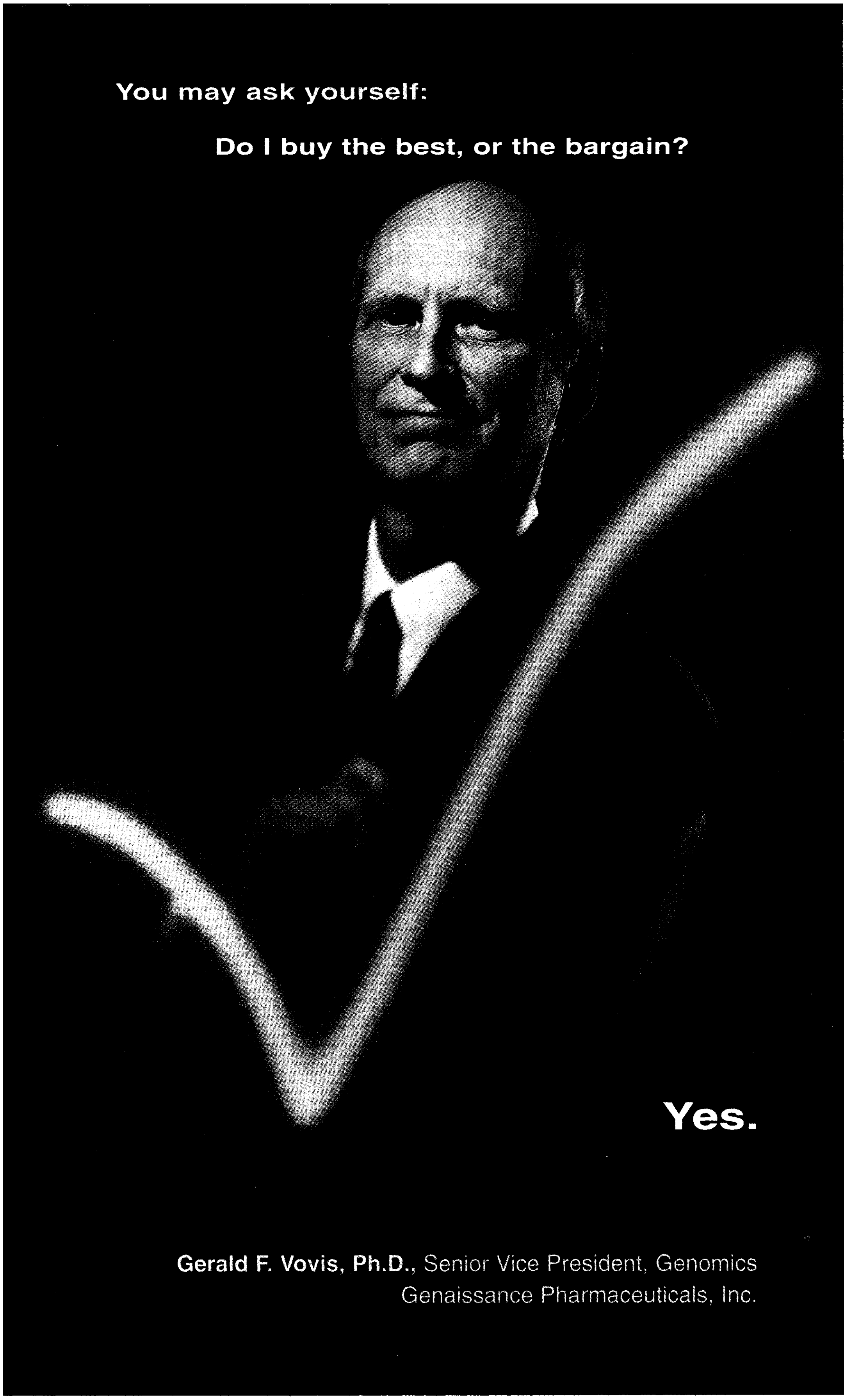
How do we incorporate new facts into our apparently rationally constructed worldview? Johnson-Laird *et al.* (p. 531) suggest that we reason by building a mental model from premises, whether affirmative or negative, when they are true. This resource-sparing approach of not including false premises leads to predictable instances of illusory consistency that are confirmed empirically in two sets of behavioral trials.

TECHNICAL COMMENT SUMMARIES

Toxicity of ALS-Linked SOD1 Mutants

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/288/5465/399a

Detailing results of studies of cultured motor neurons, Estévez *et al.* (Reports, 24 Dec., p. 2498) concluded that failure to incorporate zinc into superoxide dismutase (SOD), an antioxidant protein, "can be sufficient to induce motor neuron death in culture by an oxidative mechanism" involving nitric oxide. Such a mechanism, they suggested, may participate in sporadic and familial amyotrophic lateral sclerosis (ALS). Williamson *et al.* comment that the evidence presented by Estévez *et al.*, "although persuasive in vitro, may have little relevance to the in vivo pathway of motor neuron death," arguing that the Estévez *et al.* hypothesis tying zinc-depleted SOD and consequent nitration to motor neuron disease is unsupported by available in vivo tests. Beckman *et al.* respond that some of the points raised by Williamson *et al.* "may actually support our proposed mechanism" and that others highlight the need for further study. "The issues raised by Williamson *et al.*," conclude Beckman *et al.*, "underscore the need for a combined approach including human tissues, transgenic animals, neuronal culture models, and in vitro biochemistry."



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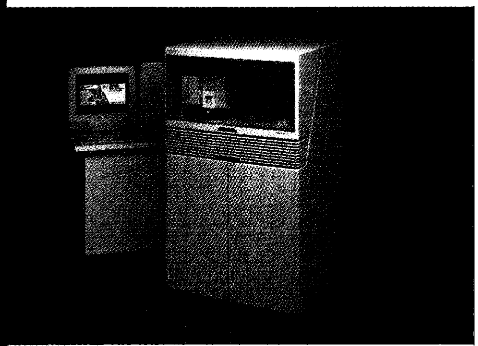

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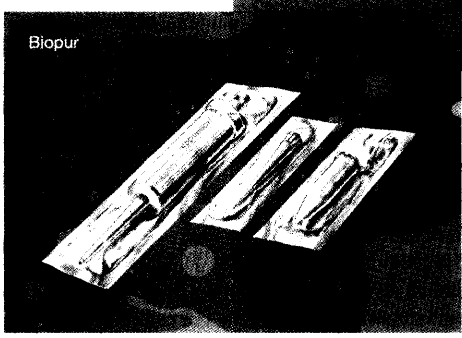

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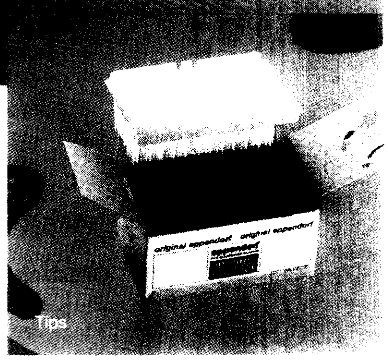

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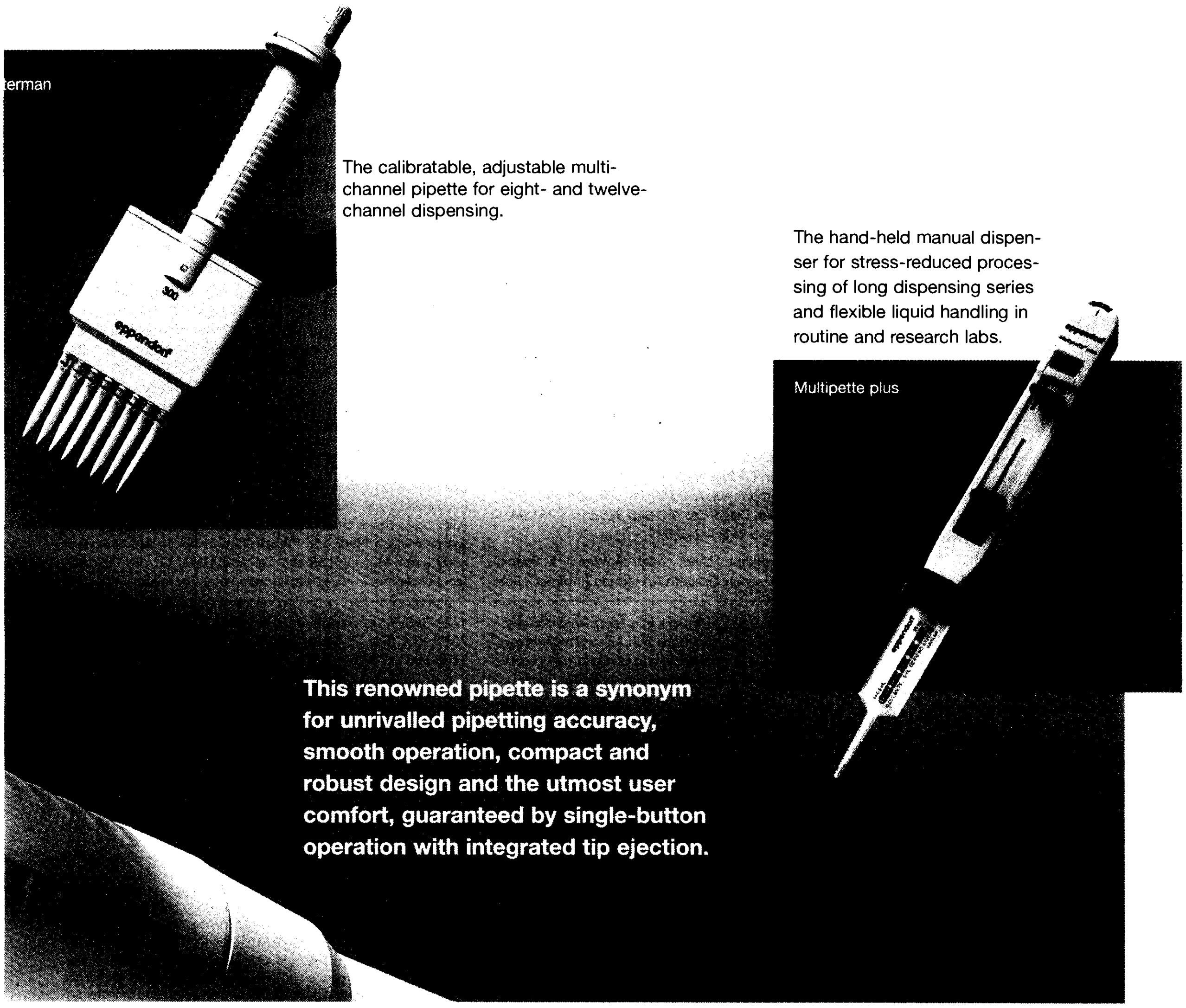

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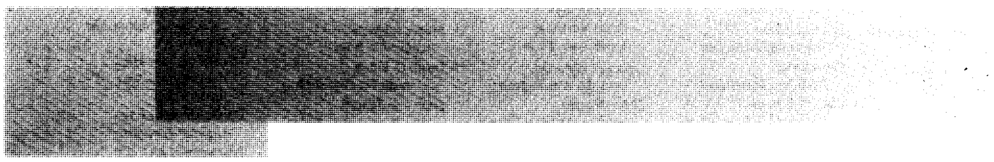

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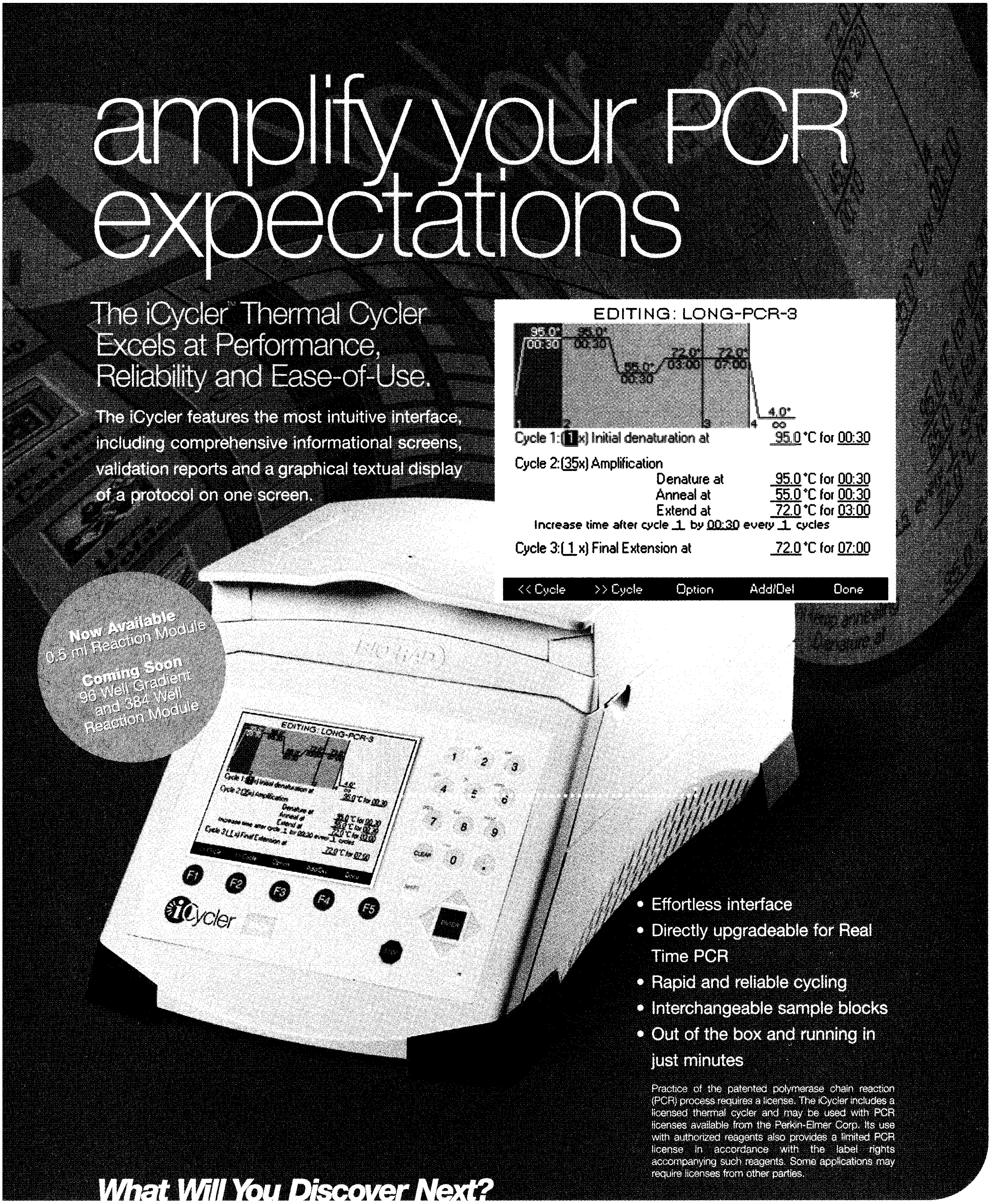
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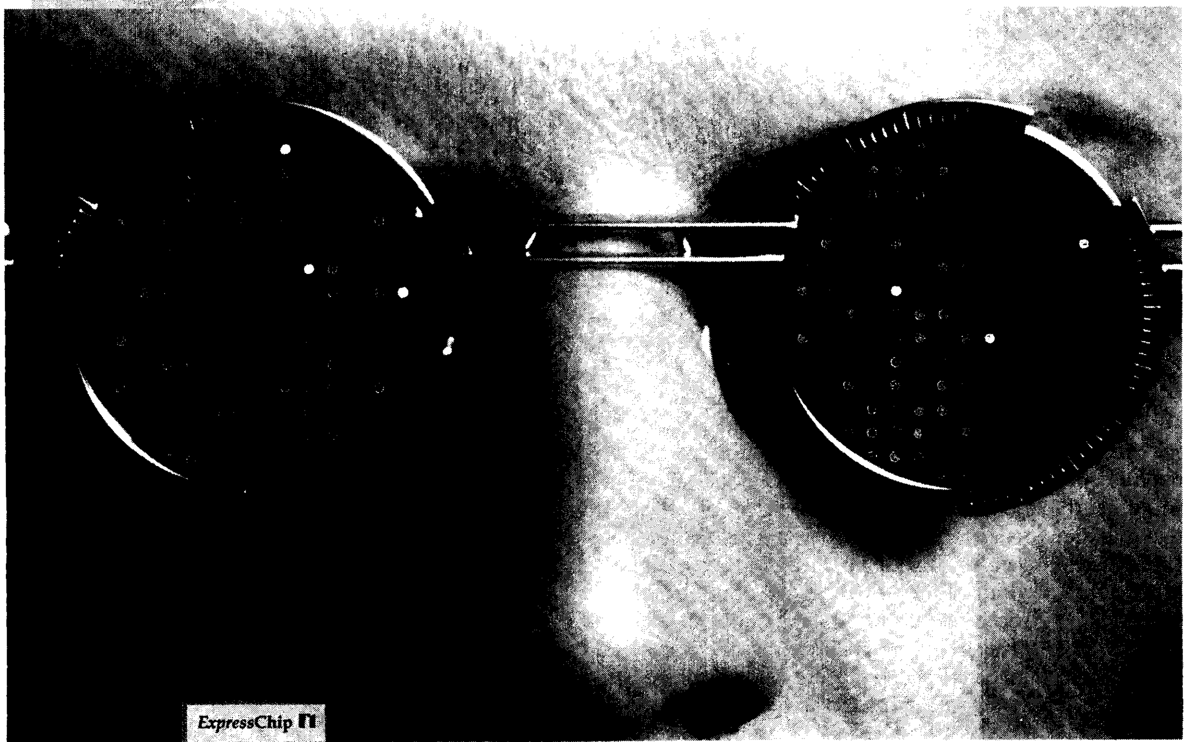

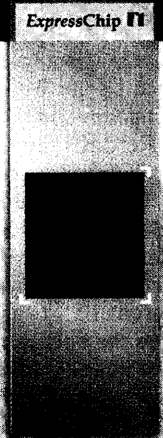

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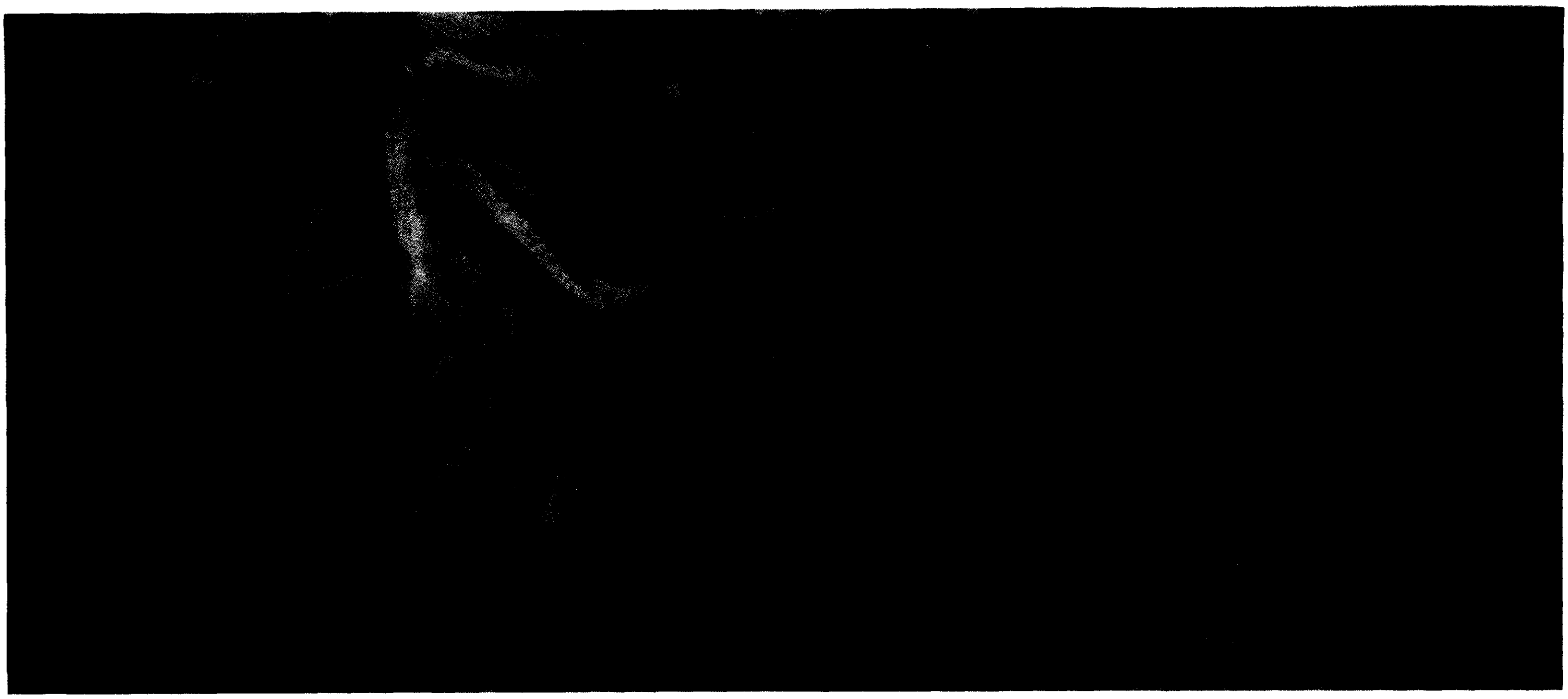

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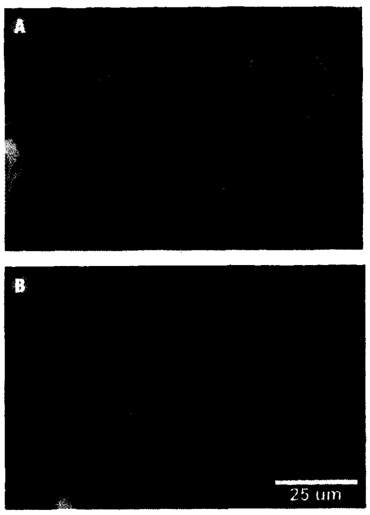

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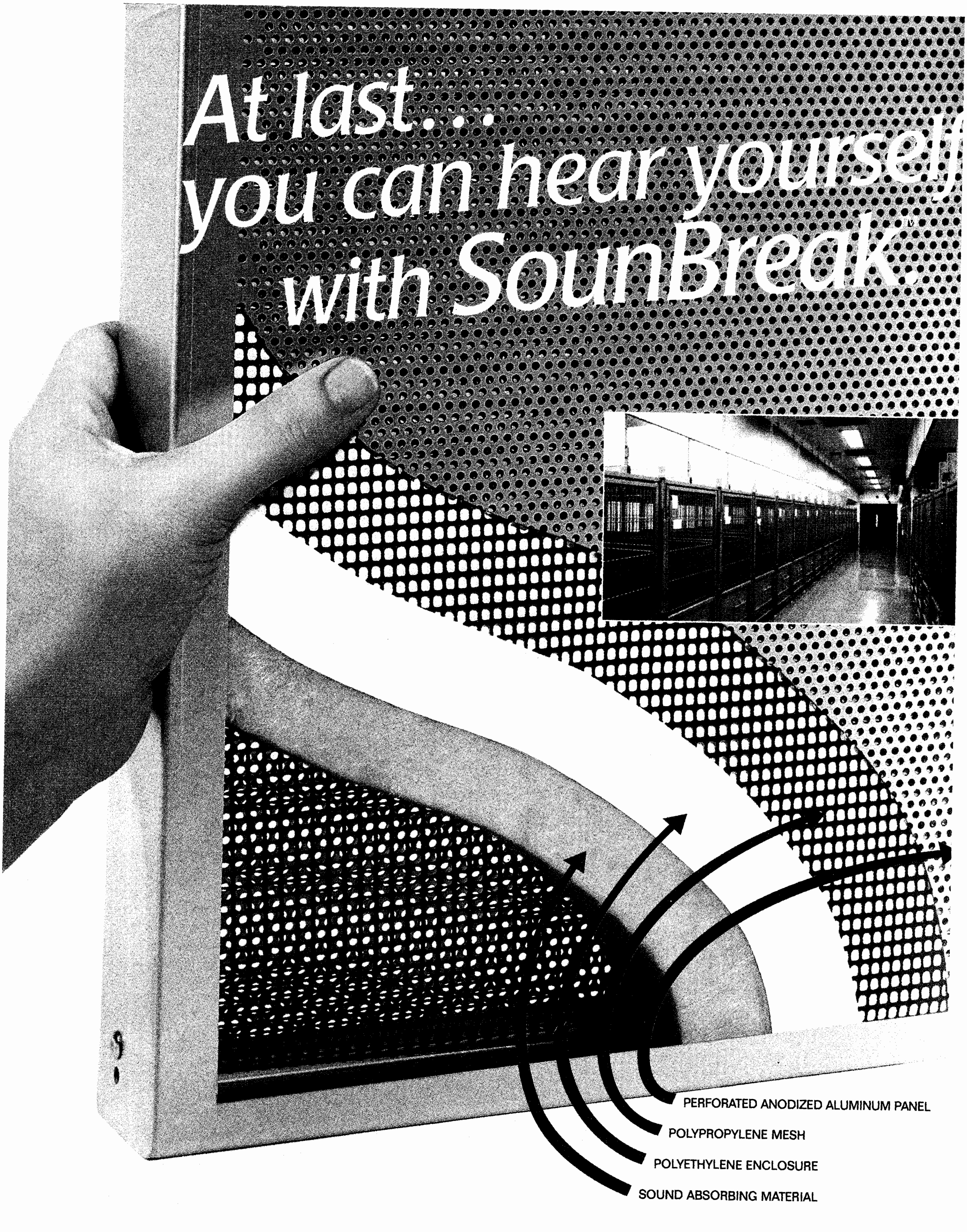
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The unique snap-together panel allows easy access for internal cleaning. The SounBreak™ Acoustical Panels are easily removed from mounting brackets. Simply lift up and pull the panels away from the wall, ceiling, or kennel partition. The panels will withstand dusting, vacuum cleaning, wet wiping and hosing. The panels can be washed at 190° F for 30 minutes using appropriate detergents.

SounBreak™ Acoustical Panels help create a healthy and more productive environment for man and animal. At last you can hear yourself think.

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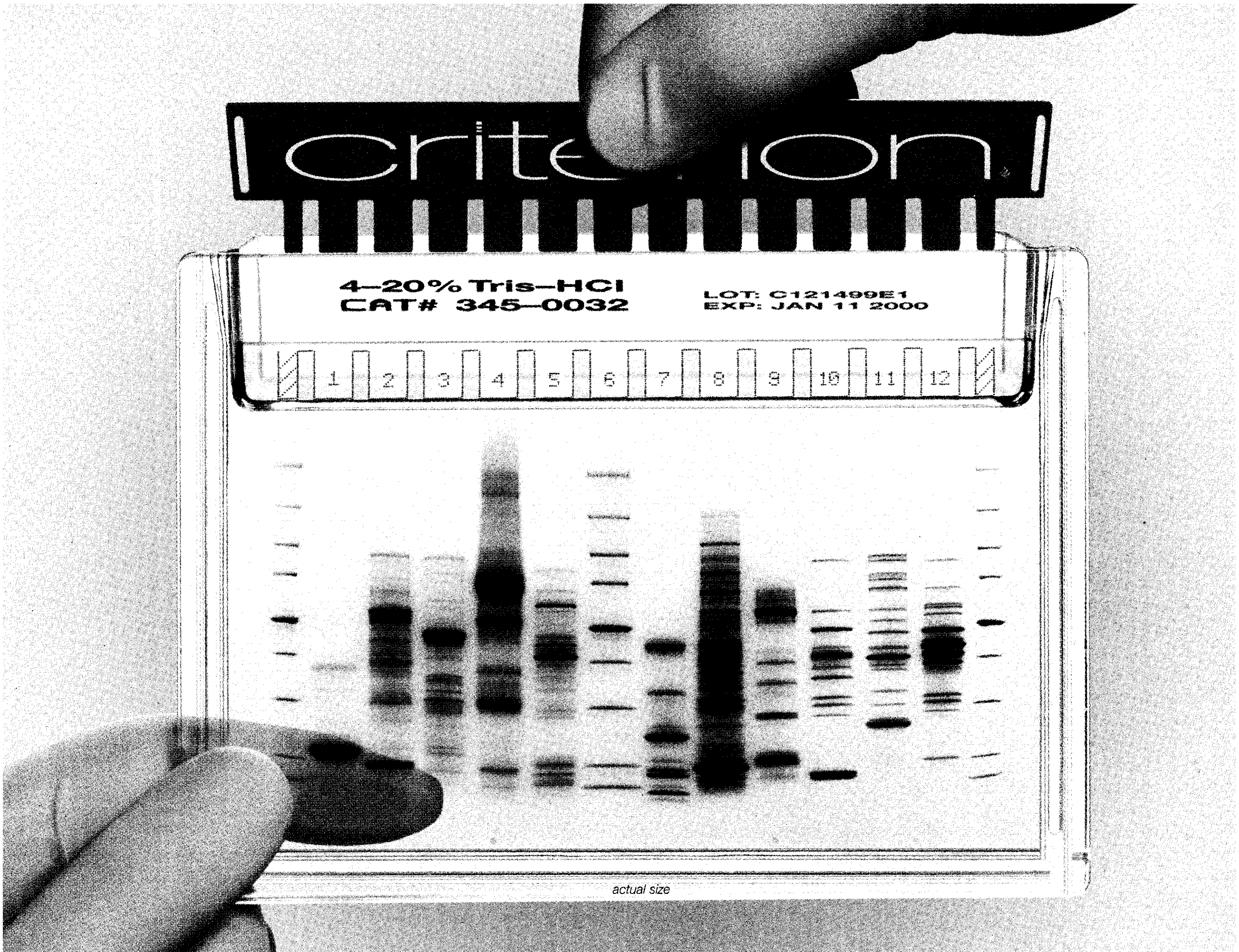

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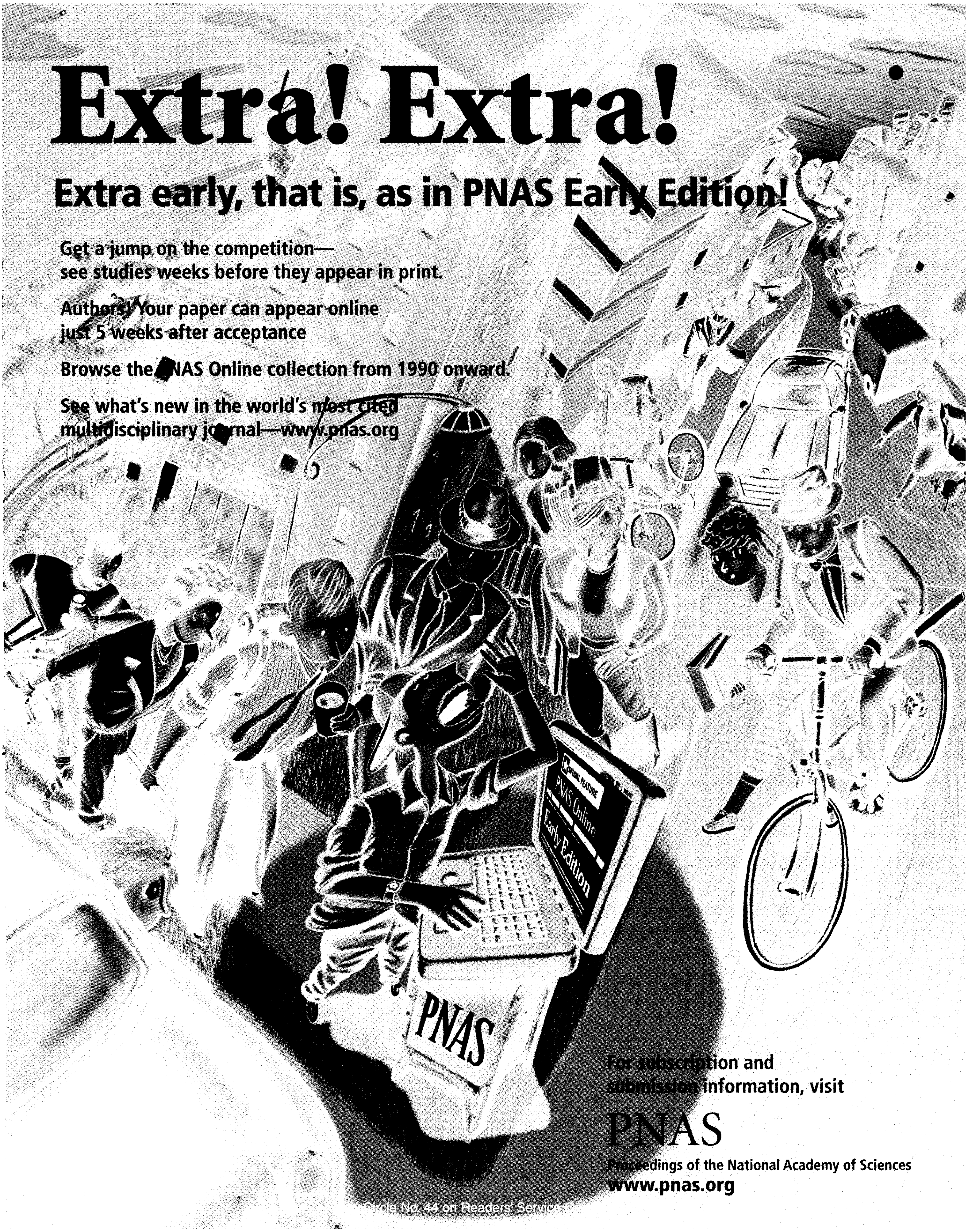

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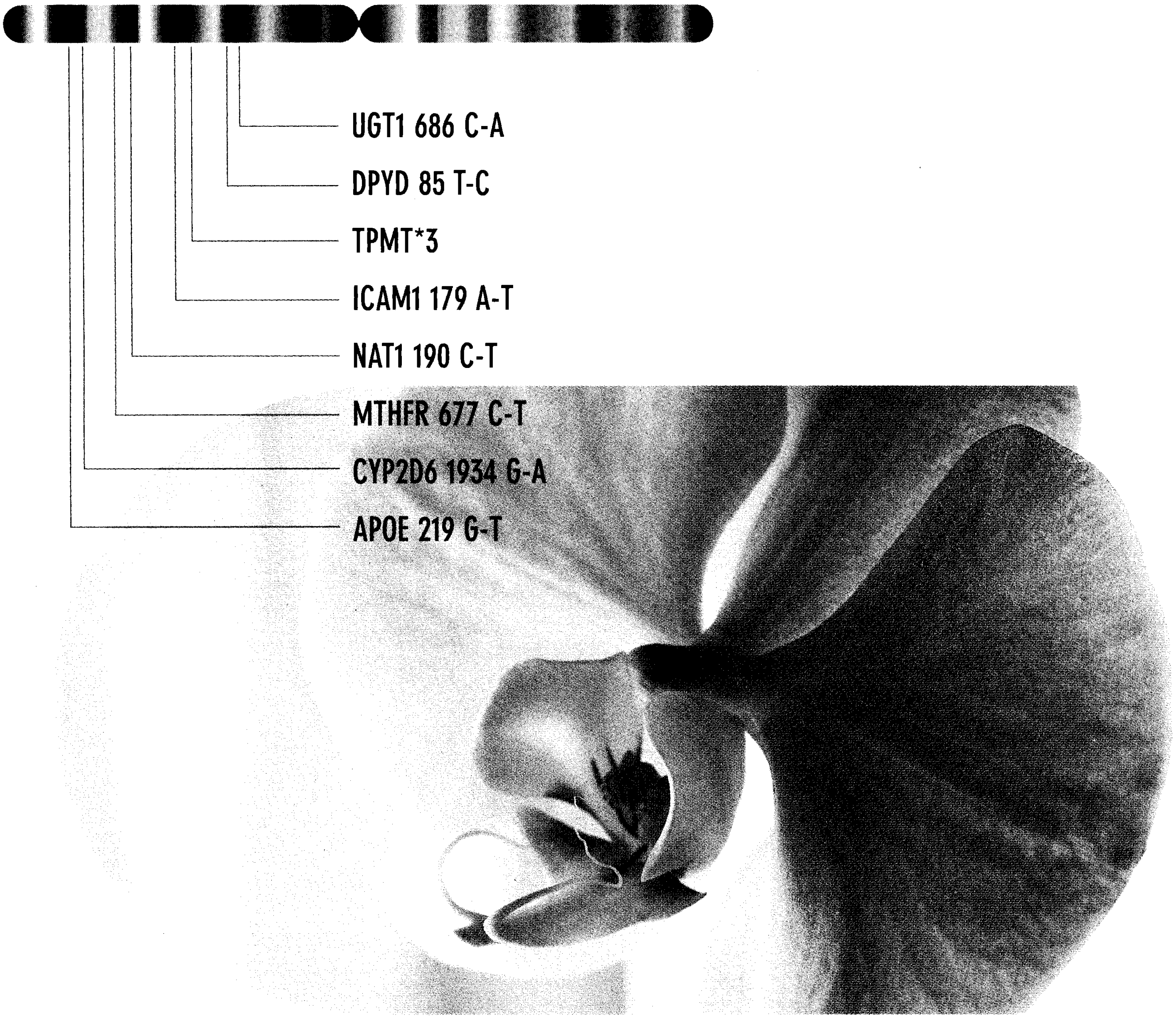
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