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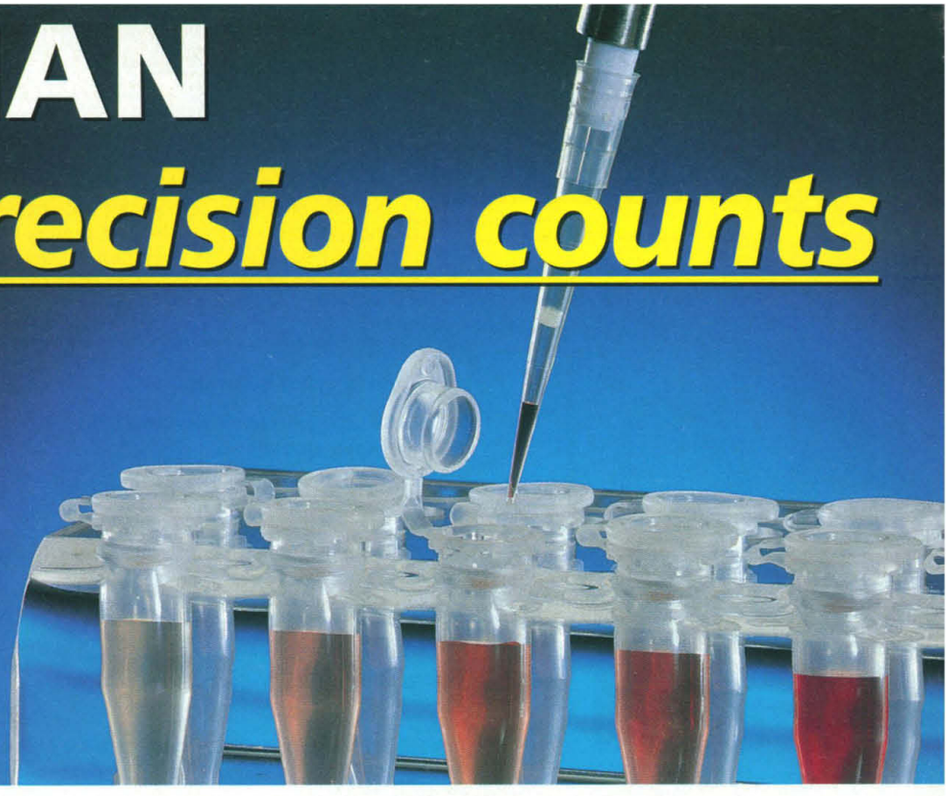

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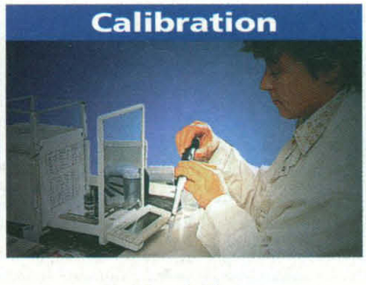

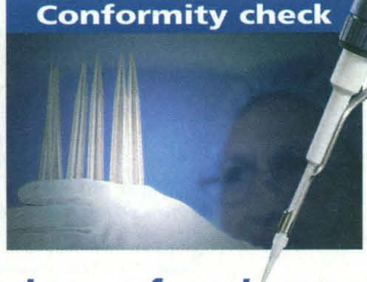

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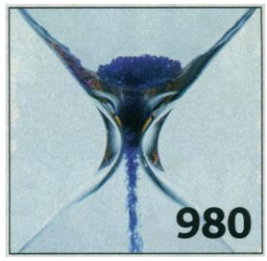

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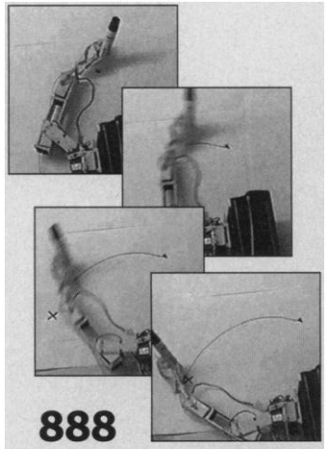

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Driving prostheses with brain signals

NEWS

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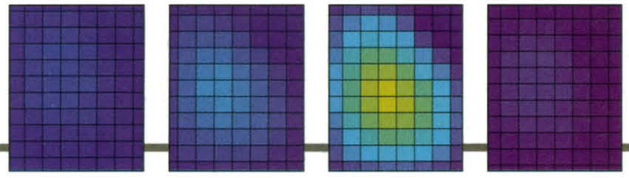

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Magma rising

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Disrupting the mitotic spindle

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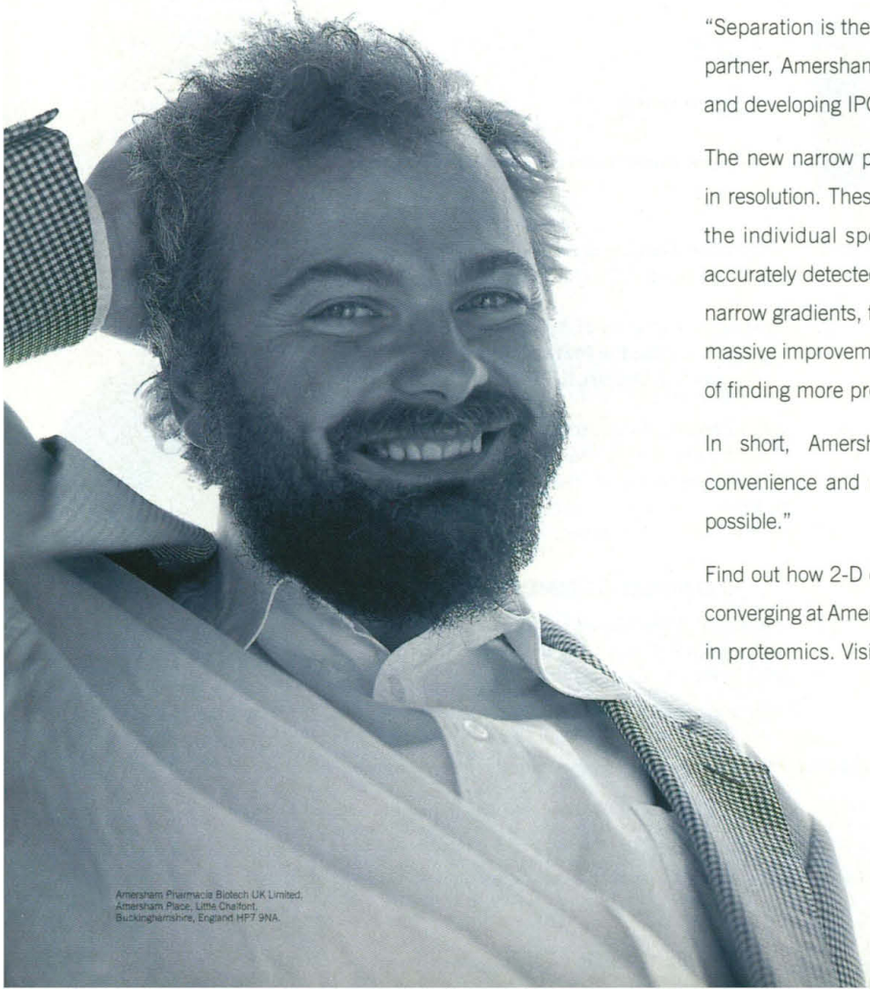

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PROCESSING CRUST IN THE MANTLE

Under the high temperature and pressure conditions of the mantle, rocks are ductile. However, oceanic crust subducted into the mantle can remain relatively cold and can thus fracture and cause deep earthquakes. Mineral transformations that occur as subducted oceanic crust warms up may trigger these deep earthquakes (see the Perspective by Stein and Rubie). Subducted oceanic crust is transformed into an anhydrous denser rock (called eclogite) that is composed mainly of garnet and omphacite. Peacock and Wang (p. 937) derived thermal models and determined at what depth the related mineral transformations would occur for two distinct subduction zones beneath Japan. They found that the subduction zone beneath northeastern Japan was much colder than the subduction zone beneath southwestern Japan, which would require the eclogite transformation to occur at much greater depths in the northeast. The difference in the depth of the eclogite transformation provides a simpler explanation for the difference in seismicity and volcanism between the two subduction zones than has been suggested previously.

A NEW ROOT FOR FLOWERING PLANTS

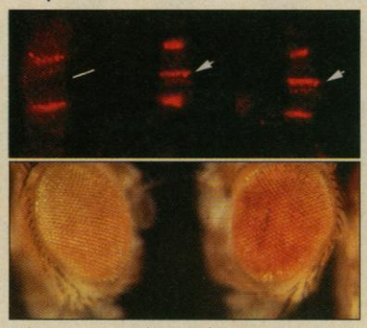
The origin of the angiosperms (flowering plants) has long been debated. Even with the advent of molecular techniques for phylogenetic analysis, the question has been thought intractable because of the significant evolutionary distance between the angiosperms and their closest relatives in the plant kingdom. Mathews and Donoghue (p. 947) attacked the problem by analyzing duplicate phytochrome genes. They root the family tree of the angiosperms among the water-lilies and two primitive Australasian plant genera, *Amborella* and *Austrobaileya*.

SPINNABLE INORGANIC SEMICONDUCTORS

Inorganic materials generally have better electronic properties than their organic counterparts, but this benefit is often accompanied by relatively higher processing costs. In an effort to combine the benefits of low-cost processing of organic materials with the superior electronic properties of inorganics, Kagan *et al.* (p. 945) introduce a synthesis route for the formation of hybrid organic-inorganic materials that can be spun onto a substrate and processed at low temperatures. They demonstrate the potential of such a material by fabricating a thin film transistor with electronic properties similar to those fabricated through more costly high-vacuum techniques.

STAYING ACTIVE

Early in fruit fly development, a cascade of transcription factors functions to direct transient homeotic gene expression for development of structures such as the leg or antenna. The established regulation, be it activation or repression, is then maintained by



trithorax or polycomb group proteins, respectively. This regulatory state can be maintained through cell division. Cavalli and Paro (p. 955) now report that the mechanism of inheritance for the activated state is through the acetylated histone H4, an active chromatin state, and not simply through the removal of a repressor molecule.

OF ICE AND AIR

Oxygen isotopic ratios of ice cores have provided an important record of paleotemperatures. Their analysis is complicated, however, by variations in annual precipitation, and analysis of accompanying bubbles of trapped air must account for age differences between the bubbles and the older ice (which remains porous for many years until compacted by additional layers of snow). The use of other isotopic records, such as those of atmospheric nitrogen and argon, can help calibrate this paleothermometer (see the Perspective by Jouzel). The end of the last glacial period, marked by a rapid warming event in the North Atlantic region called the Bølling Transition, was accompanied by an increase in atmosphere methane concentrations. Severinghaus and Brook (p. 930) show that the trigger for deglaciation was related to North Atlantic Ocean thermohaline circulation rather than to changes in the tropics. They measured the concentration of methane and the isotopic composition of argon and nitrogen gas trapped in bubbles in ice from Summit, Greenland, and correlated the isotopic values with the interpolar atmospheric methane gradient. They find that North Atlantic warming occurred several decades before tropical warming. During the 90,000-year duration of the last glaciation, the cold glacial climate was punctuated by numerous warm intervals (Dansgaard-Oeschger events) that exhibited rapid increases in temperature over short time periods (≈100 years). The resulting temperature gradient caused the gas contained in the firn (the porous region of recrystallizing snow that eventually forms the bubbles of air trapped in the ice) to fractionate isotopes. Lang *et al.* (p. 934) combined measurements of the isotopic composition of nitrogen trapped in bubbles from Greenland Ice Core Project ice and a physical model of ice accumulation to estimate the warming in central Greenland during Dansgaard-Oeschger event 19 (71,000 years ago). They conclude that the mean surface temperature change was 16°C. By comparing their nitrogen isotope record to that of the oxygen isotopes in the ice, they were able to determine the difference between the ages of the ice and the gas it traps.

FIGHTING RNA WITH RNA

When foreign DNA or RNA is introduced into plants, animals, or fungi (either through viruses or transgenes), a host defense system is initiated in which the foreign nucleic acid is silenced. This process is called post-transcriptional gene silencing (PTGS), and is believed to involve host antisense RNA that pairs with the "invading" RNA in order to degrade it or interfere with its processing or translation. Hamilton and Baulcombe (p. 950; see the news story by Strauss) have now detected the elusive antisense species. They examined four different classes of PTGS in plants and identified discrete antisense RNA approximately 25 nucleotides in length. The small RNA molecules are long enough for sequence specificity but short enough to move through the organism to mediate silencing.

DRAWING FRIENDLY FIRE?

T cells may not have an "appetite," but Huang *et al.* (p. 952) report that T cells can ingest the major histocompatibility complex (MHC) proteins bound to a spe-

CONTINUED ON PAGE 871

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CONTINUED FROM PAGE 869

cific antigenic peptide. Internalization begins within minutes, and the internalized MHC-peptide complex is taken to an acidic compartment. However, while the MHC-peptide complex is on the surface of the T cell, it could serve as a target for other T cells that have the same specificity. Thus, the T cell could be destroyed by its comrades. If this process also happened in vivo, it could be a mechanism by which T cells are "exhausted" when large concentrations of antigen are present.

T CELL DIVERSITY

How many different T cell receptors (TCRs) are circulating on T lymphocytes in human blood? Because of the way that the TCR is constructed, the potential diversity is 10^{15}. Not all T cells make it into the circulation, however, so measuring the real number has been extremely difficult. Arstila *et al.* (p. 958) have now measured a fraction of the repertoire and were able to estimate the actual extent of the diversity. They came up with a minimum number of 2.5×10^7 different T cells. Memory T cells constitute only about 1×10^5 to 2×10^5 different clones, albeit some of these clones make up a large percentage of the total number of cells in circulation.

FOSSILS IN THE X CHROMOSOME

By analyzing short regions of sequence similarity in otherwise nonrecombining regions of human X and Y chromosomes, Lahn and Page (p. 964; see the news story by Vogel) have found traces of the evolutionary history of sex chromosomes. They identified discrete "strata" along the length of the X chromosome that have different evolutionary ages, as measured by synonymous nucleotide substitutions. The oldest stratum was about 300 million years old, approximately the period when mammalian sex chromosomes first appeared. They hypothesize that a series of inversions on the Y chromosome during evolutionary history suppressed X-Y recombination in one region and created these defined regions.

TIMING VACCINATIONS

Mass vaccination has reduced the incidence of childhood infections in many countries. Vaccination campaigns are also associated with changes in the pattern and spatial synchrony of epidemics. Rohani *et al.* (p. 968) analyzed weekly incidence data for measles and whooping cough in England and Wales from 1944 to 1994, during which period vaccination campaigns led to changes in the dynamics of the diseases. Although vaccination disrupted pre-existing synchrony in measles epidemics, it had the opposite effect on whooping cough and induced synchrony where none previously existed. Models suggest that differences in the incubation periods underlies the different progress of the two infections. These results have implications for the timing of pulsed mass vaccination for whooping cough.

ARREST AND DRUG SEARCHES

Some compounds that cause the mitotic arrest of cells show antitumor activity in humans. Mayer *et al.* (p. 971; see the Perspective by Compton) have applied a cell-based visual screen to a library of small molecules and have identified a cell-permeable molecule that blocks normal bipolar mitotic spindle assembly in cultured cells. This molecule specifically inhibited the motor activity of the mitotic kinesin Eg5. Mitotic kinesins may therefore serve as potential targets for the development of anticancer drugs.

TECHNICAL COMMENT SUMMARIES

Mantle Recycling of Argon

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/286/5441/871a

Sarda *et al.* (Reports, 29 Jan., p. 666) found a correlation between the lead and argon (Ar) isotopic composition of oceanic basalts in the Atlantic Ocean. They argued that this correlation implied that some Ar was recycled into Earth's mantle at subduction zones. Such recycling would have implications for reconstructions of Earth's degassing history and volatile gas budget.

Burnard proposes instead that "most of the variation in Ar isotopic composition could be the result of shallow-level atmospheric contamination" of the basalts and is not an indication of recycling.

Sarda *et al.* respond that their analysis implies that "argon can possibly be recycled at...concentrations...of the same order of magnitude as the degassed part of the mantle."

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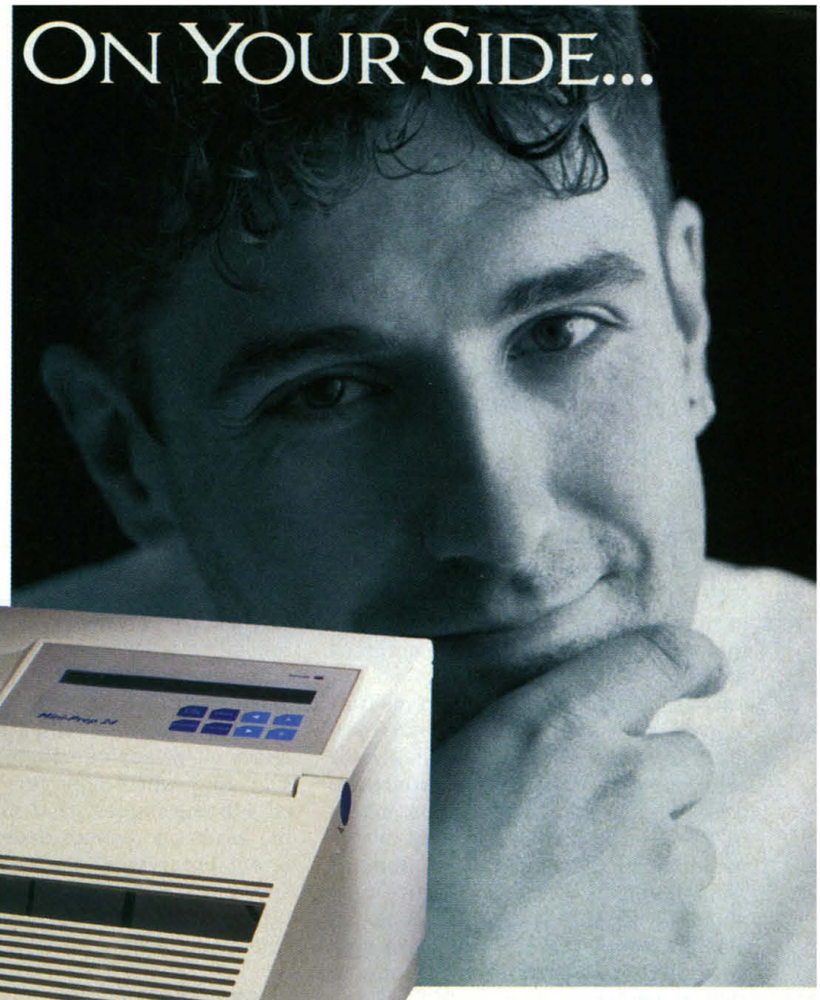

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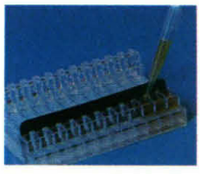

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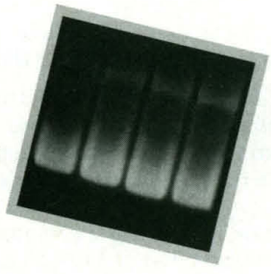

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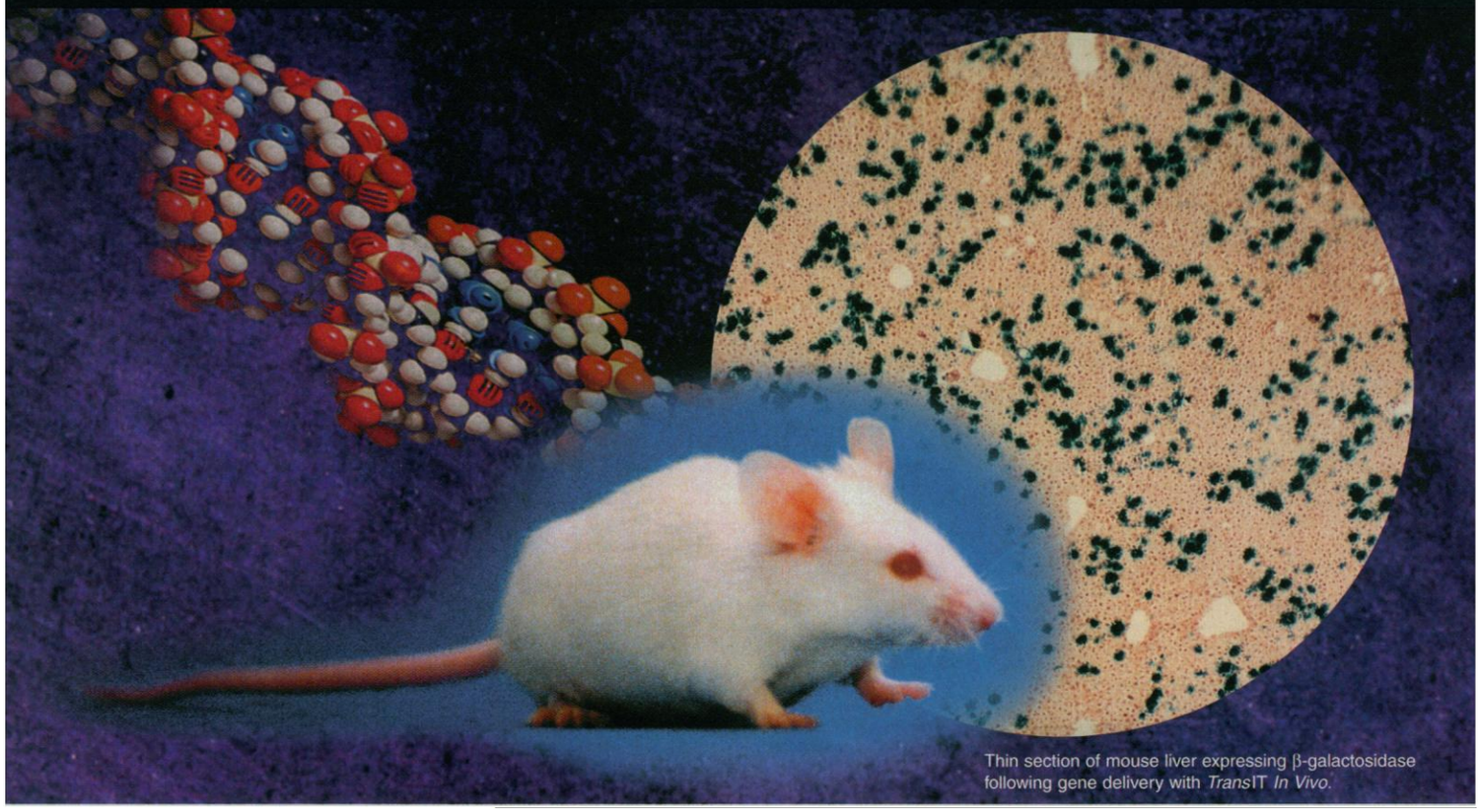

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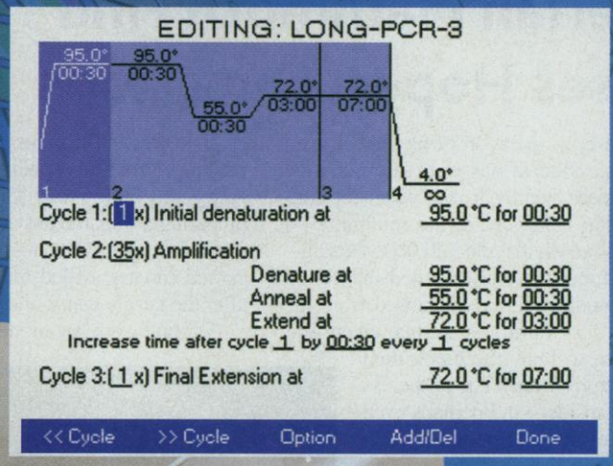

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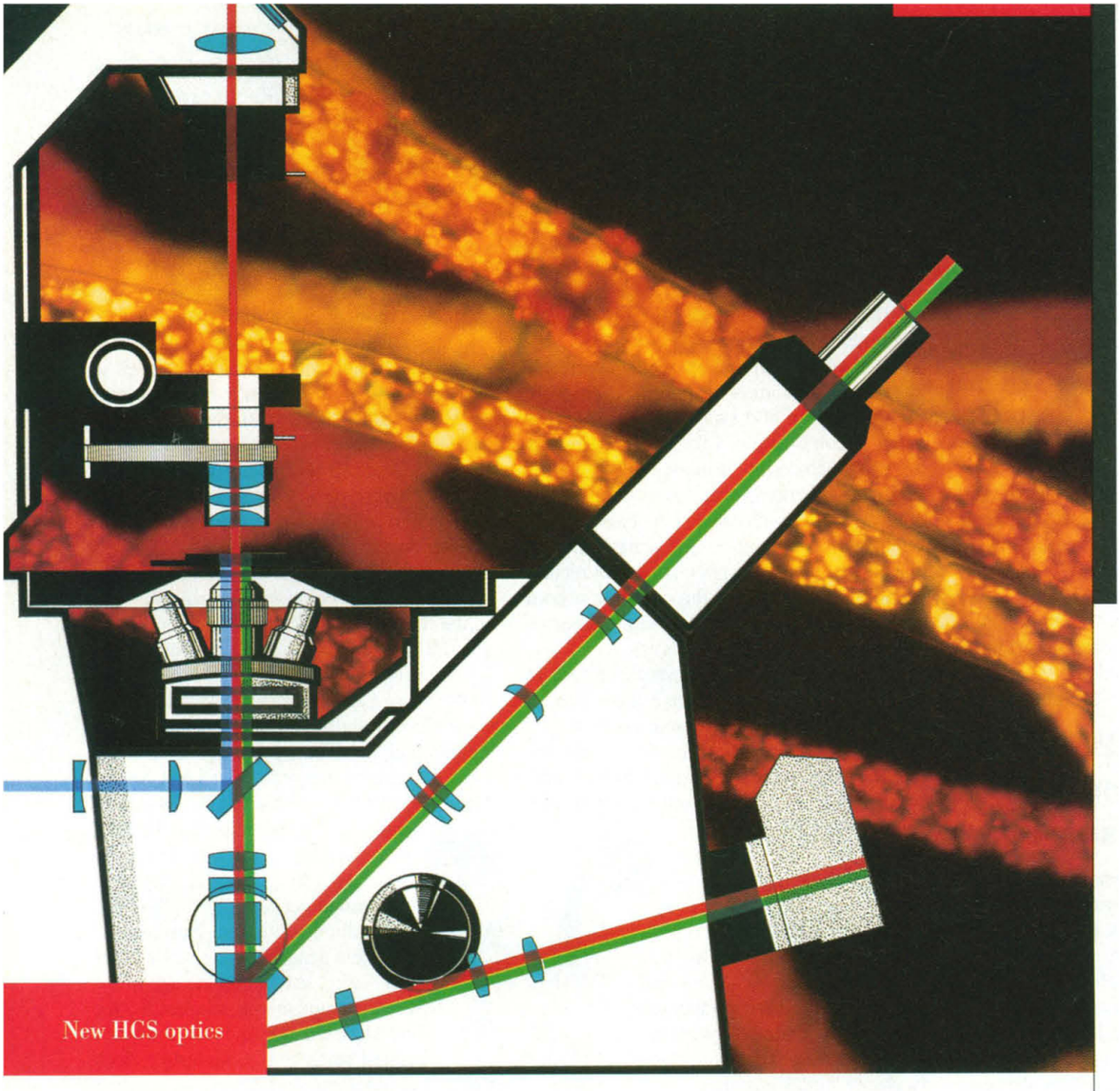

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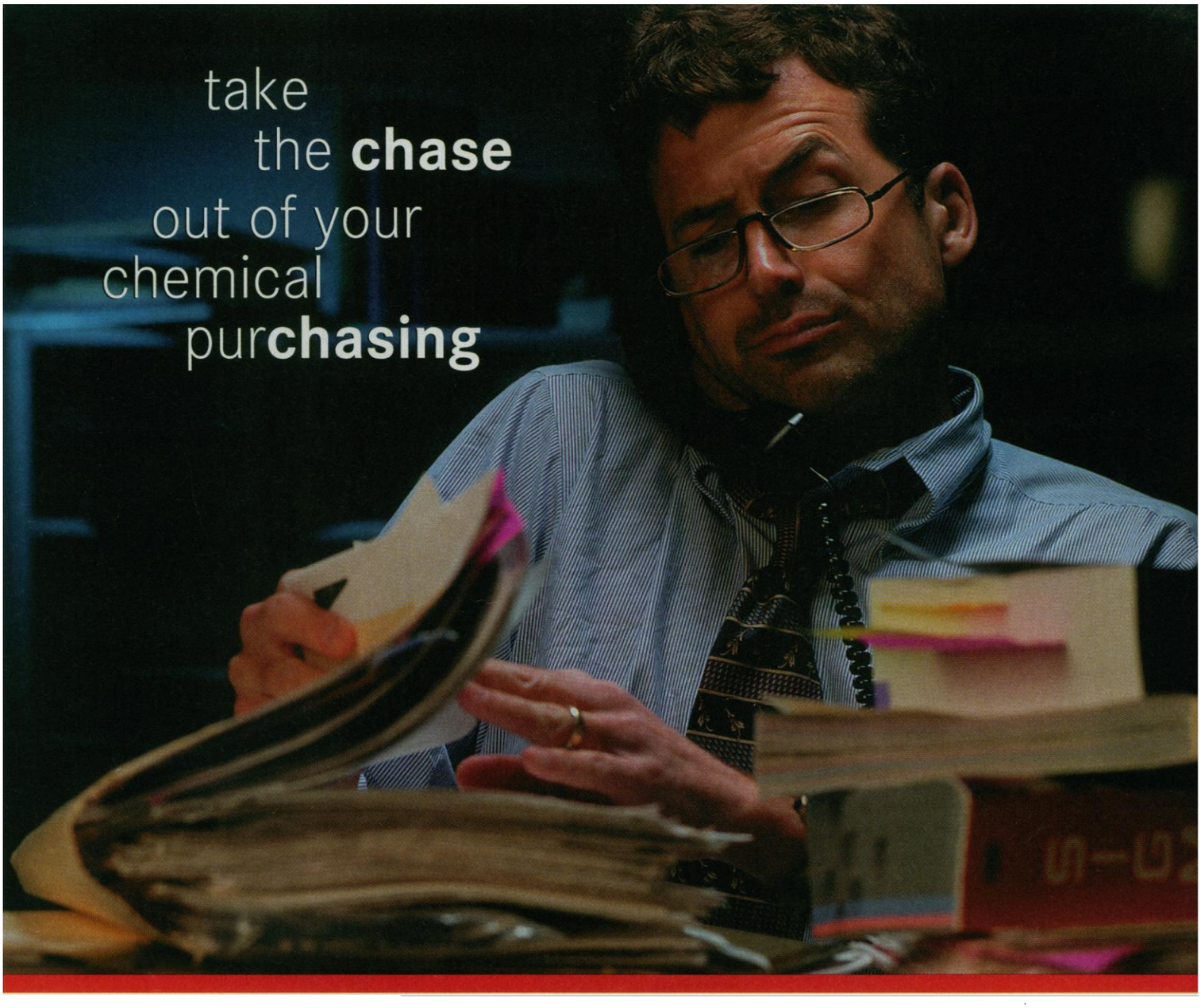

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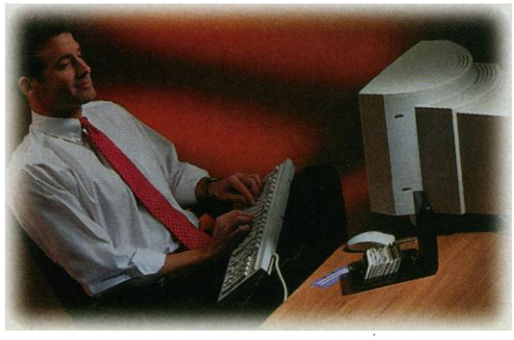

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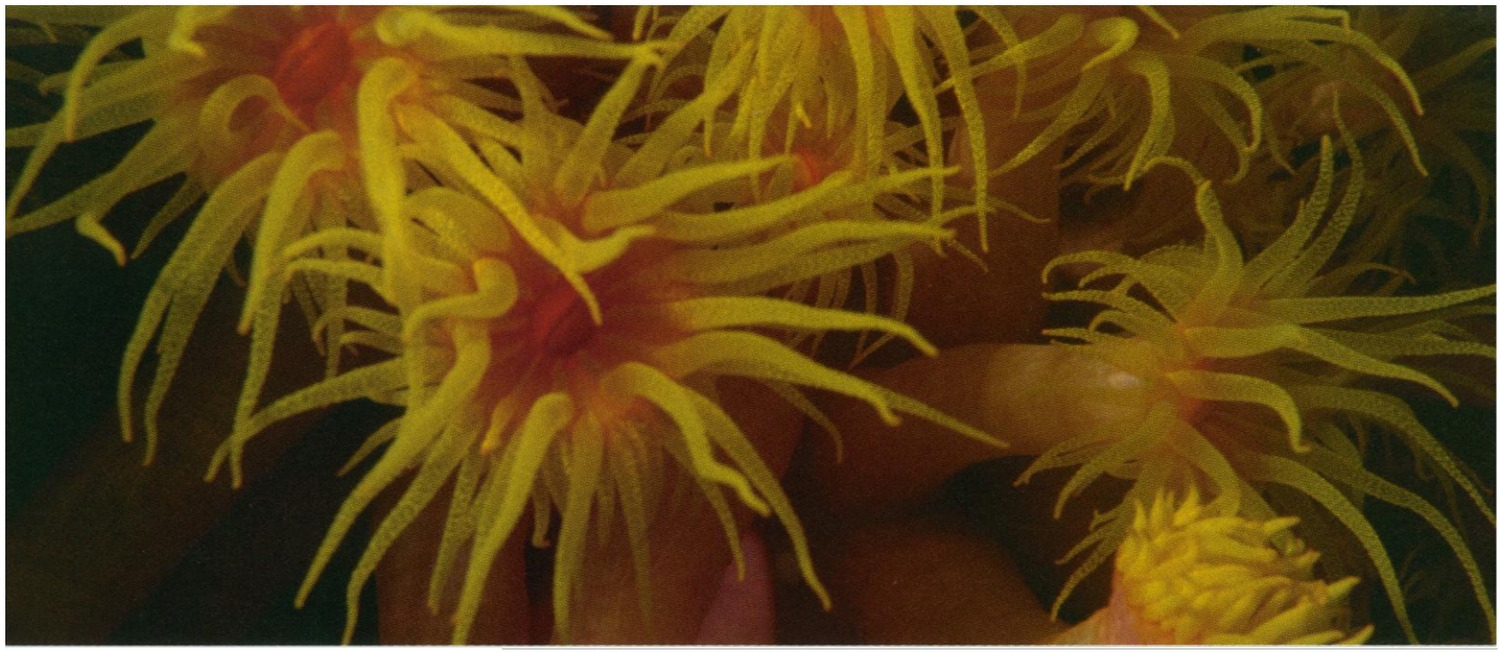

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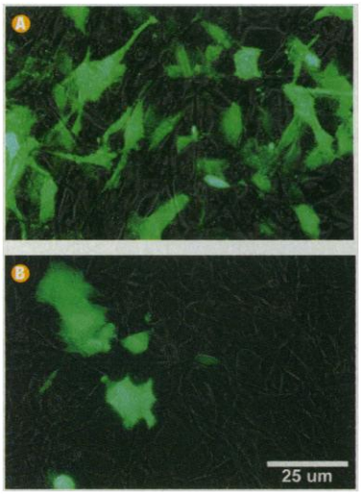

Expression of GFP in MC3T3-E1 cells, following transfection with vector phGFP-S65T using (A) FuGENE 6 Reagent or (B) leading supplier's liposomal transfection reagent (LF). *(Data courtesy of S. Ritter, Univ. of Texas, Houston, TX, USA)*

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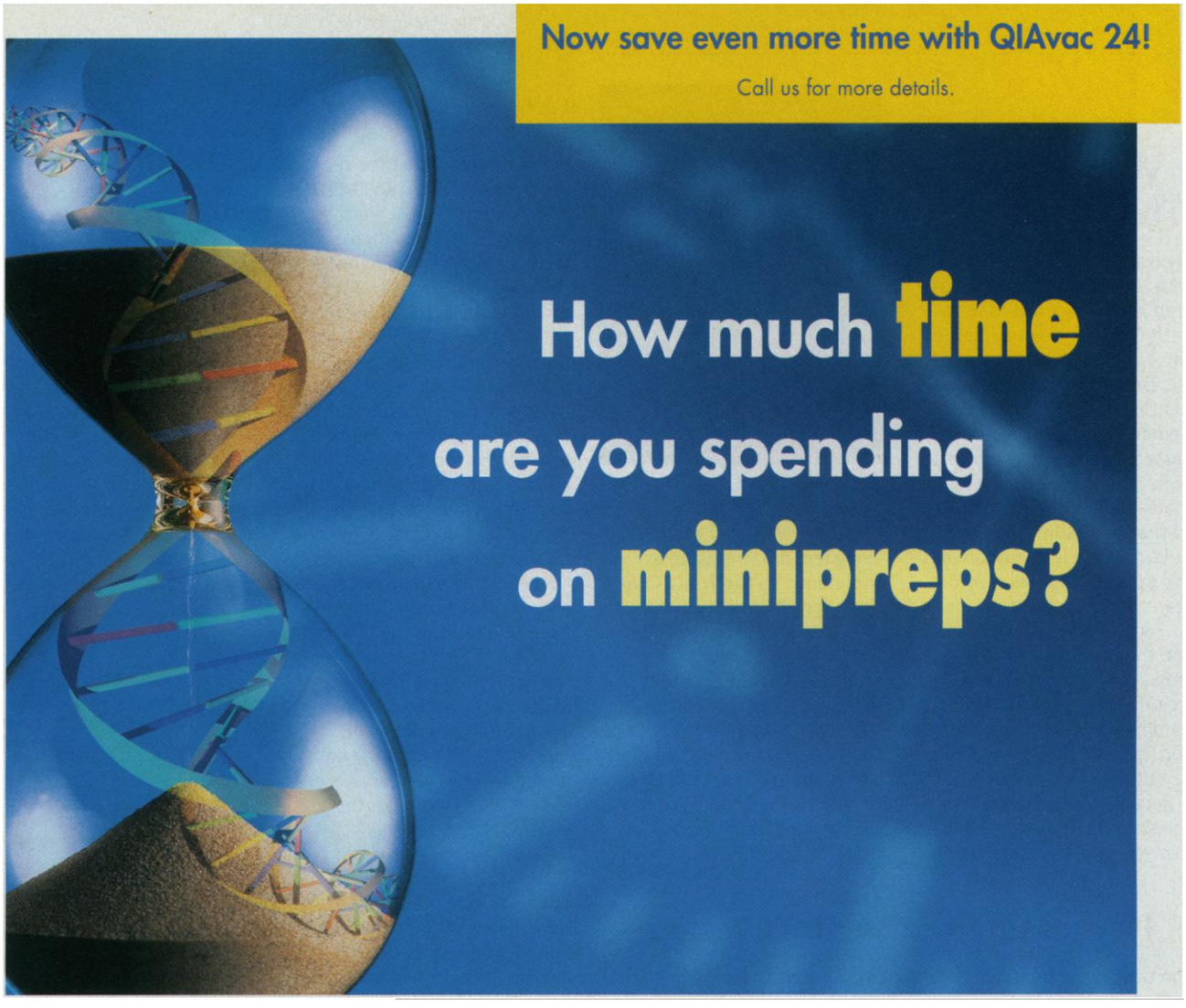

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Dr. Norrie Russell, President and CEO, Lynx Therapeutics inc.

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Dr. Hanno Langen, head of the Proteomics group at Hoffmann-La Roche, genetics department

"Proteomics is all-encompassing and all-absorbing. It brings together various disciplines and technologies that have been around for quite a time now. It is this convergence that is the great enabling factor. With Amersham Pharmacia Biotech focusing on this area, I look forward to user-friendly, fully integrated systems which offer the convenience and reproducibility that make serious research in Proteomics possible and will allow us to focus on what we researchers in drug discovery like doing best, identifying proteins of interest."

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Prof. Dr. Mathias Uhlén,
the Royal Institute of Technology, Stockholm
"Proteomics is the exciting and daunting challenge to explore protein function of all genes discovered through genome efforts using modern techniques, such as high-throughput chromatography, electrophoresis and mass spectrometry. The enabling tools for Proteomics research are today provided by Amersham Pharmacia Biotech. In the future, one can envision new technology platforms, such as protein 'chips' based on combinatorial libraries to allow massive parallel analysis of protein extracts using protein arrays. The future is function and thus the future is protein bioscience."

Prof. Dr. Angelika Görg,
Technical University, Munich
"The realization of the Immobiline™ concept for 2-D electrophoresis was our major concern. There is undeniably a great sense of achievement in seeing one's ideas develop and become widely accepted and used by the scientific community. With Amersham Pharmacia Biotech as a partner, scientists the world over can look forward to working at the forefront of Proteomics."

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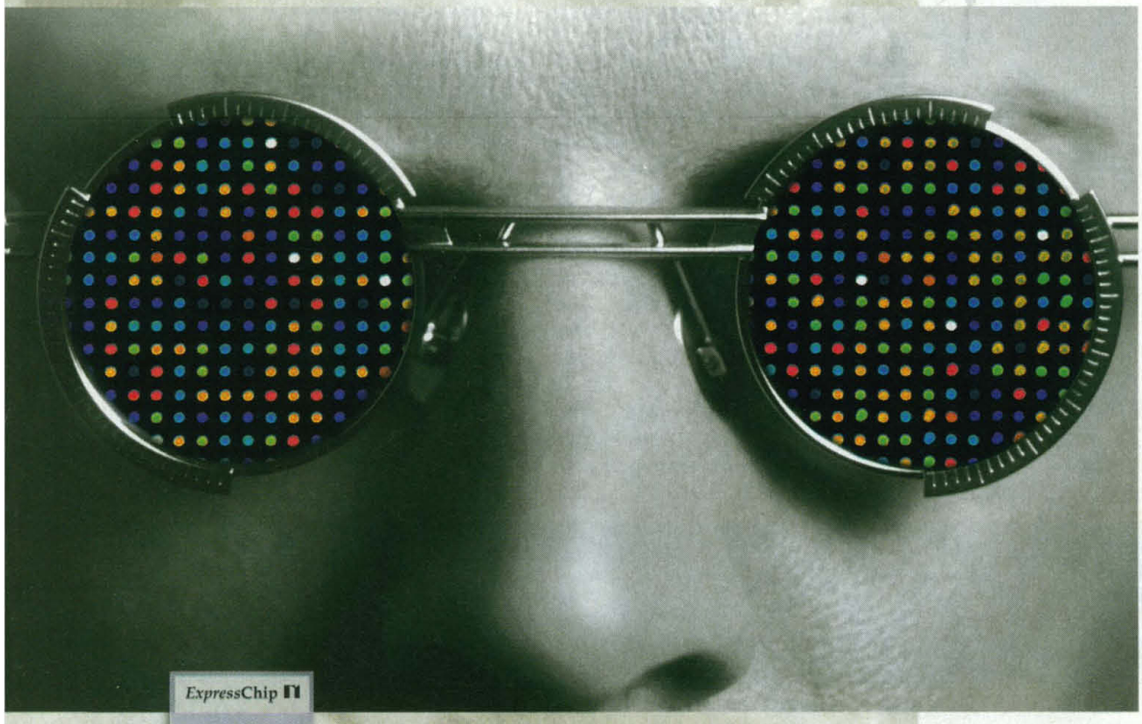

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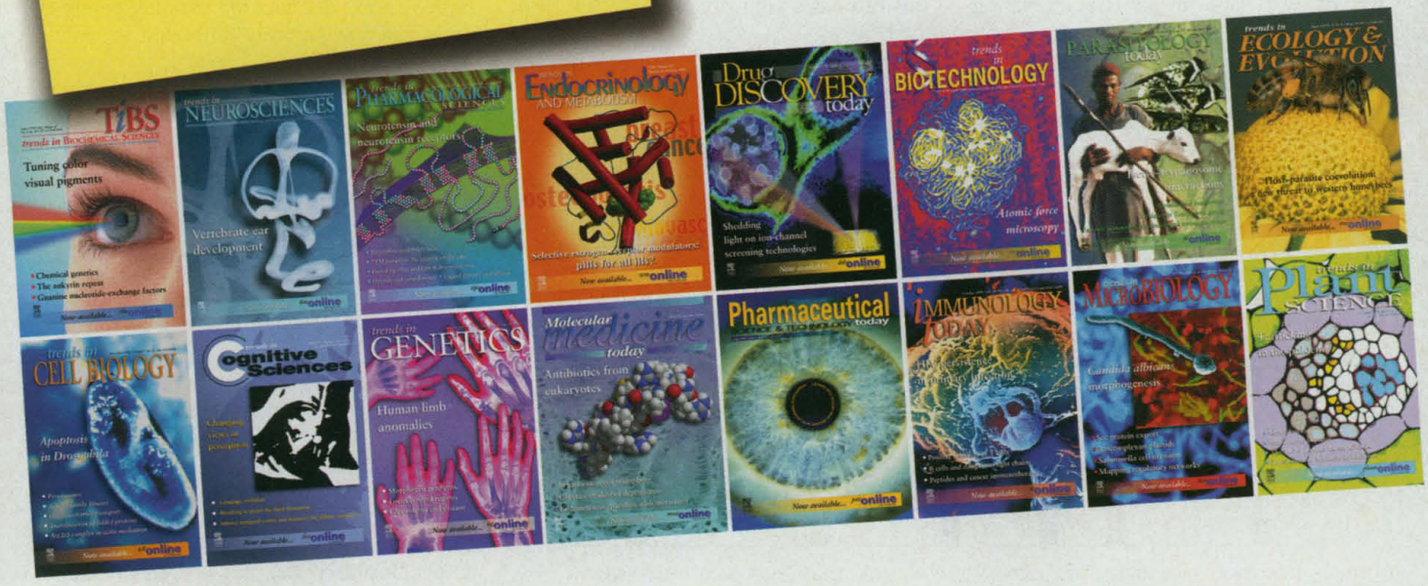

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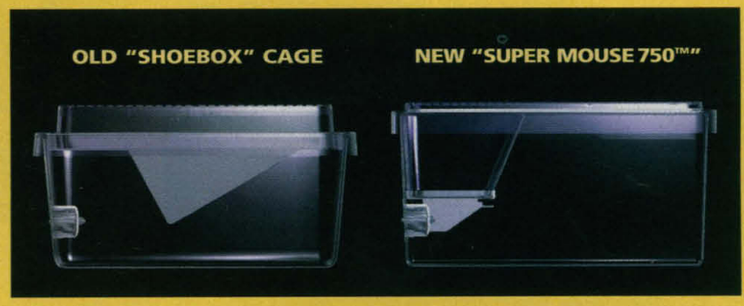

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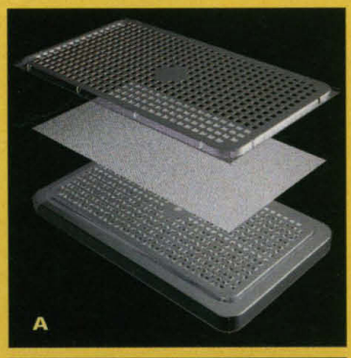

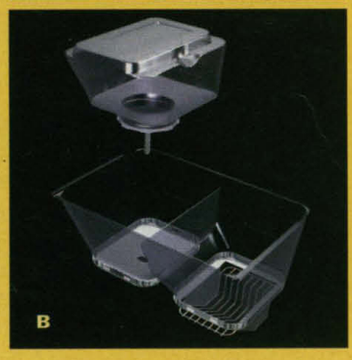

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*Guide for the Care and Use of Laboratory Animals, Institute of Laboratory Animal Resources, Commission on Life Sciences, National Research Council, National Academy Press, 1996.

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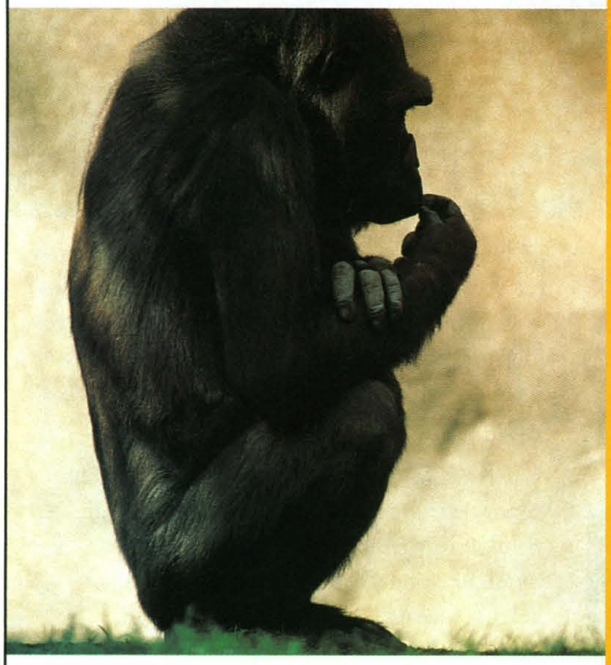

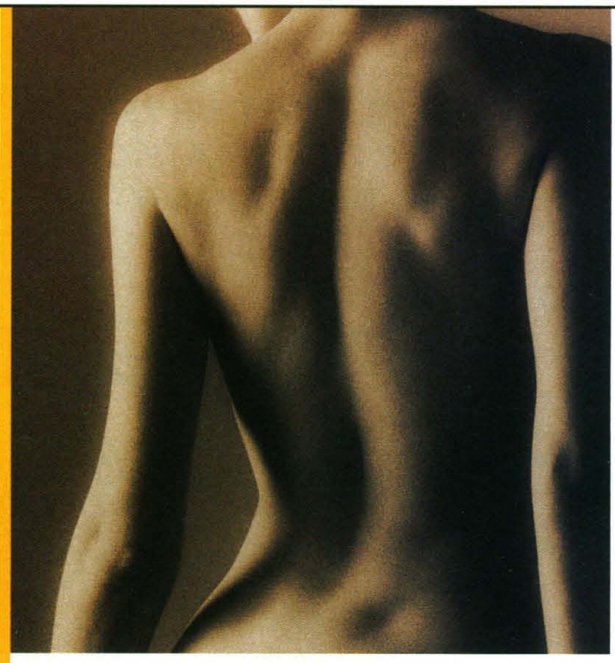

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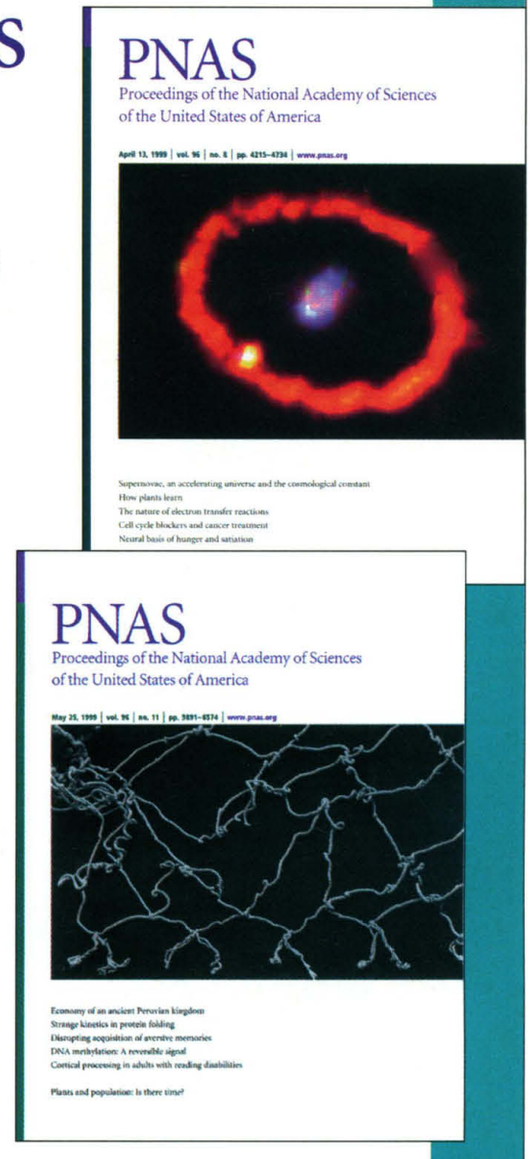

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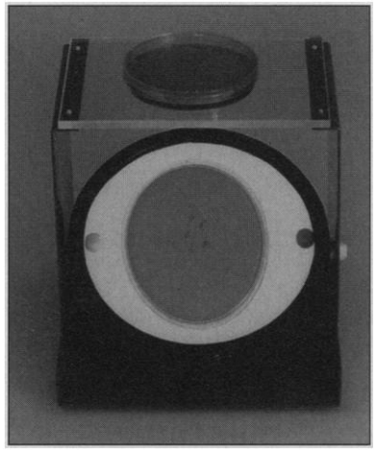

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