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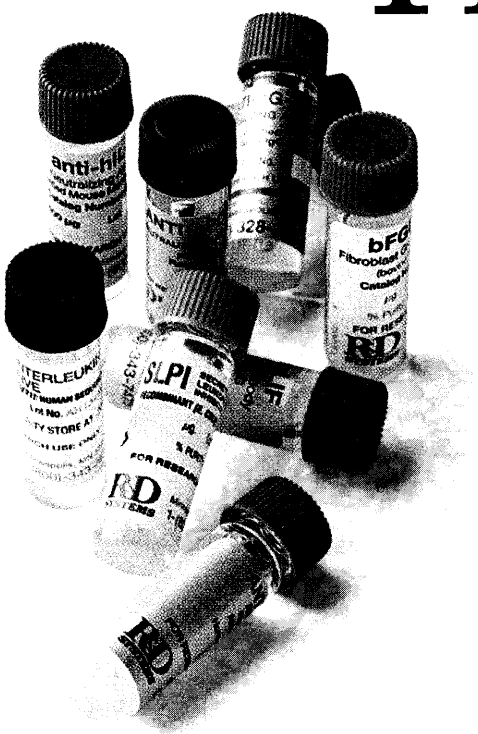

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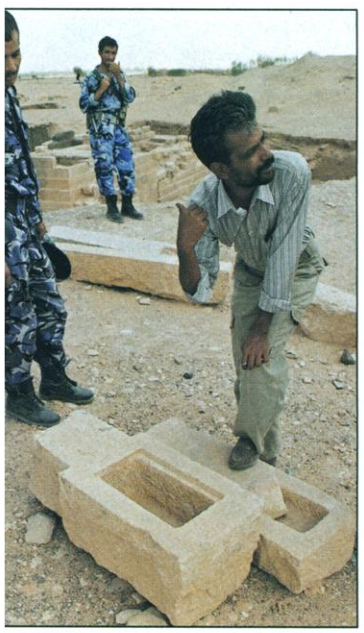
Volume 294 26 October 2001 Number 5543



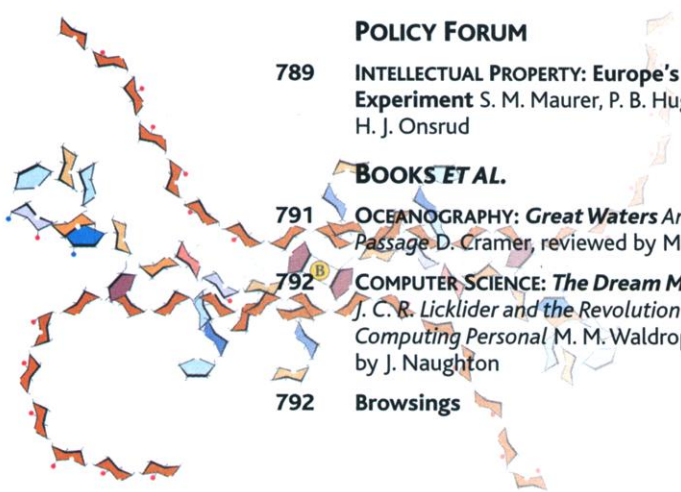
766
Science in the shadow of war

NEWS

759
Why Cipro?

SCIENCE'S COMPASS

795
Chain reaction



RESEARCH

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RESEARCH ARTICLES

REPORTS

COVER 882

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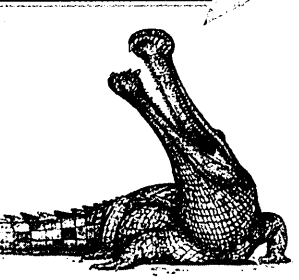
843

Diversity and productivity: The plots thicken

New on *Science* Express Giant dinosaur-eating crocodile



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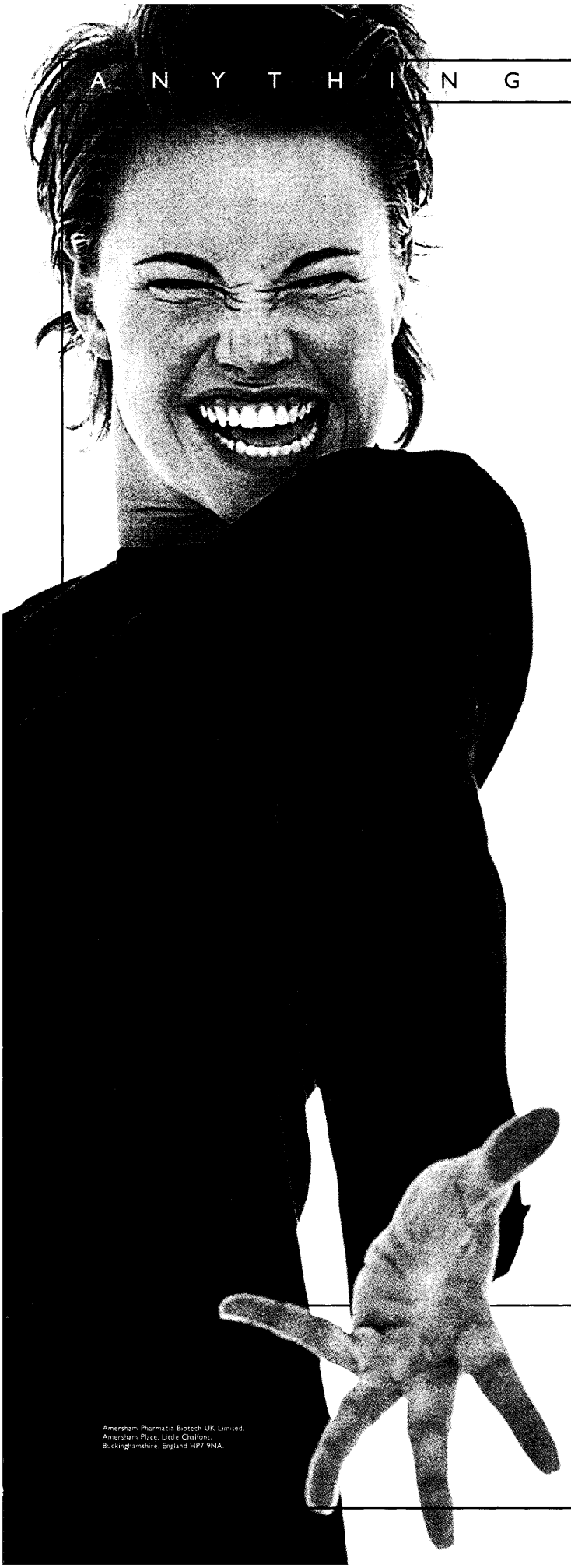

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The Giant Crocodyliform *Sarcosuchus* from the Cretaceous of Africa
P. C. Sereno, H. C. E. Larsson, C. A. Sidor, B. Gado

New fossils of the giant *Sarcosuchus imperator* show that, unlike other giant crocs, it inhabited rivers and had a diverse diet that included dinosaurs.

Identification of Ubiquitin Ligases Required for Skeletal Muscle Atrophy S. C. Bodine *et al.*

Analysis of rodent models has revealed two ubiquitin ligases that likely play key roles in the muscle wasting that accompanies illness and aging.

Predictability of the UK Variant Creutzfeldt-Jakob Disease Epidemic J. N. Huillard d'Aignaux, S. N. Cousens, P. G. Smith
770 New predictions for the vCJD epidemic in the UK suggest it will peak at a few hundred cases.

γ-Secretase Cleavage and Nuclear Localization of ErbB-4 Receptor Tyrosine Kinase C.-Y. Ni, M. P. Murphy, T. E. Golde, G. Carpenter

Nuclear localization of the intracellular domain of the receptor tyrosine kinase ErbB-4 is facilitated by the enzymatic action of presenilin-dependent gamma-secretase.

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career resources for scientists

UK: Will Devolution Deliver for Scotland's Contract Researchers? A. Neil

A member of the Scottish parliament, and a champion of the cause of Scotland's academic contract researcher, explains why he believes that the time for action is now.

Europe: From Dutch Pyramid into Babel's Tower? R. Tan and M. Meijer

On the Eurodoc Exchange, we hear from Ph.D. students in The Netherlands concerned about the lack of communication between senior and junior scientists.

Canada: Patent Agency Careers in Canada—A Well-Kept Secret K. Marsman

Our author discusses what it takes to become a Canadian patent agent, her path to job satisfaction, and the ins and outs of a patent agency.

US: The NAGPS Survey—What *Do* America's Grad Students Think of Their Programs? R. Weibl

The data are in, the analyses are complete . . . but what do they say about the state of U. S. graduate education?

US: Jumping Off the Academic Bandwagon, Part 1—An Agonizing Decision H. Sawyer

It took a long time and a lot of thought before the author realized that academia was not for her.

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science of aging knowledge environment

Classic Paper: Pleiotropy, Natural Selection, and the Evolution of Senescence G. C. Williams

How natural selection frequently maximizes vigor in youth at the expense of vigor at older ages.

Noteworthy This Week: Faustian Bargain R. J. Davenport

Cellular senescence at first prevents, later promotes cancer.

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signal transduction knowledge environment

Perspective: Signaling By Fibroblast Growth Factors—The Inside Story M. Goldfarb

The intracellular actions of FGF and FGF-like proteins.

Perspective: Signaling Pathways Regulating Golgi Structure and Function C. Preisinger and F. A. Barr

What are the signals for Golgi disassembly during mitosis?

Connections Map: The Jasmonate Biochemical Pathway
Pathway Authorities: E. E. Farmer and R. Liechti

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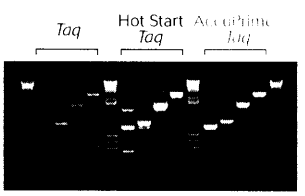

Comparison of PCR specificity with various *Taq* Polymerases.

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THIS WEEK IN Science

edited by Phil Szuromi

Chemical Waves That Spiral In

Spiral waves in reaction-diffusion systems, seen initially in the Belousov-Zhabotinsky (BZ) reaction, also occur in surface reactions and in many biological systems, such as Ca^{2+} release in cells. To date, all of the spirals propagate outward from the center. Vanag and Epstein (p. 835) show that when the BZ reaction is run in water droplets dispersed in a water-in-oil emulsion, the spirals can run backward and propagate inward. Spirals propagated inward when a critical droplet fraction of the microemulsion was exceeded.

High Seas

Sea level is rising, but how quickly and why? Tide gauge records indicate that sea level has been rising at 1 to 2 millimeters per year (mm/yr) for the past 100 years. However, the Intergovernmental Program on Climate Change's evaluation of expected climate- and human-related impacts suggests that this value should be closer to 0.7 mm/yr. Cabanes *et al.* (p. 840; see the Perspective by Church) report the results of satellite measurements of sea level between 1993 and 1998 that show an average rate of more than 3 mm/yr. They calculate that most of this rise is due to thermal expansion of the oceans, and that the residual amount, presumably due to global warming, is about 0.7 mm/yr. Estimates based solely on tide gauge values might overestimate the rate of sea level rise by a factor of 2.

The Universal Quantum Hall Effect?

One of the pursuits of theoretical physics is the unification of the three pillars of modern physics—quantum mechanics, special relativity, and general relativity. Unification of the first two principles has been done successfully with the development of relativistic quantum field theory, but unifying gravity and quantum mechanics has remained elusive. An ideal solution would be finding a quantum-mechanical wave function, or Hamiltonian, of a system from which relativity emerges. Zhang and Hu (p. 823) have taken the quantum Hall effect, a many-body effect involving electrons confined to a two-dimensional (2D) plane in a magnetic field, and generalized the mathematical description to a 4D space plus time. Upon examination of the low-energy states on the surface of this space, they find that certain elements of electromagnetism and gravity emerge from the mathematics. By no means a grand unification theory, the work does suggest that the symmetry properties of other systems may provide a route for further study.

843

Teamwork in Plants

Are ecosystems with more plant species more productive? Debate has centered on whether productivity effects attributed to diversity were "sampling effects," sometimes interpreted as experimental artifacts, or as "niche complementarity," which is evidence for positive effects of diversity on productivity. Tilman *et al.* (p. 843) present the results of a 7-year field experiment in a Minnesota grassland system which show that sampling effects explained much of what happened during years 1 to 3 and that niche complementarity took over in years 5 to 7. High-diversity communities can be markedly more productive than the best-performing monoculture. The results have implications for the likely effects of biodiversity loss on ecosystem function, and hence for applied habitat management and conservation.

And in Brevia ...

An analysis by Sagarin and Micheli (p. 811) of the data set provided by the Nenana Ice Classic betting competition in Alaska, where the moment that a wooden tripod falls through river ice in the spring is guessed, indicates that the ice now breaks up on average 5.5 days earlier than it did 84 years ago, when the competition started.

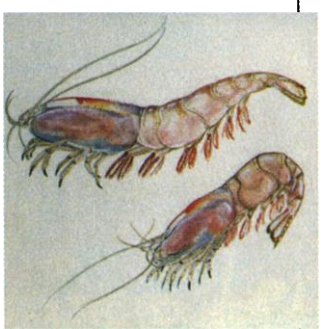
A study of 3352 men and women in the Ivory Coast by Levine *et al.* (p. 812) reveals that women work on average 2.75 hours longer than men, yet sleep for the same period of time, indicating that women spend less time at leisure and nonwork-related travel than men.

Toward Rational C_{60} Synthesis

Although the vaporization of graphite to form C_{60} and C_{70} produces these compounds in quantity, it has been difficult to produce higher fullerenes by this route. An initial step toward the rational synthesis of higher fullerenes would be to accomplish this goal with C_{60} itself. Boorum *et al.* (p. 828) report the synthesis in nine steps of polycyclic aromatic hydrocarbon (PAH) precursor, $C_{60}H_{30}$, that loses hydrogen under laser irradiation to form C_{60}. Control experiments with labeled compounds and larger and smaller PAHs confirm that the remaining bonds form directly during dehydrogenation and that the parent PAH does not merely fragment and recombine.

Vent Fauna of the Indian Ocean

Hydrothermal vents on mid-ocean ridges support a surprisingly diverse fauna of chemosynthetic organisms. Although some sparse sampling has been performed on the Pacific and Atlantic sea floor, little is known about the fauna from the Indian Ocean. Van Dover *et al.* (p. 818) sampled and analyzed fauna from two hydrothermal vents, the Kairei and Edmond, along the Central Indian Ridge. They found a potentially new family of scaly-foot gastropods, faunal affinities with some of the western Pacific vent fauna, the absence of some major Pacific fauna (such as tubeworms), and a dominant shrimp species that has only evolved in the past 500,000 years that has affinities to Atlantic vent shrimp. The Indian Ocean fauna from these two vents represent a new biogeographic province with affinities



CONTINUED ON PAGE 743

CREDITS: (TOP TO BOTTOM) SAGARIN AND MICHELI; VAN DOVER *ET AL.*

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to, and differences from, other oceanic ridge provinces that are thousands of kilometers away, but that are still in evolutionary communication over geologic time scales.

Predicting Foot-and-Mouth Outcomes

The current foot-and-mouth epidemic in the United Kingdom has devastated the livestock industry there and has had substantial consequences both for farming and other sectors of the economy. Keeling *et al.* (p. 813; see the 5 October news story by Enserink) modeled the dynamics of the epidemic using an individual farm-based spatial model to study its spread. The spatial detail of the epidemiological data is much finer than for most other diseases and allows the exploration of the dynamics of disease at much greater resolution than is normally possible with livestock diseases. This aspect of the model will permit improved prediction of the likely course of the epidemic under various scenarios of disease control.

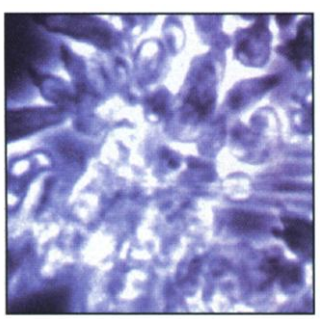
Boron, Pectins, and Plant Cell Walls

Plant cell walls are complex mixtures of complex carbohydrates as well as multiple other components. As the plant grows and develops, its cell walls must be altered in order to accommodate changes in cell shapes. O'Neill *et al.* (p. 846; see the Perspective by Höfte) now show, through biochemical analysis and study of mutant versions of *Arabidopsis*, that disruptions in the structure of rhamnogalacturonan pectins and their borate-mediated dimerization in the cell wall have striking effects on the plant's growth. Thus, the pectins, as well as the better understood cellulose fibrils, are both critical to cell wall function.

Tiny RNA World Discovered

Two small temporal RNAs (stRNAs), let-7 and lin-4, play an important role in the development of the nematode *Caenorhabditis elegans*. Let-7 is also highly conserved throughout bilateral animals, including *Drosophila* and humans. Are there other small regulatory RNAs? Three reports by Lagos-Quintana *et al.* (p. 853), Lau *et al.* (p. 858), and Lee *et al.* (p. 862) indicate that there are a very large number (>60) of these tiny ~22-nucleotide microRNAs (miRNAs)and that they have molecular characteristics similar to the two known stRNAs. The miRNAs are developmentally and tissue-specifically expressed and are conserved between different organisms. Some of the RNAs are organized in an operon-like fashion and may be processed from a single precursor. In a Perspective, Ruvkun calls the RNAs the "biological equivalent of dark matter" and suggests that they may provide a potent means for regulating gene expression.

A Sense of Direction



CREDIT: UEDA *ET AL.*

Intracellular signaling events that regulate chemotaxis are thought to be restricted to the edge of the cell that faces the highest concentration of attractant. However, a chemotactic *Dictyostelium* amoeba displays a constant and uniform surface distribution of its chemotactic receptors. Ueda *et al.* (p. 864) have used single-molecule imaging on live *Dictyostelium* cells to determine that the ligand binding kinetics of chemotactic receptors at the leading edge is different from other locations on the cell surface. Thus, the mechanism for directional sensing relies on differences in the signaling state of the receptors.

Genetic Response to a Pathogen

Different classes of pathogens infect and propagate themselves within their hosts by highly diverse means. Specialized dendritic cells (DCs) encode pathogen-specific molecular patterns and then direct the most appropriate immune response. Huang *et al.* (p. 870; see the Perspective by Modlin and Bloom) scrutinized genes expressed by DCs in response to viruses, bacteria, and fungi using microarray analysis. Along with a central cohort of genes that were expressed regardless of the pathogen encountered, large nonoverlapping sets of genes were also induced, which suggests that highly tailored programs of expression occur.

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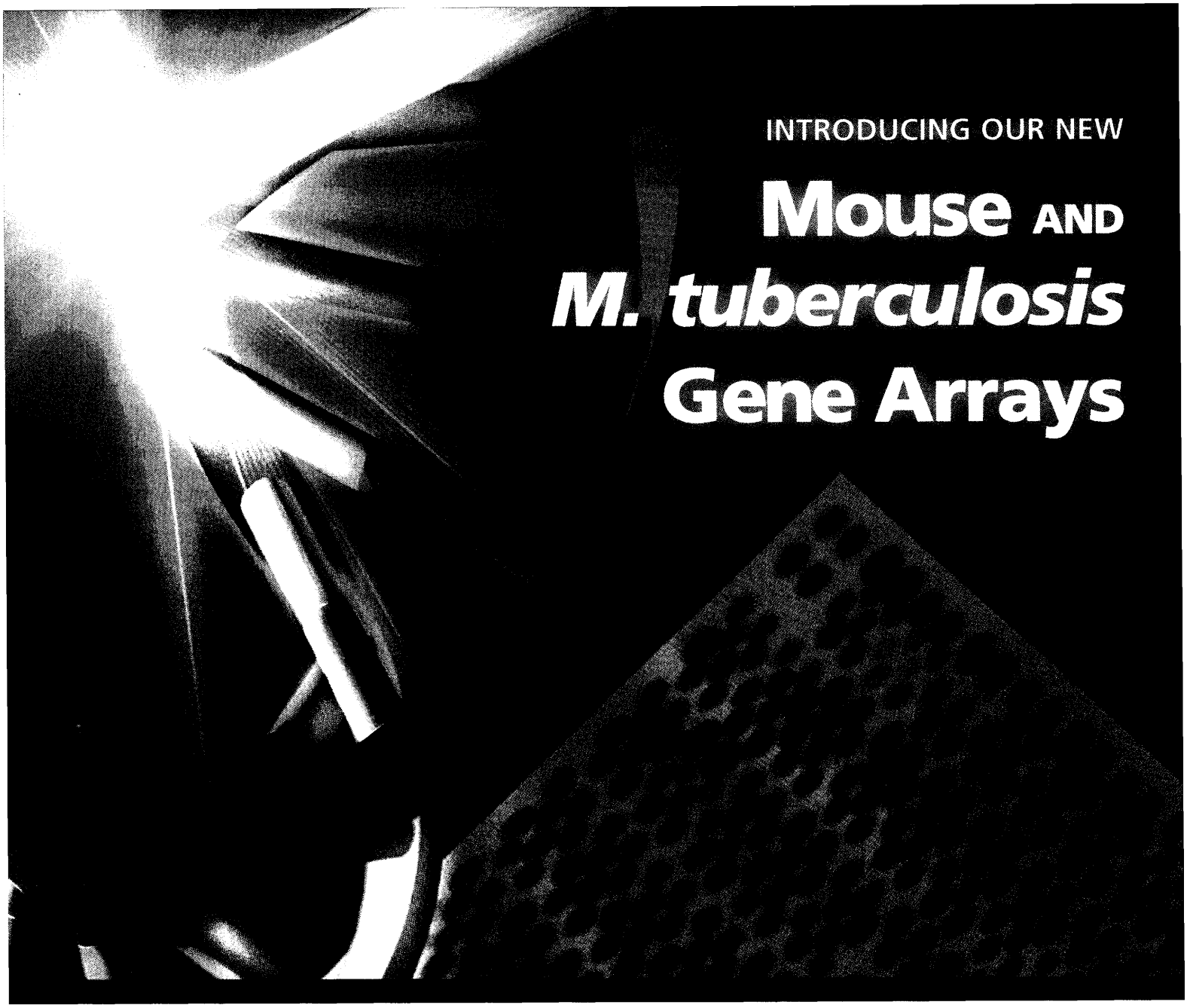

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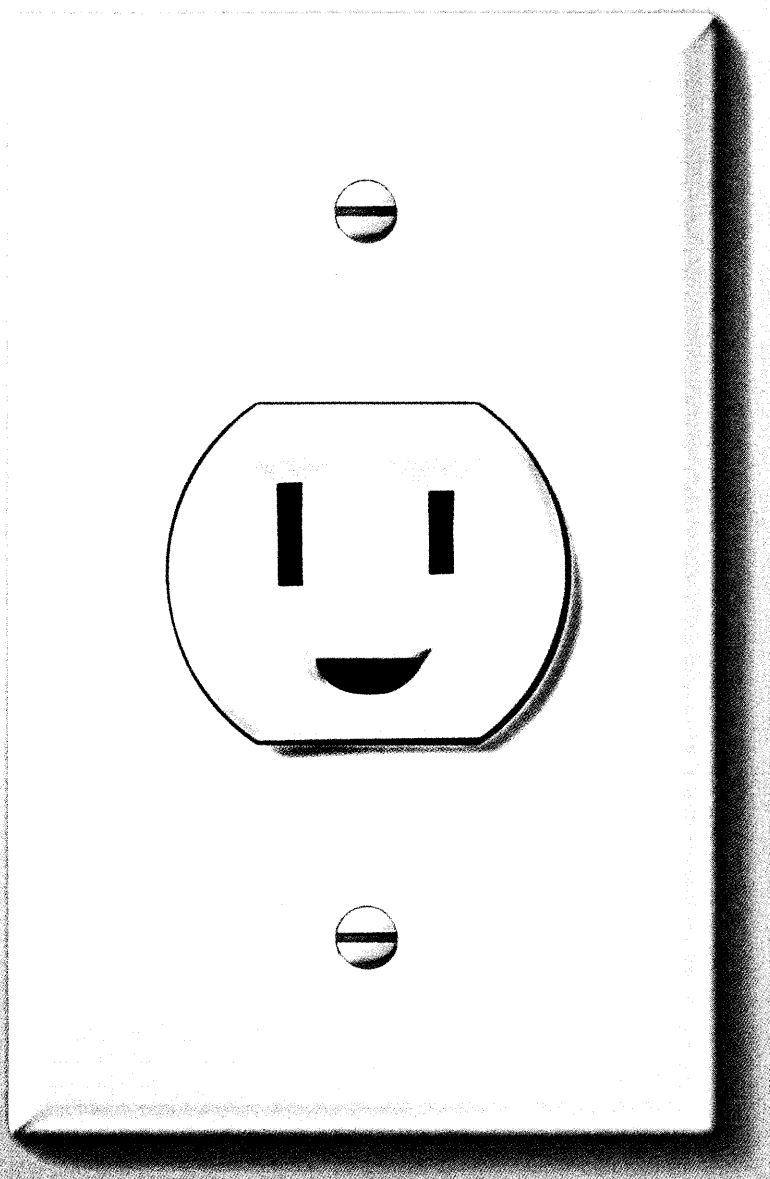

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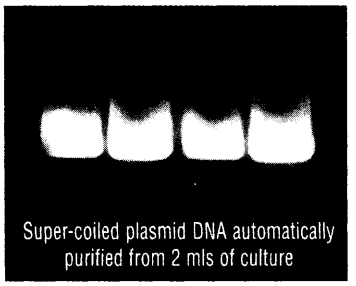

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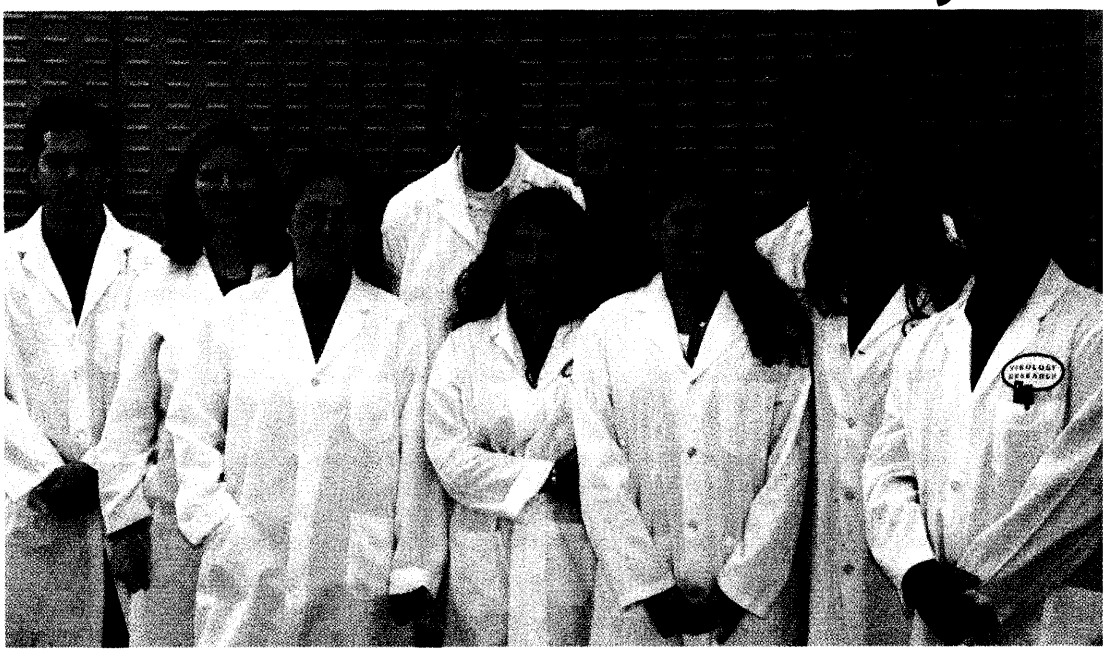

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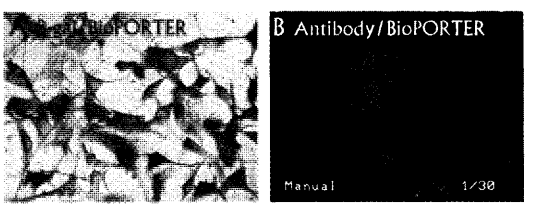

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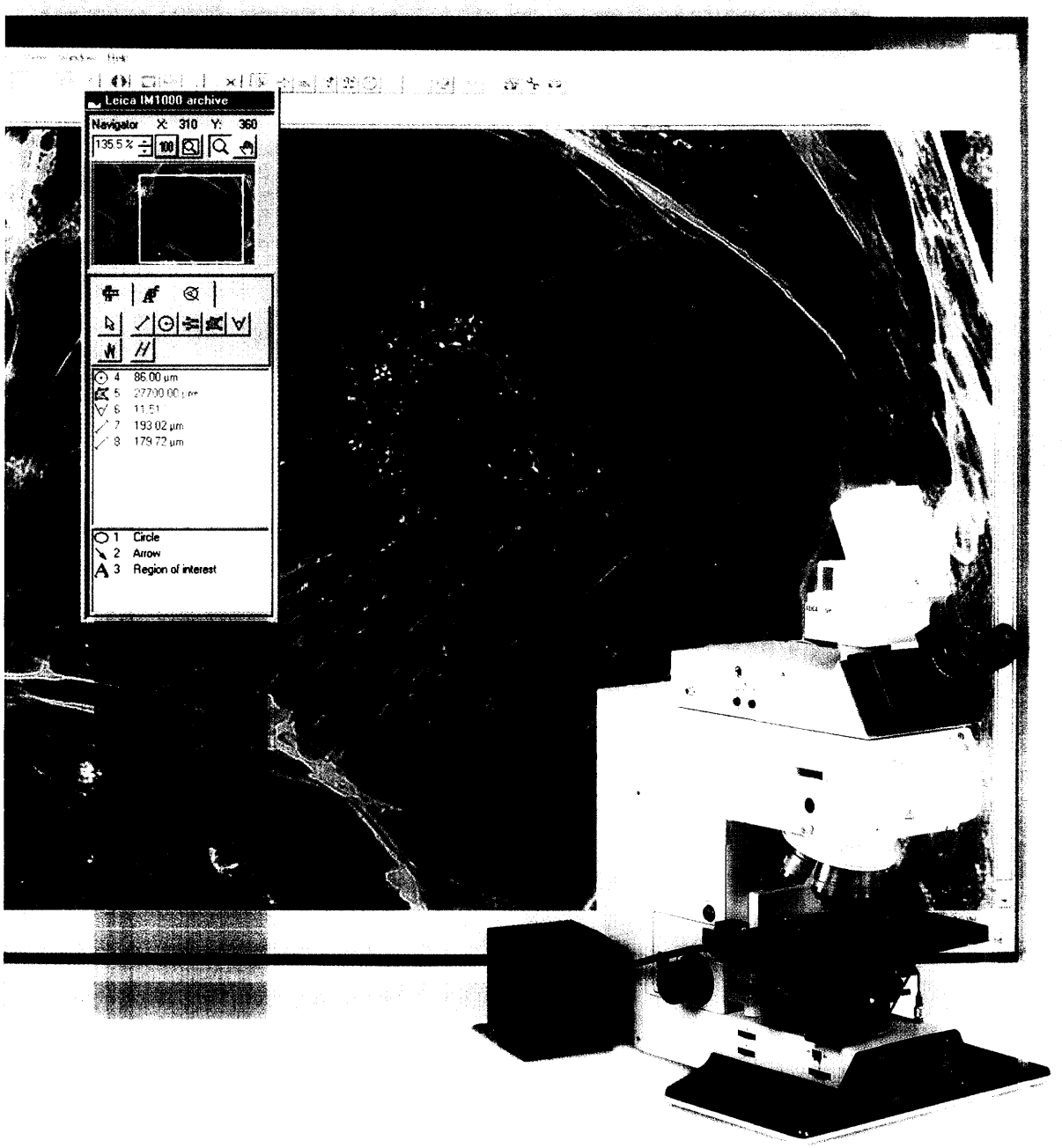

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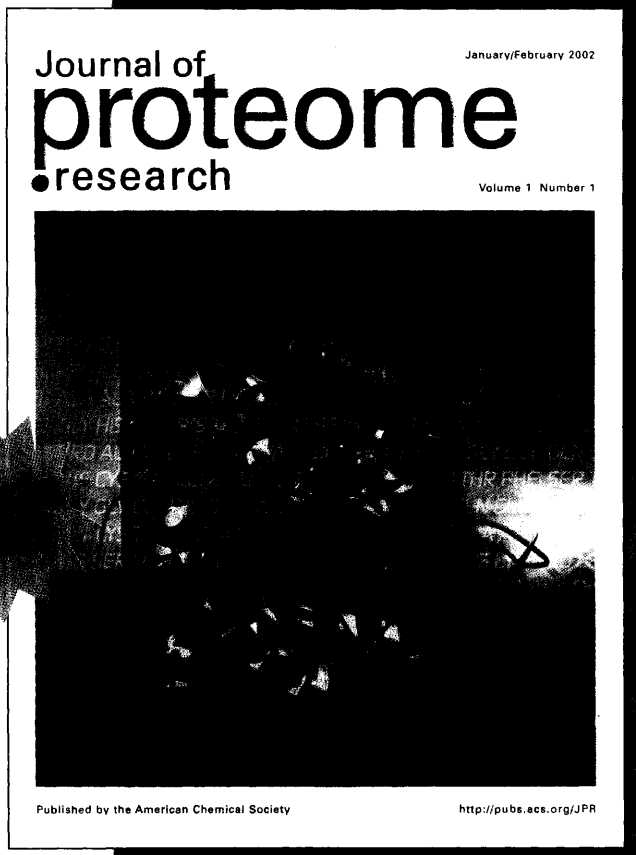

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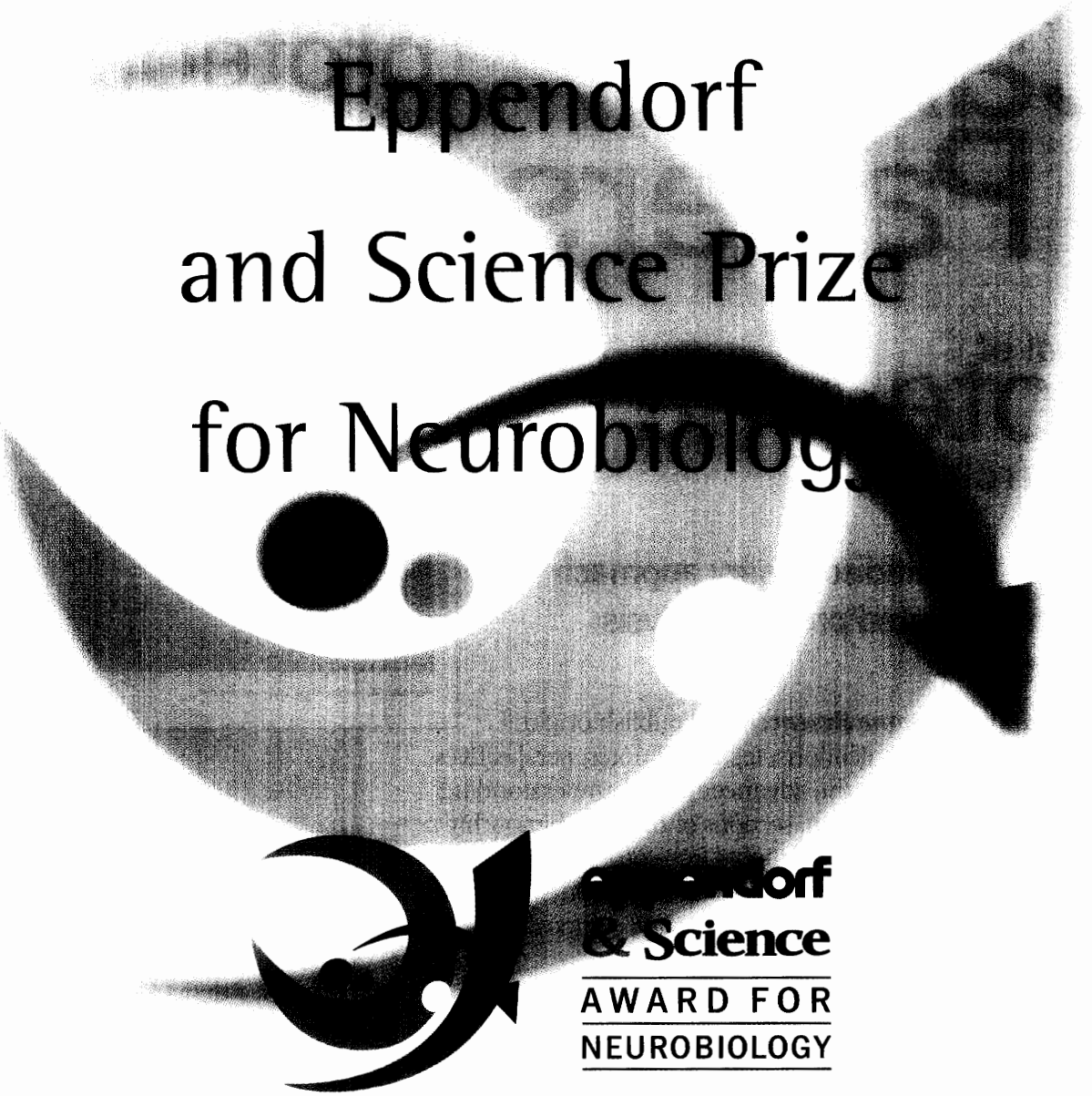

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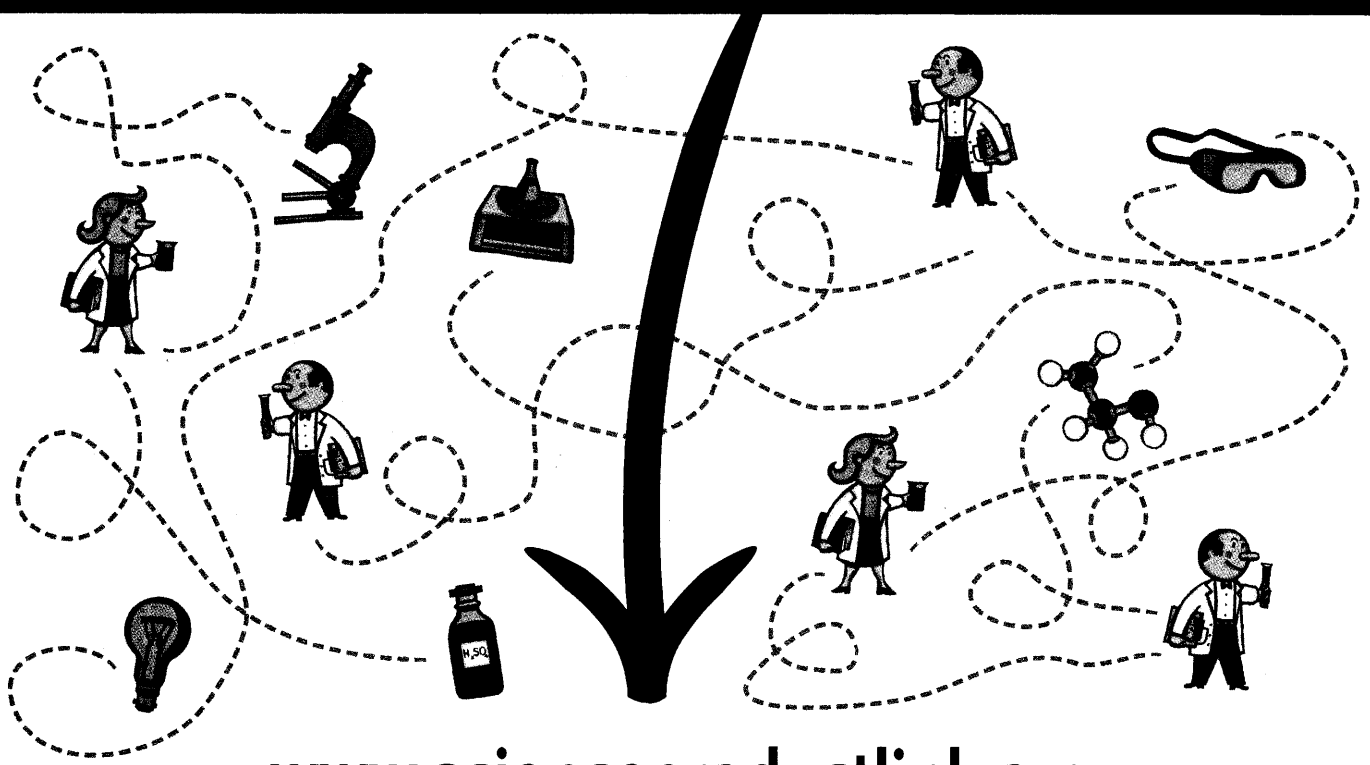

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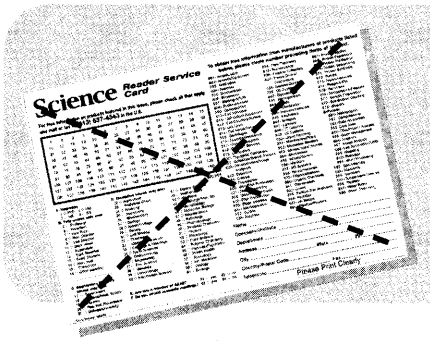

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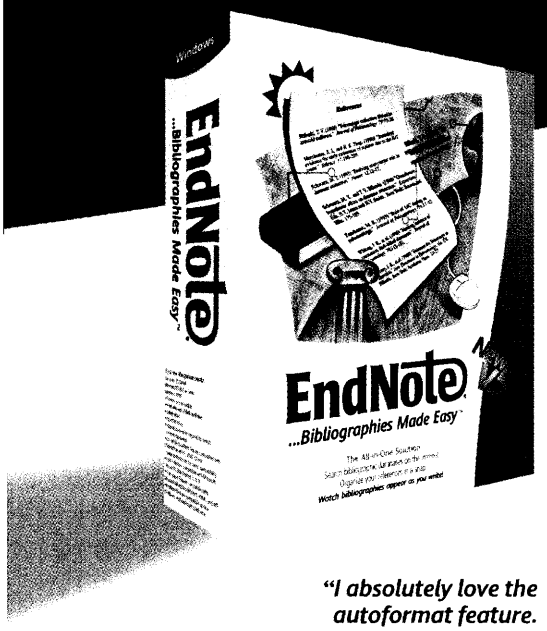

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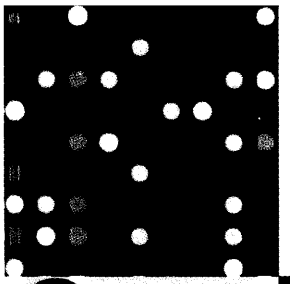

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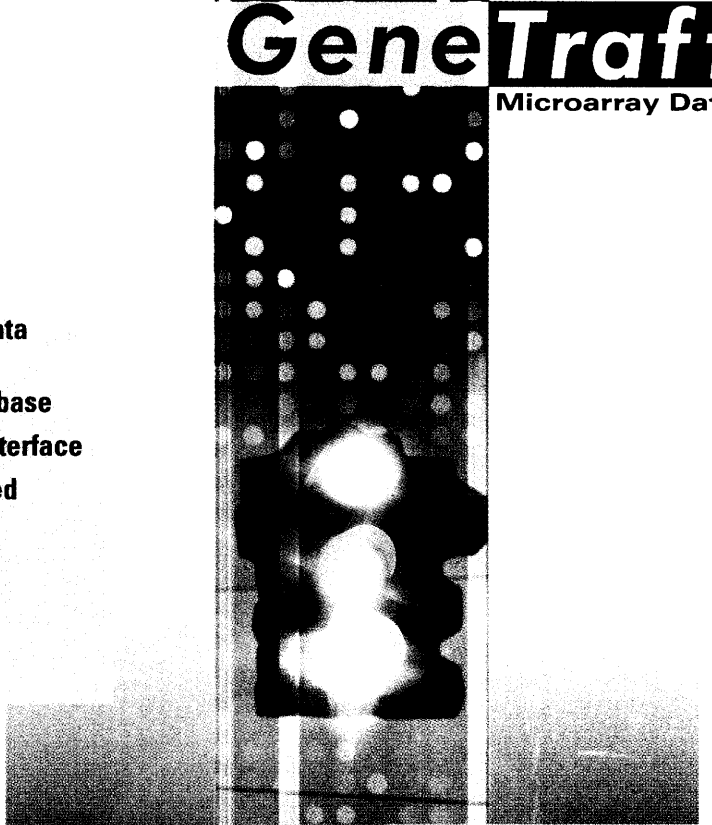

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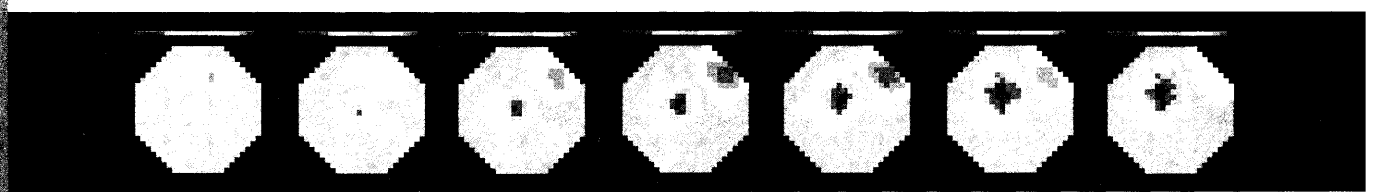

Propagating population wave in turtle visual cortex. J. Prechtl, L.B. Cohen, and D. Kleinfeld (NeuroPlex II).

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