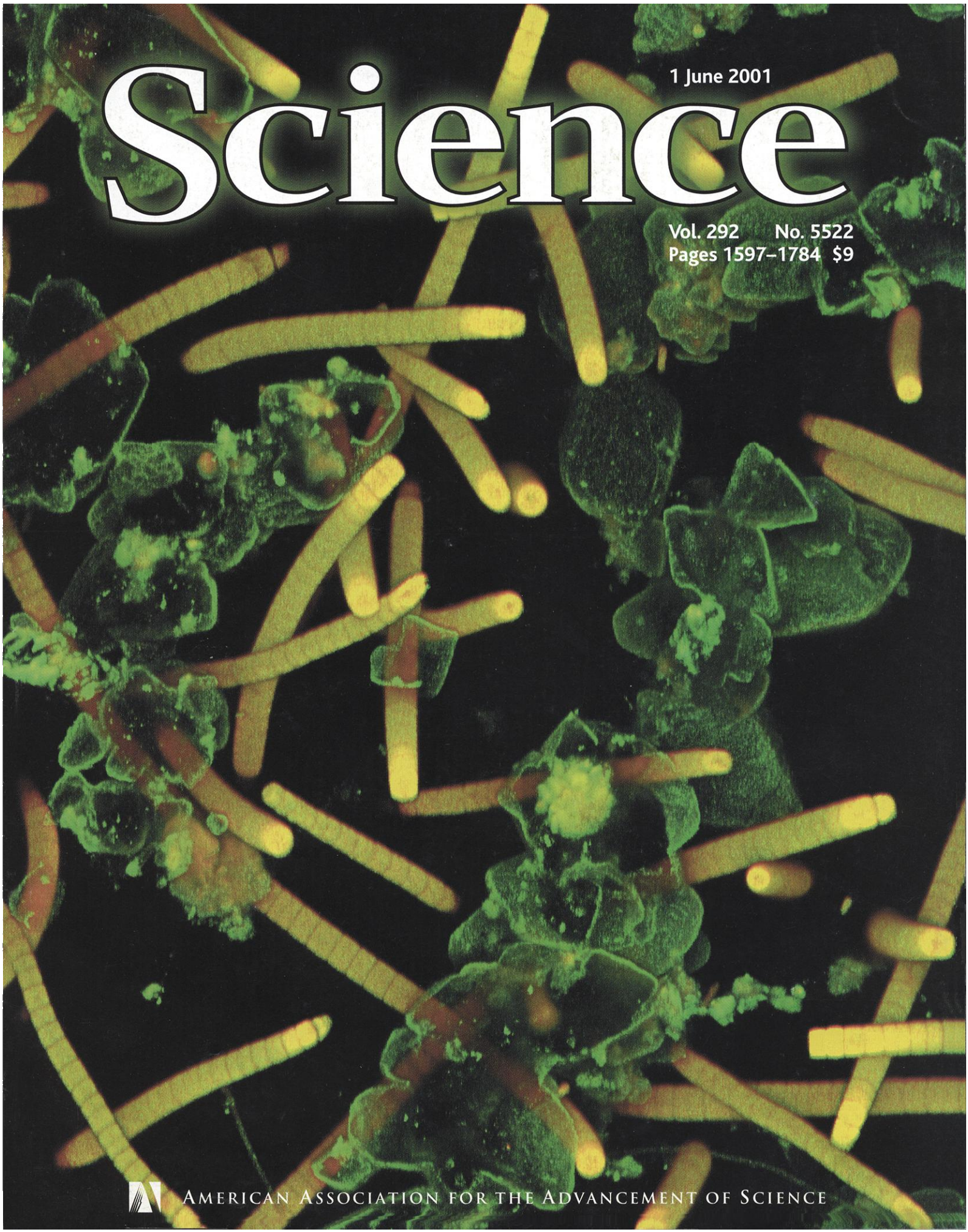
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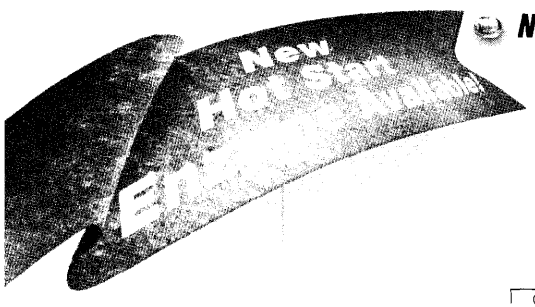

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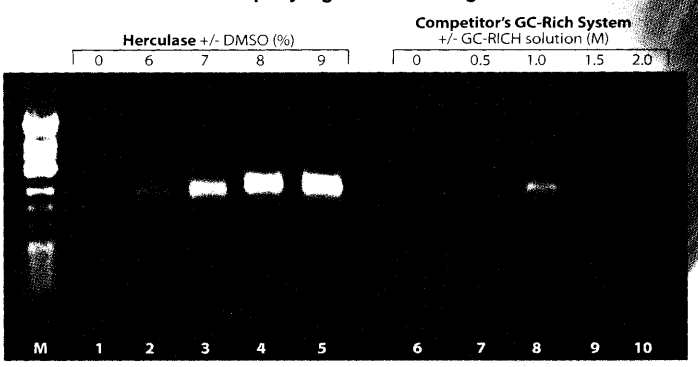

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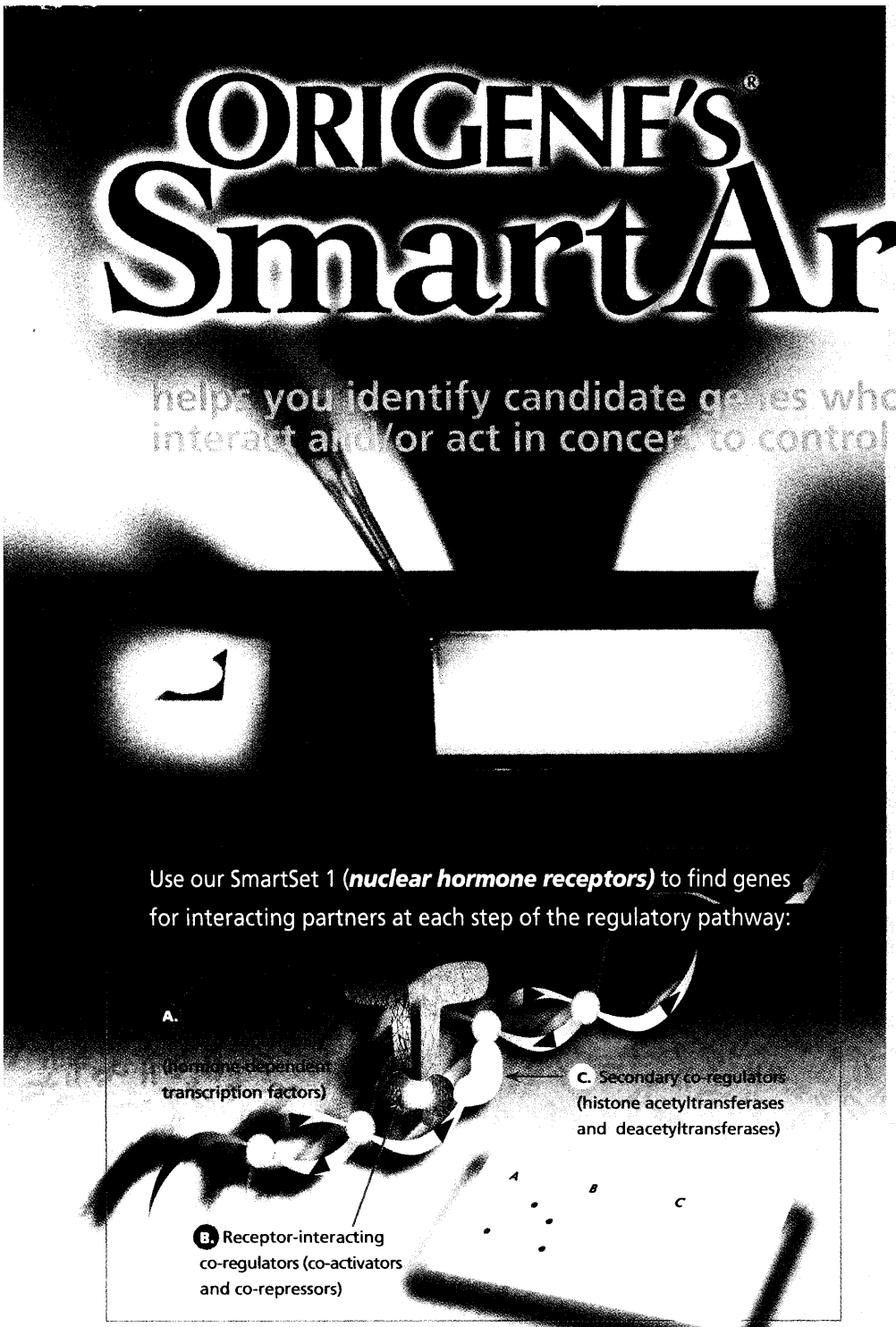

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NEWS

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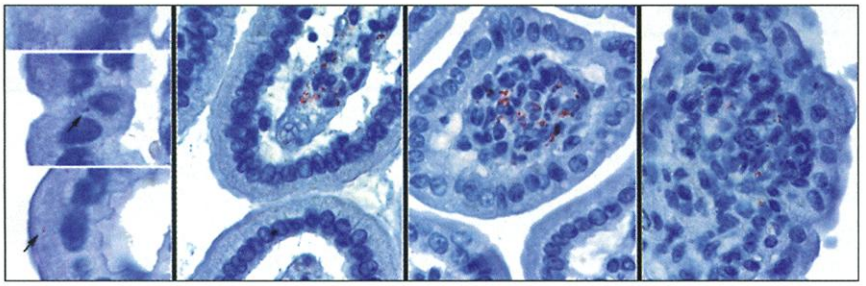
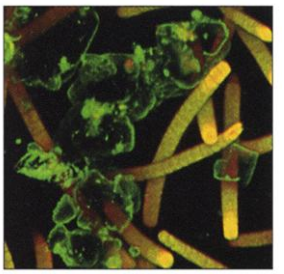


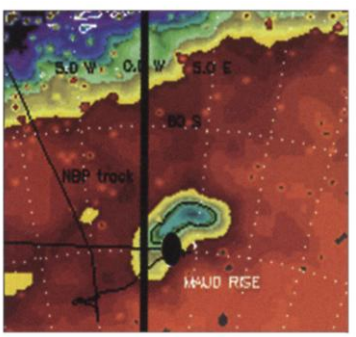
1722
How *Listeria* cross the gut



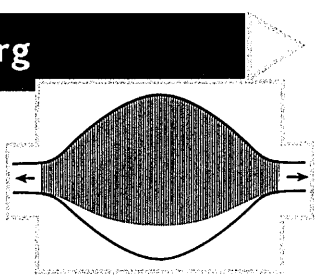
COVER 1701

A confocal laser scanning micrograph shows cyanobacterial filaments (yellow, 5 μm wide) and calcite crystals of a soda lake biofilm (green). Cyanobacterial photosynthesis can induce biofilm calcification only in settings low in dissolved inorganic carbon and high in calcium. These conditions can be traced throughout past oceans by corresponding calcareous microfossils of cyanobacteria. [Image: G. Arp; Christian Böker, Carl Zeiss Jena]

RESEARCH



1697
Ice-free zone



Origin of mass-independent isotope effects

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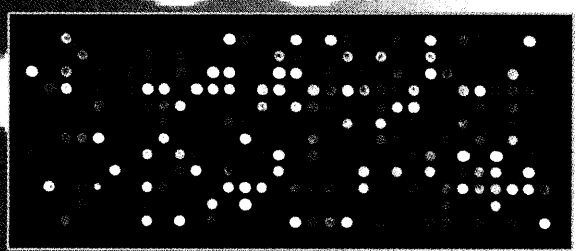

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Strange and Unconventional Isotope Effects in Ozone Formation
Y. Q. Gao and R. A. Marcus

The unusual patterns of mass-independent and mass-dependent oxygen isotopic fractionation that occur during the formation of ozone are investigated using RRKM-based theory.

Stimulation of RNA Polymerase II Elongation by Hepatitis Delta Antigen
Y. Yamaguchi *et al.*

The hepatitis delta antigen directly binds to RNA polymerase II to affect hepatitis delta virus RNA replication—and elucidation of that mechanism could assist in drug design.

Methylation of Histone H4 at Arginine 3 Facilitates Transcriptional Activation by Nuclear Hormone Receptor H. Wang *et al.*

Methylation of histone H4 by the enzyme PRMT1 modulates further covalent modification of the H4 amino-terminal tail and facilitates the activation of transcription, providing further evidence of the "histone code."

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Perspective: Lnk Adaptor—Novel Negative Regulator of B Cell Lymphopoiesis C. E. Rudd

Linking adaptor proteins to cell maturation.

Events: Upcoming Signal Transduction Symposia and Meetings

Everything from cytokines to lipid metabolism.

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Global: Careers in Museums, Zoos, and Botanical Gardens

Few positions, tough competition, a lack of funding: Why would anyone consider a job behind the scenes at a public collection? As our feature contributors show, the rewards for helping to conserve precious artworks and global biodiversity far outweigh the frustrations.

Germany: Back to My Roots P. Cramer

What would persuade a German scientist to return from the US to take up a tenure-track position in Germany? Cramer, a recent returnee from Stanford, shares his thoughts.

US: The Gift of the Gab—Learning How to Give a Better Talk A. Agrawal

Rather be in the casket than giving the eulogy at a funeral? The Postdoc Network has some tips for you.

US: Establishing Offices for Postdoctoral Education—Overcoming Obstacles, Part 2
K. Karpa

The second of two articles, this piece looks at how to secure funding and garner administrative support in creating postdoctoral offices.

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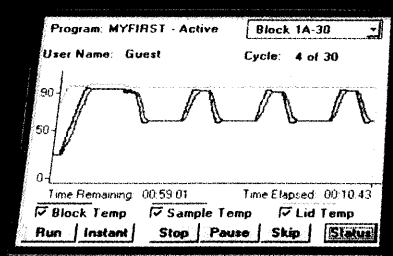

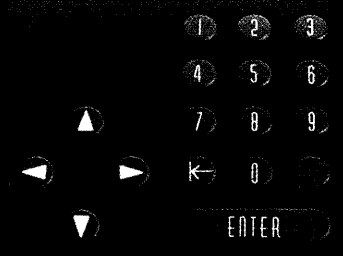

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THIS WEEK IN Science

edited by Phil Szuromi

A Dynamic Hole in the Ice

Since the time it was first seen in the mid-1970s, a hole in the winter ice (called a "polynya") of the Weddell Sea, Antarctica, has appeared at irregular intervals, but always in the same general vicinity. This formation of this irregularly shaped opening—which can reach the size of Great Britain—has long been suspected to be related to the presence of the Maud Rise, a nearby massive seamount, but the mechanism by which the polynya is created and sustained has remained uncertain. Holland (p. 1697; see the Perspective by Lemke) develops a dynamic model of the Weddell Polynya, in contrast to the commonly held thermodynamic model, that explains the structure as the result of large, cyclonic oceans eddies produced by prevailing ocean currents being shed from the Maud Rise seamount. This polynya may have an important role in deep-water formation and ocean-atmosphere CO_2 exchange.

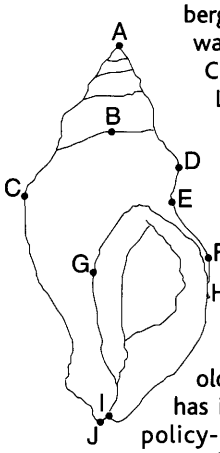
1701

Climate Change Caught in Film

Marine cyanobacteria precipitated calcium carbonate throughout most of the Phanerozoic, when the oceans contained sufficiently high concentrations of dissolved calcium to allow supersaturation of $CaCO_3$ to occur in the biofilms of these organisms. Almost no calcified cyanobacteria are found in the Precambrian, however, and after the late Cretaceous they are no longer found. Arp *et al.* (p. 1701; see the cover) have combined a model of photosynthetic cyanobacterial biofilm calcification and estimates of paleoatmospheric CO_2 concentrations to show that Cretaceous oceans must have had calcium concentrations significantly lower than in the earlier Phanerozoic, and that Precambrian oceans must have had high concentrations of dissolved inorganic carbon. Each of these conditions would have prevented the formation of $CaCO_3$ by cyanobacteria.

Shell Games

For species with an abundant fossil record, the integration of paleontological and molecular data permits the tracking of evolutionary responses to past climatic changes. Hellberg *et al.* (p. 1707) demonstrate that a northward expansion of the geographic range of a Californian marine gastropod caused by the Late Pleistocene climatic change resulted in rapid morphological evolution. Significant morphological evolution at the population level resulted from these climate-driven range shifts that were concentrated in the recolonized part of the species' geographic range. These findings contradict the traditional expectation that morphological evolution should be concentrated in Pleistocene refugia. As well as its value to paleobiologists and evolutionary biologists, this work has implications for conservation biologists and policy-makers concerned with the biotic consequences of climate change.



CREDIT: M. E. HELLBERG *ET AL.*

Forming Planets in Extreme Environments

Planetesimals are thought to form through the aggregation of particles within an orbiting disk of gas and dust around a central star. Simulations have had difficulty forming planets in these disks because the dust and gas escape before a large enough planetesimal can form. Throop *et al.* (p. 1686) model the effects of ultraviolet radiation from young stars in the Trapezium cluster on a nearby planetary disk, Orion 114-426, in the Orion nebula. Relatively large silicate grains (maximum diameter of 1 meter) can form within the inner edge of the disk and can avoid destruction by ultraviolet radiation from other stars. The presence of large grains is also consistent with the authors' recent observations in Orion 114-426. These grains may become the starting material for the formation of Earth-size planets. However, the formation of Jupiter-size planets under these radiative conditions remains elusive.

Computing with Ions

The physical implementation of quantum computers will likely require the ability to perform a series of accurately controllable quantum operations on a set of two-level systems (the qubits). One such architecture is based on a linear series of ions held in a trap, in which computation involves manipulating the states of the individual, but entangled, ions. Duan *et al.* (p. 1695; see the Perspective by Lloyd) propose a geometric approach to the manipulation and storage of information for quantum computation of such an array of ions. A set of quantum gates would be obtained by constructing looped paths in the parameter space available to the ions. As the ions are manipulated in this parameter space, they obtain a geometrical, or Berry phase, that is then used to keep tabs on their evolution and that can then be mapped to the computational space.

Feeding the Kids

Offspring demand, and parents supply. The tensions in this relationship, well known to many human parents, are present in various forms across the entire animal kingdom, and the behavioral ecology of parent-offspring conflict has received much attention. Agrawal *et al.* (p. 1710) present an experimental study with burrower bugs (*Sehirus cinctus*) that begins to address parent-offspring conflict from a genetic as well as behavioral perspective. The authors use cross-fostering coupled with manipulations of clutch size or food levels to show that female burrower bugs provision their offspring in response to their need (clutch size and hunger level). Members of the same family resemble each other in elicitation. Offspring levels of elicitation and levels of maternal provisioning were negatively related (providing sufficient food may require less signaling for food).

Lost and Found

One of the best collections of dinosaurs from northern Africa, found by Ernst Stromer in Egypt and housed in Munich, was lost along with most of his records during a bombing raid in 1944. The

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CONTINUED ON PAGE 1607

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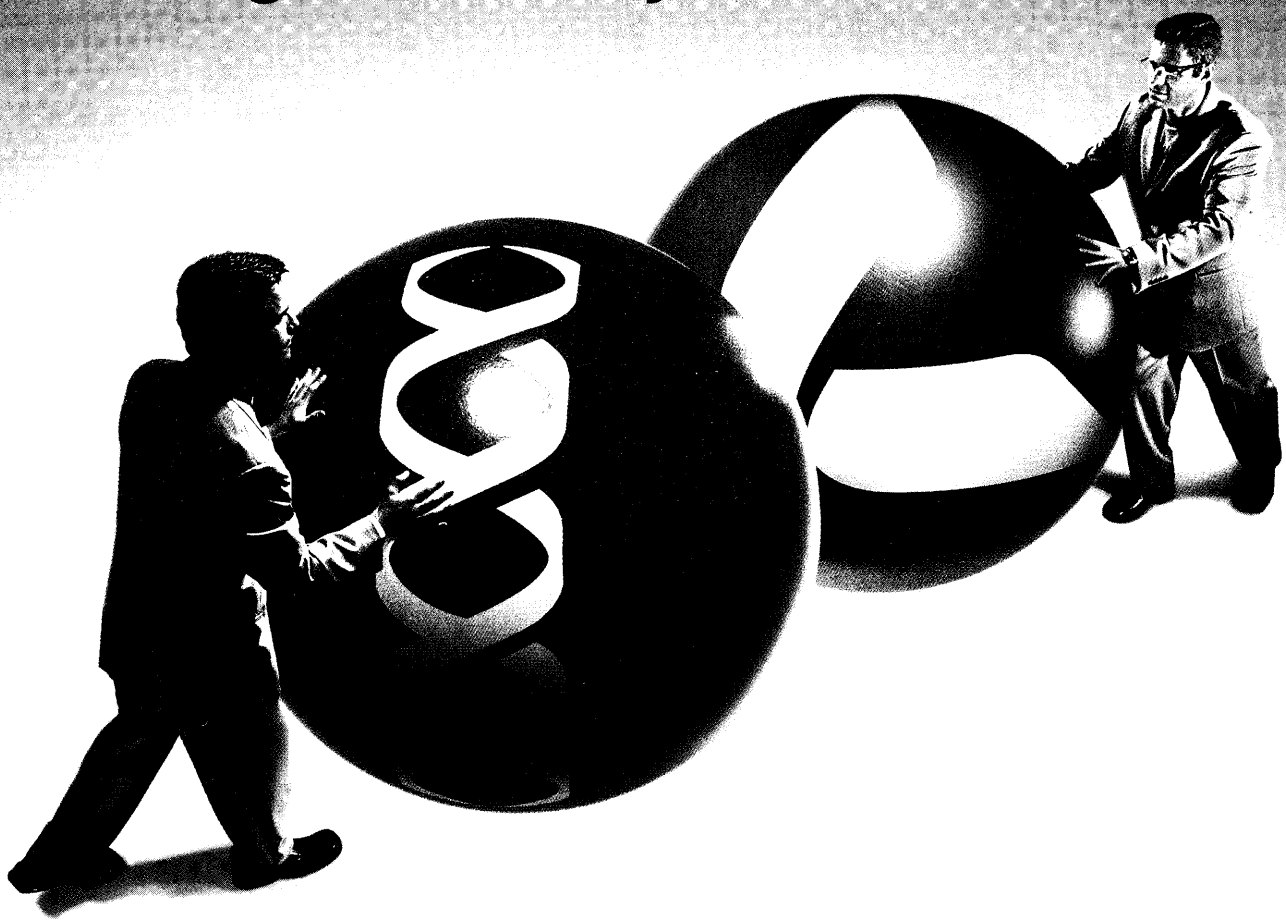

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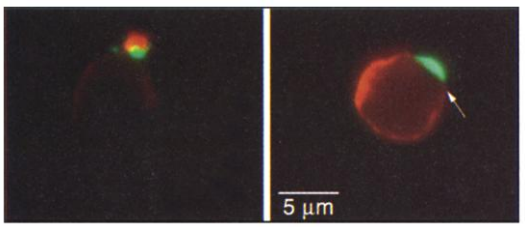
lack of many African dinosaur specimens has hampered understanding the effects of the breakup of Pangea in the Late Mesozoic on dinosaur faunas. Smith *et al.* (p. 1704; see the news story by Stokstad) have now apparently rediscovered Stromer's site in the Bahariya Formation of Egypt. They found a huge sauropod that may have topped out at just under 90 metric tons and 30 meters in length, making it the largest known sauropod and largest dinosaur from Africa. This sauropod and other dinosaurs may have lived in a mangrove environment.

Shared Recipe for a Synapse



Clustering of membrane proteins is essential for signaling by T lymphocytes and neurons and, in both cases, depends on the transit of membrane microdomains across the plane of the cell surface. Khan *et al.* (p. 1681; see the Perspective by Trautmann and Vivier) show that agrin, a protein required for organization of the neuromuscular synapse, is also expressed in T cells and influences the formation of the immune synapse. Addition of purified agrin to T cell cultures or enhancement of clustering with an antibody to agrin significantly lowered the threshold of antigen responsiveness by T cells. Thus, the modes for information delivery between lymphocytes and neurons may be more closely related than previously anticipated.

Sorting Sorted Out

When lysosomal enzymes travel from the Golgi complex to the lysosome, they are packaged into clathrin-coated vesicles at the exit (trans) side of the Golgi complex. In this sorting step, lysosomal enzymes bind to the mannose 6-phosphate receptor (MPR), which in turn is packaged into vesicles for onward trafficking. It has been thought that the adaptin family of proteins mediated the packaging process. Puertollano *et al.* (p. 1712) and Zhu *et al.* (p. 1716) now show that it is likely that the so-called GGA family of proteins are the key to this sorting event (see the Perspective by Tooze). The GGAs interact with the mannose 6-phosphate receptor in the trans-Golgi network, and a mutant form of one of the GGA proteins could block Golgi export of the MPR. Conversely, mutant receptors that could not bind GGAs did not correctly sort to lysosomes.

Building Blocks of Breakout

Mammals are an assemblage of organisms, many of which are harbored in the gut and remain confined there, usually to mutual benefit. Occasionally, some armed with virulence factors escape containment and cause life-threatening infections, such as the notorious *Listeria monocytogenes*. In an elegant in vivo model for listeriosis, Lecuit *et al.* (p. 1722; see the Perspective by Finlay) show how the breakout occurs. *Listeria* bears a molecule on its surface known as internalin, which binds in a species-specific manner to a complementary host molecule known as E-cadherin. *Listeria* does not cause invasive infections in mice unless the mice are engineered to express the human form of E-cadherin. This molecule then binds *Listeria*'s internalin and permits the bacteria to enter the cells lining the gut wall, cross the cells, exit, and then start a systemic infection.

The Act of Glucose Uptake

Insulin is essential for proper control of the concentration of glucose in the blood, and failure of insulin signaling contributes to type 2 diabetes mellitus. The insulin receptor produces multiple intracellular signals, however, and it has not been clear which of these are important for regulation of metabolism in liver and muscle and thus of blood glucose concentrations. Cho *et al.* (p. 1728) report that animals lacking the protein kinase Akt2 (also known as protein kinase Bβ) were mildly hyperglycemic and that insulin appeared to be less effective in these animals than in wild-type animals in causing glucose uptake from the blood. Insulin's effect to suppress glucose production from the liver was strongly decreased. Thus. signaling through Akt2 appears to account for physiologically relevant metabolic effects of insulin.

CREDIT: A. A. KHAN *ET AL.*

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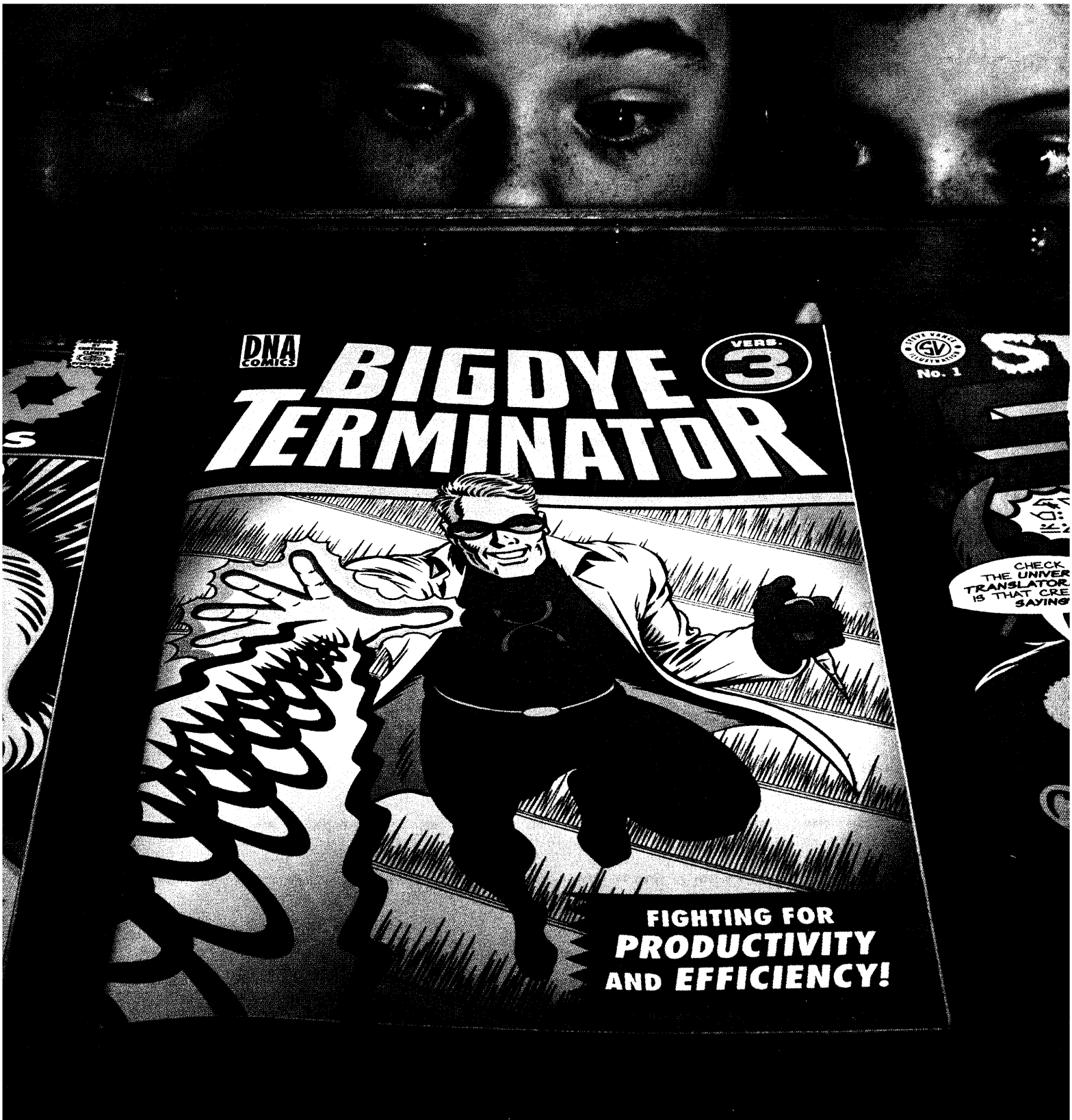

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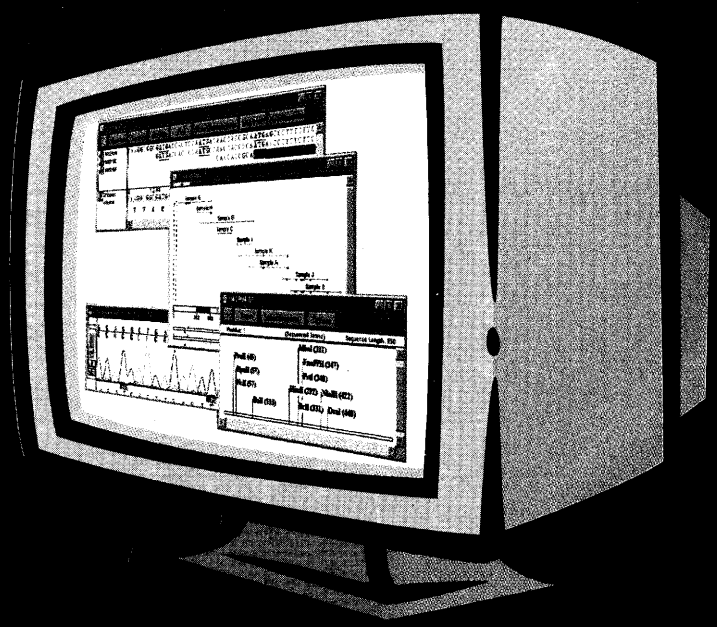

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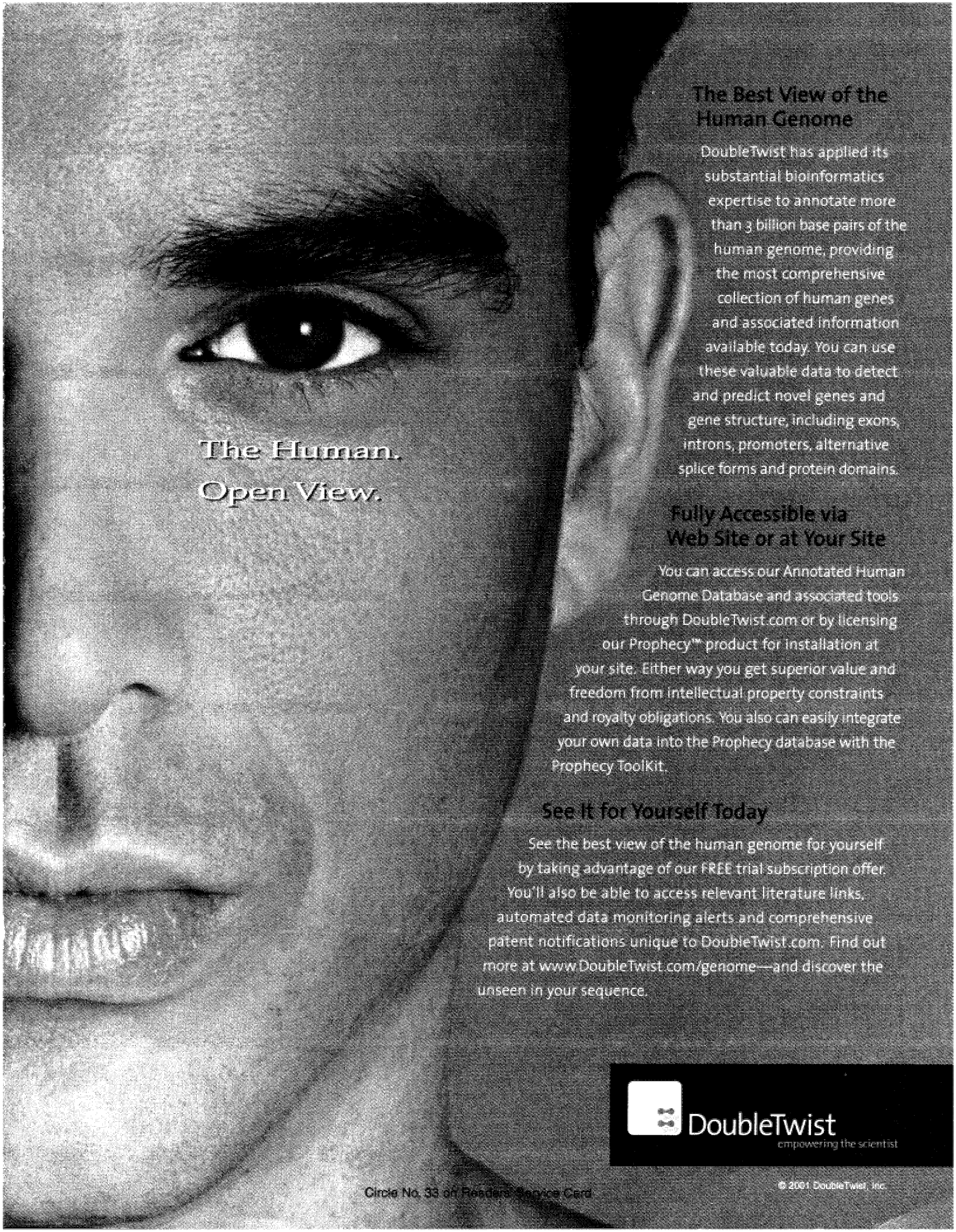

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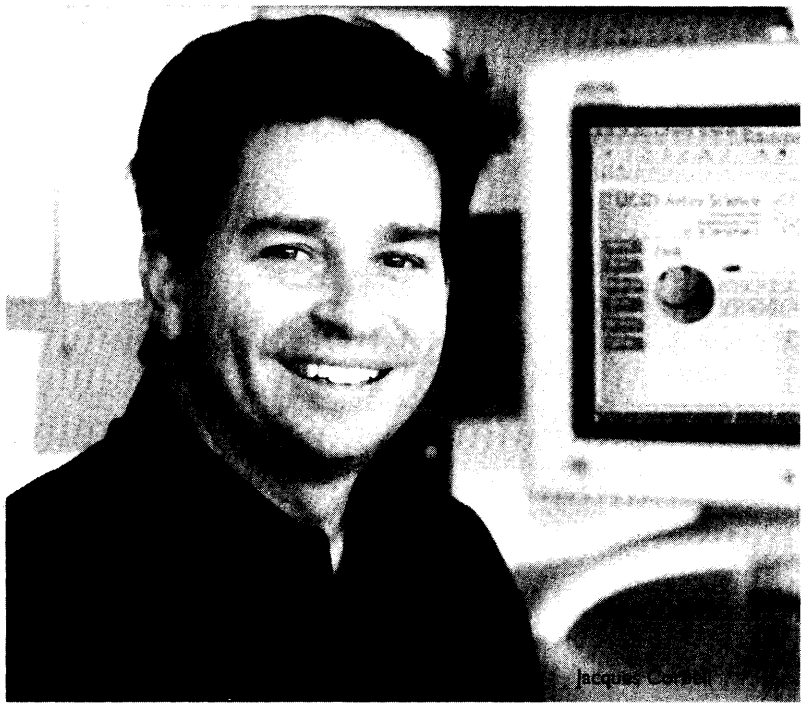

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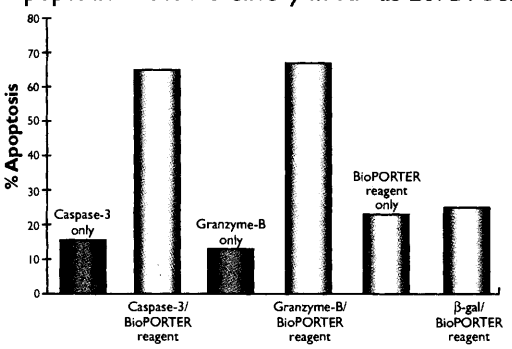

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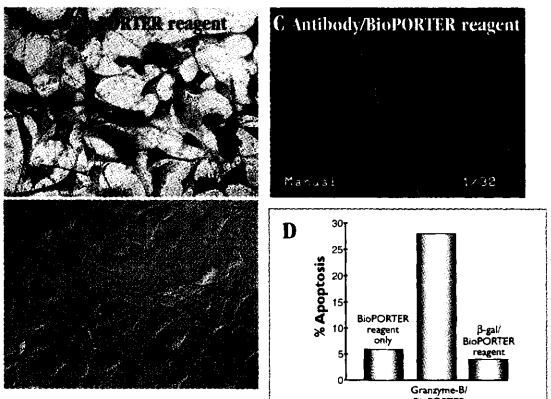

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Fig. D Functional Granzyme-B Delivery Into Jurkat Cells
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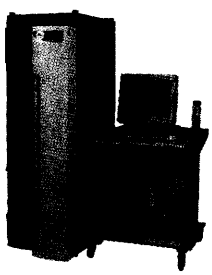

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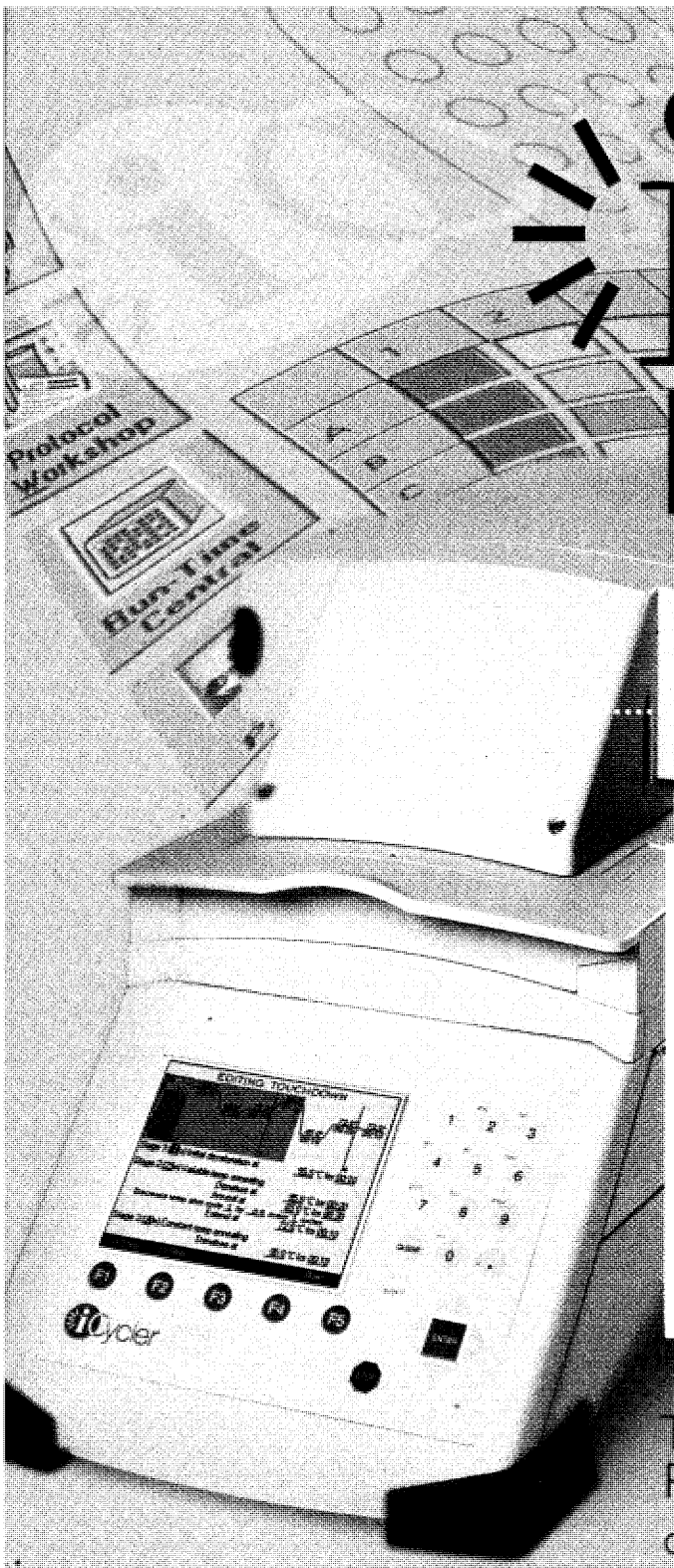

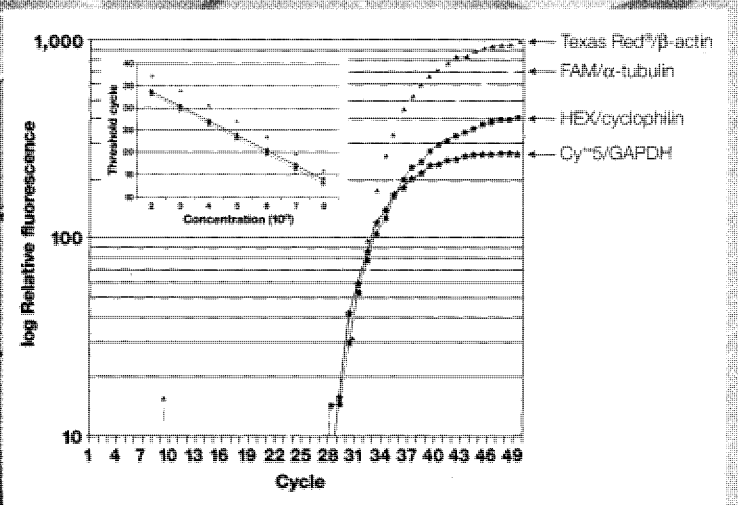

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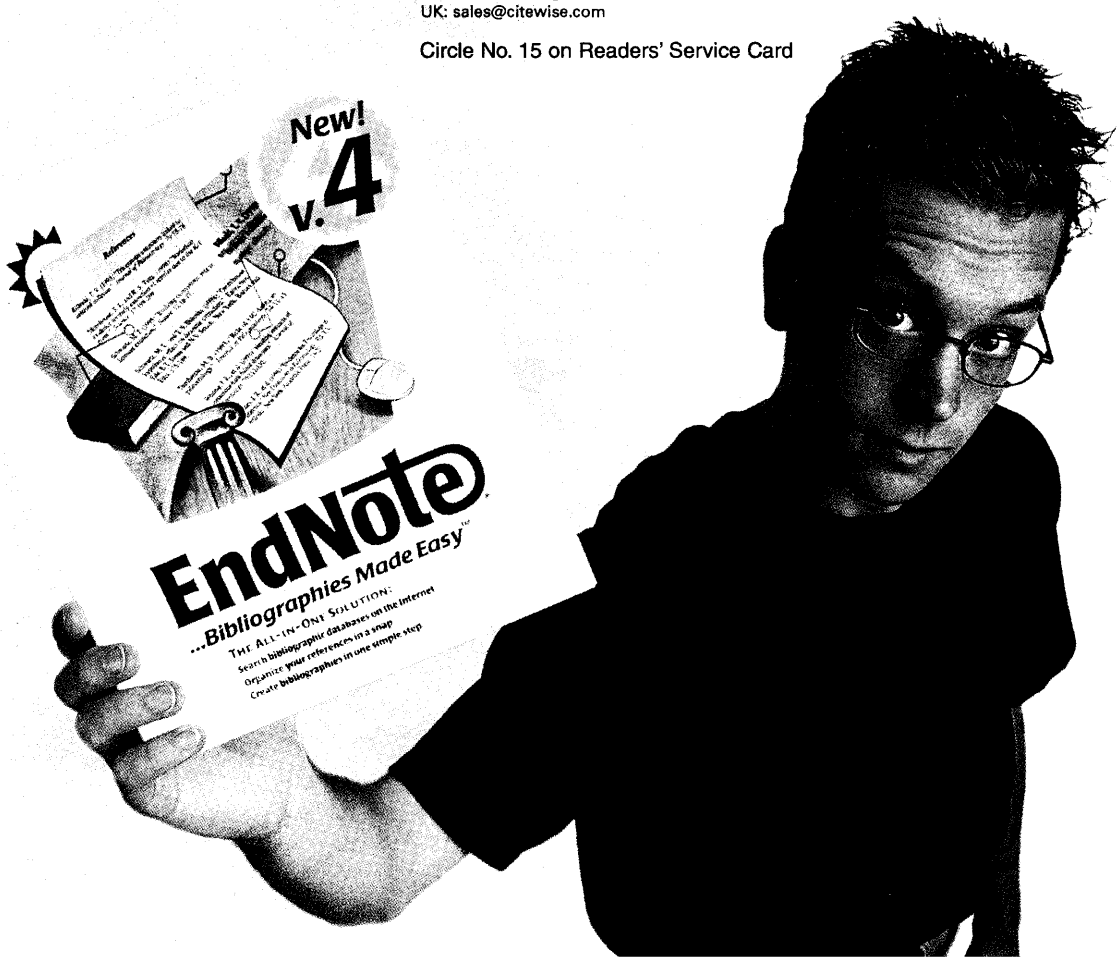

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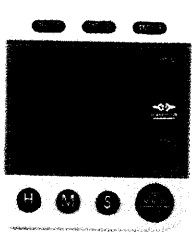

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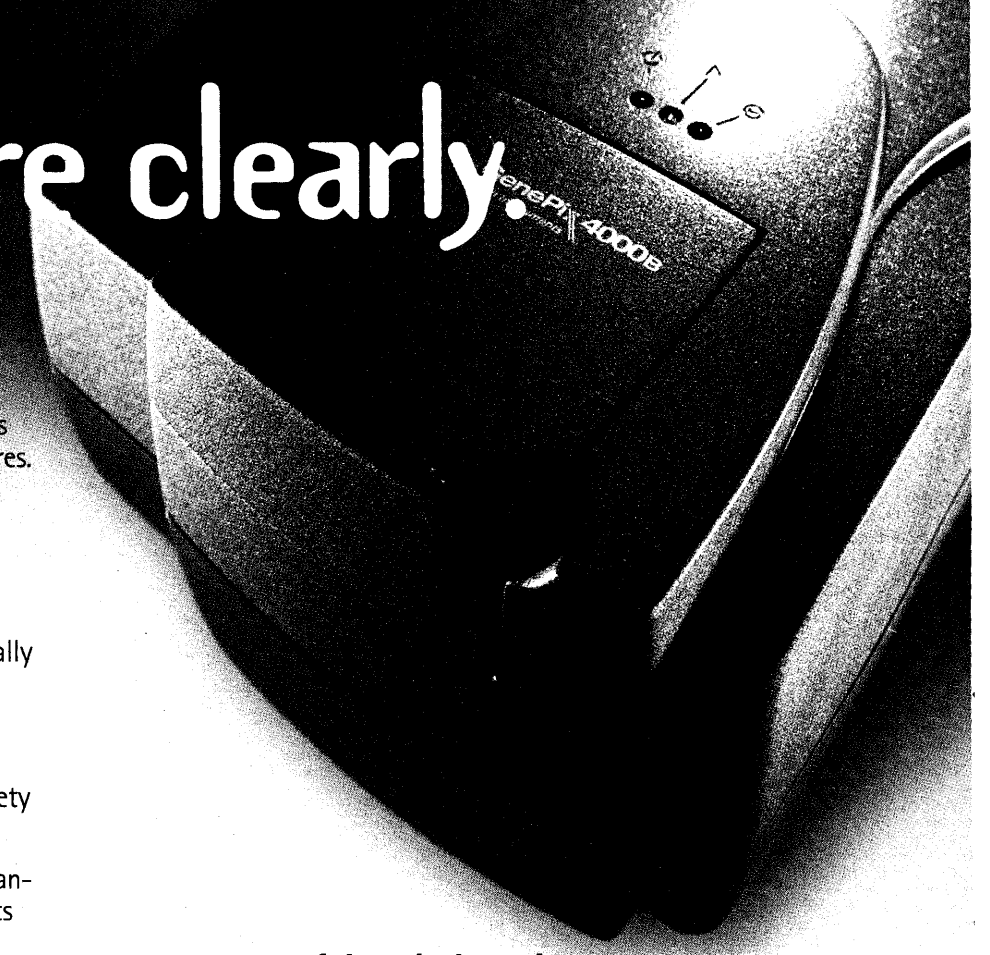

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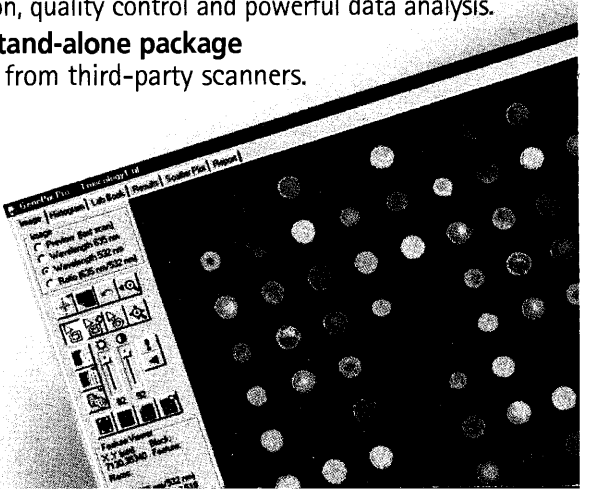

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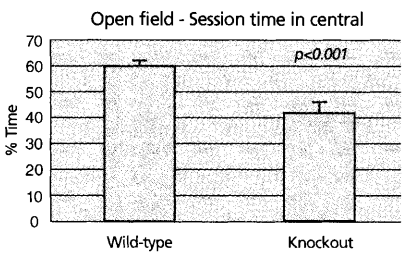
Phenotypic analysis

Gene: Orphan G protein-coupled receptor

The lacZ reporter gene present in the knockout construct allows for the analysis of gene expression. In mutant mice, lacZ expression is detectable in the cortex region of the brain, as shown in this whole-mount image.

Within the brain, lacZ is highly expressed throughout the cortex, hippocampus and amygdala. In normal animals, the hippocampus is essential for spatial processing and some types of exploratory behavior, while the amygdala is important for fear and anxiety behaviors.



The homozygous mutants spent less time in the central region in the open field test, indicating a higher level of anxiety compared to their wild-type siblings.

With this information, researchers can make informed decisions about which new gene targets to advance into small molecule screening programs. DeltaBase offers the possibility of faster drug discovery and improved overall efficiency in the drug development process.

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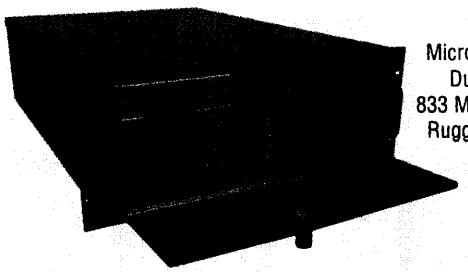

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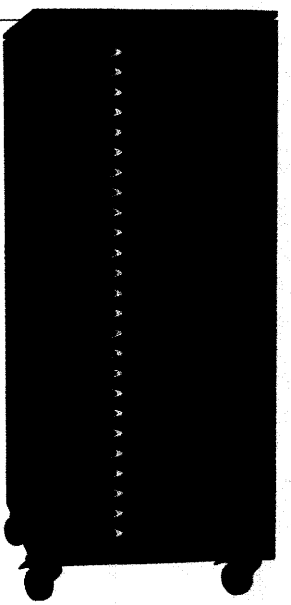

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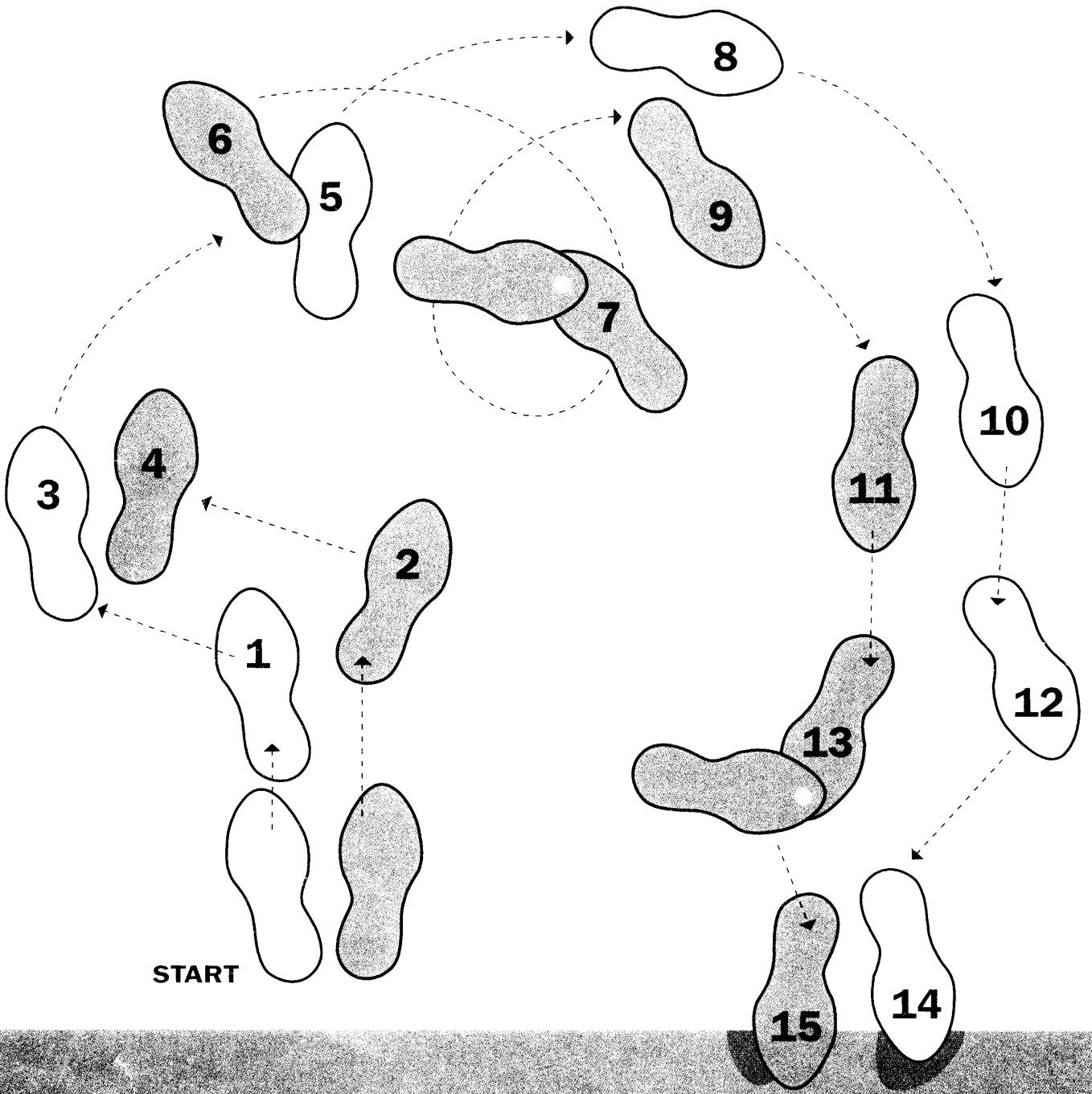

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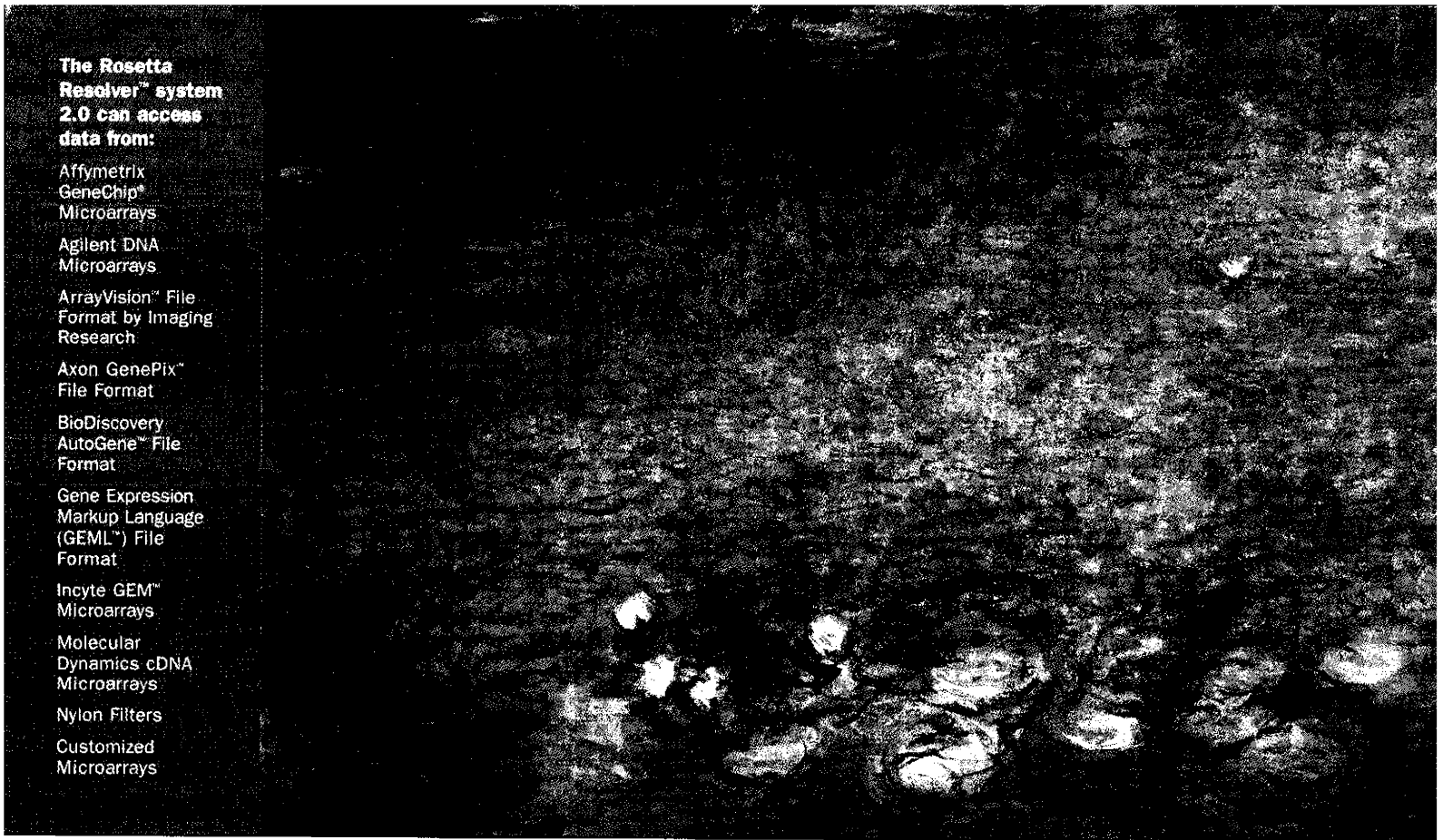

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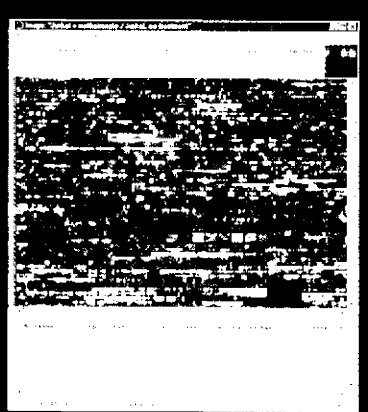

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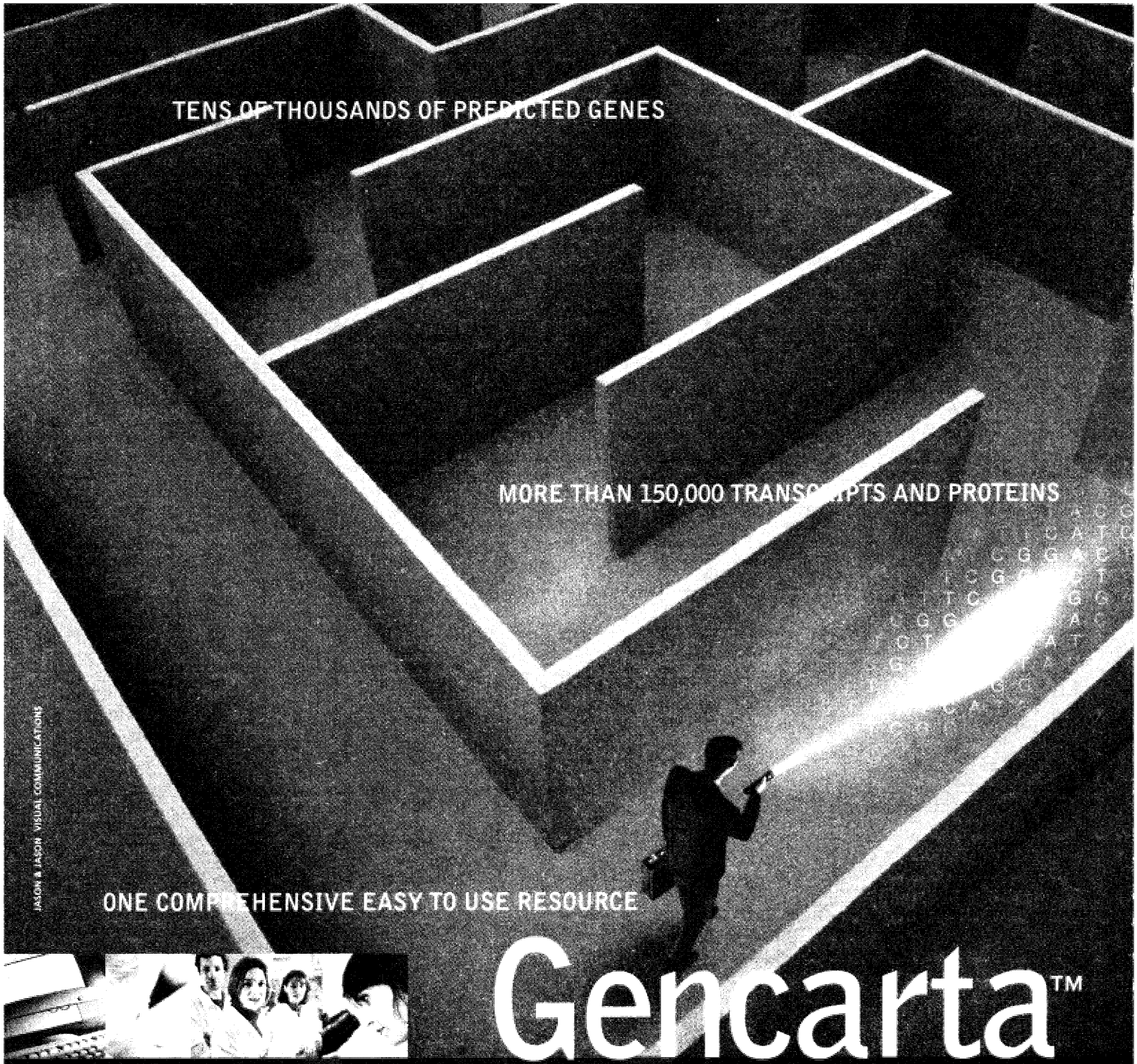

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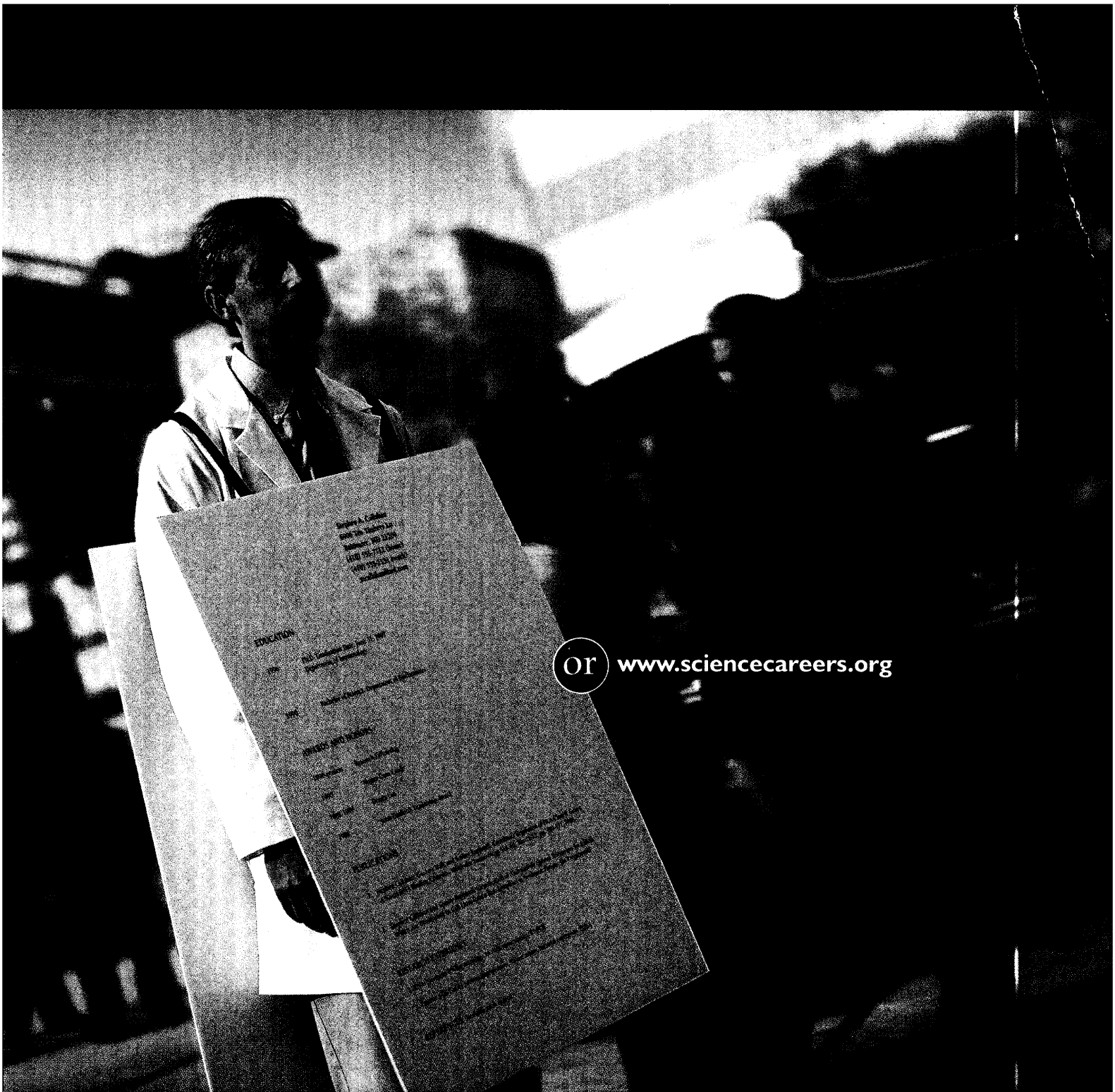

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*1) Nat. Biotechnol. **18**, 630-634 (2000)*

*2) Proc. Natl. Acad. Sci. USA **97**, 1665-1670 (2000)*

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