19 January 2001

Science

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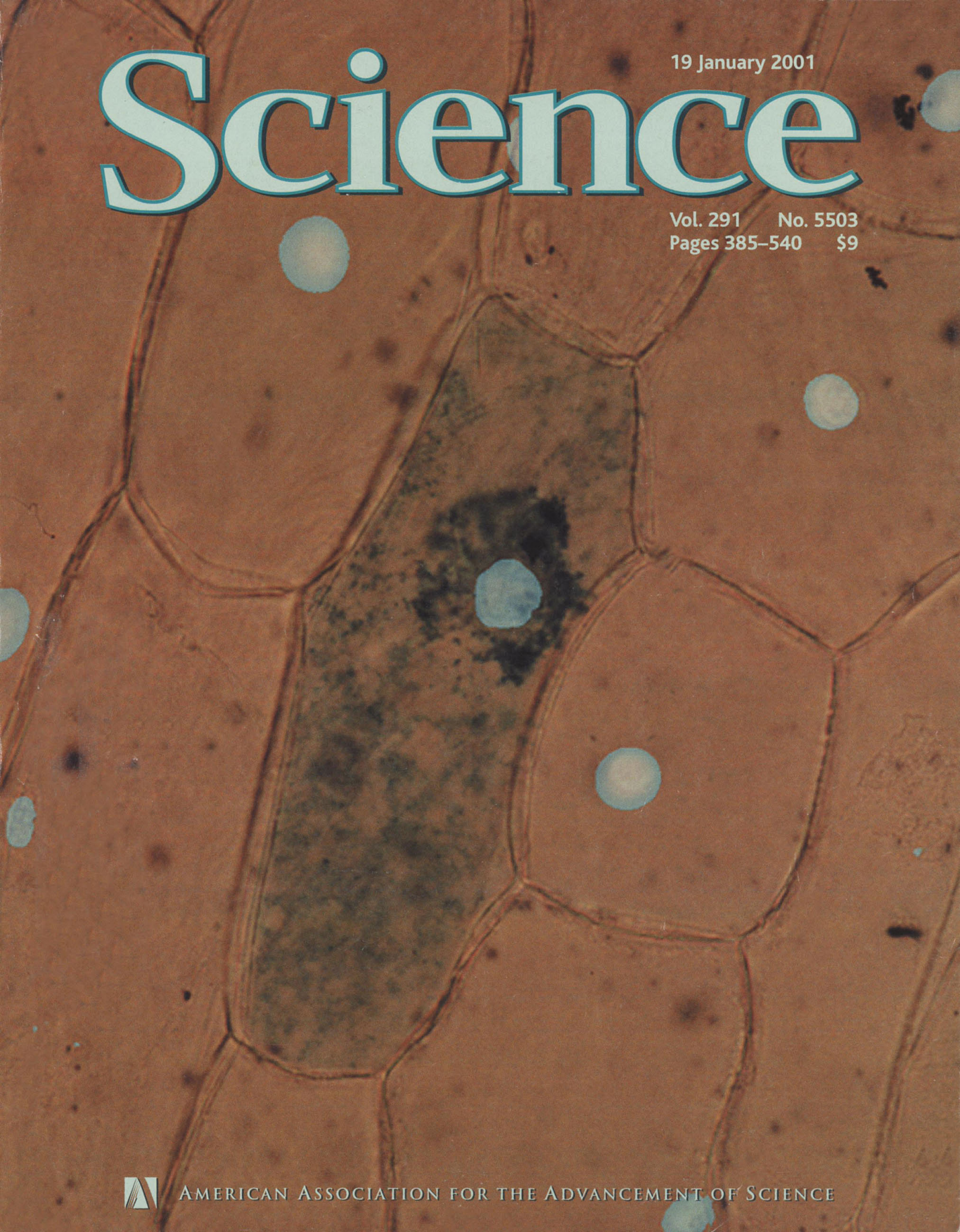
Pages 385–540 $9



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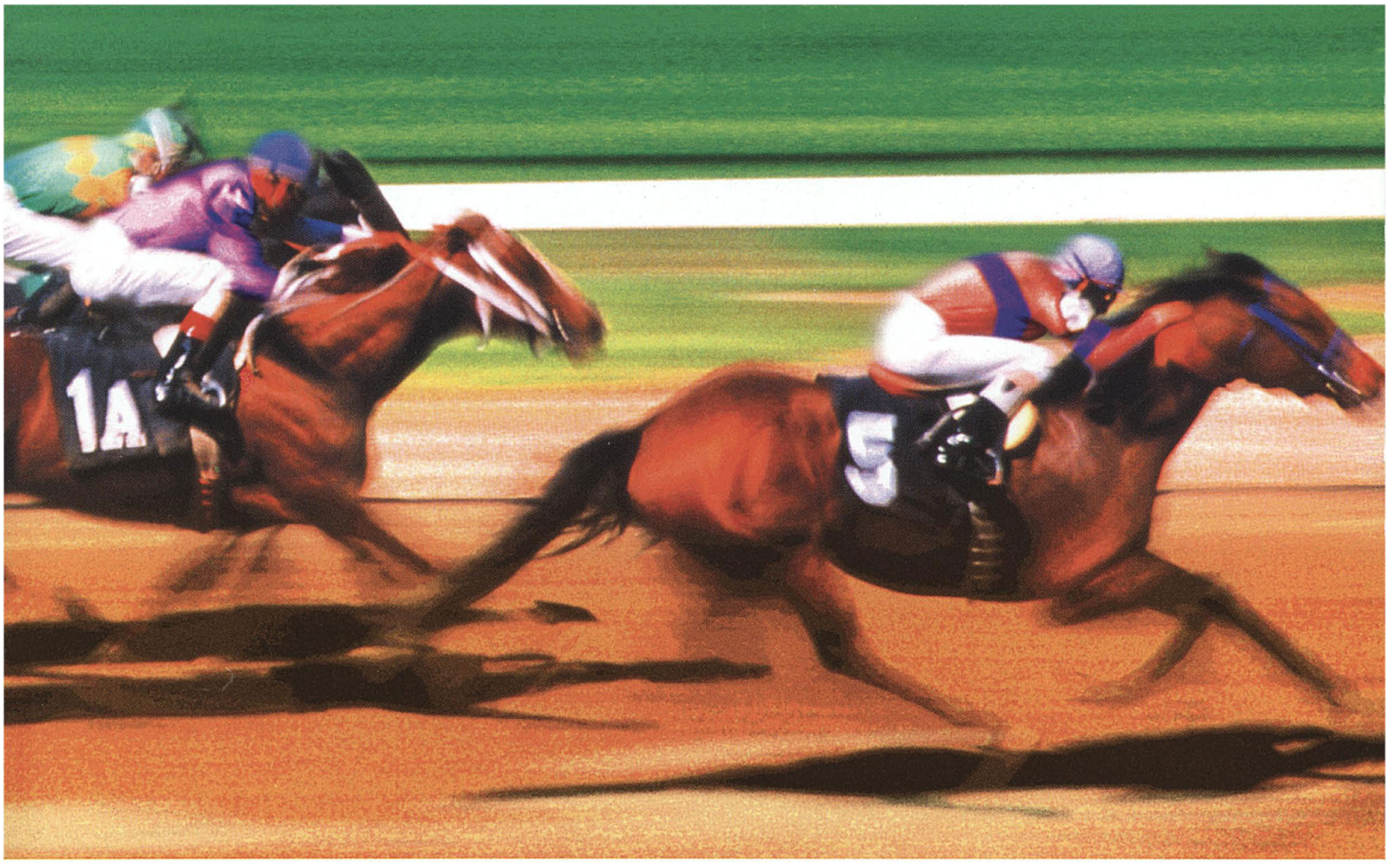

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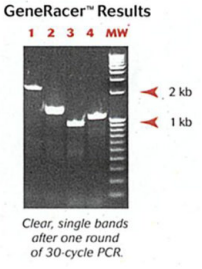

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Science

Volume 291 19 January 2001 Number 5503

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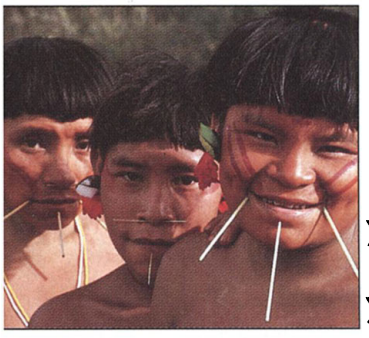

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Fighting over the Yanomamo

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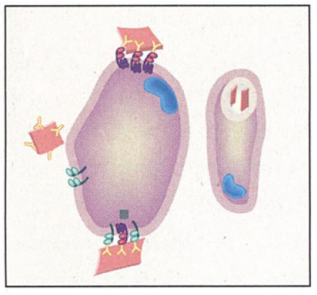

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Saving platelets with IVIG

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Simple associations only?

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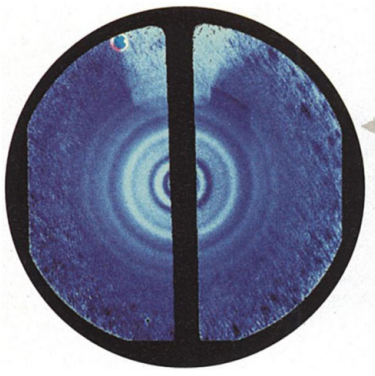

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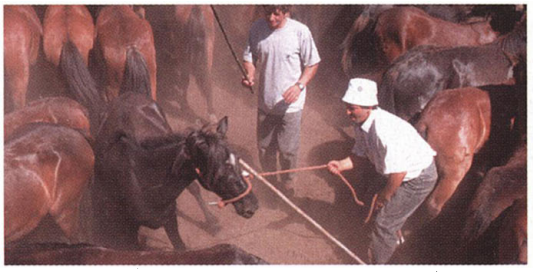

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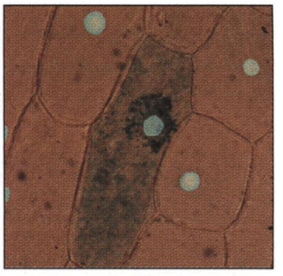
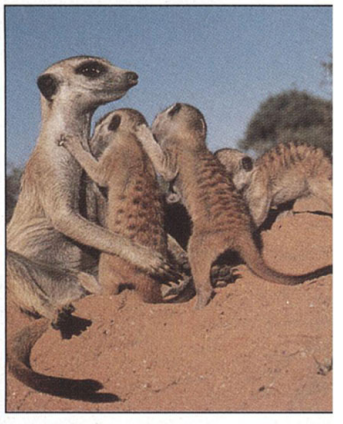
Multiple origins for domestic horses



COVER 487

In the plant *Arabidopsis*, light captured by the photoreceptive molecules cryptochrome and phytochrome regulates development through a signaling pathway containing SUB1, a calcium-binding protein. The SUB1 protein is enriched around the nucleus (dark blue) in plant cells transfected with a SUB1-GUS fusion protein. Cell nuclei are shown in turquoise (magnification, ×1600). [Image: H. Guo and T. Mockler]



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The social life of meerkats

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TRP-PLIK, a Bifunctional Protein with Kinase and Ion Channel Activities L. W. Runnels, L. Yue, D. E. Clapham

A functional protein kinase domain in a newly discovered ion channel appears to regulate channel conductance.

Lack of Replicative Senescence in Normal Rodent Glia N. F. Mathon, D. S. Malcolm, M. C. Harrisingh, L. Cheng, A. C. Lloyd

Lack of Replicative Senescence in Cultured Rat Oligodendrocyte Precursor Cells D. G. Tang, Y. M. Tokumoto, J. A. Apperly, A. C. Lloyd, M. C. Raff

PERSPECTIVE: **When Do Telomeres Matter?** J. W. Shay and W. E. Wright

Two types of rat cells bypass replicative senescence if the culture conditions are appropriate.

SPECIAL FEATURES

***Science* Functional Genomics** www.sciencegenomics.org

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PDK2: A Complex Tail in One Akt T. O. Chan and P. N. Tsichlis

Teasing apart the elaborate regulation of the kinase Akt, a critical regulator of cell life and death.

science's next wave www.nextwave.org

UK: Going Global—Why and Who? P. H. Dee

In the first of a two-part series, our "Yours Transferably" columnist explores the benefits grad students can realize in collaborations with other research groups.

US: Midnight in the Garden of Training and Education E. Klotz

The Postdoc Network devotes its attentions this week to the Graduate Research, Education, and Training meeting held recently in Savannah, Georgia.

US: Shared Shoulders and Shared Resources—The Advantages of a Team Approach to Your Job Search D. Jensen

Collaborations are *de rigueur* in science, but they can also work well for job seekers.

Canada: Back to School at York U. L. McKarney

After an 11-week strike by teaching assistants, students at Canada's third-largest university finally resumed classes this week. Can they catch up?

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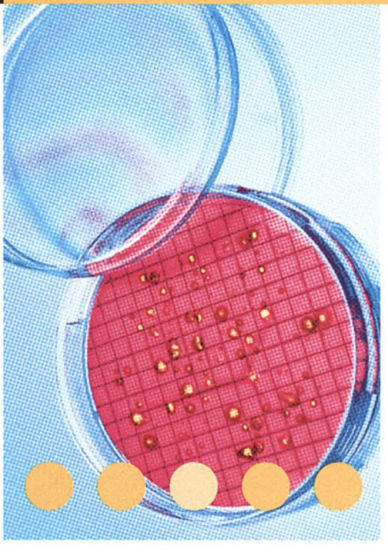

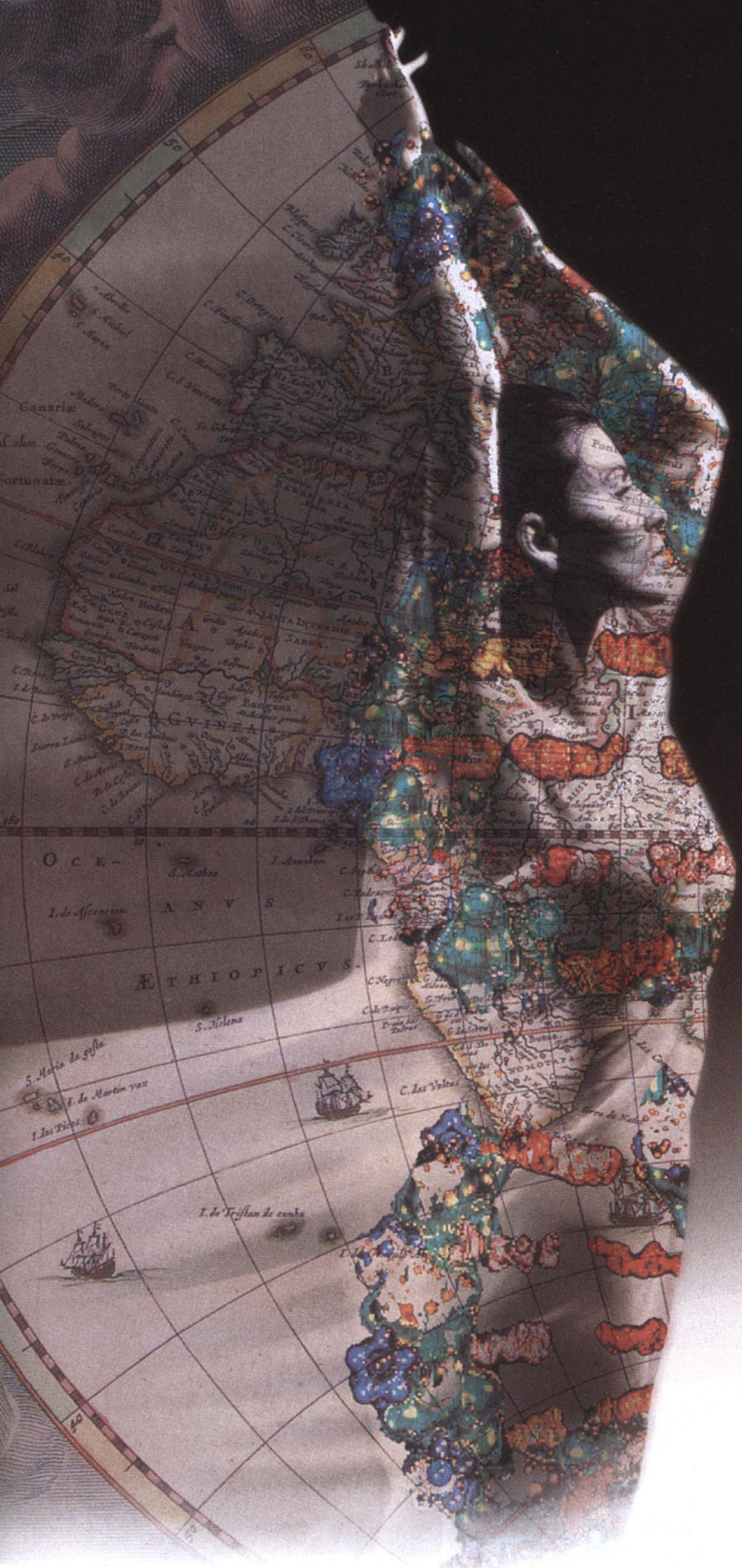

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THIS WEEK IN Science

edited by Phil Szuromi

Ellipsoidal Colloidals

One approach for making colloidal particles is to use crystals of colloidal particles as templates. The intervening space can be filled with a polymer, and upon removal of the original colloid, used as a template to make particles of other materials that may have interesting magnetic or optical properties but that do not readily form uniform colloidal particles in a particular size range. Jiang *et al.* (p. 453; see the Perspective by Mallouk) demonstrate this approach in a general way for metals, oxides, and polymers using a polymer template. They also show that the polymer can be deformed uniformly in one direction so that ellipsoidal particles with axial ratios up to 4 can be made.

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447
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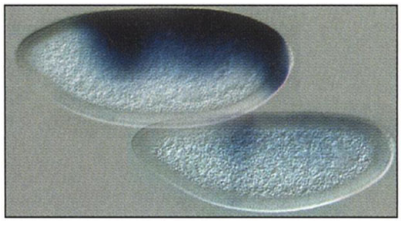
Biological Insulators

Insulators or chromatin boundary elements are specialized chromatin structures that regulate gene activity. These structures block the action of transcriptional enhancers or silencers when located between the gene regulatory element and the gene's promoter. Two studies, performed by Cai and Shen (p. 493) and Muravyova *et al.* (p. 495), used *Drosophila* genetics to examine the mechanism of action for insulators. Experiments in which insulator copy number and position were altered indicate that insulators are likely to affect enhancer-promoter interactions by stimulating the formation of chromatin loop domains through the interaction of protein-bound insulator complexes. A review by Bell *et al.* (p. 447) highlight recent research on the structure, function, and regulation of a wide range of insulators.



SOURCE: H. N. CAI

Gas-Phase Dynamics at the Structural Level

Ultrafast dynamics of chemical reactions, which can be initiated by femtosecond laser pulses, are usually probed indirectly, such as by vibrational or mass spectroscopy. Direct structural studies of such processes, as can be obtained with x-ray diffraction, are usually limited to crystals or surfaces. Ihee *et al.* (p. 458) now report on results obtained with an ultrafast electron diffaction apparatus for gas-phase reactions of small molecules. They characterized the stepwise elimination reaction of haloethane and the ring opening of a cyclic hydrocarbon. The latter case shows that heavy atoms are not necessary in order to obtain useful ultrafast electron-diffraction data.

Entanglement in a Quantum-Dot Molecule

Potential solid-state schemes for quantum computing are of interest because these implementations offer the possibility of scale-up and integration. Bayer *et al.* (p. 451) describe results on a vertically coupled pair, or molecule, of single quantum dots. Under optical excitation and an applied electric field, a coupled electron-hole pair (exciton) is created on the molecule with just four possible arrangements for the electron-hole pair. When the dots are coupled, the excitation spectrum differs from those for the single dots. Entanglement between these possible exciton states manifests itself as an energy splitting in the excitation spectrum. Moreover, the energy splitting increased to 40 millielectron volts as the dot separation was reduced to 4 nanometers, which indicates that room-temperature operation may be possible.

Little Green Lines on Venus

Optical emissions from solar irradiation of planetary atmospheres produce distinctive line emissions that can be used to understand the composition and dynamics of the atmospheres. In particular, a common transition of atomic oxygen produces a green line emission that can be used to estimate the density of oxygen atoms. Venus does not have a green line emission based on observations by the Venera and Pioneer missions and model studies which suggested that the atomic oxygen transitions were quenched by collisions with carbon dioxide. Slanger *et al.* (p. 468) used the high-resolution echelle spectrograph on the Keck I telescope to obtain spectra of the atmosphere of Venus and detected a strong green line emission. Thus, models of the abundance and dynamics of oxygen in the venusian atmosphere will need to be refined.

Depleted Polar Tropospheric Ozone

When the Arctic sun rises after the long polar night, surface-level ozone can become severely depleted. Laboratory studies have suggested that this depletion results from a catalytic process initiated by bromine release from gas-phase precursors like Br_2, HOBr, or BrCl. Foster *et al.* (p. 471) now report in situ measurements of Br_2 and BrCl in ambient air at the surface of the snow in the Canadian Arctic. Increases in the concentrations of these species were tightly correlated with ozone depletions. The absence of Cl_2 indicates that BrCl is the dominant source of photolyzable chlorine in the polar regions, contrary to what had often been assumed.

Tracing Horse Pedigrees

Archaeological evidence suggests that the horse was domesticated about 6000 years ago in Central Asia, with major consequences for human civilization. Was domestication achieved using individuals from one or a small handful of wild populations, or using multiple wild populations over a wide area and time span? Vilà *et al.* (p. 474; see the news story by Pennisi) used mitochondrial and microsatellite markers to quantify genetic variation in modern horse breeds and from wild horse remains 12,000 to 28,000 years old. These results show that the modern domestic horse population was founded by a diverse array of matrilines,

CONTINUED ON PAGE 395

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implying multiple ancestry and possibly a period of extensive taming from wild populations. The interaction between humans and horses may have long preceded the first morphological evidence of domestication.

Kept in Line

In some cooperative animal societies, breeding is distributed unevenly across the adult females, such that only a few dominants reproduce while the remainder are "helpers." Different models have been advanced to account for this "reproductive skew," but have proved difficult to test unequivocally. In a 7-year study of meerkats in southern Africa, Clutton-Brock *et al.* (p. 478; see the Perspective by Koenig and Haydock) find that subordinates will only breed when beyond the control of dominant females. They find no evidence for the alternative hypothesis that dominant females periodically allow subordinates to reproduce in order to retain their services as helpers.

Gauging Rain

Understanding the patterns and mechanisms of ecosystem responsiveness to climate variability is fundamental to any attempt to predict ecosystem response to climate change. Traditional views of plant production in ecosystems have held that interannual variability of production should correlate directly with variability in precipitation. A long-term study of 14 different ecosystems in the United States, spanning a range of precipitation from 250 to 1400 millimeters per year, indicates that the pattern is more complex. Knapp and Smith (p. 481; see the news story by Kaiser) show that variability among years in production is not associated with variability in precipitation, and that the sites with the highest variability in precipitation do not exhibit the highest variation in production. They propose that the variability in production depends on an interaction between precipitation and growth potential of plants.

New Ideas on an Old Remedy

The beneficial effects of administering intravenous γ globulin (IVIG) in a range of illnesses have long been recognized, yet at a mechanistic level this treatment has remained poorly defined. One of the major applications for IVIG is in the treatment of immune thrombocytopenia (ITP), a disease in which platelets are excessively removed from the circulation by phagocytic cells through an antibody-dependent pathway. In their study of a mouse model of ITP, Samuelsson *et al.* (p. 484; see the Perspective by Lin and Kinet) present convincing evidence that the effects of IVIG are mediated by inhibitory Fc receptors. The exposure of the inhibitory Fc receptor pathway in a proven therapeutic setting is likely to set important clinical precedents in the treatment of inflammatory disorders.

Setting Some Clocks Ahead

Animals have numerous circadian clocks in peripheral organs that are thought to be driven by the light-entrained "master" clock in the hypothalamus. However, Stokkan *et al.* (p. 490) show that this master-slave relation is not so clear. The authors engineered rats to express the luminous molecule luciferase so that they could easily monitor the animals' clocks in vivo. When the rats were put on an altered feeding schedule, the liver clock—but not the brain clock—was rapidly entrained to the new feeding times.

Starting Off Correctly

For accurate protein synthesis, the initiator transfer RNA (tRNA) must be base-paired to the messenger RNA start codon in the P site of the 30*S* ribosomal subunit. In prokaryotes, this is achieved in an initiation complex that also has three initiation factors (IF1, IF2, and IF3) bound. Carter *et al.* (p. 498) have determined the crystal structure of a complex of IF1 and the 30*S* subunit. The A site appears to be sterically blocked by IF1, which, together with IF2, may be involved in the correct positioning of initiator tRNA in the P site. Local structural changes caused by IF1 binding induce conformational changes in regions of the 30*S* subunit that contact the 50*S* subunit in the intact ribosome.

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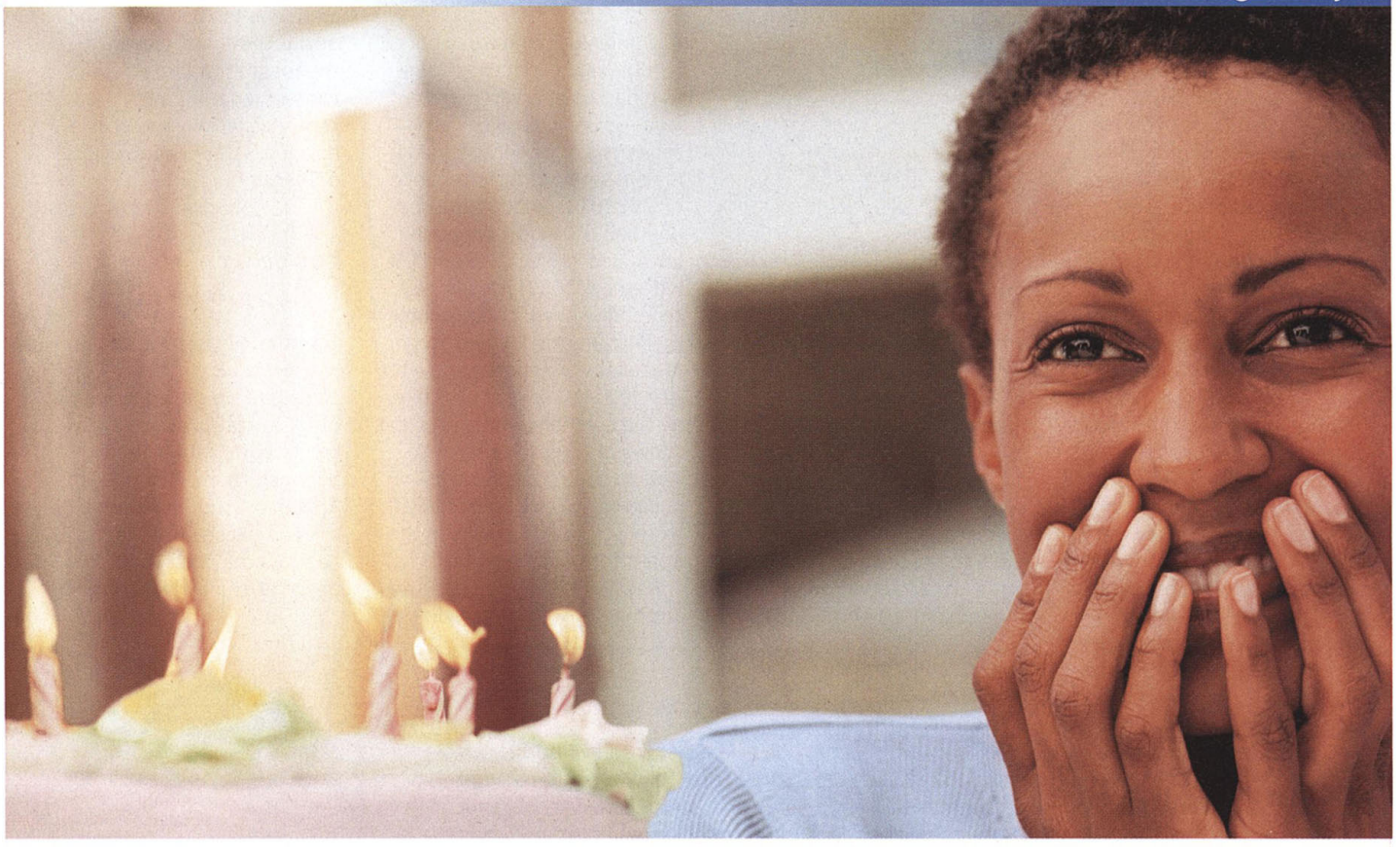

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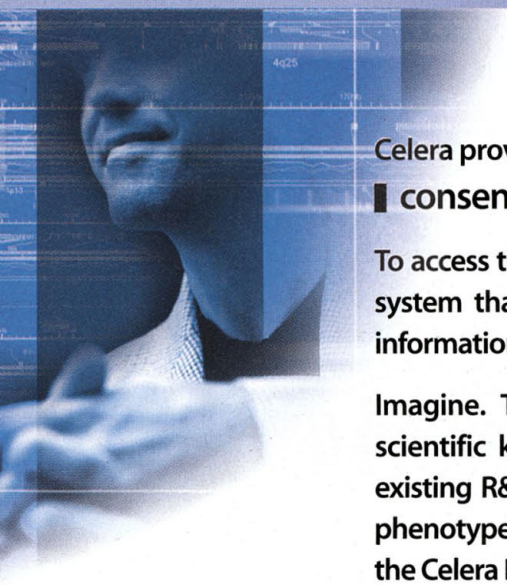

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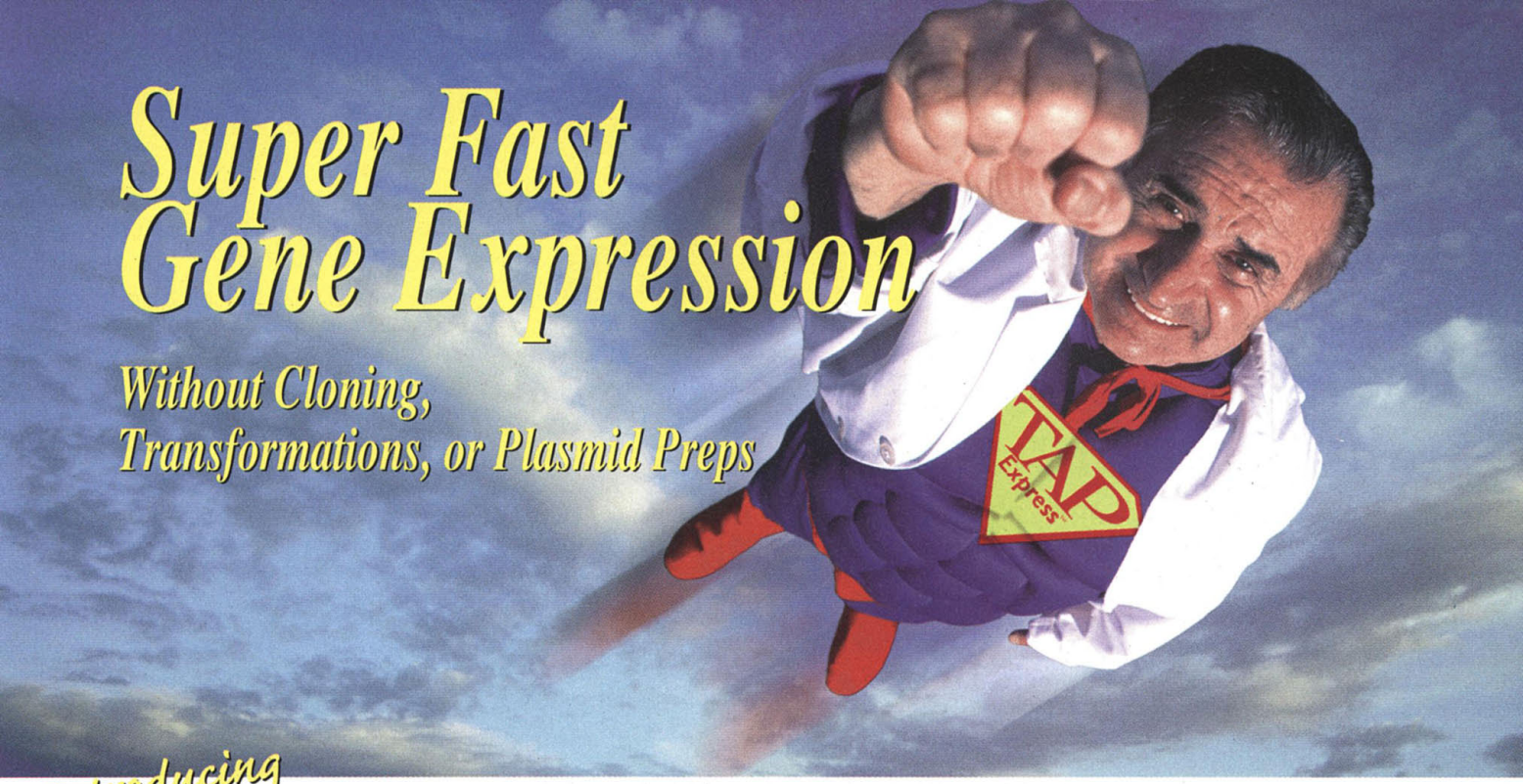

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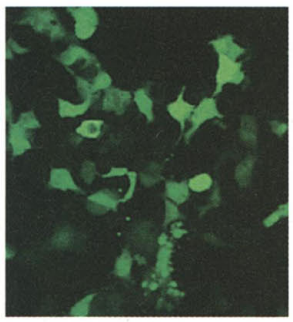

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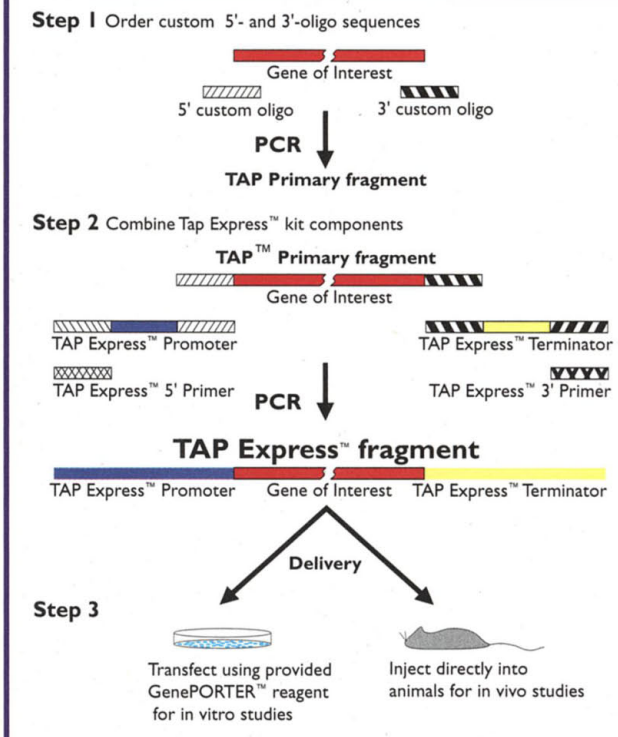

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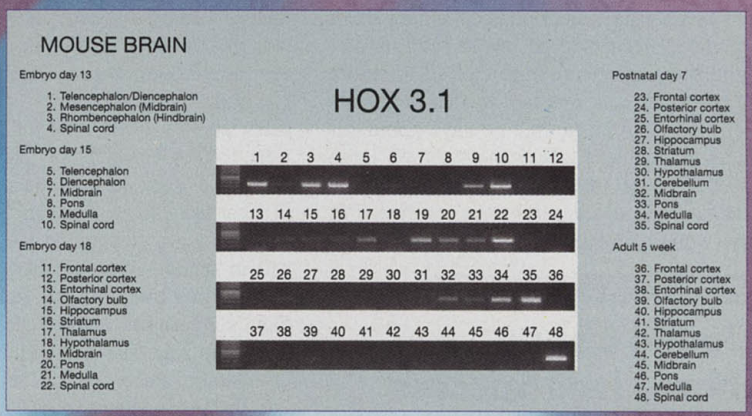

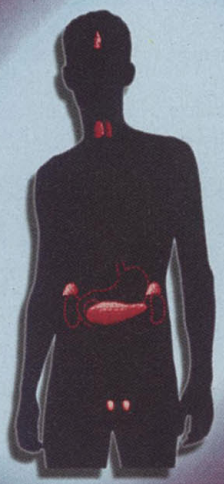

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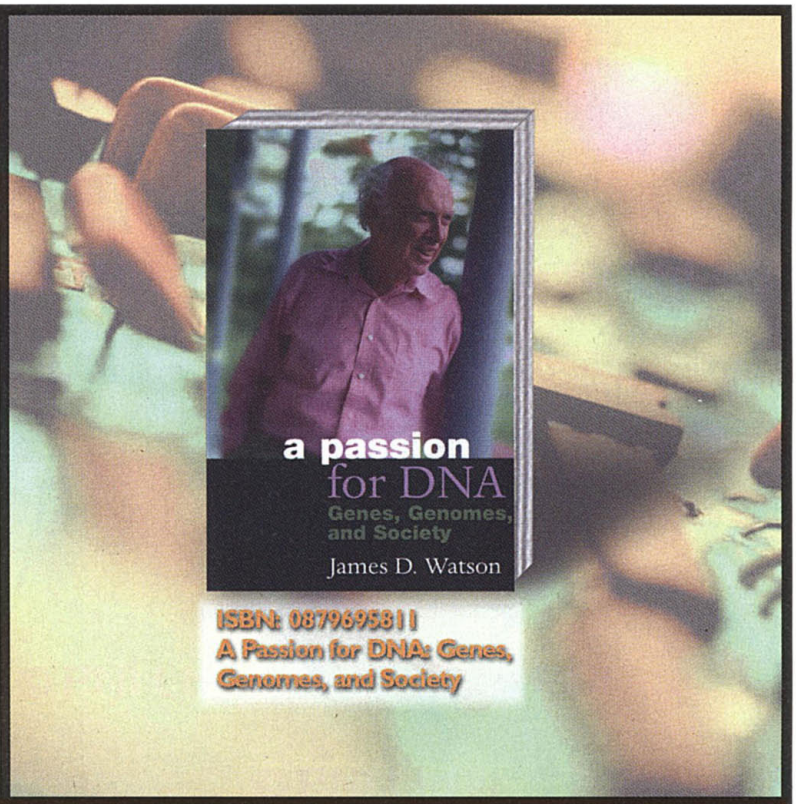

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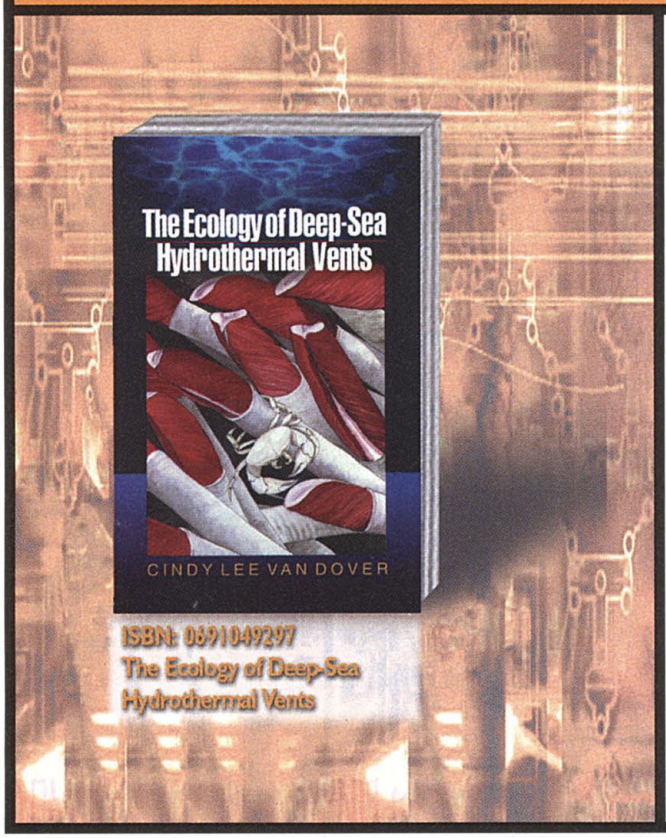

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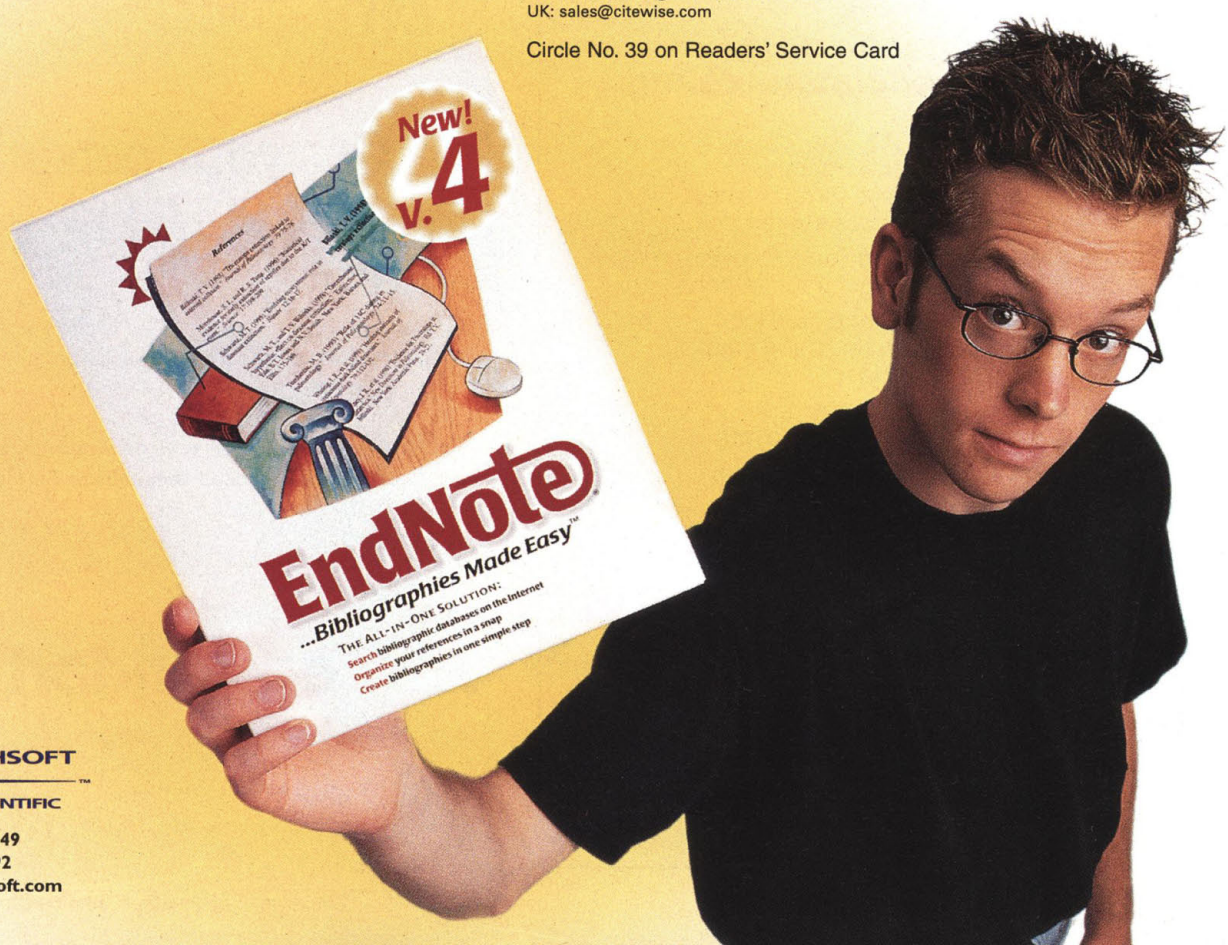

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