5 April 2002

Science

Vol. 296 No. 5565
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The RICE Genome

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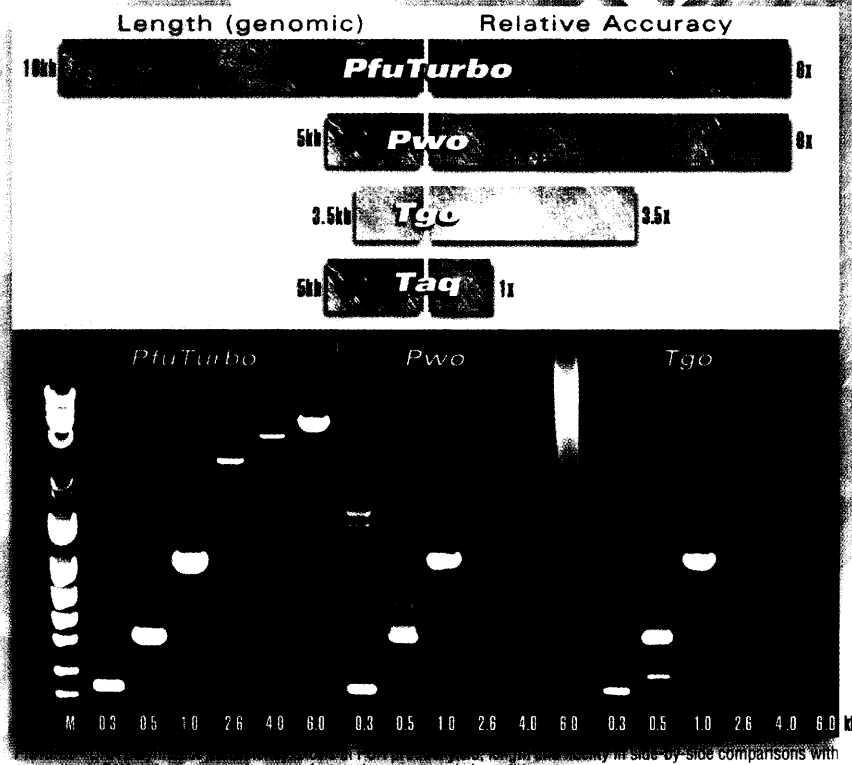

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1. Hogrefe, H., et al, (2002) *Proc Natl. Acad. Sci. USA* 99, 596-601
‡ PhorTech International, DNA Amplification, 1999/2000 U.S. MSPPSA Series

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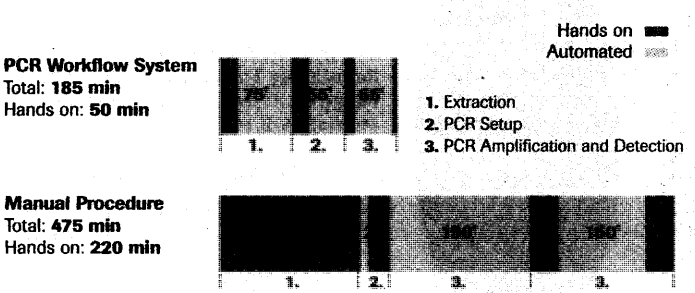

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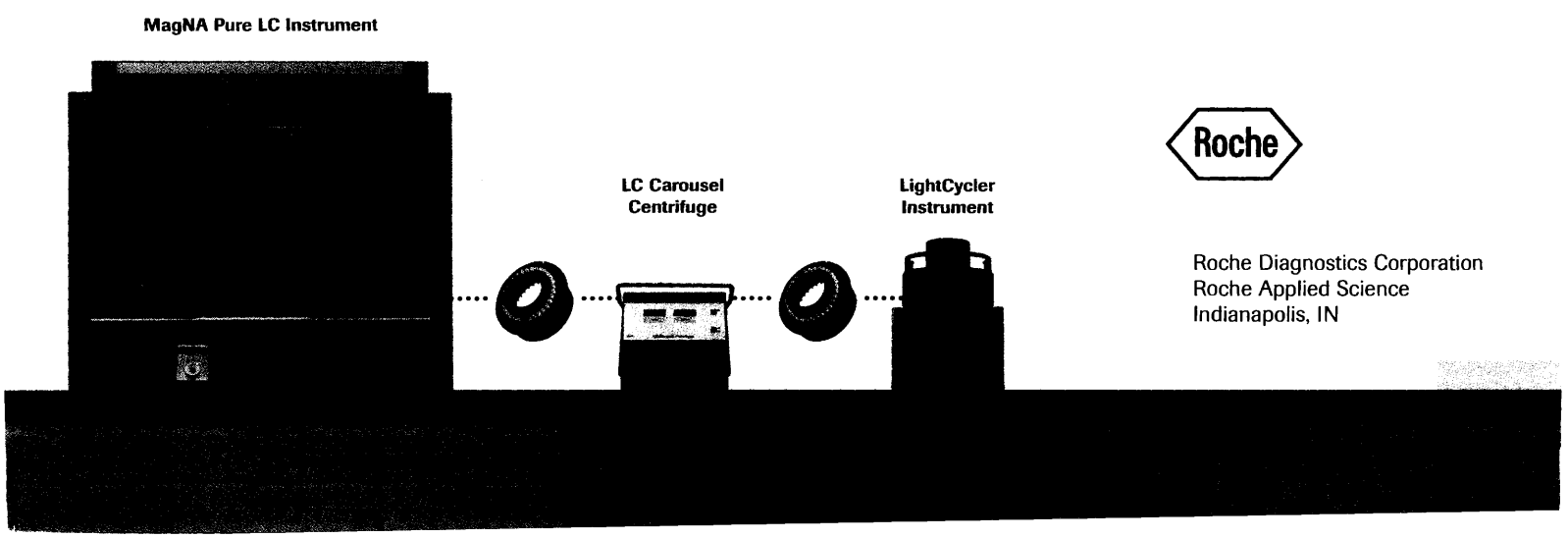

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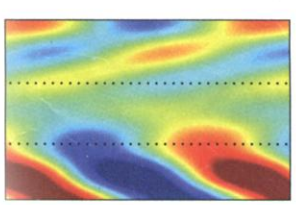
Volume 296 5 April 2002 Number 5565

NEWS

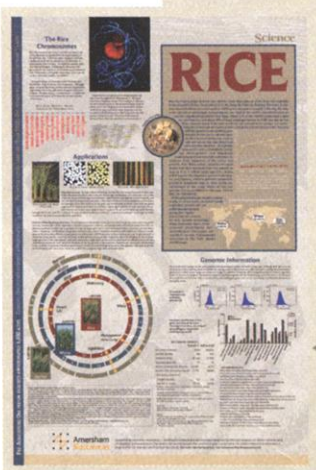
SCIENCE'S COMPASS

RESEARCH

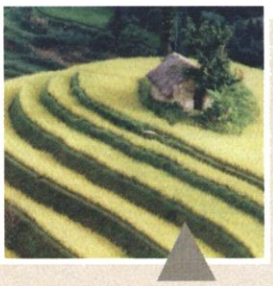


RESEARCH (CONTINUED)

THE RICE GENOME



115 Pull-out section highlighting rice genomics



COVER 79, 92

Photograph of the Honghe Hani rice terraces in Yunnan Province, China. In this issue, two separate research groups report draft sequences of two strains of rice—*japonica* and *indica*. In addition, the Editorial, News Focus, Letters, and Perspectives highlight the significance of the rice genome to the world's population. [Image: Liwen Ma and Baoxing Qiu, Beijing Genomics Institute]

New on *Science* Express Buzzing a comet: Glimpse of the nucleus

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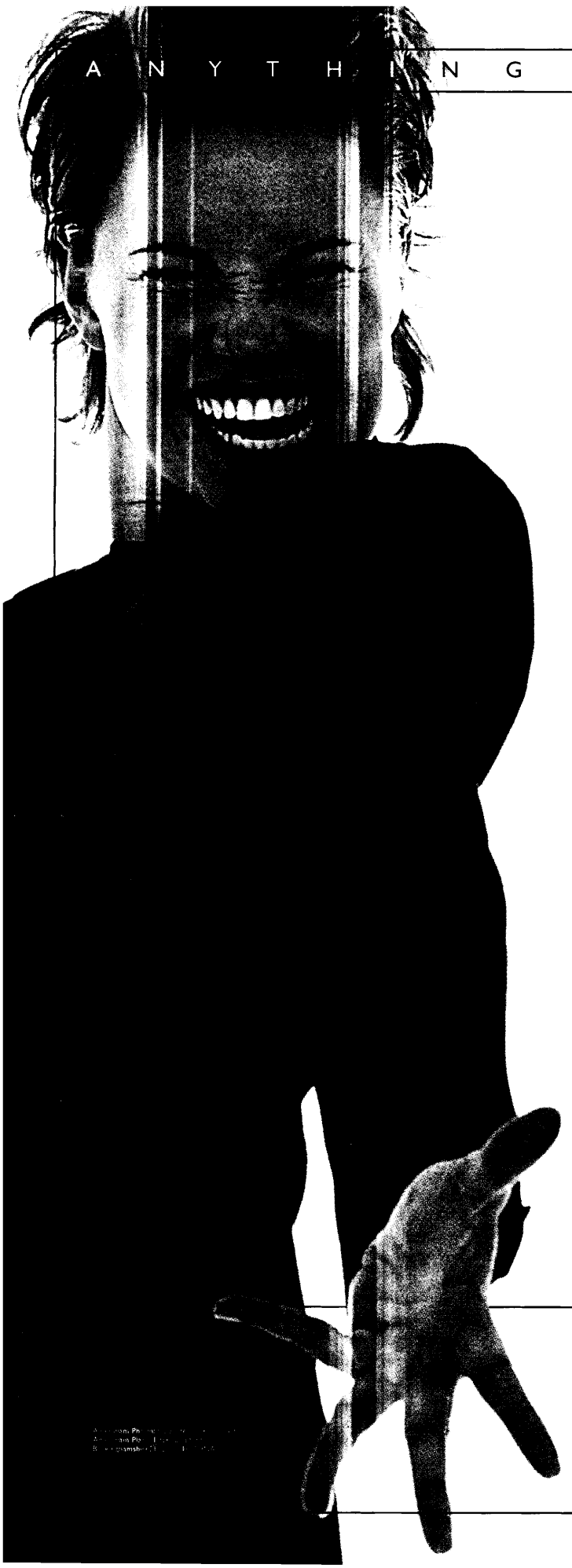

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CONTENT HIGHLIGHTS AS OF 5 APRIL 2002

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Observations of Comet 19P/Borrelly by the Miniature Integrated Camera and Spectrometer Aboard Deep Space 1 L. A. Soderblom *et al.*

Images and spectra of the comet's nucleus, collected by the innovative, ion-propelled Deep Space 1 spacecraft, show that it is dark and dry, yet dynamic, spewing off fans and jets of dust and gas.

Genomic Instability in Mice Lacking Histone H2AX A. Celeste *et al.*

Absence of the DNA repair–associated protein, H2AX, leads to a poor DNA damage response and a range of genetic abnormalities.

Transcription Control by E1A and MAP Kinase Pathway via Sur2 Mediator Subunit J. L. Stevens *et al.*

The Mediator confers selectivity in its transcriptional activity through its various subunits that interact directly with specific transactivators.

TECHNICAL COMMENTS

The California Current, Devils Hole, and Pleistocene Climate

Herbert *et al.* (Research Articles, 6 July 2001, p. 71) found that sea surface temperatures (SSTs) in the area now dominated by the California Current warmed 10,000 to 15,000 years before deglaciation at the past five glacial maxima but did not rise before deglaciation south of the modem Califomia Current front. Thus, they concluded, early warming in this area (including the trend recorded in vein calcite at Devils Hole, Nevada) likely represented not a global signal but a regional one tied to weakening of the Califomia Current due to growth of the Laurentide ice sheet, and that the Devils Hole record "does not pose a fundamental challenge to the orbital ('Milankovich') theory of the ice ages." In a comment, Winograd, citing evidence of pre-deglaciation warming across a wide range of latitudes, asserts that the "intriguing notion linking California Current SSTs and the Laurentide ice sheet" is "open to question, as is [the] assertion" that the work resolves internal inconsistencies in the Milankovich theory. Herbert *et al.*, in response, offer several arguments in support of their "basic conclusion that regional climate processes are important and are expressed in the preserved paleoclimate record."

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/296/5565/7a

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career resources for scientists

Global: Clinical Research Careers Edited by K. Cottingham

Throughout April: Find out how to break into the clinical research field, and read about the opportunities available for clinical scientists around the world.

US: GrantsNet's April News K. Cottingham

International research fellowships and grants from the NSF, a profile of an American Society for Microbiology Robert D. Watkins Minority Graduate Fellow, and the latest biomedical funding news.

Singapore: Clinical Research Odyssey in India S. Jayanthi, A. Kumar, N. Anand, V. Chhatwal

The clinical research scene in India emphasizes clinical trials and workforce development.

US: Raising Their Voices—The Emergence of Postdoc Grievance Procedures J. Gabriel

Postdocs are organizing to establish standardized grievance procedures, including postdoc representation on grievance committees.

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The Werner Syndrome Helicase-Nuclease M. Fry

One protein, many mysteries.

A Jump-Start for Replication R. J. Davenport

When DNA-copying machinery conks out, Bloom's syndrome helicase brings repair proteins to the rescue.

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Perspective: Calcium Release and Influx in Yeast—TRPC and VGCC Rule Another Kingdom M. Bonilla and K. W. Cunningham

Lessons in capacitative calcium entry from yeast.

Review: ADAP-ting TCR Signaling to Integrins E. K. Griffiths and J. M. Penninger

Inside-out signaling comes to the immune system.

Connections Map: Jak-STAT Pathway Pathway Authorities: D. Aaronson and C. Horvath

A canonical view of cytokine signaling.

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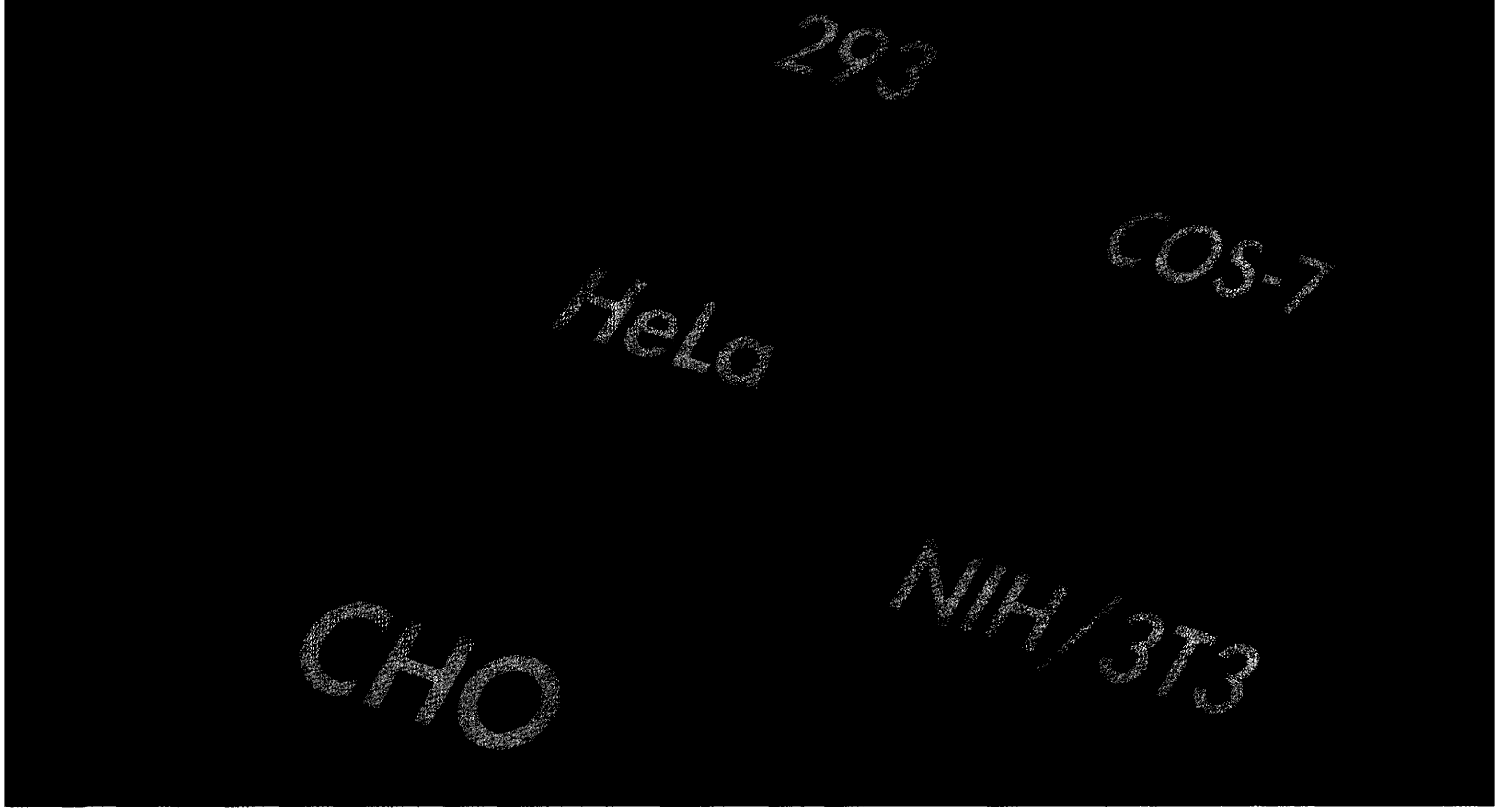

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THIS WEEK IN Science

edited by Phil Szuromi

Sun Twists

The Sun's 11-year cycle of magnetic activity is characterized not only by changes in sunspot concentration but also by latitudinal variations in the rotation rate of bands of plasma at the Sun's surface. Vorontsov *et al.* (p. 101; see the Perspective by Toomre) have used oscillations in the acoustic gravity waves in the Sun's interior collected by the Solar and Heliospheric Observatory (SOHO) to track these zonal bands over a period of almost 6 years into the Sun's interior. The entire convection zone of the Sun is involved in the differential rotation and latitudinal shifts of the zonal bands. Such measurements should help in connecting the observed surface features and the solar magnetic field with the deeper dynamo, which is thought to be located at the base of the convective zone.

Dodging Asteroids

Normally, it is difficult to predict the orbital path of asteroids beyond a few decades because of the nonlinear nature of the processes that perturb their orbits. Giorgini *et al.* (p. 132; see the news story by Kerr) have recognized that asteroid 29075 (1950DA) presents a special case. Extensive radar and optical data collected over decades, an inclined orbit that reduces perturbations, and a previously unrecognized gravitational resonance that modulates the uncertainty of its orbital path allow an accurate orbital path prediction that extends for hundreds of years—including a possible collision with Earth in March 2880. The largest uncertainty in the orbital path simulation is related to 29075's unknown surface characteristics because anisotropic thermal re-radiation of absorbed solar energy from the asteroid's surface (the Yarkovsky effect) can significantly alter the orbit over a long time. In Brevia, Spitale (p. 77) shows that we can potentially mitigate asteroid hazards by altering the asteroid's surface, and the Yarkovsky effect, enough to avoid a collision with Earth.

Into Africa

A record of biogenic silica accumulation from Lake Malawi assembled by Johnson *et al.* (p. 113; see the Perspective by Baker) suggests a connection between cold conditions in the Northern Hemisphere (between 11,000 and 25,000 years ago) and high diatom productivity caused by north winds over that part of equatorial Africa. More frequent north winds over the Malawi basin may have resulted from a more southerly migration of the Intertropical Conversion Zone. This interpretation is supported by the Nb-Ti ratio of the sediments. This ratio, which varies roughly in concert with the biogenic silica accumulation rate, is controlled by the input of windblown volcanic ash that originates from a region north of the lake.

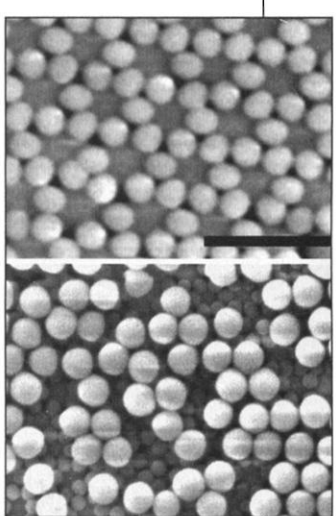
79
92

Going with the Grain

Two separate research groups report high-quality draft sequences of the rice genome that are expected to facilitate advances in the agriculture of this critical food grain. Yu *et al.* (p. 79) sequenced the indica variety of rice, and Goff *et al.* (p. 92) sequenced the japonica variety of rice. Comparisons will show how these two popular rice strains have diverged. The rice genome also provides a useful road map for investigating the larger genomes of related cereal grains such as wheat and maize [see also the report by Seki (p. 141) on *Arabidopisis* complementary DNA clones]. Related pieces include a pull-out wall chart that gives a summary of important aspects of rice genome research, the editorial discussing the agreements that govern accessibility to some of the data, and letters to the editor that call for continuing with the sequencing of rice to the point of a final, complete sequence. In the Perspectives, Bennetzen, as well as Ronald and Leung, discuss the implications for genomic and agricultural sciences, Cantrell and Reeves discuss the implications that sequencing the rice genome holds for promoting worldwide food security, and Serageldin discusses the interplay between worldwide economic development and food security. News stories discuss the background on what many of the various rice genome-sequencing groups have been doing, the Celera-type agreements that are governing release of the data for the Goff *et al.* paper, and a profile of the Chinese group that authored the Yu *et al.* paper.

Controlling Colloids

Insights into the formation of glasses and crystals by molecules can be gained by studying and manipulating similar processes in colloidal particles, which can be more readily imaged (see the Perspective by Frenkel). Different amorphous states of a material can be observed that have different density, as has been observed for water. Pham *et al.* (p. 104) confirm through a mixture of simulations, theory, and experiments that two distinct glassy phases of a colloid can form that depend on the nature of the interparticle attractions. At high colloid concentrations, the particles jam against each other and produce a glass based on repulsive interactions. The addition of a noninteracting polymer first causes the glass to melt by causing additional repulsive interactions that open up the structure. Adding more polymer, however, produces a different glassy phase that forms through attractive interactions between the colloidal particles. In binary crystals of large (L) and small (S) colloids, crystal structures can be obtained that are analogous to the atomic structures, such as an LS_2 structure analogous to that of AlB_2. Working with concentrated systems and a narrow range in the ratio of S:L sizes, Velikov *et al.* (p. 106) create colloidal crystals through a layer-by-layer deposition technique. They not only replicated the LS_2 and LS structures but also managed to obtain the LS_3 structure, which does not have an atomic analog. By building the crystal from two materials, they could selectively remove the small colloidal particles to leave behind a hexagonal, non–closed packed crystal.



CREDIT: VELIKOV *ET AL.*

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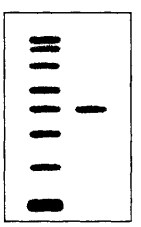

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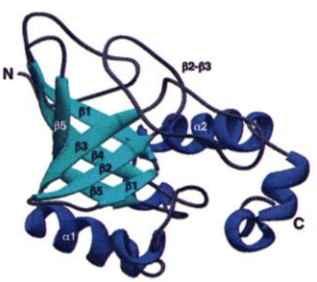
Birds, Bile, and Breeding

Birds use a variety of physiological and environmental cues to determine when best to lay eggs, but learning also plays a role. Grieco *et al.* (p. 136; see the news story by Withgott) have discovered, in experiments with blue tits in a Netherlands forest, that a female bird's experience of food supply in 1 year can influence the date of egg-laying in the subsequent year. By increasing the availability of food during the nestling period, the birds were duped into laying eggs later in the following year. Female sea lampreys must travel long distances up streams to reach the nests that their male counterparts have already built. The females follow a chemical cue released by the males, but the known fish sex pheromones, which include steroids, only act at short ranges. Li *et al.* (p. 138) show that male lampreys release a bile acid that can signal both their location and reproductive status to females over such large migratory distances.

Cdc13 Joins the Fold

The ends of eukaryotic chromosomes are capped by specialized nucleoprotein complexes called telomeres. The telomeric single-stranded (ss) DNA binding protein used by the budding yeast *Saccharomyces cerevisiae*, Cdc13, is unrelated in amino acid sequence to the telomere end-binding proteins in other organisms. Mitton-Fry *et al.* (p. 145) determined the solution structure of a complex containing the Cdc13 DNA binding domain and telomeric ssDNA and found that despite its distinctive primary sequence, Cdc13 uses the same structural motif for DNA binding—the so-called "OB fold"—as the other proteins.



CREDIT: MITTON-FRY *ET AL.*

Tracking the Origins of Chromatin Acetylation

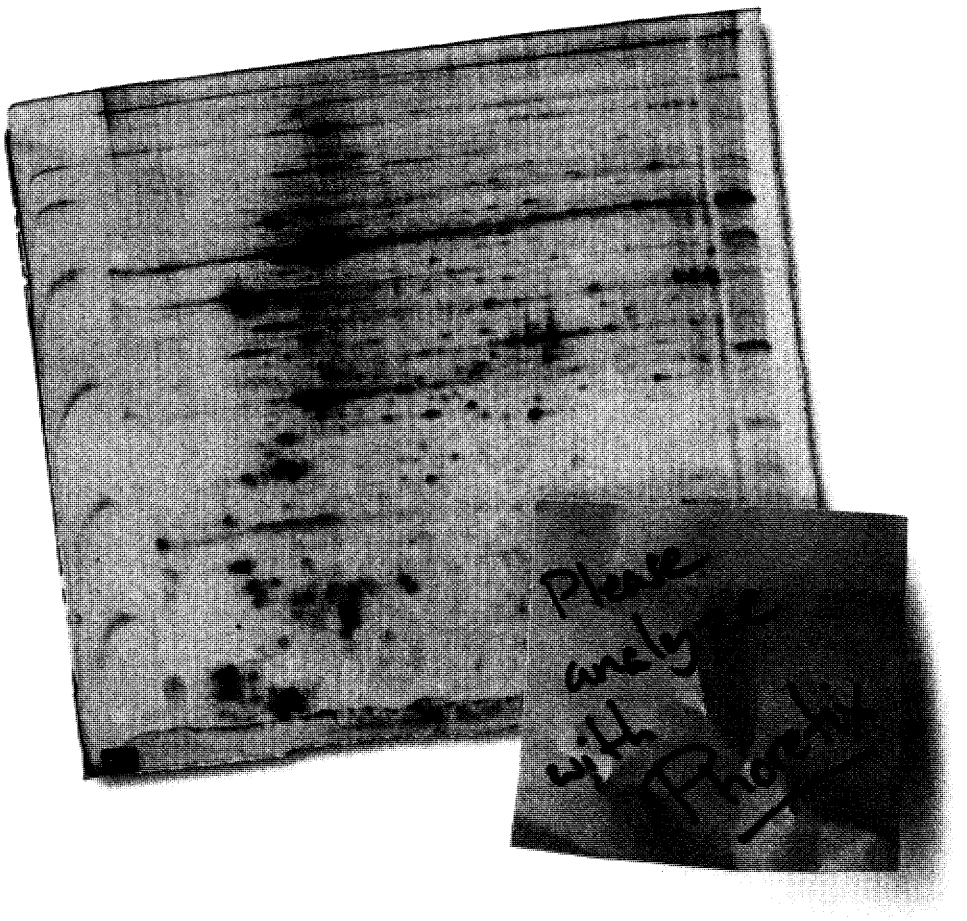
Modulation of chromatin structure plays key role in the regulation of gene expression in eukaryotes, whereas in archaea, gene regulation is thought to be effected by simple bacteria-like repressors. Sir2, which plays an important role in chromatin dynamics in yeast, is highly conserved across prokaryotes, archaea, and eukaryotes. Bell *et al.* (p. 148) show that Sir2 from the archaeon *Sulfolobus solfataricus* modulates (and increases) the DNA binding activity of the chromatin protein Alba by deacetylating two of the lysine residues in its amino terminus. This step in turn facilitates Alba's ability to repress transcription in vitro. These results suggest that regulation of chromatin structure by acetylation arose in the common ancestor of the archaea and eukaryotes.

The Outs and Ins of Signaling

Integrins, which are central to cell adhesion, are cell surface molecules comprised of α and β transmembrane subunits. Their extracellular domains bind to external ligands containing the Arg-Gly-Asp tripeptide motif, and this results in the canonical "outside-in" signaling common to many cell surface receptors: Internal signals transmitted to their intracellular domains alter the ligand-binding competency of the external regions. Xiong *et al.* (p. 151) present the structure of the complex between the extracellular portions of the integrin αV-β3 and a cyclic peptide. The contacts made by the Arg-Gly-Asp residues lead to conformational changes in the relative orientations of the α and β subunits.

Damage Control

Successful repair of injured tissue relies on removal of products generated in the turnover of the extracellular matrix. Teder *et al.* (p. 155) offer direct evidence that CD44, a receptor for the matrix protein hyaluronan, is pivotal in this process. In a model of lung injury that usually resolves within 2 weeks, mice lacking CD44 expression developed fatal pulmonary inflammation caused by persisting inflammatory cells and low-molecular-weight hyaluronan fragments at the damaged site. Normal removal of these agents was associated with transforming growth factor–β activation and could be mostly attributed to CD44 expression on hematopoietically derived cells, rather than parenchymal cells of the lung.



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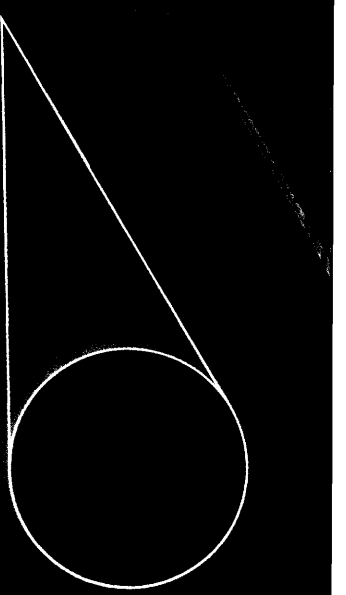

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10 min

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Heat 10 minutes **(at 95 °C)**

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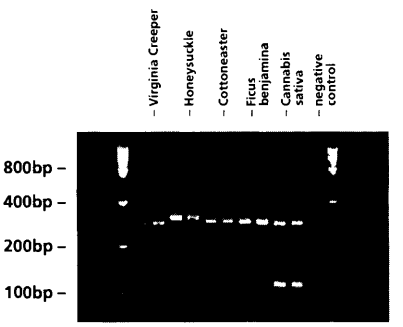

Extract-N-Amp Plant PCR Kit with 5 different plant specimens. *Genomic DNA was extracted from 0.5 cm leaf disks that were cut using standard paper punch. DNA was extracted using the Extract-N-Amp Plant PCR Kit in less than 15 minutes. All samples were then amplified using the specially formulated Hot Start PCR mix. The products were generated from a 30-cycle duplex reaction containing primers specific to plant chloroplast (upper band) and primers specific for Cannabis sativa DNA (lower band).*
Data provided by Andy Hopwood, Forensic Science Service, Birmingham, England.

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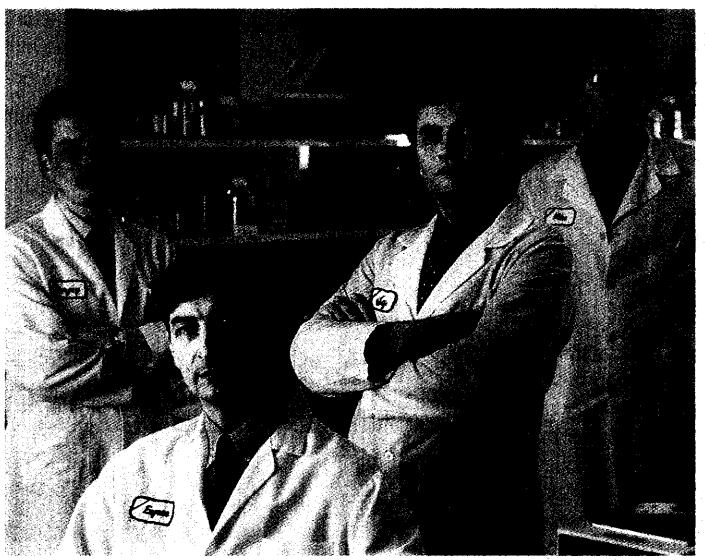

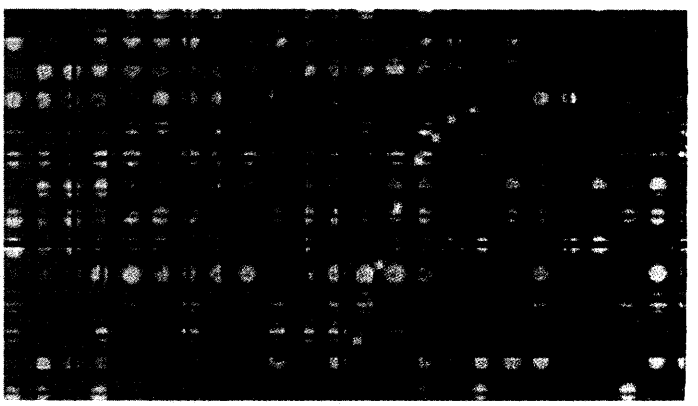

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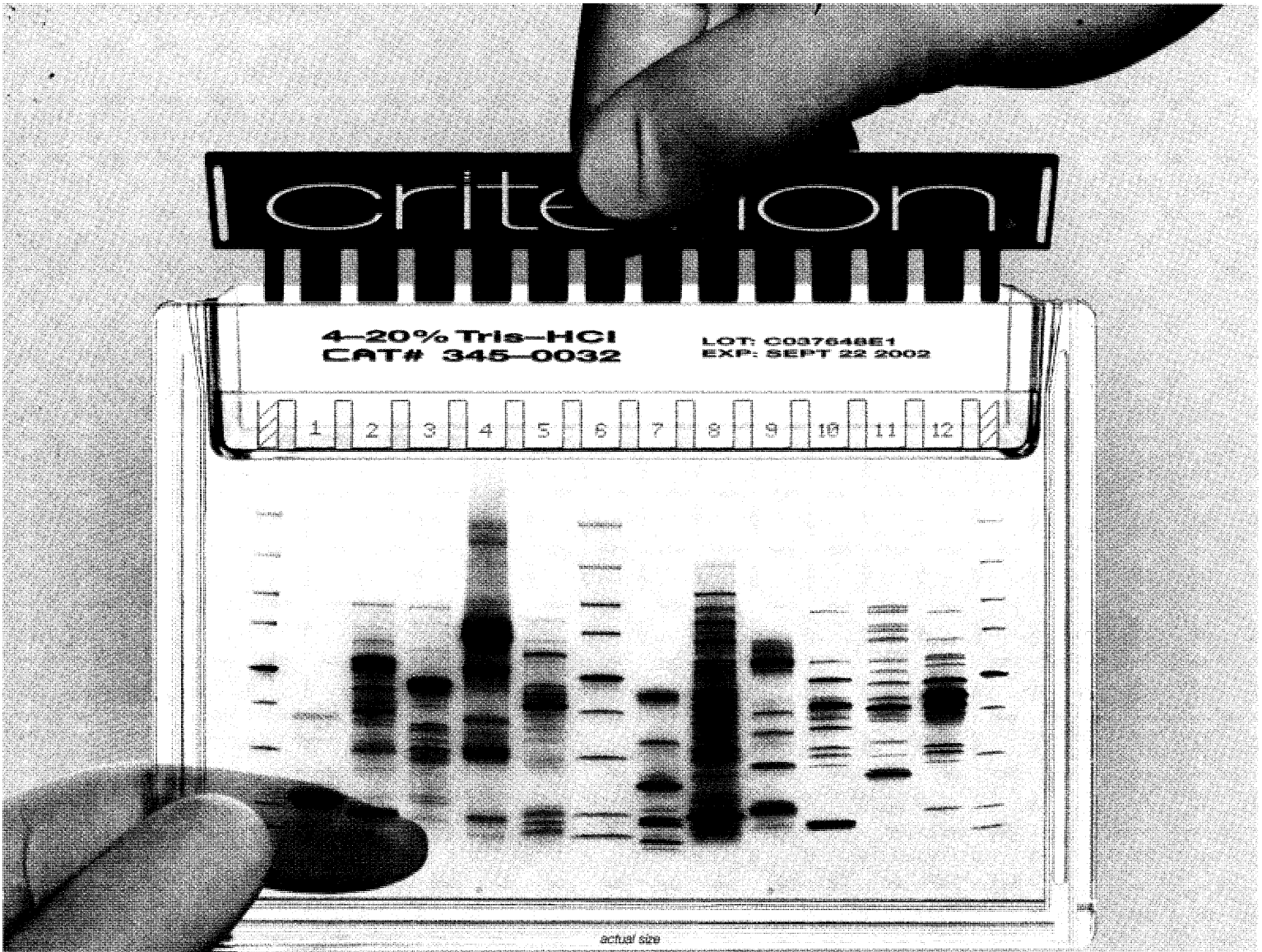

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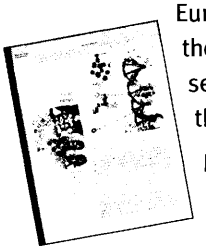

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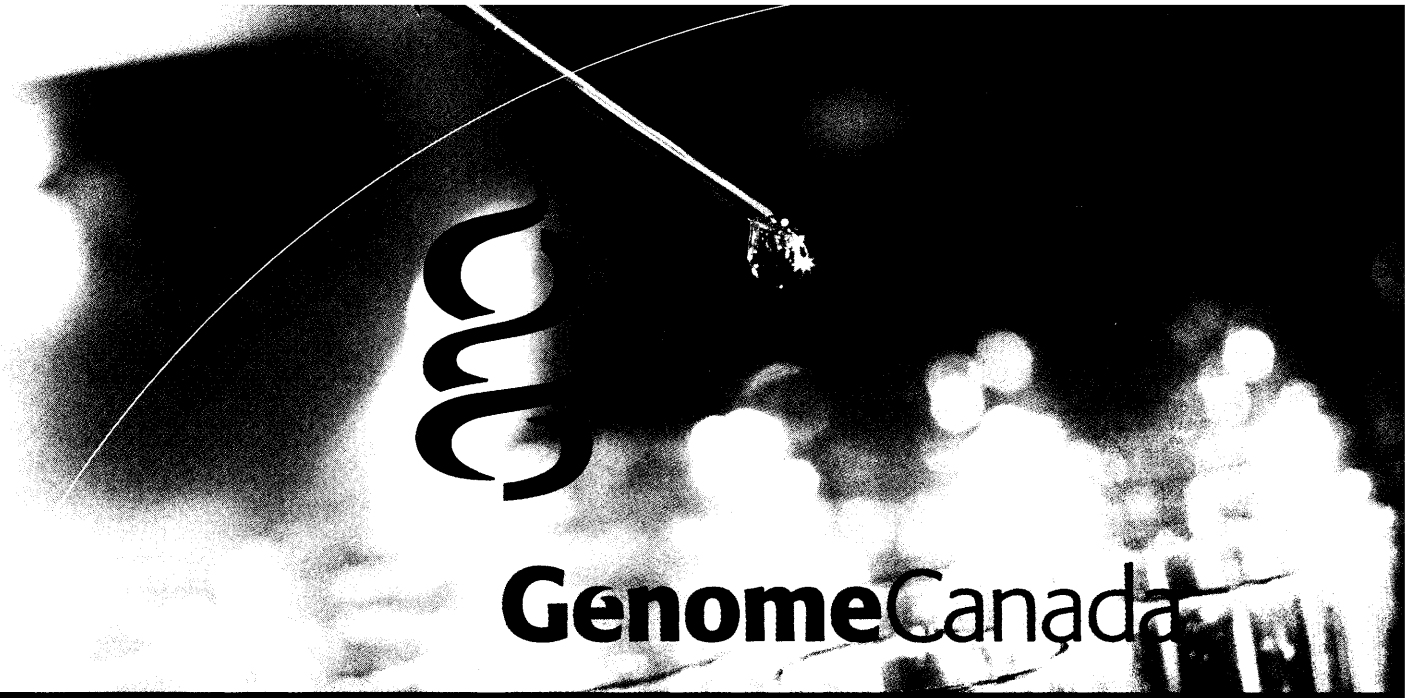

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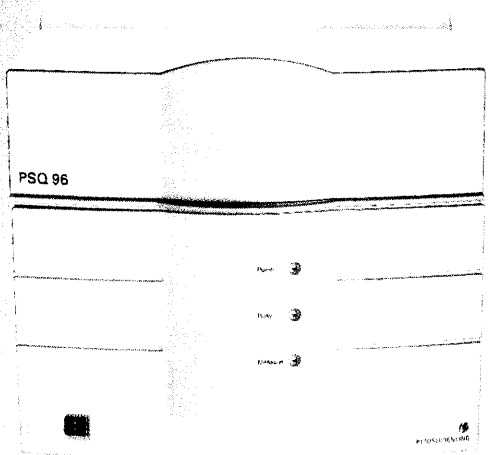

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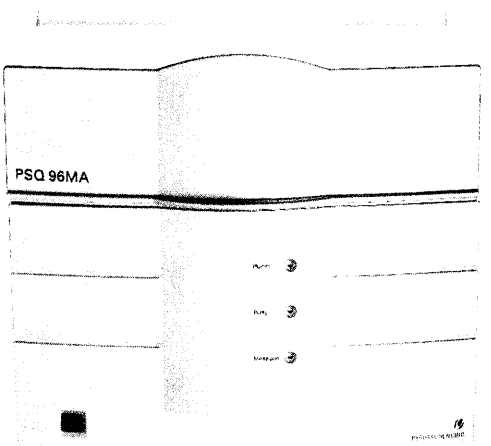

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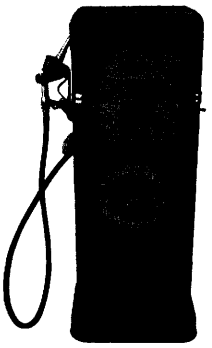

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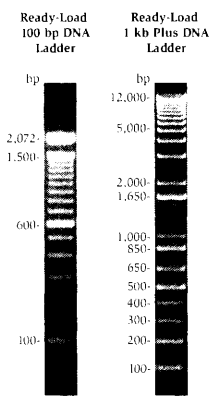

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Inchinnan Business Park
Paisley PA4 9RF, UK
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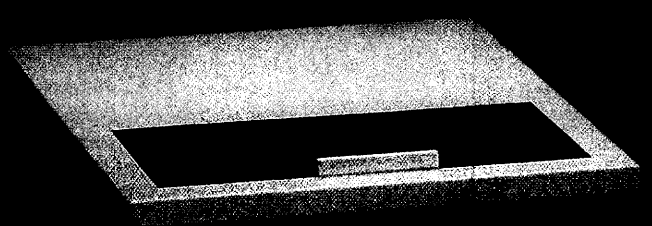

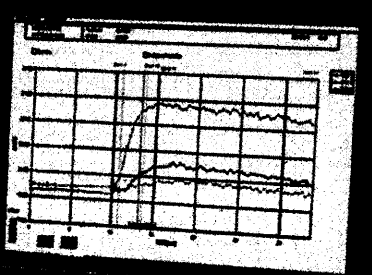

BMG Labtechnologies GmbH, Hanns-Martin-Schleyer-Str. 10, D-77656 Offenburg/Germany
Phone: +49 781 96968-0, Fax: +49 781 96968-67, germany@bmglabtech.com

AUSTRALIA
BMG Labtechnologies Pty. Ltd.
Phone: +61 3 59734744
Fax: +61 3 59734711
australia@bmglabtech.com

FRANCE
BMG Labtechnologies SARL
Phone: +33 1 48862020
Fax: +33 1 48864707
france@bmglabtech.com

UNITED KINGDOM
BMG Labtechnologies Ltd.
Phone: +44 1296 336650
Fax: +44 1296 336651
uk.irl@bmglabtech.com

UNITED STATES
BMG Labtechnologies Inc.
Phone: +1 919 8061735
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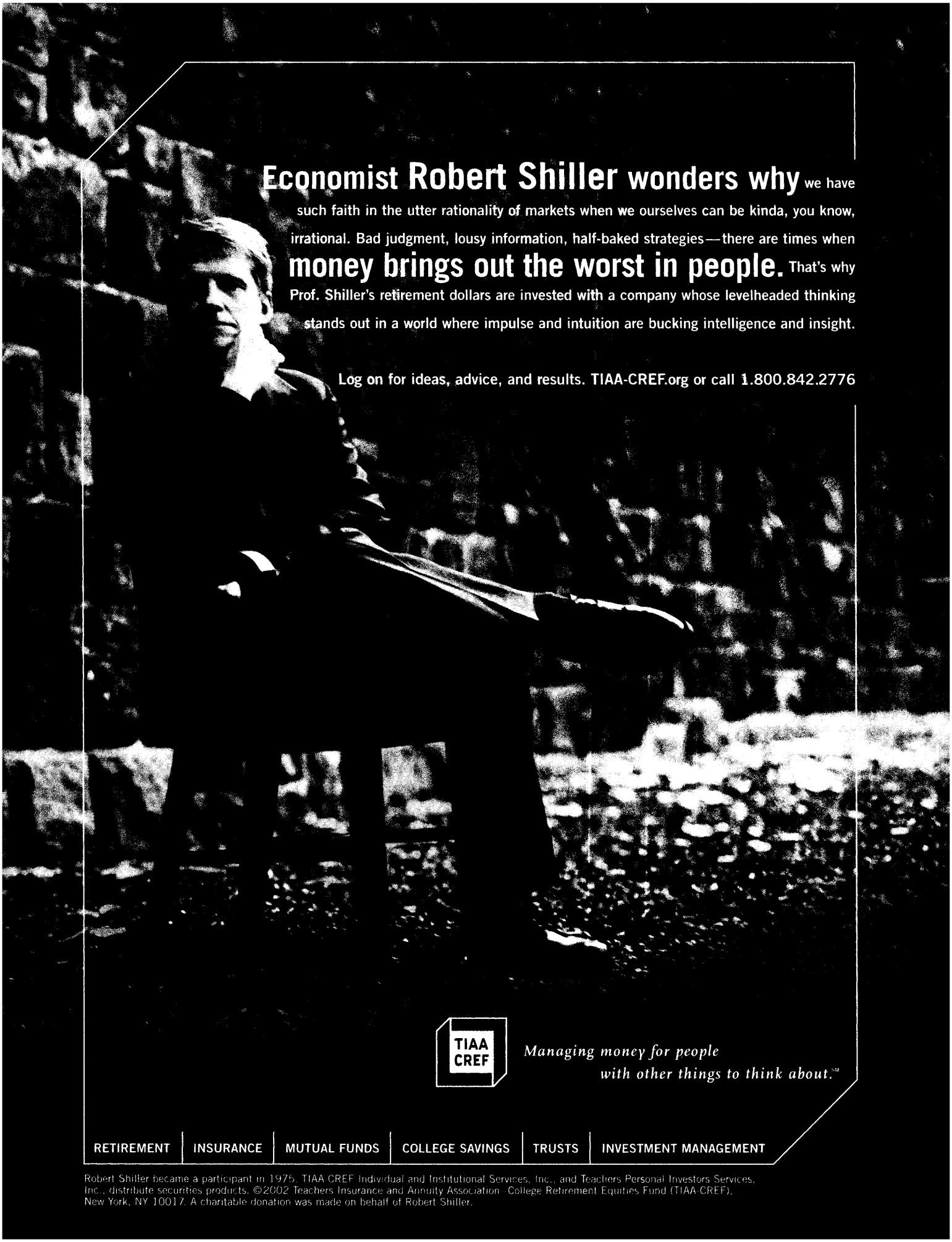
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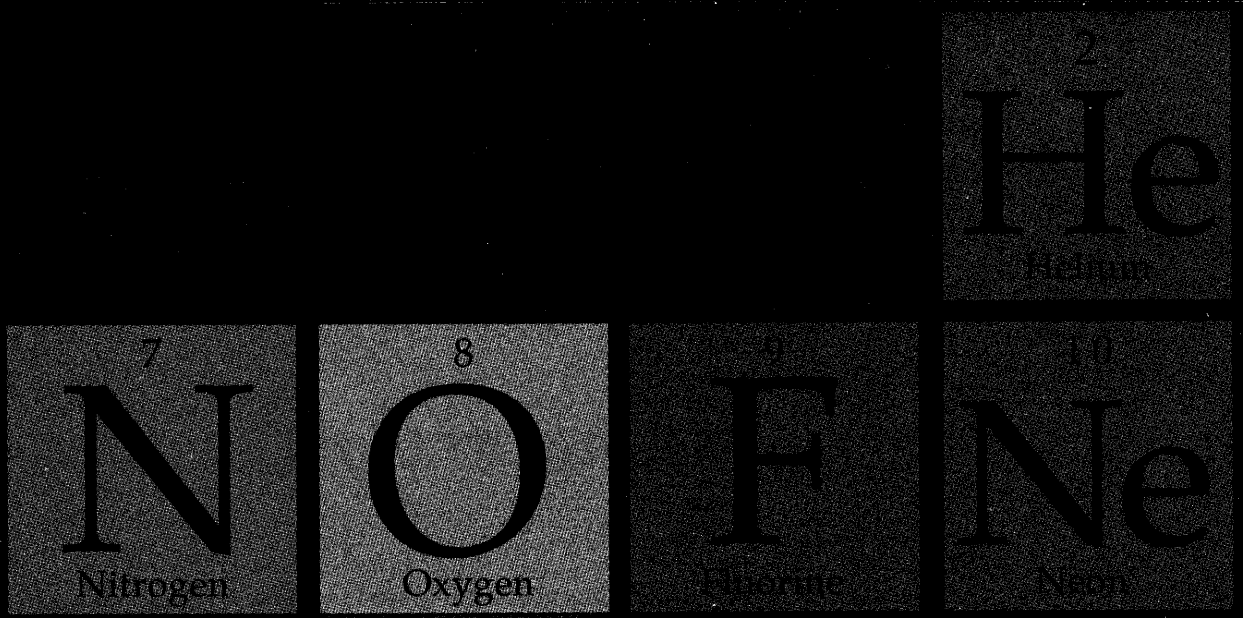

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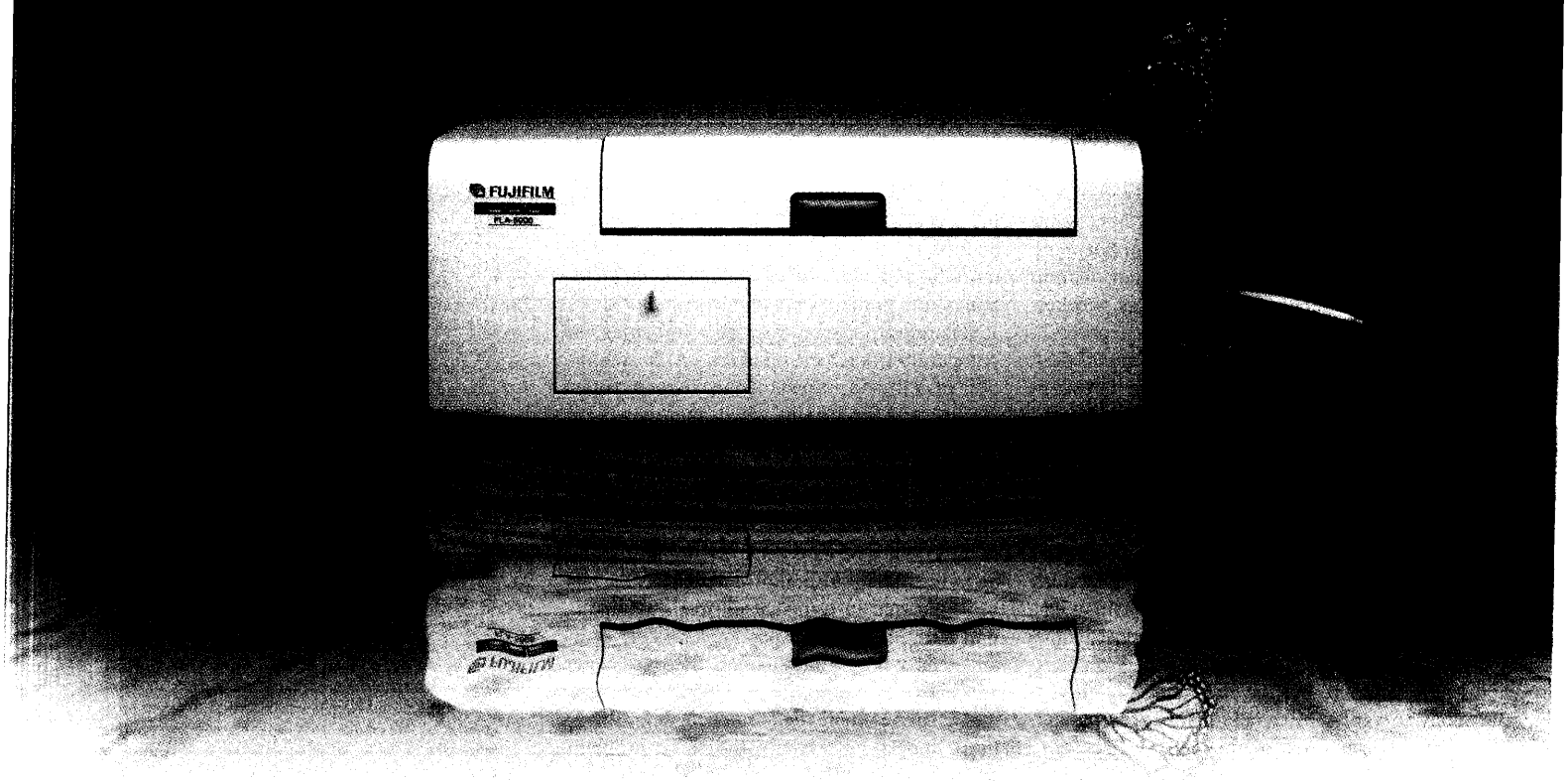

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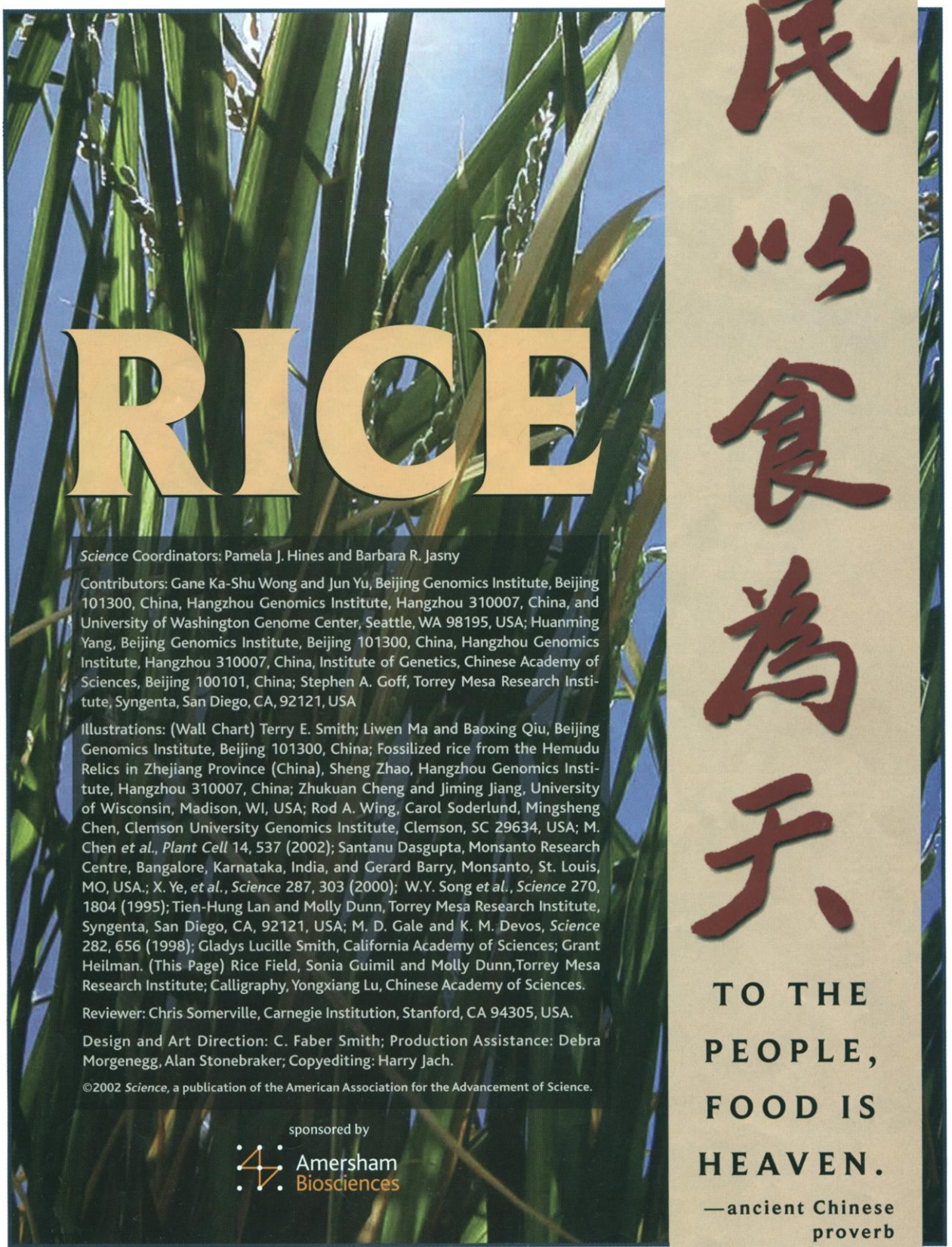
Science



RICE

民以食為天

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—ancient Chinese proverb

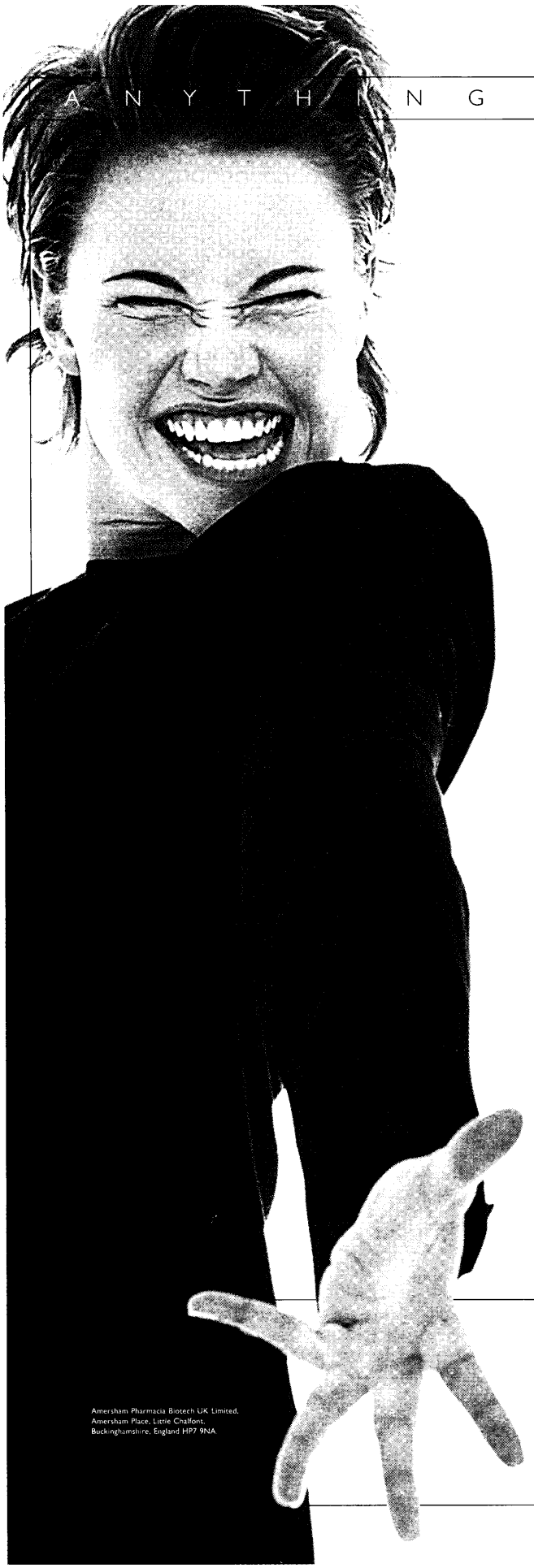
Science Coordinators: Pamela J. Hines and Barbara R. Jasny

Contributors: Gane Ka-Shu Wong and Jun Yu, Beijing Genomics Institute, Beijing 101300, China, Hangzhou Genomics Institute, Hangzhou 310007, China, and University of Washington Genome Center, Seattle, WA 98195, USA; Huanming Yang, Beijing Genomics Institute, Beijing 101300, China, Hangzhou Genomics Institute, Hangzhou 310007, China, Institute of Genetics, Chinese Academy of Sciences, Beijing 100101, China; Stephen A. Goff, Torrey Mesa Research Institute, Syngenta, San Diego, CA, 92121, USA

Illustrations: (Wall Chart) Terry E. Smith; Liwen Ma and Baoxing Qiu, Beijing Genomics Institute, Beijing 101300, China; Fossilized rice from the Hemudu Relics in Zhejiang Province (China), Sheng Zhao, Hangzhou Genomics Institute, Hangzhou 310007, China; Zhukuan Cheng and Jiming Jiang, University of Wisconsin, Madison, WI, USA; Rod A. Wing, Carol Soderlund, Mingsheng Chen, Clemson University Genomics Institute, Clemson, SC 29634, USA; M. Chen *et al.*, *Plant Cell* 14, 537 (2002); Santanu Dasgupta, Monsanto Research Centre, Bangalore, Karnataka, India, and Gerard Barry, Monsanto, St. Louis, MO, USA.; X. Ye, *et al.*, *Science* 287, 303 (2000); W.Y. Song *et al.*, *Science* 270, 1804 (1995); Tien-Hung Lan and Molly Dunn, Torrey Mesa Research Institute, Syngenta, San Diego, CA, 92121, USA; M. D. Gale and K. M. Devos, *Science* 282, 656 (1998); Gladys Lucille Smith, California Academy of Sciences; Grant Heilman. (This Page) Rice Field, Sonia Guimil and Molly Dunn,Torrey Mesa Research Institute; Calligraphy, Yongxiang Lu, Chinese Academy of Sciences.

Reviewer: Chris Somerville, Carnegie Institution, Stanford, CA 94305, USA.

Design and Art Direction: C. Faber Smith; Production Assistance: Debra Morgenegg, Alan Stonebraker; Copyediting: Harry Jach.



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