5 February 1999

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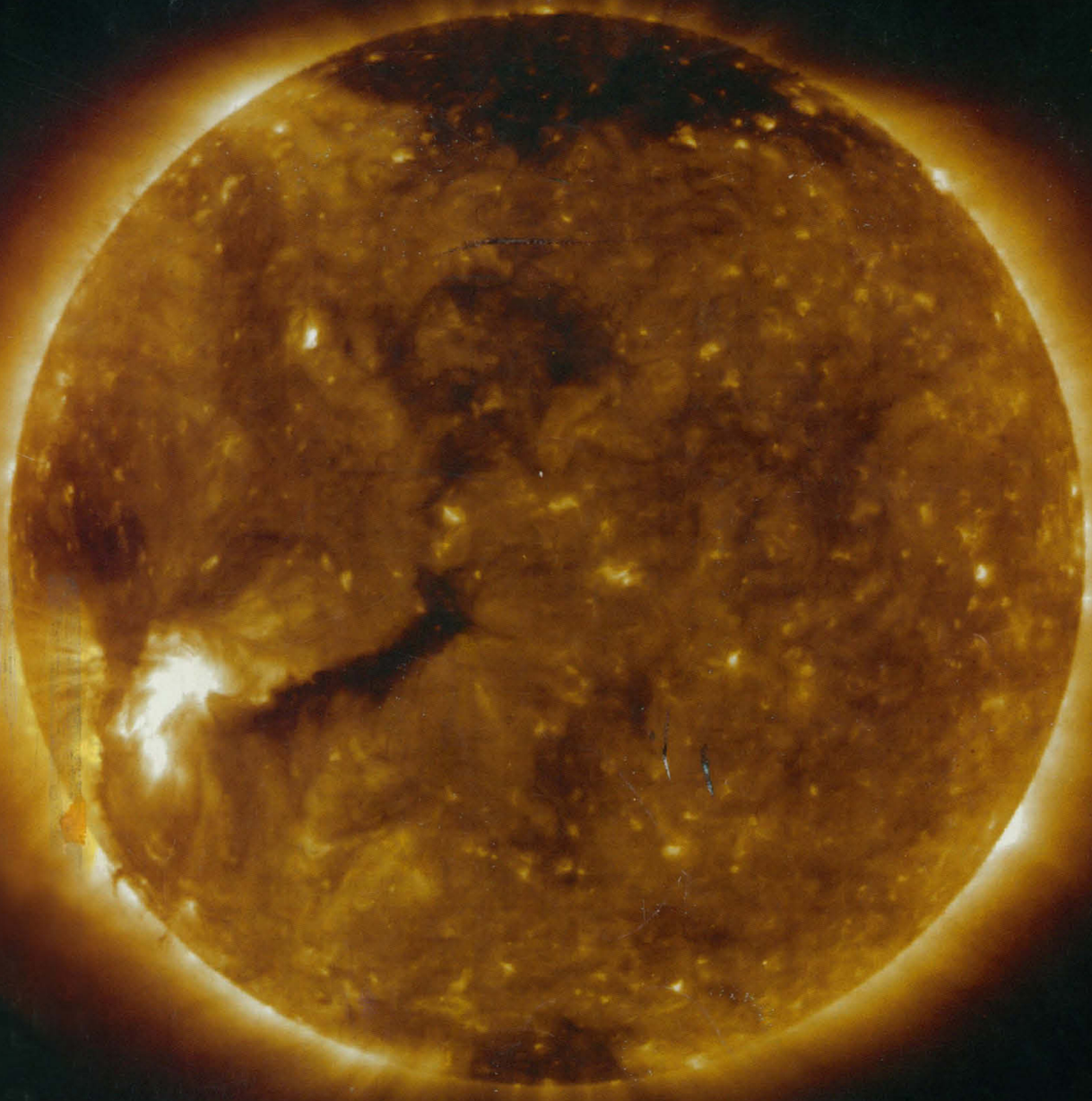

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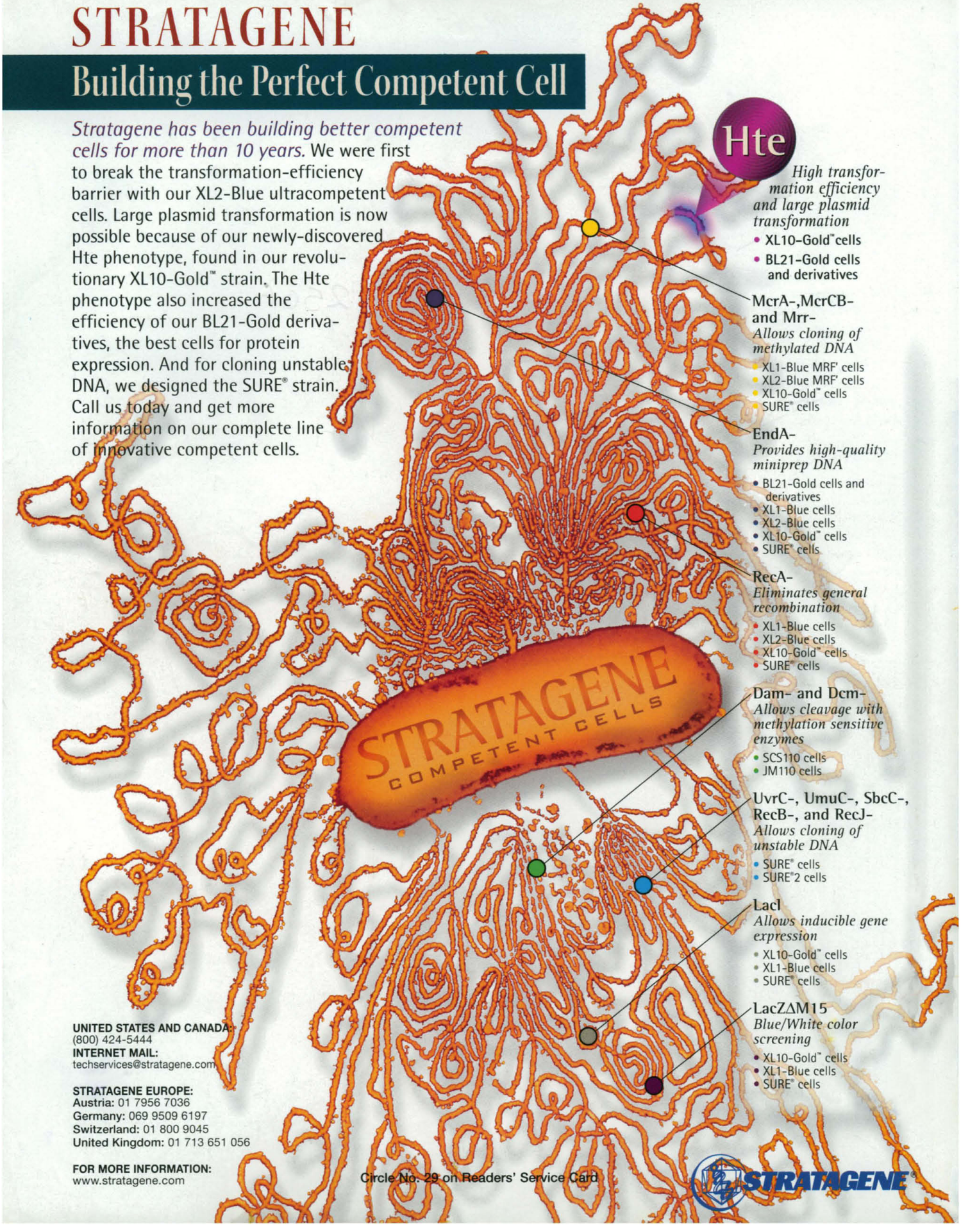

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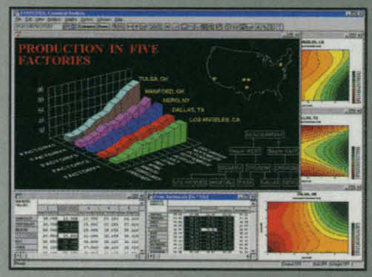

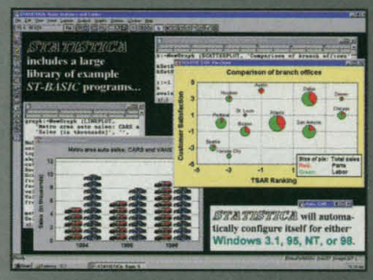

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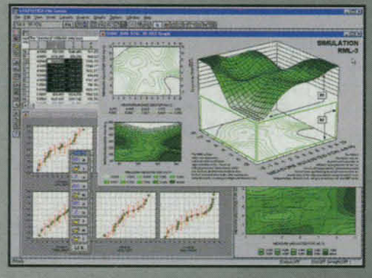

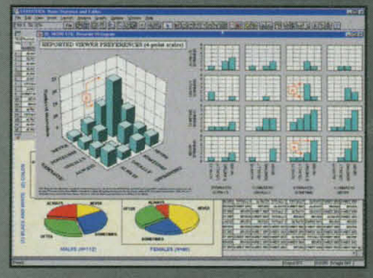

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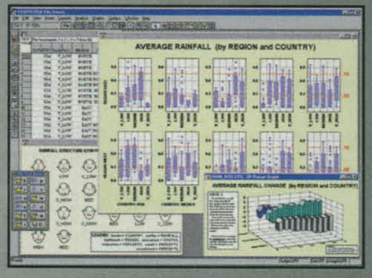

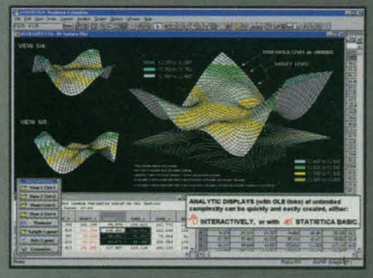

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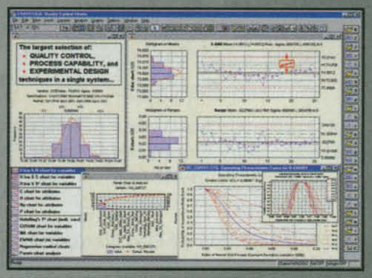

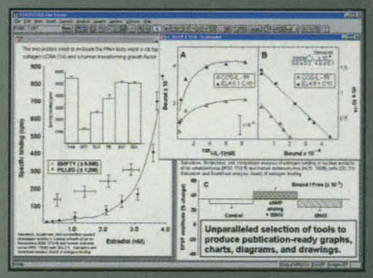

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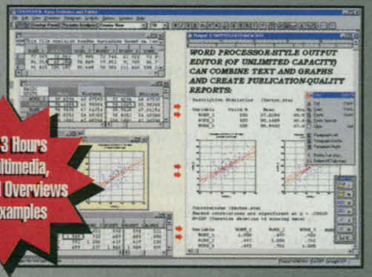

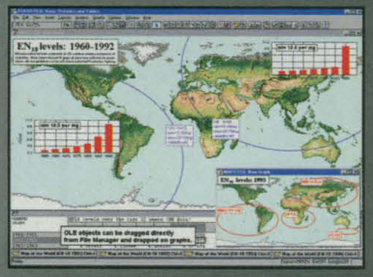

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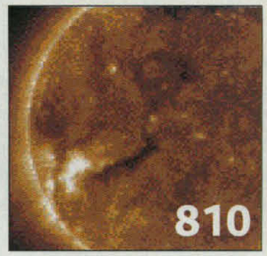

Cover Extreme ultraviolet image of the sun revealing gas at 1.5 million kelvin shaped by magnetic fields. Bright regions are hot, dense plasma loops with strong magnetic fields, while dark regions imply open magnetic field lines and are the source of the high-speed solar wind. The image was taken by the Extreme Ultraviolet Imaging Telescope (EIT) on the ESA/NASA Solar and Heliospheric Observatory (SOHO) spacecraft. [Image: Courtesy of the SOHO/EIT Consortium]

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Tilting away from biomedicine

NEWS

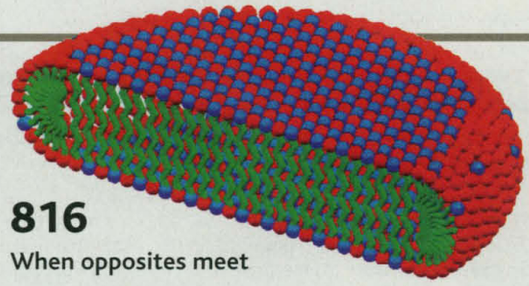
NEWS OF THE WEEK

NEWS FOCUS

RESEARCH

RESEARCH ARTICLE

REPORTS



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When opposites meet

DEPARTMENTS

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Alluring misconceptions by which we live

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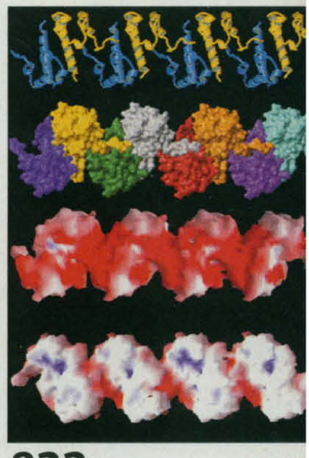

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Structural basis for a signaling platform

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FAST WINDS FROM CORONAL HOLES

Coronal holes are regions of low density and temperature within the solar corona. Observations in the 1970s and 1980s suggested that high-speed solar wind is ejected from areas of the coronal holes where the magnetic field lines are open. Hassler *et al.* (p. 810; see the cover) present Doppler velocity measurements of emitted Ne^{7+} from a polar coronal hole and the equatorial region of the sun obtained from the SOHO spacecraft. Fast outflows of Ne^{7+} ions from the coronal hole (at speeds as high as 20 kilometers per second) are correlated with sheets or intersections of sheets of intense silicon II radiation in the chromosphere below the corona. Most of the Ne^{7+} is flowing downward in the equatorial region between the intense Si II regions. Thus, energy is being brought up from along chromospheric boundaries or intersections and accelerating material along the open magnetic field lines in coronal holes.

SOLAR NEBULA CHEMISTRY

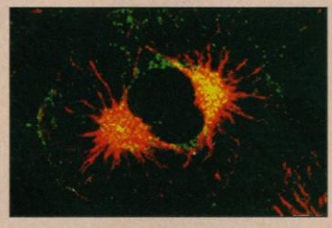
Highly refractory calcium-aluminum–rich inclusions (CAIs) in meteorites are considered to be the most pristine remnants that accreted from the gas and dust in the solar nebula. Hiyagon and Hashimoto (p. 828) analyzed the oxygen isotopic abundances of another, less refractory inclusion type that accreted later, olivine inclusions (OIs), in the Yamato-86009 and Murchison chondrites. The OIs have oxygen-16 enrichments similar to those in the CAIs, which indicates that the two different types of inclusions formed in the same oxygen environment. This unexpected similarity favors a common chemical process for ^{16}O enrichment in the solar nebula rather than an exotic ^{16}O-rich phase residing exclusively within CAIs.

NANODISC FORMATION

Mixing of anionic and cationic surfactants leads to the formation of molecular bilayers at low concentration that may form vesicles or flexible cylinders. Usually, excess salt in the solution screens their electrostatic interactions and tends to destabilize the aggregates. Zemb *et al.* (p. 816) show that in a system without excess salt, achieved by using only H^+ and OH^- counterions, stiff nanodiscs of 3-nanometer thickness form spontaneously and have high charge density at the strongly curved edges; their diameter can be turned from a few micrometers to 30 nanometers. The structures may be used as templates for orienting molecules or for inorganic polymerization.

ON THE DOUBLE

Excessive duplication of centrosomes is found in cancerous cells, but normal cells maintain strict control of duplication of centrosomes during cell division because formation of more than two spindle poles would lead to improper chromosome segregation.



Hinchcliffe *et al.* (p. 851; see the news story by Pennisi) report that replication of centrosomes is regulated through activity of the cyclin-dependent kinase 2–cyclin E (Cdk2-E) complex. In *Xenopus* egg extracts arrested in the S phase of the cell cycle, centrosomes underwent multiple rounds of replication that was strictly dependent on the activity of the Cdk2-E complex. The results help elucidate the molecular basis by which a single round of centrosome replication is coupled to the machinery that controls progression through the cell division cycle.

ORGANIC TRANSISTORS WITH OXIDE GATES

Although all-organic transistors offer the possibility of inexpensive components with low fabrication costs, they typically require high switching voltages (tens of volts). Dimitrakopoulos *et al.* (p. 823; see the news story by Hellemans) now show that field effect transistors based upon pentacene with insulating gates made from amorphous barium zirconate titanate can be fabricated on plastic substrates in an room-temperature process. High carrier mobilities could be achieved at operating voltages typical of silicon devices (5 volts).

LONG-TOOTHED BROWSERS

High-crowned fossil horse teeth suggest a diet of mostly abrasive grasses (C_4 plants) typical of grazers in a tropical or temperate open grassland, whereas short-crowned teeth suggest a diet of soft and leafy plants (C_3 plants) typical of browsers in a wooded or aquatic environment. MacFadden *et al.* (p. 824; see the news story by Morrell) have measured carbon isotopes in the tooth enamel from six species of 5-million-year-old horses that lived in Florida during a time of changing ecosystems. These extinct species had high-crowned teeth, but the isotopic data indicate that five of these species either browsed and grazed or were entirely browsers. The authors suggest that once these species evolved high-crowned teeth, they did not revert to short-crowned teeth despite the change in their diet, possibly because of their rapidly changing environments.

HYDROTHERMAL BREW

One possible location for the synthesis of chemicals needed for the origin of life is submarine hydrothermal systems, where sea water circulates through and reacts with the oceanic crust. Imai *et al.* (p. 831) designed an experiment that simulates aspects of this process. Sea water containing glycine was repeatedly circulated through and heated in a flow reactor, which led to the formation of oligopeptides. Addition of copper ions helped further elongate the peptides.

HOOKED TOGETHER

The sterile alpha motif (SAM) domain is present in a variety of proteins ranging from protein and lipid kinases to transcription factors. This diversity extends to the homotypic and heterotypic protein interactions mediated by this module. Thanos *et al.* (p. 833) report that a SAM domain monomer can interact in two distinct ways with another monomer. Repeated combinations of these interfaces could form higher order oligomers and possible platforms for recruiting other proteins. This mechanism of interaction may explain how proteins utilize SAM domains to regulate different cellular processes.

DIAGNOSIS: IRON LIMITATION

Understanding the factors that limit photosynthesis in the oceans is problematic because of the vast areas involved and the lack of ready diagnostic techniques. Behrenfeld and Kolber (p. 840; see the Perspective by Mullineaux) have identifed a physiological response in phytoplankton that can be used as an indicator of iron limitation. In the open ocean and in labo-

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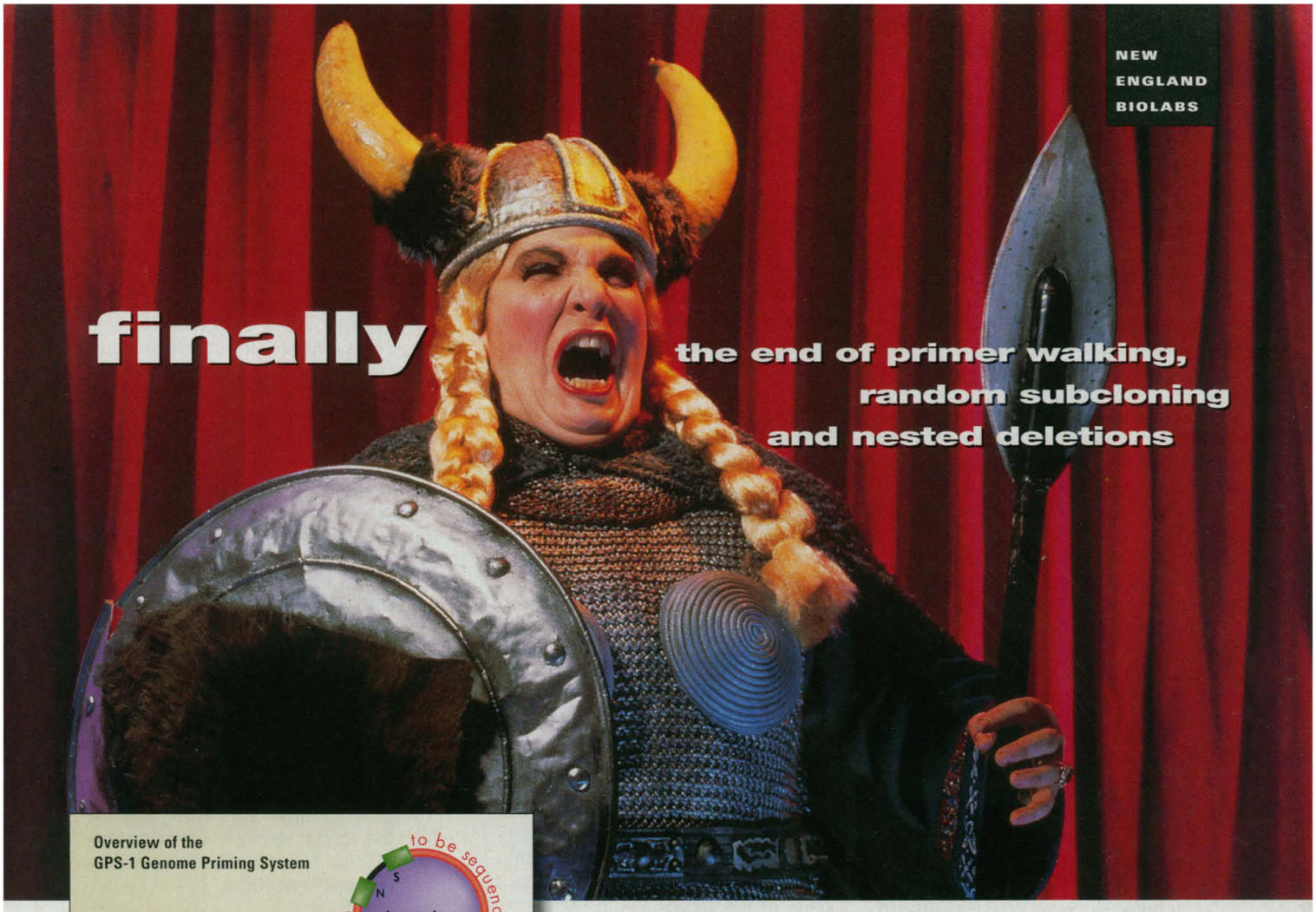

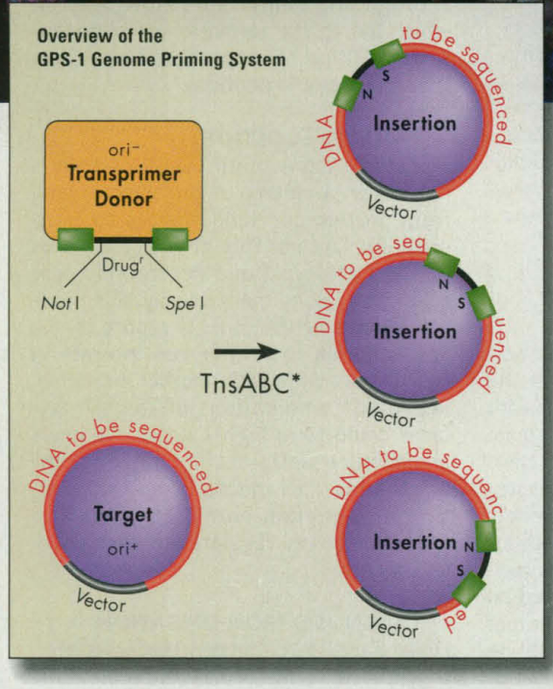

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CONTINUED FROM PAGE 757

ratory cultures of marine *Synechococcus*, iron-limiting conditions are associated with characteristic diel patterns in variable fluorescence; these patterns are lost upon enrichment with iron. Application of the method suggests that, unlike the Atlantic, much of the South Pacific Ocean is iron-limited.

CORAL BLEACHING BASICS

Are episodes of coral bleaching evidence of human interference with the natural environment or natural variation? Bleaching is characterized by the expulsion of zooxanthellae (symbiotic algae). Fagoonee *et al.* (p. 843) present a 6-year field study of zooxanthellae dynamics in the coral *Acropora formosa* in a shallow lagoon in Mauritius. Bleaching has a complex causation; considerable (and unexpected) natural temporal variation in zooxanthella contributed such factors as a strong seasonal cycling and density-dependence effects, in addition to significant environmental influences, such as nitrate loading.

HOMING SIGNALS

Stem cells that replenish the hematopoietic system reside in the bone marrow, but transplanted stem cells often fail to establish themselves and repopulate mature blood cells. The factor SDF-1 is a potent chemokine that attracts cells expressing its receptor, CXCR4. In an in vivo model of human $CD34^+$ stem cell engraftment, immunodeficient NOD/SCID mice are transplanted with human bone marrow cells. Peled *et al.* (p. 845) report that blocking the SDF-1–CXCR4 system inhibits the repopulation of the NOD/SCID mouse's hematopoietic cells with human cells generated from the transplant. The induction of higher CXCR4 expression ex vivo, before transplanting the stem cells, increased the numbers of engrafting stem cells. This approach could potentially increase the efficacy of human bone marrow transplants.

MYCOBACTERIAL TOXIN

Bacterial virulence is often mediated by secreted toxins. For the mycobacteria, which are responsible for such diseases as tuberculosis and leprosy, the only species for which there has been evidence for a toxin has been *Mycobacterium ulcerans*, which causes Buruli ulcer, a severe tropical skin disease. George *et al.* (p. 854) have now purified this toxin, mycolactone, and identify it as a polyketide containing a 12-membered ring. This cytopathic toxin induces similar types of skin lesions in guinea pigs. This finding may aid in the identification of other mycobacterial toxins.

CD8 CONTROL OF HIV-1

Although there has been circumstantial evidence that cell-mediated immune responses are important for controlling human immunodeficiency virus–type 1 infections, definitive evidence would require a "knock-out" type of experiment. Schmitz *et al.* (p. 857) provide such data by using an antibody to deplete $CD8^+$ T cells from the blood and lymph nodes of rhesus monkeys. In cases of primary infection, removal of this T cell population was associated with increased viral replication and more rapid progression of disease. Viremia was also increased in cases of chronic infection but was suppressed again when the $CD8^+$ cells reappeared. These results bolster strategies of vaccine design that rely on induction of cell-mediated immunity.

TECHNICAL COMMENT SUMMARIES

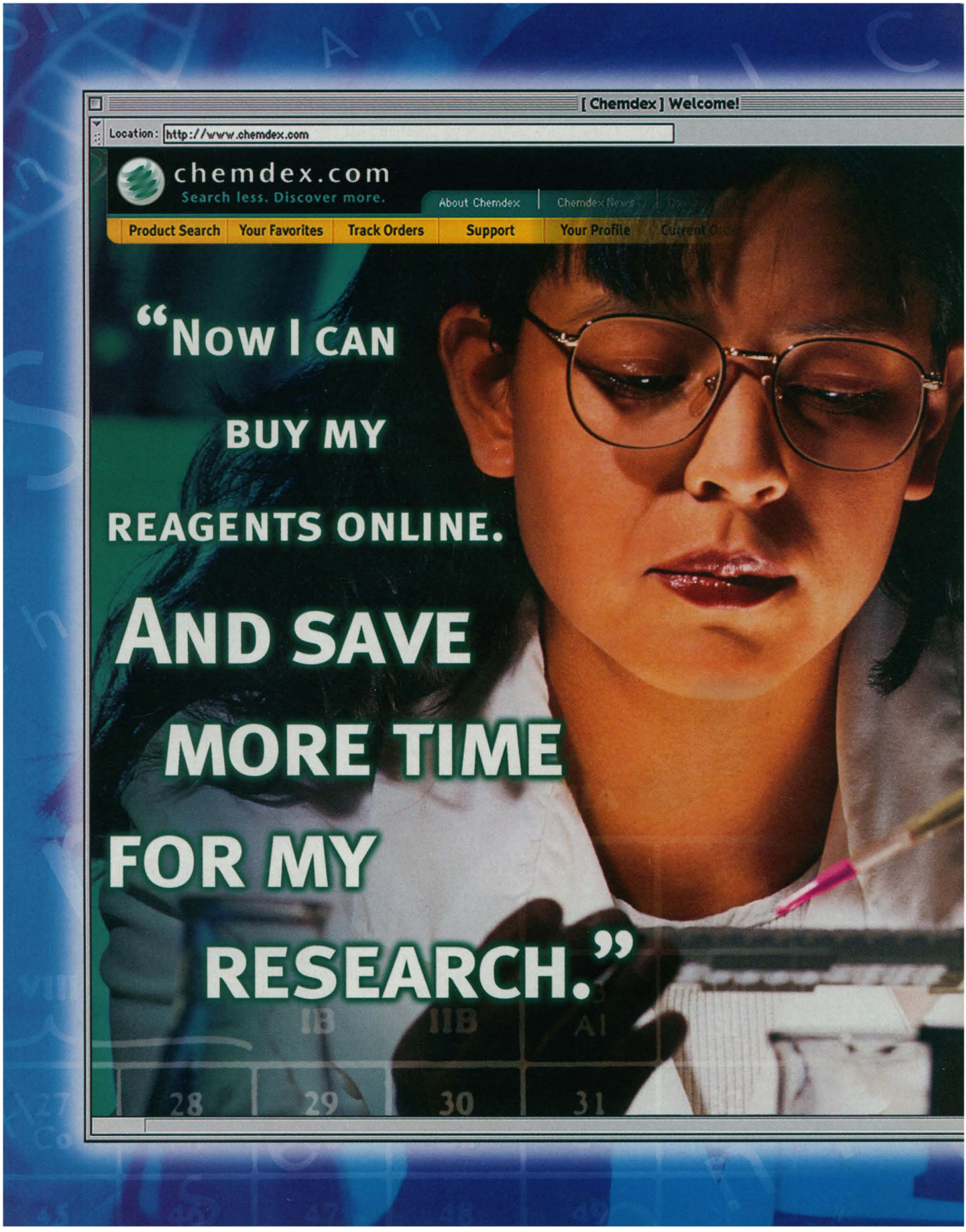
Temperature Changes During the Younger Dryas in New Zealand

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/283/5403/759a

C. Singer *et al.* (Reports, 7 Aug., p. 812) studied "pollen records of deglacial sequences from northwest Nelson, New Zealand," and found "that there was no significant temperature decline" associated with the Younger Dryas (about 10,000 years ago) there.

R. Newnham comments that the report does not account for "well-established limitations" of late glacial pollen records such as "poor chronological resolution" and "uncertainties surrounding pollen representation and provenance." He states that "the existence of Younger Dryas cooling cannot unequivocally be confirmed or refuted from these data."

In response, J. Shulmeister *et al.* discuss details of the "site hydrology effect" and their use of the term "warm indicator" for *Halocarpus* pollen. They state that the "whole series of deglacial pollen records" are "unambiguously contrary to a Younger Dryas with a large thermal event in New Zealand."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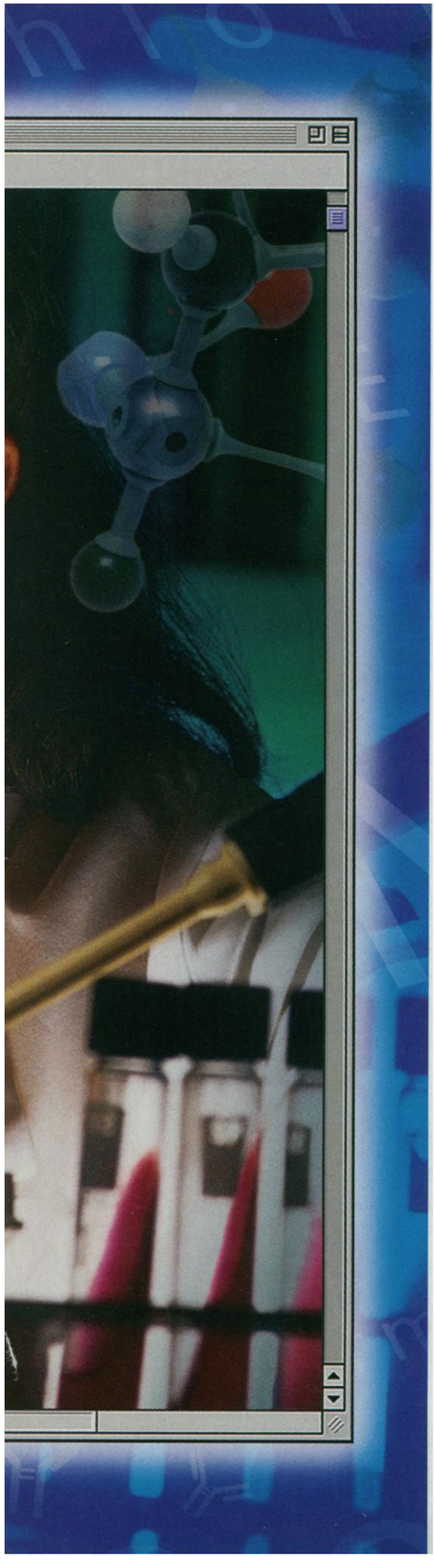

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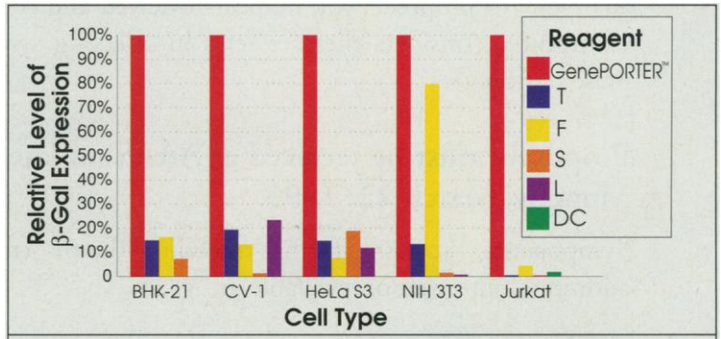

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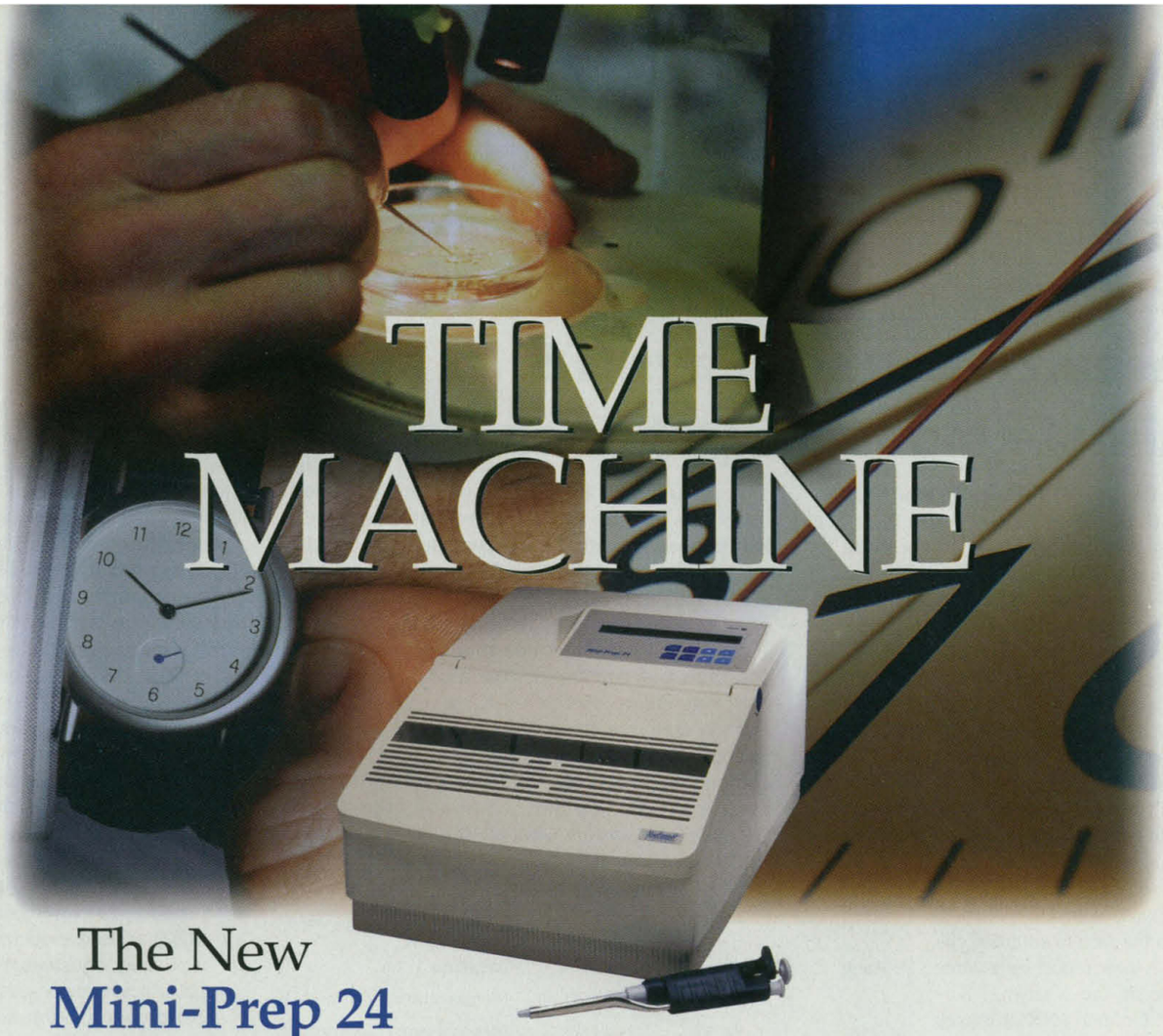

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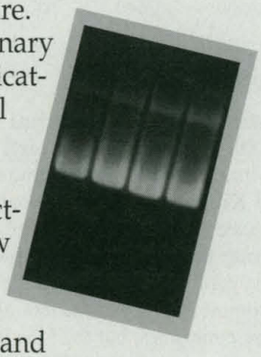

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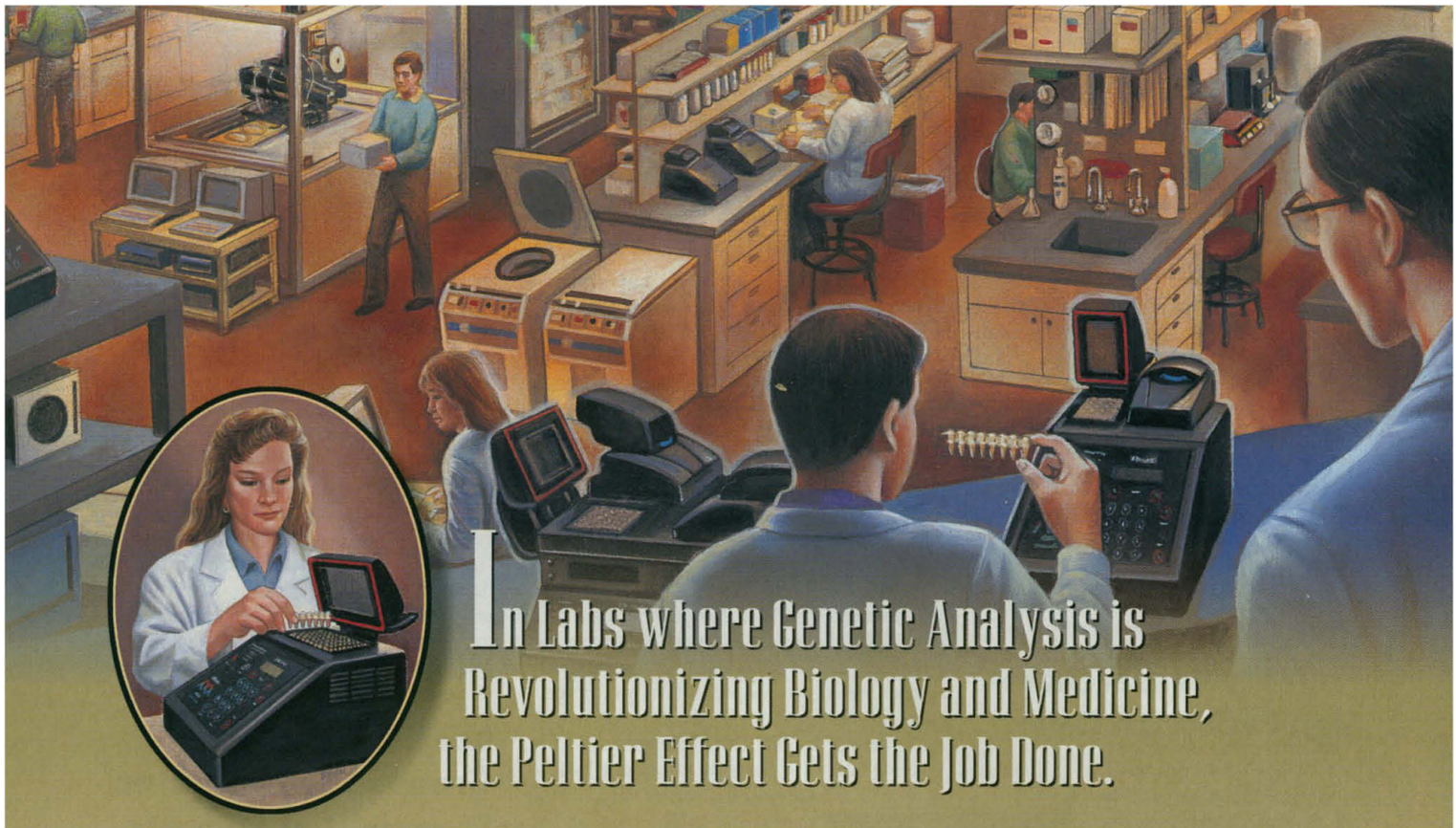

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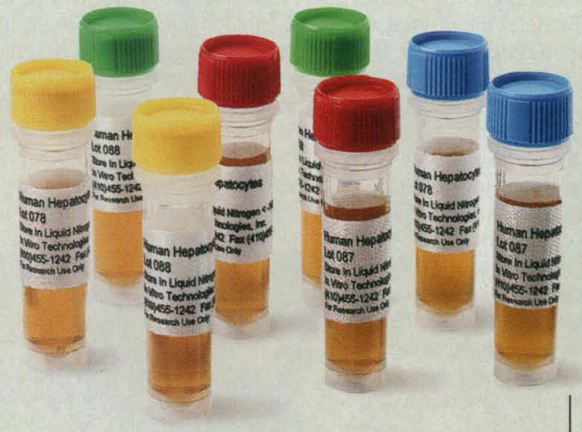

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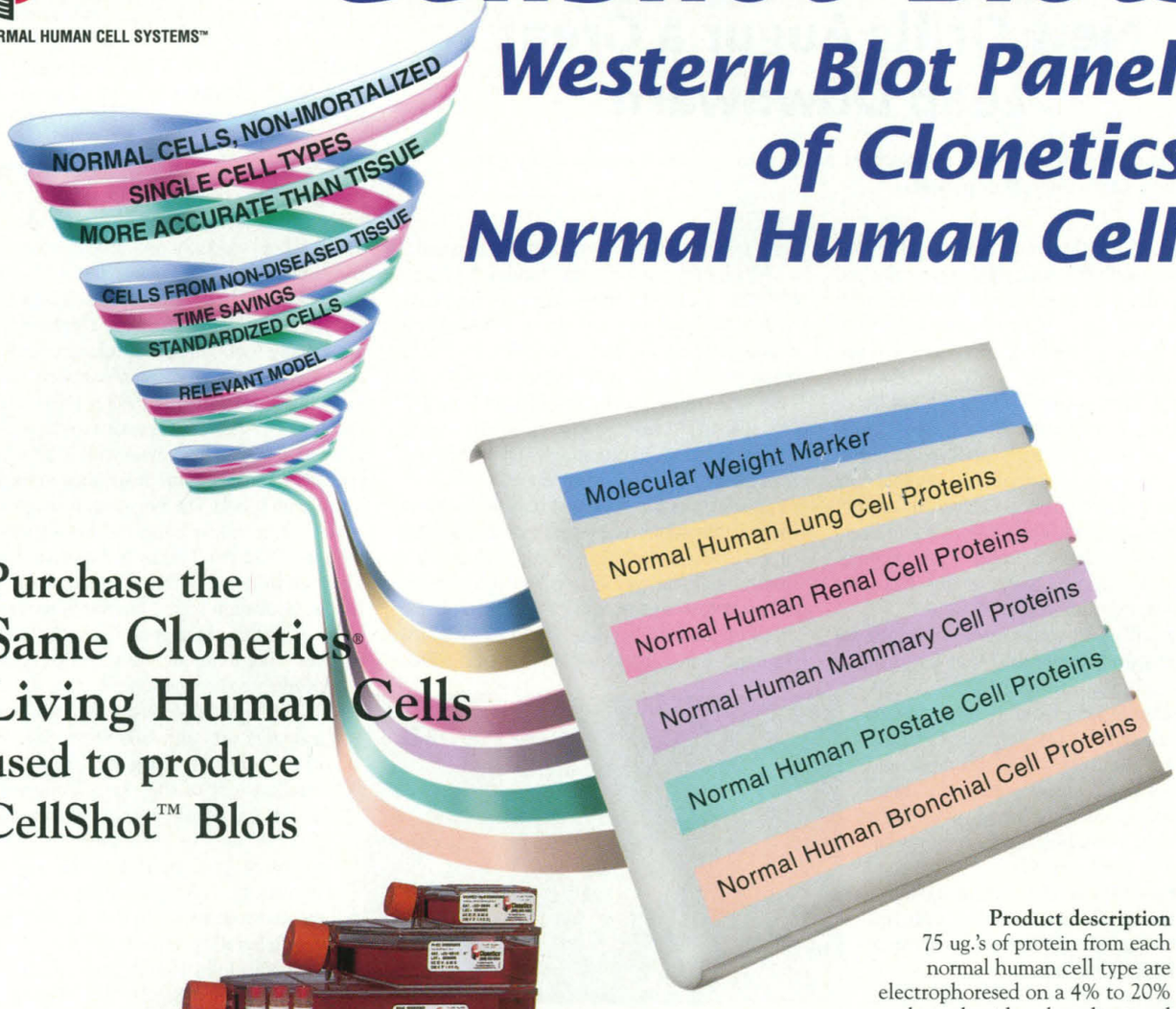

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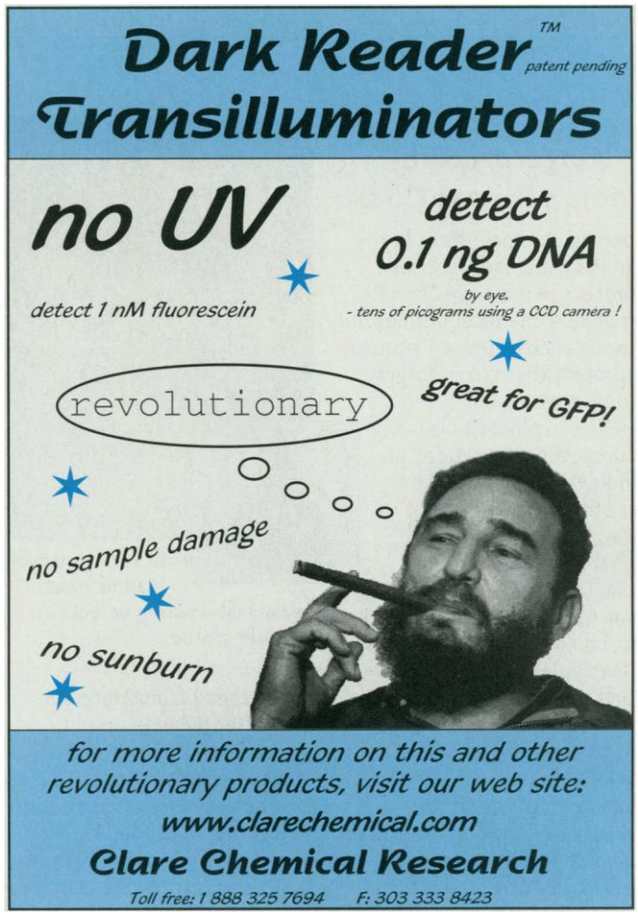

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MAMMALIAN GENOTYPING SERVICE

Sponsored by the
National Heart, Lung, and Blood Institute
National Institutes of Health

The Mammalian Genotyping Service is funded by the National Heart, Lung, and Blood Institute to assist in linkage mapping of genes which cause or influence disease. Genotyping is carried out using short tandem repeat polymorphisms at Marshfield, Wisconsin under the direction of Dr. James Weber. Capacity of the Service is currently about 5,000,000 genotypes (DNA samples times polymorphic markers) per year and growing. Although the Service was initially established for genetic projects dealing with heart, lung, and blood diseases, the Mammalian Genotyping Service will now consider all meritorious applications.

To ensure that the most promising projects are undertaken, investigators must submit brief applications that are evaluated by a scientific advisory panel. At this time, only projects involving human, mice or rat samples, and only projects with ≥ 10,000 genotypes, will be considered. There are no genotyping fees for approved projects. Application deadlines are every six months.

Upcoming Application Deadlines
March 31, 1999
September 30, 1999

For Application Instructions and additional information see:

http://www.marshmed.org/genetics

or contact:
Beth Busscher, Center for Medical Genetics
Marshfield Medical Research Foundation
1000 N. Oak Avenue
Marshfield, WI 54449
PHONE: (715) 389-3525 FAX: (715) 389-5757
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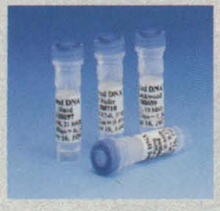

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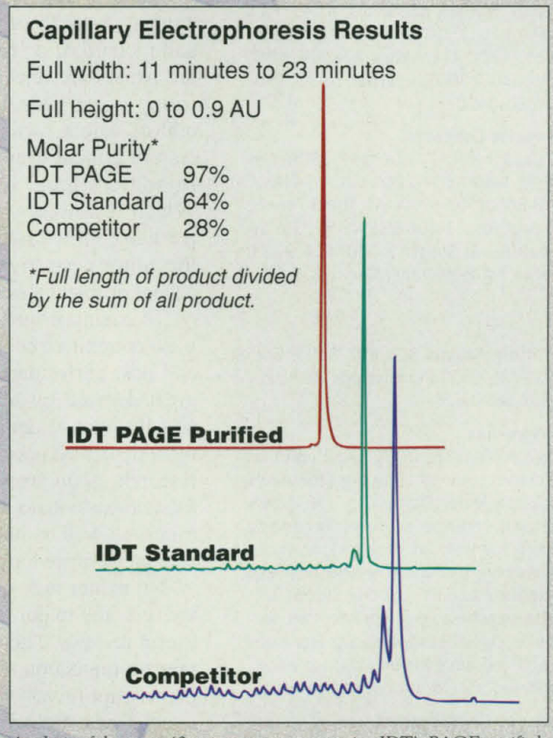

Analysis of the same 40-mer sequence comparing IDT's PAGE purified synthesis to standard oligos from IDT and six major competitors. Please visit our web site to download a complete report.

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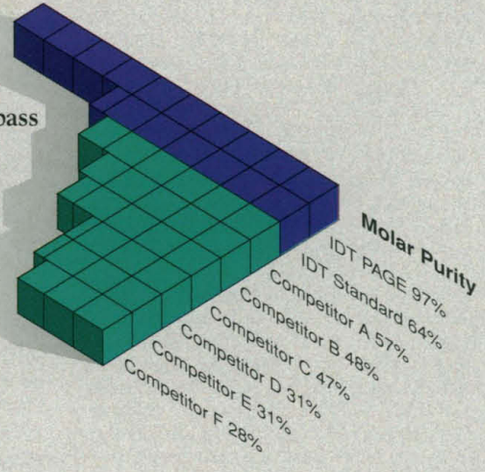

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