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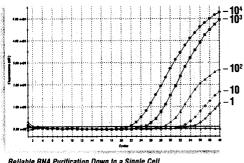
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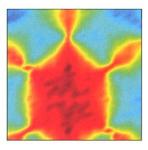
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#### **COVER 1483**

Calculated neutron scattering pattern for the "spin ice" state where spins (magnetic moments) mimic the proton disorder in water ice. The study of spin ice materials such as Ho<sub>2</sub>Ti<sub>2</sub>O<sub>7</sub> may shed light on the role of competing or frustrated interactions in many areas of condensed matter science. [Image: Byron den Hertog]

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#### New on *Science* Express

Holocene solar forcing of climate



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**CONTENT HIGHLIGHTS AS OF 16 NOVEMBER 2001** 

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#### **SCIENCE EXPRESS**

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#### The Formation of the First Star in the Universe T. Abel,

G. L. Bryan, M. L. Norman

Debate continues about the first object to form in the universe; now simulations illuminate that object—and it is a simple star.

#### Persistent Solar Influence on North Atlantic Climate During **▼the Holocene** G. Bond et al.

1431 Marine sedimentary evidence reveals an important link between the Sun and climate changes on centennial to millennial time

#### Identification of a Major Gene Regulating Complex Social ▼Behavior M. J. B. Krieger and K. G. Ross

<sup>1434</sup> A gene has been identified that has major effects on colony social behavior in fire ants.

#### **TECHNICAL COMMENTS**

#### **Endothelial Cells and Radiation Gastrointestinal Syndrome**

Paris et al. (Reports, 13 July 2001, p. 293) used mouse models to suggest that microvascular endothelial apoptosis leads to damage of stem cells in the intestine and thereby to gastrointestinal (GI) syndrome, the principal toxic side effect of cancer radiation therapy. In a comment, Suit and Withers argue that such apoptosis must result from severe hypoxia, a scenario not supported by data from intestinal cell death curves. Separately, Hendry et al. suggest that both epithelial and endothelial cell populations in the GI tract must be considered equally susceptible to radiation damage, in contrast to the hypothesis presented by Paris et al. for GI syndrome. Kolesnick et al. respond that their data showed that epithelial cells are more resistant to radiation than are endothelial cells and suggested focal regions of hypoxia rather than global tissue hypoxia. They also emphasize the difficulty in studying GI stem cells for which no markers exist and the need for new genetic and molecular reagents to provide complete answers.

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/294/5546/1411a

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career resources for scientists

#### Canada: Bioengineering at U of A S. Gittens, E. Smith, H. Uludag

Training at the University of Alberta's Biomaterials and Tissue Engineering Laboratory is preparing students to join Canada's burgeoning bioengineering workforce.

#### US: Surviving Tricky Interview Situations—Interviews That Went Wacky D. Jensen

Tricky situations can crop up on interview day; our Tooling Up columnist offers advice on how to deal with them.

#### Singapore: Keeping Your Technological Head Above the Waves I. Wong

How do Singapore's scientists keep up with rapid advances in technology, to stay on the cutting edge?

#### UK: Chemistry in the Community K. Urquhart

Chemistry Week starts today, and getting involved is a great way to generate CV fodder.

#### Germany: Reorganizing Research S. Steghaus-Kovac

The Helmholtz Association, Germany's largest group of research centers, is about to undergo major reforms. What impact will they have on young scientists?

#### **KNOWLEDGE ENVIRONMENTS**

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Hot Topic Orientation Article: Aging Research Grows Up M. Leslie Why and how we age.

**Discussion: Can Current Evolutionary Theory Explain Experimental Data on Aging?** 

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Review: Plant Histidine Kinases---An Emerging Picture of Two-Component Signal Transduction in Hormone and Environmental Responses T. Urao, K. Yamaguchi-Shinozaki,

Histidine kinases involved in cytokinin and ethylene signaling.

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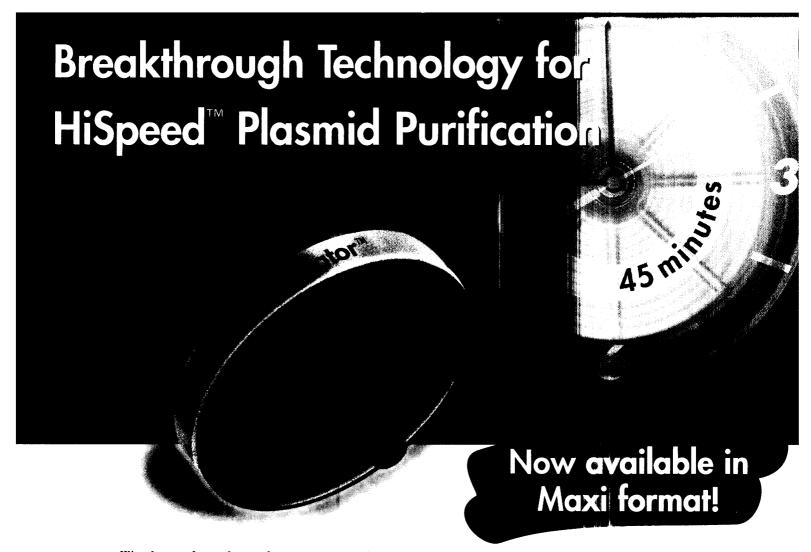
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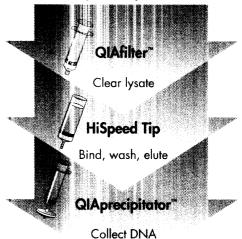
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## ALIGH FT AL

## THIS WEEK IN Science

edited by Phil Szuromi

#### Catalysts Caught in Action

Many industrial catalysts consist of a precious metal on an inorganic support, as well as "promoters," species that are not active on their own, but enhance reaction rates or product selectivity. Often these catalysts are transformed greatly under reaction conditions, but many surface-sensitive techniques, including transmission electron microscopy (TEM), are usable only under vacuum conditions. Hansen et al. (p. 1508; see the Perspective by Campbell) were able to perform high-resolution TEM studies of an ammoniasynthesis catalyst (ruthenium supported on boron nitride with a barium promoter) by using an

environmental cell and differential pumping. Under reaction conditions, they find that the ruthenium particles coalesce to an optimum size (~2 nanometers in diameter) and become partially coated with barium, which appears to act as an electronic promoter.

#### **Bridging a Route Toward Organic Magnets**

The general approach taken so far for the preparation of organic-based materials exhibiting magnetic behavior has involved the substitution of magnetic ions, or the use of radical ions, where the resultant exchange coupling between these isolated spins results in weak magnetic behavior at very low temperatures. Rajca *et al.* (p. 1503) pursued a macromolecular approach that exploits through-bond interactions in a conjugated polymer. The polymers contained macrocyclic groups with large spin moments that are bridged with cross-links that have a smaller spin moment, and this coupling of spins between macrocycles and cross-links could be designed to give rise to antiferromagnetic or ferromagnetic behavior. These polymers exhibit reorientation of their magnetization in small magnetic fields at temperatures below 10 K.

#### Magma Source for Mt. Vesuvius

Determining the hazard associated with Mt. Vesuvius requires an understanding of its subsurface structure. Auger *et al.* (p. 1510) have found a large sill of magma mixed with solid rock about 400 square kilometers in area, at about 8 kilometers in depth beneath Vesuvius. The sill, which probably formed by pooling magma in an extensional regime, represents an important source of magma for the next eruption.

#### **Colossal Crocodiles**

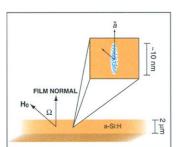
Several species reached tremendous size during the Cretaceous, including a giant crocodile, *Sarcosuchus imperator*, which had a body length of up to 13 meters. Sereno *et al.* (p. 1516) describe new fos-

#### 1505 NMR Signatures of Nanoscale Confinement

Dipole interactions are ubiquitous in gases and liquids, but with a few exceptions, are difficult to use in a diagnostic manner—these interactions usually

sum to zero in the bulk. Baugh *et al.* (p. 1505; see the Perspective by Warren) now show that nanoscale confinement of a gas orders the intermolecular interactions and leads to dipole-dipole effects that

can be seen in nuclear magnetic resonance. Studies of hydrogen trapped in the nanovoids of amorphous silicon show line broadening and peak position shifts as a function of the angle of the sample to the applied magnetic field. Such effects could be used to characterize the shape, size, and volume fraction of nanovoids.



sils of this giant predator that provide information on its habitat, growth, and evolution. Unlike most other large crocodiles that fed on fish in the ocean, the largest of crocodiles evidently lived in rivers and fed on dinosaurs as well as fish. It apparently achieved its large size by extended growth over 50 to 60 years.

#### Recovering from Catastrophe

Catastrophic events such as hurricanes can provide large-scale, ready-made experiments in ecology (see the Perspective by Brooks and Smith). Schoener et al. (p. 1525) document the effects of a massive hurricane on the

occurrence of a common lizard species on 66 islands in the Bahamas archipelago. Before the hurricane, island area was the best predictor of the presence of lizard populations. Just after the hurricane had passed, altitude was the better predictor, but during the next 2 years, island area gradually resumed its dominance. Restoration of the species-area distribution resulted from overwater dispersal and from hatching of eggs that survived inundation during the hurricane. In a separate biogeographical contribution, Ricklefs and Bermingham (p. 1522) examined the dynamics of landbird species composition in the Lesser Antilles over an evolutionary time scale. Periodic catastrophic events have effectively prevented an equilibrium between colonization and extinction, and thus the bird fauna has never been in a steady state.

#### From Hormones to Genes in Plants

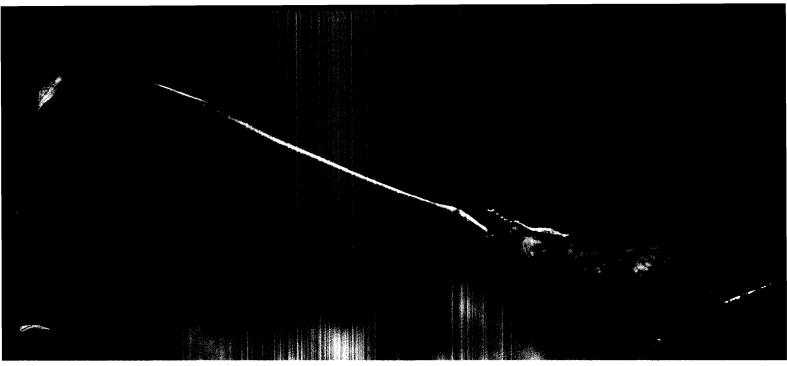
The receptor for the plant hormone known as cytokinin is a histidine kinase. Sakai et al. (p. 1519) now demonstrate that a target for this receptor kinase is the response regulator ARR1, which contains DNA binding domains that can be put to good use in activating downstream target genes. The receptor and the response regulator together act as a two-component system that transduces hormone detection into transcriptional regulation.

#### Separated in Time Rather Than Space

The oxygen that cyanobacteria release during photosynthesis is anathema to nitrogen fixation, but most cyanobacteria have resolved this problem by differentiating specialized cells called heterocysts. *Trichodesmium* is a ubiquitous cyanobacterium that makes a significant contribution to marine nitrogen fixation, but it does not possess heterocysts. Instead, as Berman-Frank *et al.* (p. 1534; see the news story by Pennisi) have discovered, it partitions photosynthesis and nitrogen fixation temporally within the

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CONTINUED ON PAGE 1415



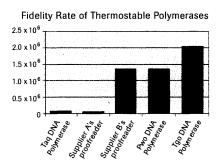
Parson's Chameleon (Calumma parsonii)

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photoperiod. When nitrogen fixation is maximal, photosystem II activity is minimal; nevertheless, linear photosynthetic electron transport still appears to be needed.

#### **Nuclear Attack on Cancer**

Alpha particles are high-energy helium nuclei that are extremely potent cell-killing agents. Monoclonal antibody—mediated targeting of these particles to tumor cells has been investigated as an anticancer therapy, but the short half-life of the particles has limited the success of this approach. McDevitt et al. (p. 1537) developed a molecular-sized generator that produces atoms that emit alpha particles and then targeted the generator itself to the tumor cells. Treatment of mice bearing solid or disseminated cancers with a single nanocurie level dose of these constructs induced durable tumor regressions. In principle, such atomic "nanogenerators" could be used for treatment of a wide range of human cancers.

#### A Change for the Worse

In addition to generating immunity toward infection, dendritic cells (DCs) direct tolerance to the body's own antigens. Abnormal behavior of DCs might lead to autoimmunity, but no direct links have been established. Blanco  $et\ al.$  (p. 1540) now offer a connection by showing increased activity of DCs in the blood of patients with the antibody-mediated autoimmune disease, systemic lupus erythromatosus (SLE). In culture, serum from SLE patients induced peripheral blood monocytes to differentiate into DCs, which could provoke vigorous responses from naïve CD4T cells. Of the potential serum factors that might have induced this effect, the cytokine interferon- $\alpha$  was essential, thus establishing a possible target in therapies for SLE.





#### **Assembling Acrosomes**

During spermiogenesis (the events from spermatid to spermatozoan), many proacrosomic vesicles coalesce into a single acrosomic vesicle that covers much of the cell's nuclear surface. Defects in acrosome development or function result in fertility problems. Kang-

Decker et al. (p. 1531) report the identification of a protein involved in acrosome formation. When the Hrb protein was eliminated from mice via homologous recombination, infertile but otherwise normal males developed because the proacrosomic vesicles failed to form a single acrosomic vesicle. In addition, spermatozoa decreased in number and displayed reduced motility—likely the result of the midpiece and tail defects.

#### **Hot Choices**

Animals can make rational choices among several options by weighing up the advantages and disadvantages of each, but the neural pathways that confer this decision-making ability are largely unknown. In a series of experiments with *Drosophila* in a flight simulator, Tang and Guo (p. 1543) have determined that part of the fly brain called the mushroom body is necessary for choice behavior in these organisms. Flies were conditioned (using heat as punishment) to choose a particular flight path in response to either a color or shape cue and then were tested with contradictory cues after training. As the salience of the color and shape cues altered, normal flies could change their preferences, whereas flies with mutant or ablated mushroom bodies could not.

#### **Memory-Making Events?**

Nerve cells communicate with one another through specialized cell-cell junctions called synapses, and changes in how efficiently information is transferred across these junctions are believed to underlie memory. Antonova et al. (p. 1547) examined the clustering of proteins at synapses in culture as they underwent simulated learning. Within minutes of the teaching stimulus, the amount of a key protein required for sending information, synaptophysin, increased on the presynaptic side of the synapse, and there was a parallel increase in GluR1, the postsynaptic receptor that received the information. The change was unexpectedly rapid (appearing within 5 to 10 minutes) and depended on an intact actin cytoskeleton, which suggests that this clustering may reflect the conversion of silent synapses into active ones.

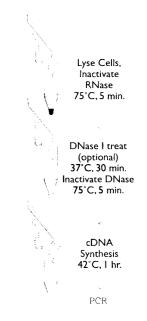
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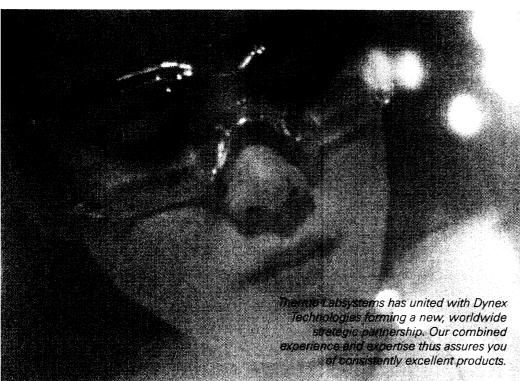
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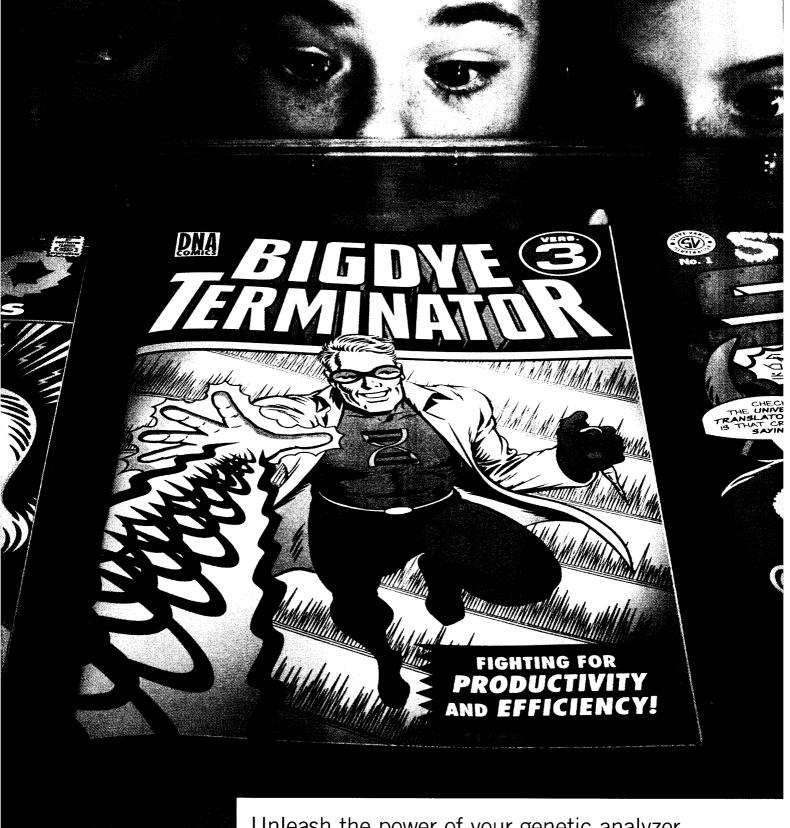
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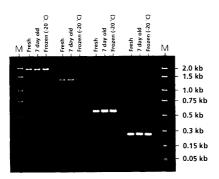
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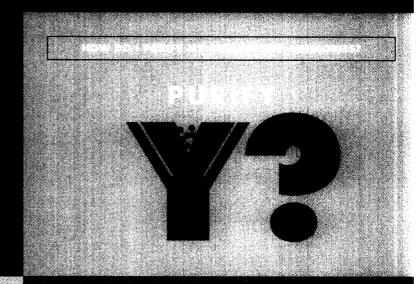
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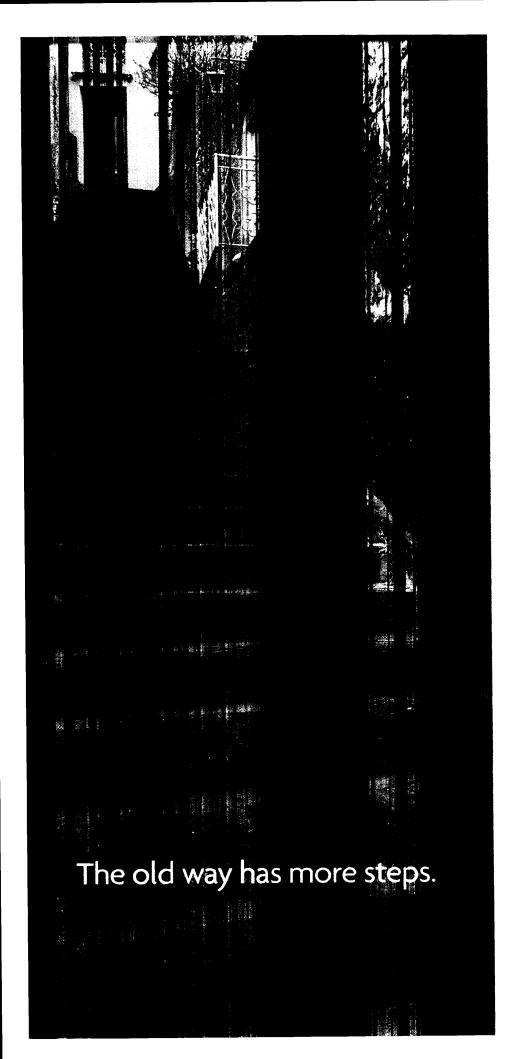
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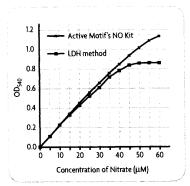


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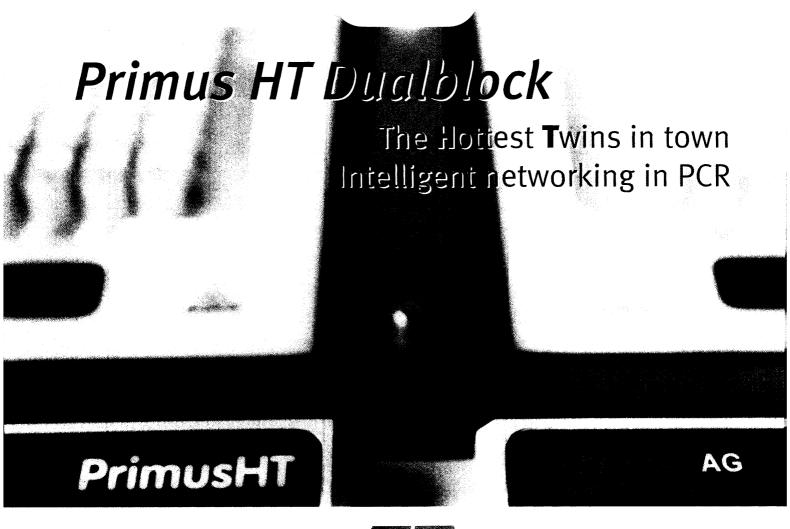
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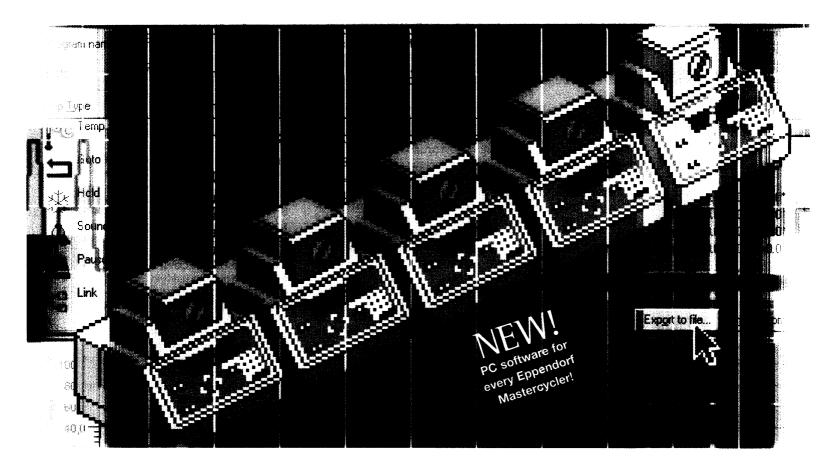


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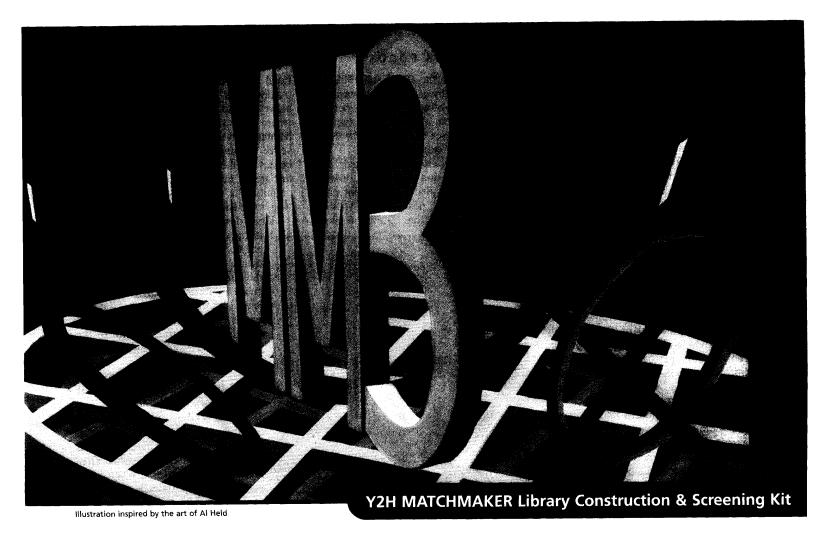
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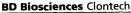
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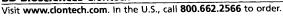
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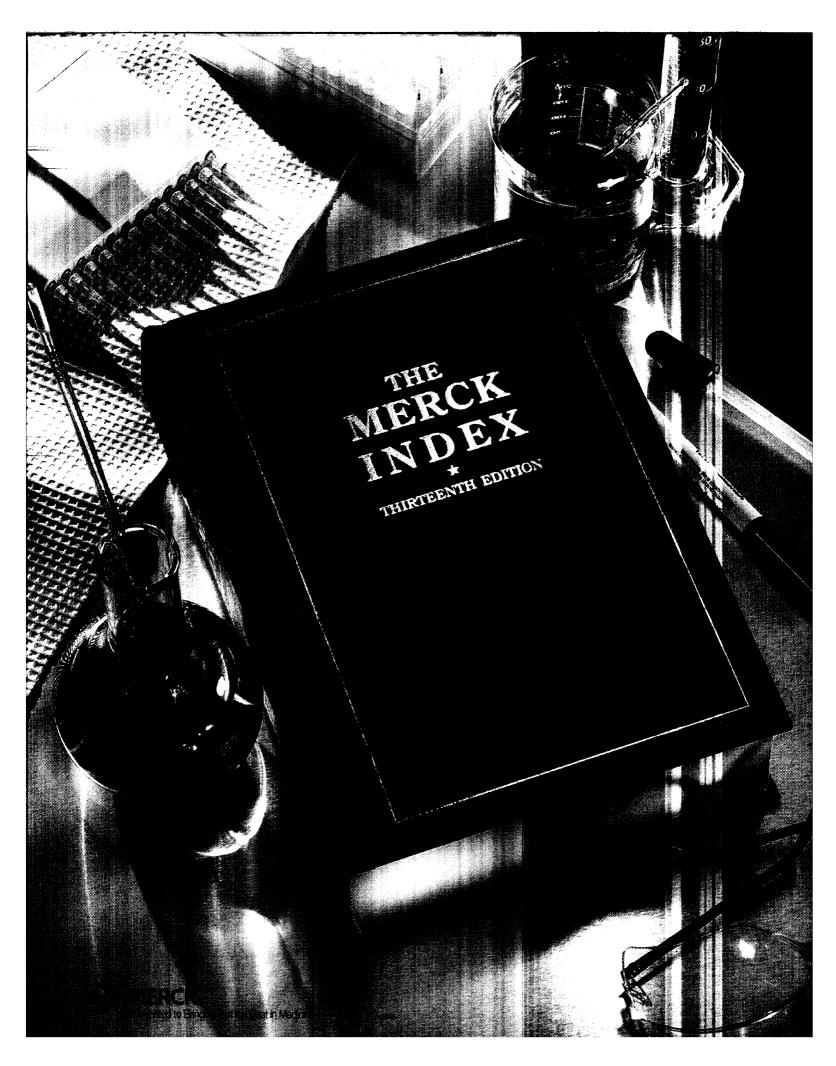
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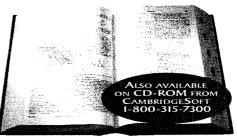
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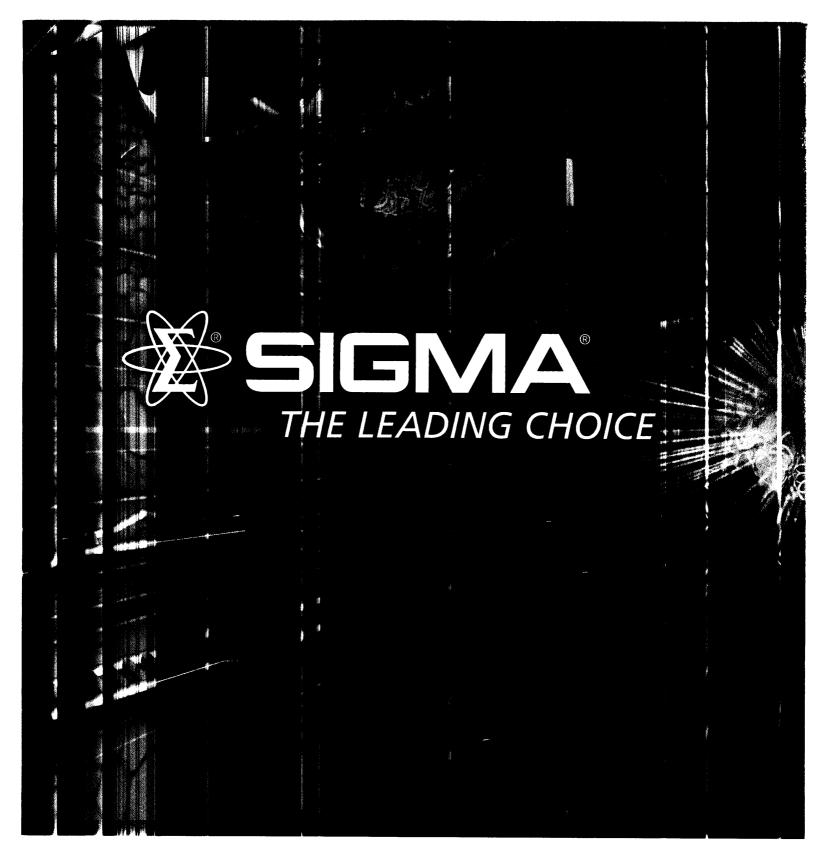
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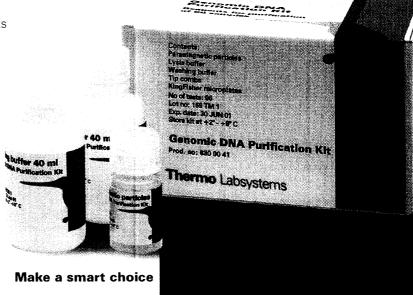
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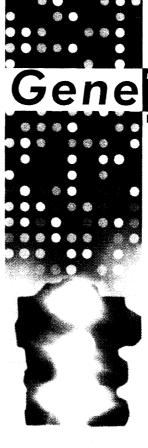


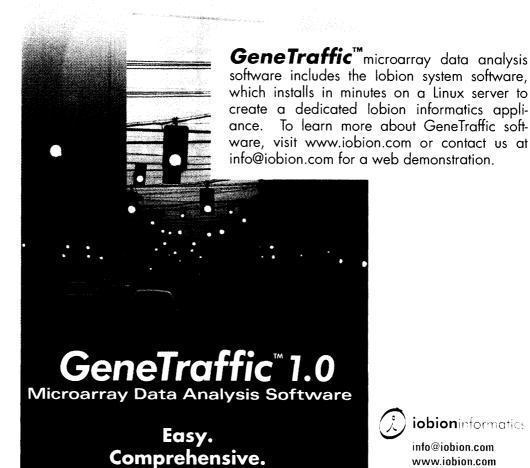
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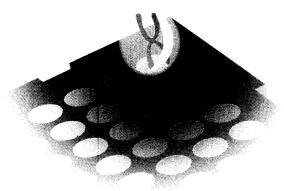
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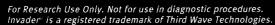
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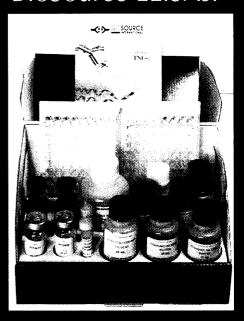
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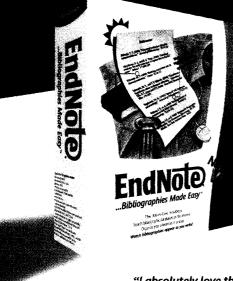
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#### **EDUCATION**

1996

Ph.D, Graduation Date: June 31, 1997

Ph.D. Graduation Date: June 21, 1997
Department of Immunology - Cornell University Medical Stoan-Kettering Cancer Center Memorial Sloan-Kettering Cancer Center

1990

Bachelor of Science, Department of Biochemistry, Laurence of Biochemis

#### AWARDS AND HONORS

1990-present

Research Fellowship from the Graduate School of Corners Company American

1990

1987-1990

Dean's List

1986

John Danforth Leadership Award

#### **PUBLICATIONS**

- 1. John Doe, Gustave Hall, and Sossity Rapparell. Coordinate Regulation of Has Gamplex. Molecular Immunology, Vol. 66, No. 11/12 pp. 490-511, 1998
- 2. John Doe and Sossity Rapparell. Identification of Alternatively Spliced Income a Bare Lymphocyte Syndrome Patient. [In Preparation]

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