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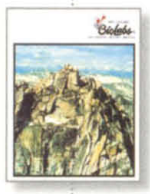
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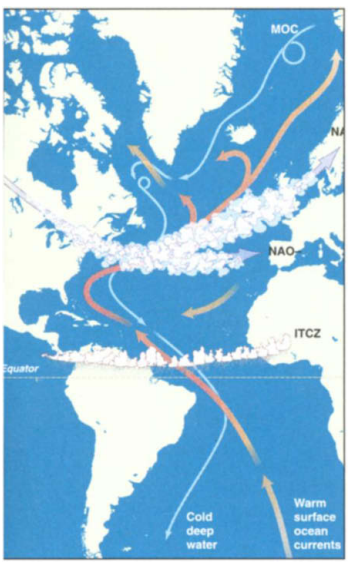

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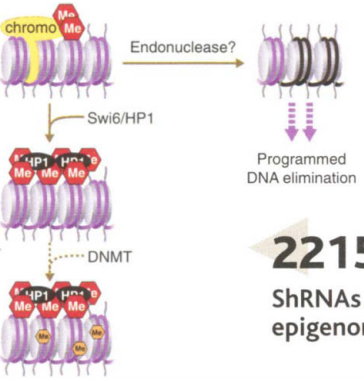

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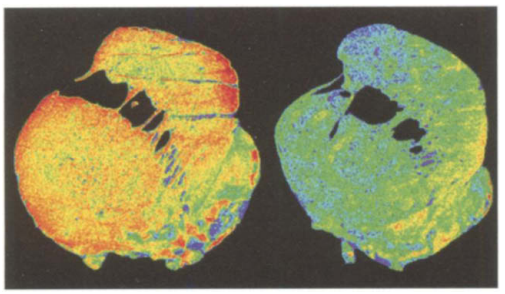

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The life cycle of *Drosophila melanogaster*. Gene expression patterns during the entire course of development are reported in this issue. [Image: Cameron Slayden]

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GREG BAKER/AP

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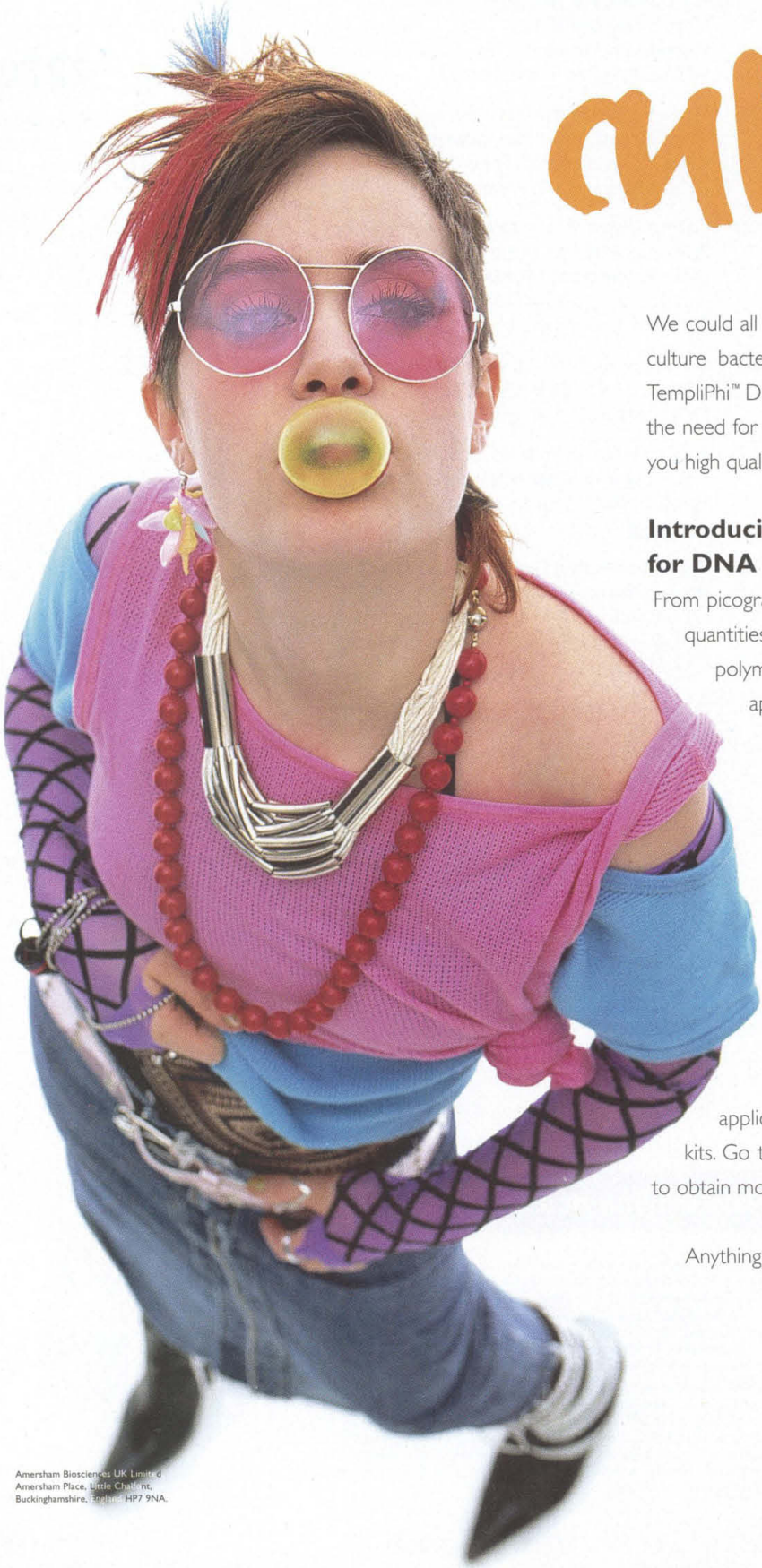

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CONTENT HIGHLIGHTS AS OF 27 SEPTEMBER 2002

science magazine www.sciencemag.org

SCIENCE EXPRESS www.sciencexpress.org

Microfluidic Large-Scale Integration T. Thorsen, S. J. Maerkl, S. R. Quake

A demonstration of integrated microfluidic-based circuits, analogous to integrated electronic circuits on a single chip.

Role of Histone H3 Lysine 27 Methylation in Polycomb-Group Silencing R. Cao *et al.*

The Polycomb ESC-E(Z) complex methylates histone H3 on lysine 27, thus recruiting the Polycomb Repressive Complex 1 and turning off gene expression.

Contribution of Human α-Defensin-1, -2, and -3 to the Anti–HIV-1 Activity of CD8 Antiviral Factor L. Zhang *et al.*

Defensins contribute to the ability of CD8 cells to inhibit HIV replication.

TECHNICAL COMMENTS

Random Perturbations and Lattice Effects in Chaotic Population Dynamics

Henson *et al.* (Reports, 19 Oct. 2001, p. 602) used experimental evidence to illustrate that lattice effects, which can occur in both deterministic and stochastic systems, can dramatically alter the predictions of ecological models of population dynamics, most of which are continuous-state models. They concluded that "a complete understanding of some population systems will require a stochastic blending of both continuous-state and discrete-state models." Domokos and Scheuring comment that although lattice effects can dominate even in models with a very fine lattice size (i.e., for large habitat sizes in ecological models), there is nonetheless a minimal random noise level that will "destroy all lattice effects" and recover the dynamics of the continuous model. In a response, King *et al.* comment that although Domokos and Scheuring make interesting inferences, they are based on a model different from the original study model and "a noise structure that appears to be inappropriate for ecological systems."

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/297/5590/2163a

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EUROPE: Stem Cell Cash Causes Delight . . . and Controversy K. Hallermalm

Not everyone is happy with the first awards from a major new Swedish stem cell research fund.

CANADA: FeLaSoFi—Strength in Numbers L. McKarney

Organizations team up to help promote physics research and education in Latin America.

US: Making Sense of Graduate Studies in Turbulent Times M. P. DeWhyse

Our *Educated Woman* columnist examines graduate student attitudes in a time of war.

MISCINET: Negotiating Salaries L. B. Kass and K. Gale

Advice for women and minorities seeking to avoid the low starting salary trap.

SINGAPORE: Growing Professionally as a Teacher P. Goh

An experienced educator shares his coping strategies.

UK: Help! What Do I Do with My Degree? The CareerDoctor

Our new columnist offers her advice to freshly minted graduates.

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NOTEWORTHY THIS WEEK: Closing the Generation Gap M. Beckman

Yeast moms that produce energy inefficiently bear old daughters.

NOTEWORTHY THIS WEEK: Hanging Out M. Beckman

Freewheeling chromosome ends might signal old age.

GENETICALLY ALTERED MICE: Harlequin G. Zitnik

Diminished free radical scavenger protein yields neurodegeneration.

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signal transduction knowledge environment

PERSPECTIVE: Insider Information—How Palmitoylation of Ras Makes It a Signaling Double Agent L. G. Berthiaume

Protein lipidation influences on which membranes Ras proteins will reside and thus controls signaling localization.

CONNECTIONS MAP: *Drosophila* PI3K Pathway S. J. Leevers

A pathway regulating cell growth, cell size, and cell number in the fruit fly.

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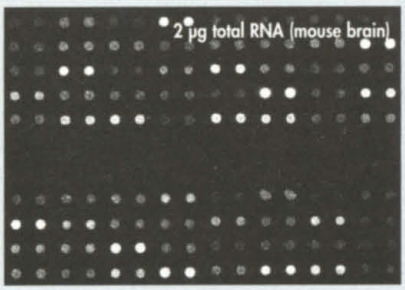

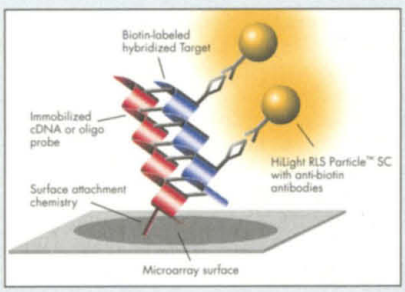

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THIS WEEK IN Science

edited by Phil Szuromi

Past the Brink of Collapse

Bose-Einstein condensates (BECs) can be generated through sympathetic cooling, in which escaping atoms carry away heat, in part because the bosons, which occupy the same quantum state, interact with one another. For fermions, additional particles occupy higher energy states, and thus collapsed states are more difficult to form. One approach is to mix fermions with bosons and borrow the latter's energy dissipation. Modugno *et al.* (p. 2240) now present experimental evidence that as a mixed rubidium-87 boson and potassium-40 fermion gas undergoes evaporative cooling, a point is reached where the number of potassium atoms lost abruptly changes. This collapse of the Fermi gas is attributed to attractive three-body interactions between two Rb atoms and one K atom that turns on when a critical number of particles is reached. EX

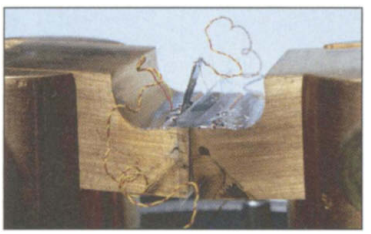
2247 Drier Hydrogen Clathrates

Hydrogen has generally been thought not to form conventional water clathrates in which the hydrogen is contained in a water cage. Also, typically, clathrates at ambient pressure are thought to be limited to a ratio of caged to water molecules of no more than 1:6. Mao *et al.* (p. 2247) now report a hydrogen clathrate that can be synthesized at high pressures yet is stable at ambient pressures and has a ratio of 1:2. Such high concentrations of hydrogen in a stable clathrate have implications for the composition of the interiors of icy planets, and potentially for hydrogen storage.

And in Brevia ...

Xenografting of mouse ovarian tissue to a different species by Snow *et al.* (p. 2227) produced mature oocytes that are fertilizable and yield embryos that can develop into live young.

The Cooler Side of Thermoelectrics



Semiconductor-based devices that cool down when current is passed through them have long been promised as efficient, clean, and quiet refrigeration units. However, the realization of such devices has been limited somewhat by the rather low efficiencies achieved to date. Optimizing the figure of merit that characterizes thermoelectrics, the *ZT* factor (that takes into account the electronic and thermal properties of the materials), often involves gains in one property at the expense of the other. To date, *ZT* values around 1 are typical, but higher values are required if thermoelectrics are to live up to their expectation. Harman *et al.* (p. 2229) show that quantum dot superlattice structures, based on ternary and quaternary compounds of lead, tin, selenium, and tellurium, have *ZT* values of 1.3 to 1.6 at 300 kelvin. An initial demonstration of a simple device structure reveals a significant improvement of the cooling ability over existing bulk thermoelectric materials.

Visibly Improved

The efficient dissociation of water into hydrogen and oxygen by sunlight over a suitable catalyst is an important goal in renewable energy production. Most materials to date, such n-doped TiO_2, are inefficient because they only generate the charged carriers needed to complete the reaction from photons in the ultraviolet, thus wasting the visible portion of the spectrum. Khan *et al.* (p. 2243; see the news story by Service) produced an n-type TiO_2 that absorbs visible light by the controlled burning of titanium metal in a natural gas flame. This carbon-doped TiO_2, biased at 0.3 volt, was about eight times more efficient than n-type TiO_2 biased at 0.6 volt.

Asian Soot

During the past few decades, while most of the world has been getting warmer, there has been a trend toward increased summer drought in North China and increased flooding in South China, as well as moderate cooling in China and India. Many of these changes have been attributed to overgrazing, overfarming, and destruction of forests, but now it seems that another cause may be more important. Menon *et al.* (p. 2250; see the Perspective by Chameides and Bergin) report results from climate model simulations of the direct radiative effect of aerosols in the region of China and India. The observed changes in temperature and precipitation in China and India can be attributed to the absorption of sunlight by black carbon (BC) particles, or "soot," produced by low-temperature household burning of biofuels and coal.

Global Insecticide Resistance

The selection pressure exerted by human use of insecticides is ubiquitous, and there has been a global spread of resistance among insects. So far, resistance has been identified as originating in the selection of increasingly insensitive targets for the pesticides in the nervous system or in the accelerated metabolism of the chemicals before they reach their targets. Daborn *et al.* (p. 2253; see the Perspective by Denholm *et al.*) have identified another route. A form of this resistance, as seen in the fruit fly *Drosophila melanogaster*, is mediated by the overexpression of a single allele of cytochrome P450 that has now spread worldwide.

Making Heterochromatin

The formation of higher-order chromatin domains plays a vital role in processes such as transcription, imprinting, dosage compensation, recombination, chromosome condensation, and segregation. The posttranslational modification of histone tails is central to chromatin assembly. Hall *et al.* (p. 2232; see the Perspective by Jenuwein) show that a small 4.3-kilobase cenH repeat se-

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CONTINUED ON PAGE 2167

CREDITS: (TOP TO BOTTOM) SNOW *ET AL.*; HARMAN *ET AL.*

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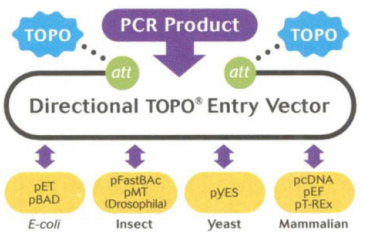

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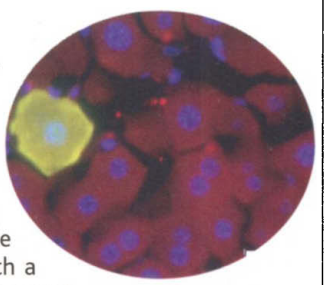
quence, which has strong homology to centromeric repeats, is both necessary and sufficient for the initiation of heterochromatin formation at the silent mating-type region of fission yeast, as well as at an ectopic location. This repeat sequence can direct post-translational methylation of the histone H3 lysine 9 residue, a critical determinant of heterochromatin, in the absence of the heterochromatin protein Swi6. This ability is dependent on the RNA interference (RNAi) machinery. Maintenance of heterochromatin and its inheritance through mitosis and meiosis requires Swi6 but does not require the RNAi machinery.

Limits to Stem Cell Plasticity



Whether adult hematopoietic stem cells (HSCs) can alter their developmental fate and generate cells of non-hematopoietic tissues has been a point of active debate. Compared with other tissue-specific stem cells, HSCs are relatively available. Regrettably, their plasticity may not extend much beyond hematopoietic tissues in the normal animal. Wagers *et al.* (p. 2256) analyzed the fate of single transplanted HSCs as well as the fate of HSCs in mice with a surgically joined circulatory system. The results suggest that contributions of HSCs to nonhematopoietic tissues occur rarely, if ever.

CREDIT: WAGERS *ET AL.*

More Dangers from Designer Drugs

In recent years, MDMA, or "ecstasy," has become a widespread recreational drug in the Western world. Current research has suggested already that this substance is selectively damaging serotoninergic synaptic transmission. Ricaurte *et al.* (p. 2260; see the news story by Holden) show that ecstasy causes not only serotoninergic but also dopaminergic neurotoxicity in monkeys. MDMA might then interfere with motor function even when given in recreational doses. Because neuropsychiatric disorders are often related to dopamine dysfunction, recreational users may be putting themselves at risk for developing such diseases.

Also Traveling in Pairs

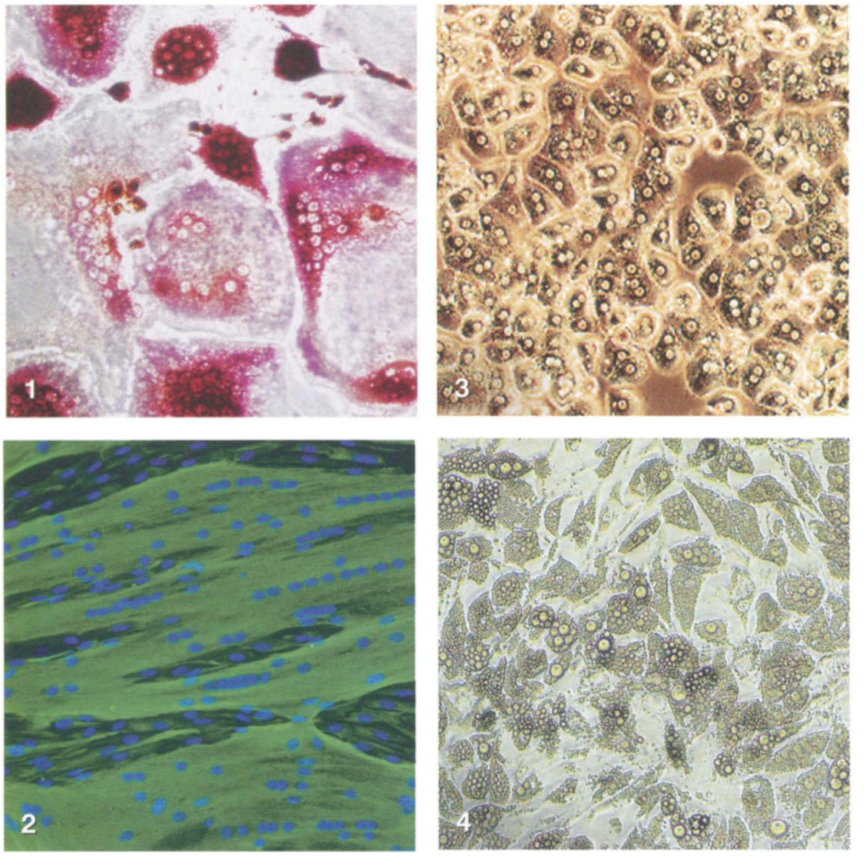
Most members of the kinesin superfamily of motor proteins move processively along microtubules as dimers. However, the Unc104/Kif1a kinesin had been observed to move as a monomer by a diffusion process. Tomishige *et al.* (p. 2263) show that Unc104/Kif1a develops the processive movement of conventional kinesin when dimers are generated through either fusion to a strong dimerizing coiled-coil segment or by raising their concentration. The observed velocity is comparable to that in vivo, indicating that dimers of Unc104 likely control the fast transport of synaptic vesicles.

Clues to Treating Celiac Sprue

The treatment of human autoimmune disorders is often difficult because of a lack of clear causative factors. Celiac sprue (also known as celiac disease) is a highly prevalent autoimmune disease that is triggered by gluten, such as that found in wheat, barley, and rye. A variety of in vivo and in vitro approaches were used by Shan *et al.* (p. 2275; see the Perspective by Schuppan and Hahn) to identify a relatively short gluten peptide that appears to be the primary initiating factor. This multivalent gluten peptide could be detoxified by exposure to a bacterial peptidase, which suggests a strategy for oral peptidase supplement therapy for this disease

A Lifetime's Worth of Gene Expression

Gene expression data provide an important resource for defining gene function and for identifying hierarchies and networks of genes that regulate specific developmental programs. Arbeitman *et al.* (p. 2270; see the cover) have sampled one-third of the genes in the *Drosophila* genome by DNA microarray analysis. This genome-wide transcriptional profile reveals patterns of gene expression in the whole organism associated with different developmental stages, from fertilized egg through metamorphosis to the aging adult.



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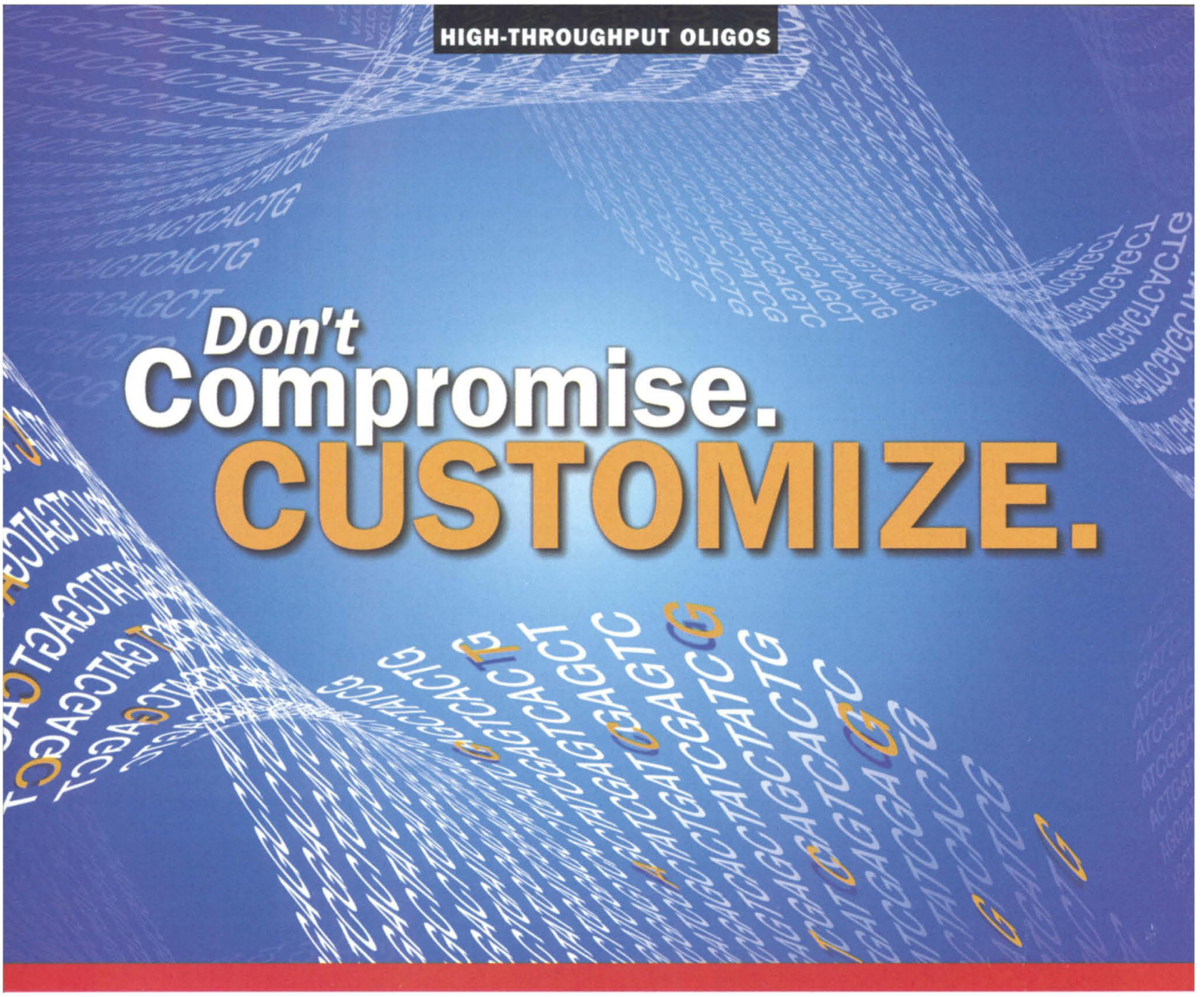

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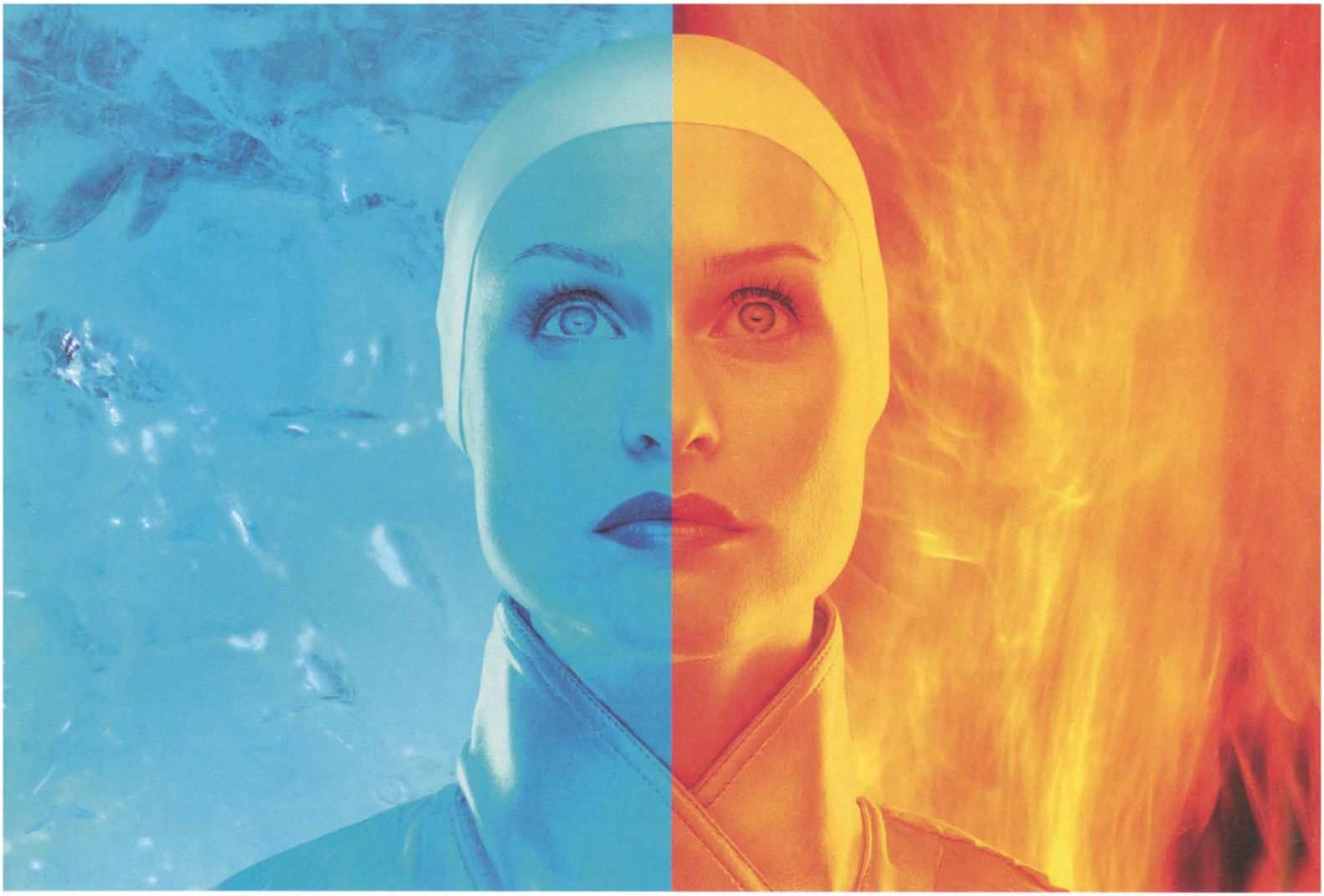

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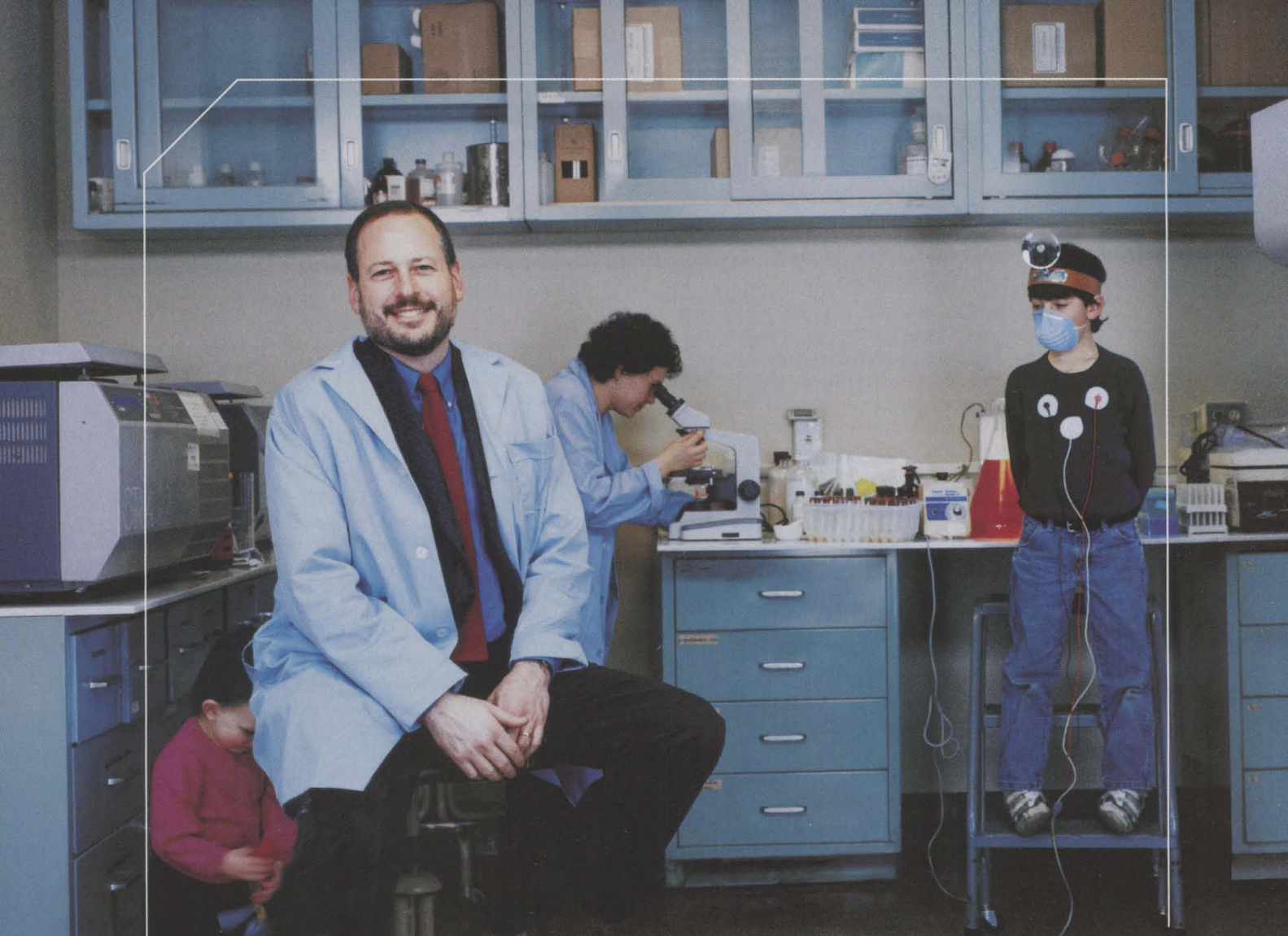

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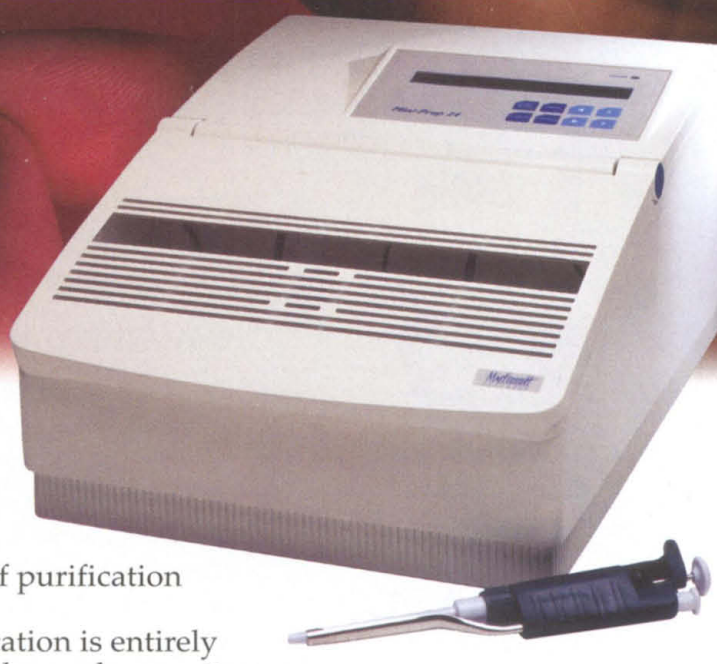

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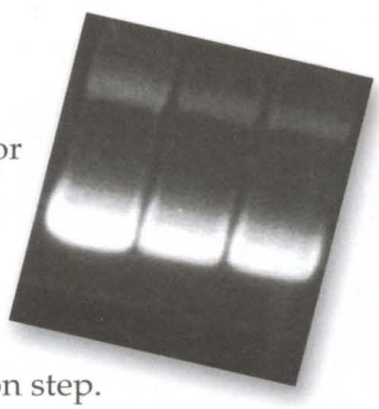

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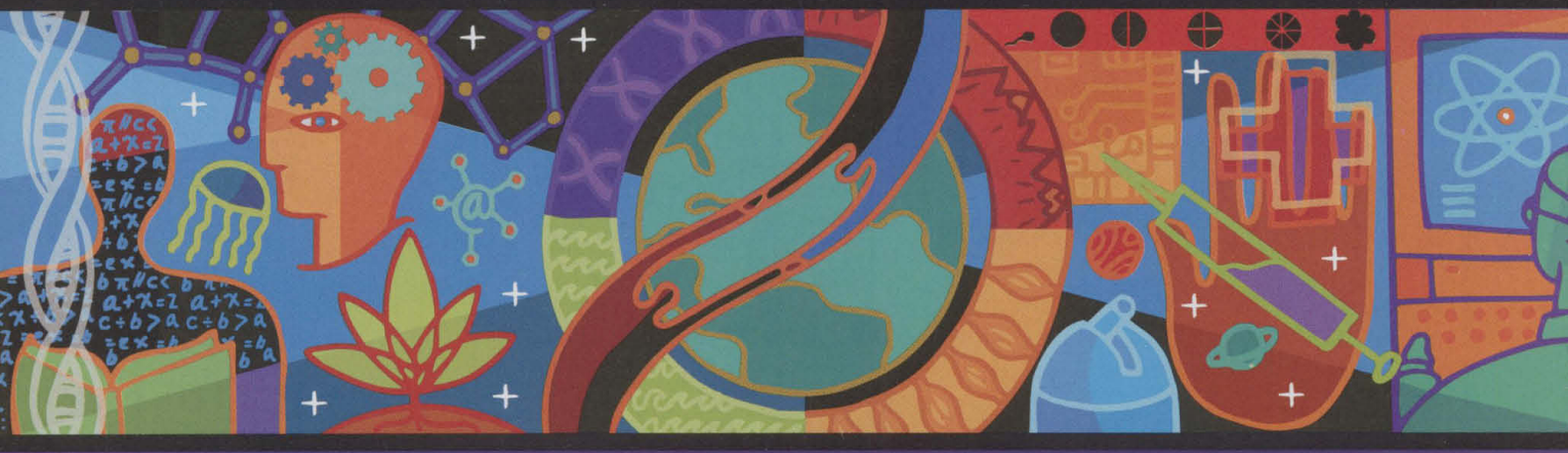

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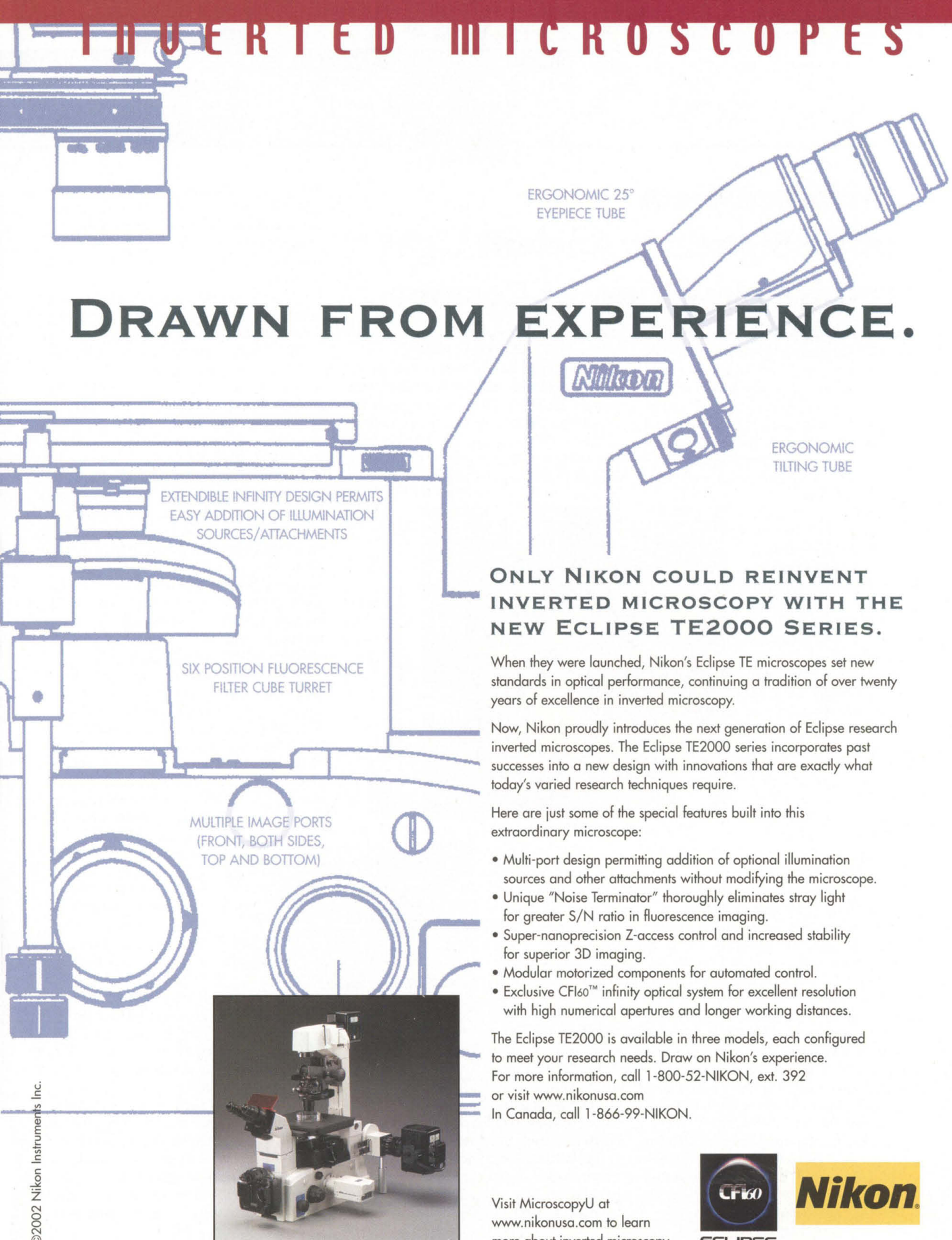

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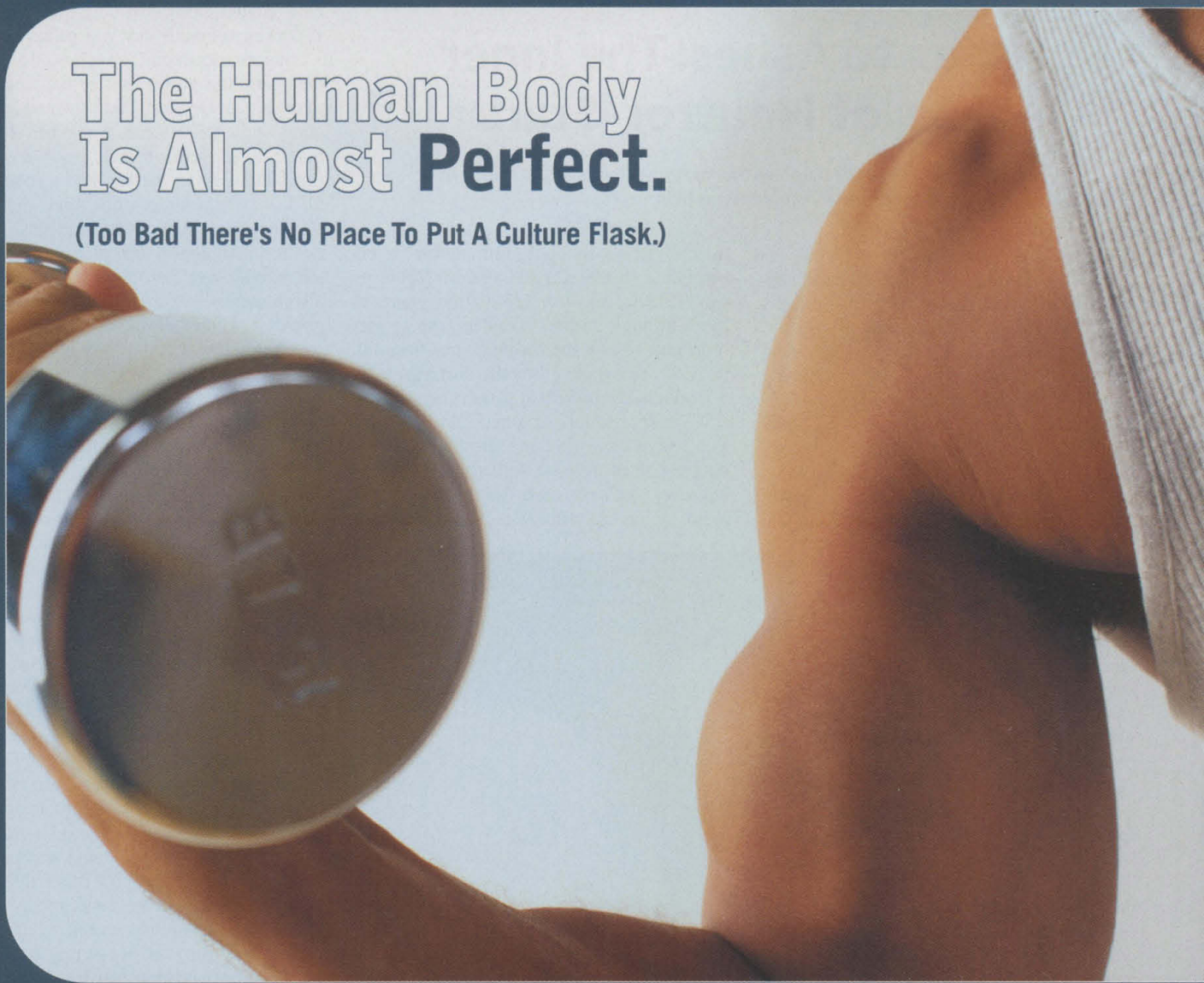

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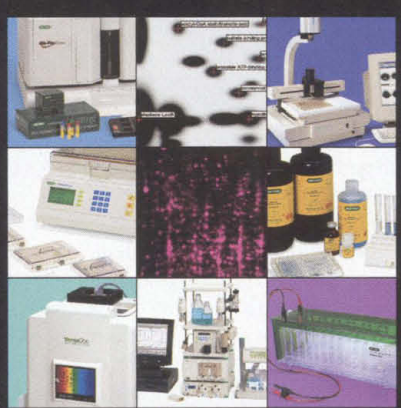

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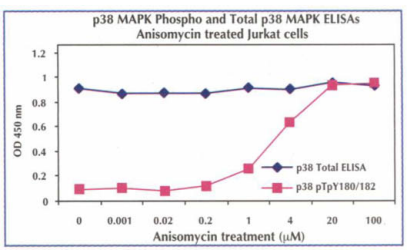

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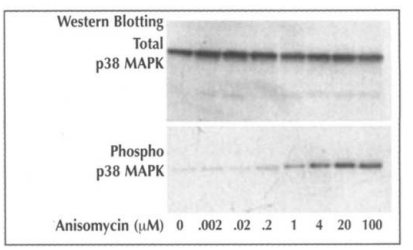

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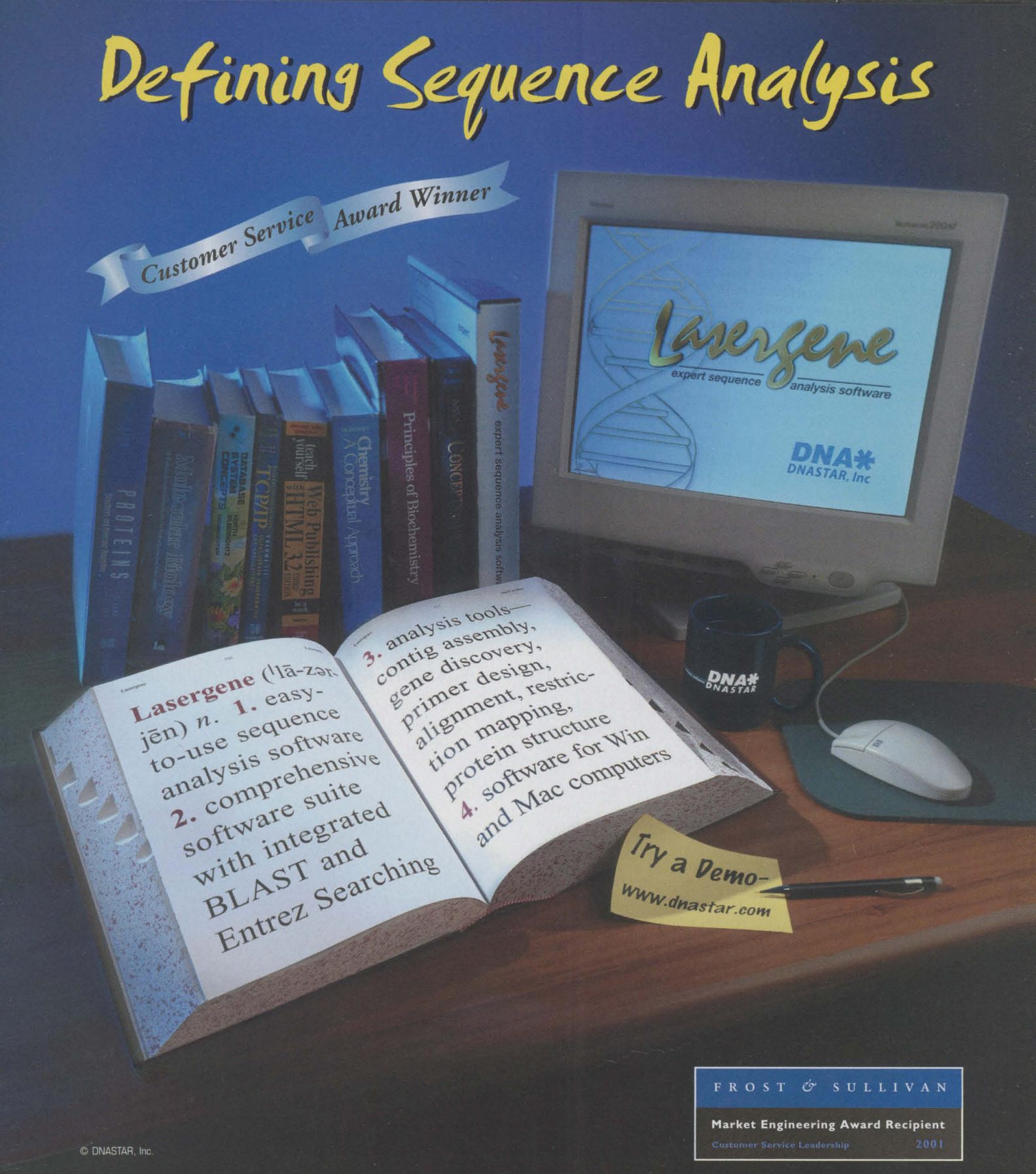

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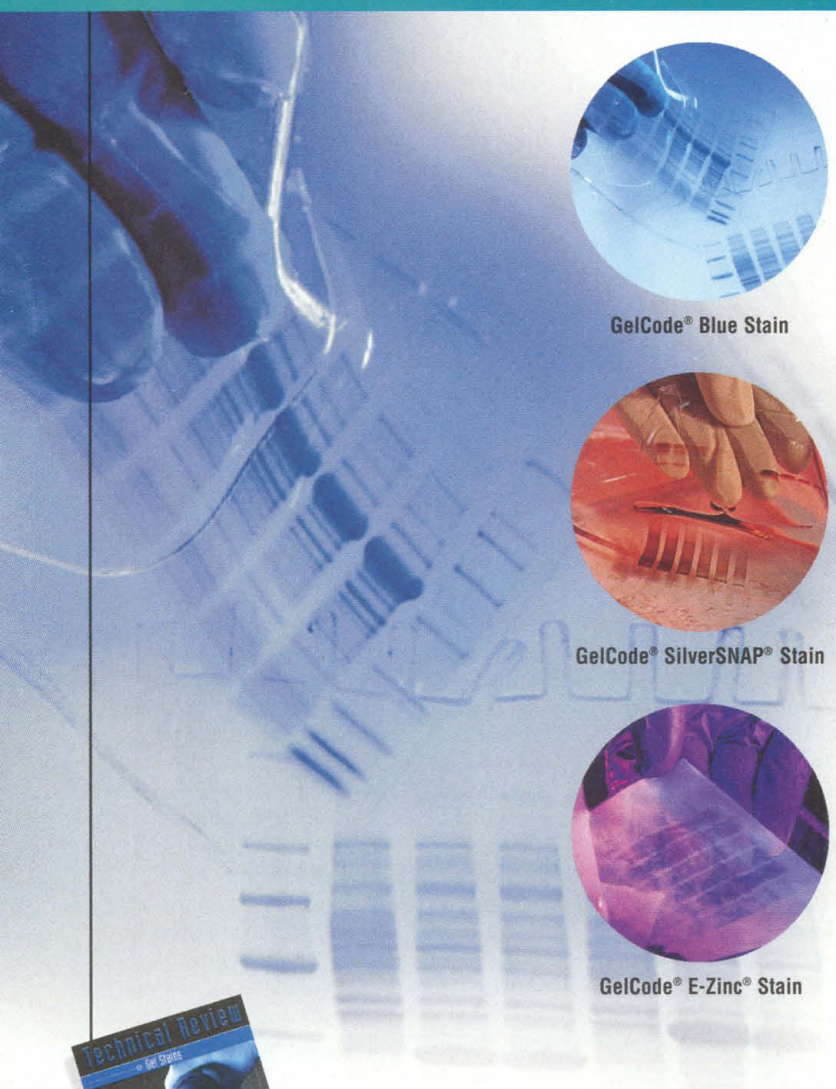

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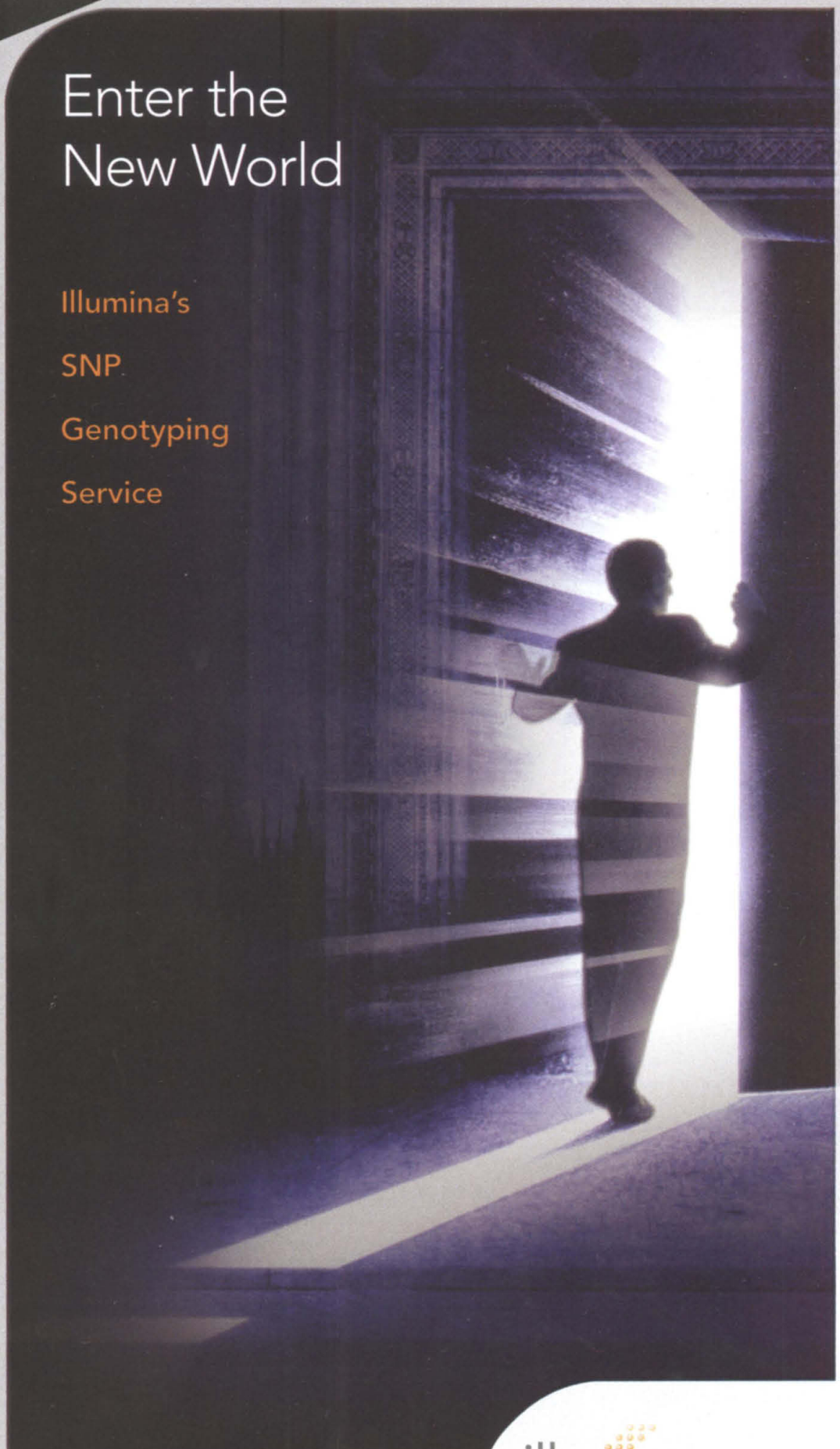

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