20 August 1999

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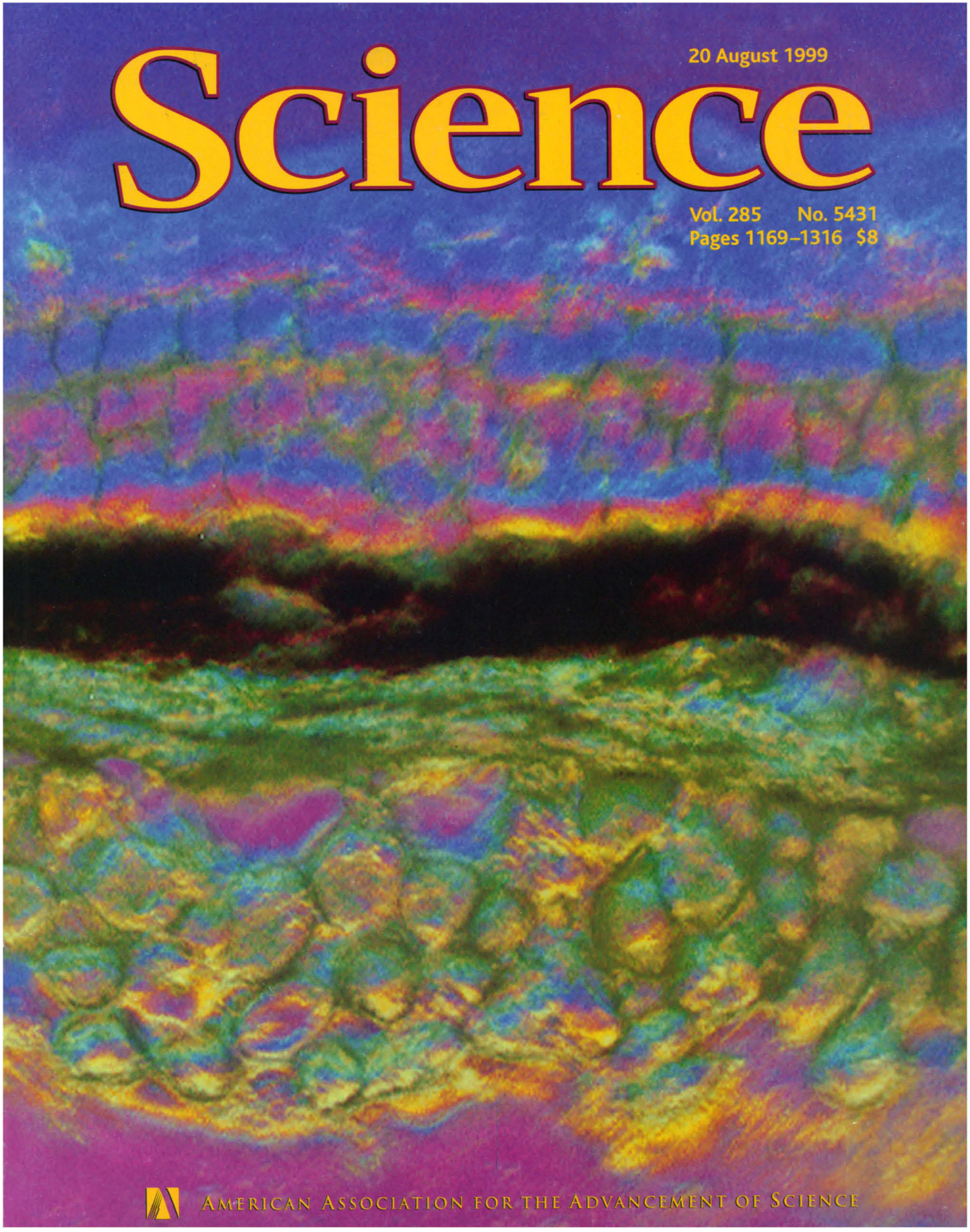

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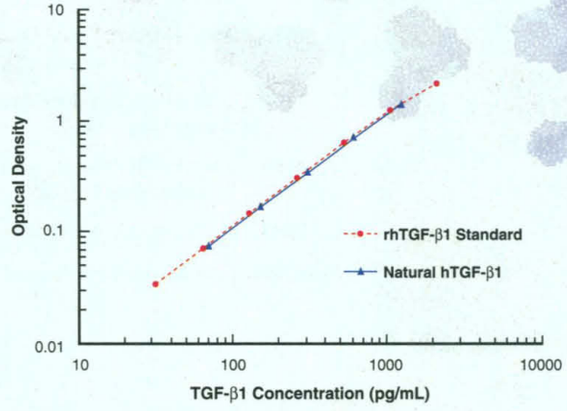
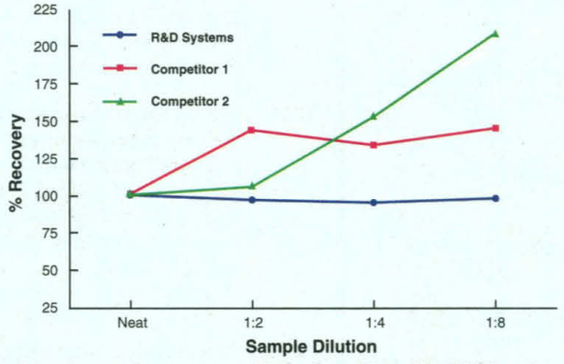


A serum sample containing activated human TGF-β1 was serially diluted and compared to the TGF-β1 standard curve. Results show that the Quantikine TGF-β1 ELISA measures recombinant and natural TGF-β1 in parallel.



A serum sample was assayed in the Quantikine sFas ELISA and two competitor ELISAs. Results show that samples recover 100% when diluted in the Quantikine ELISA.

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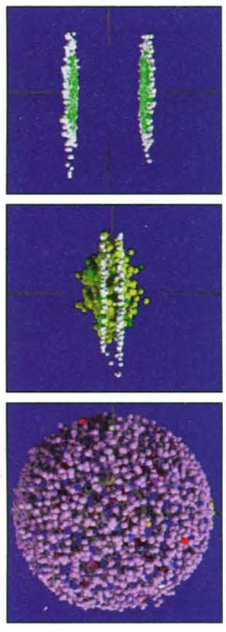
COVER Cross section of an unstained rat retina (image width, ~500 μm) viewed with an infrared microscope/spectrometer with all-reflecting differential interference contrast optics. Imaging the molecular chemistry of individual retinal layers is made possible by combining microscopy and infrared spectroscopy. This emerging technology, used in materials and forensic sciences, is now applied to biological research. [Photo: D. L. Wetzel and S. M. LeVine; T. J. Tague Jr. (Spectra-Tech, Inc.)]



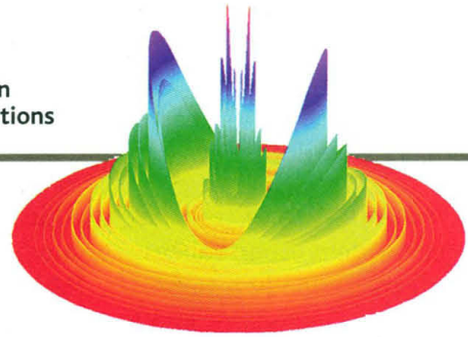
1194
Making quark soup

NEWS

NEWS OF THE WEEK

NEWS FOCUS

1249
Interference in chemical reactions



RESEARCH

RESEARCH ARTICLES

REPORTS

DEPARTMENTS

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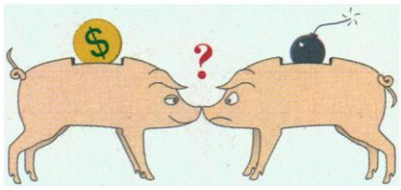

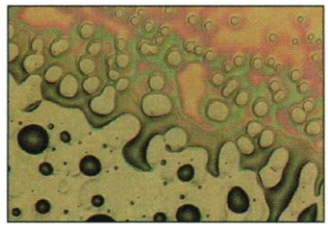

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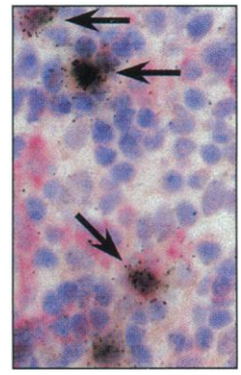

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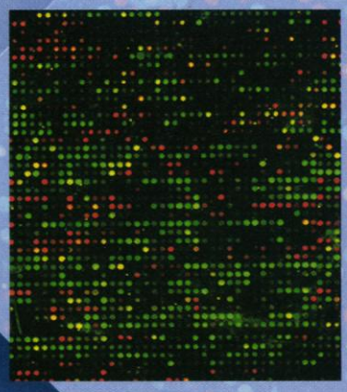

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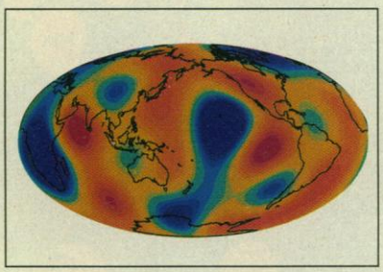
CONSTRAINING MANTLE DENSITY

The determination of the composition and convection of Earth's mantle requires an understanding of the lateral and vertical variations in Earth's density. Seismic imaging normally uses short-period shear and compression waves that are sensitive to effects other than density variations. The recent large Bolivian earthquake in 1994 was sufficiently large and deep to excite long-period normal modes, or free oscillations of the Earth, that can be used to constrain density models. Ishii and Tromp (p. 1231) combined such normal-mode data with gravity data to calculate the density structure of Earth's mantle. Among their findings is the occurrence of denser material at the core-mantle boundary beneath the Pacific Ocean and Africa, where previous convection simulations have suggested that denser material may be piling up in the mantle or being introduced from the heavier core.



PAIRING VERSUS CONDENSING

For some high-temperature superconductors, the spectral weight of the interlayer conductivity (the sum of the real part of the conductivity over a large frequency range) is highly temperature dependent, even though standard sum-rule arguments would argue for a weak temperature dependence. This deviation may be related to a kinetic energy change associated with the formation of the superconducting condensate. Ioffe and Millis (p. 1241) have analyzed the frequency and temperature dependence of the interplane conductivity in copper oxide superconductors and provide a theoretical explanation for this apparent anomaly. Electron pairing can occur without the long-range ordering that leads to superconductivity and magnetic flux exclusion; in underdoped materials, this process would also create the pseudogap seen in underdoped materials.

BROKEN UP AT THE FRONT

Thin liquid films on solids are often unstable and dewet from the surface. Single-component films can dewet through "spinodal decomposition," which is driven by thermal fluctuations, or through film rupture that nucleates at defects or contamination sites. Yerushalmi-Rozen *et al.* (p. 1254) identify a dewetting process in films of two partially miscible components that may place limitations on their potential applications. Phase separation leads to dewetting at an interface that moves inward from the outside edge of the film. The dewetting front appears to be driven by Marangoni flow, as seen in "tears of wine."

SWITCHING STICKINESS

If the wettability or tackiness of an organic material needs to be altered permanently, a coating can be applied, such as when a fabric is coated with a nonstick spray. A greater challenge is to create organic materials that change their surface properties reversibly in response to external conditions, such as a change in temperature, while maintaining other desirable properties. De Crevoisier *et al.* (p. 1246; see the Perspective by Russell and Kim) have synthesized a fluorinated copolymer that has a liquid crystalline layered texture at room temperature but changes to an isotropic solid near 35 degrees Celsius. Over this temperature range, the material changes from hard and water-resistant to tacky and wettable. One possible application would be soil-resistant hand grips for clubs and racquets.

ASSESSING XENOTRANSPLANT SAFETY

The shortage of human organs for transplantation has prompted consideration of other species as donors (xenotransplantation). However, this prospect has raised serious concerns that human patients may become infected with animal viruses; these concerns have been heightened by the knowledge that the AIDS epidemic probably began through transfer of a virus from chimpanzees to a human host. Paradis *et al.* (p. 1236; see the Perspective by Weiss) did not find evidence for transmission of porcine endogenous retrovirus in 160 patients who received living pig tissues. Surprisingly, they did find much longer maintenance of pig cells in human blood than had previously been suspected (up to 8.5 years). Although these are promising results, further testing will be necessary to establish the safety of this approach.

UNSTEADILY ERODING

Several studies have suggested that extensive soil erosion has been occurring in agricultural areas. Trimble (p. 1244; see the news story by Glanz) provides some long-term data from the Coon Creek watershed, Wisconsin. The sediment budget of this watershed has been assessed through several studies since about the 1850s, over which time agricultural practices have changed greatly. The data for the recent period (1975 to 1993) surprisingly show much less soil loss in the uplands compared to earlier times; they also show that soil is redistributed greatly within the basin. The latter finding, if representative, complicates the assessment of soil erosion in many other watersheds.

HOLDING THE SALT

Approaches to developing plants that can tolerate salty conditions have included genetic engineering to increase the accumulation of protective solutes. A different approach is now taken by Apse *et al.* (p. 1256; see the Perspective by Frommer *et al.*) who have found a way to insulate most of the plant cell from the detrimental effects of excess Na^+. Overexpression of a Na^+/H^+ antiporter in *Arabidopsis* promotes accumulation of Na^+ in the central vacuole. The resulting plants can tolerate considerably saltier growing conditions than can their wild-type cousins.

UNDERESTIMATING ESTROGEN EFFECTS

Considerable effort has been made to evaluate the effects of "environmental estrogens," chemicals released into the environment that mimic the biological effects of estrogen. Such compounds can potentially impact reproductive development and function of exposed humans and wildlife. Spearow *et al.* (p. 1259; see the news story by Helmuth) show that a strain of mice commonly used to estimate biological activity of such compounds is relatively insensitive to estrogens. In males of the CD-1 strain of mice, which has been subjected to genetic selection for large litter size, doses of es-

CONTINUED ON PAGE 1179

CONTINUED FROM PAGE 1177

trogen that completely blocked spermatogenesis in other strains produced little or no effect.

CANDIDA'S SECRET SEX LIFE?

Candida albicans causes thrush and mucosal and systemic infections in immunocompromised individuals; it is the most prevalent fungal pathogen. Unlike its more extensively studied relative, *Saccharomyces cerevisiae*, it was thought to lack the ability to reproduce sexually, which complicates attempts to study its genetics. Hull and Johnson (p. 1271) have now found expression of genes in *C. albicans* predicted to encode proteins similar to the mating-type loci of *Saccharomyces*. They are arranged similarly to mating-type loci of other fungi and also have similar activities in transcriptional repression. Whether *Candida* uses these genes for sexual reproduction or to control other processes of the infection has not yet been demonstrated, because of difficulties associated with analysis of this organism in vivo.

THE FIRST DOORWAY FOR HIV

Which cells are infected first in the transmission of human immunodeficiency virus? Stahl-Hennig *et al.* (p. 1261) show that when simian immunodeficiency virus is applied to the tonsils of rhesus macaques, the first cell infected is not, as assumed previously, a dendritic cell or macrophage, but the $CD4^+$ T cell. Although the surface epithelium is similar in histology to tissues like the vagina and anus, the specialized antigen-transporting epithelium was critical to transmission and acute infection.

GOING BEYOND RELAXATION

Epoxyeicosatrienoic acids (EETs) are signaling molecules derived from arachidonic acid that help maintain proper functioning of the cardiovascular system through their ability to relax vascular smooth muscle cells. Node *et al.* (p. 1276) show that EETs also reduce vascular inflammation by inhibiting the proinflammatory transcription factor NFκB. Because of their dual activity, EETs may be particularly valuable targets for new therapies to fight cardiovascular disease.

NOT JUST HITCHHIKING

After synaptic vesicles release neurotransmitter molecules into the synaptic cleft of a nerve terminal, new vesicles are formed by clathrin-mediated endocytosis at the plasma membrane. For very active neurons, such replenishment occurs rapidly. Haucke and De Camilli (p. 1268) suggest that membrane proteins bearing a tyrosine-based signal for endocytosis stimulate both the formation of, and their incorporation into, clathrin-coated pits. A peptide and a synaptic vesicle membrane protein containing the endocytosis signaling motif enhanced recruitment of the clathrin coat component AP-2 to synaptosomal membranes. The motif induced a conformational change in AP-2 that enhanced AP-2 interaction with synaptotagmin, a synaptosomal membrane protein. Hence, by participating in the formation of a coated pit, membrane proteins may ensure their incorporation into synaptic vesicles.

TECHNICAL COMMENT SUMMARIES

Phylogenies, Temporal Data, and Negative Evidence

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/285/5431/1179a

D. L. Fox *et al.* (Reports, 11 June, p. 1816) compared conventional cladistic methods (which "exclude temporal data from the initial search for optimal hypotheses") with stratocladistics, which does include such data. They found that stratocladistics recovered "the true phylogeny in over twice as many cases as [did] cladistics" in tests using "known, simulated evolutionary histories given the same, evolved character data."

J. E. Heyning and C. Thacker comment that "the use of temporal data [in stratocladistics] inherently invokes the use of negative evidence" and is thus invalid. They state that "a phylogeny's character debt...and its stratigraphic debt...are incomparable lines of evidence and therefore should not be combined in an analysis." They discuss other "problematic" aspects of the data and analysis in the report.

In response, D. C. Fisher *et al.* state that, "as with any distributional data, the signal used to evaluate competing hypotheses is a complex mix of 'positive' and 'negative' observations...." They agree that "morphologic and stratigraphic data are different, and within cladistics they may appear 'incomparable,'" but they maintain that "stratocladistics provides its own analytical framework within which both can be evaluated for their fit to phylogenetic hypotheses." [See related Letters to the Editor, p. 1209.]

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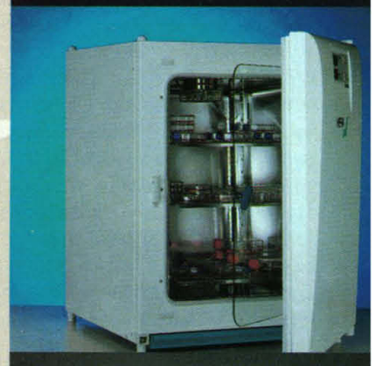

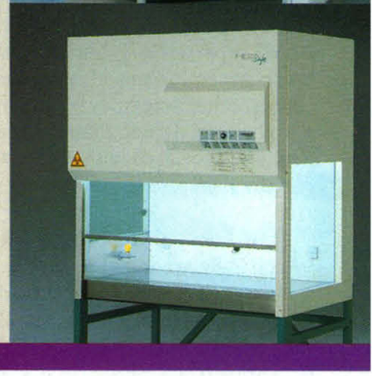

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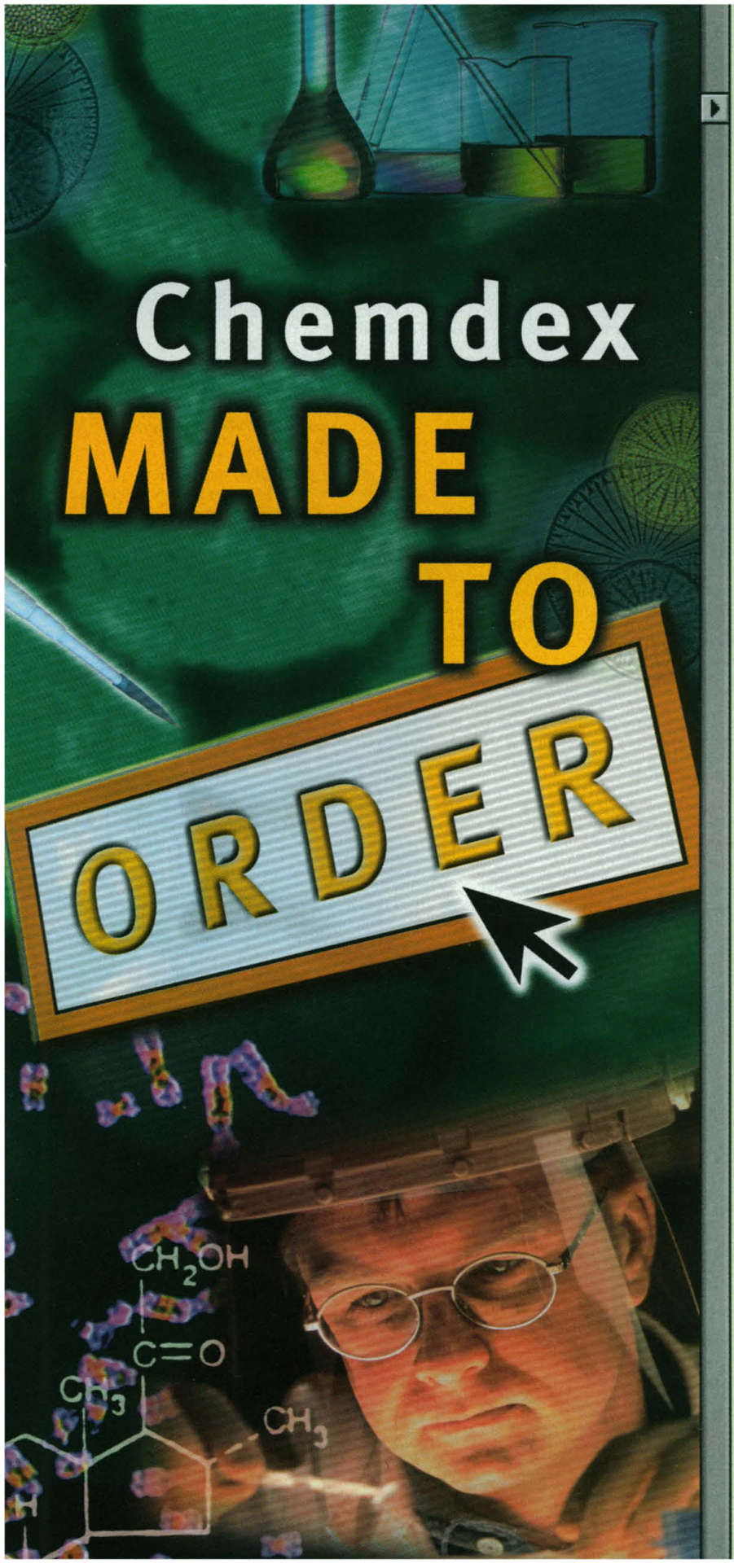

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Plate: Image of NIH 3T3 transfected with green fluorescent protein (GFP) plasmid. **Background:** CHO-K1 transfected with β-gal plasmid.

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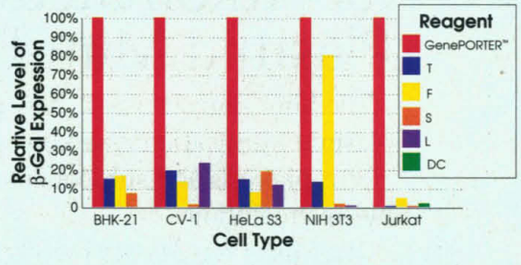

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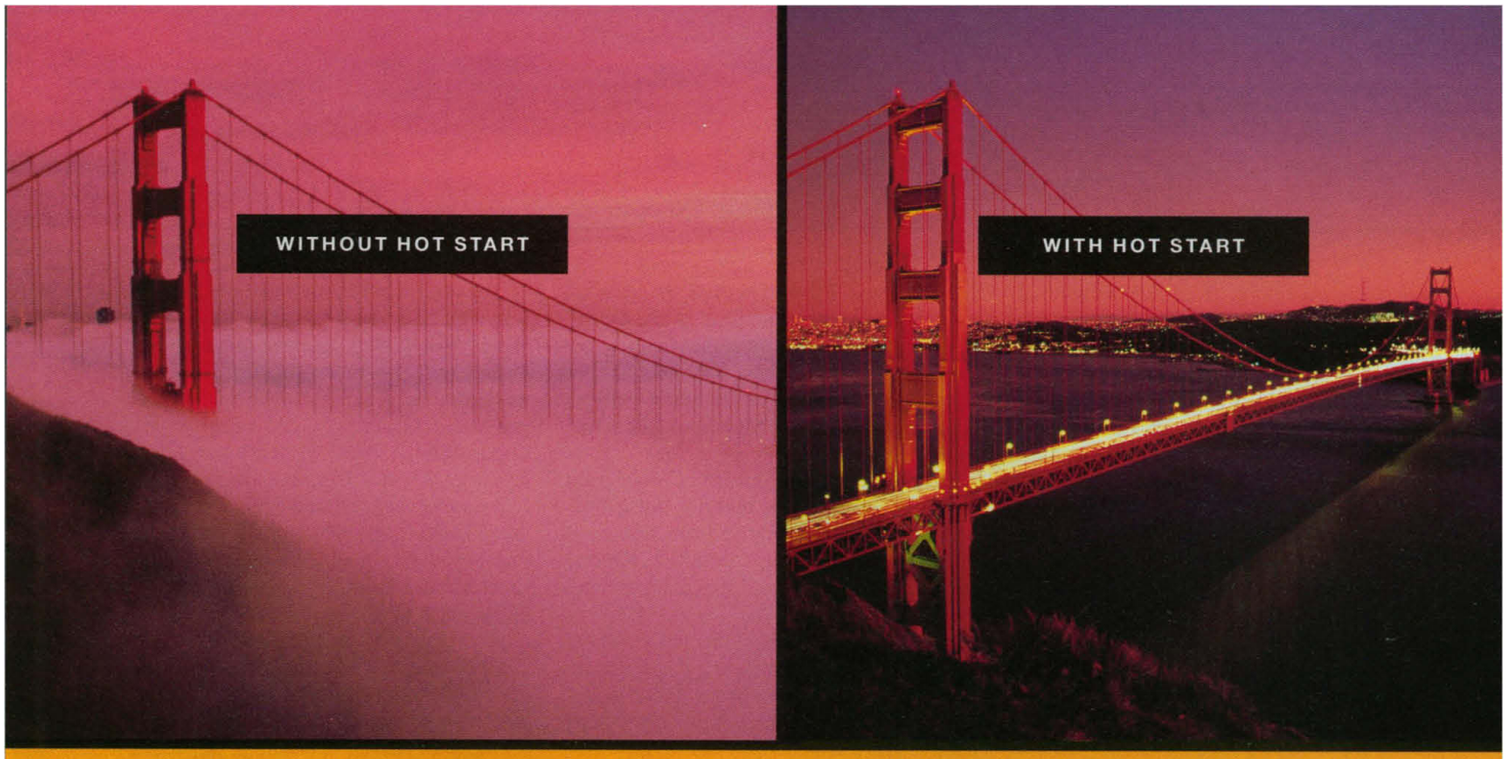

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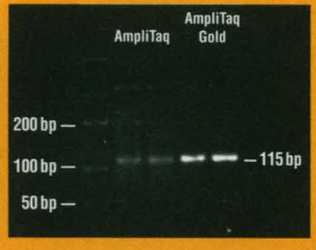

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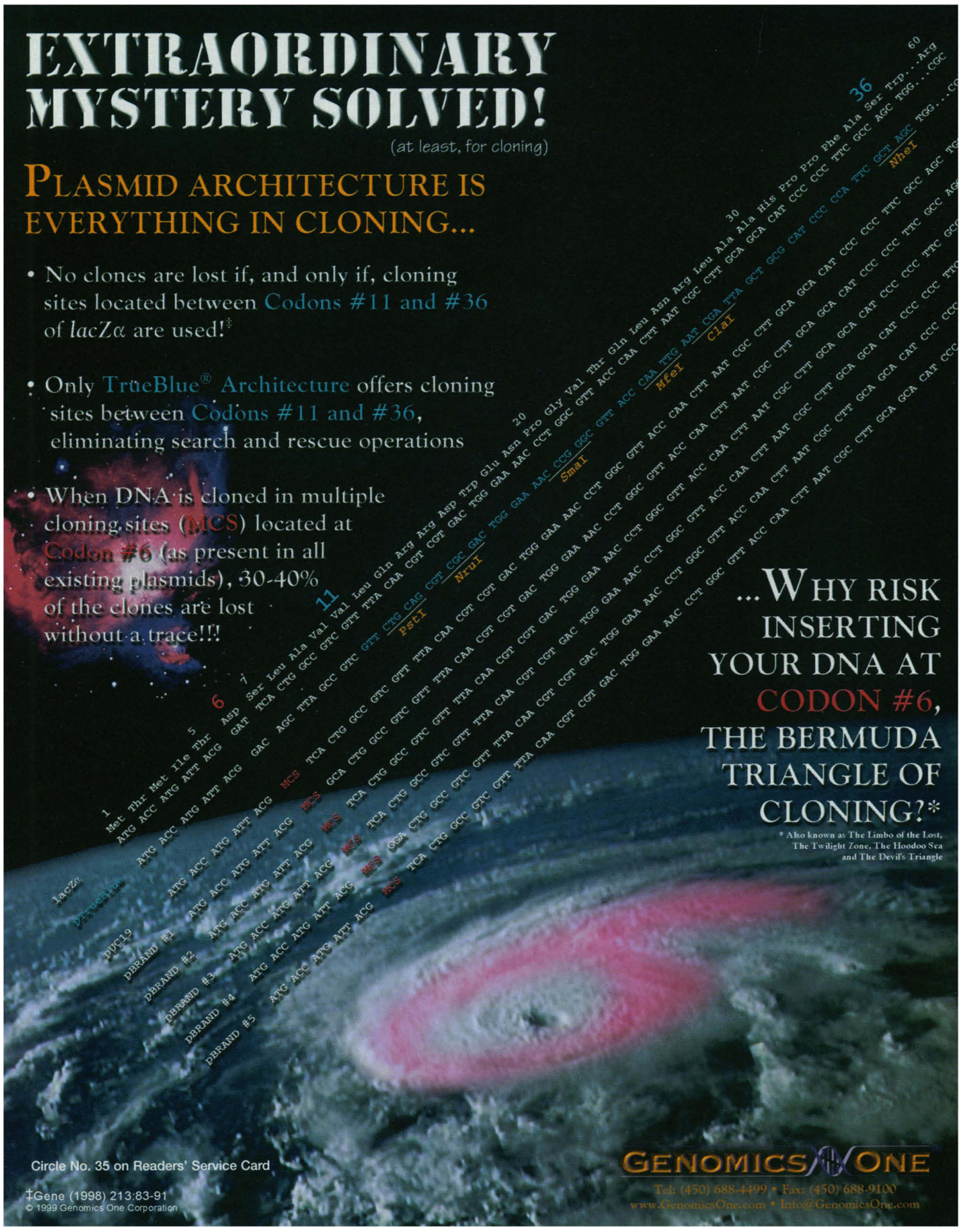

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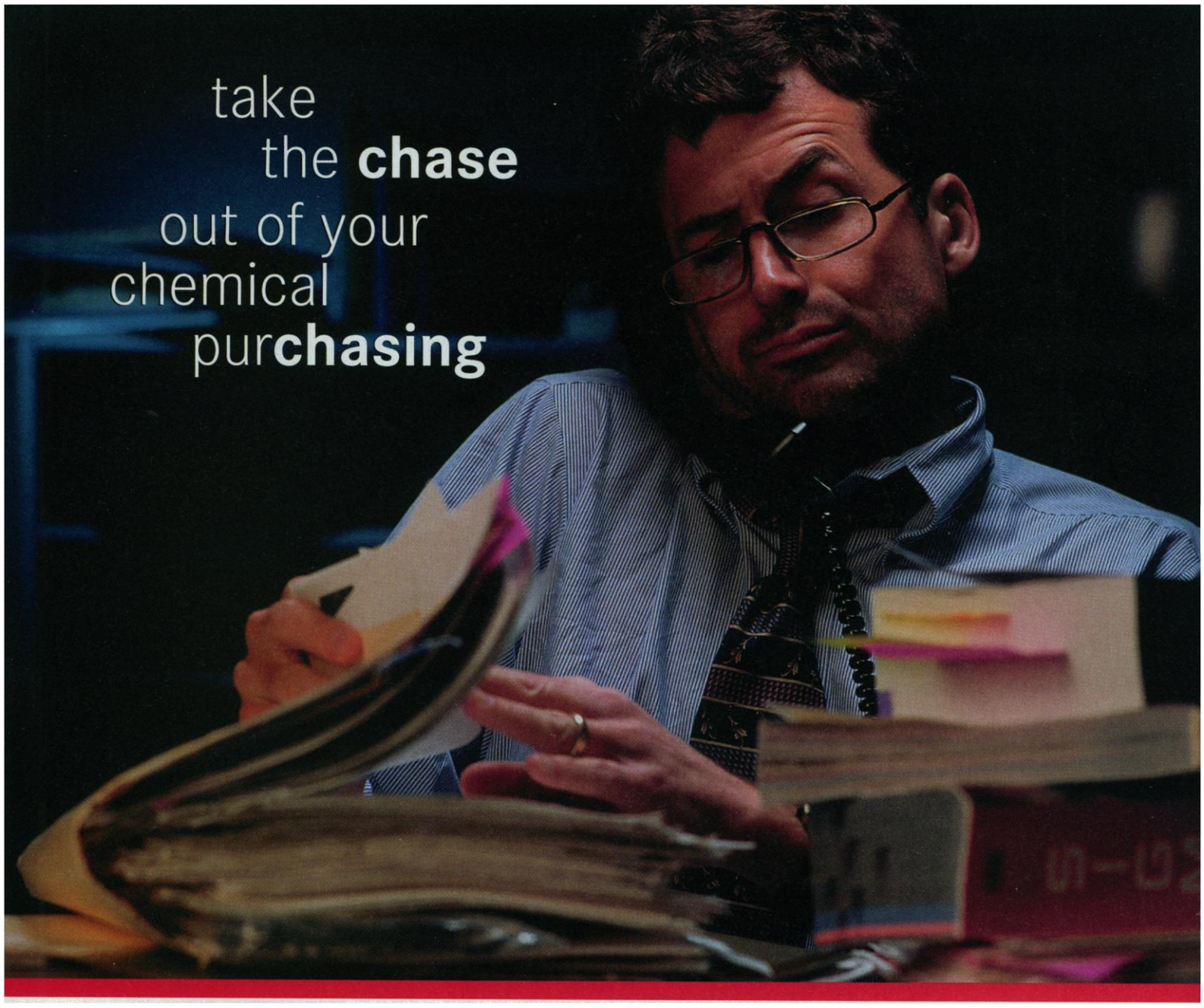

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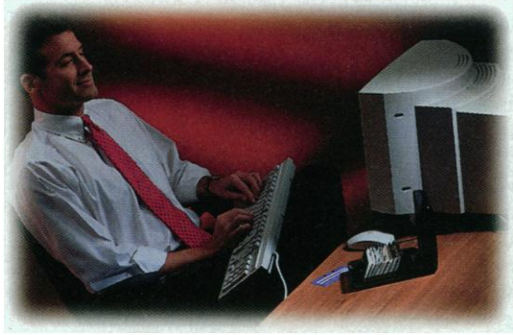

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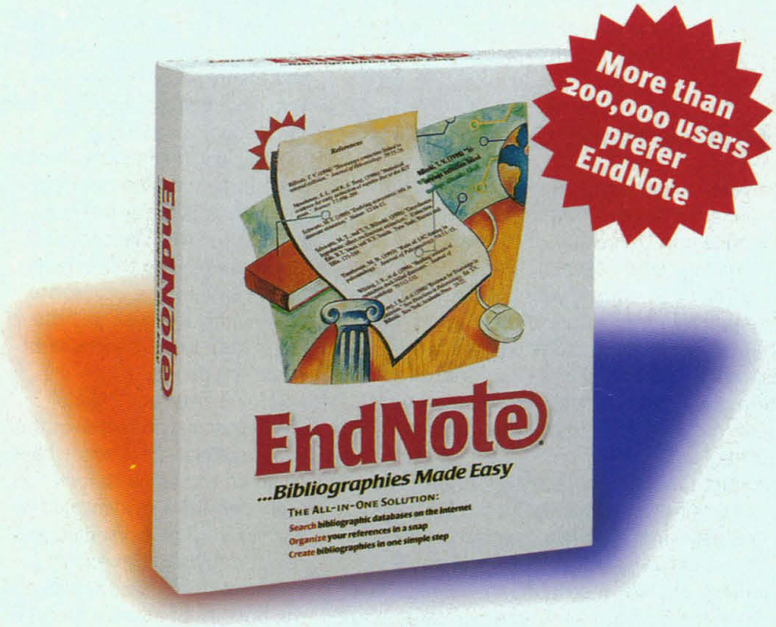

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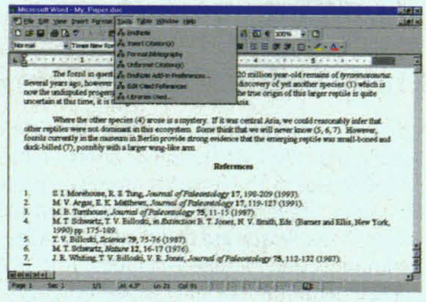

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The NCI Clinical Trials Cooperative Groups have banked tumor specimens from large numbers of uniformly treated cancer patients with a variety of malignancies. Each group has a review process for research proposals. If proposals receive favorable reviews, specimens with clinical, treatment and outcome data can be made available to researchers through collaborative arrangements. These banked specimens are most useful for clinical correlative studies on uniformly treated patient populations. Contact the NCI Human Specimen and Data Information System website at: http://www.specimens.ims.nci.nih.gov, or the NCI Tissue Expediter, (301) 496-7147; e-mail: tissexp@mail.nih.gov.

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The NCI Cooperative Breast Cancer Tissue Resource (CBCTR) can provide researchers with access to over 9,000 cases of formalin-fixed, paraffin-embedded primary breast cancer specimens, with associated pathology and clinical data. The collection is particularly well - suited for validation studies of diagnostic and prognostic markers. Contact CBCTR's website at: http://www-cbctr.ims.nci.nih.gov, or Ms. Sherrill Long, Information Management Services, Inc., (301) 984-3445; e-mail: sherrill@ims.nci.nih. gov.

The NCI AIDS Malignancy Bank (AMB) is a collection of tissue and biological fluids with associated clinical and follow-up data from patients with HIV-related malignancies. The specimens and clinical data are available for research studies, particularly those that translate basic research findings to clinical application. Contact the AMB website at: http://cancernet.nci.nih.gov/amb/amb.html, or Dr. Ellen Feigal, NCI, (301) 496-6711; e-mail: ef30d@nih.gov.

Each of the resources listed above has an established review process for specimen requests and/or requirements that must be met for access to specimens. Additional details may be obtained from the resource websites and/or resource contacts.

The NCI Breast Cancer Specimen and Data Information System can provide additional information on breast cancer tissue resources (http://www-napbc.ims.nci.nih.gov).

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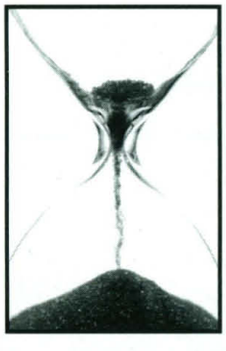

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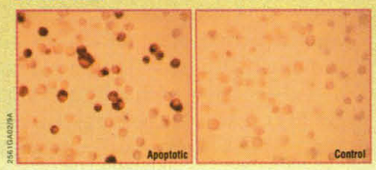

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