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23 July 1999

Vol. 285 No. 5427
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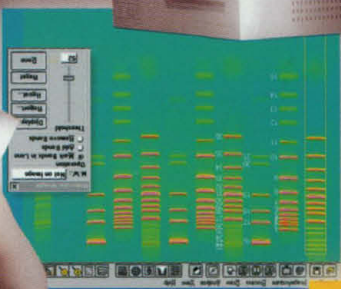
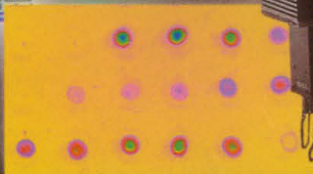
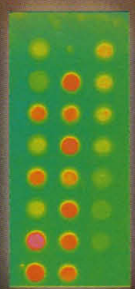
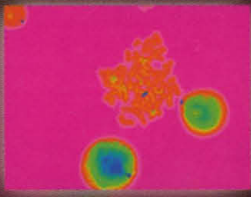
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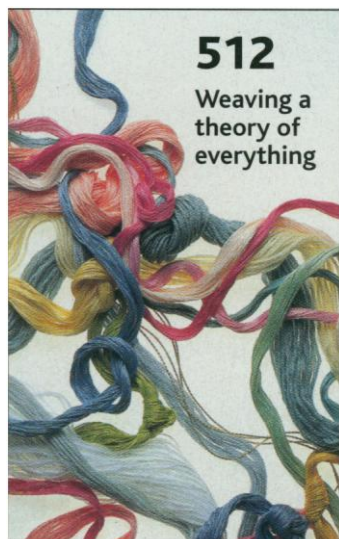
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COVER Cross section of *Arabidopsis* flowers (image width, 0.56 mm). Regulatory elements of the homeotic gene *AGAMOUS* can direct expression of a reporter gene (staining intensity increases from pink to purple) in the center of flowers, where *AGAMOUS* specifies stamen and carpel development. Activation of these elements requires that they are bound by *LEAFY*, a transcription factor that determines whether flowers will be generated instead of shoots or leaves. [Image: K. Bomblies/D. Weigel]



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Weaving a theory of everything

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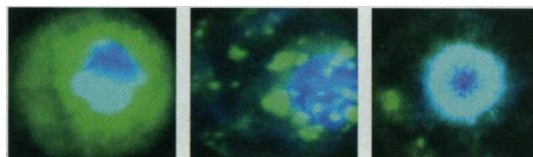
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SCIENCE (ISSN 0036-8075) is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1200 New York Avenue, NW, Washington, DC 20005. Periodicals Mail postage (publication No. 484460) paid at Washington, DC, and additional mailing offices. Copyright © 1999 by the American Association for the Advancement of Science. The title SCIENCE is a registered trademark of the AAAS. Domestic individual membership and subscription (51 issues): \$110 (\$62 allocated to subscription). Domestic institutional subscription (51 issues): \$325; Foreign postage extra: Mexico, Caribbean (surface mail) \$55; other countries (air assist delivery) \$90. First class, airmail, student, and emeritus rates on request. Canadian rates with GST available upon request, GST #1254 88122. Publications Mail Agreement Number 1069624. Printed in the U.S.A.

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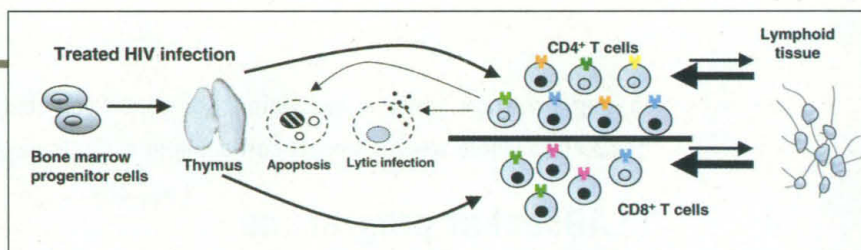
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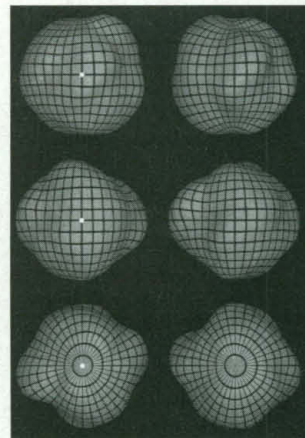
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An asteroidal offspring, all wound up



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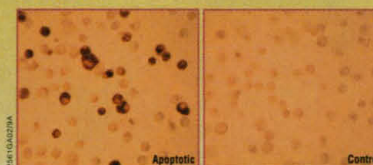
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SPINNING FRAGMENTS IN SPACE

Optical and radar observations by Ostro *et al.* (p. 557) have determined the characteristics of the recently discovered near-Earth asteroid 1998 KY26. The asteroid, which is nearly spherical in shape (its diameter is about 30 meters), has spectral characteristics that are similar to those of carbonaceous chondrite meteorites and has a fast spin rate—about 10 minutes. These features suggest that KY26 is a collisional fragment ejected from a larger object, an event which likely occurred within the last 10^7 to 10^8 years.

A CLOSER LOOK AT EROS

The Near Earth Asteroid Rendezvous (NEAR) spacecraft flew within 4000 kilometers of the asteroid 433 Eros in December 1998. Spacecraft tracking and Doppler data collected by Yeomans *et al.* (p. 560) were combined with imaging completed by Veverka *et al.* (p. 562) to determine the bulk properties of Eros, which appears to be an elongate and cratered body. Its density, about 2.5 grams per cubic centimeter, is similar to that of Ida, another S-type asteroid, and much greater than that of Mathilde, a C-type asteroid. Eros appears to fit within its spectrally defined class and is more structurally coherent than Mathilde.

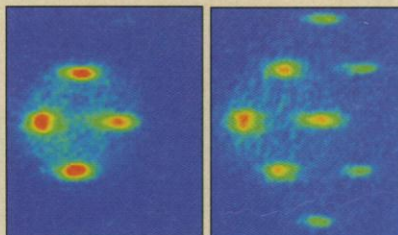
ASTRONOMICAL FORCING OF CLIMATE

Forcing of Earth's climate system by long-term periodic changes in Earth's orbit is the focus of two reports (see the news story by Kerr). Some expected periodicities are absent from the climate record, and researchers have struggled to find a satisfactory explanation. Rial (p. 564) shows that the mysterious absences can be explained using frequency modulation theory, if the key missing periodicity, at 413,000 years, drives the other, shorter frequencies. Modeled frequencies based on this assumption match the observed patterns. However, the physical mechanism underlying this explanation remains unknown. The cause of the inception of glaciation in the Northern Hemisphere about 2.75 million years ago has been uncertain. For some reason, Earth's climate during this period became sensitive to orbital variations in solar radiation such that ice sheets grew. Willis *et al.* (p. 568) provide a glimpse of this period through an analysis of laminated lake sediments from Pula maar, Hungary. The sequence pro-

vides a record based on pollen at a high resolution (about every 2500 years) from 2.6 to 3.0 million years ago. Cyclical climate variations at less than about 15,000 years appear shortly before the onset of Northern Hemisphere glaciation. These cycles are less than the normal Milankovitch orbital cycles (which are prominent at earlier times) and may have helped stabilize large ice sheets.

SUPERRADIANT RAYLEIGH SCATTERING

Rayleigh scattering of photons off of atoms causes the scattering of white light that gives the sky its blue color. The elementary process involves absorption of the photon followed by spontaneous re-emission from one



atom, which occurs in any direction and thus impacts a random recoil momentum to the atom. Inouye *et al.* (p. 571) have studied Rayleigh scattering for the case of coherent light (laser emission) interacting with coherent atoms—Bose-Einstein condensates, in which groups of atoms are condensed into the same quantum state. As the photons impart momentum to the condensate, the recoiling atoms set up an atomic diffraction grating. This process results in highly directional Rayleigh scattering of the photons that is superradiant—emission occurs not through one atom but rather through a group of atoms.

A SMALLER CARBON SINK

Not all anthropogenic carbon emissions remain in the atmosphere, but the size of the terrestrial and oceanic carbon sinks and the mechanisms by which they sequester carbon remain controversial. Houghton *et al.* (p. 574; see the Perspective by Field and Fung) studied the effects of long-term land-use change in the United States on the carbon sink. They determine that the sink, which is on the order of 10 to 30% of U.S. fossil fuel

emissions, is much smaller than that found in an earlier study based on atmospheric measurements.

THE IMMUNODEFICIENCY CHALLENGE

Treatments for cancer and transplantation often include regimens that destroy the immune system, as do infectious agents such as the human immunodeficiency virus. Greenberg and Riddell (p. 546) review the approaches now being tried to reconstitute the cellular immune system, the limitations associated with each, and what may lie ahead.

DOUBLE DUTY

The photosensitive protein cryptochrome has been suggested to be an integral part of the intrinsic circadian clock in plants, insects, and mammals. It has also been proposed as the photoreceptor that transmits a light signal to reset the clock. In an *in vitro* replication of a portion of the circadian clock in the fruitfly *Drosophila*, Ceriani *et al.* (p. 553; see the news story by Barinaga) show that CRYPTOCHROME may actually do both. The CRYPTOCHROME protein interacts with TIMELESS, a key clock component, and sequesters it in the nucleus of cells. This biochemical action is triggered by light.

A HANDLE ON YEAST INFECTIONS

Candida species cause more than 8% of all hospital-acquired infections. Determining how the yeast species adhere to epithelial cells will be important in understanding pathogenesis and should aid in the design of more effective therapeutics. Cormack *et al.* (p. 578; see the Perspective by Goldman) were able to generate pools of tagged insertion mutants for analysis by exploiting the simpler haploid nature of the *Candida glabrata* genome and its high rate of nonhomologous integration in combination with a technique called signature-tagged mutagenesis. After screening, an adhesin (EPA1) was cloned from a pathogenic fungus and the ligand specificity of this lectin was partially determined.

BEFORE THE BLOOM

The beauty of flowers depends on an intricate series of molecular controls that begins when a small group of undifferentiated proliferating cells, the shoot apical meristem, switches from making more shoot tissue to making inflorescence and floral tissue. Busch *et al.* (p. 585; see the

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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 455

cover) and Wagner *et al.* (p. 582), working with *Arabidopsis*, investigated how the *LEAFY* gene regulates these various fates. *LEAFY* is an immediate upstream regulator of the homeotic gene *AGAMOUS* and also a direct regulator of the gene *AP1* for its earliest functions.

TRICKING THE HOST

Enteropathogenic *Escherichia coli* (EPEC) infection of the colon is a leading cause of infantile diarrhea. The outer-membrane protein intimin of EPEC can bind to its receptor Tir, which the microbe shoots into epithelial cells, and to β_1 -integrins on T cells. By using mutated intimin, Higgins *et al.* (p. 588) determined that the binding to mucosal T cells is what is crucial for successful infection. When intimin binds to the T cells with ligated T cell antigen receptors, the T cells are activated in a synergistic fashion and initiate a massive response of mucosal T helper cell-type 1 that culminates in mucosal thickening, crypt cell hyperplasia, and shedding. This up-regulation of the host-immune response may provide an environment conducive to continued EPEC colonization and survival.

SCREENING PEPTIDES INSIDE CELLS

Powerful genetic selections and screening methods can be combined to both identify inhibitors of biological signaling pathways and to reveal the functional roles of new components of such pathways. Norman *et al.* (p. 591) expressed peptides with random sequences of 16 amino acids within an exposed loop on the surface of a carrier protein in budding yeast. They used genetic selection to isolate peptides from the random library that inhibited pheromone signaling, transcriptional silencing, or the spindle checkpoint of the cell division cycle. These peptides were then used to screen for interacting proteins in a two-hybrid screen that allowed

the identification of a new component of the spindle checkpoint. Analysis of patterns of transcription by whole genome DNA microarray analysis showed that expression of such peptides produces specific effects similar to those of known genetic modifications. Such inhibitor peptides may prove useful in analysis of cellular signaling pathways and may also serve as starting points for development of drugs that specifically influence a particular signaling pathway.

COMPLEMENT AND STROKE

In an animal model of focal cerebral ischemia and reperfusion, Huang *et al.* (p. 595) analyze the possible role of the complement cascade, one of the body's unspecific defense mechanisms. They show that the expression of the protein C1q is increased in neurons in the ischemic brain, which may target these cells for a complement-mediated attack. Administration of a hybrid protein that contained the extracellular domain of the complement receptor, sCR1, modified by glycosylation, proved very efficient in inhibiting the accumulation of platelets and neutrophil cells. This treatment reduced brain damage in their animal model of stroke.

FORMING CONNECTIONS

Peripheral sensory inputs have traditionally been thought to be dominant in shaping the firing pattern during development of higher processing centers in the brain. Weliky and Katz (p. 599; see the Perspective by McCormick) present data from multi-electrode recordings in the lateral geniculate nucleus, an important relay station in the visual pathway, of the developing ferret. Activity in the lateral geniculate is not a simple reflection of the retinal input—the visual cortex plays a major role in shaping correlated activity across different geniculate layers.

TECHNICAL COMMENT SUMMARIES

The Autocorrelation Function and Human Influences on Climate

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/285/5427/495a

T. M. L. Wigley *et al.* (Reports, 27 Nov., p. 1676) searched for signs that human activity affects Earth's climate. They found that "solar forcing alone cannot reconcile the differences in autocorrelation structure between observations [of hemispheric-mean temperature] and model control-run data," which suggested an anthropogenic influence.

A. A. Tsonis and J. B. Elsner comment that "there may indeed be a human influence on climate. However, the use of the autocorrelation function as a tool for such comparisons presents a problem." They show mathematically that the autocorrelation function as used in the report produces a "meaningless" result.

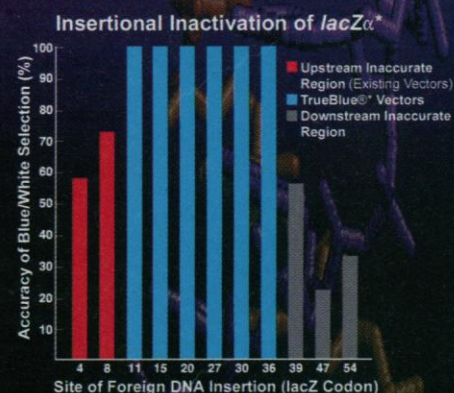
In response, Wigley *et al.* agree that the comment makes a point that is technically correct, but they say that it "does not invalidate any of the conclusions of our report."

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*Siliaty, S.N. and Lebel, S. (1998) *Gene* 213:83-91
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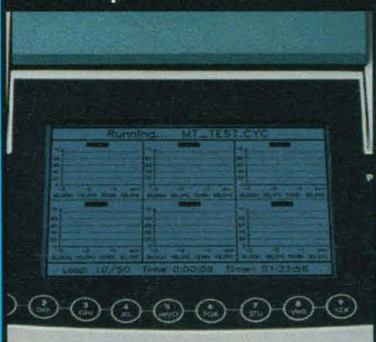


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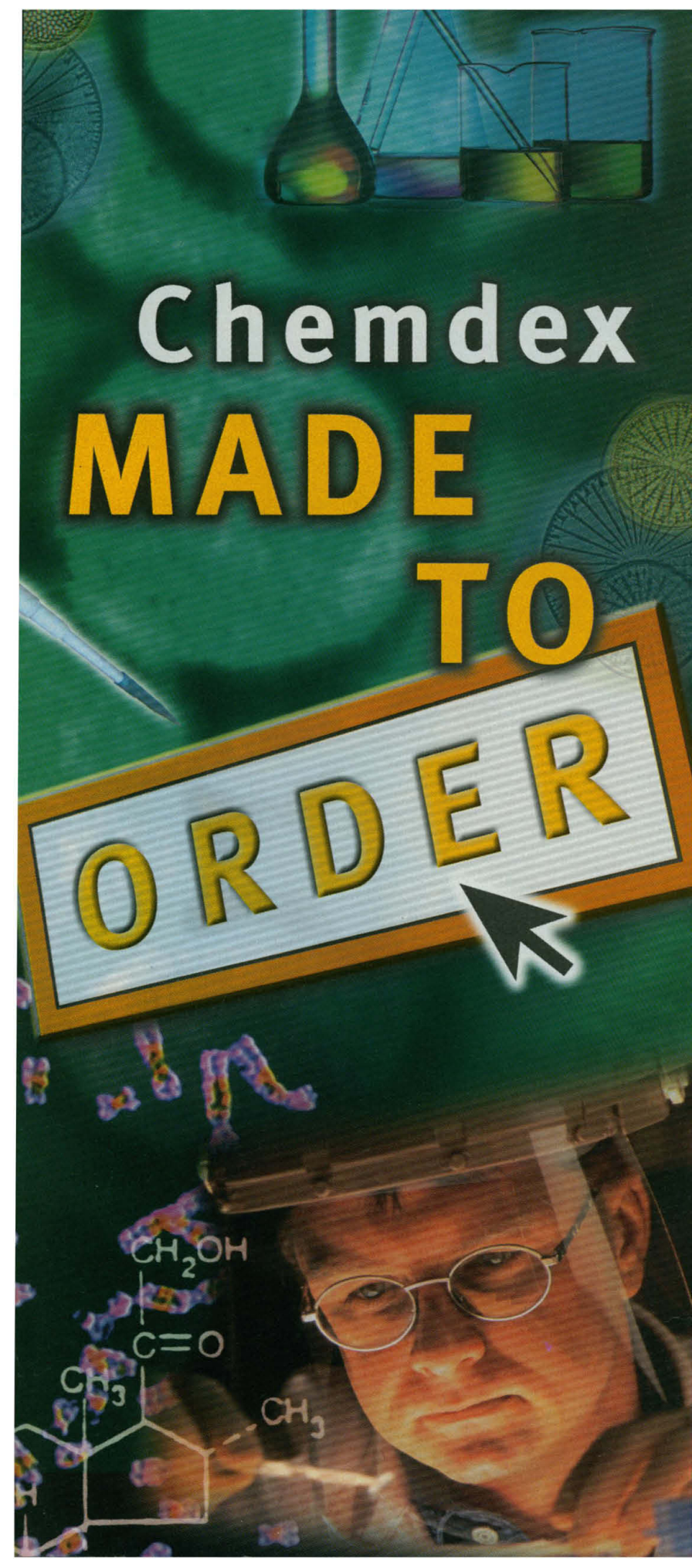
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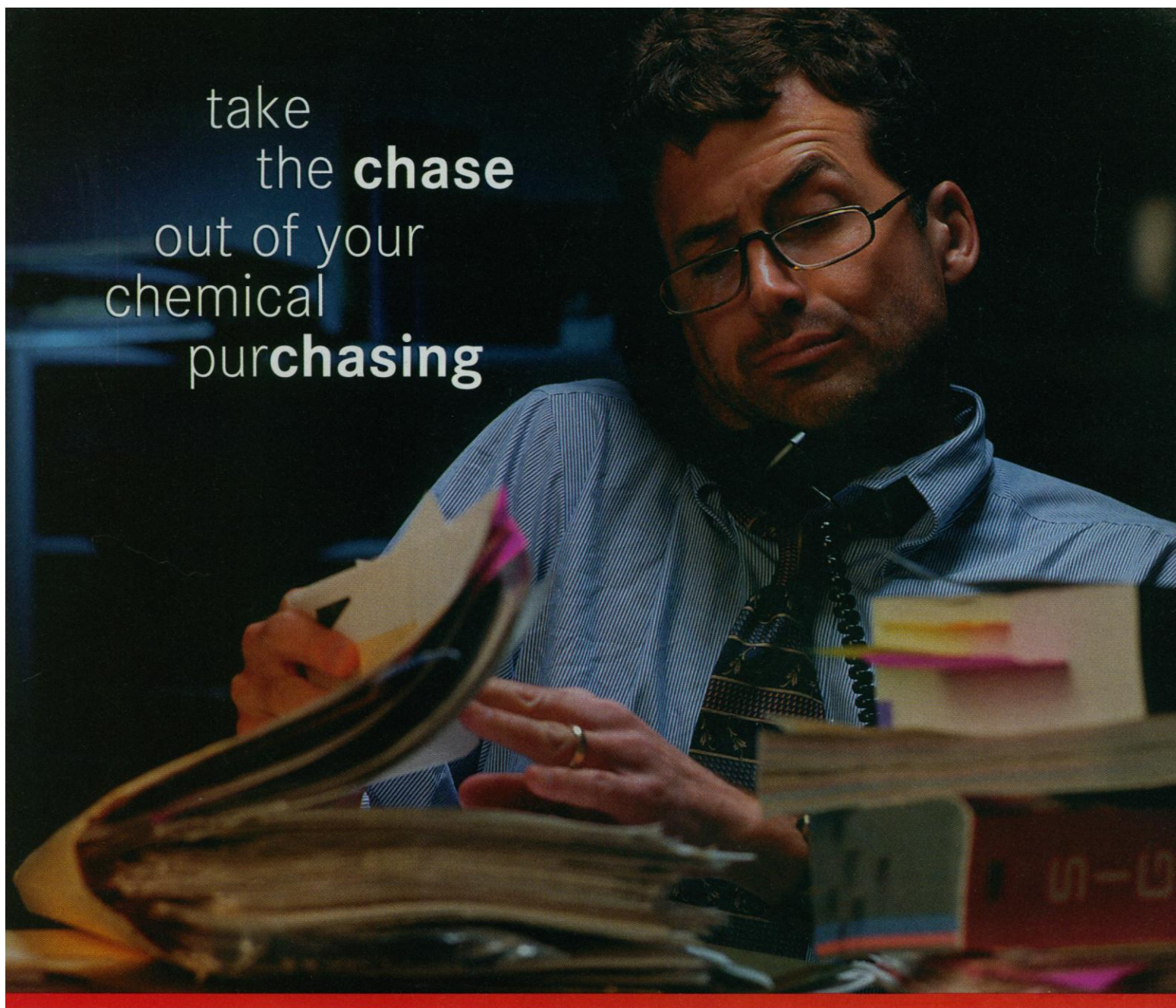


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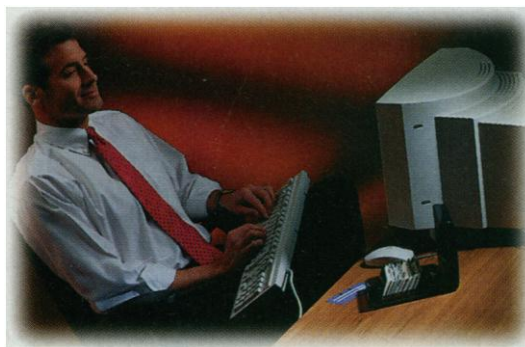
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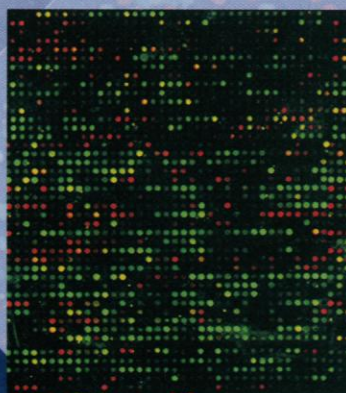
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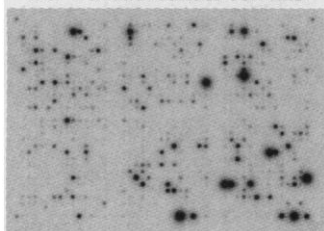
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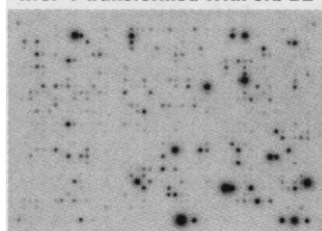
1,200 genes

Illustration inspired by the art of Piet Mondrian (1872–1944).

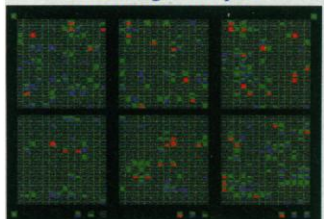
MCF-7 breast cancer cell line



MCF-7 transformed with erb B2



AtlasImage Analysis



AtlasImage 1.0 was used to compare hybridization patterns obtained with the Atlas Human Cancer 1.2 Array. Red indicates up regulation greater than 2-fold and blue indicates down regulation greater than 2-fold.

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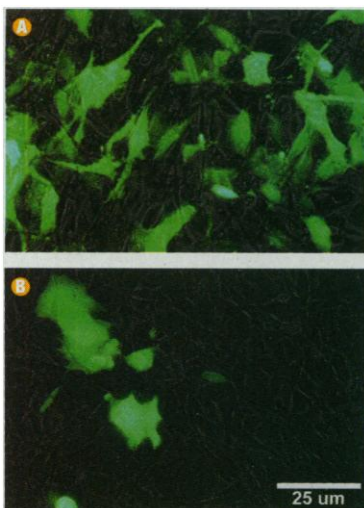
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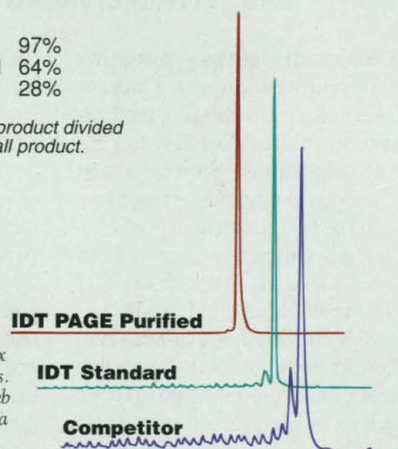
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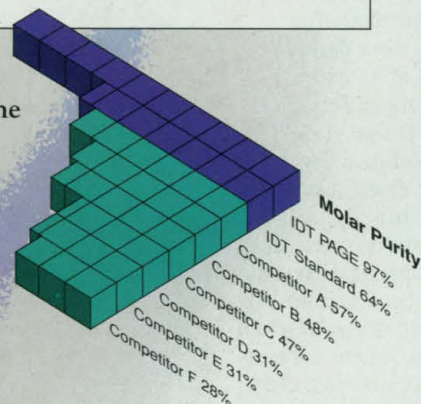
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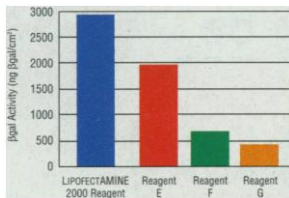
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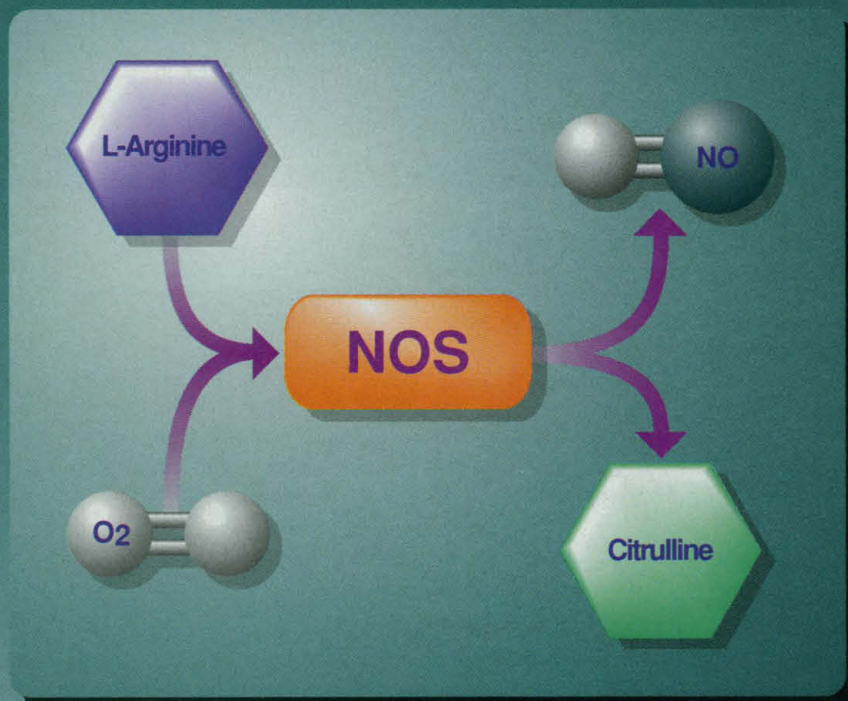
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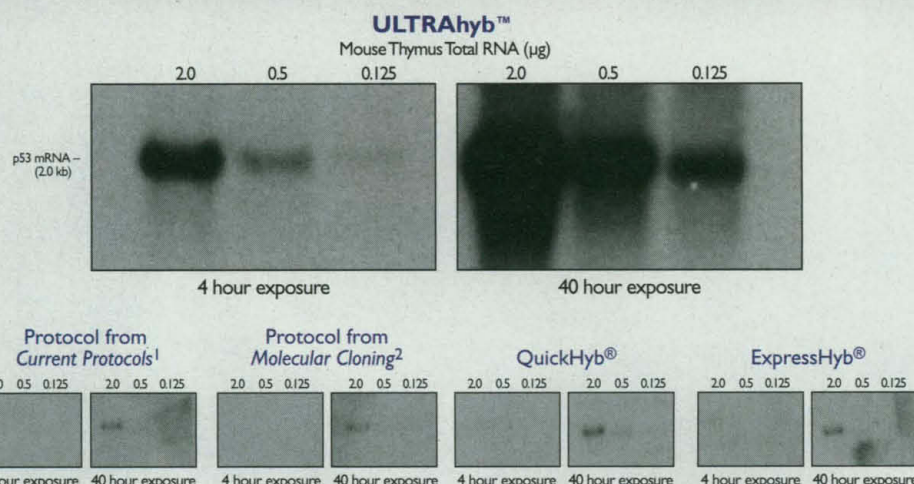
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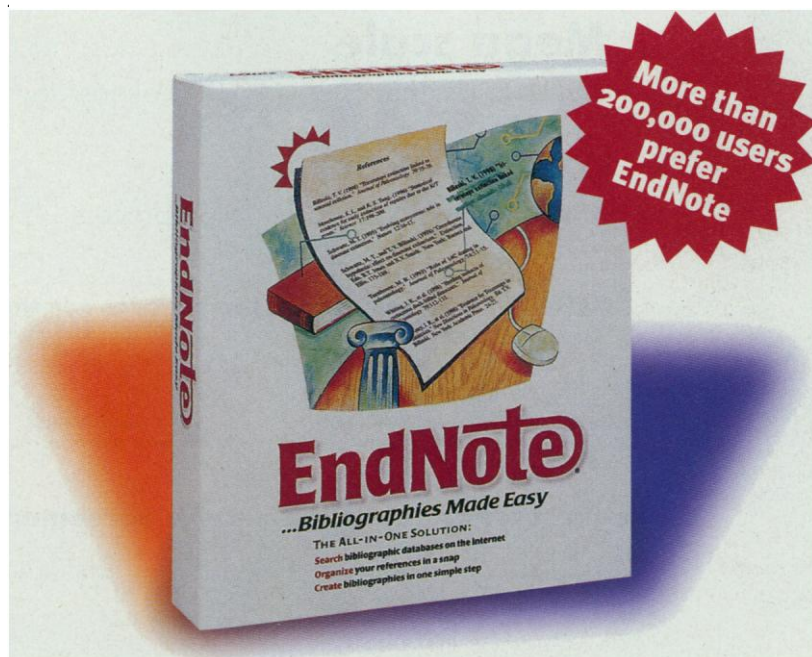
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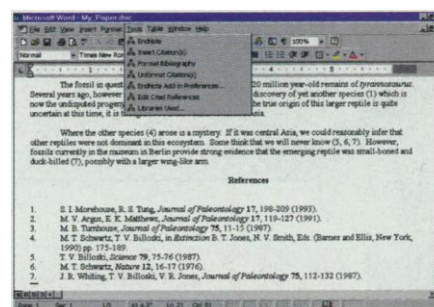


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