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1 October 1999

Vol. 286 No. 5437
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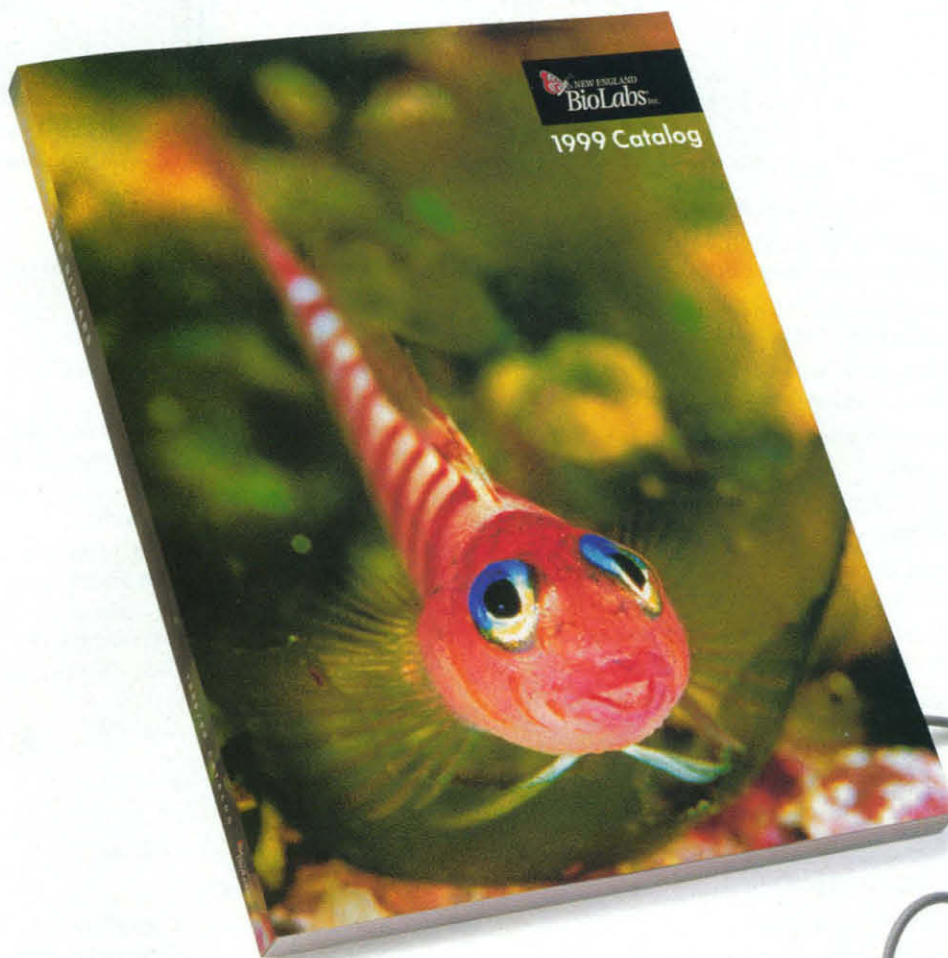
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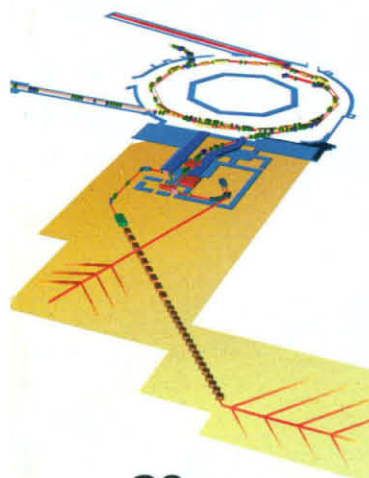
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COVER An artistic view from Ganymede, one of the four large moons orbiting Jupiter. Europa, Jupiter, Io, and Callisto are shown from left to right. Observations from planetary science missions have enhanced our understanding of the jovian system and other planets, and astronomers have detected extrasolar planets and imaged planetary disks. These advances are part of the special section on planetary systems beginning on page 65. [Images: JPL/NASA; composite by Alan T. Stonebraker]



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Serving up hot nuclei

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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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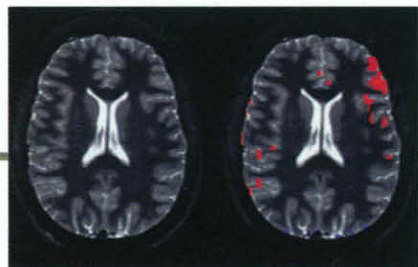
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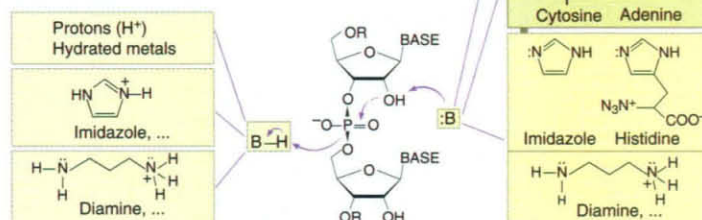


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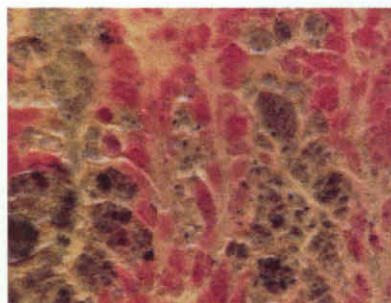
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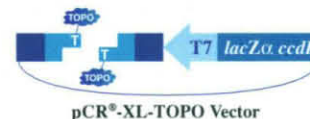
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CLIMATIC WRINKLES ON VENUS

Most of the surface of Venus is covered by ridged plains that were formed by major volcanic eruptions and then deformed by tectonic processes. The wrinkling of some of these ridged plains has been suggested to have occurred on a short time scale (less than 100 million years) soon after the plains were emplaced. In a modeling study, Solomon *et al.* (p. 87) found that an increase in the temperature of the atmosphere, which would have resulted from a major volcanic eruption releasing greenhouse gases such as water and sulfur dioxide, could have thermally stressed the subsurface sufficiently to wrinkle the ridges.

OLDER MARTIAN ALTERATION

The martian meteorite ALH84001, which has been suggested to carry relics of biogenic organisms, has been dated by isotopic methods. These previous studies put the age of the primary minerals at about 4.5 billion years old (Ga); however, the age of the secondary minerals (the carbonates formed by aqueous alteration of the primary rock) was only about 1.3 Ga. Borg *et al.* (p. 90) dated the carbonates extracted with a leachate technique and derived much older ages of about 3.9 Ga by lead-lead dating and about 4.0 Ga by rubidium-strontium dating. These older ages suggest that the carbonate minerals formed when there was water flowing on the martian surface and possibly during the late heavy bombardment period on Mars, when impacts occurred at a much higher rate.

SULFUR CYCLES ON EUROPA

Galileo's near-infrared imaging spectrometer detected hydrated species in spectra of Europa's icy surface. Carlson *et al.* (p. 97) have derived laboratory spectra of hydrated sulfuric acid ($\text{H}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$) that match the europian spectra. The presence of hydrated sulfuric acid would suggest that cycling occurs on the surface (between polymerized sulfur, sulfur dioxide, and sulfuric acid) that is driven by irradiation from the jovian plasma and possibly by extrusion of sulfur-rich liquids from below. Such a sulfur cycle may explain the patterns of dark and bright terrains on Europa.

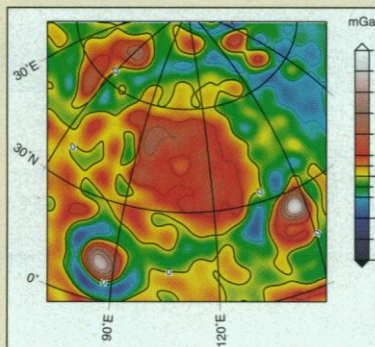
MORE THAN METHANE INSIDE?

Uranus and Neptune are thought to contain middle layers of ice rich in methane, water, and ammonia at high pressures and temperatures. Benedetti *et al.* (p. 100; see the news story by Kerr) laser-heated methane in a dia-

mond anvil pressure cell to comparable conditions and found that methane partially dissociated into diamond, amorphous carbon, and hydrocarbons. These experiments suggest that models of the dynamics of the interiors of Uranus and Neptune should consider the effects of carbon phases and hydrocarbons rather than methane, which may be unstable.

SURVEYING MARTIAN GRAVITY

Doppler tracking of the Mars Global Surveyor spacecraft has allowed Smith *et al.* (p. 94) to measure gravitational anomalies. A global map of the gravity field reveals large, distinct positive gravity anomalies associated with the Tharsis, Olympus Mons, and Alba Patera volcanoes. These results suggest that each volcano had sepa-



rate sources of magma. A large negative gravity anomaly associated with the 11-kilometer-deep Valles Marineris canyon extends into the Chyrsse basin, which suggests that the basin formed by water erosion of material from the canyon.

ARRESTED CRACKS IN LAYERED CERAMICS

Metals and other ductile materials can deform plastically and heal the formation of cracks and voids, but ceramics usually fail catastrophically because there is no internal mechanism to hinder or blunt crack growth. Rao *et al.* (p. 102) fabricated a material containing alternating thick layers of alumina (0.6 millimeters) and thin layers of alumina and mullite (0.04 millimeters) that exhibited crack arrest at or near a layer interface for tensile stresses up to 480 megapascals. They present a theoretical analysis to account for the role of thin compressive layers in resisting crack extension.

EYESIGHT FOR BEGINNERS

Experiments in animals have shown that visual deprivation can arrest visual acuity at or near newborn values, and the onset of visual input can induce a rapid development of acuity toward normal levels. Maurer *et al.* (p. 108; see the Perspective by Sireteanu) use a human disease state—children with congenital cataracts—to study this problem. Children who had cataracts removed 1 week to 9 months after birth showed significant improvements in visual acuity, in some cases in 1 hour after the onset of focused vision. Patterned visual experience is thus necessary for acuity to develop.

A LITTLE LTD

The minimal localization of plasticity on a neuronal dendrite is still not known. Dodt *et al.* (p. 110) approached this question by using ultraviolet lasers to uncage glutamate in neurons under spatially controlled conditions. They recorded postsynaptic excitatory currents and induced long-term depression (LTD) caused by presenting a train of light flashes at 5 hertz onto a 1-micrometer spot on a dendrite. The LTD induced was dependent of *N*-methyl-D-aspartate receptors and on calcium and could completely occlude stimulation-induced synaptic LTD. The spread of LTD along the dendrite was less than 10 micrometers, which shows that LTD can be evoked and expressed purely postsynaptically and can be localized on a single synapse.

MATRILYSIN AND INNATE IMMUNITY

Antimicrobial peptides are found on mucosal surfaces, such as in the lungs or in the intestines, and are thought to be one of the body's first lines of defense against bacterial invasions. However, what their true role is has been difficult to assess, because they are a large family of cleaved proteins that come from multiple genes. Wilson *et al.* (p. 113) report that mice that lack the matrix metalloproteinase matrilysin, which is produced by the same cells in the gut that produce the α -defensin antimicrobial peptides, also lack the cleaved forms of the peptides and were more susceptible to infection. Matrilysin was able to cleave the defensins *in vitro*. Thus, matrilysin may be responsible for regulation of defensin activity *in vivo* and may be key to innate immunity.

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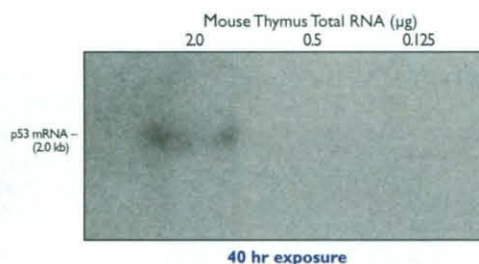
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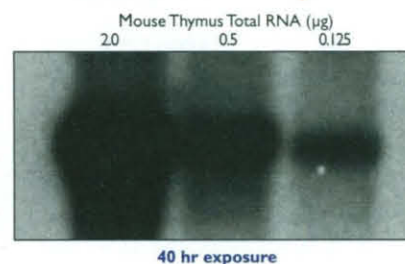
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1. *Molecular Cloning: A Laboratory Manual*, 1989. Sambrook, J., Fritsch, E.F., Maniatis, T. Cold Spring Harbor Laboratory Press.

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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 9

TETHERING TELOMERASE

The proteins Est1 and Cdc13 bind to telomeres (the ends of chromosomes) and, together with the enzyme telomerase, control telomere replication in the yeast *Saccharomyces cerevisiae*. By constructing a series of fusion proteins that in effect tether telomerase to the telomere, Evans and Lundblad (p. 117) show that Cdc13 may mediate accessibility of telomeres to the telomerase complex and that Est1 assists in that function. These results suggest that telomere length homeostasis is maintained at least in part by restricting access of telomerase to chromosome ends.

IN SMALL PACKAGES

Protamines neatly package DNA into chromosomes in sperm cells. Brewer *et al.* (p. 120) used "laser tweezers" and fluorescence microscopy to examine this packaging process. A single DNA molecule was grabbed by the laser, and protamines were applied to and then removed from the DNA molecule to observe the condensation and decondensation processes, respectively. The technique used here to perform and repeat biophysical measurements on a single DNA molecule may be applied to many other protein-DNA analyses.

BASE MOTIFS

One of the key capabilities of protein-based enzymes is general base (or acid) catalysis of a reaction. Because intracellular pH must be maintained within a narrow window, it is not possible to increase the concentration of hydroxide (or hydrogen) ion in order to increase the rate of reaction. Enzymes rely on amino acid side chains for abstraction (or donation) of a proton and can, for example, increase the negative character of an attacking nucleophile. Ribozymes (RNA-based enzymes)

have a more limited side-chain repertoire and often use metal ions to generate hydroxide ions at neutral pH. Perrotta *et al.* (p. 123; see the Perspective by Westhof) now show that a cytosine residue in the self-cleaving ribozyme of hepatitis delta virus can perform general base catalysis.

MOM'S FAVORITE

In birds, offspring sired by more highly ornamented males often have enhanced survival. Is this because these males have greater genetic quality (the so-called "good genes" model of sexual selection) or because the females invest differentially in the eggs fertilized by these males? Gil *et al.* (p. 126; see the news story by Vogel) show that female zebra finches mated to experimentally ornamented males deposit more testosterone in eggs than when mated to unornamented males. Additional testosterone has effects on the growth rate and later dominance of the chicks within the brood. Thus, it seems that post-mating maternal effects may play an important role in the differential development of offspring.

NEANDERTAL CANNIBALISM

The possibility that Neandertals practiced cannibalism has been a recurrent theme in paleoanthropology, but evidence has remained scant. New excavations of 100,000-year-old cave deposits in France, reported by Defleur *et al.* (p. 128; see the news story by Hellemans), have revealed extensive indications of butchery in the skeletal remains of several neandertal individuals and deer at the site. Cut marks on the bone provide evidence of disarticulation and defleshing, and damage consistent with a hammer-and-anvil technique indicates that marrow was extracted. Cannibalism thus appears to have deep pre-historical roots.

TECHNICAL COMMENT SUMMARIES

Knotted Polymers and Bond Breaking

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/286/5437/11a

M. Grandbois *et al.* (Reports, 12 Mar., p. 1727) covalently attached polysaccharide molecules to surfaces and then used an atomic force microscope to pull the molecules off. From an analysis of the rupture events, they concluded that changes in force with extension corresponded to progressive rupture of surface attachments, which allowed a determination of Si-C bond strengths.

A. Stasiak *et al.* comment that the authors' interpretation is unlikely and suggest instead that "the observed peaks preceding the final breakage could be the 'signatures' of progressive tightening of complex knots in the polysaccharide chain."

In response, although H. Gaub *et al.* "agree that knotted polymers will break at lower forces than unentangled ones," they present a reanalysis of their data which indicates that only about 5% of the events they observed might reflect tightening of knots.

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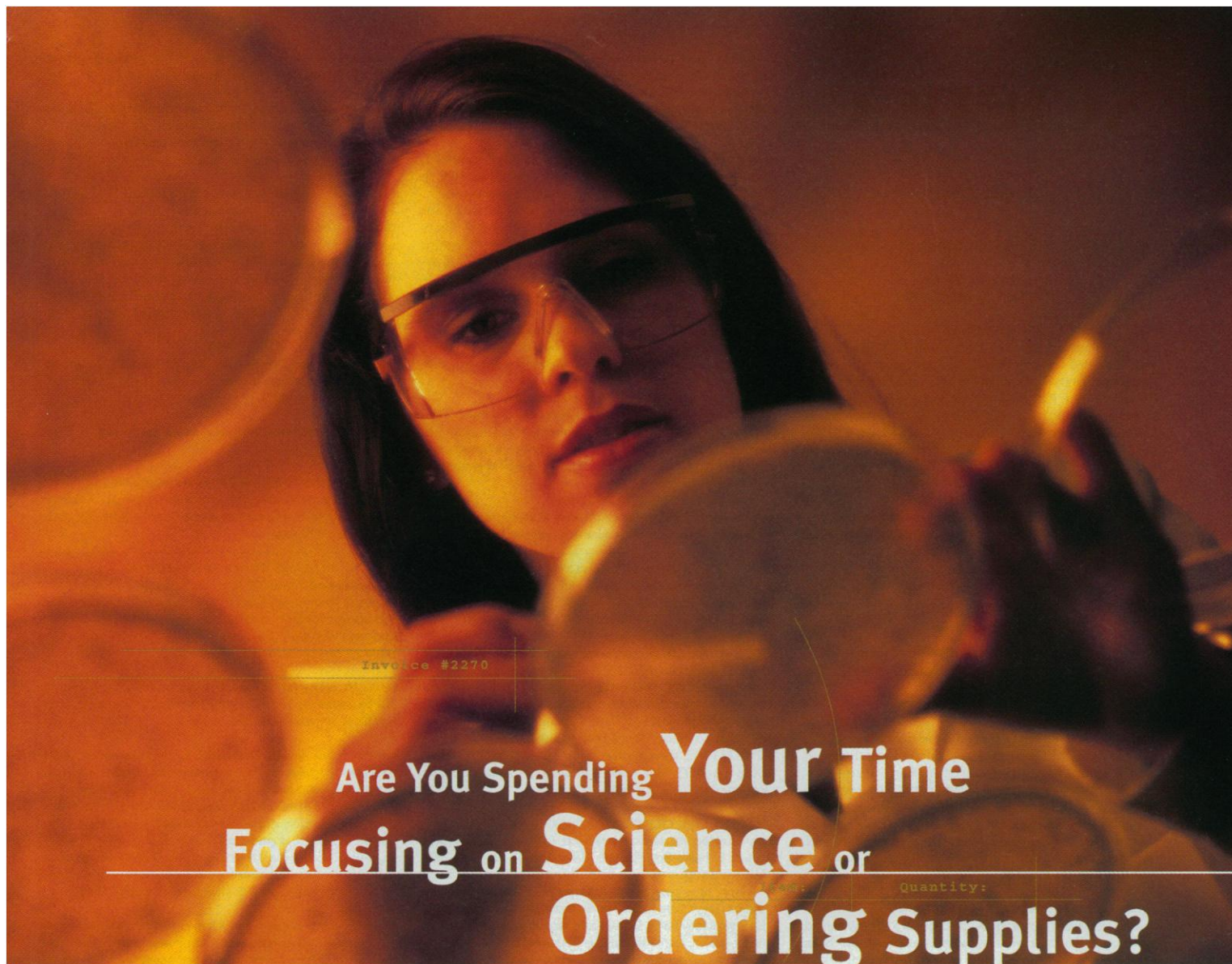
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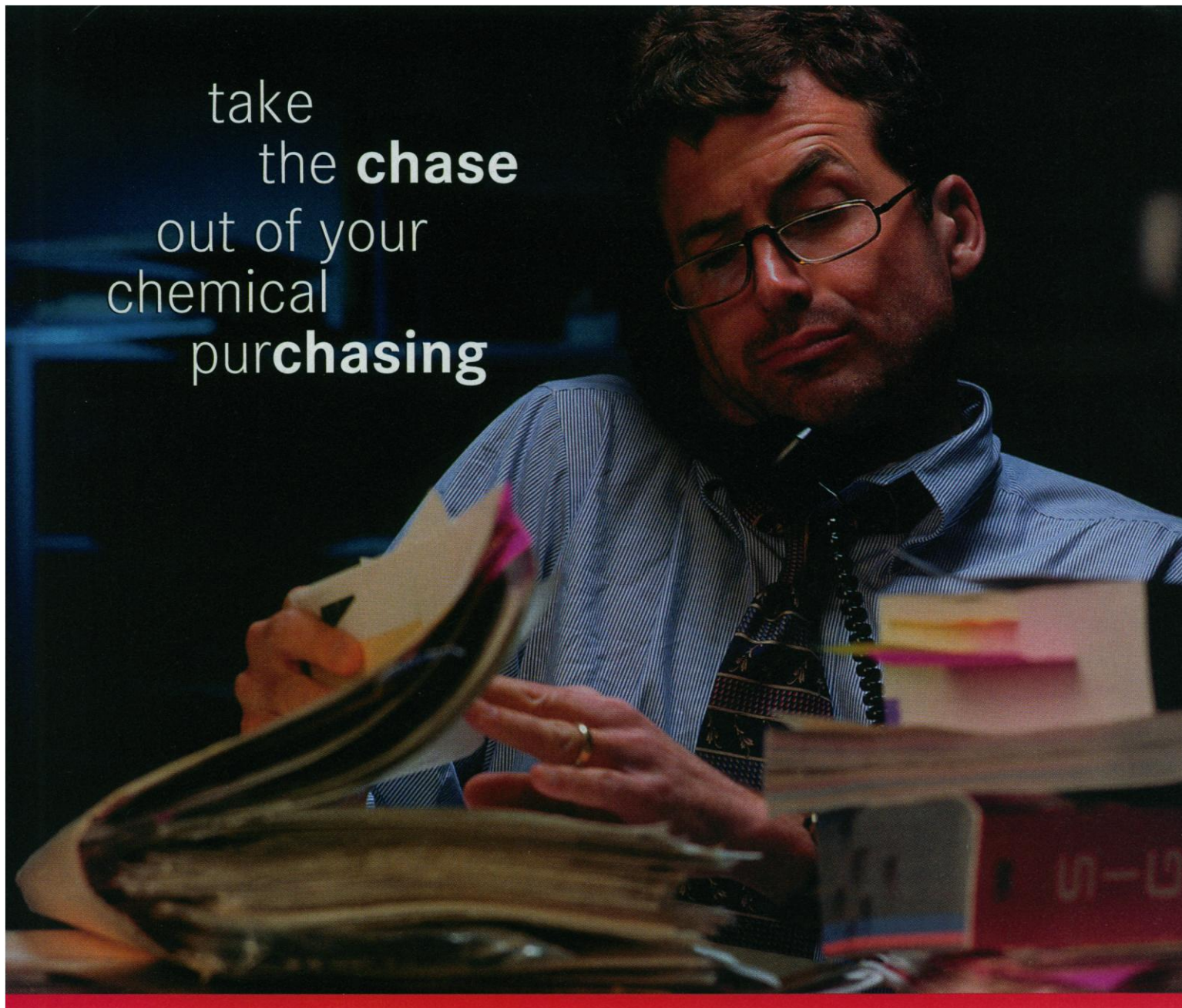
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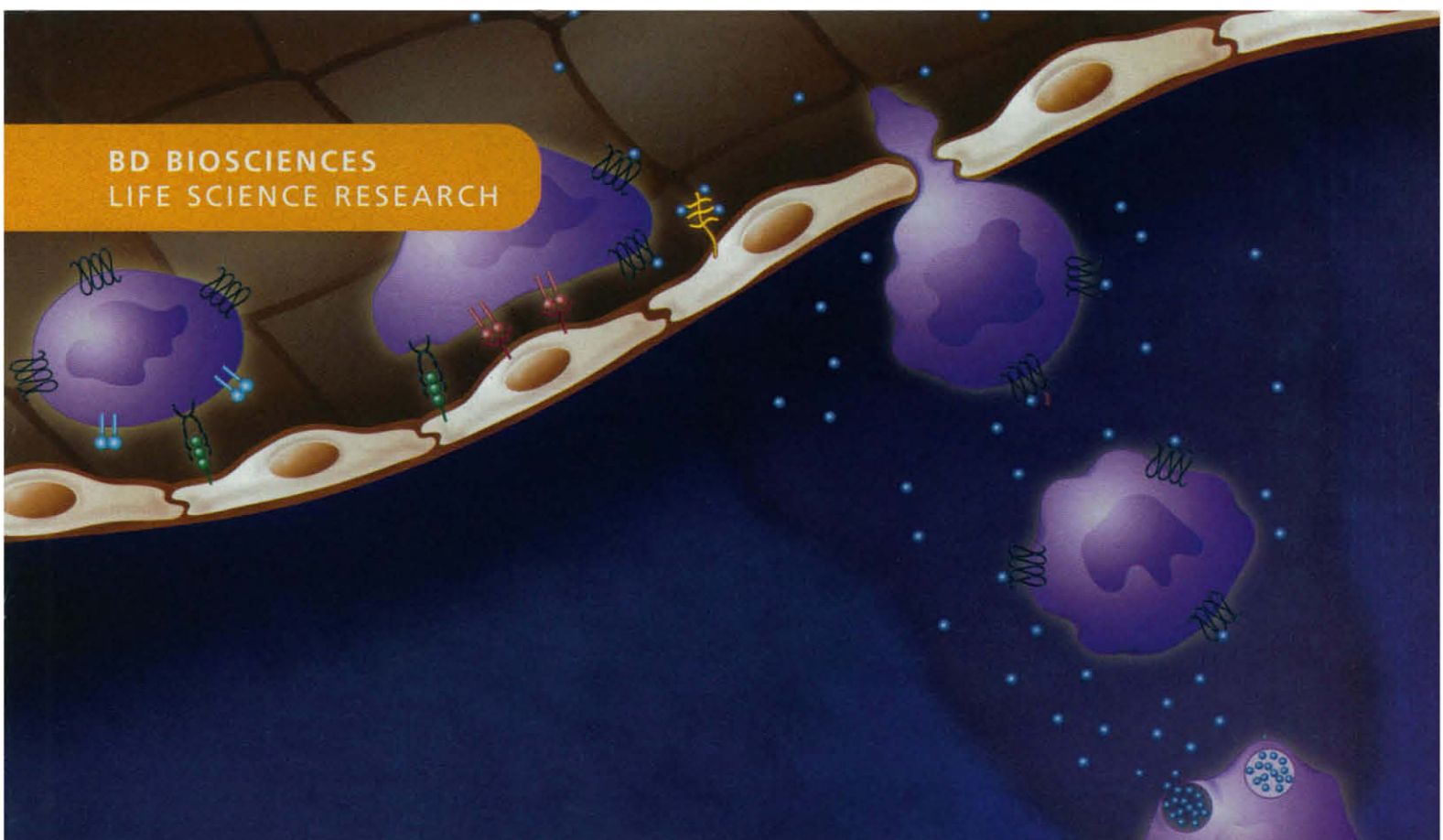
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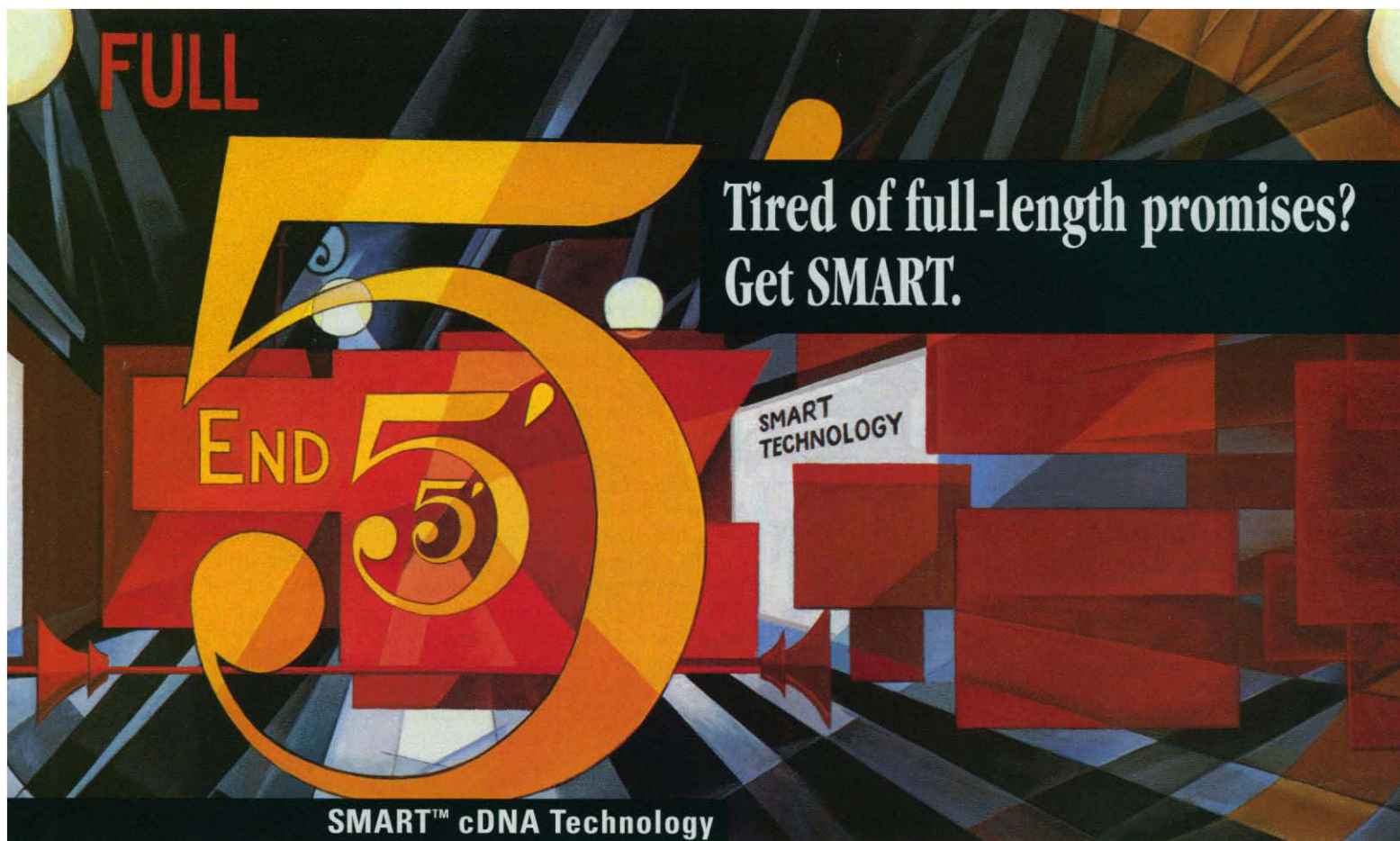
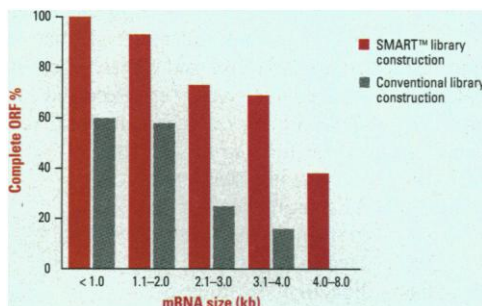


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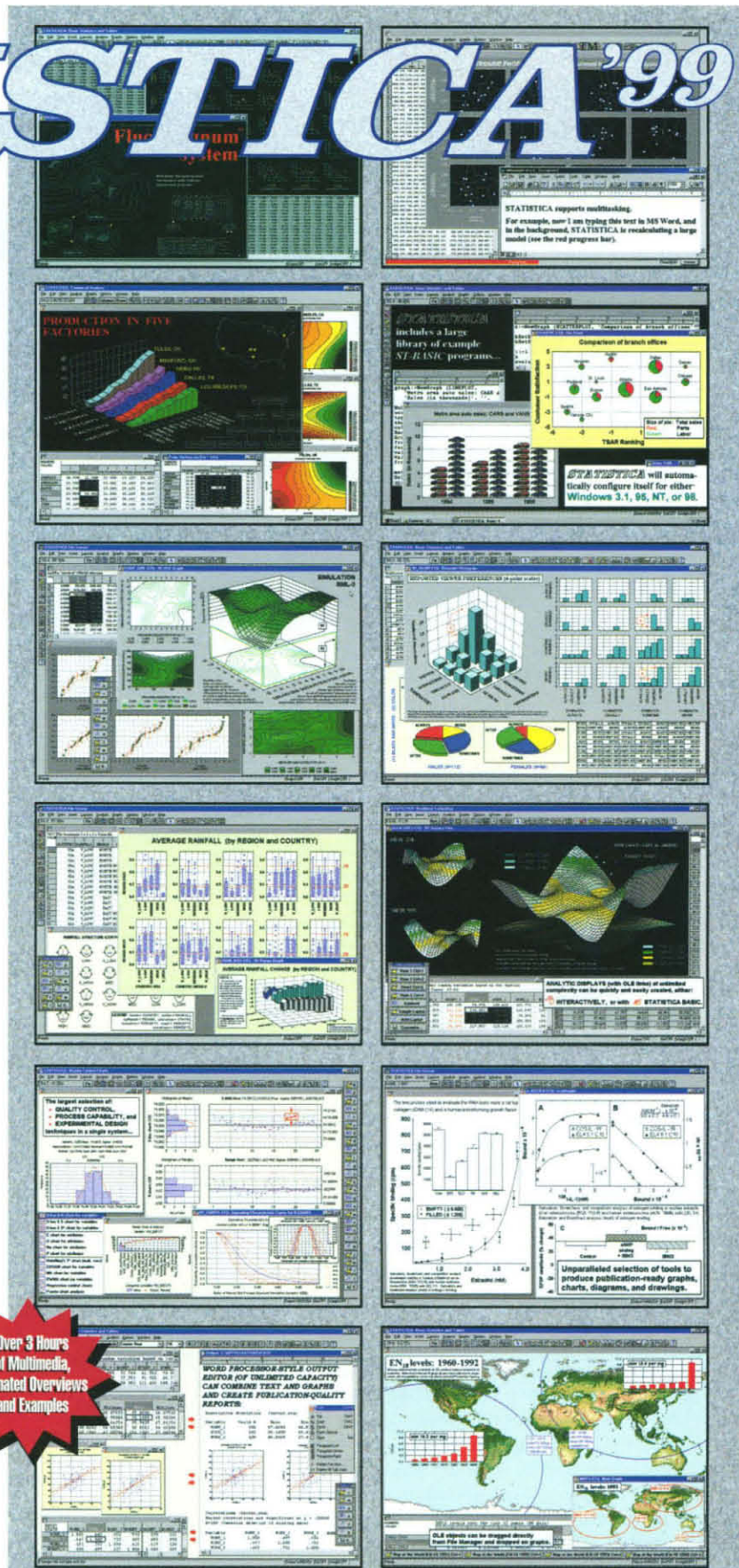
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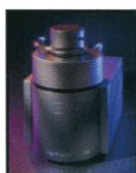


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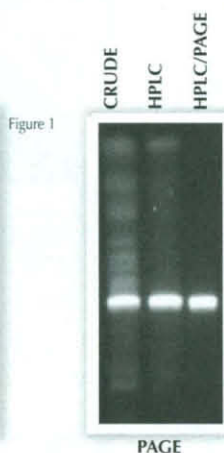
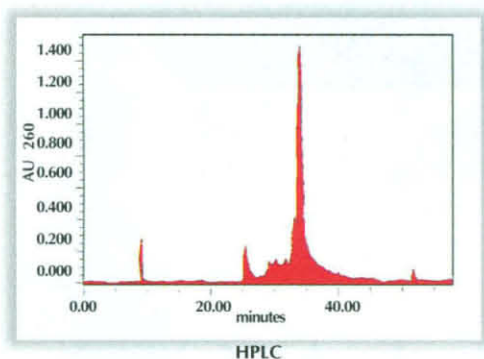
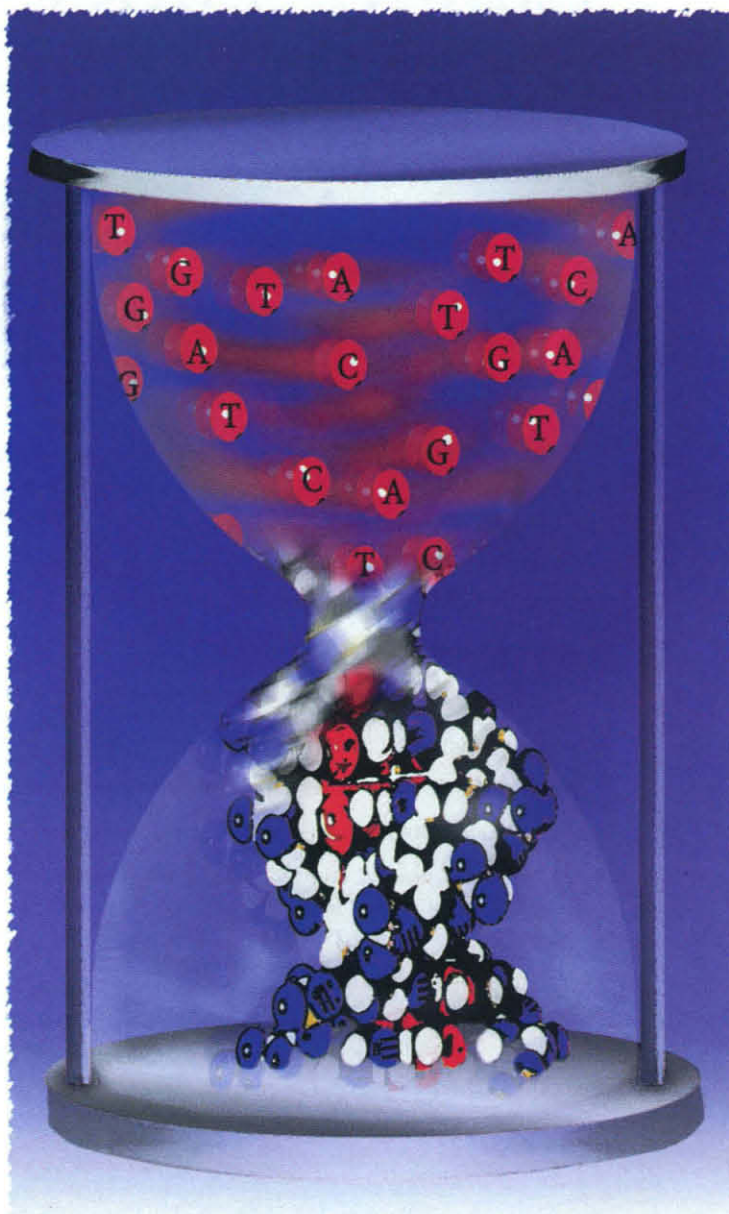
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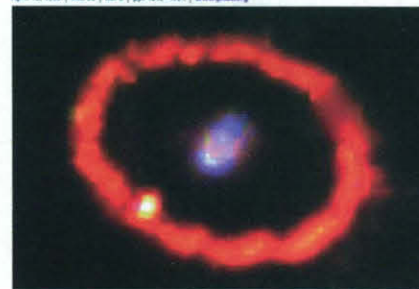
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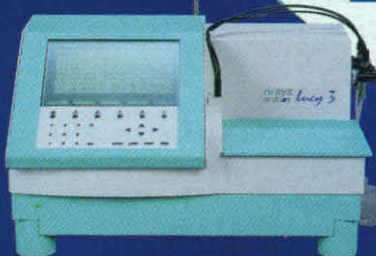
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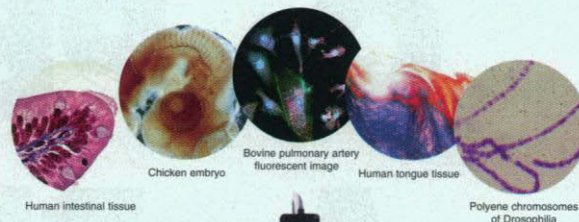
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THE MCKNIGHT TECHNOLOGICAL INNOVATIONS IN NEUROSCIENCE AWARDS

The McKnight Endowment Fund for Neuroscience invites letters of intent for the 2000
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The McKnight Technological Innovations in Neuroscience Awards seek to stimulate
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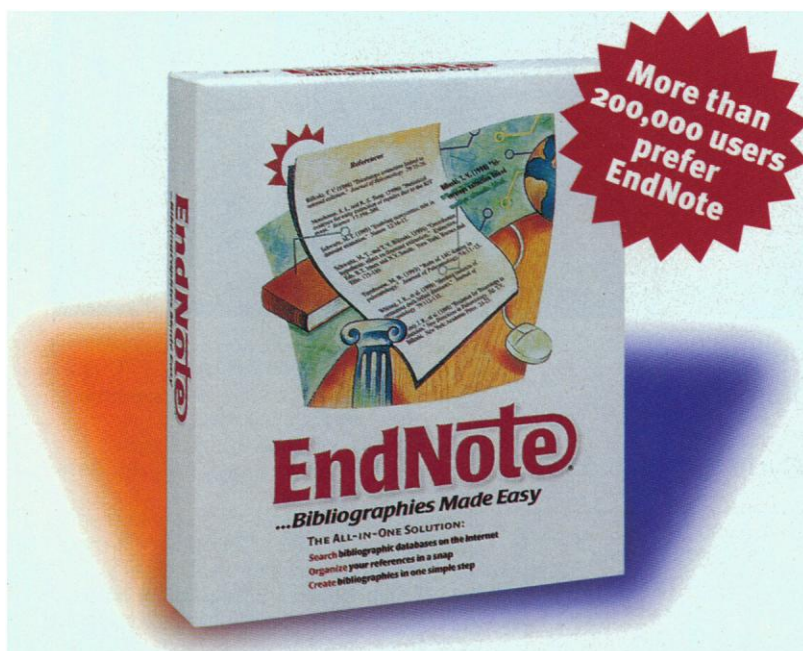
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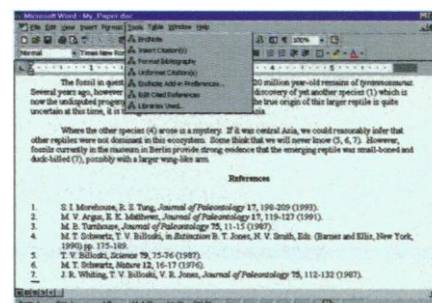


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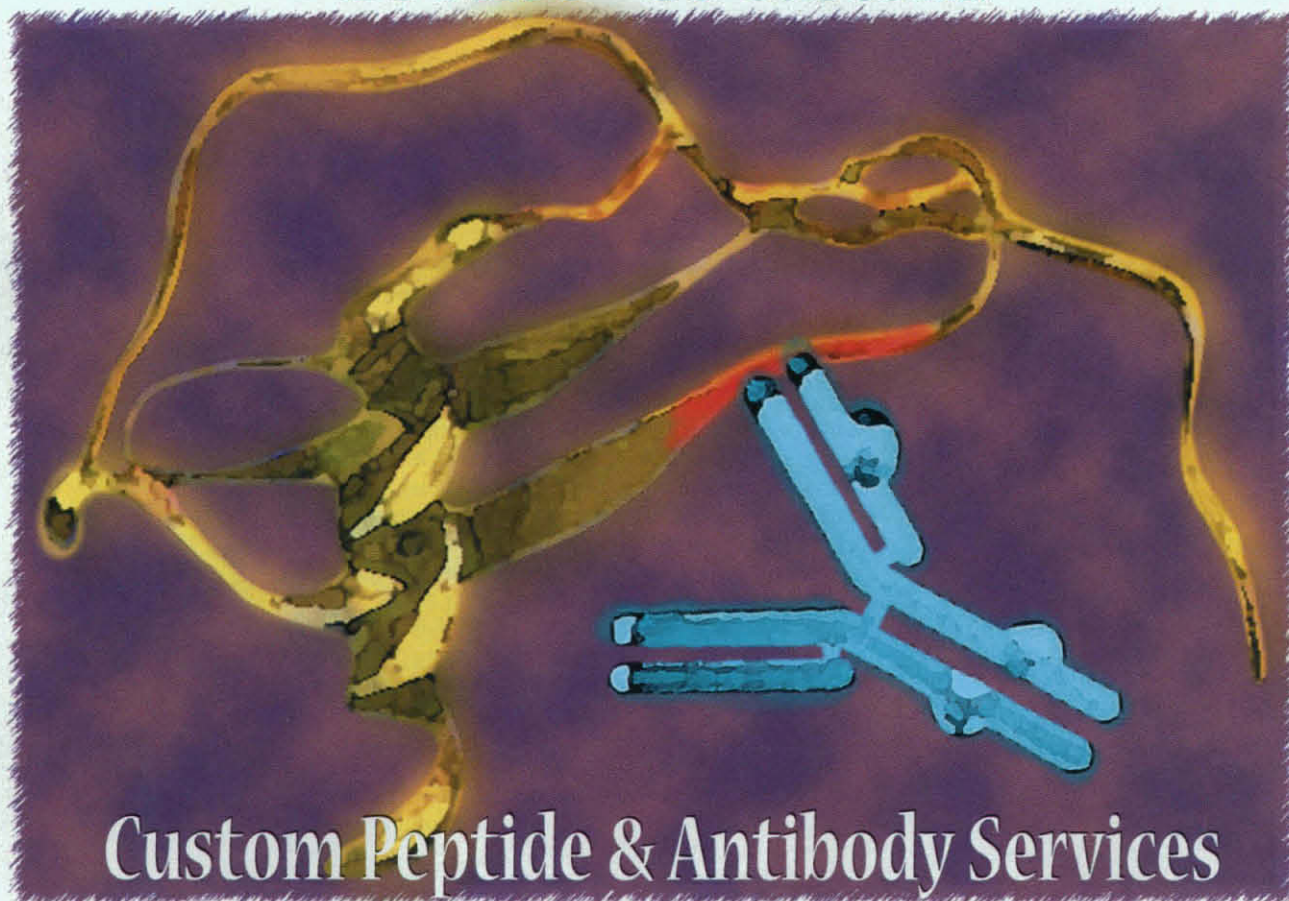
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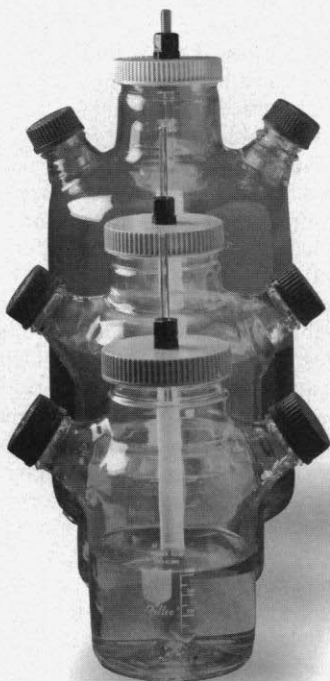
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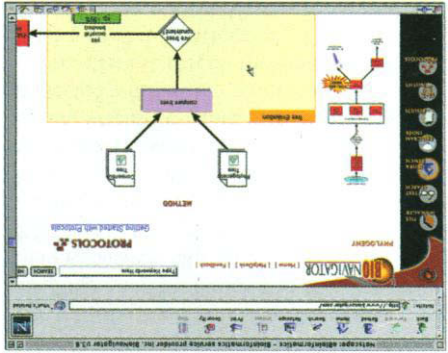
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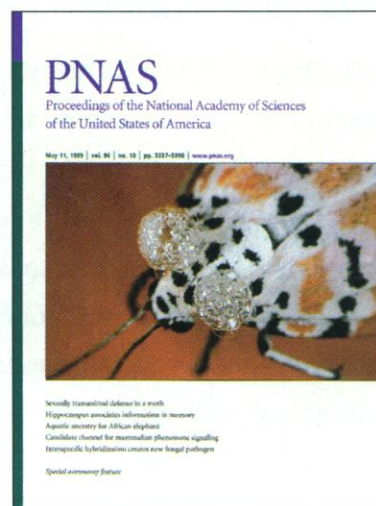
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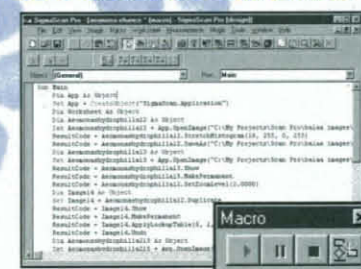
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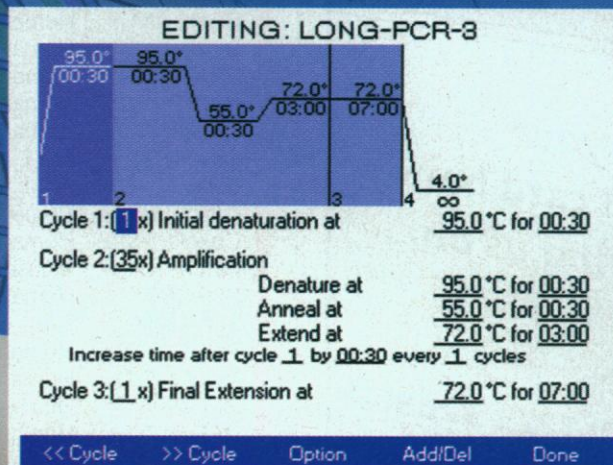
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