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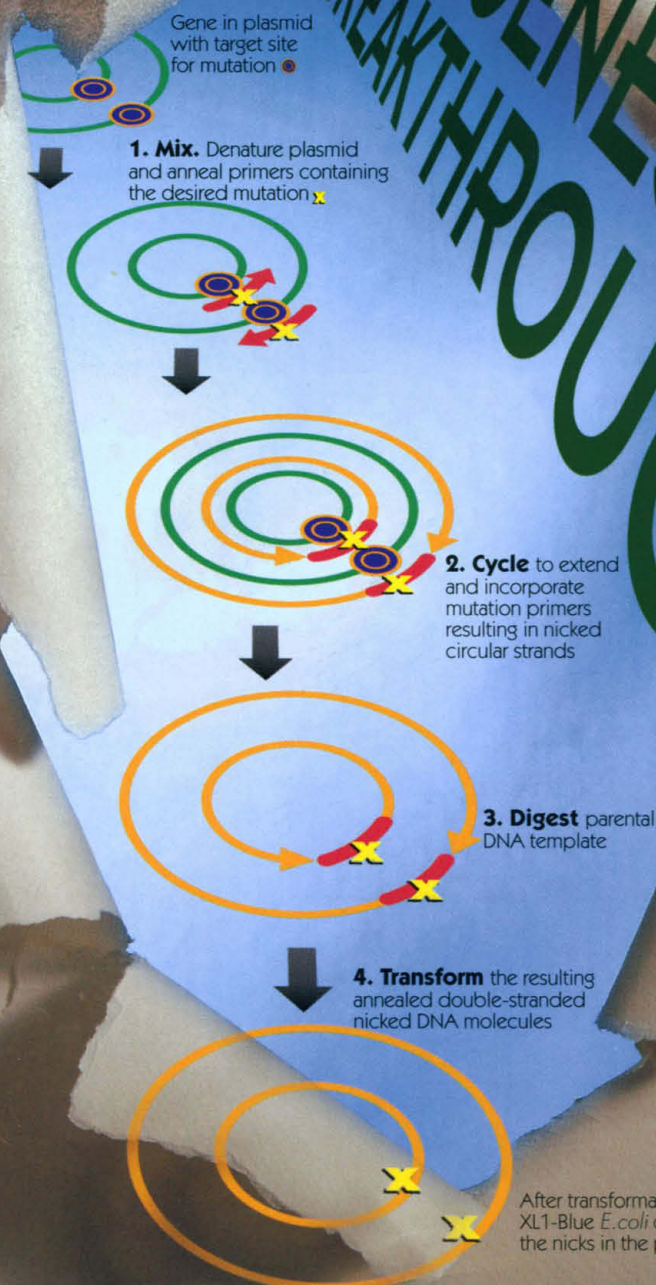
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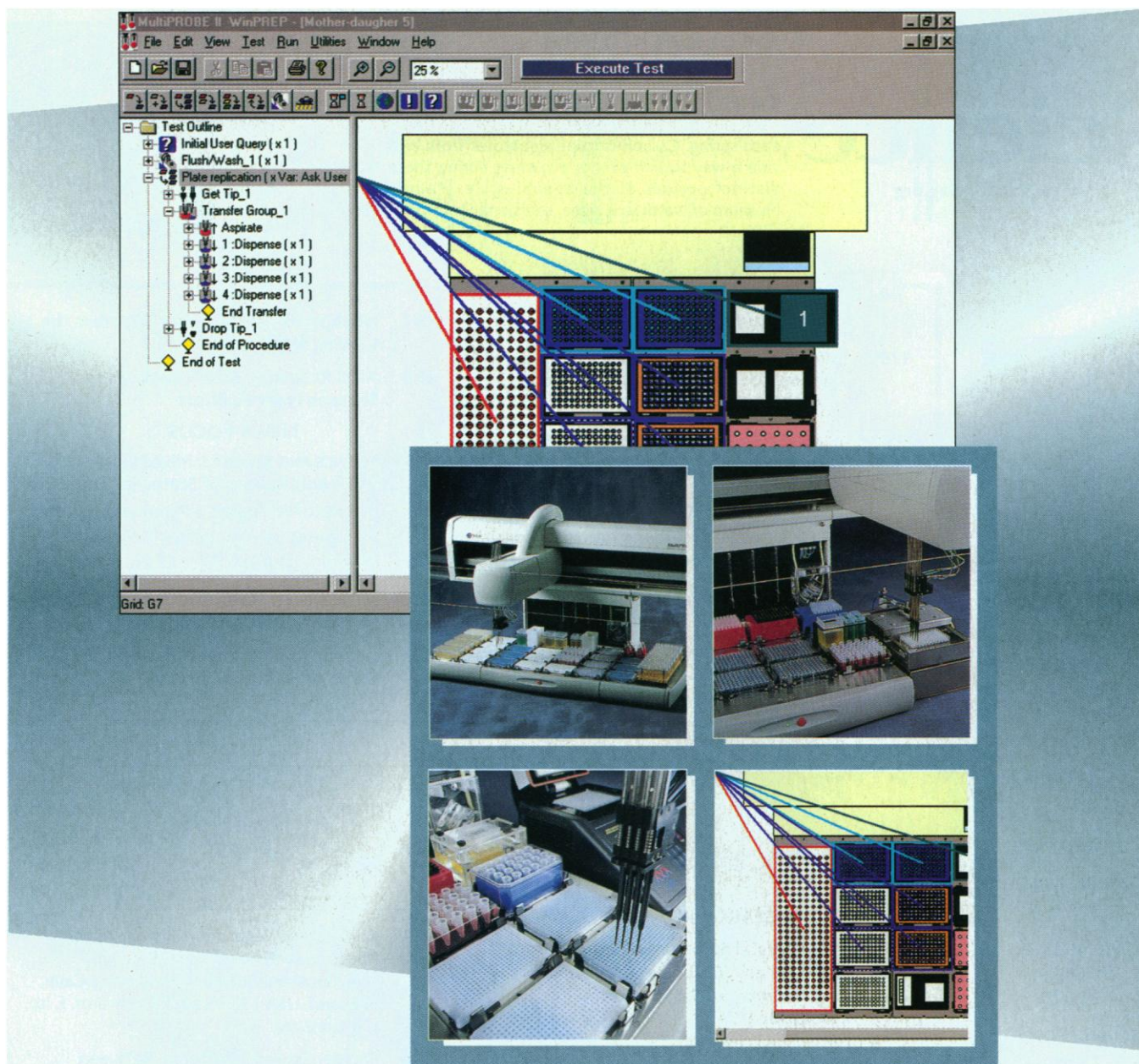
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COVER Male and female American redstarts migrate from tropical wintering quarters to breeding areas in the United States and Canada each spring. Carbon isotope signatures from birds in the tropics provide a way to link events occurring during these two geographically distinct periods of the annual cycle. [Painting: John P. O'Neill, Museum of Natural Science, Louisiana State University]



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NSF's \$600 million education experiment

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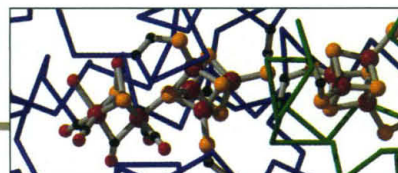
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- 1865 **⁵³Mn-⁵³Cr Dating of Fayalite Formation in the CV3 Chondrite Mokoia: Evidence for Asteroidal Alteration** I. D. Hutcheon, A. N. Krot, K. Keil, D. L. Phinney, E. R. D. Scott
- 1868 **Magnetic Microstructure of Magnetotactic Bacteria by Electron Holography** R. E. Dunin-Borkowski, M. R. McCartney, R. B. Frankel, D. A. Bazylinski, M. Pósfai, P. R. Buseck



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A cluster of clusters

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▼ 1890 **KCNQ2 and KCNQ3 Potassium Channel Subunits: Molecular Correlates of the M-Channel** H.-S. Wang, Z. Pan, W. Shi, B. S. Brown, R. S. Wymore, I. S. Cohen, J. E. Dixon, D. McKinnon

1893 **Linkage of ATM to Cell Cycle Regulation by the Chk2 Protein Kinase** S. Matsuoka, M. Huang, S. J. Elledge

1897 **dMi-2, a Hunchback-Interacting Protein That Functions in Polycomb Repression** J. Kehle, D. Beuchle, S. Treuheit, B. Christen, J. A. Kennison, M. Bienz, J. Müller

▼ 1900 **Requirement of RSF and FACT for Transcription of Chromatin Templates in Vitro** G. LeRoy, G. Orphanides, W. S. Lane, D. Reinberg

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1911 **Role of MEKK1 in Cell Survival and Activation of JNK and ERK Pathways Defined by Targeted Gene Disruption** T. Yujiri, S. Sather, G. R. Fanger, G. L. Johnson

1914 **Mutation-Specific Functional Impairments in Distinct Tau Isoforms of Hereditary FTDP-17** M. Hong, V. Zhukareva, V. Vogelsberg-Ragaglia, Z. Wszolek, L. Reed, B. I. Miller, D. H. Geschwind, T. D. Bird, D. McKeel, A. Goate, J. C. Morris, K. C. Wilhelmsen, G. D. Schellenberg, J. Q. Trojanowski, V. M.-Y. Lee

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1858

Trapped in the ice

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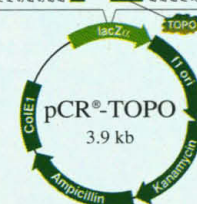
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RECORDING TROPICAL AND TEMPERATE CLIMATES

Climate records from tropical glaciers in the Andes allow researchers to assess whether the events recorded in polar glaciers were truly global in their extent and timing. Thompson *et al.* (p. 1858) present a high-resolution carbon-14 paleoclimate record from a Bolivian glacier that extends back to the Last Glacial Stage (LGS, about 20,000 years ago). The record adds to the growing body of evidence that the LGS was global in extent and shows an abrupt cold reversal during deglaciation at about the same time as the Younger Dryas cooling in Greenland records. In contrast to polar locations, cooler global temperatures were associated with greater precipitation and reduced evaporation. Most of our detailed records of climate during the last several glaciations have come from marine sediments or coral; few records are available from continental interiors, and radiocarbon dating extends to only about 45,000 years ago. Dorale *et al.* (p. 1871) now provide a record of climate changes in central North America from 75,000 to 25,000 years ago from stalagmites dated by thorium-230 in Crevice Cave, Missouri, which is just south of the farthest extent of ice during the last glaciation. The climate records are replicated in four stalagmites, indicating that their formation was not biased by local processes. Stable carbon and oxygen isotope data show that a marked episode of cooling began about 55,000 years ago, and forest replaced prairie at the site.

TUNING THE EAR

Sound waves reaching the ears must be transformed into nerve impulses, but comparisons of the response properties of auditory nerve fibers and the basilar membrane of the inner ear have been indirect, as data from different subjects had to be used. Narayan *et al.* (p. 1882) present recordings from the basilar membrane and auditory nerve fibers in the same cochlea. In chinchillas, cochlear frequency selectivity can be explained by the vibrations of the basilar membrane. This observation is a strong argument against the hypothesis of a second filter in the mammalian cochlea.

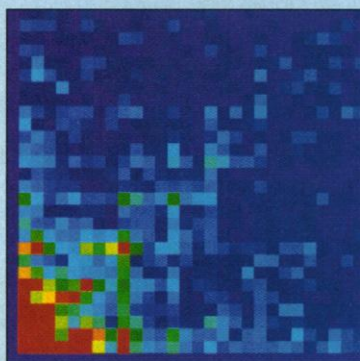
ALTERED ASTEROIDS

Chondrites, primitive meteorites composed of rounded mineral aggregates called chondrules and refractory grains, are thought to be the first components to

accrete in the solar nebula. However, the mineral phases in a chondrite may have been altered by high temperatures, high pressures, and infiltration of fluids even on the relatively small parent bodies that later formed. Ion microprobe analysis of fayalite grains in the Mokoia carbonaceous chondrite by Hutcheon *et al.* (p. 1865) revealed a radiogenic chromium-53 excess derived from the decay of manganese-53. They infer that the fayalite crystallized after the solar nebula had dissipated during later alteration processes.

WATCHING SINGLE ENZYME MOLECULES IN ACTION

Studies of single molecules allow processes that would normally be hidden in studies of large ensembles of molecules to be revealed. Lu *et al.* (p. 1877) present evidence for a "memory effect" in the activity of the enzyme cholesterol oxidase. The rate of reaction could be determined with confocal microscopy because the enzyme's cofactor, flavin adenine dinu-



cleotide, is fluorescent only in its oxidized form. The distribution of times for fluorescence to "switch on" varied considerably between single enzyme molecules, and even for a single enzyme molecule, the distribution of times deviates from exponential behavior in ways that can be attributed to slow fluctuations in the conformation of the molecule.

MAGNETITE IN BACTERIA

Magnetotactic bacteria contain chains of small crystals of magnetite (or other minerals) several nanometers across. Dunin-Borkowski *et al.* (p. 1868) have now used electron holography to image the magnetic microstructure of individual crystals and

crystal chains in situ in bacteria. In this approach, they compare an electron wave passing through the sample with a reference wave to create a holographic image. The magnetization directions of the smallest crystals were controlled by the larger crystals in the chains. This approach, which shows how these crystals may interact within the bacteria, might be extended to magnetite crystals in higher organisms.

CLARIFYING CONSCIOUSNESS

In an exploration of the basis of consciousness, Tononi and Edelman (p. 1846) identify key properties of the conscious experience and then survey known neural phenomenon in search of a match. They find that consciousness is integrated (cannot be subdivided) and differentiated (a conscious experience is one of a huge number possible). An ever-changing subset of neural systems in the occipital, temporal, and frontal parts of the brain are also integrated and differentiated, which leads the authors to propose the "dynamic core" hypothesis for the mechanism of human consciousness.

IRONING OUT AN ENZYME

The chemical dexterity with which microorganisms carry out simple reactions is exemplified by hydrogenases, which catalyze the conversion of two protons and two electrons into molecular hydrogen. Peters *et al.* (p. 1853; see the Perspective by Adams and Steifel) present the crystal structure at 1.8 angstroms of a hydrogenase from the anaerobic bacterium *Clostridium*. This enzyme, a medium-sized protein of less than 600 amino acids, contains a wealth of iron atoms (20 per molecule) that are arranged in five distinct clusters: Six in the active site H cluster (one [4Fe-4S] and one binuclear Fe-S) and fourteen in the four accessory iron-sulfur clusters (three [4Fe-4S] and one [2Fe-2S]). Likely pathways for how the electrons and protons travel inward to meet at the H cluster are visible.

TRACKING BIRDS ISOTOPICALLY

Studies of the population dynamics of migratory birds are hampered by the great distances between breeding and wintering habitats and the different arrival times of males and females. Marra *et al.* (p. 1884; see the cover and the news story by Wuethrich) use habitat-specific isotope signatures to link American redstarts (*Setophaga ruticilla*) in their tropical wintering grounds and temperate breeding areas.

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THIS WEEK IN SCIENCE

CONTINUED FROM PAGE 1781

Arrival times at the breeding grounds and reproductive success are heavily influenced by competition for resources during the preceding winter: The more successful birds had carbon-13 isotope values which indicated that their insect prey were associated with richer forested habitats.

MEDIATING STRESS

Members of the mitogen-activated protein kinase (MAPK) family are activated by cascades of protein kinases that begin with the MAPK kinase kinases (MAPKKKs). The MAPKKK called MEKK1 can lead to activation of two different sorts of MAPKs known as JNK and ERK, but it has been unclear what its physiological targets are in vivo. Yujiri *et al.* (p. 1911) produced mice that do not express the MEKK1 protein and showed that coupling of MEKK1 to specific MAPKs was highly dependent on the type of external stress. For example, activation of JNK in response to cold stress or serum factors was lost, but not the responses to ultraviolet radiation or heat shock. In some cases, MEKK1 contributed to activation of ERK, but other stimuli that activated MEKK1 resulted only in activation of JNK.

MEETING THE CURRENT CHALLENGE

The M-current is a potassium conductance crucial for the control of excitability and thus the response properties to synaptic inputs of many neurons throughout the nervous system. Wang *et al.* (p. 1890; see the news story by Barinaga) now show that the biophysical characteristics, the antagonist pharmacology, and the pattern of messenger RNA expression of two members of the KCNQ potassium channel gene family (KCNQ2 and KCNQ3) are identical to the M-channel

behavior and distribution in vivo. They conclude that the ion channels underlying the M-current are made of heteromers of these two subunits.

CONTINUING REPRESSION

In *Drosophila* embryonic development, the homeotic genes play pivotal roles such as specifying whether an appendage will be an antenna or a leg. Segmentation gene products perform the initial spatial restriction of homeotic (or HOX) gene expression, and this repression is later continued by Polycomb group (PcG) gene products. Kehle *et al.* (p. 1897) have now identified a link between these regulatory components. The protein dMi-2 interacts with the segmentation gene product Hunchback (Hb). In addition, genetic analyses demonstrate that dMi-2 functions in both the Hb- and PcG-mediated repression of HOX genes. Because the vertebrate homolog of dMi-2 is a component of a histone deacetylase complex, repression of HOX genes may involve histone deacetylation.

TAU ISOFORMS AND NEURODEGENERATION

Mutations in the gene encoding the microtubule-associated protein tau are associated with several neurodegenerative diseases. In frontotemporal dementia and parkinsonism linked to chromosome 17 (FTDP-17), filamentous aggregates containing tau proteins are found in the brains of patients and are similar to aggregates seen in patients with Alzheimer's disease. Hong *et al.* (p. 1914) show that different mutations seen in patients with FTDP-17 have different effects on splicing of tau exons (and thus on the isoform composition of tau in the brain) and on the ability of tau to bind to or promote assembly of microtubules.

TECHNICAL COMMENT SUMMARIES

INTERPRETING LATE PRECAMBRIAN MICROFOSSILS

The full text of these comments can be seen at www.sciencemag.org/cgi/content/full/282/5395/1783a

C.-W. Li *et al.* studied 580-million-year-old microfossils in Early Vendian Doushantuo phosphate deposits in central Guizhou (South China) and identified the remains of sponges and metazoan embryos (Reports, 6 Feb., p. 879).

Y. Zhang *et al.* comment that "the putative parenchymella larvae of sponges ... are actually acanthomorphic acritarchs ... comparable to remains of cysts of planktic eukaryotic algae." They provide figures that show how "taphonomic changes" and other degradation of the fossils could lead to misinterpretation.

In response, Li *et al.* state that they "are now able to reconstruct the sequential embryogenesis of the Wengan sponge," and they provide figures showing that "collapsed acritarchs" illustrated in the comment are more likely "filamentous bacteria" that grew on organic remains. They call for "further research and evaluation" of Wengan specimens.



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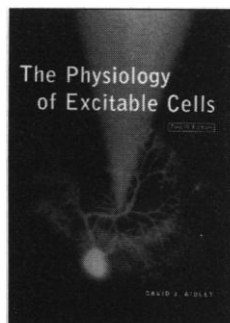
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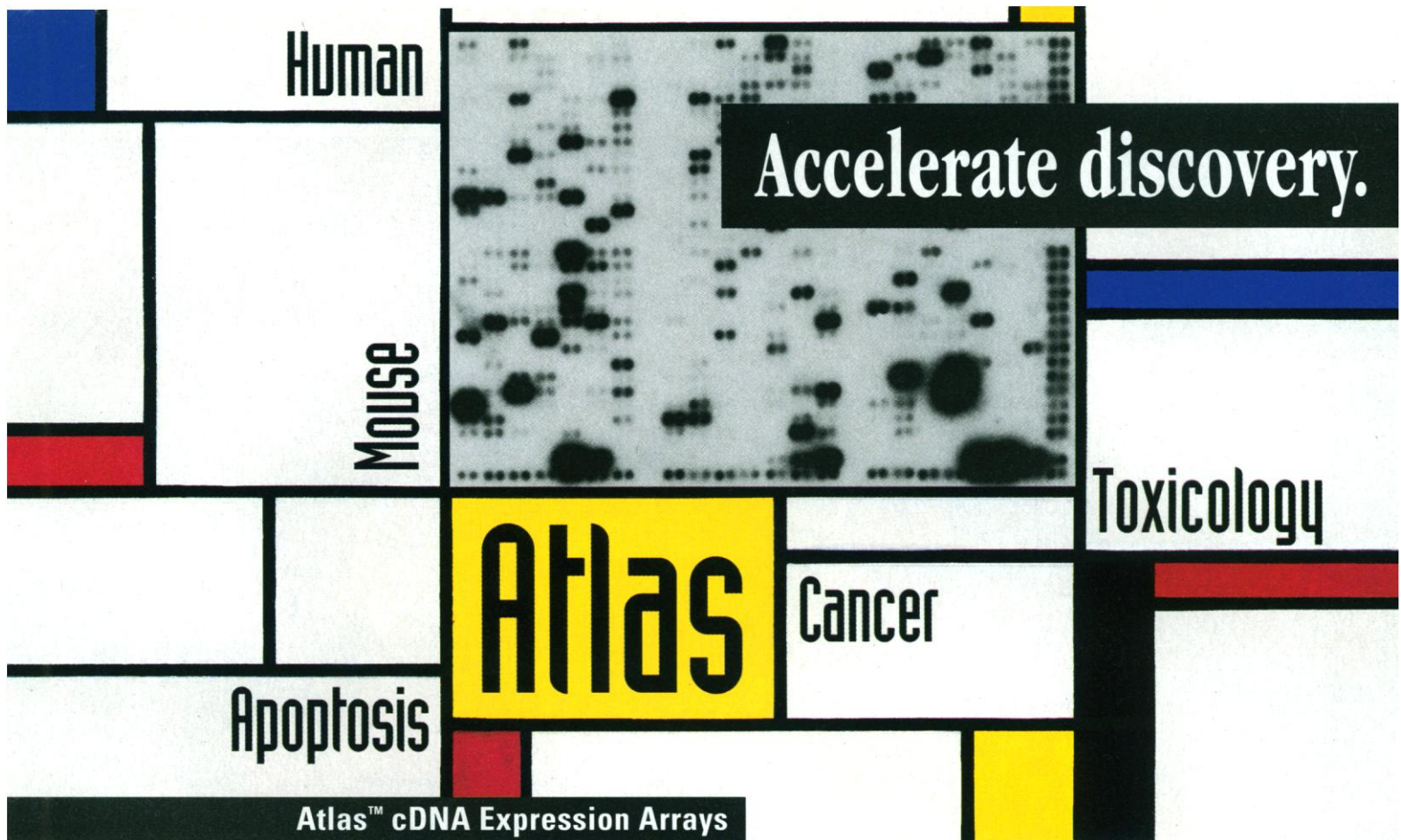


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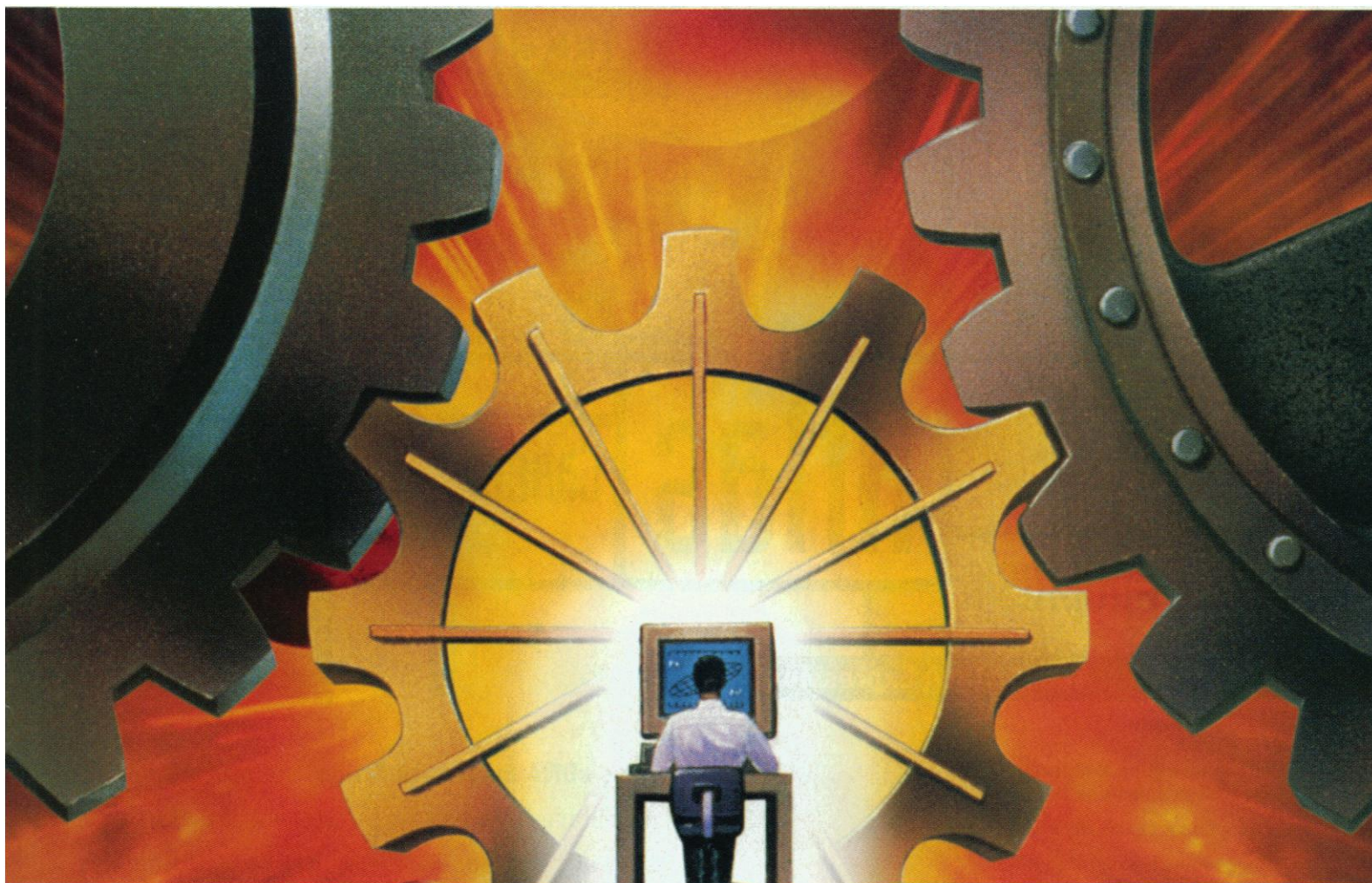
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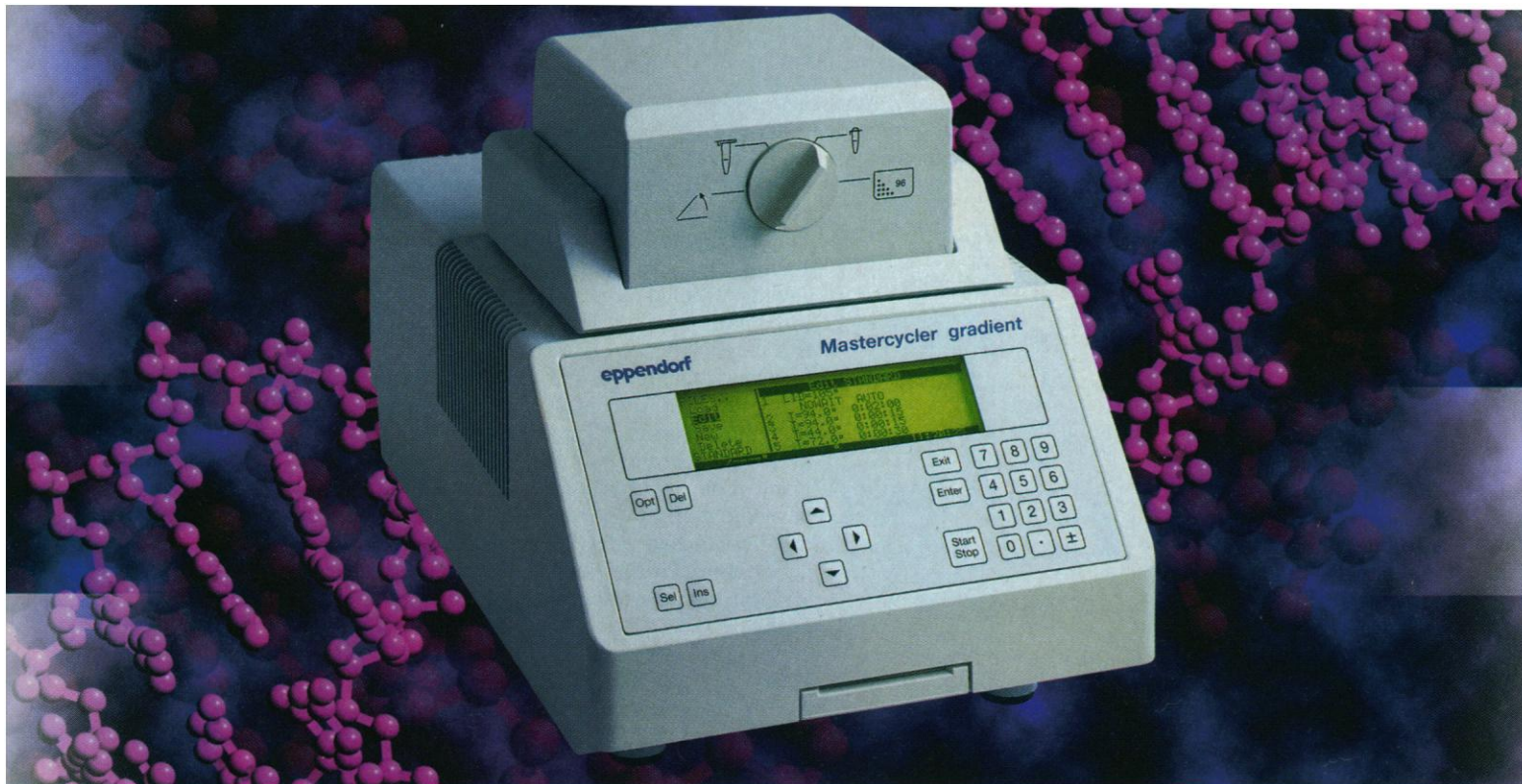
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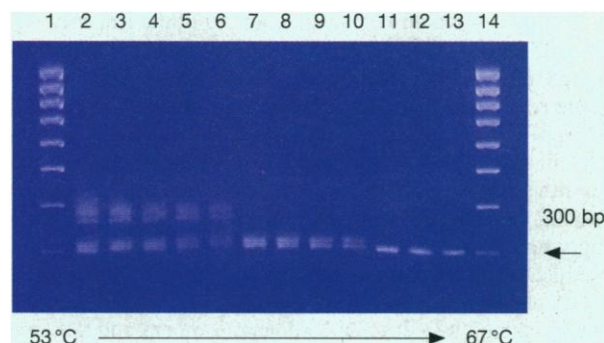
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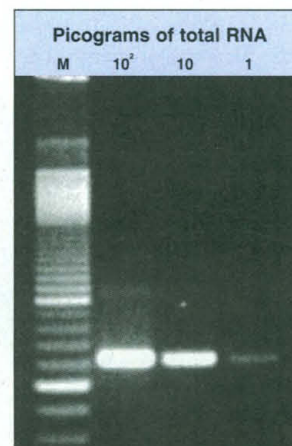
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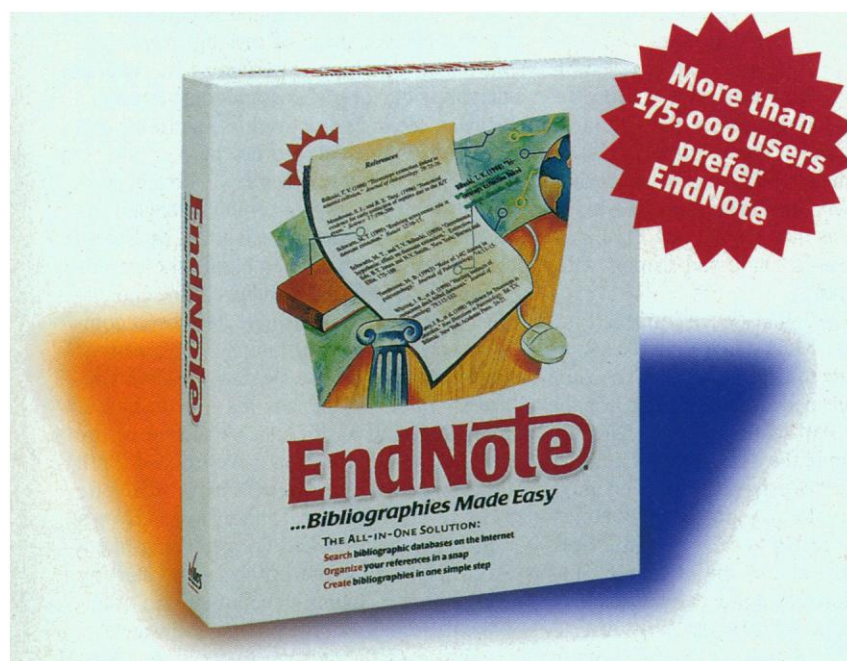
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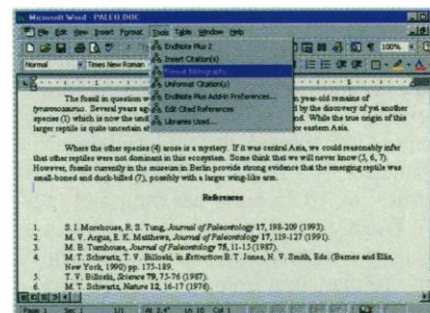


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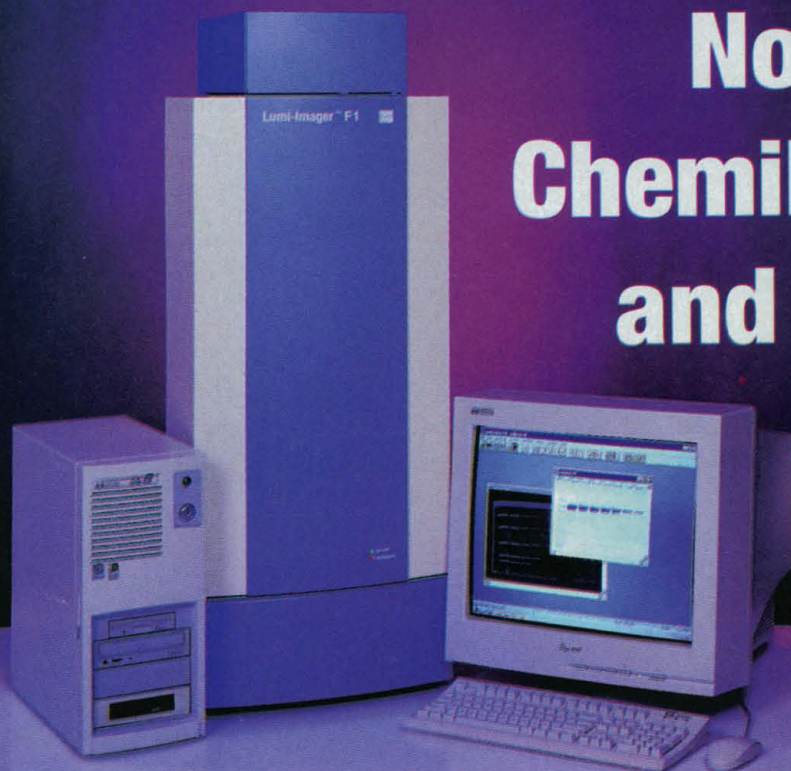
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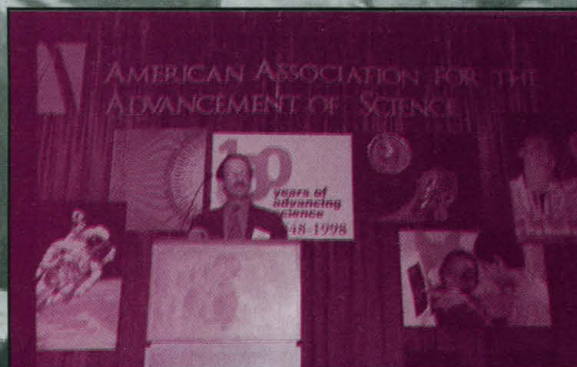


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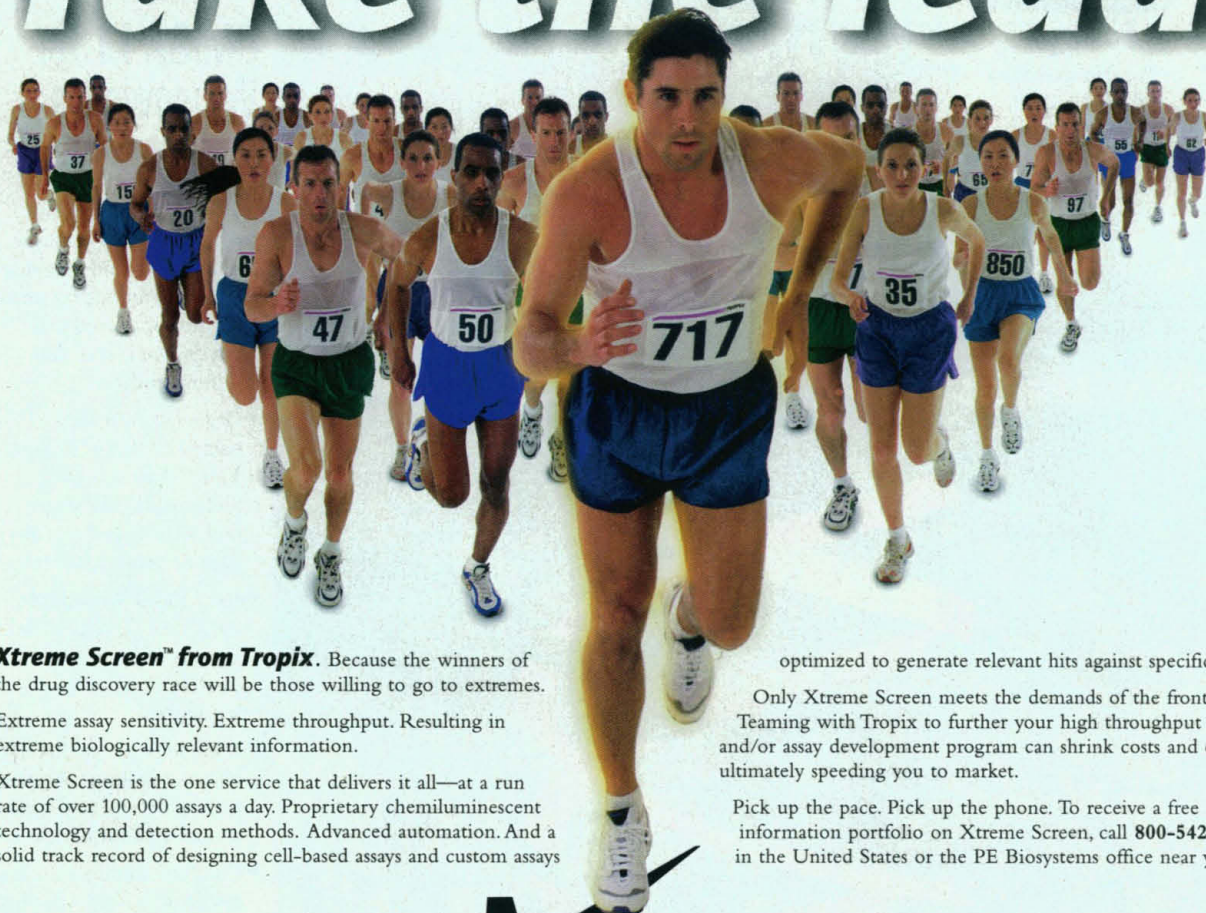
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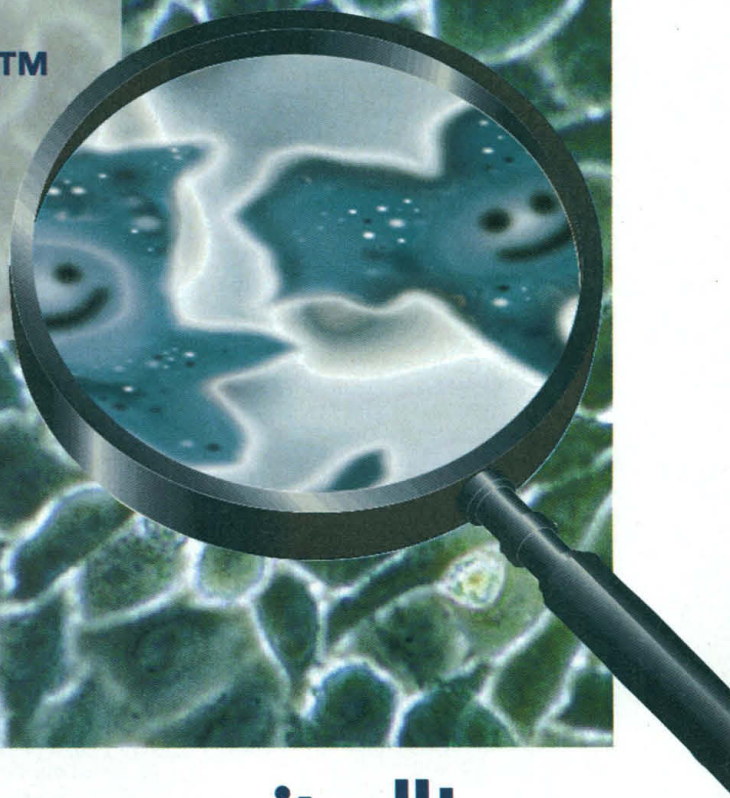
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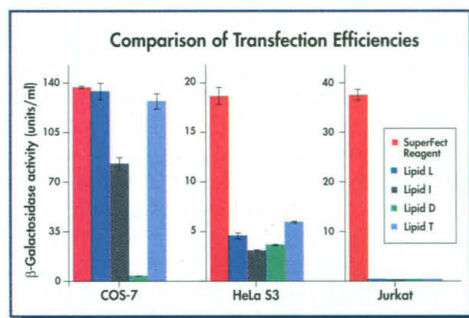


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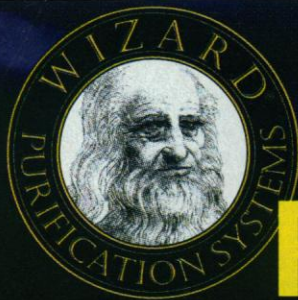
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RNA Purification Systems

- **Total RNA:** SV Total RNA Isolation System
- **mRNA:** PolyATtract® mRNA Isolation Systems

Convenience

Multiple formats including: spin, vacuum, magnetic, solution extraction, single use and 96 well formats.

Performance

High quality nucleic acids can be used in conjunction with other Promega products including TransFast™ Transfection Reagent, Dual-Luciferase™ Reporter Assay System, Access RT-PCR, Restriction Enzymes for Digestion of Genomic DNA, TnT® for Protein Expression analysis and GeneEditor™ for Mutagenesis.

PolyATtract, TnT and Wizard are trademarks of Promega Corporation and are registered with the U.S. Patent and Trademark Office. GeneEditor is a trademark of Promega Corporation.

Products may be covered by pending or issued patents. Please visit our website for more information.

Product claims are subject to change. Please contact Promega Technical Services or access the Promega on-line catalog for the most up-to-date information on Promega products.



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Please contact your local Promega Branch Office or Distributor for more information about Nucleic Acid Purification and other Promega products.

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