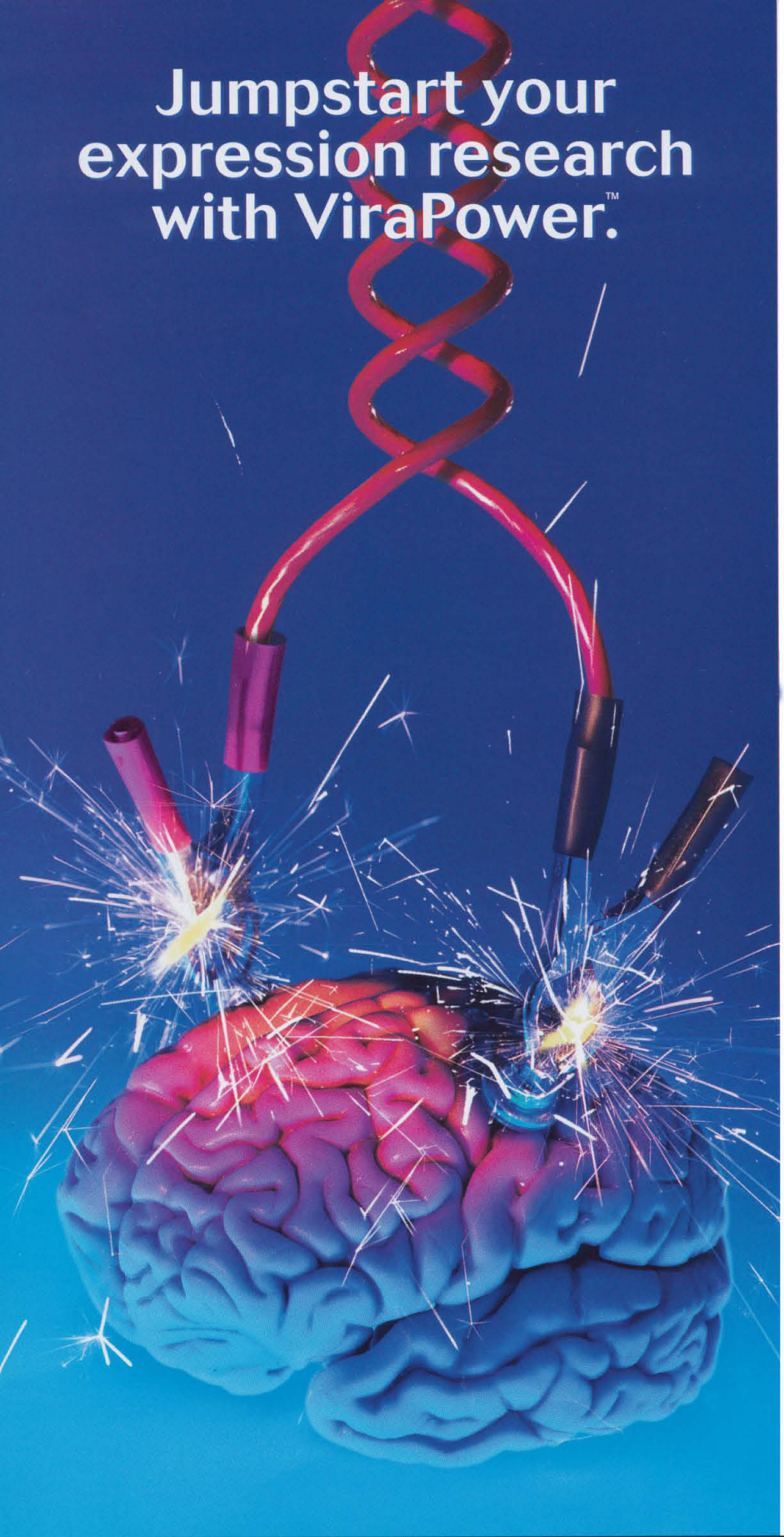

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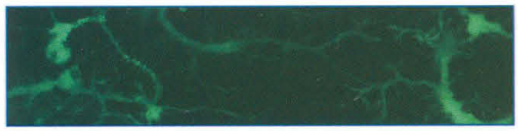

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Behind the "find of the century"

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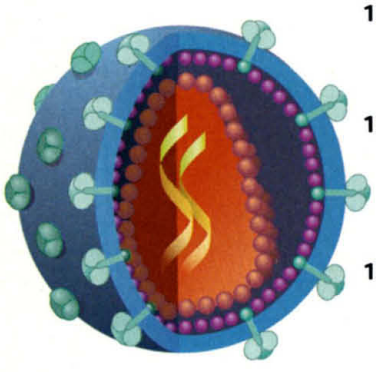
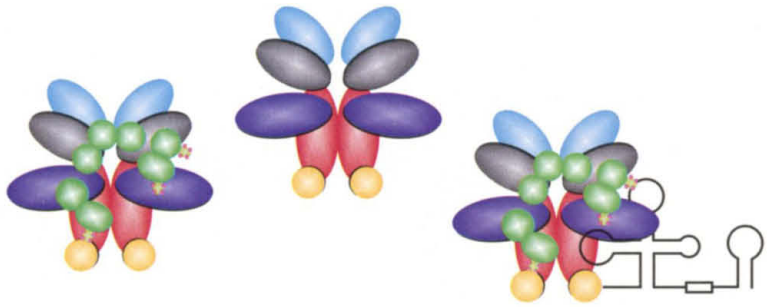
The history of a killer retrovirus





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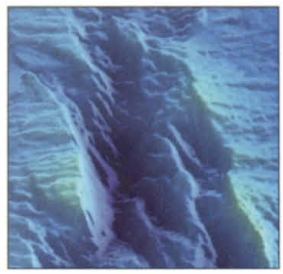
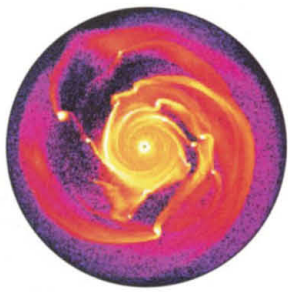
Threading RNA through a ring

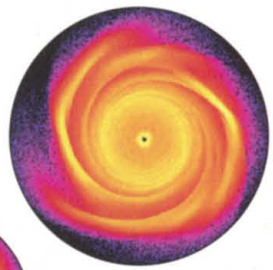


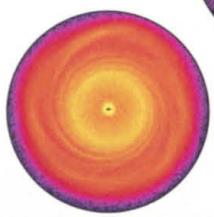
COVER 1765

A view of the Hess Deep rift seafloor, looking west-northwest. Hess Deep is located at the westernmost tip of the Galapagos Rise spreading center in the eastern equatorial Pacific. The rift valley, 5.4 km deep, is formed as the Galapagos Rise propagates westward through the oceanic crust of the East Pacific Rise spreading center (upper left corner). [Image: J. S. Floyd]

RESEARCH







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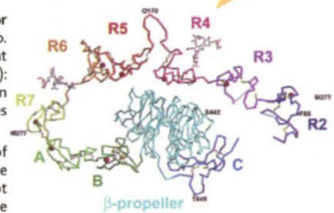
New on *Science* Express Regulating LDL levels



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CONTENT HIGHLIGHTS AS OF 29 NOVEMBER 2002

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Structure-Assigned Optical Spectra of Single-Walled Carbon Nanotubes S. M. Bachilo *et al.*

A signature for individual solubilized semiconducting single-walled carbon nanotubes has been determined using absorption, fluorescence, and Raman spectroscopies.

Structure of the LDL Receptor Extracellular Domain at Endosomal pH G. Rudenko *et al.*

An intramolecular interaction displaces ligand from the LDL receptor at low pH.

Isolation and Structure of Higher Diamondoids, Nanometer-Sized Diamond Molecules J. E. Dahl, S. G. Liu, R. M. K. Carlson

PERSPECTIVE: **Diamondoid Hydrocarbons—Delving into Nature's Bounty** A. P. Marchand

Numerous higher diamondoids, hydrocarbons whose carbon backbones are diamond cages, have been isolated and crystallized.

SPECIAL FEATURE

AIDS and HIV: Historical News Coverage

1726 To complement the four historical Viewpoint articles in this week's issue, we've posted a selection of *Science* news articles from 1983 to 2002 on the discovery of HIV and the subsequent controversy. www.sciencemag.org/feature/data/aids2002/articles.shtml

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career resources for scientists

SINGAPORE: Keeping Your Options Open L. Wong

Need to change careers? Contract work offers the possibility to explore new options.

EUROPE: European Science Bytes Next Wave Staff

A compilation of job-market news from across Europe, in convenient bite-sized chunks.

UK: Taking the Bull by the Horns P. Dee

Running your own lab practical is both scary and rewarding, says our *Yours Transferredly* columnist.

GERMANY: The Wissenschaftsrat Demands Improvements in Doctoral Training E. von Ruschkowski

Germany's Science Council asks all German universities to establish special Ph.D. programs.

CANADA: The Academic Consultant—Planning Your Business S. Cheung

Once you've decided to consult "on the side," it's time to make that decision become a reality.

US: When a Shortage Is Not a Shortage R. Weibl

A top-level committee takes a long, hard look at the current U.S. science and engineering job market.

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PERSPECTIVE: Spotlight on Nematode Mitochondria in RNAi Mega-Screen S. Melov

Meddling with mitochondrial metabolism lengthens life.

PERSPECTIVE: Biologists Finally Horn In on Senescence in the Wild C. C. Spencer and D. E. L. Promislow

Antler flies offer angles on aging in a natural population.

NOTEWORTHY THIS WEEK: Not in Medflies T. S. May

Calorie restriction doesn't increase longevity in all species.

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signal transduction knowledge environment

PROTOCOL: Internalization of Inactive EGF Receptors into Endosomes and the Subsequent Activation of Endosome-Associated EGF Receptor Y. Wang, S. Pennock, X. Chen, and Z. Wang

Methods for detecting signaling from endosomal EGFR.

PERSONALIZATION FEATURES: My Saved Searches

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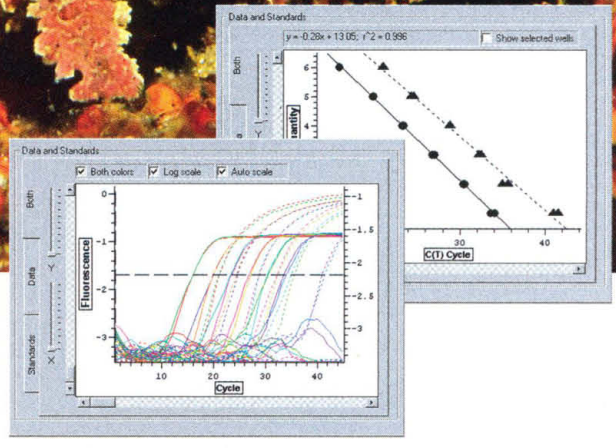

Reproducible linear standard curves in both color channels. *Duplicate reactions were performed on 10-fold serial dilutions ranging from 10^1 to 10^6 copies of both MYC (▲) and GAPDH (●) containing plasmids. Reactions were performed separately using FAM and VIC labeled Taqman® probes respectively.*

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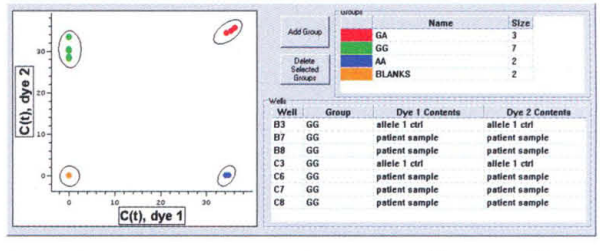

Genotyping analysis screen. *Genomic DNA extracted from patient blood samples was screened for the CYP2D6*4 allele using FAM and VIC labeled Taqman MGB probes specific for the G and A allele respectively.*

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THIS WEEK IN Science

edited by Phil Szuromi

Martian Meteorites Can Escape

Simulations of ejecta velocities from bolide impacts onto Mars have not been easy to correlate with the number and characteristics of the known martian meteorites found on Earth. Head *et al.* (p. 1752) have performed higher resolution simulations that show that the velocities of the spallated material can exceed the escape velocity for Mars. Craters as small as 3 kilometers in diameter can launch about 100 decimeter-sized fragments into interplanetary space. The small number of these fragments that have a high probability of reaching Earth are consistent with the currently observed meteorite collection corrected for the estimated sampling bias. The simulations also show that older martian terrains covered by a blanket of thicker regolith will require larger bolides (and thus larger craters) to eject martian bedrock into space.

1756 How Does Your Planet Grow?

To date, the detection of about 100 giant gaseous planets orbiting nearby stars would suggest that such planets are relatively common. However, simulations that try to account for their formation often run into difficulties in condensing the objects or, once they have formed, of not shearing them apart through tidal forces. Mayer *et al.* (p. 1756; see the news story by Kerr) have now performed higher resolution smoothed-particle hydrodynamic simulations to show that giant planets can form through gravitational instabilities in relatively cool protoplanetary disks over short time scales (about 1000 years).

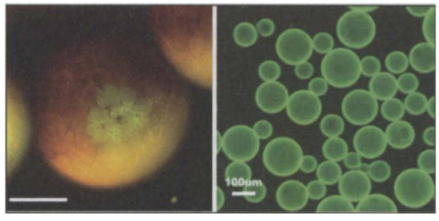
And in Brevia ...

By reducing the enzyme expression of the rpd3 histone deacetylase in *Drosophila*, Rogina *et al.* (p. 1745) show that an increase of 33% to 54% results in their normal life-span similar to the increases seen in yeast mutants.

Salt-Driven Sea

The deep ocean was colder and saltier during the Last Glacial Maximum (LGM) than it is today, and these differences affected thermohaline circulation. Adkins *et al.* (p. 1769; see the Perspective by Boyle) created a temperature and salinity "map" of the LGM deep ocean by analyzing the chloride concentration and oxygen isotope ratios of fluids trapped in deep-sea sediments from the Atlantic, Pacific, and Southern Ocean basins. The Southern Ocean was the saltiest water mass during the glacial period, the reverse of the modern Atlantic salinity gradient. Thermohaline circulation was dominated by variations in salinity during the LGM, as opposed to present conditions, where temperature is the main variable.

Harnessing Nanoparticles in Vivo



Fluorescent semiconductor nanocrystals, or quantum dots (QDs), could be ideal markers for biological studies because they photobleach much more slowly than do dye molecules and their emission wavelength can be finely tuned. However, the QDs must first be encapsulated with a biocompatible layer to improve their solubility while maintaining their stability and fluorescence and avoiding nonspecific adsorption. Dubertret *et al.* (p. 1759) encapsulated CdSe QDs with a phospholipid block copolymer and show that when conjugated to DNA, the coated QDs can be used as in vitro probes to highlight specific complementary sequences. A lineage-tracing study of *Xenopus* embryos shows that the QDs have low cell migration and low toxicity.

Crossing Over

The properties of some crystals can be modified by intercalation of molecular species to form a host-guest framework. Halder *et al.* (p. 1762; see the Perspective by Turnbull and Landee) modified a framework based on an iron(II) complex by adding ethanol guest molecules. The pure framework does not show any magnetic transitions on cooling, but the guest-complexed crystal exhibits a spin-crossover in which half of the iron sites change from a high to low spin state.

Species Formation

The formation of a new species is generally thought to be gradual and to require isolation. Greig *et al.* (p. 1773) show experimentally that speciation can occur rapidly after hybridization of yeast species. Although most of the hybrids were infertile, the vast populations that could be created with yeast allowed viable hybrid spores to be collected. Subsequent generations of hybrids had variable but increasing fertility, and showed a spectrum of growth temperature optima that depended on the parental phenotype and contribution to the offsprings' genomes. The authors suggest that the reproductive isolation seen among the different generations and with their parents originates in different combinations of gene and chromosomal incompatibilities acting across the generations. In the wild, the fitness of yeast hybrids may be compromised so much by environmental conditions that speciation is curtailed.

The Whens and Wheres of Neural Expression

For normal organ and tissue development and function, certain genes must be expressed at the appropriate place and time. For example, neural genes must be expressed in neural tissue but shut down in nonneural tissues. Lunyak *et al.* (p. 1747) examined mechanisms by which neural-specific gene expression can be restricted from nonneural tissues. The zinc-finger transcription factor REST/NRSF can mediate extraneural restriction through two different mechanisms, one of which uses active repression via a histone deacetylation complex and one that involves gene silencing via DNA methylation and the recruitment of the corepressor CoREST and silencing machinery. The latter mechanism can mediate gene silencing

CREDIT: DUBERTRET *ET AL.*

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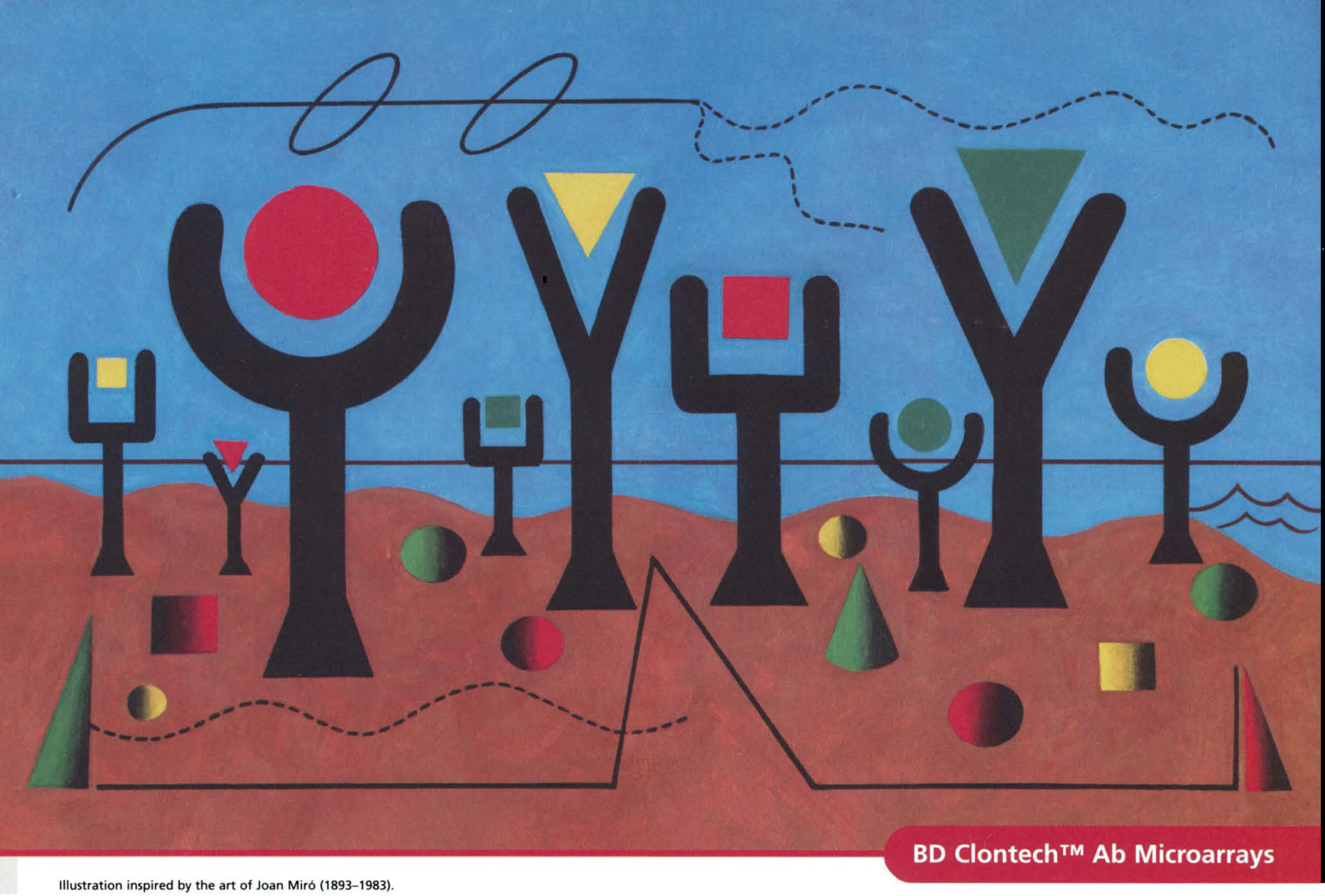

Illustration inspired by the art of Joan Miró (1893–1983).

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of specific chromosomal regions, including gene clusters encompassing neuron-specific genes, some of which do not themselves contain REST/NRSF response elements.

Step-by-Step Assembly

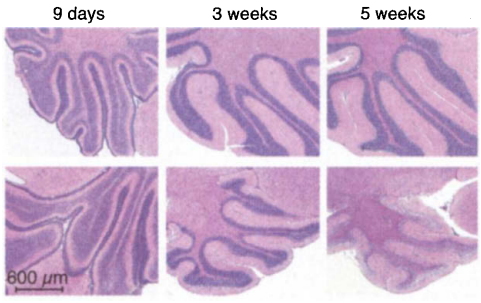
A family of RNA-protein complexes, known as the uridine-rich small nuclear ribonucleoproteins (U snRNPs), form the core of the spliceosome that excises introns and ligates exons to form messenger RNA. A functional deficiency in the survival of motor neurons (SMN) protein results in spinal muscular atrophy, a disease in which motor neurons of the spinal cord degenerate. Pellizzoni *et al.* (p. 1775) show that the SMN complex (of which the SMN protein is a part) serves to assemble in an orderly fashion the protein ingredients of U snRNPs (the Sm proteins) onto the U snRNAs. It first binds the Sm proteins, then the U snRNAs, and finally puts them together in an adenosine-triphosphate (ATP-dependent) reaction.

Neurotrypsin and Mental Retardation

Inherited mental retardation (MR) is often linked to abnormalities on the X chromosome or to abnormalities in brain development or other clinically identifiable features, but in most cases none of these attributes are present. An analysis of such nonsyndromic MR patients by Molinari *et al.* (p. 1779) revealed an association with the mutation of the serine protease neurotrypsin. In situ hybridization studies of the expression of neurotrypsin during normal development revealed that it is expressed in parts of the brain associated with learning and memory and first appears at 44 days of development. Immunoelectron microscopy localized neurotrypsin at presynaptic nerve endings. Although this mutation does not appear to be a common cause of MR, further studies may yield insights into the pathways leading to these diseases.

Neurotoxic, Cytosolic Prion Proteins

The characteristics of the prion protein, which has been linked to a variety of neurodegenerative disorders, is the subject of two reports. Ma and Lindquist (p. 1785) reveal how inhibition of the proteasome machinery in cells that produce prion proteins can lead to the accumulation of prion isoforms in the cytosol, and how, under certain conditions, misfolded self-perpetuating isoforms can be generated de novo. Ma *et al.* (p. 1781) examined the effects of retrograde-transported or cytosolically expressed prion protein in a transgenic mouse model and in neuronal cell lines. Cytosolic prion protein was highly neurotoxic, and mice engineered to possess cytosolic prion protein developed severe ataxia, cerebellar degeneration, and gliosis.



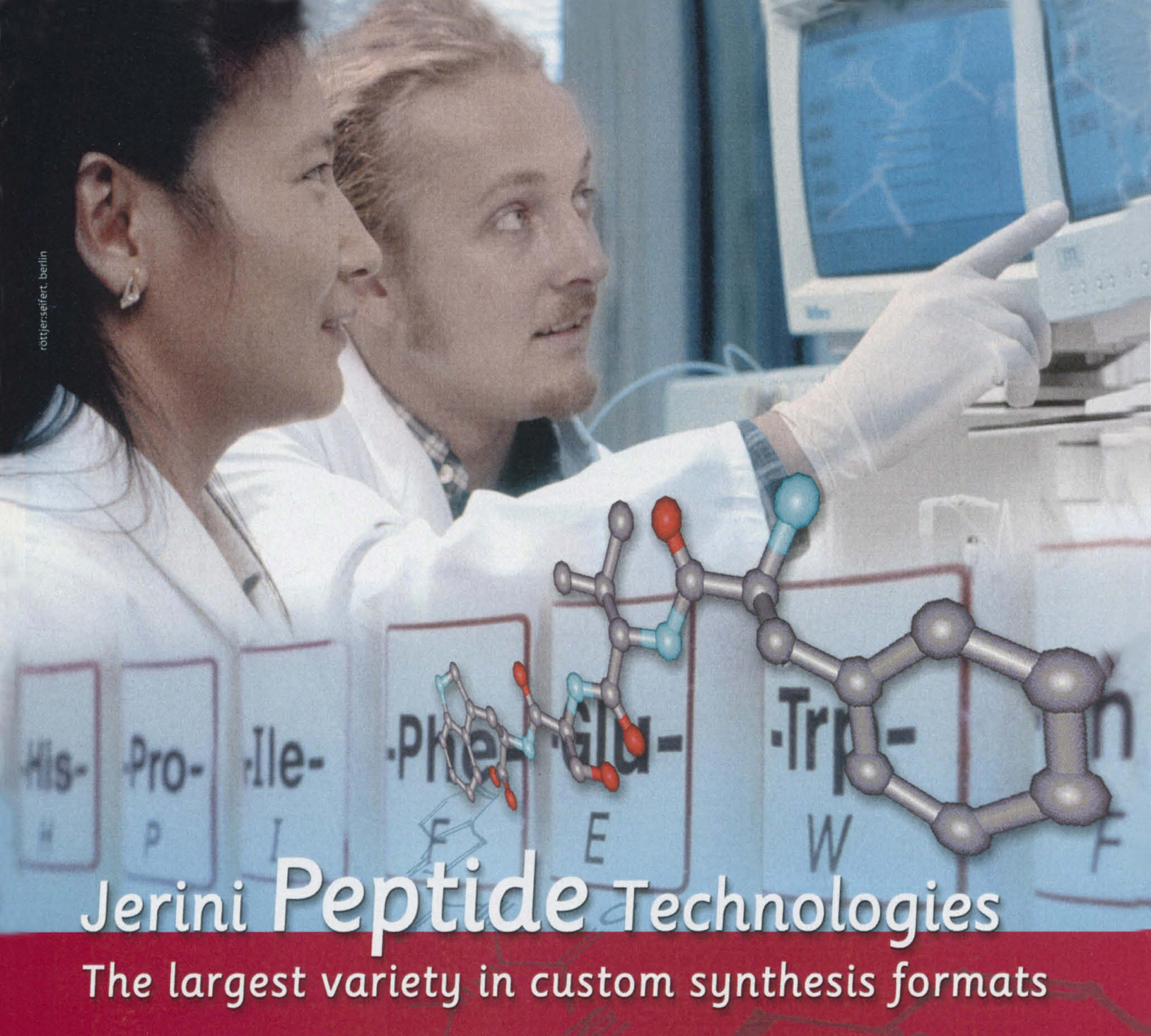
CREDIT: MA *ET AL.*

The Hydrogen Economy of the Gut

A major cause of gastritis, peptic ulcers, and certain cancers is the bacterium *Helicobacter pylori*. Olson and Maier (p. 1788) show that the colonization success of this common pathogen is boosted by hydrogen gas produced by other intestinal occupants. Molecular hydrogen in the mucous lining of the stomach stimulates the pathogen to produce more of a constitutive enzyme, hydrogenase, required to harvest the energy through a series of heme-containing electron carriers.

Glycosylation in Bacteria

N-linked glycosylation is a common posttranslational modification of membrane and secretory proteins in eukaryotes. However, the only bacterium known to modify proteins in this way is *Campylobacter jejuni*, and thus many eukaryotic proteins generated in bacterial systems are of limited use because they lack appropriate modifications. Wacker *et al.* (p. 1790) have transplanted the N-linked glycosylation machinery from *C. jejuni* to *Escherichia coli*, which should enhance the opportunities for the large-scale production of appropriately modified proteins in bioreactors.



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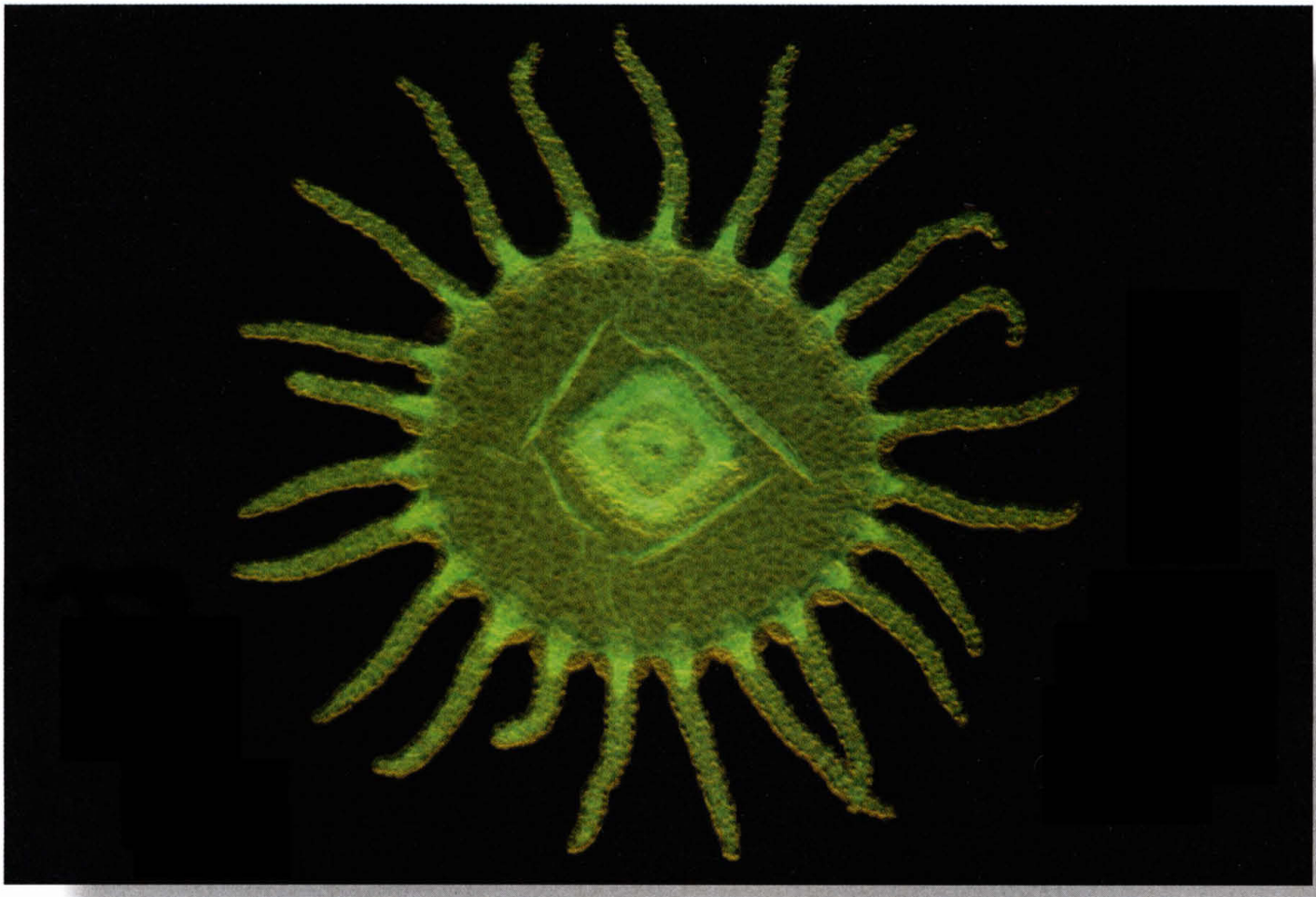

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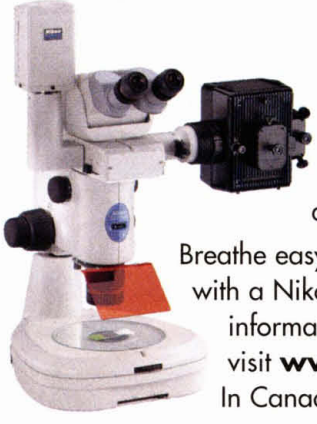

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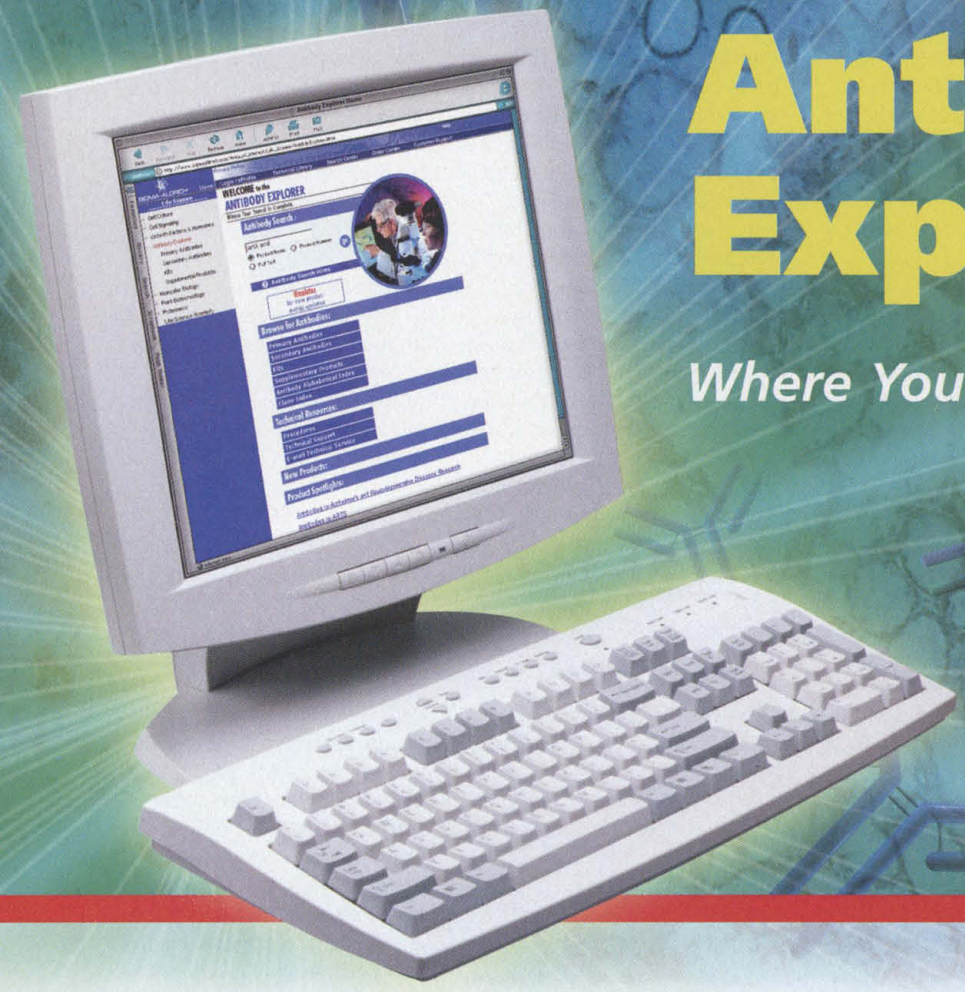

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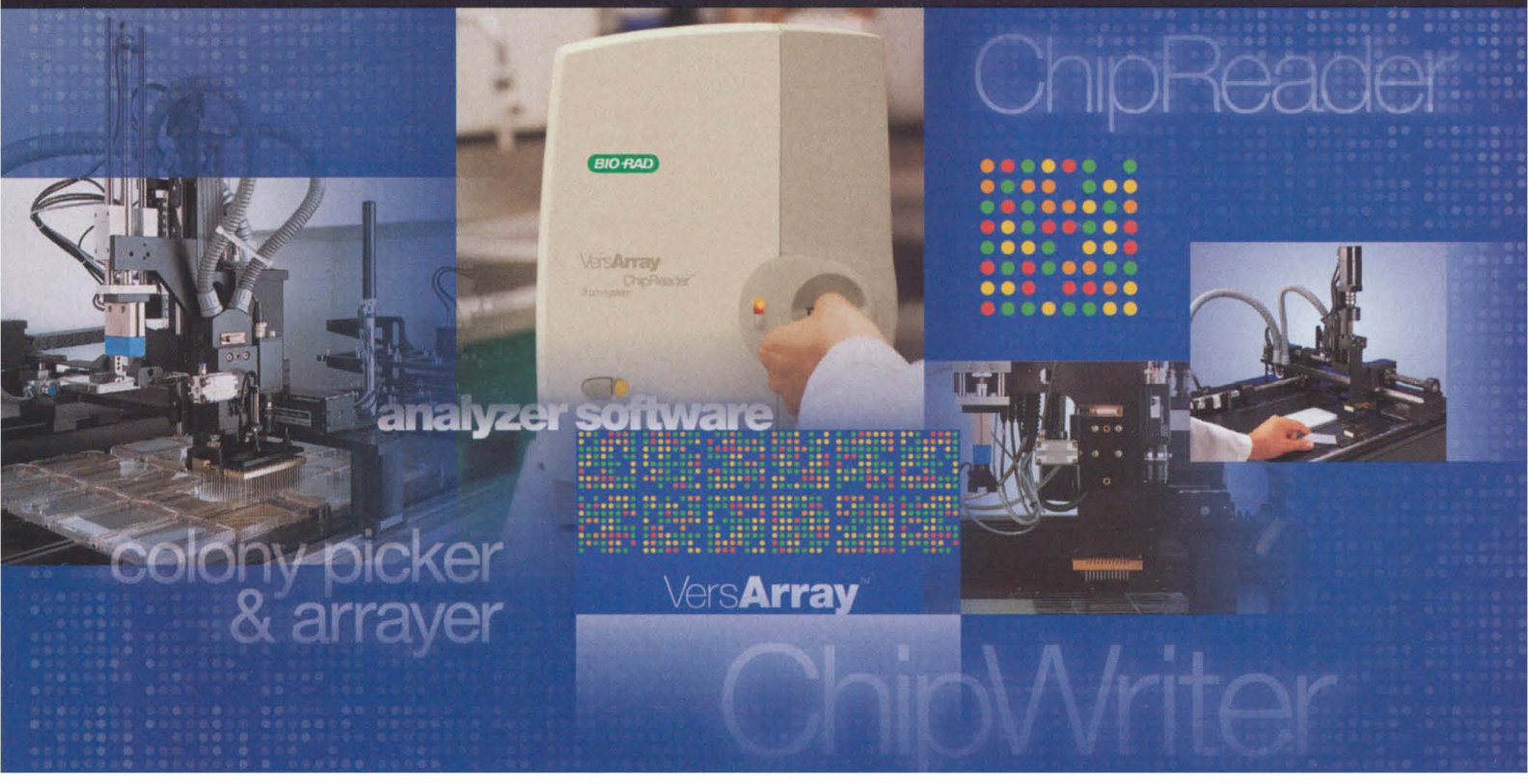

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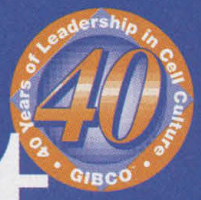

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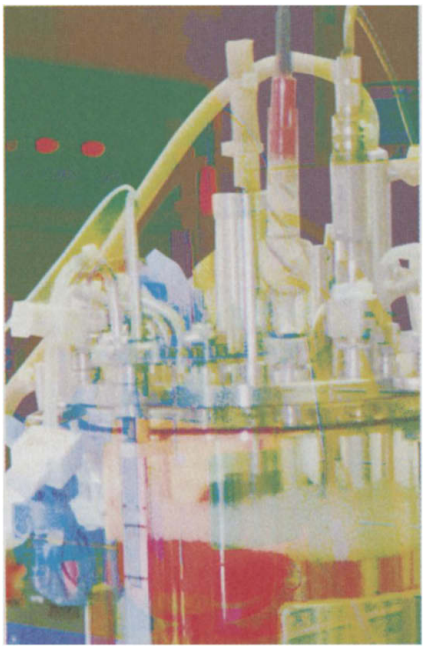

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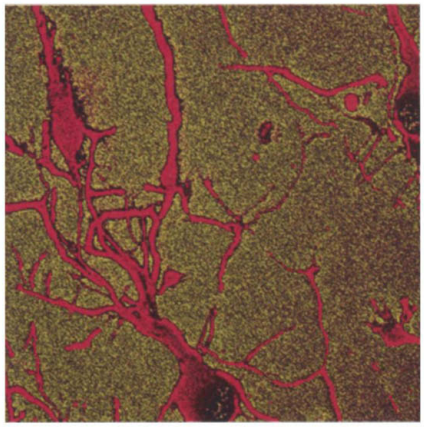

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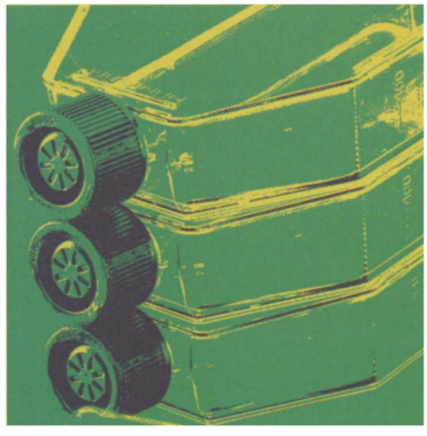

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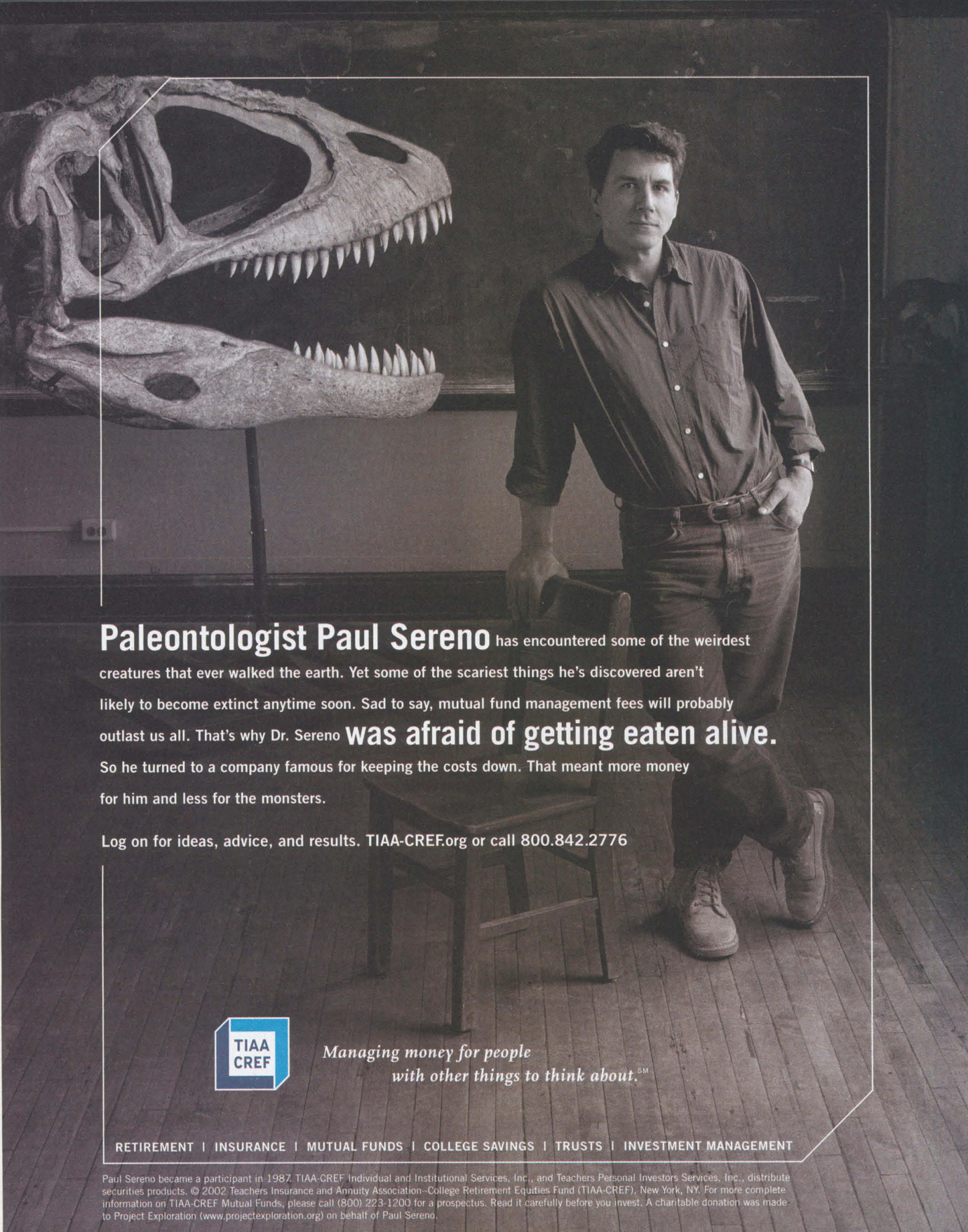
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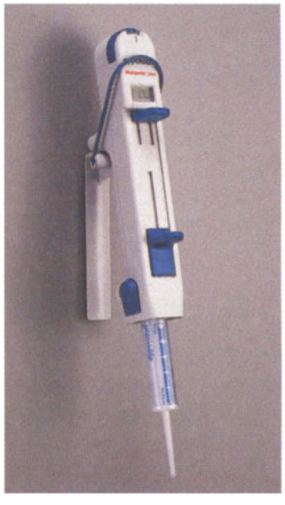

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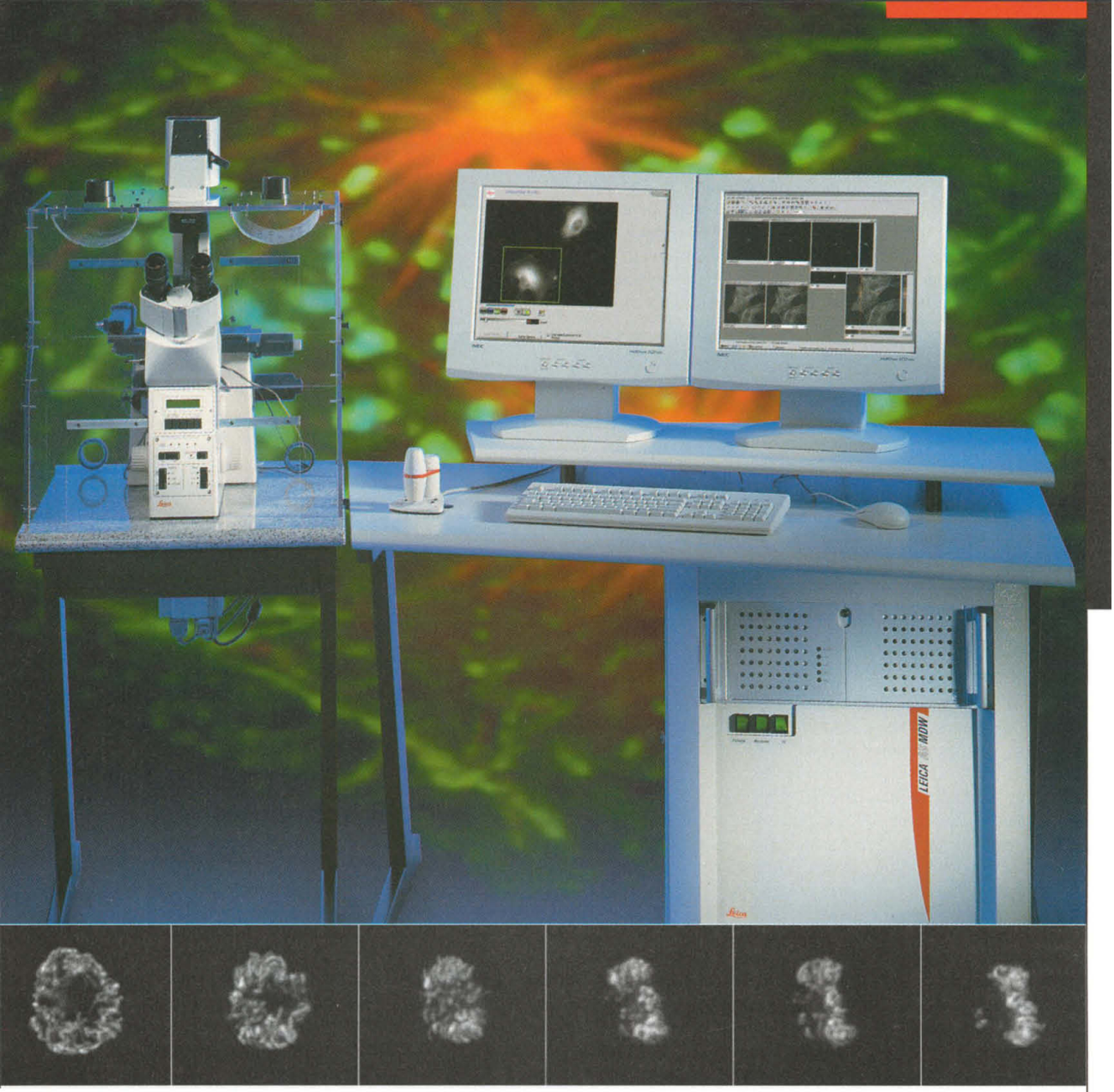

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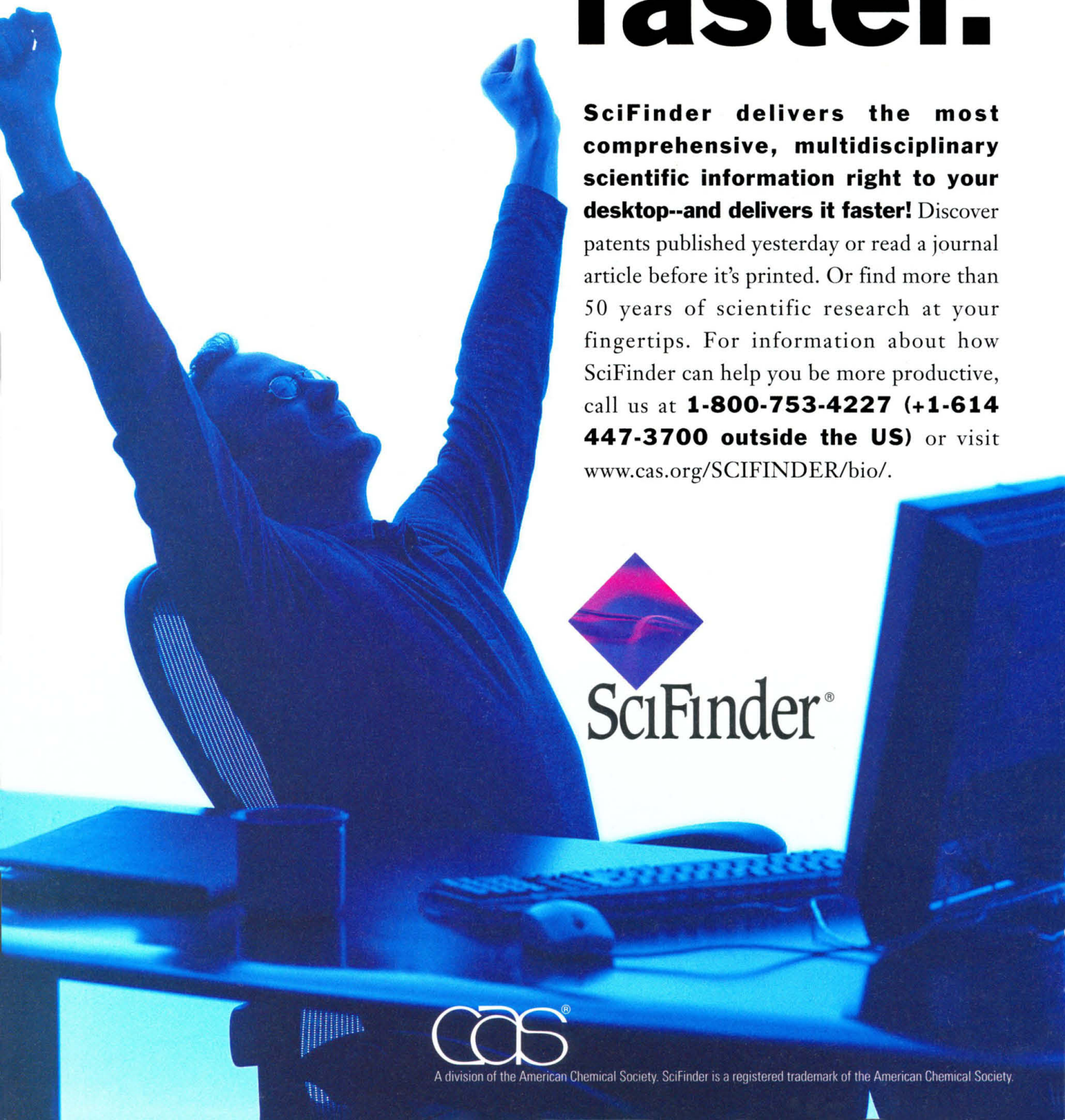

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