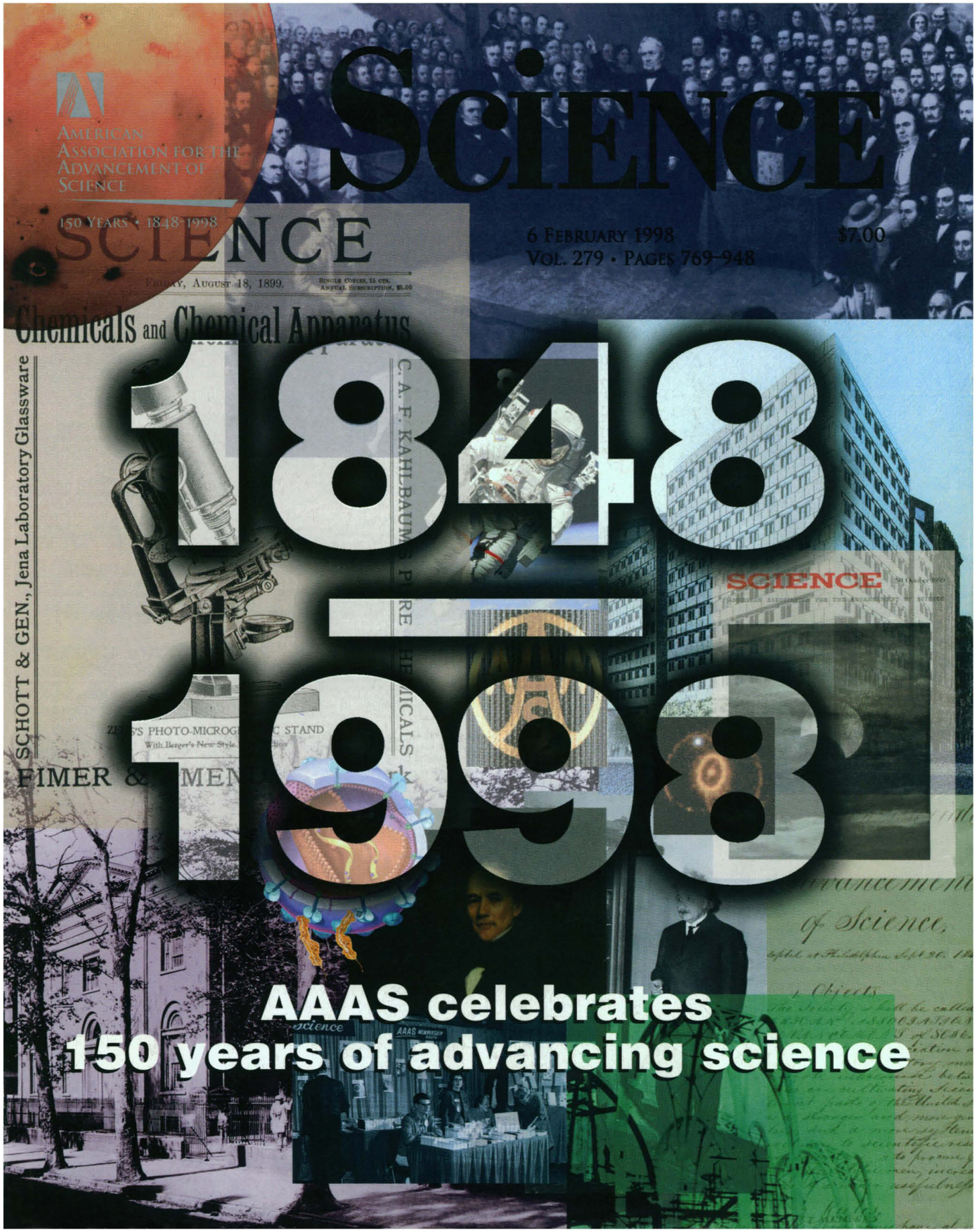
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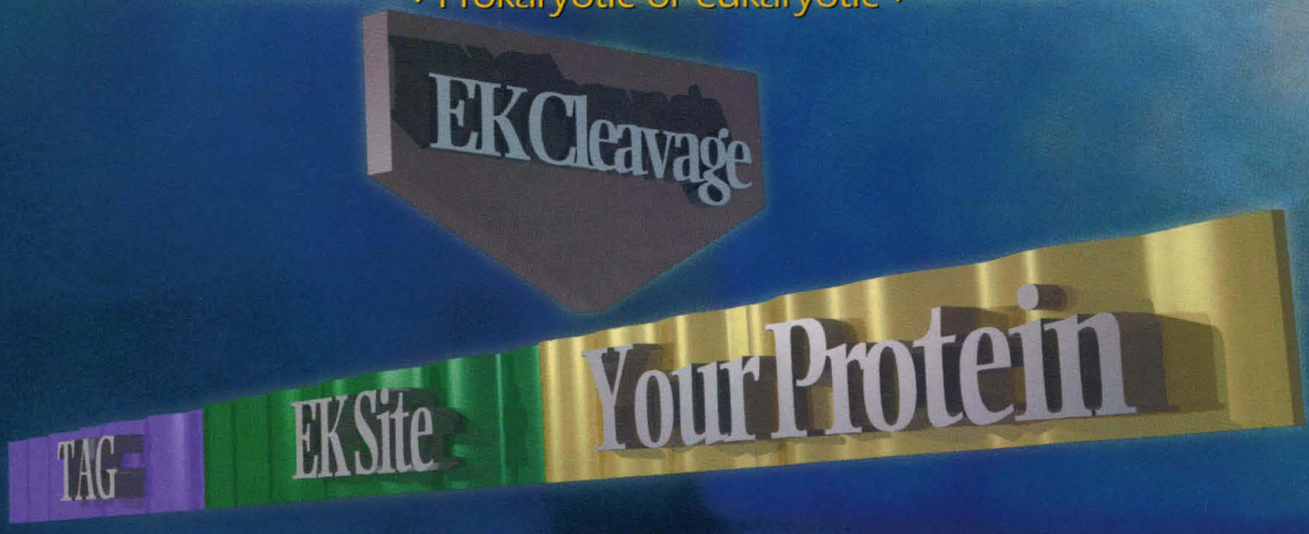

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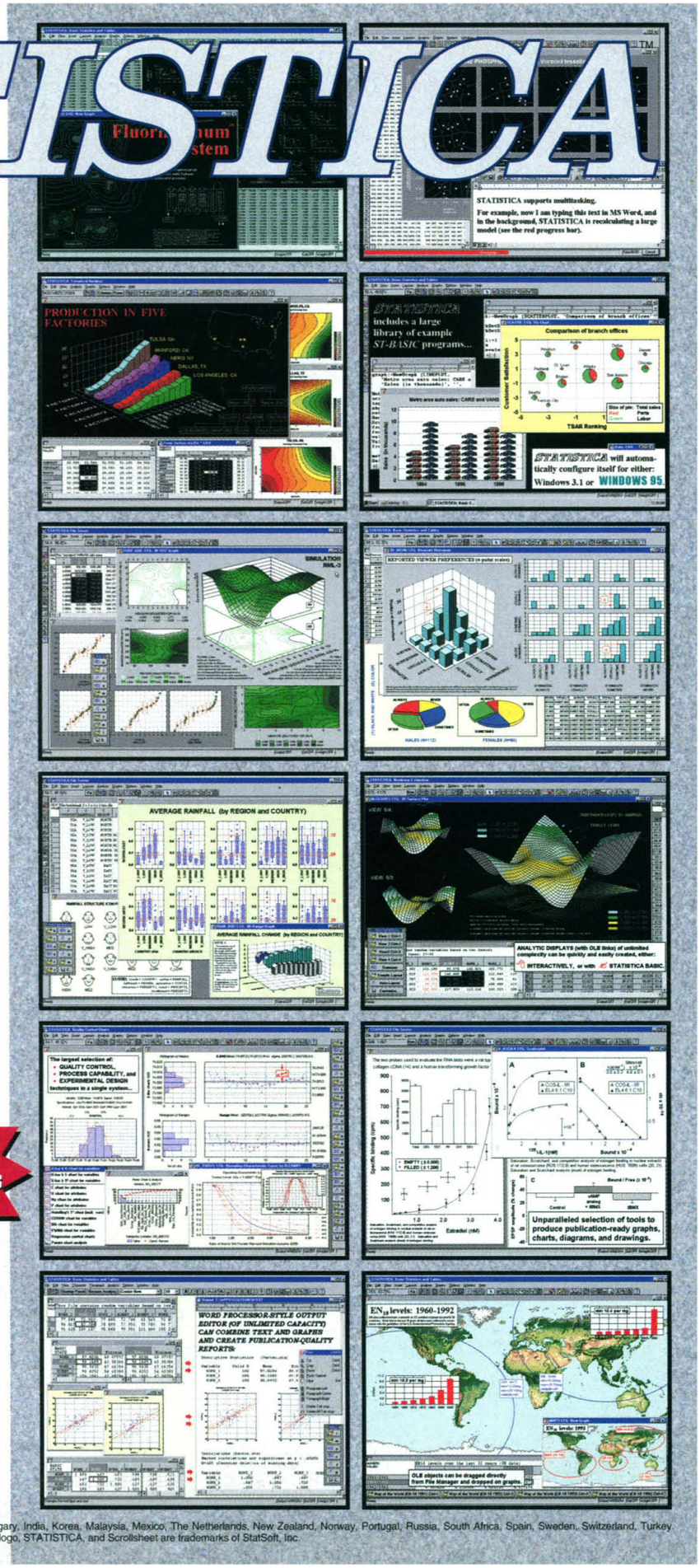

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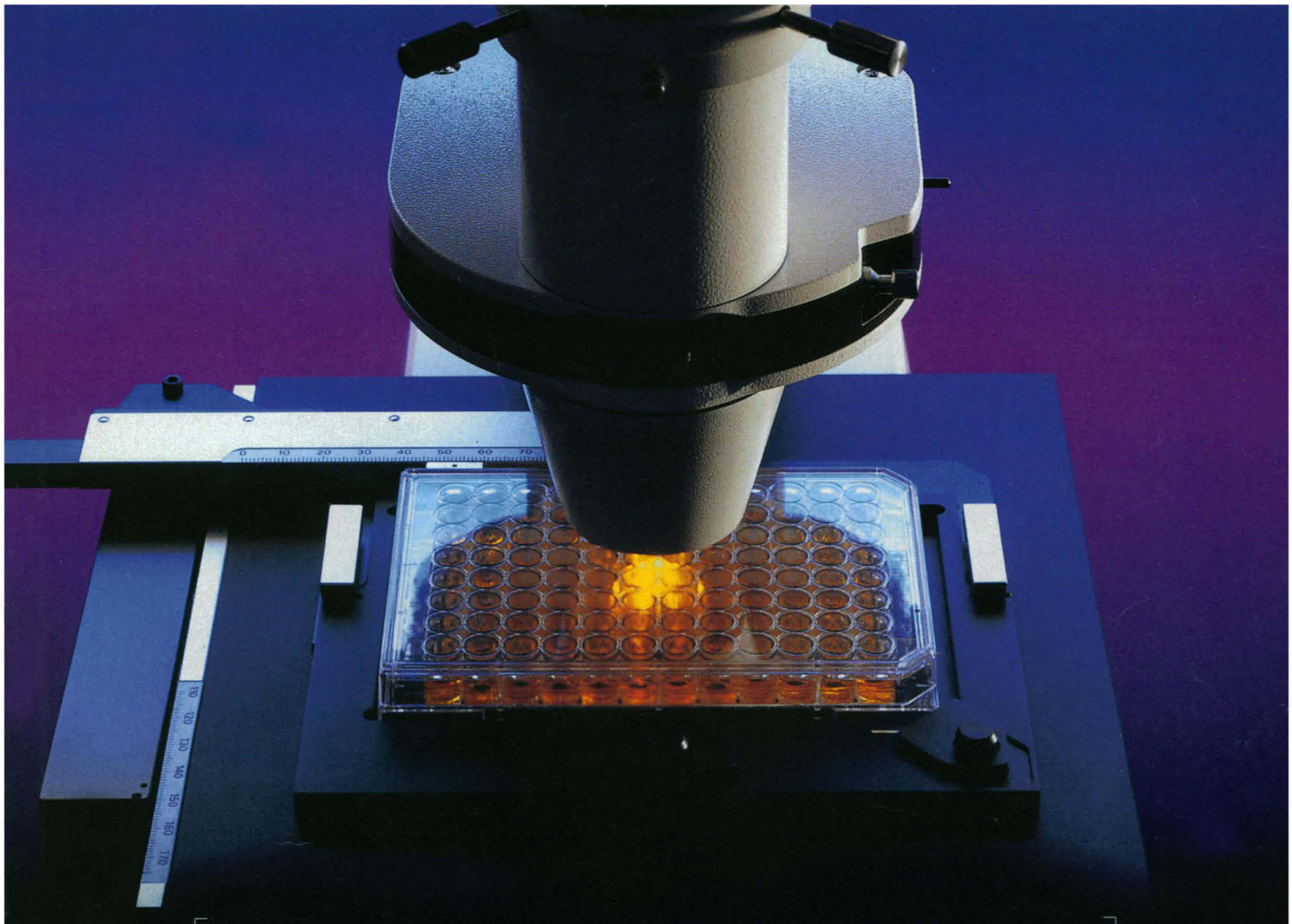

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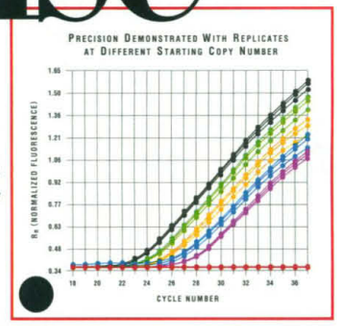

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1. Heid, Christian A., et al. 1996. Real Time Quantitative PCR. Genome Research 6: 986-994. from Molecular Endocrinology
2. Gibson, Ursula E.M., et al. 1996. A Novel Method for Real Time Quantitative RT-PCR. Genome Research 6: 995-1001

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New path for R&D

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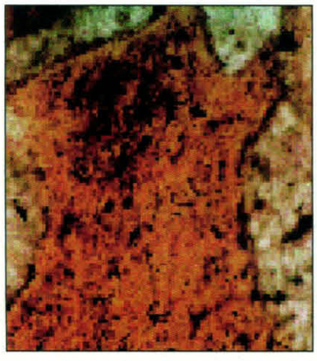
Building brighter displays



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Dawn of animals

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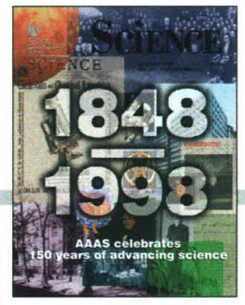
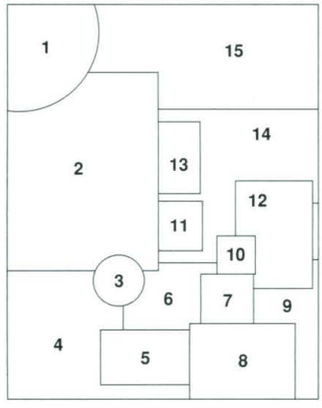
COVER

In 1848 at the Great Hall of the Philadelphia Academy of Science (bottom left), AAAS launched its tradition of migratory meetings to advance the course of science. The Association returns to Philadelphia this month to launch the commemoration of its 150 years as a far-reaching, democratic federation for science. And starting with this issue, *Science* begins a series entitled "Essays on Science and Society." An essay by paleontologist, evolutionary biologist, and author Stephen Jay Gould kicks off the series (page 812). [Collage: Patricia Riehn]





KEY

(1) Mars; NASA World Wide Web site. (2) *Science* cover from 18 August 1899. (3) HIV virus; Photodisc. (4) Great Hall at the Philadelphia Academy of Science; University of Pennsylvania. (5) AAAS membership booth in the 1950s. (6) William C. Redfield, first AAAS president. (7) Albert Einstein lecturing at the 1934 AAAS annual meeting; AP Wide World. (8) Arches of the Pacific Science Center in Seattle, WA; Pacific Science Center. (9) "Objects and Rules" of AAAS, 20 September 1848. (10) Supernova 1987A; NASA World Wide Web site. (11) Early AAAS logo. (12) *Science* cover from 30 October 1959. (13) Astronaut; Photodisc. (14) The AAAS headquarters (dedicated 1997); Paul Stevens Oles Architectural Perspectivist, Boston, MA. (15) Dudley Observatory dedication during 1856 AAAS annual meeting; Albany Institute of History and Art.

REPORTS

TECHNICAL COMMENTS

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THIS WEEK IN SCIENCE

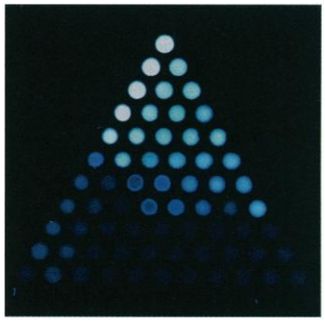
edited by BROOKS HANSON

Brightly polarized

Liquid crystal displays rely on polarizers to block or transmit light, but these polarizers absorb light and reduce efficiency. Weder *et al.* (p. 835) describe organic luminescent materials that can act as polarizers when produced as oriented thin films and also generate bright colors. Display configurations based on these materials also exhibit wider viewing angles.

Out of the blue

Combinatorial approaches to materials synthesis, such as adjusting the doping of luminescent



materials with rare-earth elements, appear to be ideal for optimizing complex systems. Danielson *et al.* (p. 837) show that a combinatorial approach can also uncover unexpected materials. They found that Sr_2CeO_4 has an unusual structure built up of chains of CeO_6 octahedra and that its blue luminescence results from charge transfer from the ligands to Ce^{4+}, as opposed to the usual metal-to-ligand charge transfer.

Wet stars

Recently hot water was identified in the spectra of sunspots at infrared wavelengths; this observation was unexpected because the sun was assumed to be too hot to contain liquid water. Jennings and Sada (p. 844) have now identified a similar set of absorption features in the infrared in two red supergiants, Betelgeuse and Antares (the rival to Mars, Ares). Although these stars are cooler than our sun and may contain hot water, some of these absorptions had been misidentified in previous work. In addition the recognition of water allows the temperature of the star's chromosphere to be estimated in order to understand how these stars cool.

Animal origins

Animals have been thought to first appear in the Vendian, about 565 million years ago, immediately before the Cambrian explosion, although the relation of these early forms to later Cambrian fossils and extant fauna has not been clear. Some molecular studies have also suggested that animals evolved earlier, although clear fossil evidence has been lacking. Li *et al.* (p. 879; see the news story by Kerr, p. 803) now describe fossils from the Doushantuo Formation in South China, dated to about 580 million years ago, that appear to be minute sponges, the most primitive metazoans. Internal cellular structures are preserved, in large part as the result of phosphate alteration. These fossils would then extend the origin of early metazoans to at least about 40 to 50 million years before the Cambrian explosion.

Wet faults

The 1994, magnitude 8.3, Bolivian earthquake occurred at a depth of 637 km, near the boundary between the upper and lower mantle. Like other rare deep earthquakes, it has been difficult to understand how such an energetic event could have occurred in the more ductile mantle. Kanamori *et al.* (p. 839; see the commentary by Wiens, p. 824) suggest that once the rupture was initiated, a thin zone of melting about 30 centimeters thick formed along the fault surface and allowed the fault to slip further. A thin melt zone and the additional fault slip that it caused would help explain the unusually slow rupture speed of the event and its large magnitude.

Wet comets

Measurement of the deuterium/hydrogen (D/H) ratio of comets is key for understanding the origin of water on Earth, and in comets it is for tracing the distribution of mass after the big bang. Comet Hale-Bopp, as a result of its large size and relatively close approach to Earth in 1997, has been studied in detail. Meier *et al.* (p. 842) used the James Clerk Maxwell Telescope on Mauna Kea, Hawaii, to obtain spectra of deuterated water (HDO). From these observations and previous detections of water they determined the D/H ratio of Hale-Bopp. The D/H ratio of Hale-Bopp is consistent with estimates for comets Halley and Hyakutake, but it is higher than that of terrestrial water and interstellar gas. This higher D/H ratio suggests that water on Earth was derived from additional sources, not just comets, and that comets are probably primitive remains from the early big bang that trapped and shielded deuterium in the cometary ices and kept it from transforming to tritium and decaying to helium.

Unequal redistribution

Theories of chemical reaction dynamics assume that the energy deposited or released in a molecule during a reaction rapidly redistributes statistically among the numerous vibrational and rotational modes. Such ergodic behavior is not always observed, but it has been thought that at high reaction energies, statistical behavior would prevail. Diau *et al.* (p. 847; see the commentary by Oref, p. 820) show experimentally that nonstatistical behavior can be observed even for reactions with available energies as high as 120 kilocalories per mole. The rate coefficients for the rapid photodissociation of carbon monoxide from cyclic ketones deviate from ergodic behavior by at least two orders of magnitude. These results indicate that redistribution of energy is slow compared to dissociation and that selectivity in femtosecond activation of reactions may be achieved even at high reaction energies.

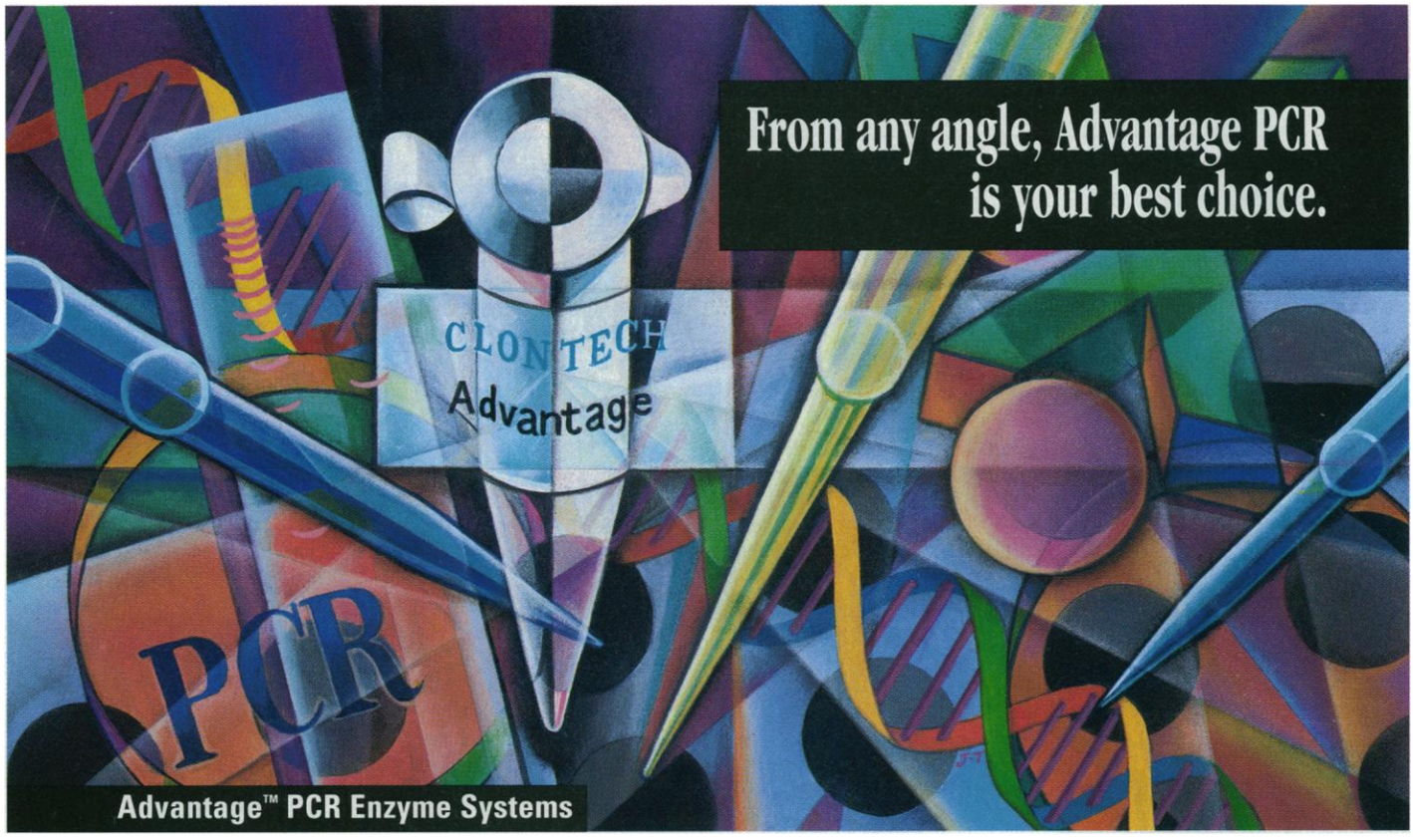
Peptide sensors

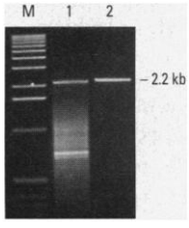
Small molecules that selectively bind tripeptides have been incorporated into sensors. Chen *et al.* (p. 851) show that different amide-linked adducts of macrocyclic tetraamides can be attached to beads and visibly fluoresce in the presence of their cognate peptide in chloroform solution.

Transmembrane prion proteins

Aberrant forms of the prion protein have been implicated in the transmission of a variety of neurodegenerative diseases including Creutzfeldt-Jakob disease in humans and BSE in cattle (mad cow disease). Its role in the pathology of the diseases themselves has been unclear, as is the role of the endogenous normal prion protein. Hegde *et al.* (p. 827) now show that an unusual intracellular transmembrane form of the prion protein can cause neurodegenerative disease in transgenic mice and is linked to a human neurodegenerative disease, in the absence of producing the infectious prion protein. The control of the intracellular processing of the prion protein is

(Continued on page 779)





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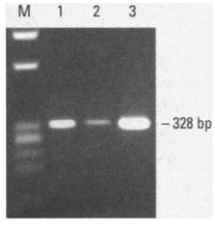

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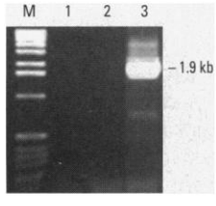
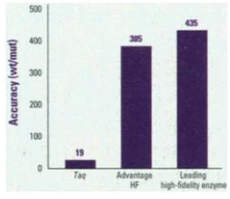


Advantage-GC (Lane 3) amplifies a 69% GC template that blocks standard PCR (Lane 1) and PCR with DMSO (Lane 2).



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(Continued from page 777)

therefore likely to be important in understanding and controlling these disorders.

■

Repeat assay

Expansion of trinucleotide repeats is the causative mutation in several human disorders such as Huntington's disease and myotonic dystrophy. Using bakers' yeast, Freudenreich *et al.* (p. 853) have created an assay system for studying the genetic defects underlying expansion of CTG repeats. Deletion of *RAD27*, a gene encoding a nuclease that processes DNA replication intermediates, caused a substantial increase in expansion rate and destabilization of the CTG tracts.

■

Putting the pieces back together

Processing of pre–messenger RNA (mRNA) involves multiple RNA and protein interactions in the form of small nuclear ribonucleoprotein particles (snRNPs). In the spliceosomal machinery, the association of U4 and U6 snRNPs through extensive base pairing is disrupted for activation of the spliceosome and catalysis of splicing. For subsequent rounds of splicing, U4 and U6 snRNPs must reanneal to form duplex U4/U6 snRNP. Raghunathan and Guthrie (p. 857) identify a specific RNA annealing protein, Prp24, that functions in a U4/U6 snRNP recycling pathway for multiple rounds of pre-mRNA splicing.

■

Fishing too deep

What is the future for fisheries worldwide? Bleak, according to an analysis by Pauly *et al.* (p. 860; see the commentary by Dayton, p. 821). From detailed assignations of trophic level for 220 marine and freshwater species, they have assessed patterns in global and regional fish-catches in long-term data. For virtually all fisheries, the average trophic level of landed catches is falling: short-lived, low trophic level invertebrates, and planktivores are replacing long-lived, high trophic level species. The apparent unsustainability of fisheries represents an urgent challenge to ocean management.

■

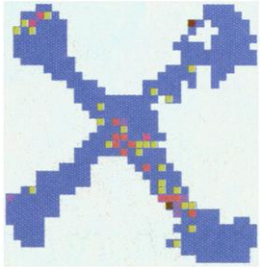
Getting around

Vitamin A (retinoic acid) binds to several different receptors. Krężel *et al.* (p. 863) show that mutant mice lacking each of three retinoic acid receptors were less mobile than their wild-type littermates, most probably due to changes in dopamine signaling in the mesolimbic system—the part of the brain that controls voluntary movements.

■

Lost in space

Since the introduction of technologies to produce transgenic and knockout mice, the molecular mechanisms underlying the expression of memory in intact animals has been the subject of much scrutiny. Giese *et al.* (p. 870) examined the effect of a

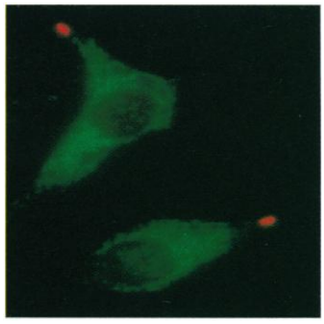


mutation in the calmodulin-dependent protein kinase—rendering it constitutively inactive—on learning. The transgenic mice were severely hampered in a spatial learning task and its electrophysiological correlate, hippocampal long-term potentiation. Cho *et al.* (p. 867) went on to show that the learning defect translated into an apparent inability of these mice to generate a cognitive map of their surroundings.

■

Virulence mechanisms

Legionella pneumophila is a bacterial pathogen that invades macrophages through the endocytic pathway. Somehow the bacterium alters its host phagosome such that fusion with the destructive compartment, the lysosome, is prevented. Vogel *et al.* (p. 873) now reveal part of the scheme that diverts the phagosome from the normal endocytic pathway. The bacterium inserts into the phagosome membrane a transport system that is capable of transferring plasmid DNA across a membrane. It is likely that this system allows the transfer of substances that block endocytic fusion events.



■

Which comes first?

It has been thought that in meiosis pairing of homologous chromosomes (synapsis) must precede recombination. However, recent studies showed that meiotic recombination occurs before synapsis in yeast. Now, with the use of *Drosophila melanogaster* mutants that are recombination defective, McKim *et al.* (p. 876) report that in fly oocytes, synapsis can occur in the absence of recombination events. Thus, the higher eukaryote *Drosophila* and lower eukaryote yeast appear to vary in their meiotic processes, displaying a differential dependence upon recombination for synapsis.

Technical Comment Summaries

Organic Shielding of Greenhouse Gases on Early Earth

C. Sagan and C. F. Chyba described a model (Articles, 23 May, p. 1217) showing that, about 4 billion years ago on Earth, gases such as ammonia and methane created a greenhouse effect that could have maintained temperatures above freezing. This model might resolve the "early faint sun paradox," in which the early sun's low luminosity could not be reconciled with evidence of liquid water on Earth.

S. L. Miller and J. R. Lyons point out how this model echoes earlier ones "of a reducing primitive Earth atmosphere, with its many attractive implications for the origin of life." For example, the resulting environment could have been hospitable to the formation of amino acids, as suggested in a study by Miller (*Science*, 15 May 1953, p. 528). Miller and Lyons briefly discuss possible sources of organic molecules and energy (solar, chemical, geothermal, and meteoritic) in this context.

In response, Chyba agrees that the model supports the notion that a "reducing 'Miller-Urey' atmosphere," would become "self-shielding against [ultraviolet] photolysis." While the presence of prebiotic organics on early Earth seems secure, "nearly all subsequent steps on the road to the last common ancestor [of all living things] are much less well understood."

For the full text of these comments see: www.sciencemag.org/cgi/content/full//279/5352/779a

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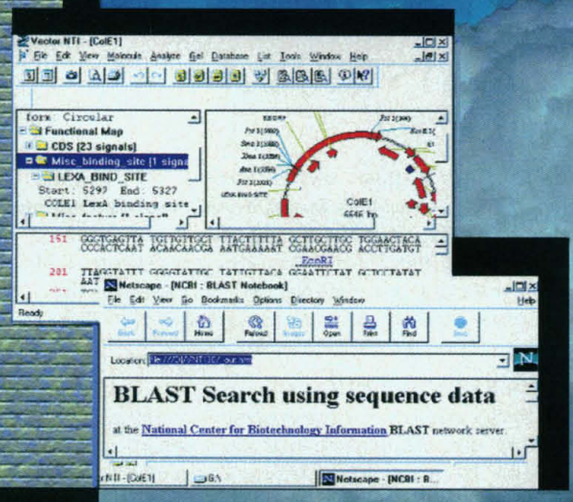

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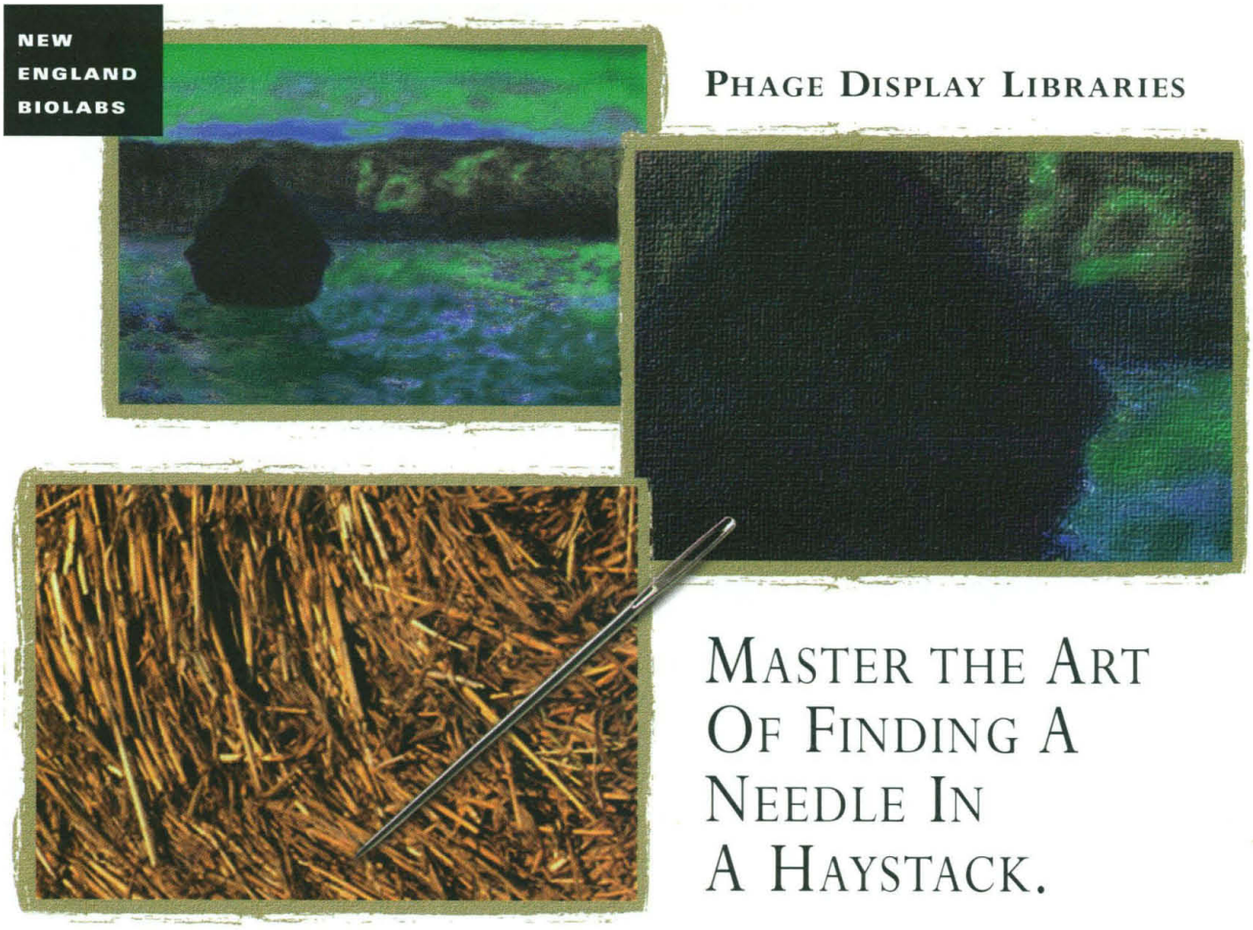

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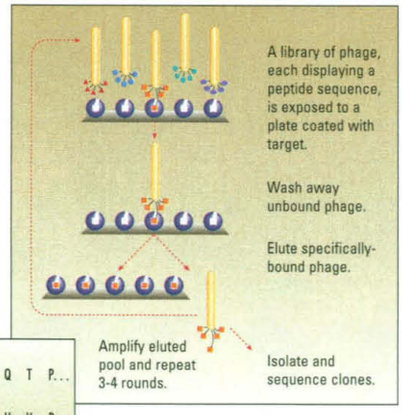

Biopanning a Phage Display Library

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Y	G	G	F	M	T	S	E	K	Q	T	P...
3rd round sequences:											
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Y	G	G	F	M	T	T	P	S	H	V	P
Y	G	G	F	I	S	Q	T	Q	H	Y	S
Y	G	G	F	I	S	Q	T	Q	H	Y	S
Y	G	G	F	G	N	S	L	V	M	P	V
Y	G	G	F	S	M	P	F	L	P	A	L
Y	G	A	F	D	V	T	T	G	V	T	S
Y	G	V	F	N	P	H	Y	L	P	S	L
A	P	S	T	D	K	Q	A	T	M	P	L
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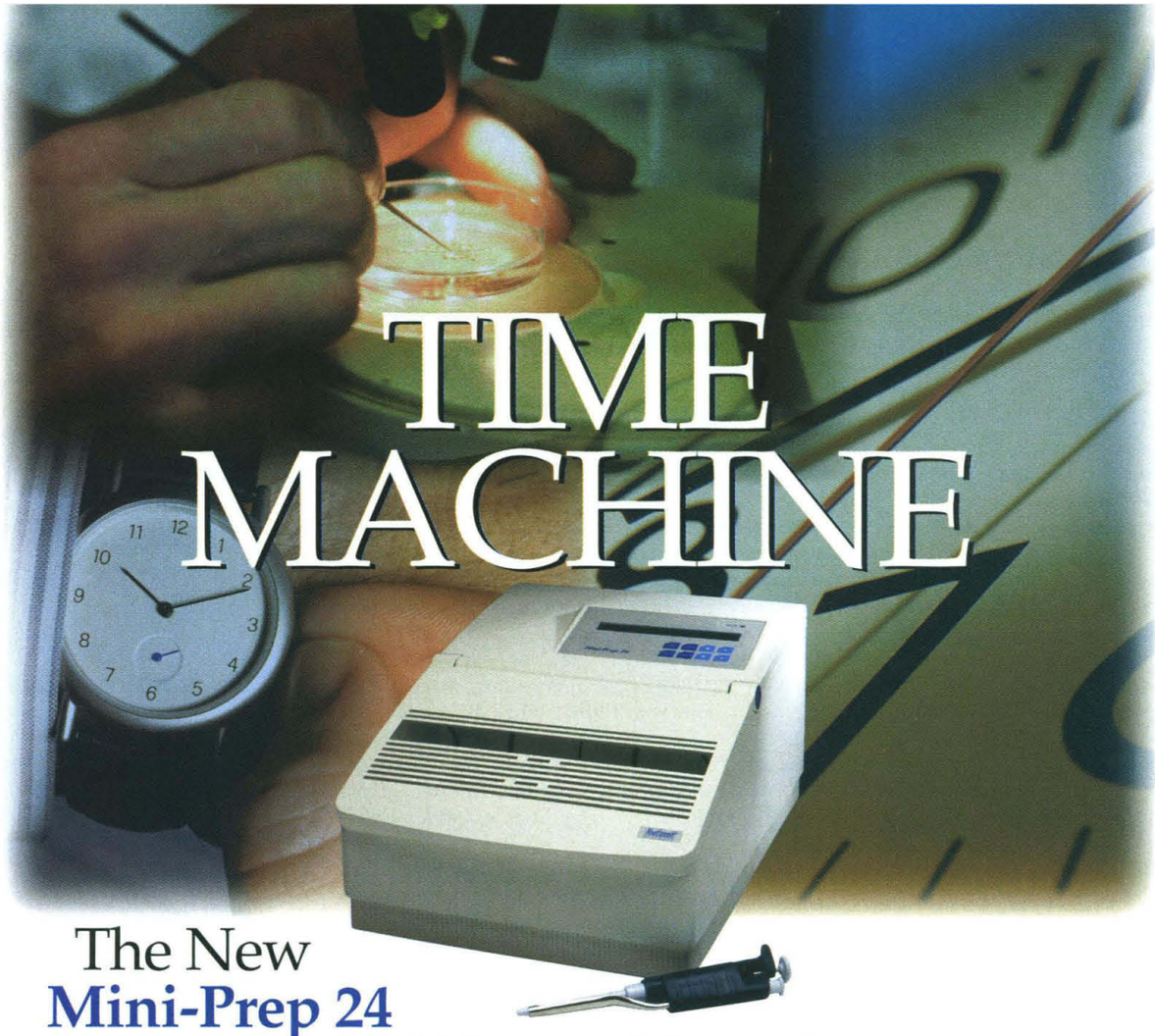

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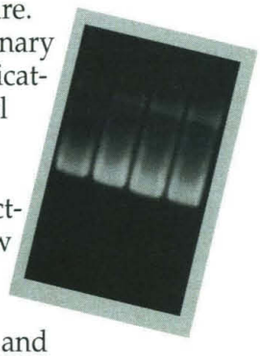

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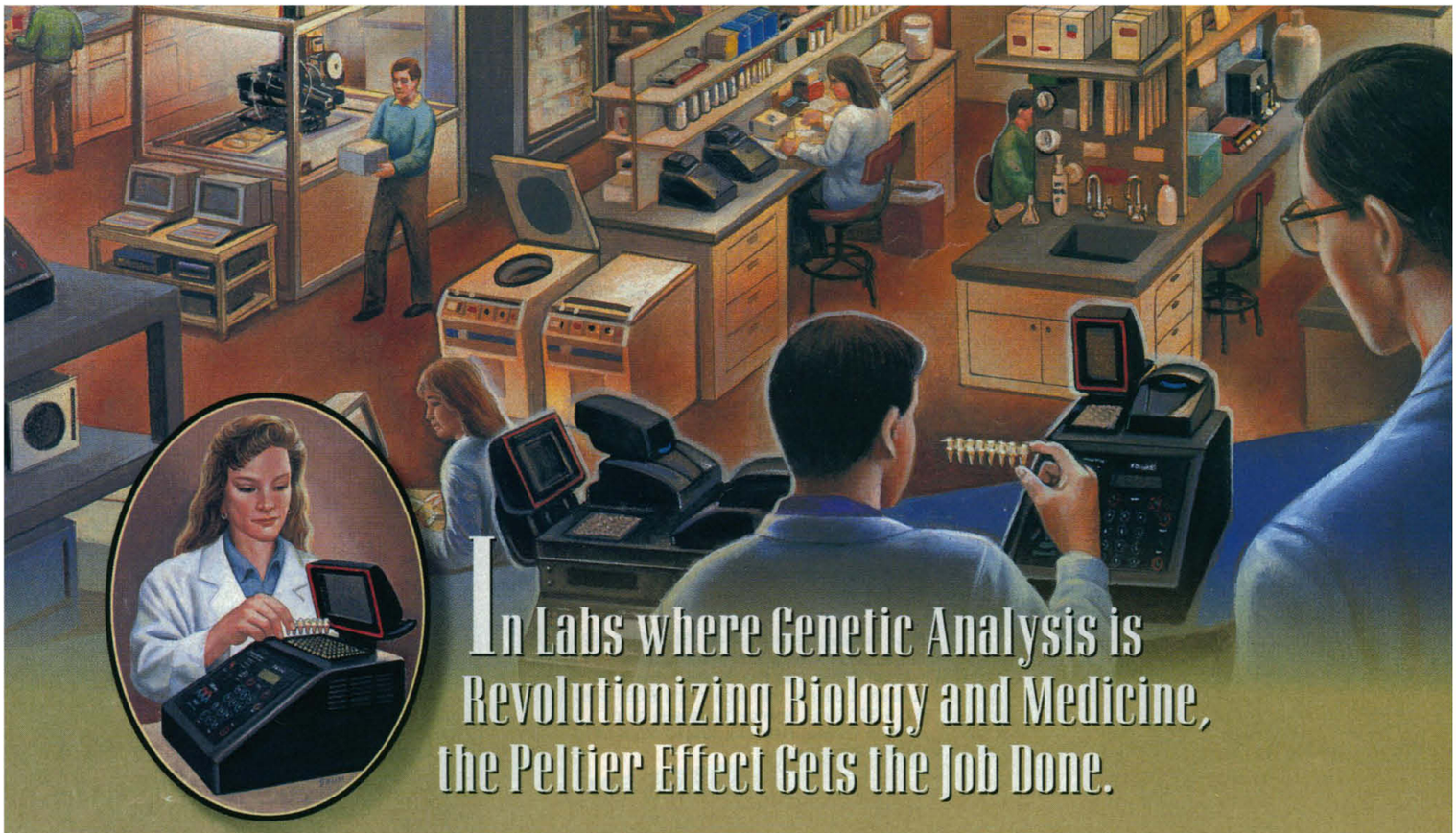

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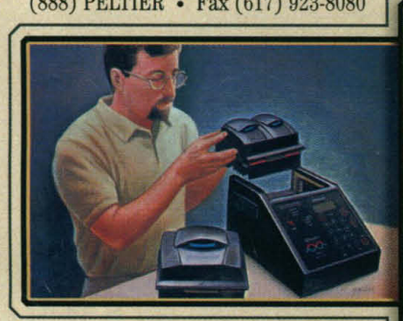

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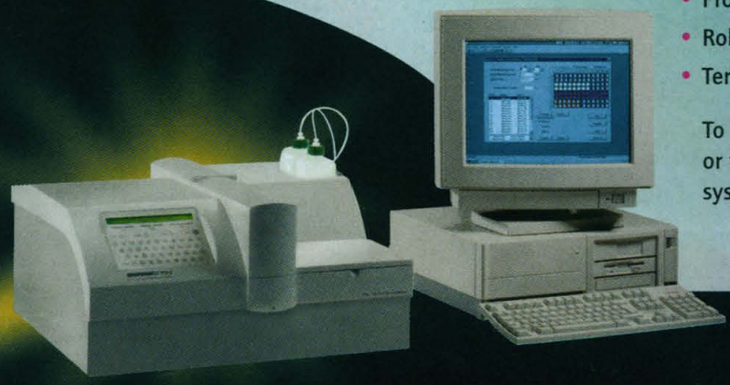

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*(10^{-21})

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Choosing a new ultraspeed isn't as easy as it used to be.

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Time was, if you wanted a new ultraspeed centrifuge, your options were pretty much limited to one source. But that's all changed. Because SORVALL®, the company which set the standard for superspeeds, now offers Discovery™ Series Ultracentrifuges – giving you a whole new level of ultraspeed choice, and value.

For unsurpassed performance in an easy-to-use, basic features package, choose between SORVALL Discovery 100 and Discovery 90 Ultracentrifuges. Or you can opt for the advanced Discovery 100S Ultracentrifuge with Compass™ Centrifugation Software, and get run calculation and simulation, scheduling and on-line help to guide you to more efficient separations. If smaller samples are the norm, we also offer the compact floor model RC-M150GX and RC-M120GX Micro-Ultracentrifuges. And consider other SORVALL exclusives, like our top-loading, top-access Surespin™ Swinging Bucket Rotors; flexible, time-saving STEP*SAVER*™ Vertical Rotor Systems; and the easy-to-use, heat-free ULTRACRIMP™ Tube Sealing System, along with our renowned Technical Service and Customer Applications support. Call today, and find out how SORVALL provides more than performance – with just the right ultraspeed solution for you.

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TransFast™ Transfection Reagents...

...helping you finish first

Promega's new TransFast™ Transfection Reagent is:

Fast: Transfect in one hour. Requires less optimization.

Easy: Resuspend in water, mix with DNA and add to cells.

Efficient: High efficiency transfection even in the presence of serum in a wide variety of cells. Can be used for transient and stable transfection.

Tfx™-10

Tfx™-20

Tfx™-50

TransFast™

TransFast™ Transfection Reagent joins Promega's team of cationic lipids in providing you with *fast, easy* and *efficient* transfection in a wide variety of cell lines. Use the table below to select the best reagent for your cell line.

CellLine	TransFast™	Tfx™-10	Tfx™-20	Tfx™-50
COS-7	●			
NIH/3T3	●			
293	●			
CHO	●			
HeLa			●	
Hep G2			●	
K-562	●			
CV-1		●	●	●
BHK		●		
PC12	●		●	
Jurkat	●			
Sf9	●		●	

WWW.promega.com/.euro.promega.com/expression/

Visit Promega at www.promega.com/expression/ for the most current cell line specific information.

Call your nearest Promega Branch Office or Distributor to request a trial size of TransFast™ or Tfx™ Transfection Reagents or to request our new Transfection Guide. While supplies last.

Tfx and TransFast are trademarks of Promega Corporation.
The cationic lipid component of the Tfx™ Reagents is covered by U.S. Pat. No. 5,527,928 assigned to The Regents of the University of California and pending foreign patents.

Promega

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