

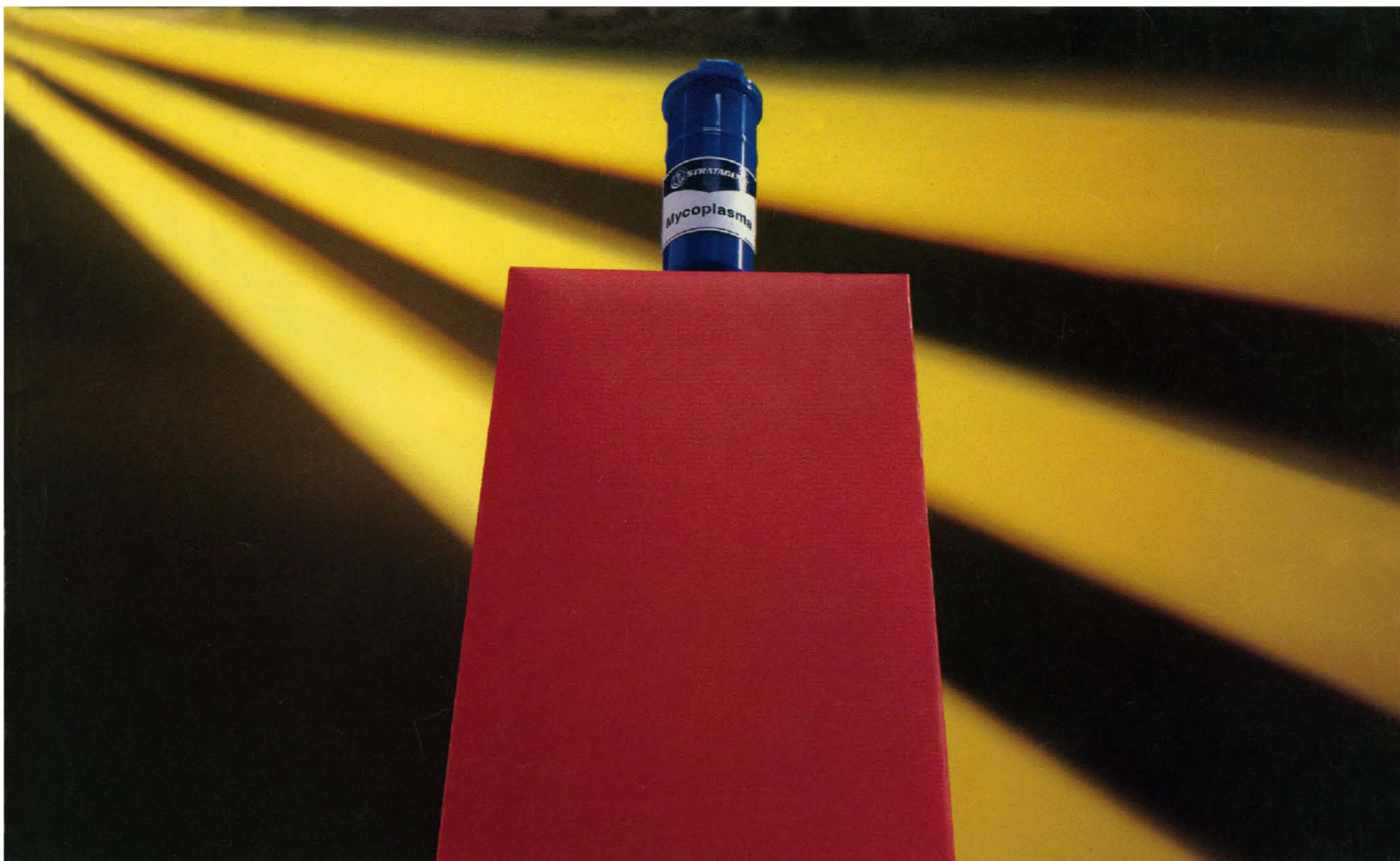
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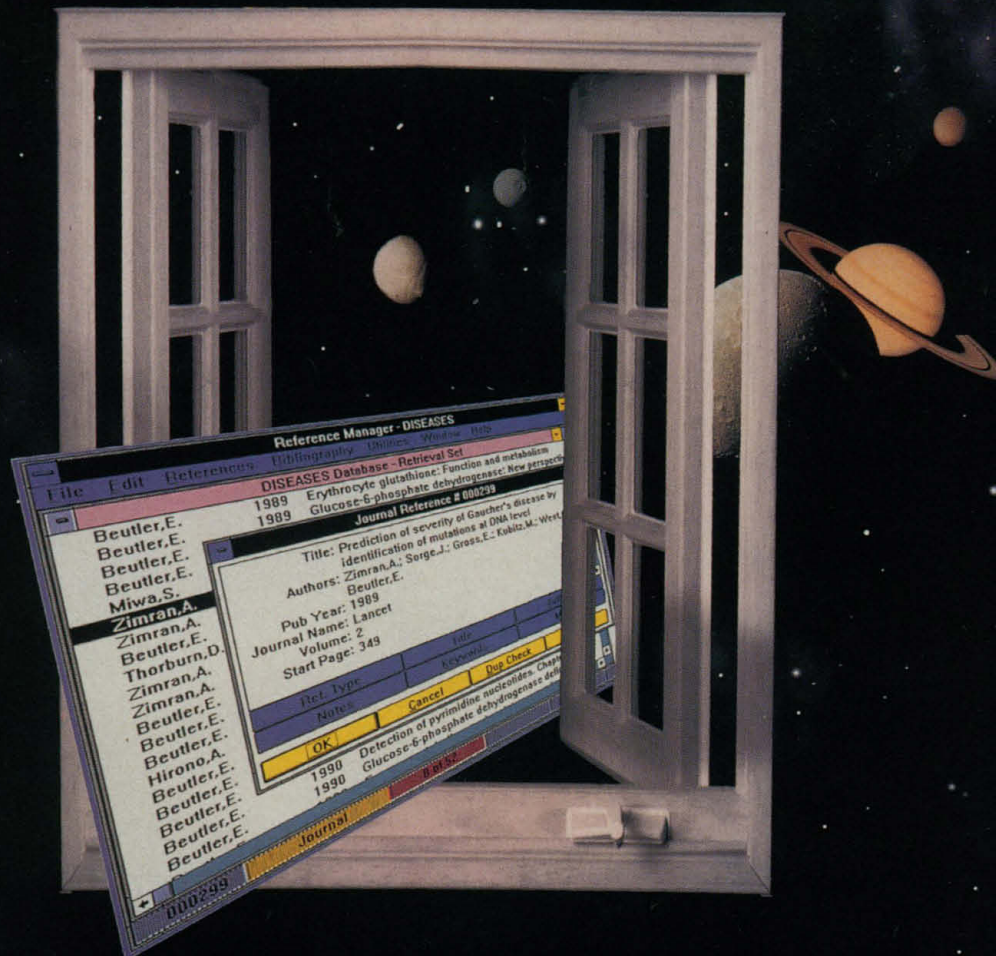
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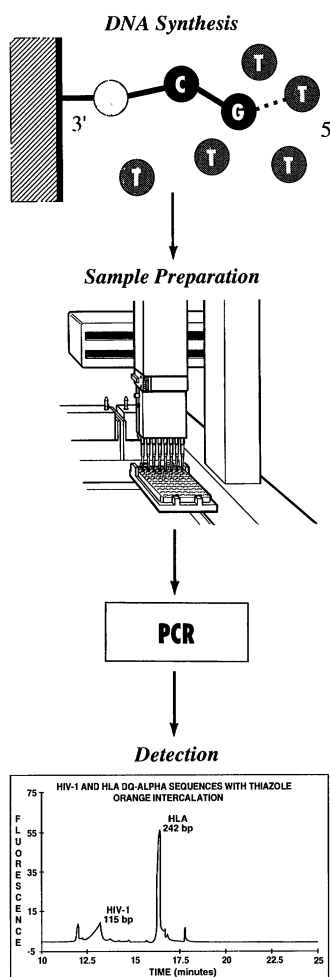
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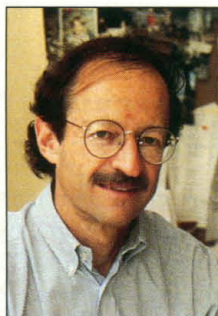
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¹ Mark Holodniy, Mark A. Winters and Thomas C. Merigan. *BioTechniques* 1992, Vol. 12, a: 1, 36-39.

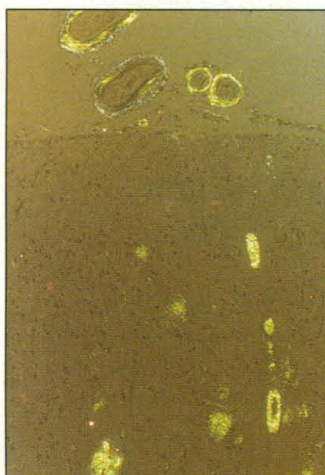
² Herbert E. Schwartz and Kathi J. Ulfelder. *Anal. Chem.* 1992, 1737-1740.

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COVER

Structure of a hypothetical protein with four helices (purple cylinders) modeled by the computer program Sculpt, a tool for guessing the structure of existing proteins or for designing new ones. In this special issue, other aspects of computing in science are discussed in

News stories, Perspectives, and Articles beginning on page 841. [Sculpt was developed by Mark Surles, University of California San Diego Supercomputer Center; Jane and Dave Richardson, Duke University; and Fred Brooks, University of North Carolina, Chapel Hill]



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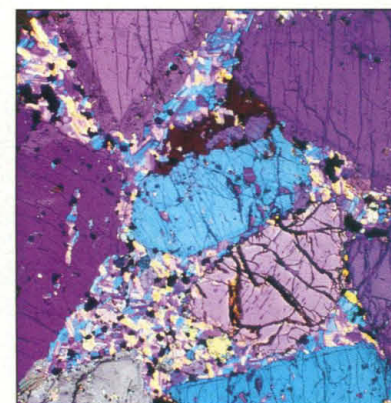
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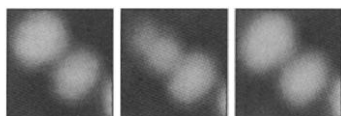
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Going native

Inclusion of metal binding sites into a simplified, designed protein has led to some insights into how specific interactions can affect protein stability. The designed protein $\alpha 4$ is a four-helix bundle that forms a molten globule structure that is stabilized by hydrophobic interactions. Handel *et al.* (p. 879) found that introducing two zinc binding sites into the protein destabilized the molten globule state. Addition of zinc ions stabilized the ground-state structure so that it more nearly resembled a native protein.

Dumbbell exercises

Many types of irreversible surface modifications have been made with the scanning tunneling microscope (STM) as a form of writing. Mo (p. 886) describes the rotation of antimony dimers on the silicon (001) surface, a reversible surface modification



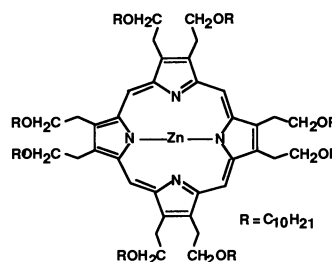
that could have memory applications. Scanning with the STM tip exerts an atomic-scale torque that rotates the dimer between two orthogonal positions, a rotated state and a more stable final state.

Charging ahead

Spectroscopic studies of bacteriorhodopsin mutants by Song *et al.* (p. 891) indicate that charged residues are critical for maintaining a fast rate of retinal photoisomerization. Replacing to the charged residues in the retinal cavity (Arg⁸², Asp⁸⁵, and Asp²¹²) reduced the photoisomerization rate. Isomerization about bonds

Charge trapping and data storage

High-density, high-speed information storage can be achieved with a device that uses a photoconductive material to record data. Liu *et al.* (p. 897) sandwiched a zinc porphyrin compound between sheets of the transparent conductor indium-tin-oxide. Shining light on this material creates electron-hole pairs; a bias voltage applied between the conducting sheets causes them to migrate. In this way a potential difference can be frozen into the material that can serve as a long-term, nonvolatile memory. The voltages can be retrieved on a subnanosecond time scale by shining light on the material under short-circuit conditions. No voltage is applied during readout, so the traps are depleted slowly and can be accessed hundreds of times. Single elements as small as 0.2 micrometer can be obtained readily, which translates into a storage density of 3 gigabytes per square centimeter.



other than the double bond between carbon atoms 13 and 14 is probably favored in the mutants, thus slowing the preferred isomerization pathway.

an analytical system, including sample pretreatment, injection, separation, and detection.

Miniature instruments under glass

A chemical analysis system has been fabricated on a small glass chip. Harrison *et al.* (p. 895) performed amino acid analysis with a capillary electrophoresis instrument that was micromachined on a centimeter-sized glass wafer. Moving parts are not needed, as electroosmotic flow was used to pump fluids through capillaries with cross sections on the order of tens of micrometers. Such small dimensions allowed separations to be performed in tens of seconds. Liquid flow at junctions could be directed by selectively applying voltages, so sample manipulations such as dilution could be performed. The amino acids were fluorescently labeled and detected by laser excitation. This miniaturized system combines the essential elements of

Dating the flood

One model for the origin of flood basalts, which represent the most voluminous volcanism on Earth, is that they are related to the ascent of a plume of hot material in the mantle, perhaps from the lower mantle. To evaluate this model and the evolution of melting as the presumed plume nears the surface, Basu *et al.* (p. 902) studied igneous rocks that mark the inception and demise of the Deccan flood basalts, which cover a large part of west-central India and were predominately erupted about 65 million years ago, near the time of the Cretaceous-Tertiary boundary. The ⁴⁰Ar-³⁹Ar dates for the early intrusions show that Deccan magmatism actually began about 3.5 million years earlier. The earliest and latest magmas were particularly alkalic, and the early magmas have high ³He/⁴He ratios, similar to certain ocean island

basalts, whereas the latest magmas show clear evidence of crustal contamination.

T cells and ζ chains

Signal transduction by the T cell receptor (TCR) is accomplished by invariant cytoplasmic subunits such as the ζ chain. Two reports examine the role of ζ chain in T cell signaling and development. Hall *et al.* (p. 915), working in COS-1 cells, show that coexpression of the ζ chain with the protein tyrosine kinase p59^{lyn} is necessary and sufficient to phosphorylate the ζ chain and phospholipase C (PLC)- $\gamma 1$ and to release intracellular calcium stores. This result suggests that p59^{lyn} may directly link the ζ chain to the PLC- $\gamma 1$ activation pathway. Love *et al.* (p. 918) used gene targeting to generate mice that lacked the ζ chain. The ζ chain is needed to transport the assembled TCR to the cell surface. A substantial decrease in the number of single positive CD4⁺ and CD8⁺ cells was seen, but unexpectedly some single positive cells were still detected in the periphery. Normal T cell expression was restored with a ζ transgene.

Hammering iron

Knowledge of the oxidation state of the lower mantle and whether the mantle is in equilibrium with metallic iron that forms Earth's core bears directly on models of the origin or the core and subsequent evolution of the mantle. Recent experimental data on the pressure dependence of the Fe³⁺ content of Fe₃O in the mantle and their implications for these questions are considered in a technical comment by Jeanloz and Hazen (p. 923) and reply by McCammon (p. 924).

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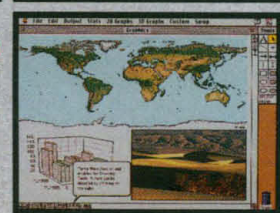
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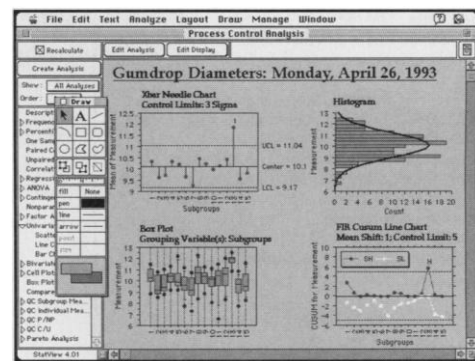
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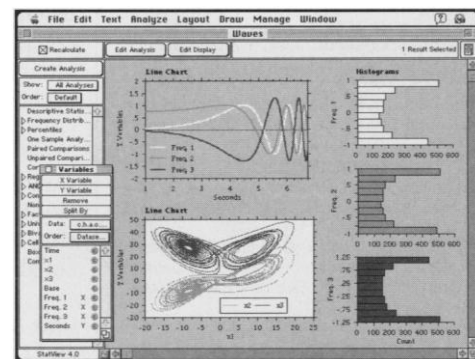
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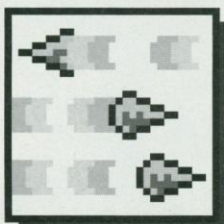
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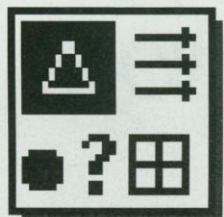
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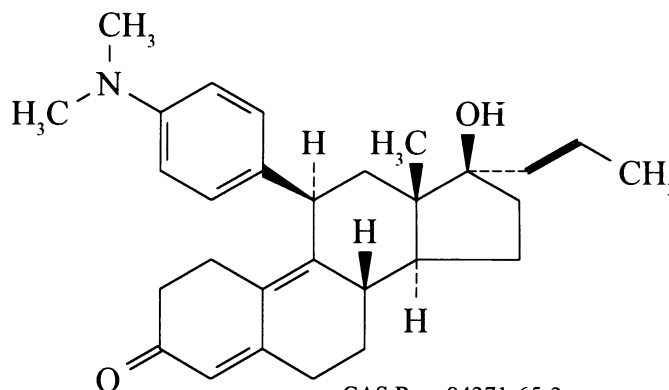
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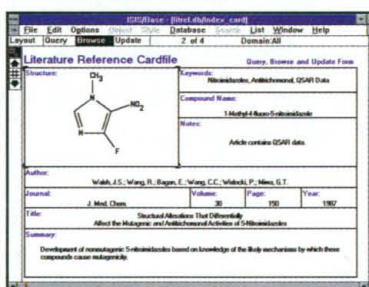
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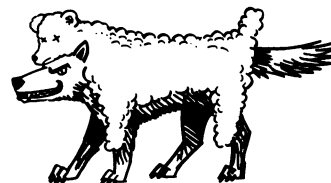


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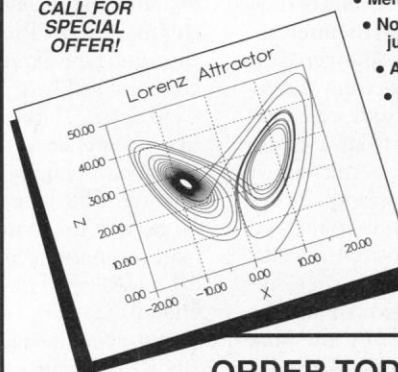
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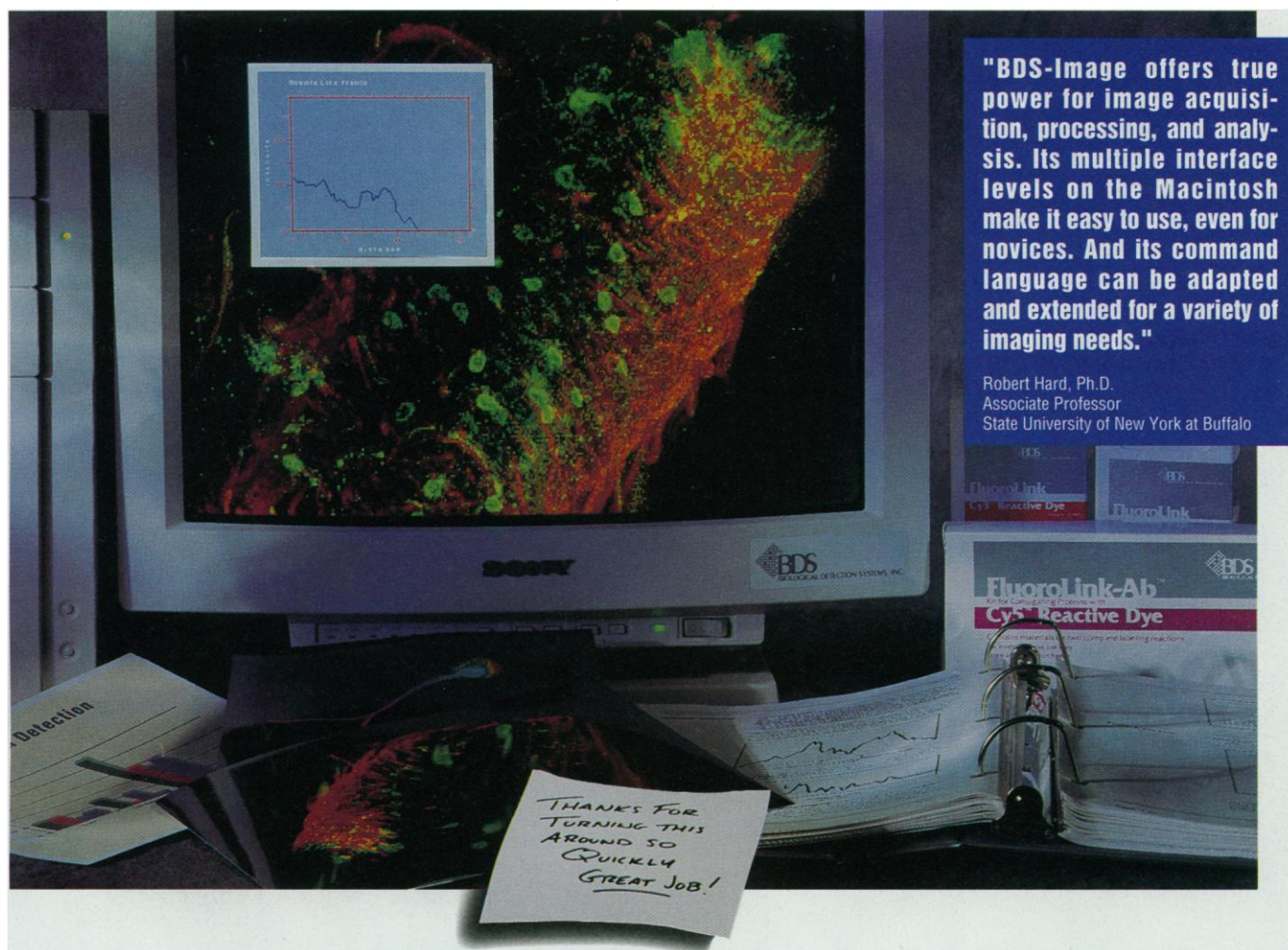
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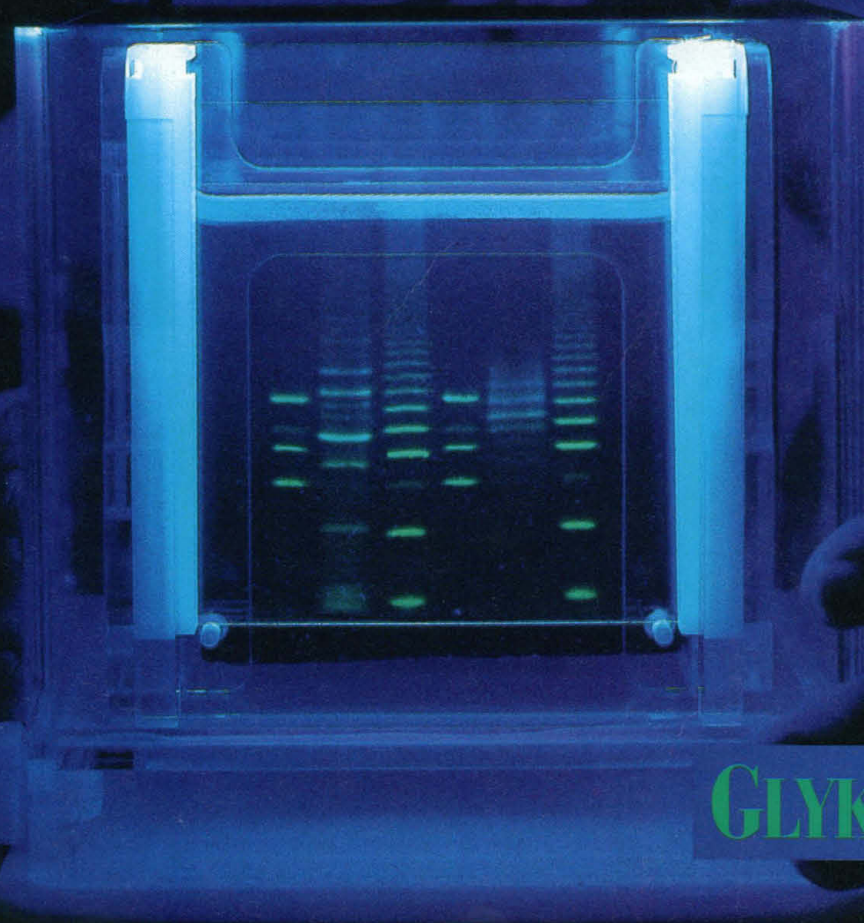
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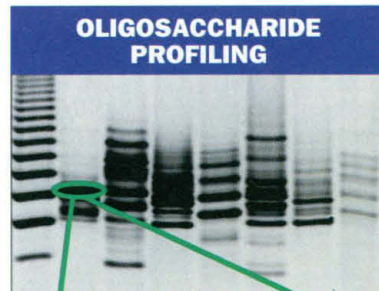
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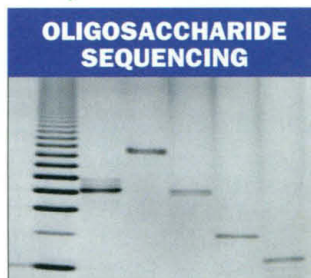
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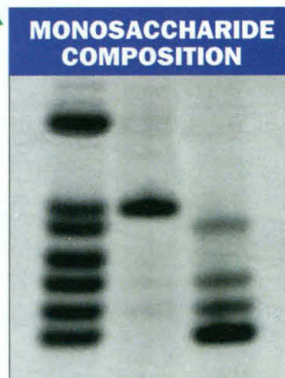
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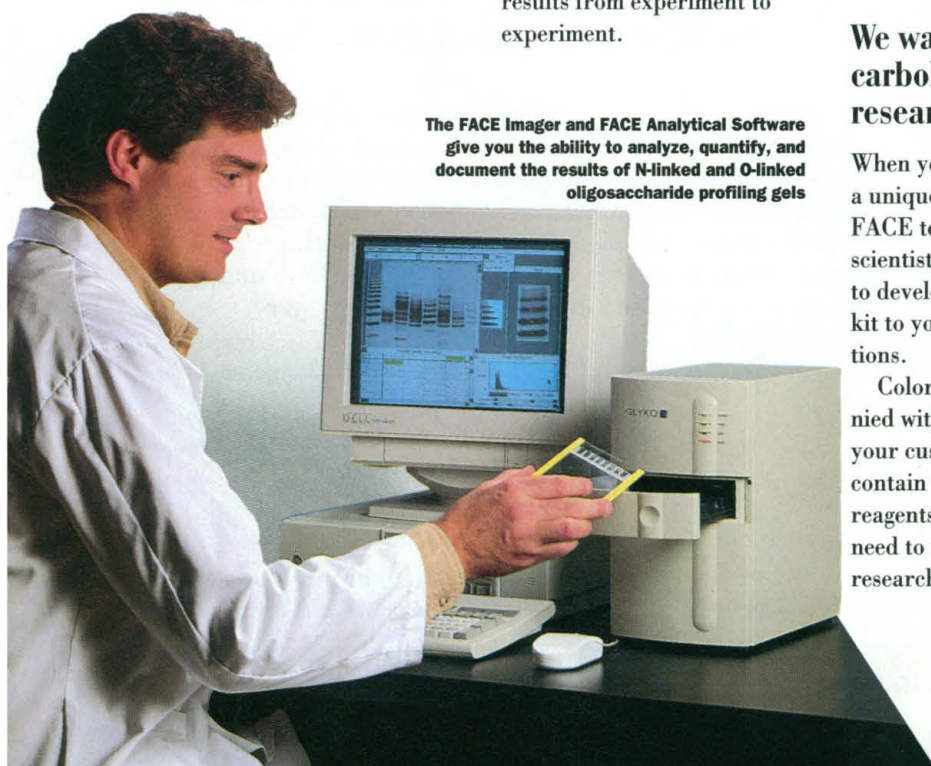
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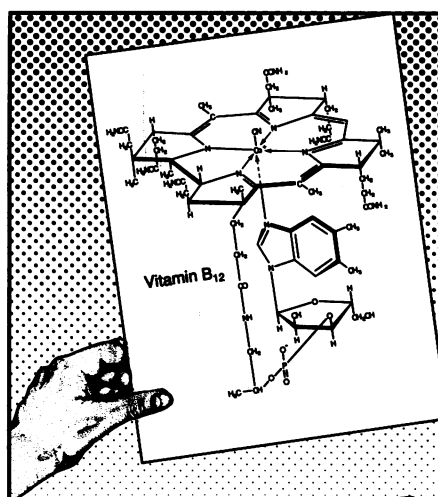
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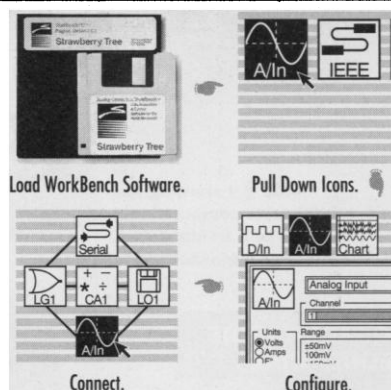


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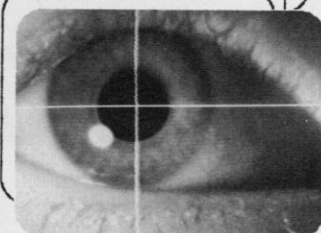
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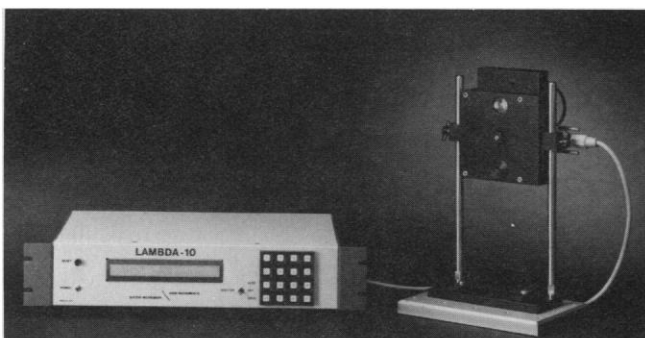


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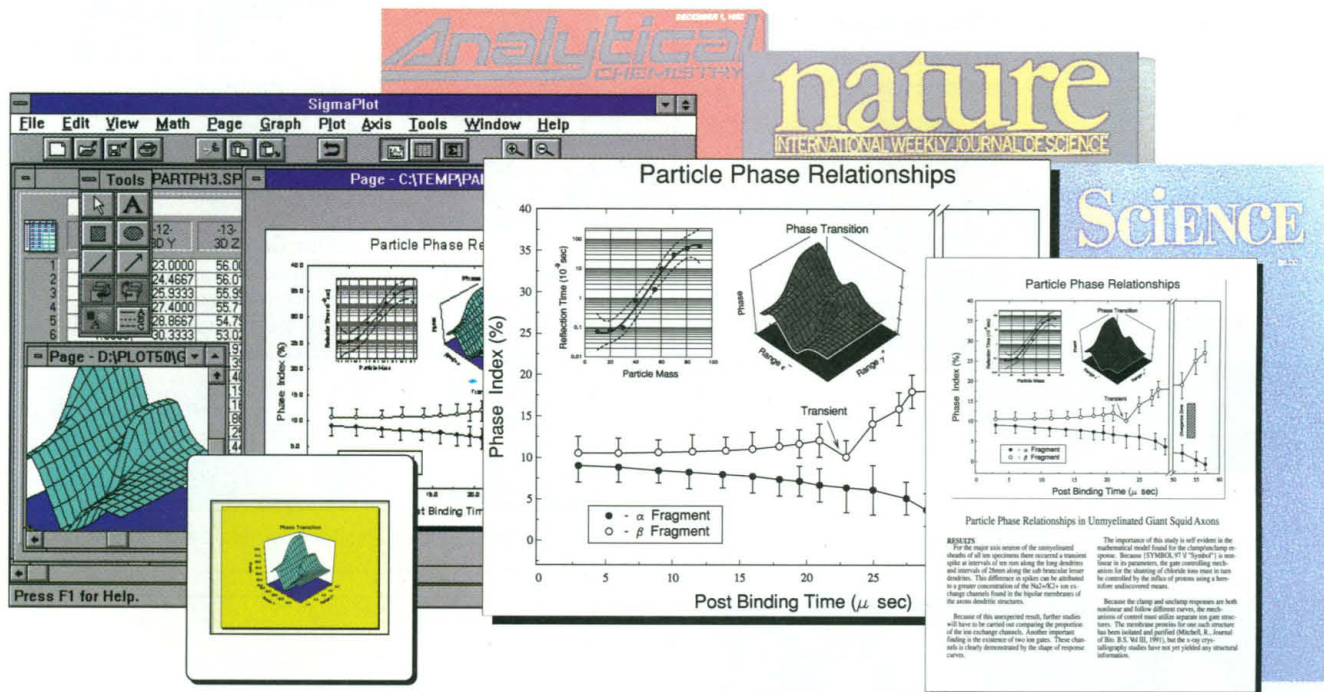
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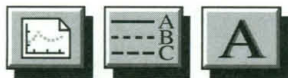


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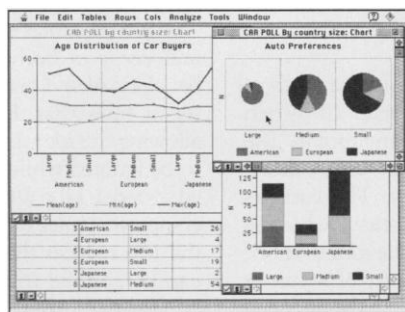
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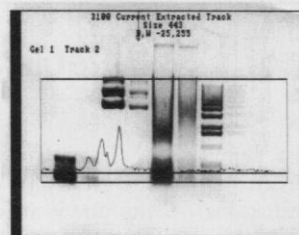
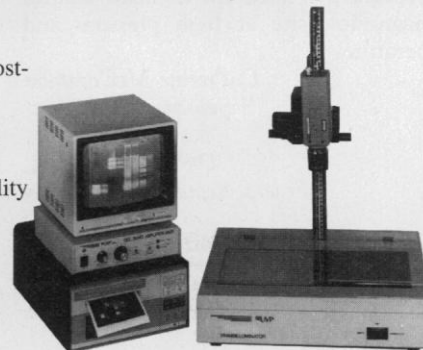
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