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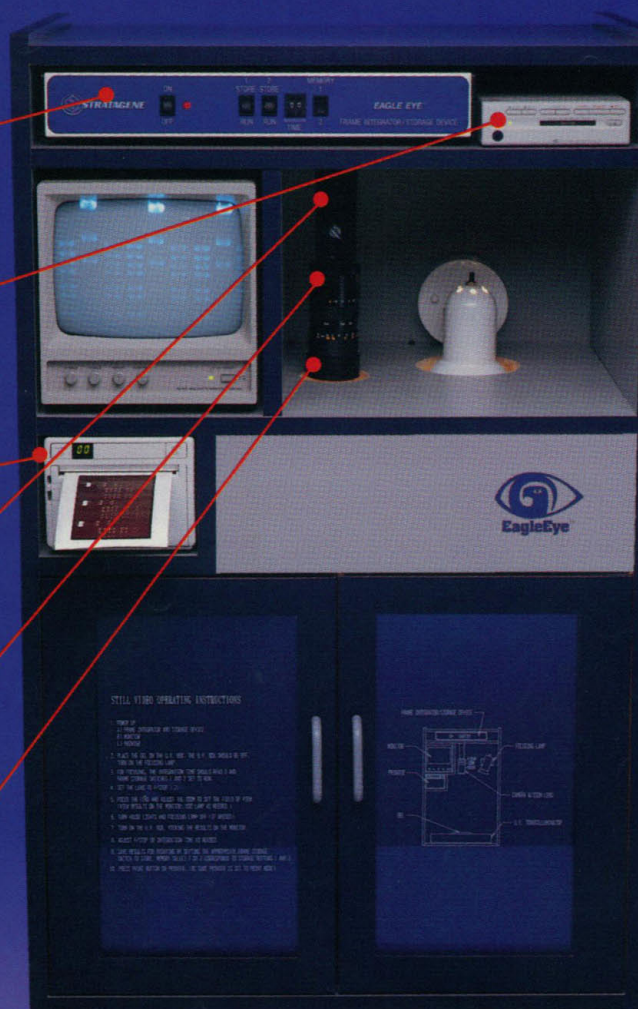
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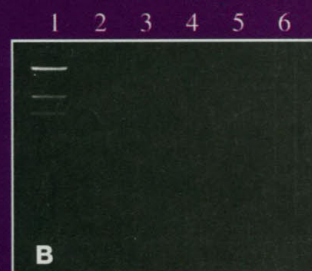
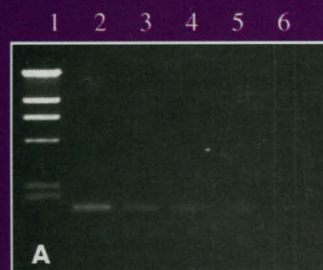
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50 ng of lambda/Hind III size markers along with various dilutions of pUC 18 supercoiled DNA were loaded on a 5 mm thick 0.8% agarose, 1X TAE slab gel and electrophoresed. The gel was stained in 0.5 mg/ml ethidium bromide for 30 minutes, then destained for 45 minutes in deionized water. All images were generated using the same transilluminator (302 nm). Lane 1: lambda/Hind III markers; Lane 2: 4 ng pUC 18 DNA; Lane 3: 2 ng pUC 18 DNA; Lane 4: 1 ng pUC 18 DNA; Lane 5: 0.5 ng pUC 18 DNA; Lane 6: 0.25 ng pUC 18 DNA.

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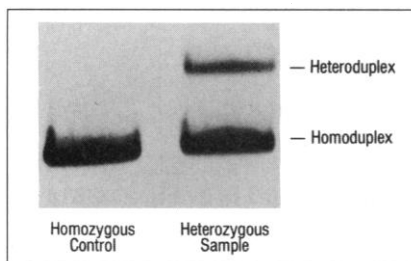
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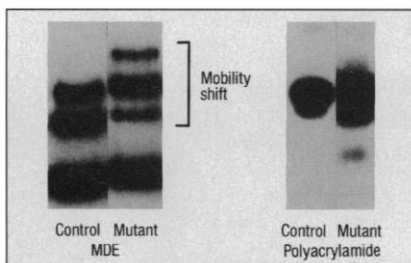
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COVER

Simulation of the reaction of nuclear waste glass with water. As the glass reacts, actinides concentrate as a stable mineral phase (blue areas) in the reacted glass and, during continued interaction with ground water, are released to solution as primary colloids. Models of

nuclear repository integrity that fail to take colloid formation and transport into account may underestimate the potential for radioactivity release. See page 649. [Image: John K. Bates, Argonne National Laboratory]



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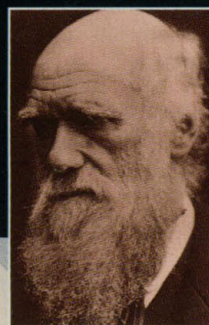
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Eukaryote evolution

How well does the information on the evolution of the eukaryotes assembled from molecular phylogenies match the view emerging from the paleontological record of their early evolution? Knoll (p. 622) discusses the biological and environmental histories that can be tested against this record. The evolutionarily successful Eucarya, which include plants, animals, fungi, and many microorganisms, are an ancient group. Phylogenies based principally on small and large ribosomal RNA indicate that eukaryotes are possibly as old as both the eubacteria and archaeobacteria; it appears that rapid bursts of evolution characterized their early history. The Precambrian paleontological and biogeochemical evidence indicates that eukaryotes were a significant part of the environment by about 1.9 billion years ago.

Calmodulin-peptide complex

Multidimensional nuclear magnetic resonance spectroscopy has revealed the solution structure of a complex between the calcium-bound form of calmodulin (CaM), a protein involved in the regulation of many signal-transduction pathways, and a target peptide, the 26-residue calcium-binding domain of skeletal muscle myosin light chain kinase. Ikura *et al.* (p. 632) found that the two domains of CaM were essentially unchanged as they clamped around the peptide to form a globular, ellipsoidal structure. Many hydrophobic interactions stabilize the complex; Trp⁴ and Phe¹⁷ of the peptide make key contacts, and numerous Met residues of CaM are involved.

Cell adhesion and learning

Certain types of learning cause new synaptic connections to form in the marine mollusk *Aplysia*, and the formation of such connections can be mimicked in culture with the neurotransmitter serotonin. Mayford *et al.* (p. 638) found that serotonin decreased the amounts of a group of cell-surface proteins on the presynaptic sensory neurons. These proteins were identified as *Aplysia* cell adhesion molecules (apCAMs) and appear to be a family of related products from a single gene. Such changes were not observed in the postsynaptic motor neuron. Bailey *et al.* (p. 645) used antibody labeling and electron microscopy to show that the decrease is due to endocytosis and apparent degradation of the apCAMs. This process could disrupt the contacts between neurons that normally inhibit growth and reorganization.

Nuclear colloids

Ground water in a nuclear waste repository could dissolve radioactive elements, and the design of such repositories usually includes multiple barriers to prevent the formation and release of dissolved actinides. In a laboratory simulation of the weathering of waste glass by water, Bates *et al.* (p. 649; cover) found, however, that some radioactive elements did not dissolve in the water but formed colloidal particles, which would need to be trapped. Transmission electron microscopy indicated that the colloids are composed of iron and sodium clay with submicrometer inclusions of a radioactive mineral. Surface reaction of the glass with water may form these colloids.

Venus waves

Ultraviolet images of the clouds of Venus reveal a large Y-shaped pattern that travels around the planet every 4 or 5 days. Detailed calculations of the possible oscillation modes in the atmosphere by Smith *et al.* (p. 652) verify previous suggestions that the pattern is a Kelvin wave, a type of wave driven by gravity and influenced by Coriolis effects. Their

model also suggests the answer to the puzzle of how the waves are maintained: cloud feedback by infrared heating might be the energy source.

Autoantibodies that nick DNA

Antibodies were found in the sera of patients with autoimmune diseases that can nick DNA through hydrolysis reactions. Shuster *et al.* (p. 665) isolated and purified immunoglobulin G (IgG) and IgM antibodies from patients with systemic lupus erythematosus. The DNA hydrolysis activity was assayed by measuring DNA polymerase I activity, which requires a nick for initiation, and by a linear dichroism method. The pattern of DNA cleavage for these autoantibodies was unlike that of deoxyribonuclease I (DNase I) or of DNase from human sera.

Fear and forgetting

The hippocampus is normally thought to be involved in temporary memory storage; damage to the hippocampus can cause retrograde amnesia, in which the recall of recent memories is

impaired. However, the hippocampus may also be crucial for long-term retention of certain emotional memories as well. Kim and Fanselow (p. 675) studied the effect of hippocampal lesions on a learned fear response in rats, in which the rats were conditioned to both a tone and to a context (a particular chamber). The fear response to the tone did not depend on the hippocampus. In contrast, the fear response to the context was initially critically dependent on the hippocampus but by 28 days after conditioning it too did not require the hippocampus. The hippocampus appears to be critical for the retention of some but not all associative fear memories, and it may have a time-limited role that is assumed later by other brain structures.

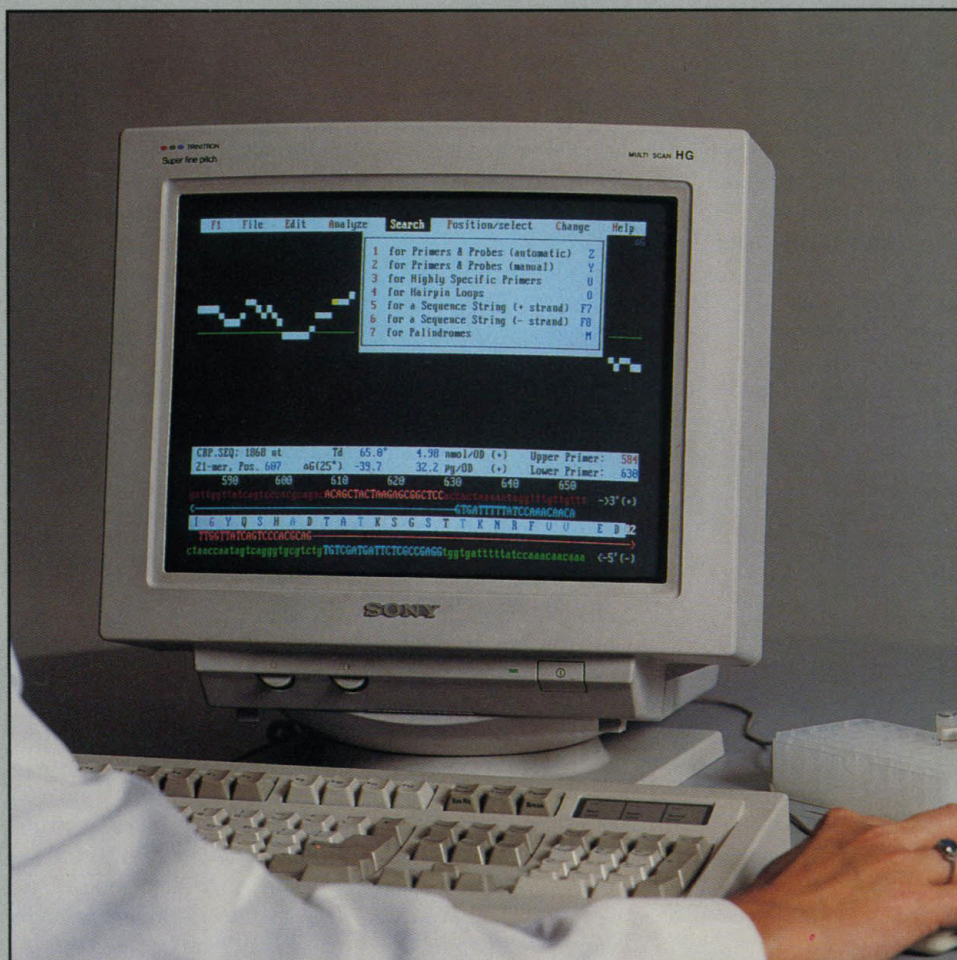
Pinpointing calcium

Release of neurotransmitters from vesicles in the presynaptic axon terminal of a neuron requires an increase in intracellular calcium; Llinás *et al.* (p. 677) present direct evidence for the existence of microdomains (less than 1 square micrometer) of high calcium concentration (200 to 300 micromolar) that presumably result from the opening of calcium channels. The influx of calcium is thought to lead to the exocytosis of vesicles, which fuse and release neurotransmitter molecules to the postsynaptic axon of an adjoining neuron. The bioluminescent protein *n*-aequorin-J was used to monitor calcium concentrations; its low affinity allowed for the time-lapse recording of areas of high calcium concentration while the neuron was continuously stimulated.

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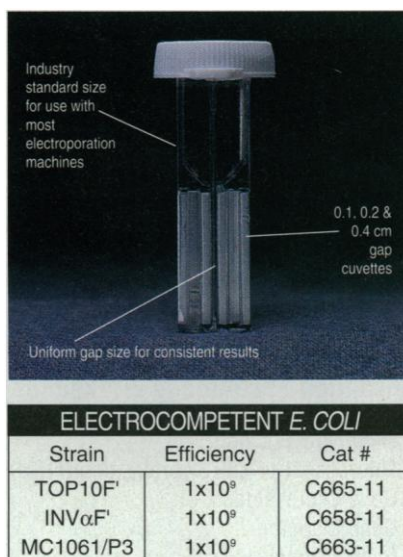
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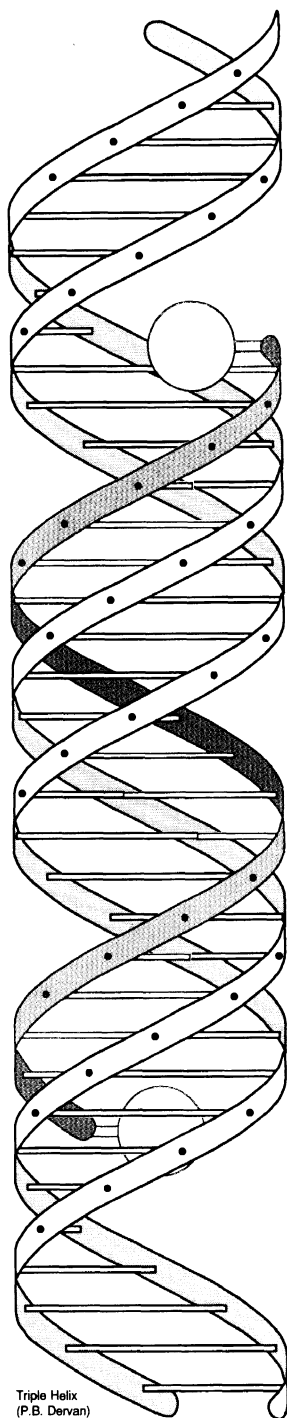
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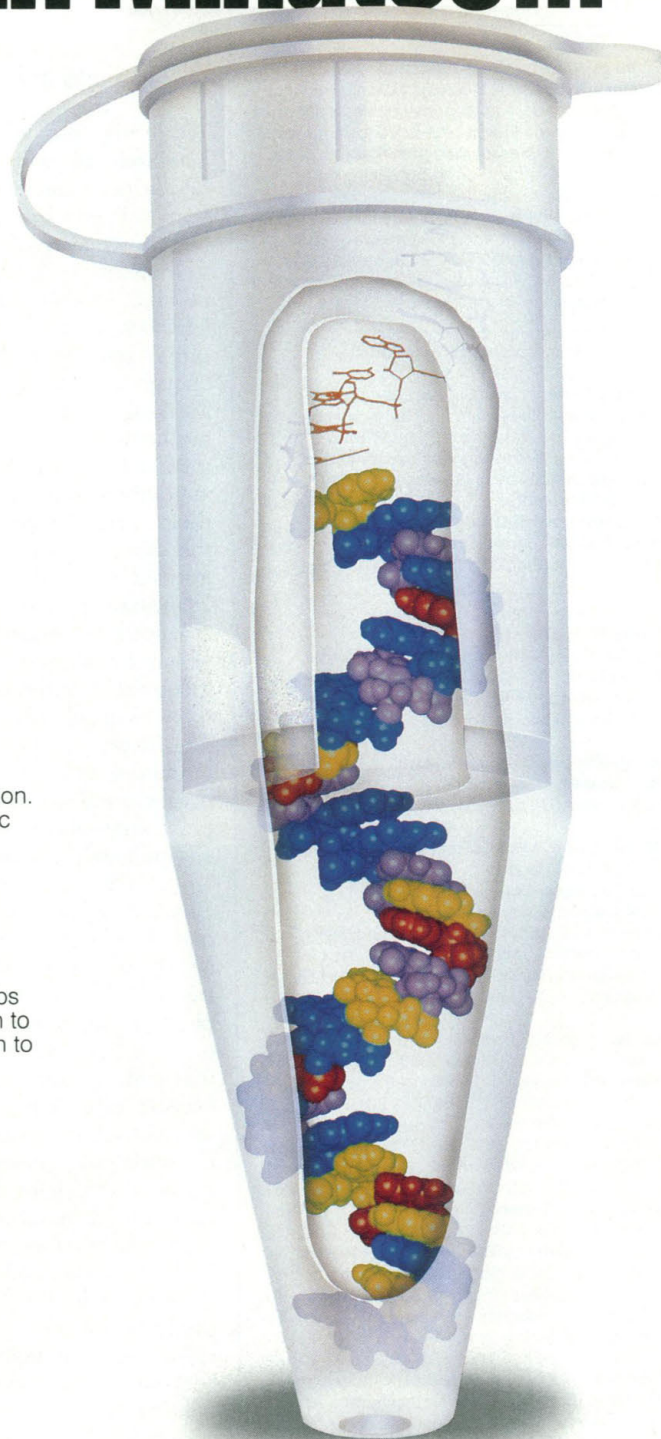


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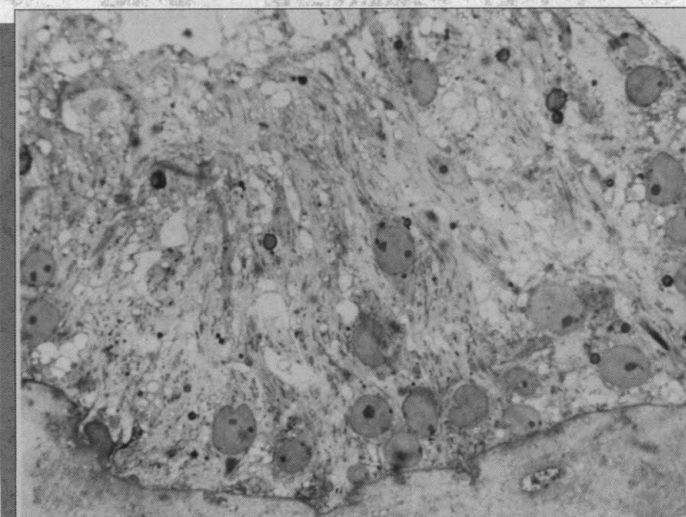




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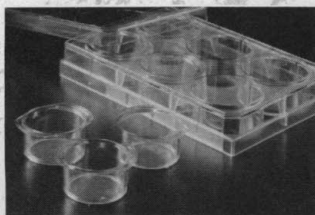


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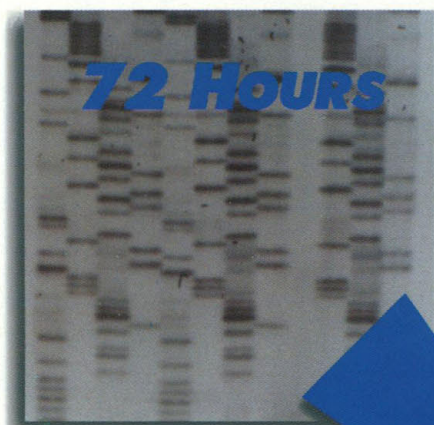
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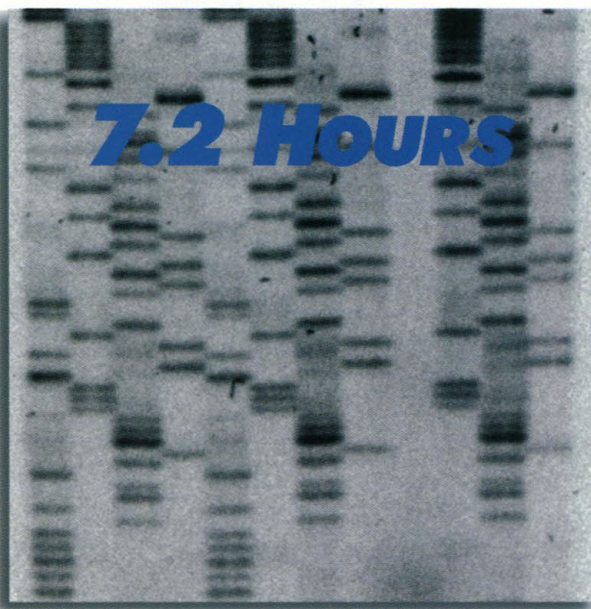
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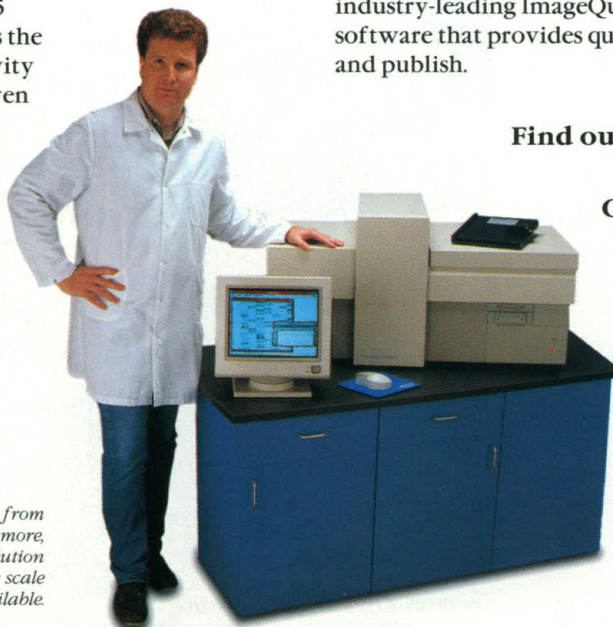
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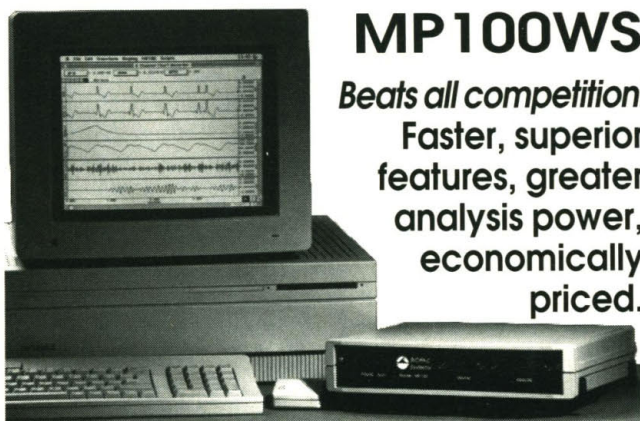
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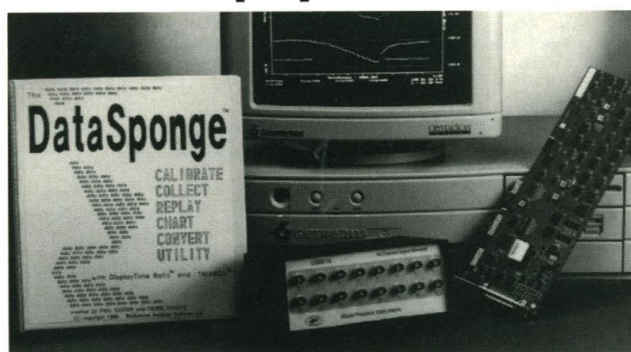
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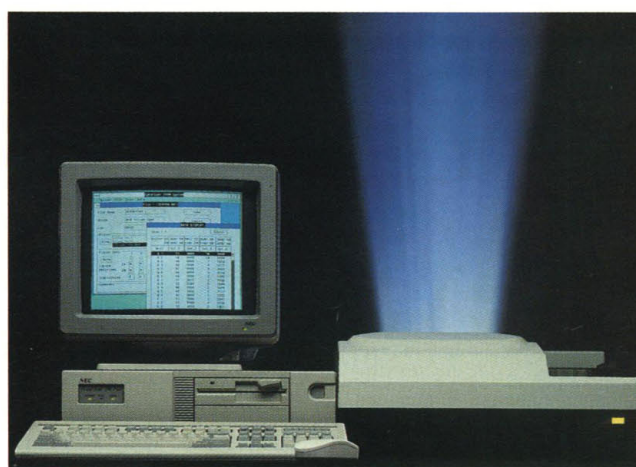
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