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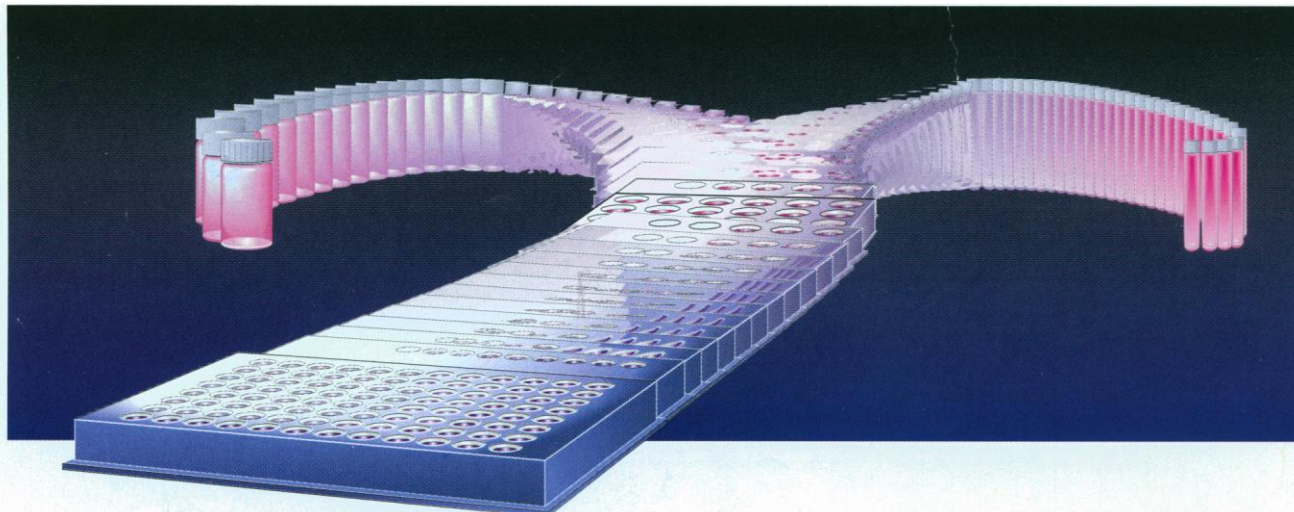
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BOOK ISSUE



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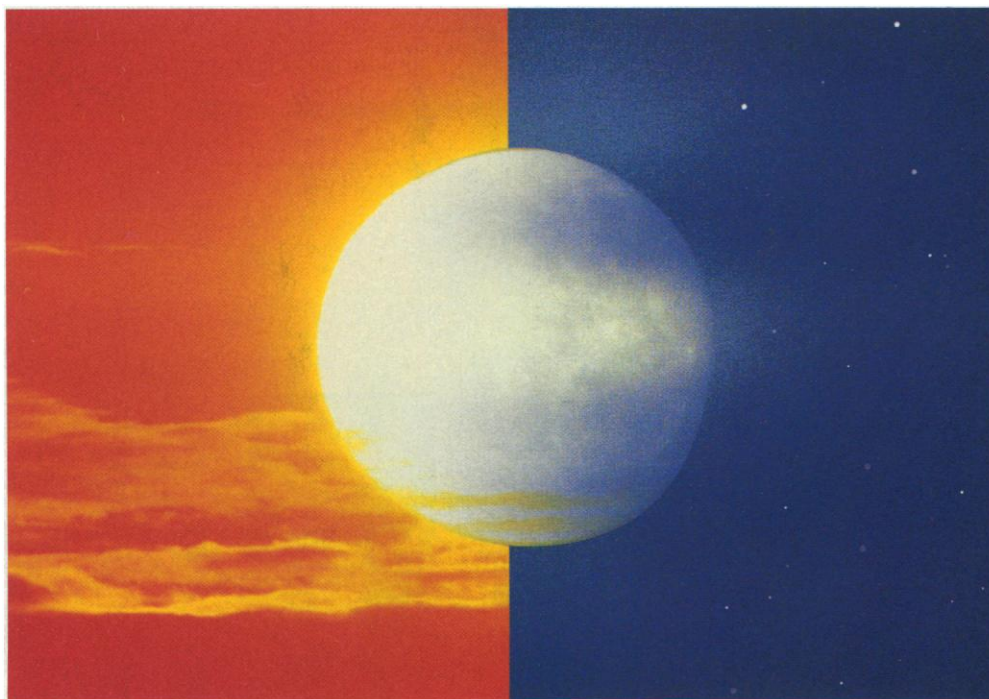


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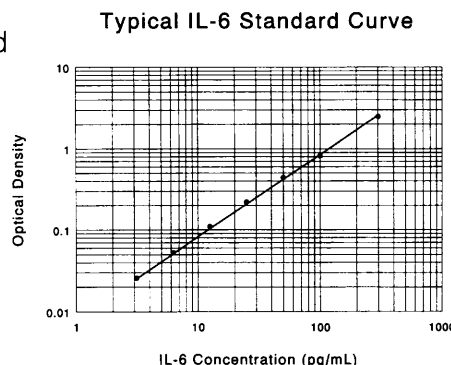


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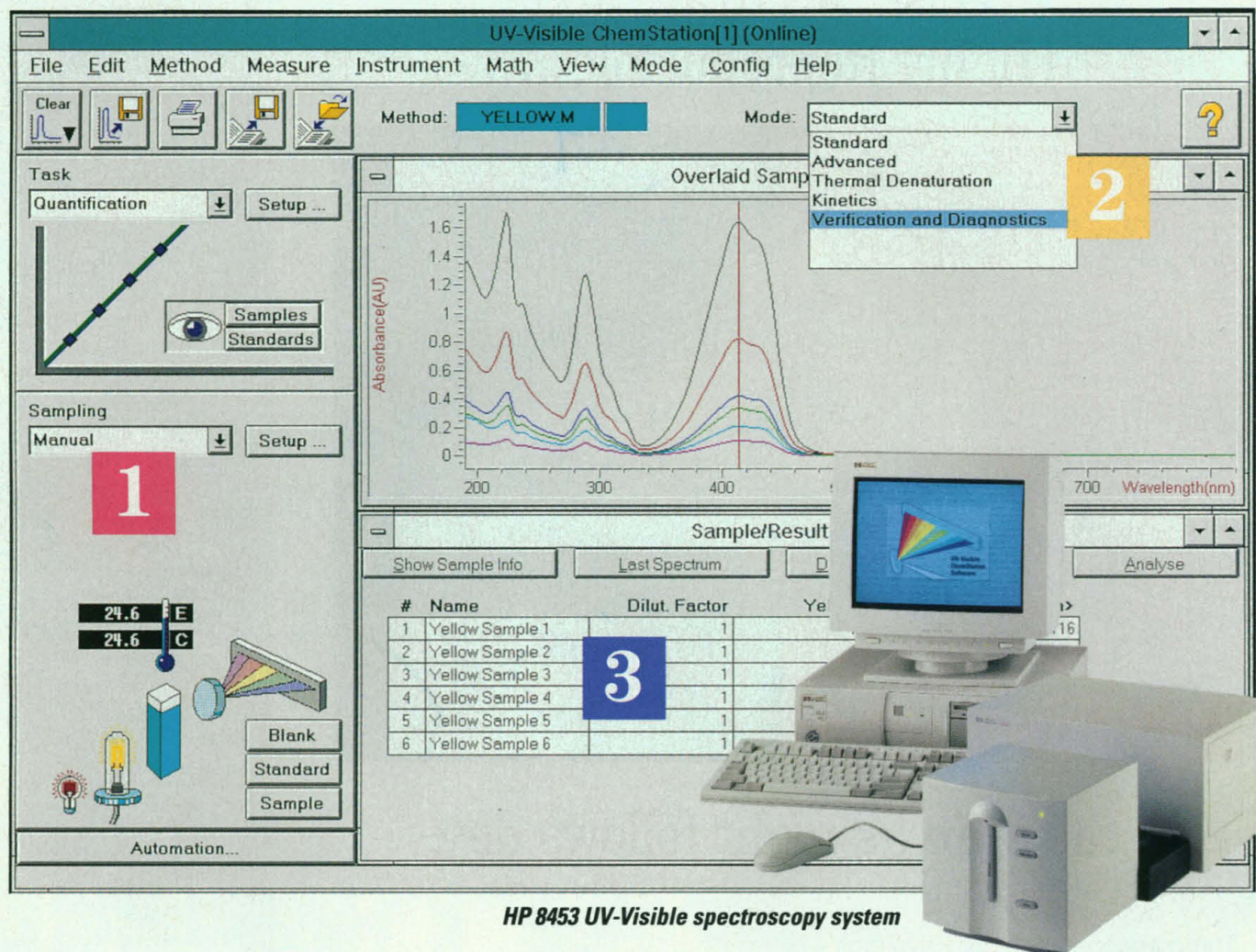
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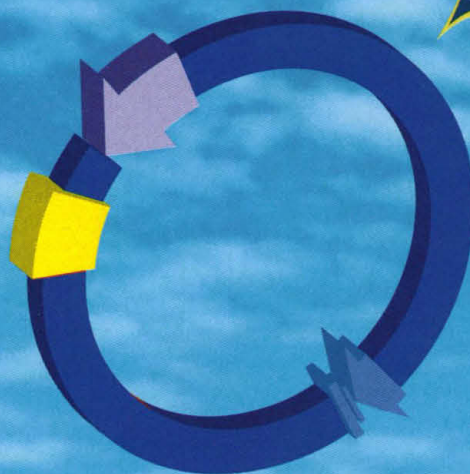


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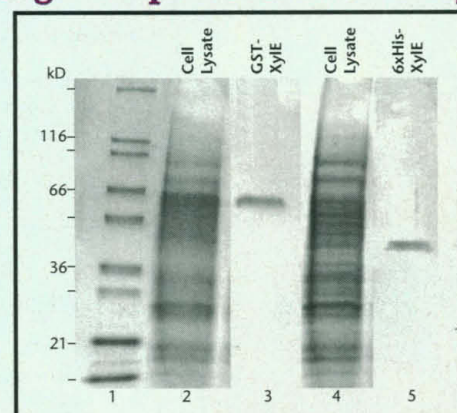
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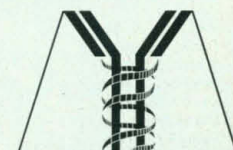


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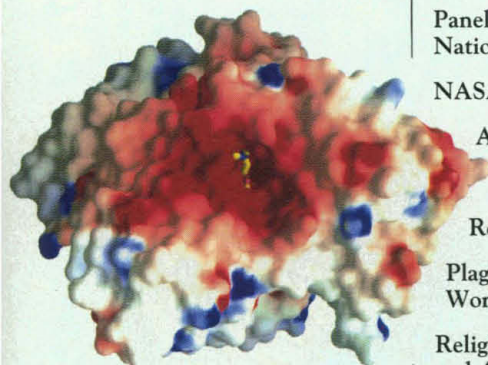
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* The 6xHis vectors were developed by PharMingen and produced in collaboration with QIAGEN. The Ni-NTA Agarose is produced by QIAGEN.

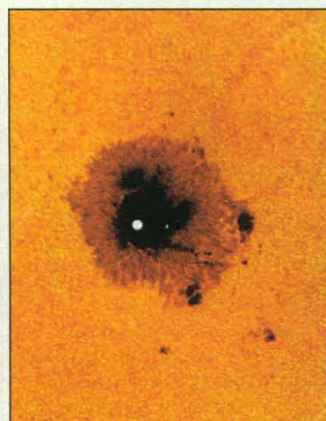


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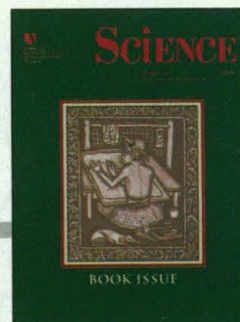
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COVER

Self-portrait by the Balinese painter I. Madé Djata (around 1938), from Hildred Geertz's book *Images of Power*, reviewed on page 1218. Botanical art, German rocketry, discoveries of the Challenger expedition, and galactic photography are among the subjects of books

treated in this special issue, beginning on page 1196. A listing of publishers' addresses and an index of books reviewed in the past year are also included. [Note: The graphic devices that separate the groups of reviews are details from an illustration in *Images of Power*]



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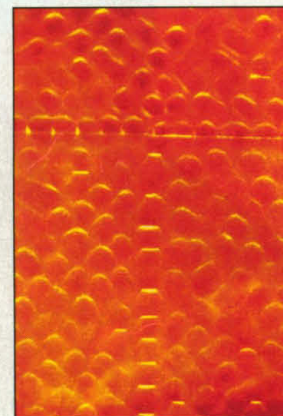
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Cracking under stress



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Hot water

The photosphere of the sun is too hot for molecular water to exist, but Wallace *et al.* (p. 1155) have found spectral evidence for water in the infrared bands recorded from the relatively cool environment of sunspot umbrae. At 3500 kelvin, the umbrae are just cool enough for water rather than OH to be the dominant oxygen-containing molecule.

■

Layer by layer

The mechanism of high temperature superconductivity in the cuprate oxides remains obscure. Anderson (p. 1154) observes that the far-infrared reflectivity of lanthanum-strontium cuprate shows anomalies if the superconductivity is viewed via a Fermi liquid model with Bardeen-Cooper-Schrieffer interactions. But if the data are interpreted with a model where the pair condensation energy comes from interlayer Josephson coupling, determinations can be made of the electron coherence length and penetration depth that agree with experiment.

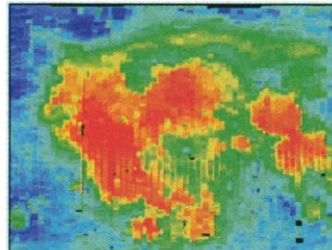
■

Sleep learning

Artificial neural networks are typically constructed from connected layers of neurons. Hinton *et al.* (p. 1158) describe an architecture with two parallel systems of connections: A bottom-up system converts input data into a network representation, while a top-down path generates "fantasy" input from representations in higher layers. The system runs in either a "wake" phase, in which generative connections are adjusted in accordance with a recognition task, or a "sleep" phase, in which the fantasy inputs are used to adjust the recognition connections.

Ironing out the moon's origin

The moon's composition, particularly its iron and aluminum contents, offers important clues to its origin. Apart from the significant but limited Apollo samples, most information derives from remote sensing. Interpretation is complicated because lunar reflectivity depends not only on the Fe content, but on processes such as solar wind exposure and physical changes associated with soil formation. Using laboratory studies of these effects, Lucey *et al.* (p. 1150) derived an empirical relation that yields Fe content from reflectance. Analyzing Clementine data, they find that the abundance of anorthosite—a rock rich in Al and poor in Fe—is much greater than previously thought. Overall, the moon is poorer in Fe and richer in refractory elements than was suspected. Together these data support the notion that the moon is the product of a giant impact into an early Earth.



Chlorine to go

Some microorganisms are capable of treating and degrading industrial wastes before they are released to the environment, but certain compounds, such as highly halogenated organic compounds, are often bioremediated very slowly, if at all. Sorokin *et al.* (p. 1163) show that 2,4,6-trichlorophenol, a by-product of paper production, can be efficiently oxidized to biodegradable products by hydrogen peroxide and an easily accessible biomimetic catalyst, iron sulfophthalocyanine.

■

Proteins that bind (I)

Many RNA-binding proteins in eukaryotes recognize uridine-rich regions known as polypyrimidine tracts, which are located upstream of 3' splice sites. Singh *et al.* (p. 1173) define the binding sequence preferences of three RNA-binding proteins: U2AF⁶⁵, an essential splicing factor; Sex-lethal, a splicing regulator; and polypyrimidine tract-binding protein (PTB). Each of these proteins has dis-

tinct RNA sequence binding preferences, and it appears that PTB can regulate alternative splicings by repressing the use of certain 3' splice sites that contain a PTB binding site.

■

Proteins that bind (II)

Tyrosine-phosphorylated proteins, generated by the activity of tyrosine kinases and subsequently assembled into signaling complexes, are essential to the signaling process initiated by growth factors and oncogenes. Both the Src homology 2 (SH2) domain and the more recently identified phosphotyrosine binding (PTB) domain bind to tyrosine-phosphorylated proteins, but Kavanaugh *et al.* (p. 1177) have now shown that the PTB domains bind to different targets than the SH2 domains; PTB domains recognize an amino acid motif that the SH2 domain passes over. The additional requirement of a specific secondary structure for high-affinity binding may offer new regulatory signaling pathways.

Paternity suite

Human evolutionary history may be discernible from sequence analysis of the paternally inherited Y chromosome, depending on its polymorphism. Dorit *et al.* (p. 1183; see also Perspective by Pääbo, p. 1141) obtained sequences of an identifiable 729-base pair intron of the Y chromosome from 38 men of varied geographical origin, and found no polymorphism: All the sequences were identical. The corresponding regions in chimpanzees, gorillas, and orangutans do show quantifiable sequence variability, ruling out functional constraints on this intron sequence as an explanation for human monomorphism. If recent common ancestry is the reason for this lack of variation, a divergence date of 270,000 years ago is indicated.

■

Unhelpful helpers

In insulin-dependent diabetes mellitus, an autoimmune disease, insulin production in the pancreas is destroyed by the action of a disparate population of leukocytes, including CD4⁺ T cells as well as many other types. Katz *et al.* (p. 1185) have investigated the idea, partially supported by some mouse experiments, that of the two broad types of CD4⁺ cells, T helper 1 (T_H1) cells promote this kind of diabetes, while T_H2 cells protect against it. Helper cells of the specific subsets were generated that expressed a T cell receptor known to cause diabetes. When introduced into mice susceptible to diabetes, both kinds of T helper cells invaded the islets of Langerhans, but only the T_H1 cells induced a damaging autoimmune response. The T_H2 cells neither affected the course of diabetes nor protected against T_H1-induced damage.

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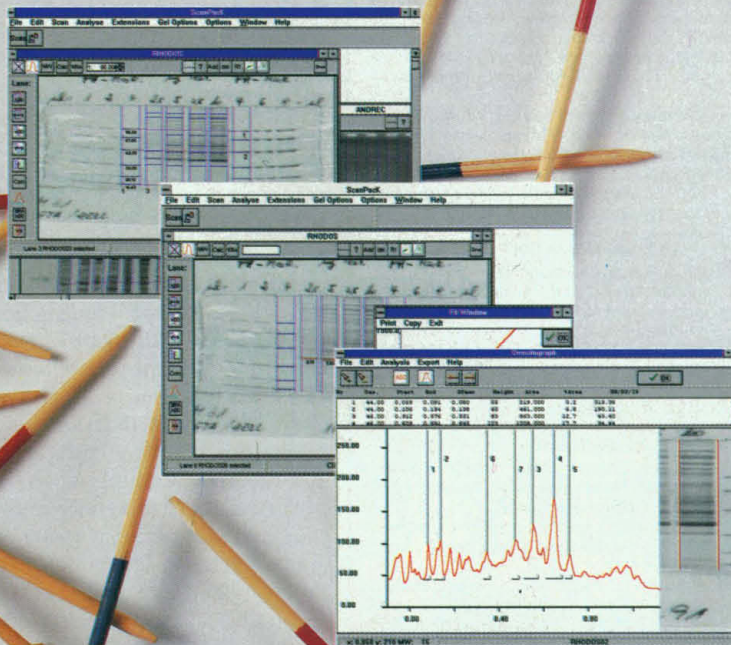
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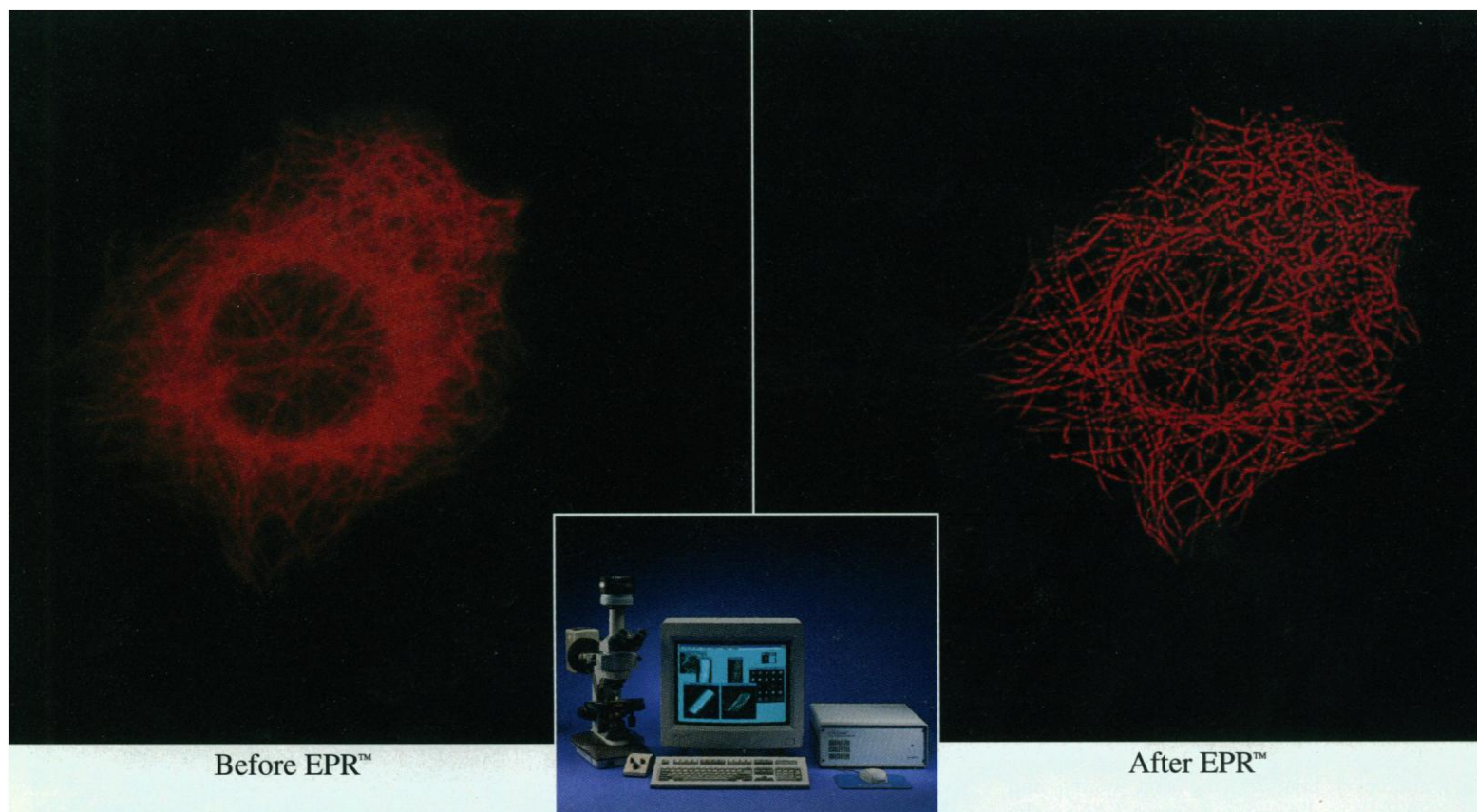
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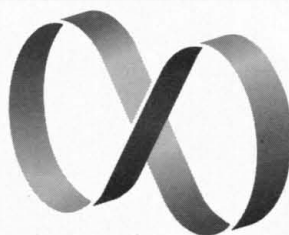
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Above: Normal Rat Kidney cell with a rhodamine label against tubulin. Images acquired by Douglas Bowman of the UMass Medical School using a conventional fluorescence microscope.

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Unfortunately, today America's technological prowess is severely threatened. As the federal government undergoes downsizing, there is pressure for critical university research to be slashed.

University research makes a tempting target because many people aren't aware of the critical role it plays. It can take years of intense research before technologies emerge that can "make it" in the marketplace. History has shown that it is federally sponsored research that provides the truly "patient" capital needed to carry out basic research and create an environment for the inspired risk-taking that is essential to technological discovery. Often these advances have no immediate practical usability but open "technology windows" that can be pursued until viable applications emerge. Such was the case with pioneering university research done on earthquakes in the 1920s, which led over time to the modern science of seismology and the design of structures that better withstand earthquake forces.

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For all these reasons, it is essential that the federal government continue its traditional role as funder of both basic and applied research in the university environment. If we want to keep the American Dream intact, we need to preserve the partnership that has long sustained it. As we reach the final years of the century, we must acknowledge that we face a moment of truth:

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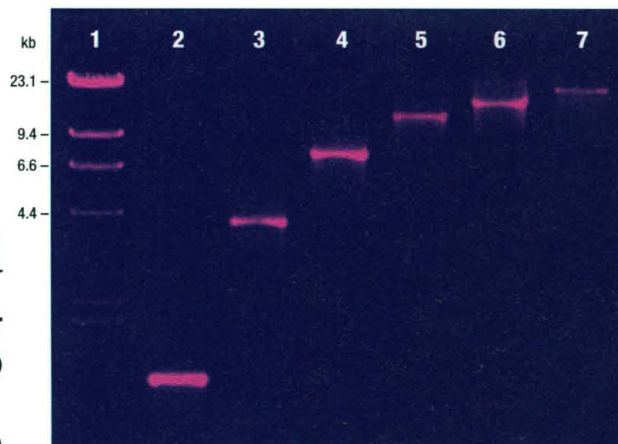
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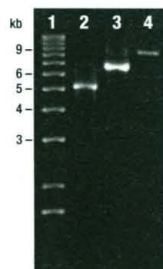
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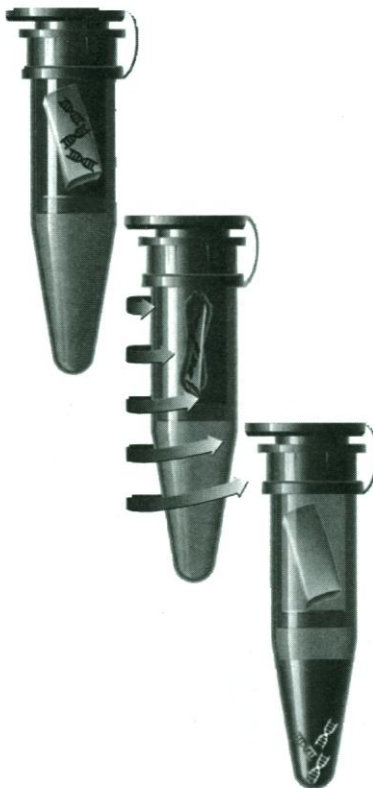
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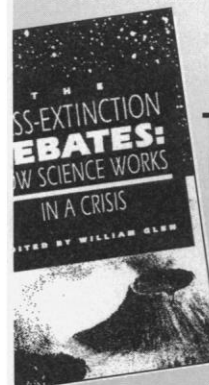
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