AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

SCIENCE

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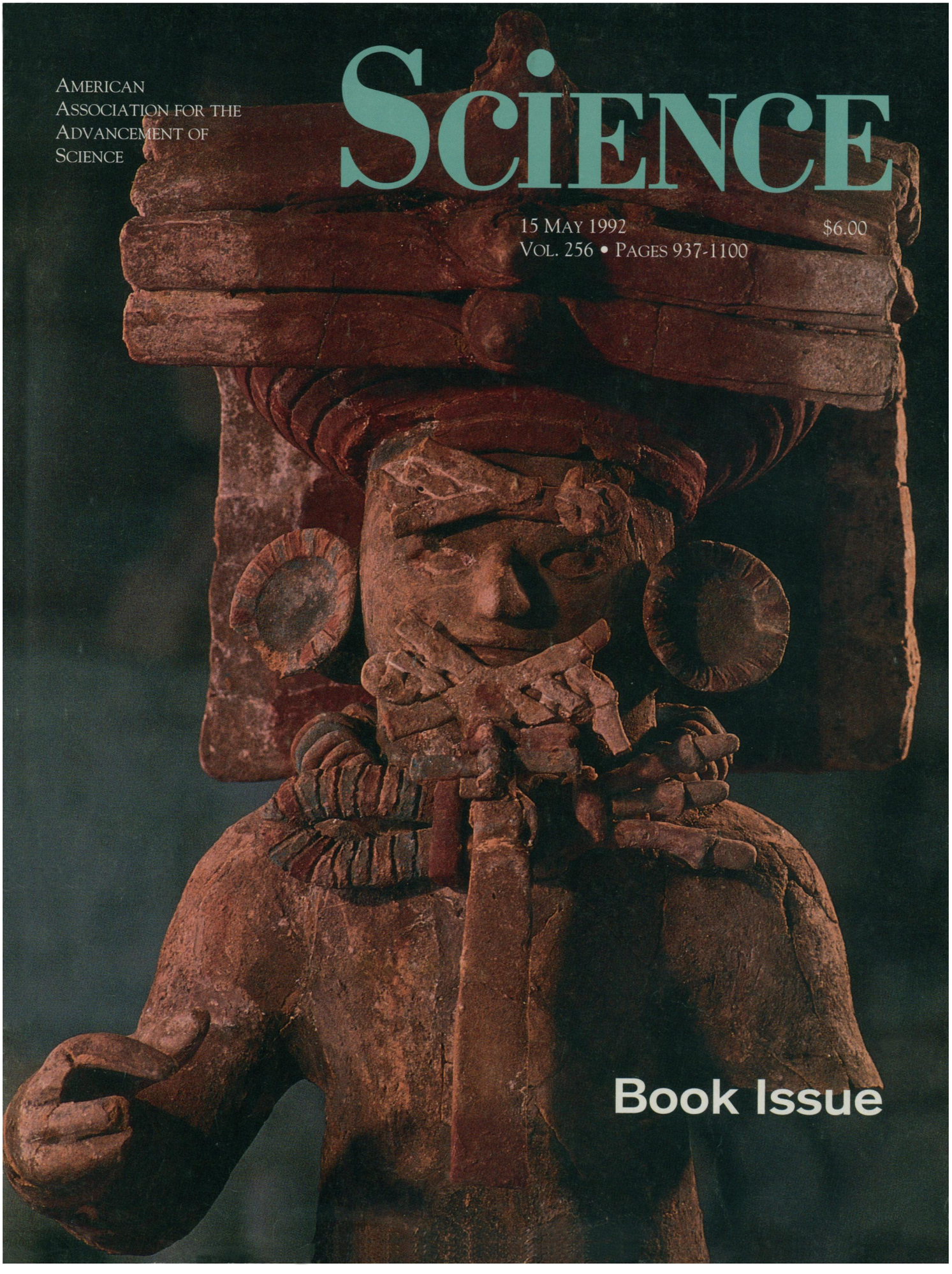
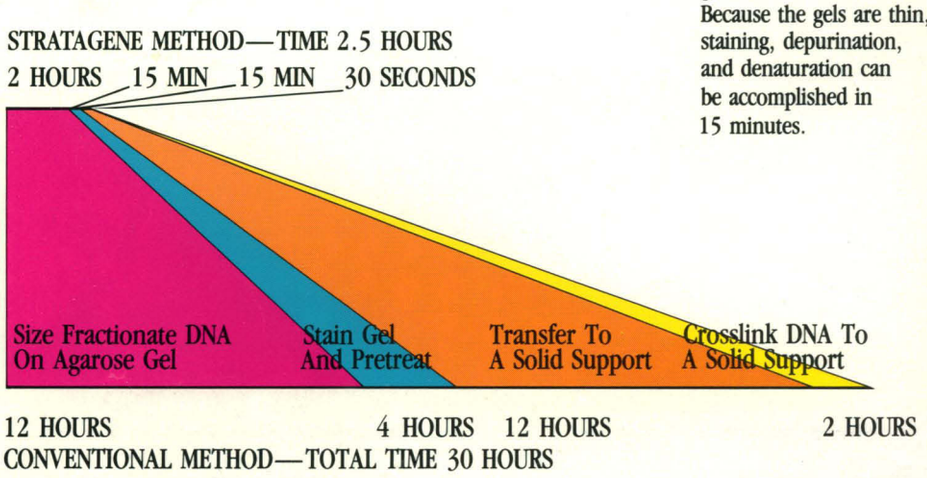


Book Issue

Southerns/Northerns: Electrophoresis, Blotting, and Crosslinking in 2.5 Hours Instead of 30.

Stratagene has streamlined agarose gel electrophoresis and blotting. The system decreases the time required, from sample loading to prehybridization ten fold.



VAGE™ System

The VAGE™ vertical agarose/acrylamide gel electrophoresis system allows the casting of agarose or acrylamide gels in the unit. Nucleic acids can be electrophoresed through a 3 mm, 0.8% vertical agarose gel in less than two hours with excellent resolution (Figure 1). Because the gels are thin, staining, depurination, and denaturation can be accomplished in 15 minutes.

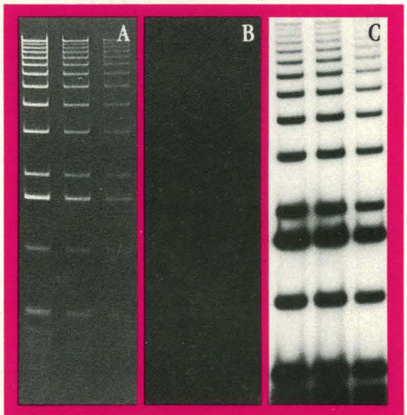
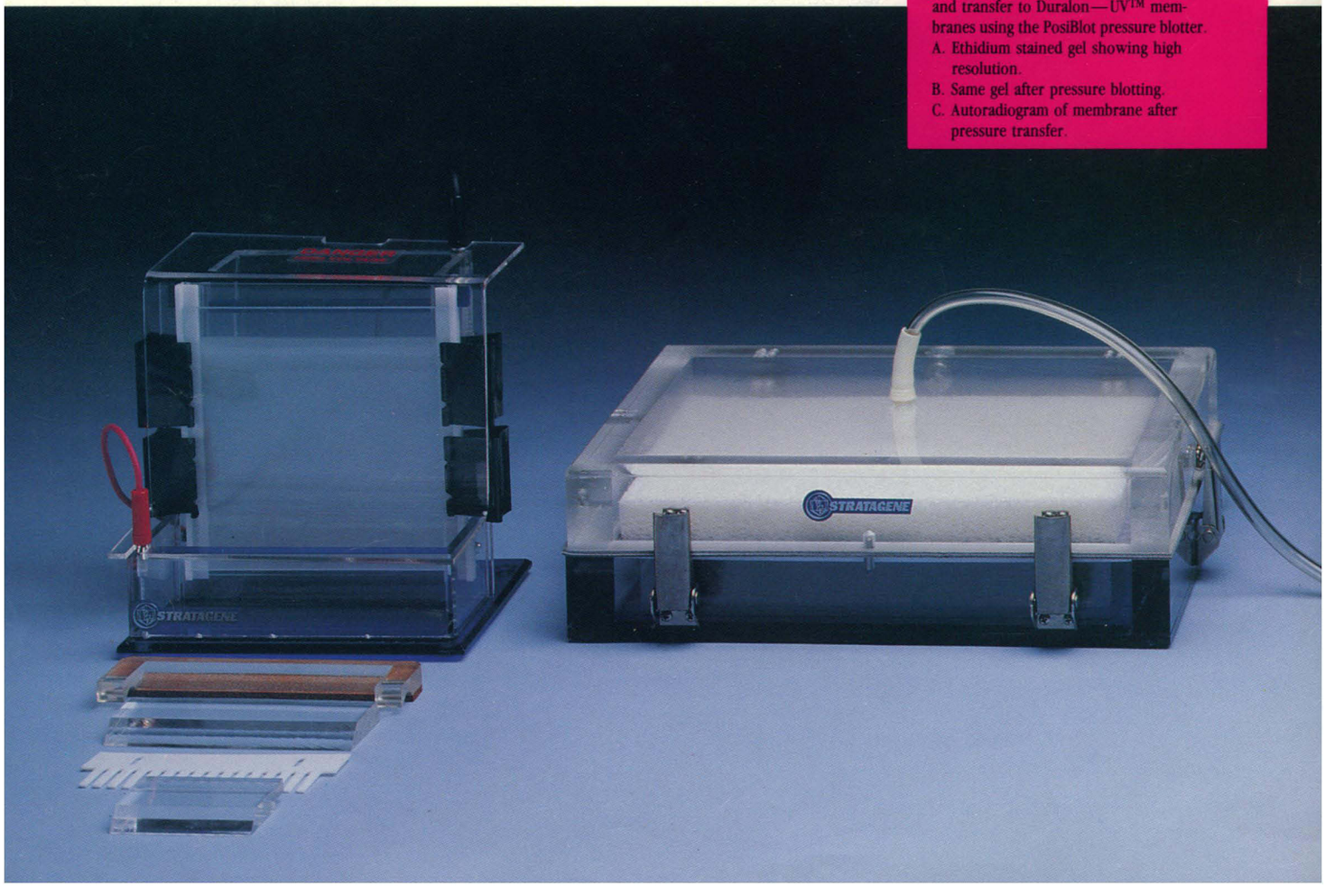


FIGURE 1:
Figure Legend: Fractionation of end labeled DNA markers on 3mm thick 0.8% agarose by the VAGE apparatus and transfer to Duralon—UV™ membranes using the PosiBlot pressure blotter.
A. Ethidium stained gel showing high resolution.
B. Same gel after pressure blotting.
C. Autoradiogram of membrane after pressure transfer.



PosiBlot™* Pressure Blotter

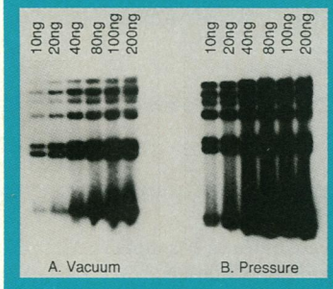


FIGURE 2:
Figure Lengend: ^{32}P end-labeled lambda Hind III markers were electrophoresed in 0.8% agarose. The DNA was then transferred to a nylon membrane with a vacuum blotter at 30mm Hg below atmospheric or with the PosiBlot pressure blotter at 100mm Hg above atmospheric. Both transfers were carried out for 15 minutes. As can be seen, pressure blotting transferred significantly more DNA in the same period of time, especially in the higher molecular weight range (largest band is 23 kilobases).

The PosiBlot™ positive pressure blotter permits the transfer of nucleic acids in 1/3 the time of vacuum blotters and 1/50 the time of capillary blotting (Figure 2). Pressure blotting does not dehydrate gels as do other methods. This allows the use of substantially higher pressure differentials, compared with vacuum blotting, without gel collapse. The PosiBlot apparatus reduces blotting time to 15 minutes.

FIGURE 3:
Figure Legend: Autoradiogram showing the resolution of 2.8 and 1.3 Kb Msp I RFLP alleles revealed by a cystic fibrosis human DNA probe using the VAGE, PosiBlot and Stratalinker all in 2.5 hours.

Stratalinker™* UV Crosslinker

The Stratalinker™ UV Crosslinker fixes nucleic acids to solid supports such as nitrocellulose or nylon membranes, in less than one minute. This compares favorably to vacuum baking, which requires 2 hours. The Stratalinker actually monitors the ultra violet energy flux and deactivates the light source upon reaching the user-programmed energy level (Figure 4). Figure 3 shows an autoradiogram of a human genomic Southern blot performed using the VAGE, PosiBlot and Stratalinker all in 2.5 hours.

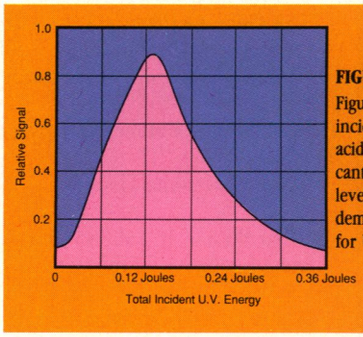


FIGURE 4:
Figure Legend: The effects of altering the incident energy for crosslinking nucleic acids to nylon membranes. The significant drop in signal intensity at energy levels below and above 0.12 Joules demonstrates the limited optimal range for UV treatment.

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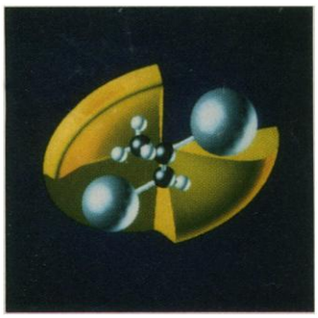
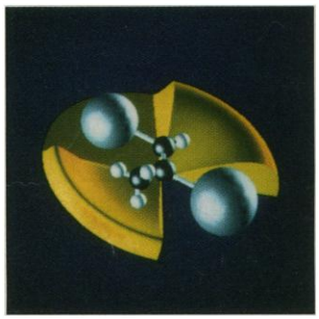
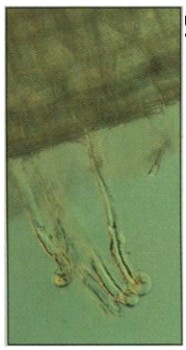




964 Choosing between mirror-image molecules



998 Alfalfa root hairs respond to *Rhizobium meliloti*

NEWS & COMMENT

RESEARCH NEWS

PERSPECTIVES

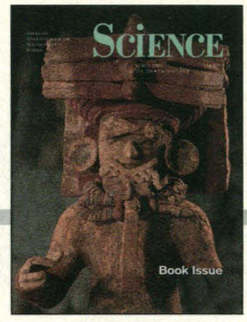
ARTICLES

RESEARCH ARTICLE

DEPARTMENTS

COVER

Ceramic effigy from outside the Maya tomb of the Royal Scribe at Copán, Honduras, one of the artifacts depicted in *Scribes, Warriors and Kings*, reviewed on page 1062. In addition to views of what years of archeological inquiry tell us about the Maya, a two-century conspectus on developmental biology and critiques of the role of scientists in public affairs are among the features of this Book Issue. For a list of books reviewed in this issue, see page 1035. [Photograph: Kenneth Garrett]



REPORTS

SPECIAL BOOK SECTION

1012
Scanning tunneling microscopy of organic superconductors

◩ Indicates accompanying News story or Perspective

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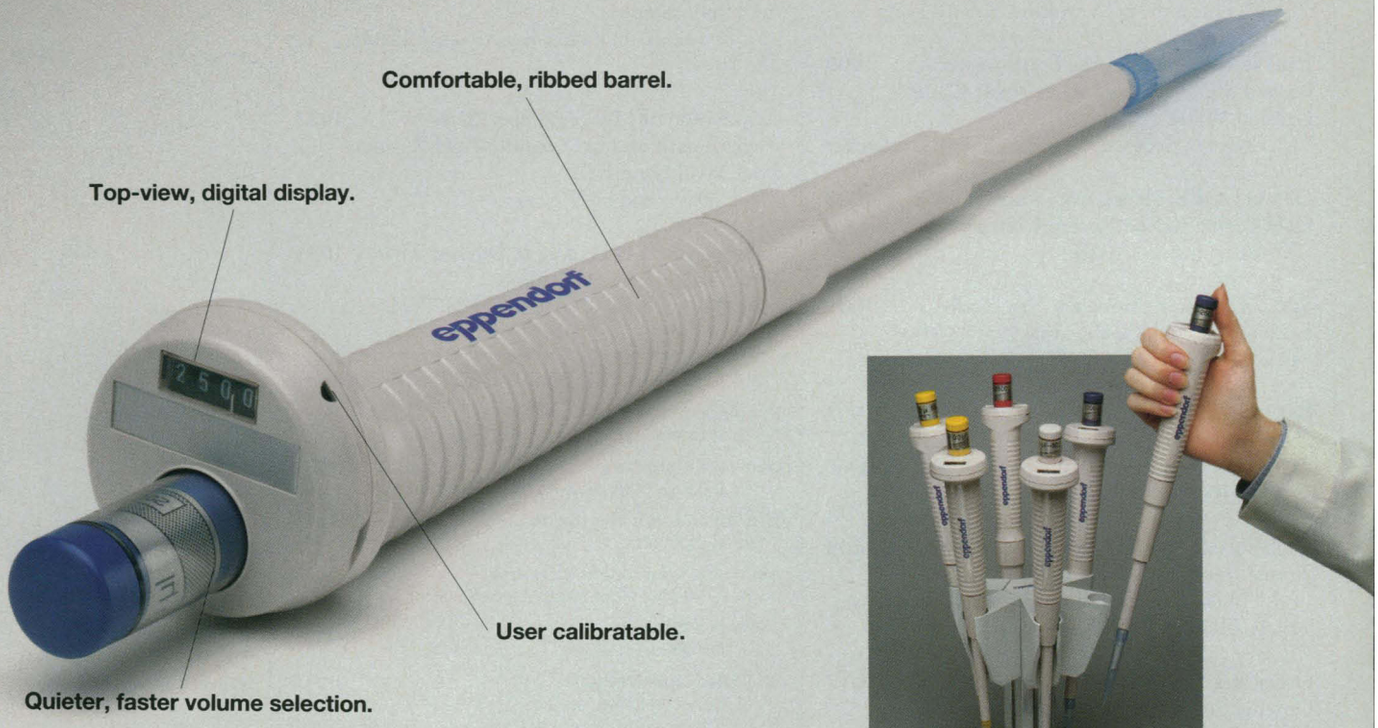

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THIS WEEK IN SCIENCE

edited by PHIL SZUROMI

Root response

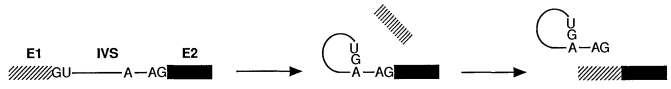
The symbiotic interaction between *Rhizobia* bacteria and leguminous plants results in the development of nitrogen-fixing root nodules. Ehrhardt *et al.* (p. 998) studied the very early response of the plant, in this case alfalfa, to the infecting bacteria, *Rhizobium meliloti*. The bacteria secrete Nod factors, which serve as early nodulation signals, and the root hairs of the plant respond to these factors by developing curled forms, which are then infected by the bacteria. Ehrhardt *et al.* found that when Nod factors are applied to intact normal root hairs, a slow depolarization of the root hair cell membrane can be detected. Root hair cells already treated with Nod factors were less sensitive to subsequent treatments.

Temperatures and paleotemperatures?

Thermometer records only extend back about 100 years, but because changes in the geothermal gradient with depth reflect changes in average air temperatures, longer records can be obtained from boreholes. Wang and Lewis (p. 1003) describe borehole measurements for the past few centuries from Quebec and show that the turn of the 20th century was marked by a cold period. Even longer continental records, covering the last glacial maximum and subsequent Holocene warming, can be obtained from noble gases dissolved in ground water systems, as described by Stute *et al.* (p. 1000). The concentrations of the gases reflect the surface temperature at the recharge sites when the waters entered the aquifer. Data from the Carrizo aquifer in Texas indicate that temperatures during the last glacial maximum at high altitudes were 5°C lower than they are today. This amount of cooling is much greater than that recorded for surface water in nearby ocean basins.

Second splicing step

Long RNA molecules that were modified at 2'-hydroxyl (2'-OH) sites were used by Moore and Sharp (p. 992) to study the importance of this group in the splicing of pre-messenger RNA. The 2'-OH–modified RNA molecules were synthesized with bacteriophage T4 DNA ligase, which has an RNA ligase activity. The RNA molecules to be joined together were aligned with a complementary DNA template. Substitution with 2'-H or 2'-OCH_3 groups revealed that the 2'-OH is not absolutely required in the first splicing step that cleaves the intervening sequence (IVS) from the 5' exon (E1) by forming a lariat structure.



However, the 2'-OH group is important at the 3' splice site in the second step in splicing in which the IVS is excised from the 3' exon (E2), which is ligated to E1.

Stressed out fault

Although the expected large earthquake has not yet appeared at Parkfield along the San Andreas fault, the microseismicity is producing interesting patterns. Malin and Alvarez (p. 1005) show that during a 12-month period the epicenters of microearthquakes slowly migrated 30 to 50 kilometers southeastward along the fault. This movement might load parts of the fault.

Follow the bonds

Electron transfer rates between metal atoms in cytochrome c molecules that contained ruthenium complexes were measured by Wuttke *et al.* (p. 1007), who found that the rates were best explained with a model in which the electron followed a σ-tunneled pathway, which included covalent bonds as well as weaker couplings provided by hydrogen bonds and through-space jumps. The rate of electron transfer between the iron atom of the heme group and the ruthenium atom, which could be attached as a metal complex to various histidine residues, was inconsistent with the edge-edge distances between the histidine and heme groups.

X-ray imaging

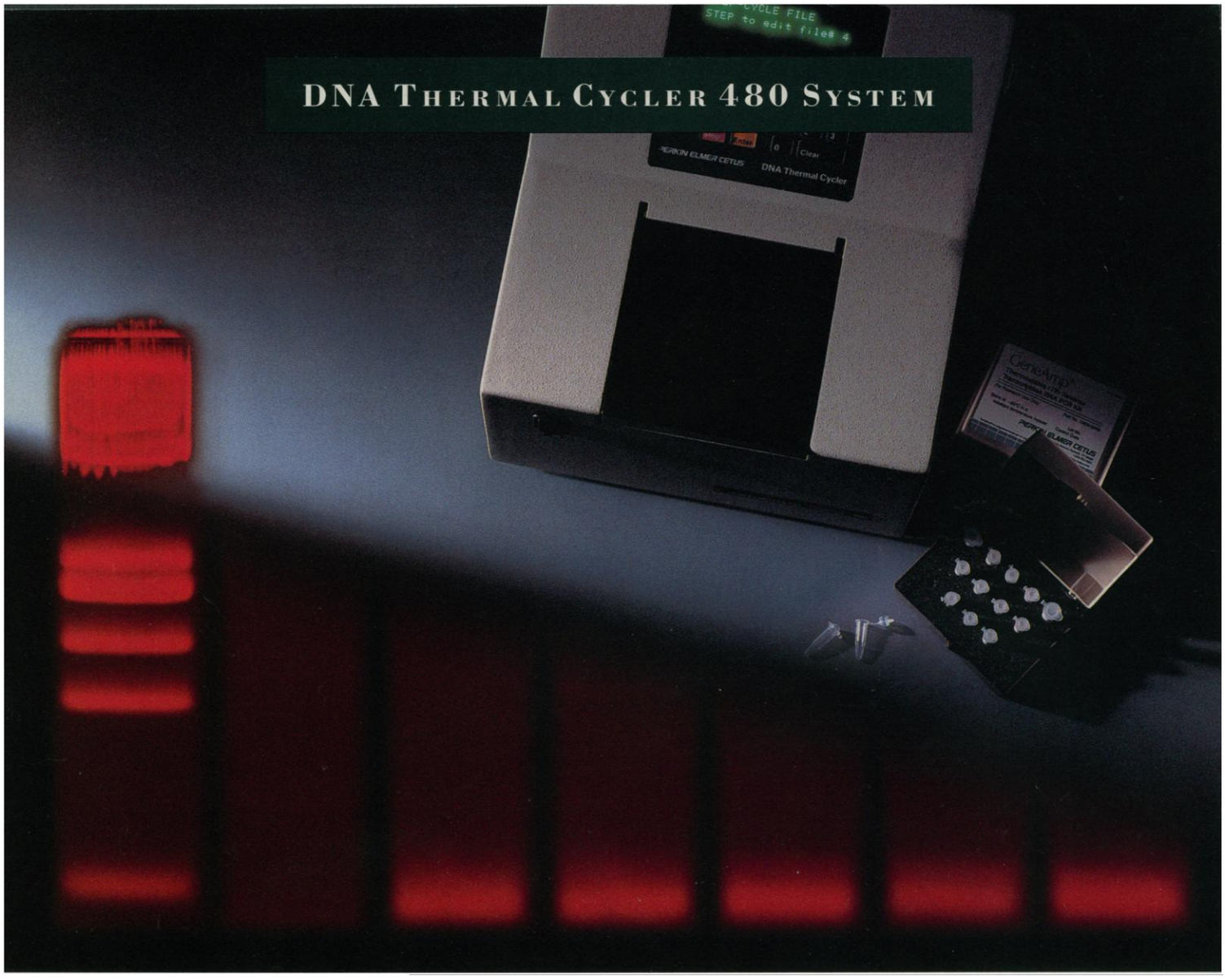
Holographic microscopy with x-rays offers the possibility of high-resolution imaging, but conventional optical systems fail with short wavelength illumination. McNulty *et al.* (p. 1009) demonstrate an imaging concept in which x-ray Fresnel lenses are used to create interference patterns that are digitally recorded with an array detector. An image of the specimen can then be numerically reconstructed by taking the two-dimensional Fourier transform. Resolution of the Fourier transform system is limited by the size of the reference source, rather than the resolution of the detector, and may ultimately approach 10 nanometers.

Acute vision

The human visual system is capable of hyperacuity—spatial judgments much finer than the spacing of rods and cones in the retina would seem to allow. Poggio *et al.* (p. 1018) propose a model in which the brain sets up, early in the visual pathway, networks that quickly learn to solve specific tasks. With photoreceptor data as input information, these network modules can solve vernier acuity tasks (such as deciding whether three dots are collinear) after being trained on only a few examples. The computer model yielded predictions about how the human visual system should perform: just as in the simulation, the error rate for an acuity task given to human subjects quickly dropped over a few tens of trials.

High frequency in the hippocampus

Intracortical recordings made with multichannel, microminiature silicon probes revealed bursts of high-frequency oscillations (200 hertz) in the hippocampal CA1 neuronal network of the rat. Buzsáki *et al.* (p. 1025) found that these oscillations were also spatially correlated across the hippocampus. Individual pyramidal cells discharged during the negative phase of the high-frequency oscillation but at a lower rate. Thus the oscillation is not due to a single cell but is a product of cellular cooperativity. Such transient bursts can produce large depolarizations in the cells targeted by the hippocampus and may result in long-term postsynaptic modifications.



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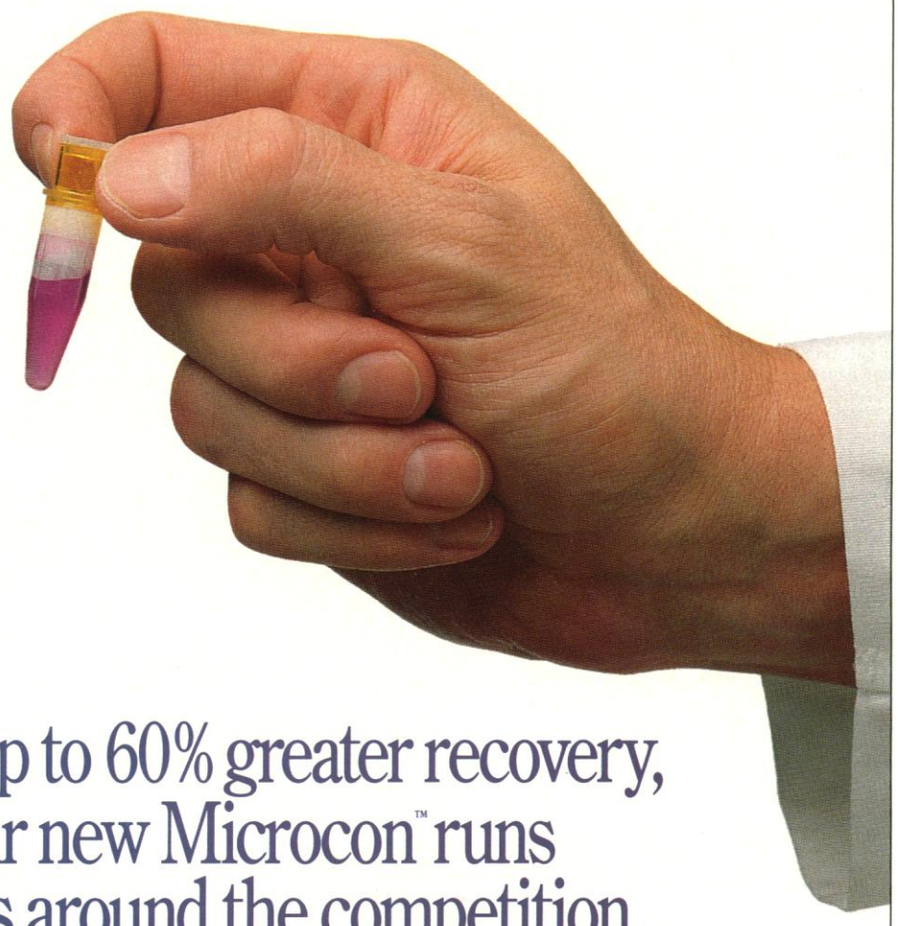

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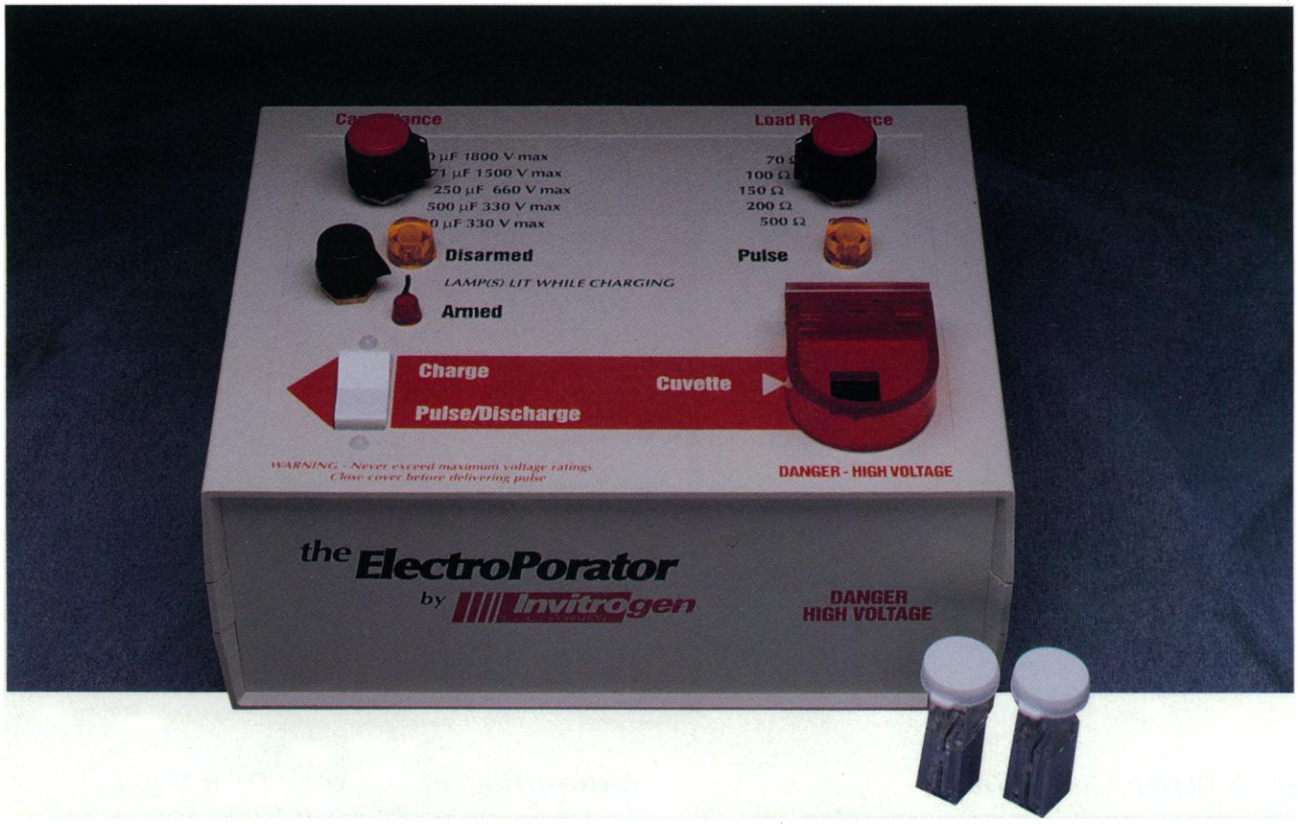

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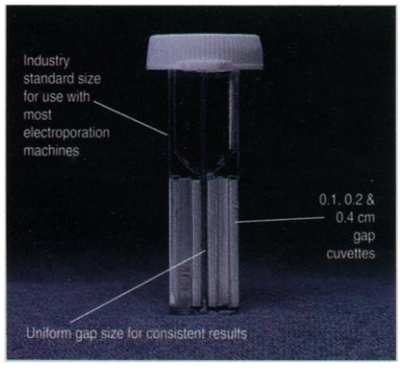

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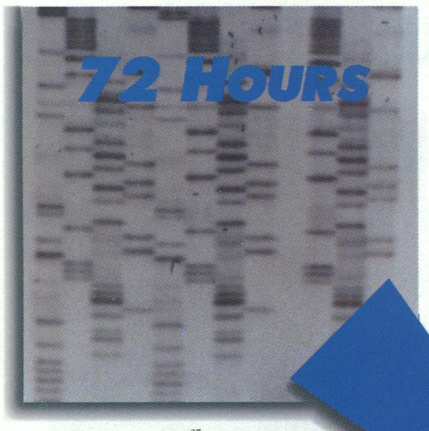

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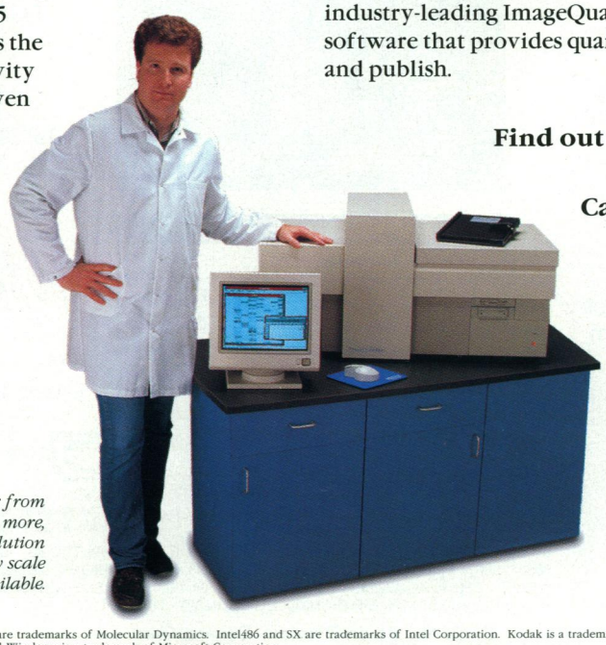

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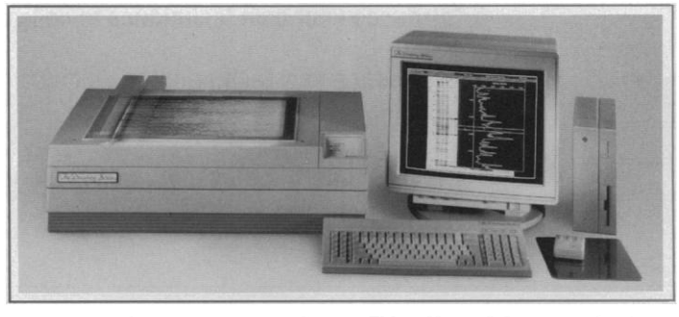

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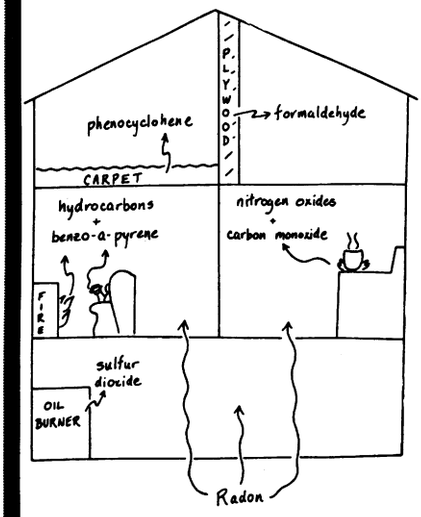

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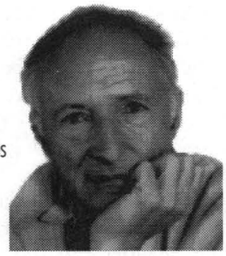

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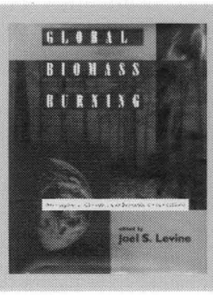

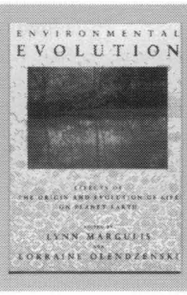

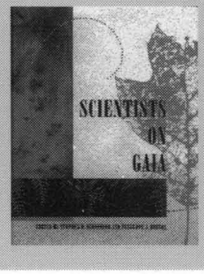

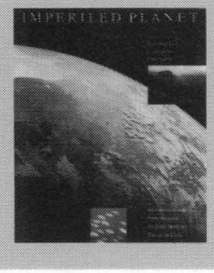

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