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# Science

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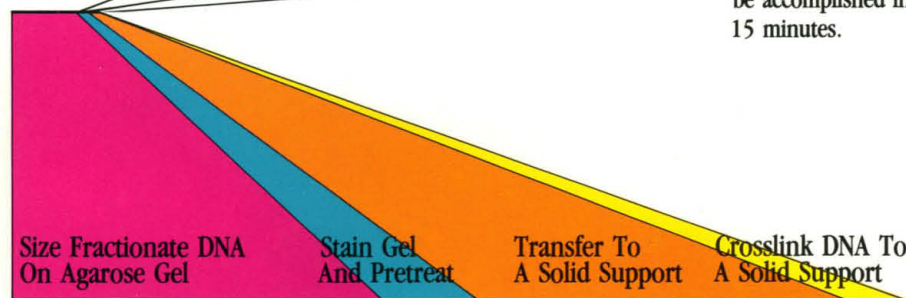
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# Southerns/Northerns: Electrophoresis, Blotting, and Crosslinking in 2.5 Hours Instead of 30.

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

STRATAGENE METHOD—TIME 2.5 HOURS  
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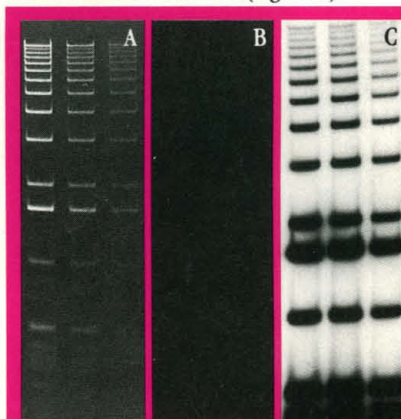


12 HOURS 4 HOURS 12 HOURS 2 HOURS  
CONVENTIONAL METHOD—TOTAL TIME 30 HOURS

## VAGE™ System

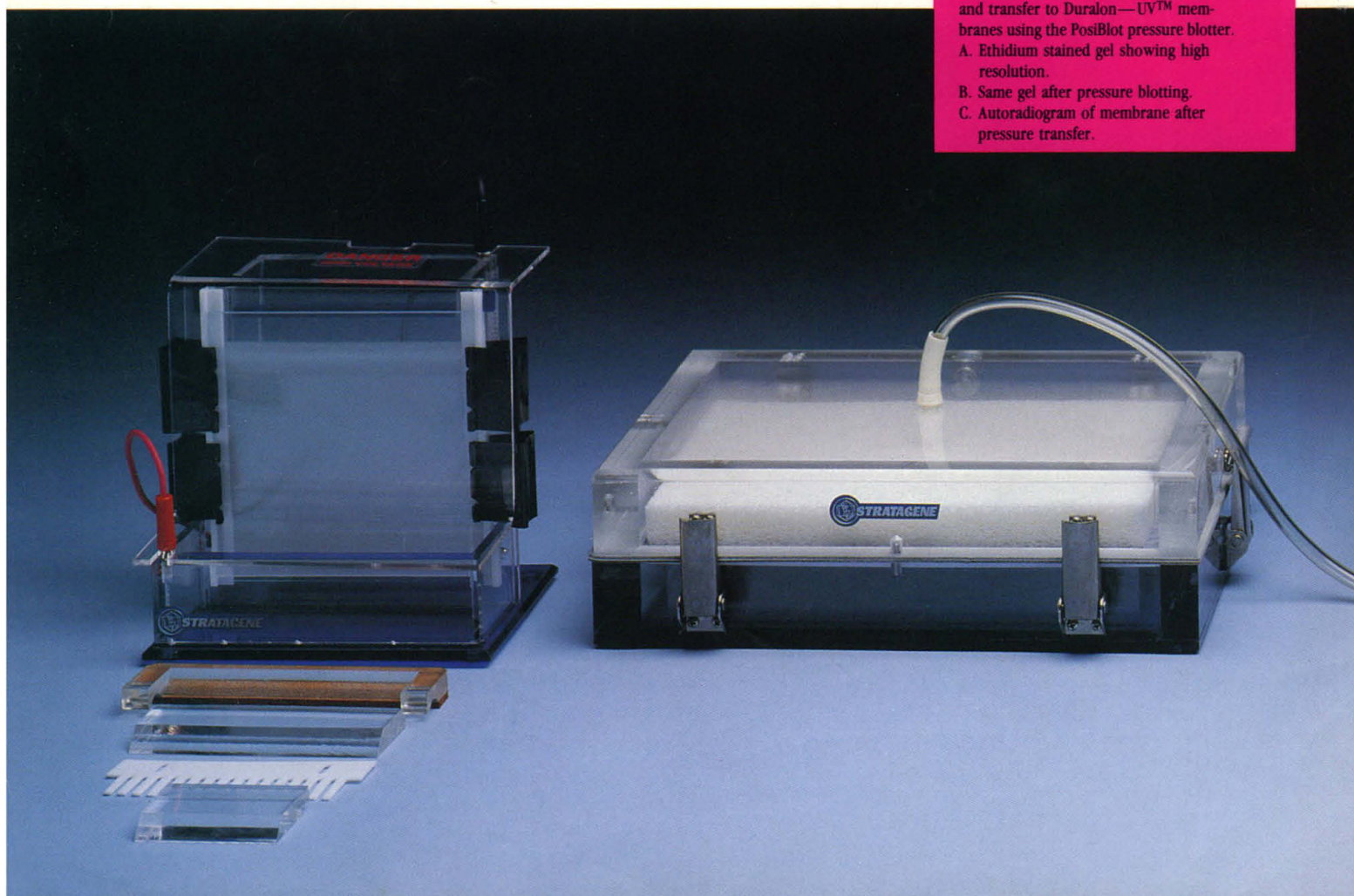
The VAGE™ vertical agarose/acrylamide gel electrophoresis system allows the casting of agarose or acrylamide gels in the unit. Nucleic acids can be electrophoresed through a 3 mm, 0.8% vertical agarose gel in less than two hours with excellent resolution (Figure 1).

Because the gels are thin, staining, depurination, and denaturation can be accomplished in 15 minutes.



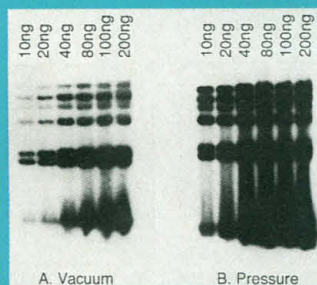
**FIGURE 1:**

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.





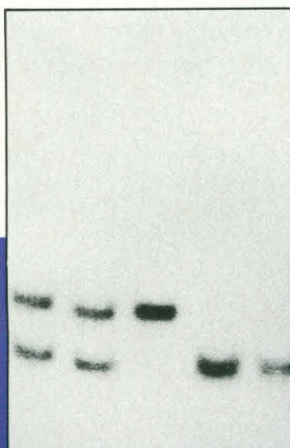
## PosiBlot™ Pressure Blotter



**FIGURE 2:**

Figure Legend:  $^{32}$ 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.

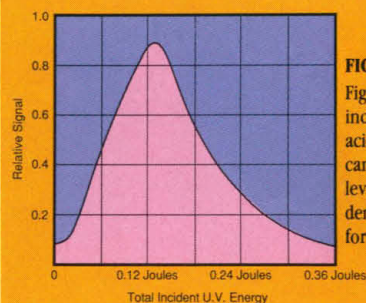


**FIGURE 3:**

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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one

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# two

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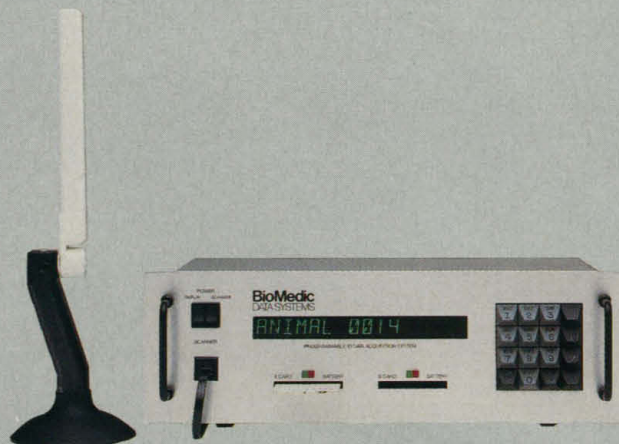
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Space shuttle as ultraviolet observatory

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Seventeenth-century  
ivory sundial



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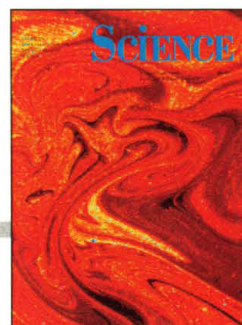
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Fractal pattern formed by small particles floating on a fluid undergoing complicated motion. High particle density (yellow-blue) indicates regions of past compressive surface flow or downwelling. Low particle density (black-red) indicates past upwelling. The pat-

tern geometrically summarizes the long-term, chaotic behavior of typical elements of the fluid surface; it is the strange attractor of a random dynamical system. See page 335. [Image: John C. Sommerer]



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Invading sexual geckos outcompete native asexual geckos



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## Space shuttle astronomy

Because Earth's atmosphere strongly absorbs ultraviolet light, astronomical objects that emit in this wavelength range must be observed with telescopes in space. The space shuttle Columbia carried the Astro-1 ultraviolet observatory into space in December 1990 for a 9-day mission. Davidsen (p. 327) reviews results from one of the instruments aboard the shuttle, the Hopkins Ultraviolet Telescope, which obtained spectrophotometric data on 77 objects at wavelengths from 912 to 1850 angstroms. Among the findings were evidence for a hot corona around the Milky Way, new information about galactic nuclei, and a measurement of the properties of the ionized interstellar medium.

□

## Metal nanocrystals in carbon particles

During the synthesis of carbon nanotubes, polyhedral carbon nanoparticles (about 20 to 40 nanometers in diameter) also form. These particles can be thought of as nested giant fullerenes that surround an internal cavity. Ruoff *et al.* (p. 346) describe the synthesis of carbon nanoparticles in which the internal cavity is filled with single crystals of a metal, the  $\alpha$  phase of  $\text{LaC}_2$ . This carbide is metallic but is hygroscopic at room temperature and readily converts to  $\text{La}_2\text{O}_3$ . High-resolution transmission electron microscopy revealed that this carbon-encapsulated form of  $\text{LaC}_2$  is stable for many days under ambient conditions.

□

## After the flood

Evidence for catastrophic flooding is observed on Earth, where

enormous floods have resulted from rupture of the ice dams of large glacial lakes, as well as on other planets, notably Mars. Baker *et al.* (p. 348) briefly review known events and describe a cataclysmic flood in the Altay Mountains in Siberia. The flows inferred from the morphology of landforms produced by the flood rival those associated with the Channeled Scabland region of the northwestern United States. Peak flows are inferred to have exceeded 18 million cubic meters per second, flow depths were 400 to 500 meters, and flow velocities may have ranged up to 45 meters per second.

□

## Gecko rivalry

Invading species frequently out compete native species, but the mechanisms are often unknown. Petren *et al.* (p. 354) investigate the mechanisms of the displacement of an asexual native gecko lizard species by an invading sexual species in the Pacific Islands. They find that light on buildings is a major factor in this competition because it attracts insects, the lizards' food source. The smaller asexual native geckos avoid the larger sexual geckos at these concentrated food sources, which leads to a decline in the condition of the asexual native geckos.

SCIENTIFIC AMERICAN, JANUARY 1993

## Physical basis of a fractal

Fractals have been discerned in everything from broccoli to the coastline of England, but few studies have rigorously connected the fractal dimensions calculated to the underlying physical principles of plant growth or shore erosion. Moreover, the mathematical fractals (known as strange attractors) that characterize many dynamic systems are abstract geometric entities. Sommerer and Ott (p. 355; cover) describe a strange attractor in physical space—tracer particles floating on a fluid surface. The particles produce a physical fractal pattern when the fluid flow is pulsed; the authors can then establish a quantitative connection between the fractal dimension of the pattern and the process that produced it.

## Open for business

The formation of an RNA polymerase-promoter complex suitable for transcription initiation requires conformational changes in both RNA polymerase and the promoter DNA. Suh *et al.* (p. 358) find that two different open complexes exist when RNA polymerase is complexed with the  $\lambda$  phage promoter Pr. Only the open complex formed in the presence of magnesium, however, has single-stranded DNA at the transcription start site.

□

## Transporting tRNA

Export of transfer RNA (tRNA) molecules from the nucleus can be slowed by specific base mutations. Singh and Green (p. 365) isolated a 37-kilodalton protein that binds to wild-type tRNA<sup>Met</sup> but not to mutants that have reduced export activity. This protein is the glycolytic enzyme glyceraldehyde-3-phosphate dehydrogenase (GAPDH). In addition to being a cytoplasmic enzyme that catalyzes the reaction between its cofactor, nicotinamide adenine dinucleotide ( $\text{NAD}^+$ ) and carbohydrates, GAPDH is also present in the nucleus, where it selectively binds tRNAs. Binding of tRNA and  $\text{NAD}^+$  is competitive, and these molecules may share a binding site.

## Detecting tumors

Some tumors can escape attack by the immune system even though they express potentially antigenic peptides; for example, if the costimulatory molecule B7 is not also expressed, then an effective T cell response against the tumor may not be elicited. Townsend and Allison (p. 368) transfected B7 into a murine melanoma cell line that expresses major histocompatibility molecules but is only weakly immunogenic. Mice implanted with melanoma cells that expressed B7 either did not develop tumors or developed tumors that regressed over time. Immunization with the B7 tumors also protected mice against the growth of implanted tumors that did not contain B7. This response was mediated by  $\text{CD8}^+$  cells. Appropriate costimulation can apparently "jump start" the cytotoxic T lymphocyte response without exogenous help from  $\text{CD4}^+$  cells (see news story by Travis, p. 310).

□

## Delivering nerve growth factor

Nerve growth factor (NGF) is a potential therapeutic agent for diseases in which cholinergic neurons degenerate, such as Alzheimer's disease, but the blood-brain barrier (BBB) prevents the delivery of this protein from the blood stream. Friden *et al.* (p. 373) conjugated NGF to an antibody to the rat transferrin receptor, which is responsible for delivering iron across the BBB. Injection of this NGF-antibody conjugate into rats increased the survival of both cholinergic and noncholinergic neurons that had been transplanted from the medial forebrain into the anterior chamber of the eye.





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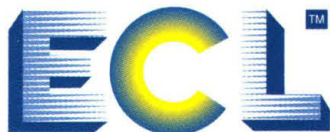
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## Shedding Light on Nucleic Acids Detection

### Nucleic acids detection

Analysis of PCR amplified material: Human genomic DNA PCR amplified using CFTR exon 9 primers, dot blotted onto Hybond™-N<sup>+</sup>, hybridized with cystic fibrosis mutation allele specific oligonucleotides prepared using the ECL 3'-oligolabelling system. 2 minute exposure to Hyperfilm™-ECL.  
Data supplied by A E Shrimpton and D J H Brock, Human Genetics Unit, Western General Hospital, Edinburgh, Scotland.

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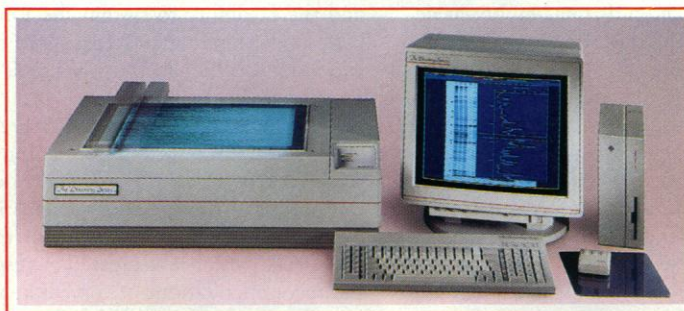
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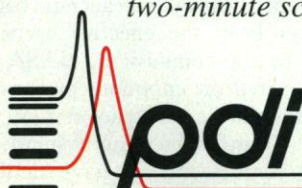
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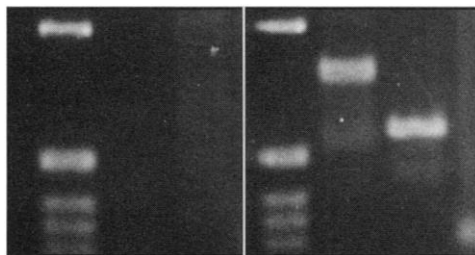
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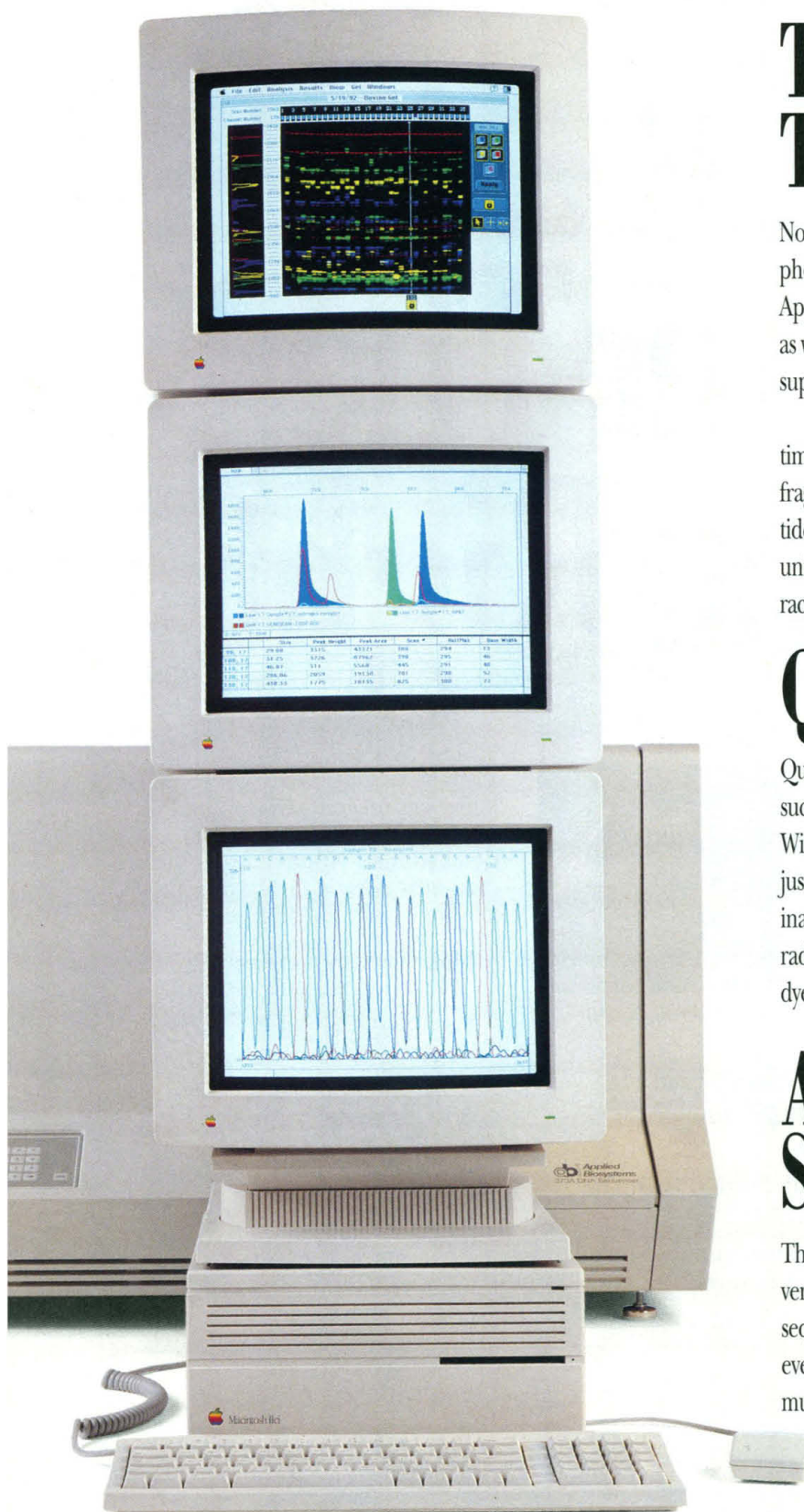
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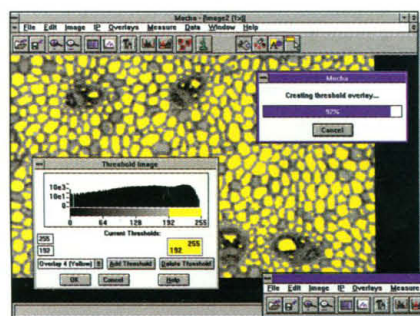
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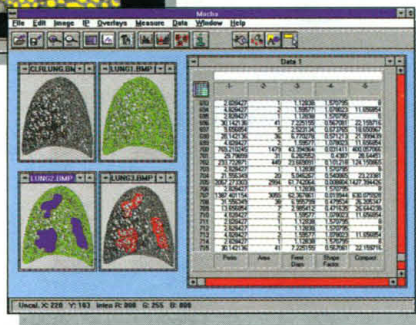
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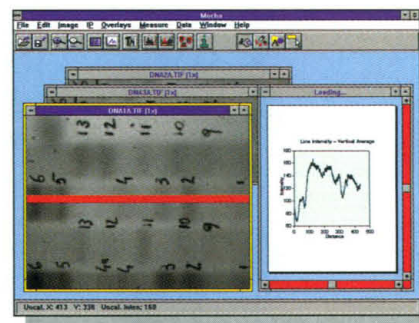
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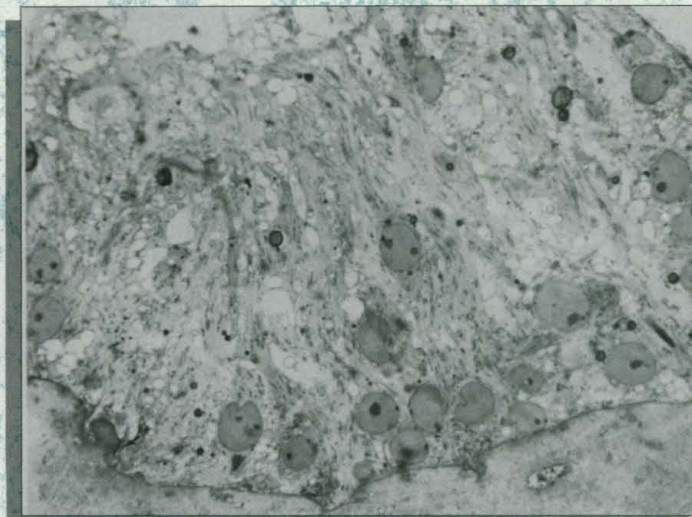
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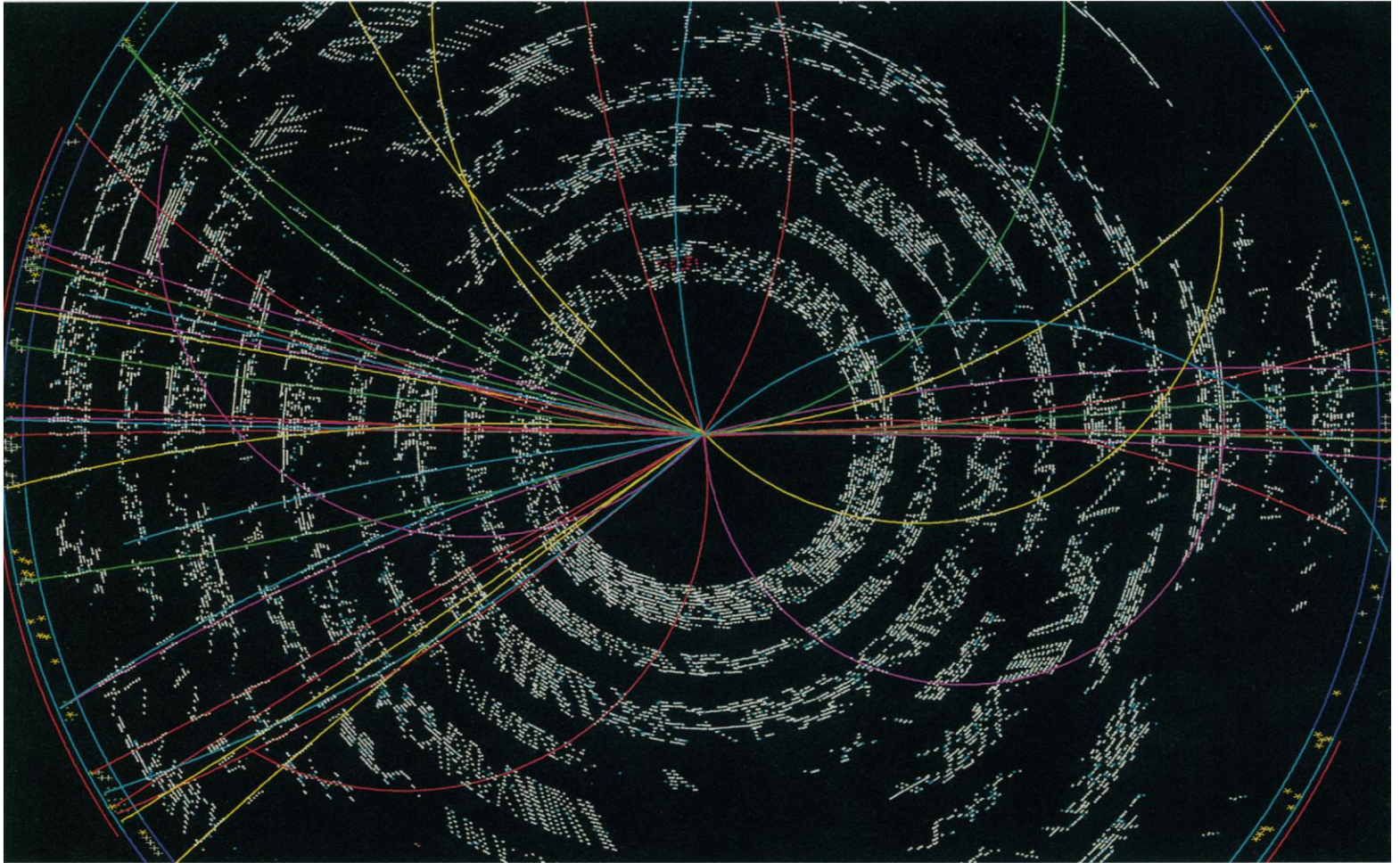
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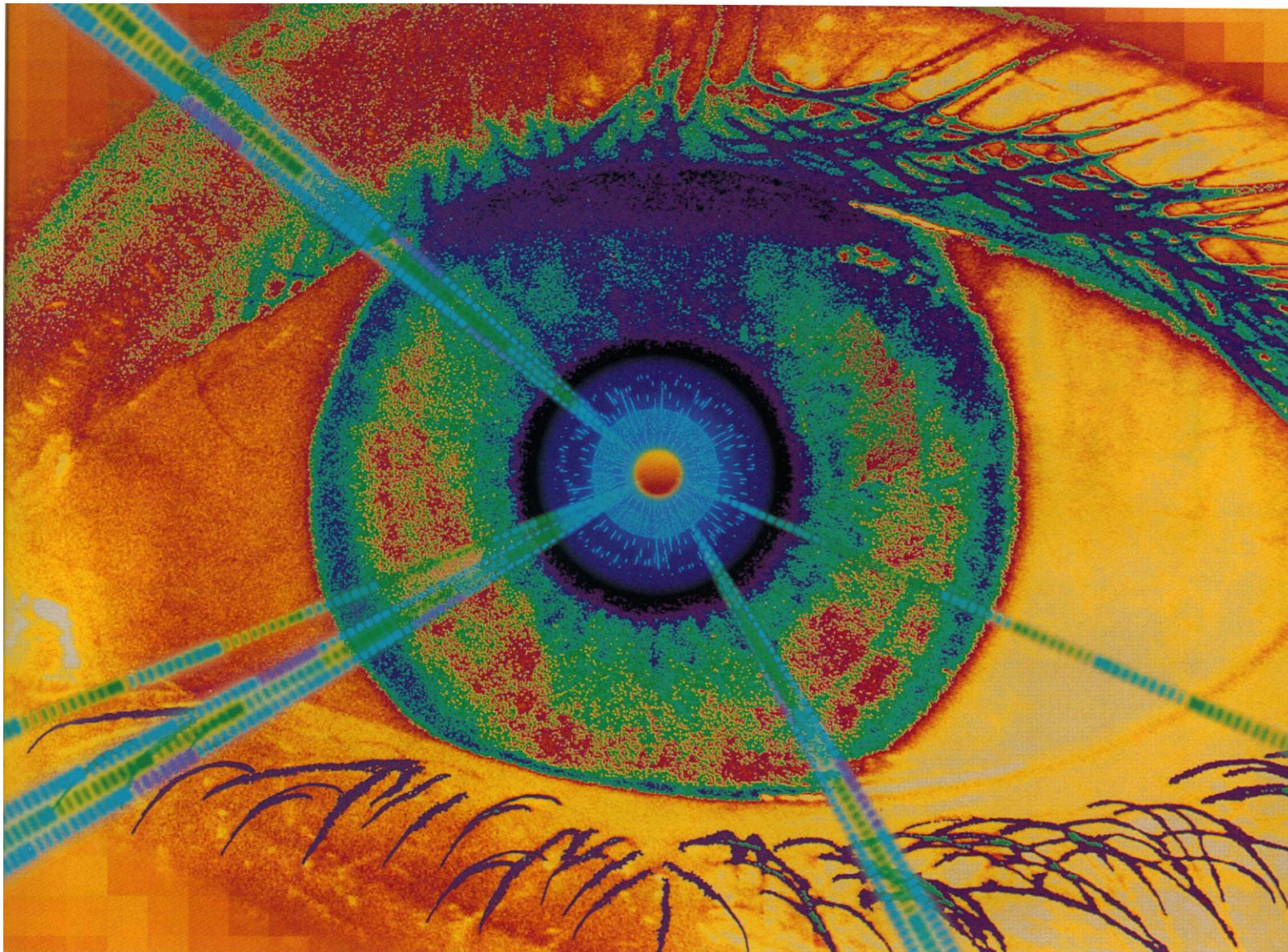
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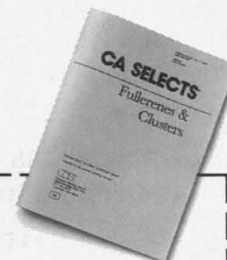
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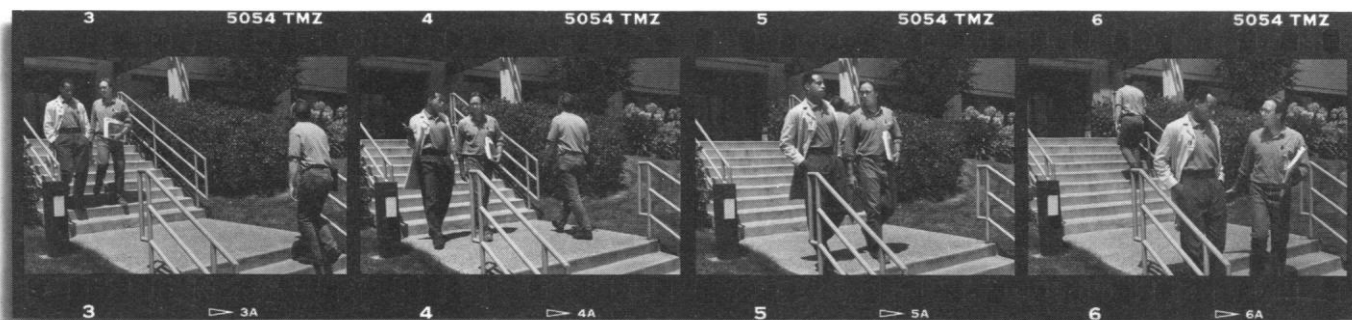


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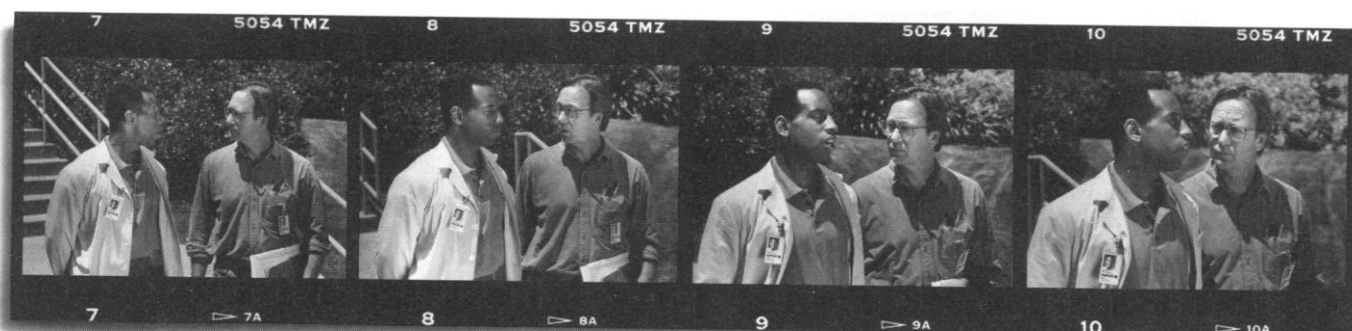
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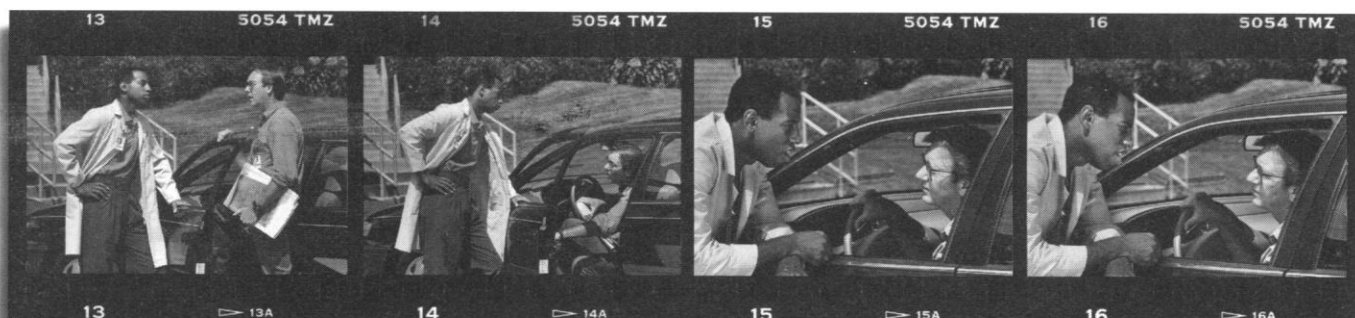




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