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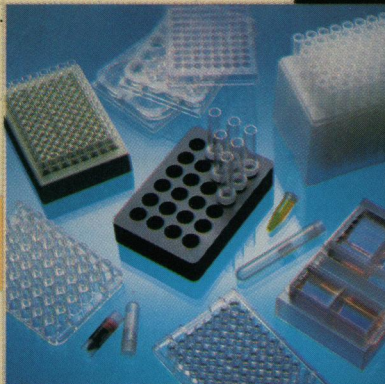
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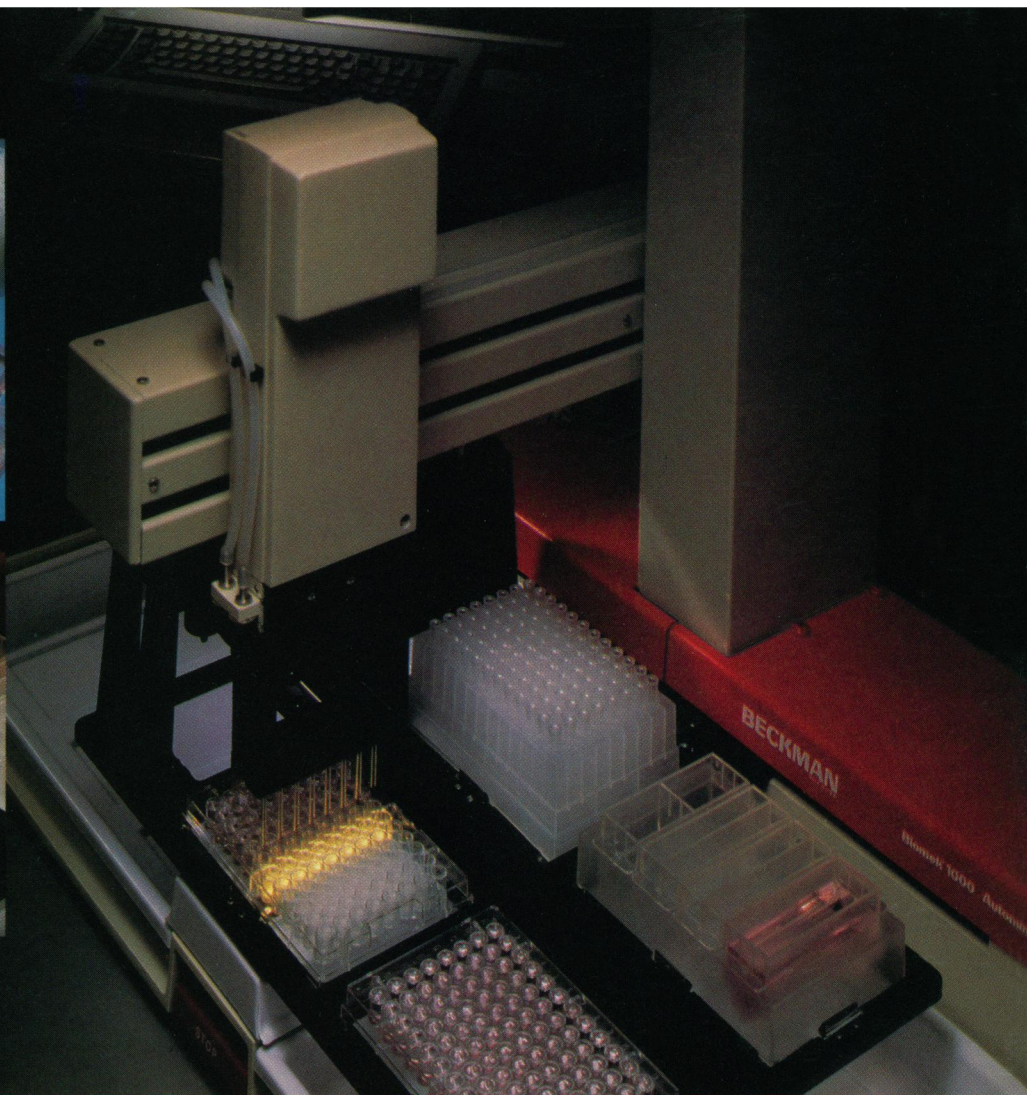
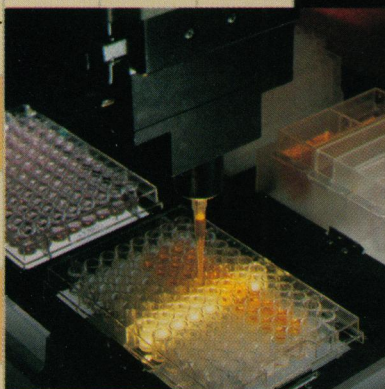
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COVER The combined red and blue beams from the two-color laser geodimeter travel across the south moat of the Long Valley caldera (California) during measurements of geodetic baselines established to monitor crustal deformation. The city of Mammoth Lakes lies in the foreground with the Ritter Range of the Sierra Nevada forming the skyline. See page 213. [Peter Bozek, U.S. Geological Survey, Menlo Park, CA 94025]

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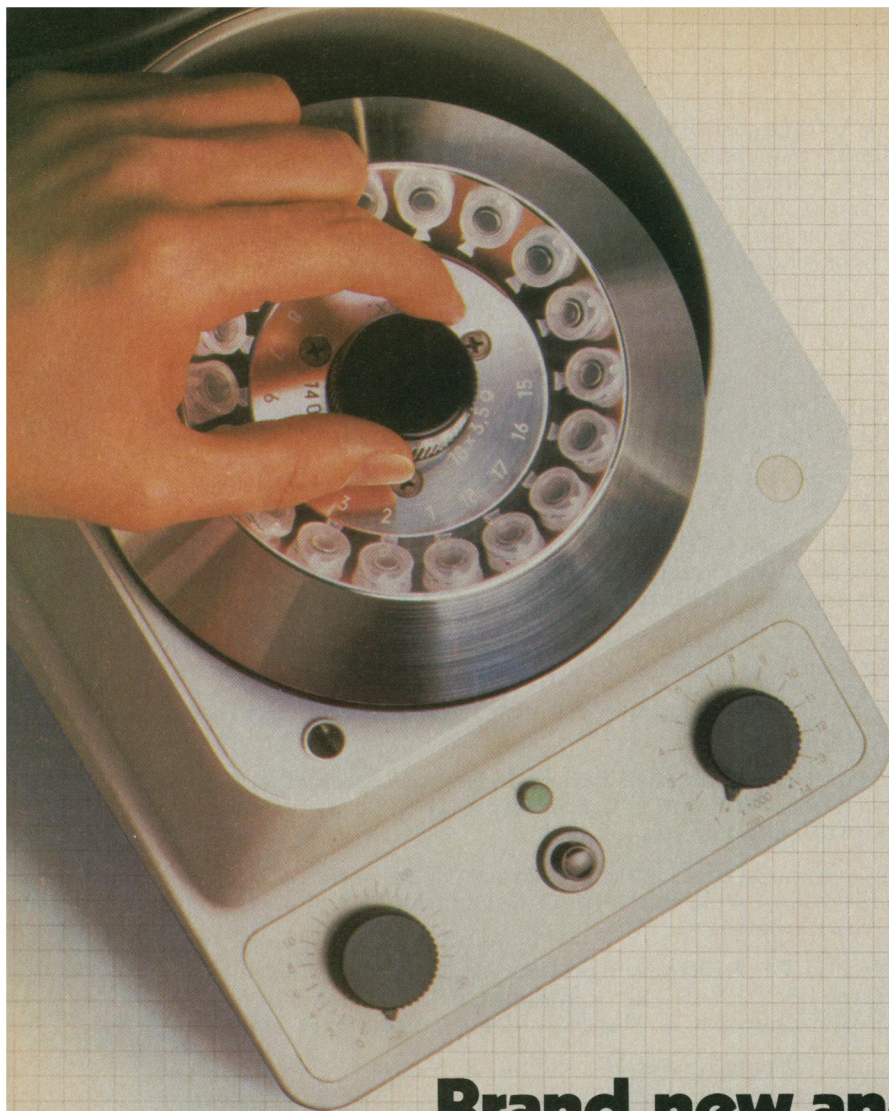
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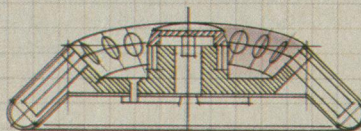
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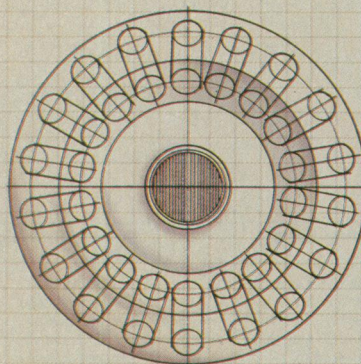
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This Week in SCIENCE

Color vision

WHETHER one sees color normally or is color blind depends on genes for three light-absorbing molecules (red-sensitive, green-sensitive, and blue-sensitive "opsins") that are components of pigments of retinal cones (pages 193 and 203). The pigments absorb photons of light of defined wavelengths, and, by a series of conformation changes and enzymatic activities, induce neural signals that produce color vision. Nathans *et al.* sequenced the genes for the three opsins, analyzed molecular details of gene structures in normal and color-blind individuals, and deduced from the structural data the genetic basis for color vision or blindness (a problem for 8% of Caucasian males). Botstein (page 142) examines these accomplishments that have confirmed long-standing theories (the first formulated almost 200 years ago) about how color is seen, discusses the amalgam of logic, molecular genetics and biology used in the experimental approach, and suggests how future adaptations in the evolving visual system may be explained from these molecular and genetic data.

The rise of Long Valley caldera

DATA collected with a two-color Geodimeter indicate that pre-volcanic activities diminished in California's Long Valley caldera region (cover) between 1983 and 1984 (page 213). Increasing seismic and volcanic signs began in 1978, and thereafter swarms of earthquakes (major ones in May 1980 and in January 1983) were recorded. The underlying volcano, which erupted violently 700,000 years ago, leaving the caldera, appeared to be heading toward another eruption. Repeat measurements of distances between two ranging stations and 11 reflecting stations showed that deformation in the caldera was occurring but had slowed. Linker *et al.* incorporate the data into existing models to explain how two factors— injection of magma into two chambers below the caldera

surface and slip along the southern fault—could account for the rising caldera floor.

Underwater tunneling

EVEN molecules in aqueous environments can be resolved at the atomic level with the tunneling microscope (see This Week in Science, 4 April); thus, someday it might be possible to analyze, at high resolution, biological processes as they are taking place in cells (page 211). Sonnenfeld and Hansma describe tunneling images obtained for two samples—graphite in water and gold in a salt solution. No image distortions were caused by the aqueous environments: the atomic structure of graphite resembled its structure in air and in a vacuum. The analysis of gold showed that images can be acquired for samples in salt solutions at salt concentrations conducive to maintaining the integrity of biological materials. In the future, images of DNA, proteins, and membranes in their biologically active states may be obtained (once problems inherent in the study of insulating materials are overcome), and such samples may even be observed in the act of replicating (DNA), catalyzing (enzymes), and transporting (membranes). The technology can already be applied to electrochemistry for analyzing electrode surfaces before and after electrode reactions.

Geometric patterns in nature

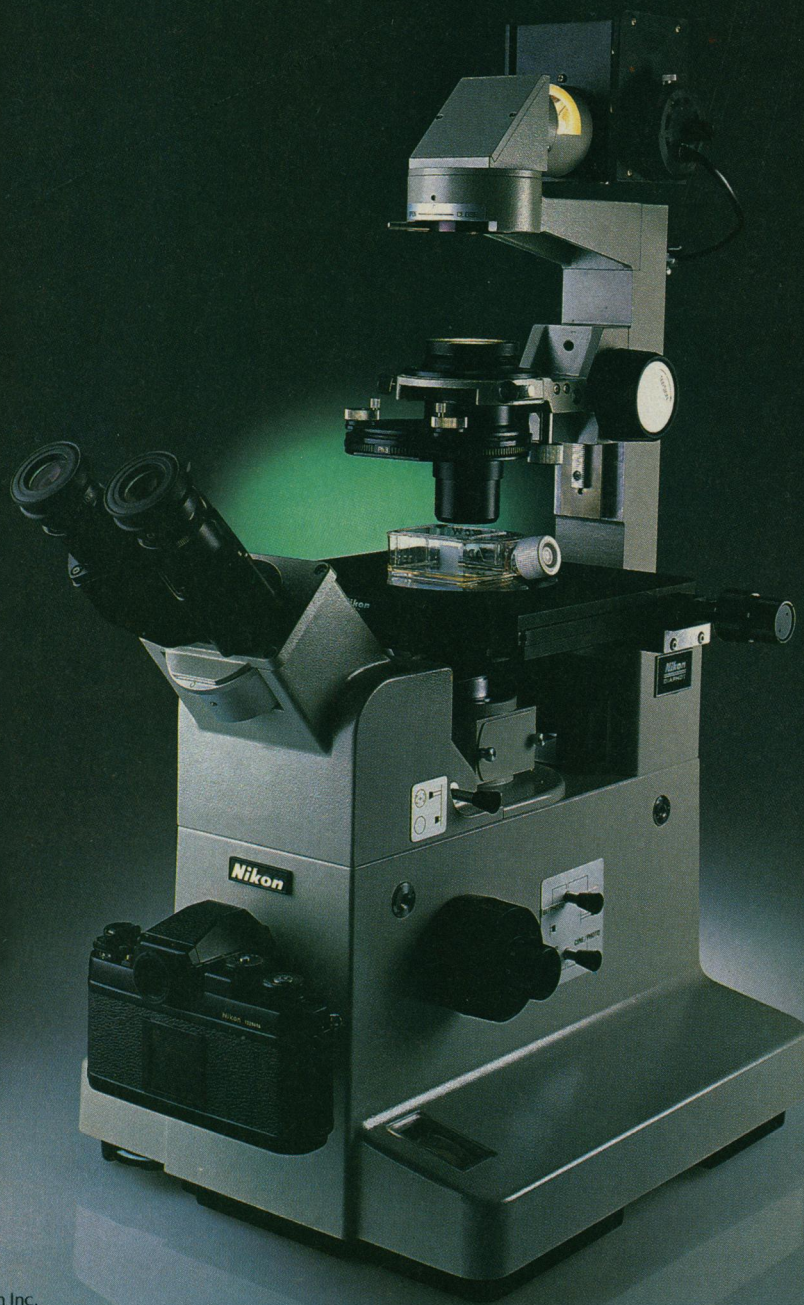
REGULAR stone-bordered geometric patterns can form at the surface of water-saturated soils in areas where freeze-and-thaw cycles occur (page 216). Gleason *et al.* found that the geometry of "sorted patterned ground" formations in the Rocky Mountains, at the Arctic Circle, and elsewhere could be described mathematically with a model based on how convective currents are generated. Water is more dense at 4°C than at 0°C; thus an unstable density stratification develops in soils subjected to freezing

and thawing, and flow within a unit volume (called a cell) generally occurs downward during a melt. The flow pattern, which reflects cell boundaries, is impressed on the underlying ice: polygonal flow patterns occur along flat surfaces and underwater, whereas striped patterns commonly form on sloped surfaces. Subsequent frost action thrusts stones that had been accumulating in the ice troughs upward; these gradually form a stone border at the surface like the pattern originally impressed in the ice. Because stones conduct heat better than soil, thawing begins at the boundaries and the surface pattern becomes increasingly prominent.

Anti-idiotypic vaccine for hepatitis

IMMUNE regulation consists of a web of interactions: when exposed to a virus, an animal produces specific antibodies; later, a second set of antibodies is produced that is specific for the first set; additional sets are made that further regulate the immune response by binding to the first, second, or other sets of antibodies (page 220). The anti-idiotypic antibodies (set two) recognize the idiotype or binding site on the first set of antibodies through which specific interactions with the antigen took place. Because structures on some anti-idiotypic antibodies closely resemble structures on the virus that started the immune cascade, anti-idiotypic antibodies are being evaluated for use in vaccines in situations where the host is unresponsive to conventional vaccines or where the original antigen cannot be isolated or even identified or is in a form that causes adverse host reactions. Kennedy *et al.* used anti-idiotypic antibodies prepared in rabbits against hepatitis-specific antibodies to immunize two chimpanzees. Protection was provided against hepatitis: no clinical or histologic signs of disease developed. Control chimps developed signs and symptoms of hepatitis. The feasibility of vaccinating primates with anti-idiotypic antibodies with "internal images" of viral antigens has thus been established.

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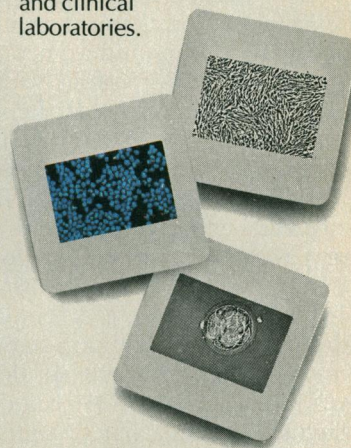
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Trends in the Use of Oil

A drop in the price of oil was predictable, and many companies last year adjusted their policies accordingly. However, the full extent of the decrease was not widely foreseen. A situation in which crude oil brings less than \$15 a barrel could lead to important sequelae provided that the dip endures for a few years. Already, significant effects have been noted in the oil-producing regions of the United States.

The first huge jump in the price of oil in 1973–1974 (a quadrupling) had little immediate effect on decreasing consumption. In part because of price controls during the following 4 years, imports into the United States increased substantially. But the further tripling of the price in 1978–1979 expedited a worldwide response. Energy was conserved. More efficient equipment and processes were employed. Other energy sources were substituted for oil. Exploration for oil in hostile environments where costs were high was encouraged and was profitable in view of the artificially high price umbrella provided by OPEC.

From 1978–1984, total world oil consumption dropped 4.3 million barrels per day (mbd). Oil production by non-OPEC countries increased 6.7 mbd. Production by OPEC countries dropped 11.9 mbd. Non-oil energy use increased the equivalent of 16 mbd. In 1984, OPEC held only 31.5% of the world oil market, down from a peak of 47.8%. The OPEC share of the world energy market was 12.5%, down from 22.4%.

In the short term, demand for oil is inelastic, and there is little that OPEC can do to quickly increase its share of the oil market. Prices of competing natural gas and coal are already trending lower. Use of oil products in transportation will respond only slightly to the lower cost. People who have installed insulation will not rip it out. Some of the demand for oil has been irreversibly lost. For example, France was at one time highly dependent on oil for generation of its electricity. Now more than 60% of its power is supplied by nuclear energy. The goal is 80%, with most of the remainder to be hydropower. Worldwide in 1985, 45 nuclear power plants began commercial operation. There are now 361 nuclear power plants operating in 26 countries. During 1985, operating nuclear capacity rose 20.7% to 249 gigawatt electric. This total is the oil equivalent of about 6 mbd.

If the world price of oil remains in the range of \$15 or less a barrel, OPEC is very likely to gradually increase its market share. This is particularly true in the United States. Geophysical exploration for oil has been curtailed, stripper wells are being closed off, and the use of oil in the generation of electricity has begun to increase.

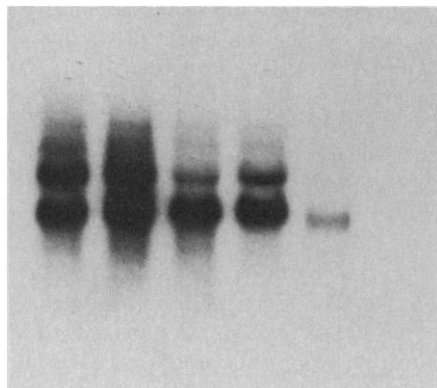
During the last few months, practically all the major U.S. oil companies have announced cuts of as much as 50% in their exploration and development budgets. Drilling had already dropped greatly in expectation of a weakness in the price of oil, and a further decrease in drilling is now occurring. At present, the number of rigs active is only about a fourth the number in 1981. Correspondingly, many earth scientists have been fired. University enrollments in geology and geophysics are down sharply in the oil-producing states. In the contiguous 48 states, most of the easily available oil has been produced. In 1984, 453,000 stripper wells that produced 10 bd or less accounted for 15% of U.S. production. About half of that oil cost \$10 or more a barrel to produce. Depending on the level of oil prices during the next year, many wells will be abandoned and plugged.

In 1979, when the price of oil tripled, electric utilities burning it made great efforts to use cheaper sources of electricity. As a result, a large fraction of the oil-fired plants were idled, and the use of oil for electricity dropped from 1.74 mbd in 1978 to 0.46 mbd in 1984. But that trend is being reversed. Already there have been announcements of increased use of oil. This will not amount to much in the short term, but over a decade could become a substantial factor in the renaissance of OPEC. Growth in demand for electricity is likely to outstrip new construction of non-oil plants. Approximately 80 gigawatt electric of oil-fired plants are now idle. If these were employed, they would consume about 2 mbd.

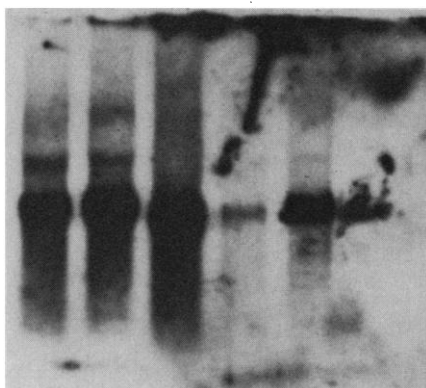
The course of events during the next decade will depend largely on the price level for oil during the next year or two. If prices hover around \$10 per barrel, production in the United States will drop substantially and imports will climb. At \$20 per barrel, adverse effects would be minimal.—PHILIP H. ABELSON

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Reference: Hardy, K.J., et al. Proc. Natl. Acad. Sci., 82, 8173-8177, 1985.

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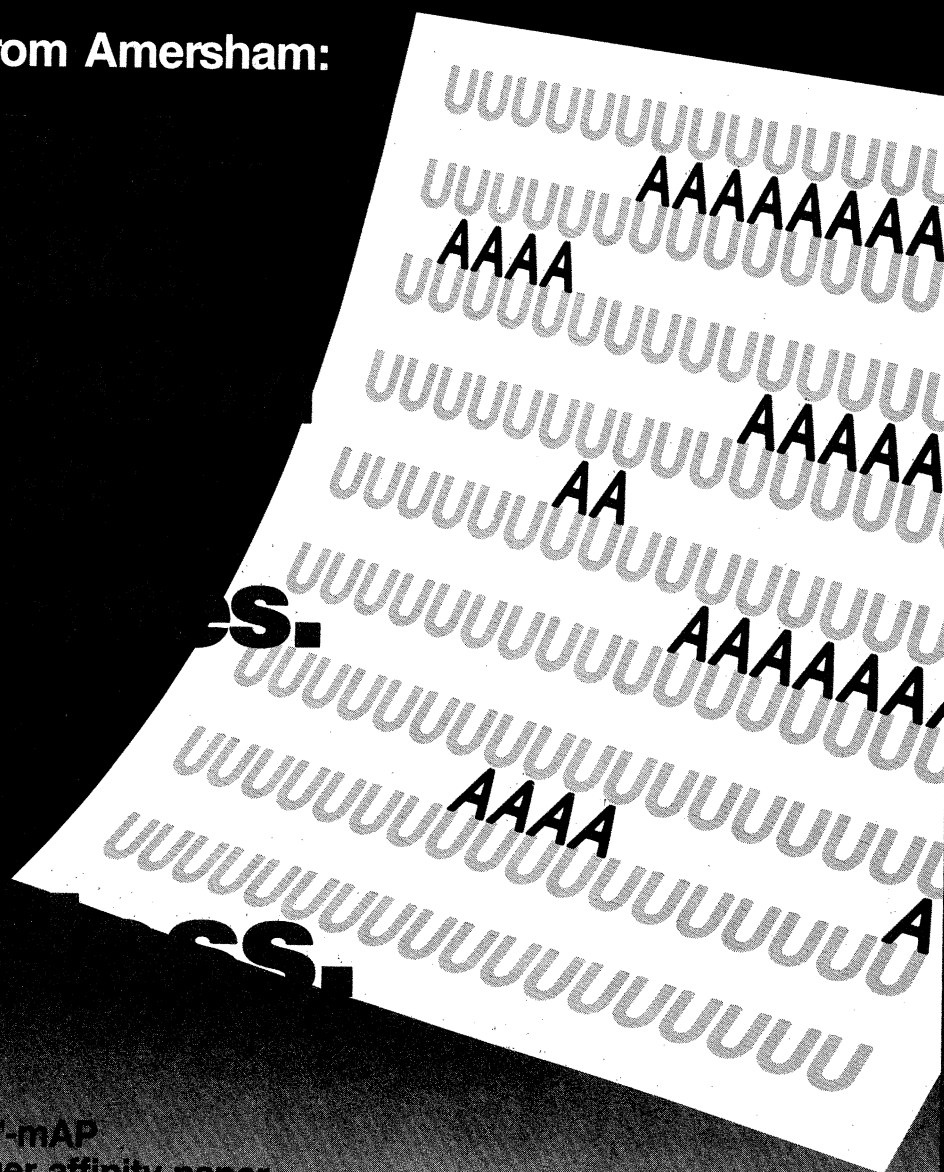
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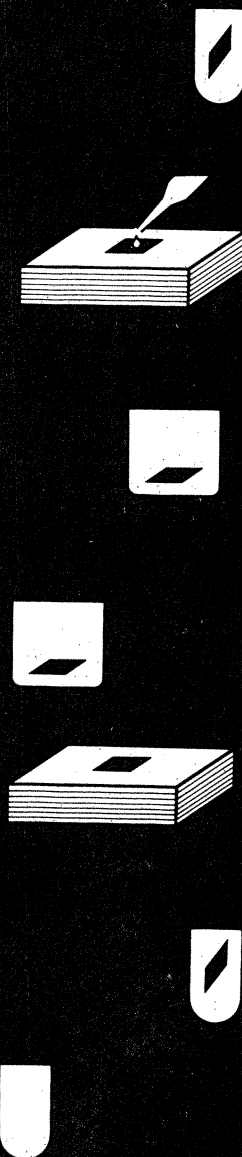
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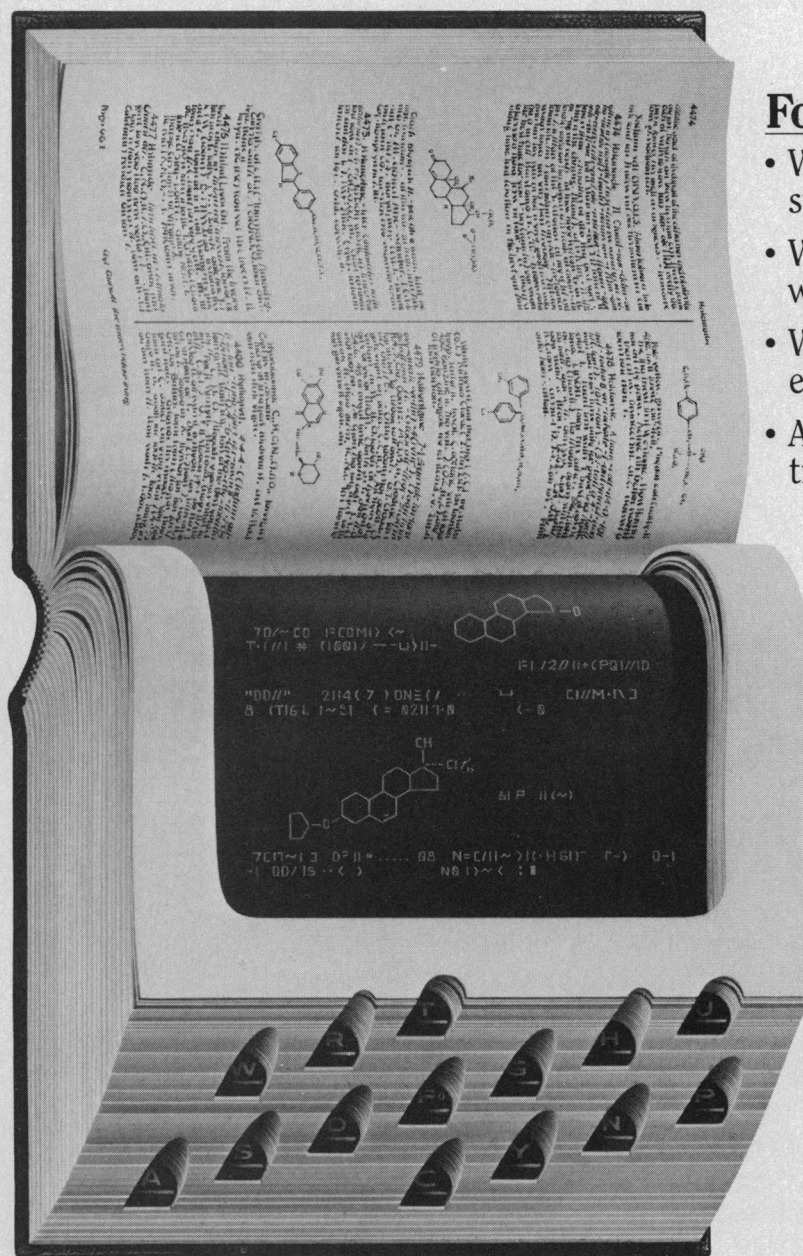
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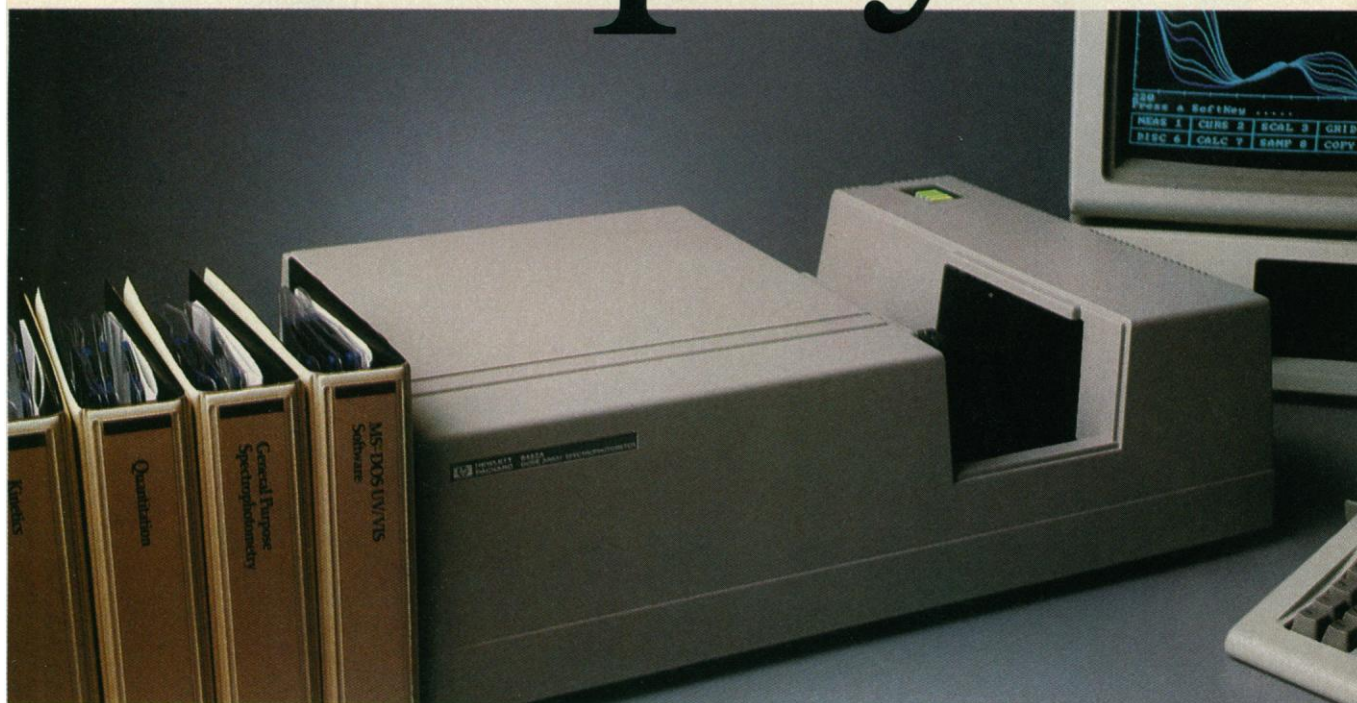
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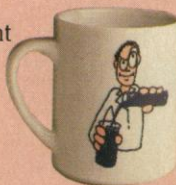
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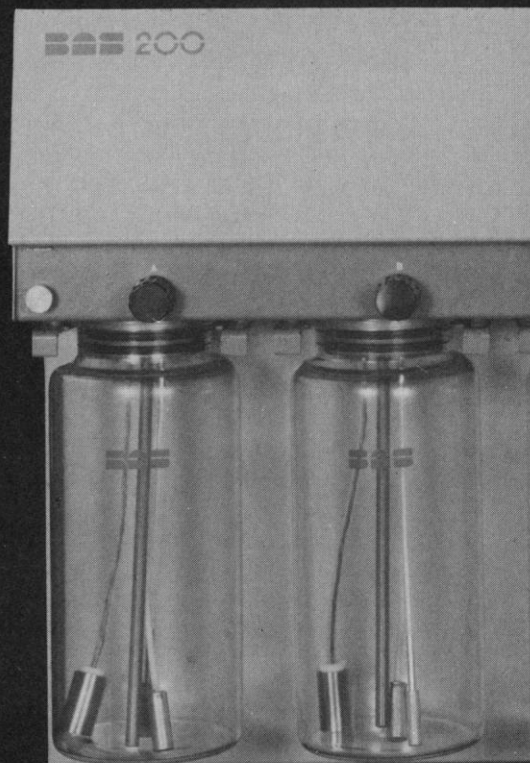
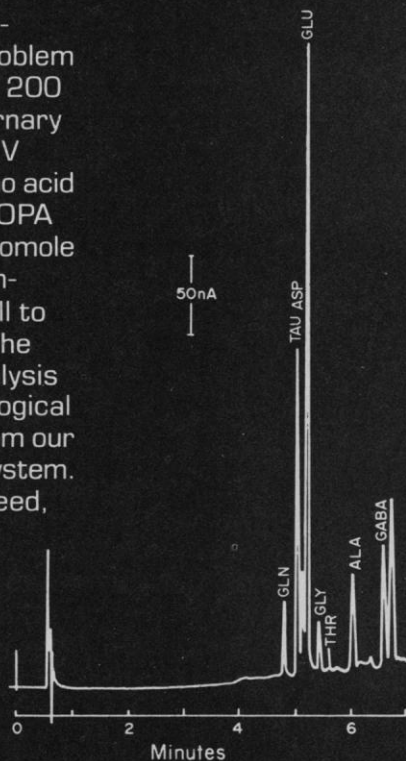
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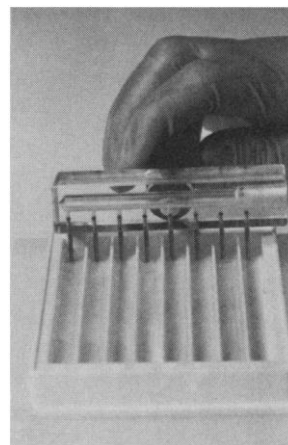


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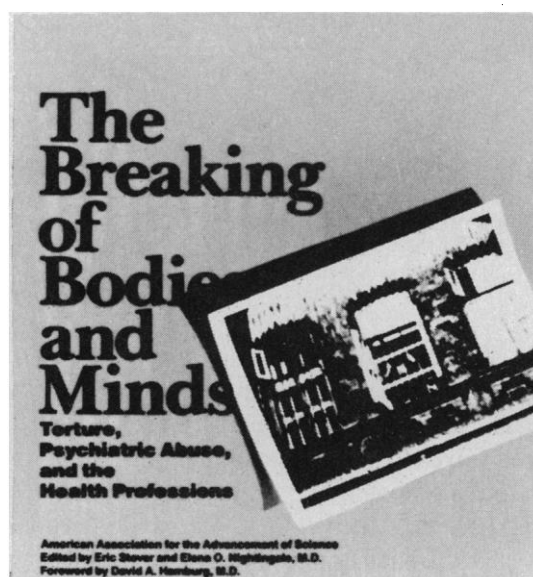
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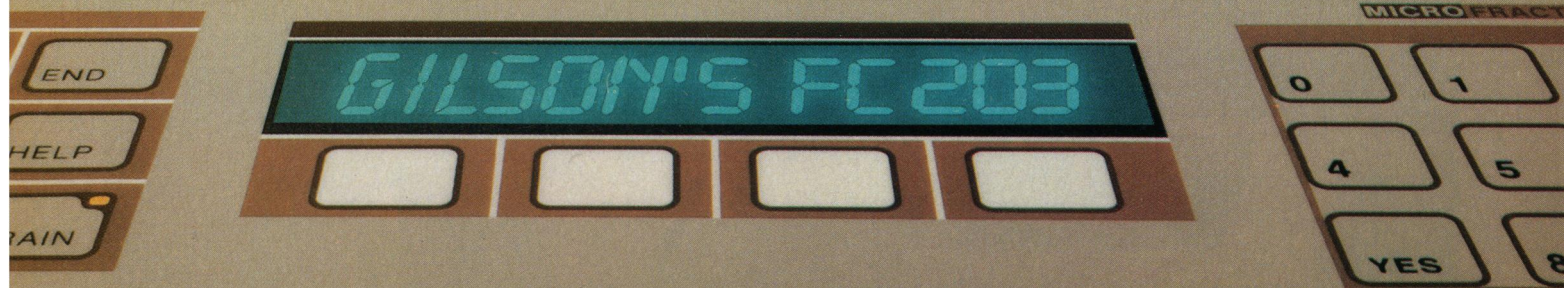


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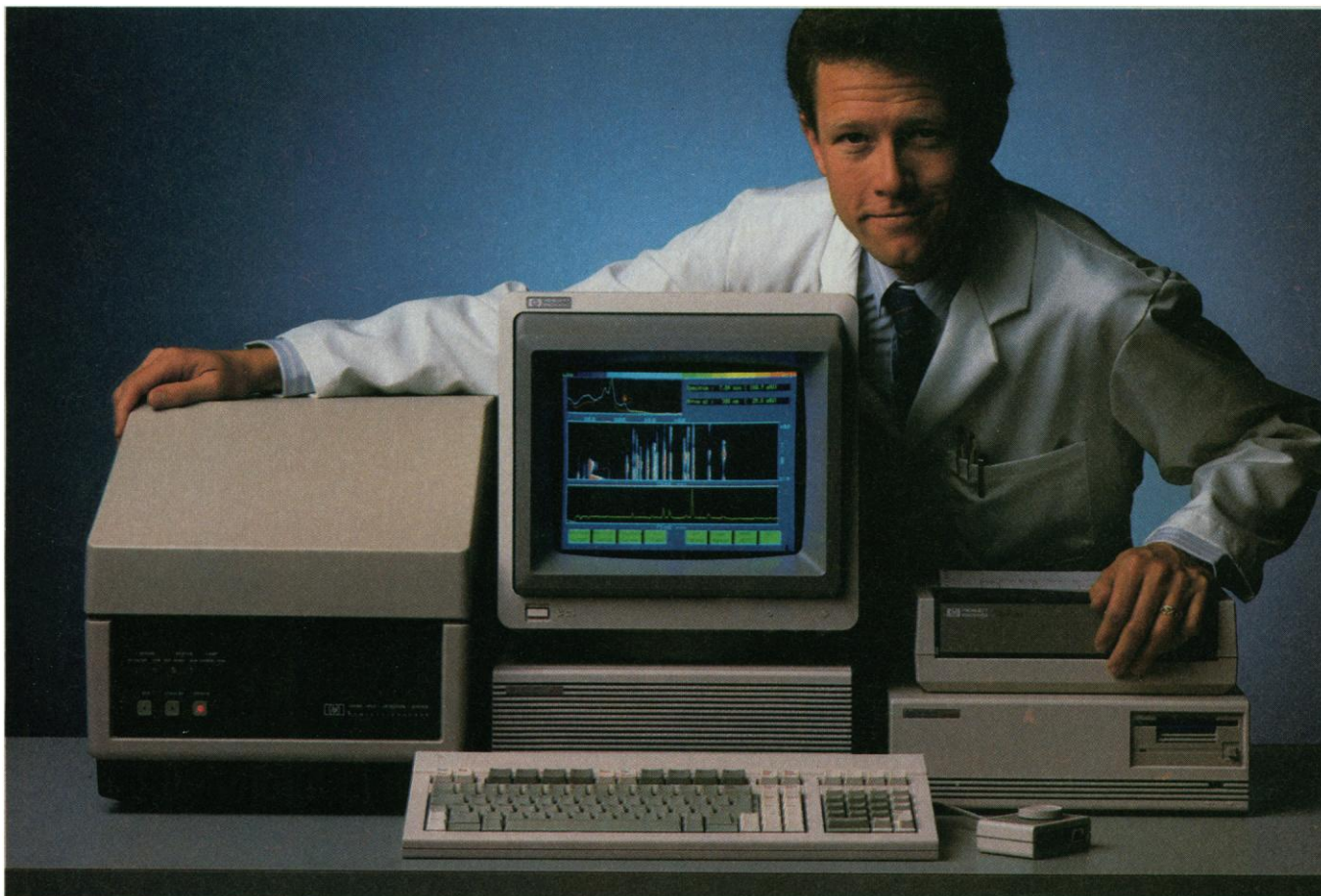


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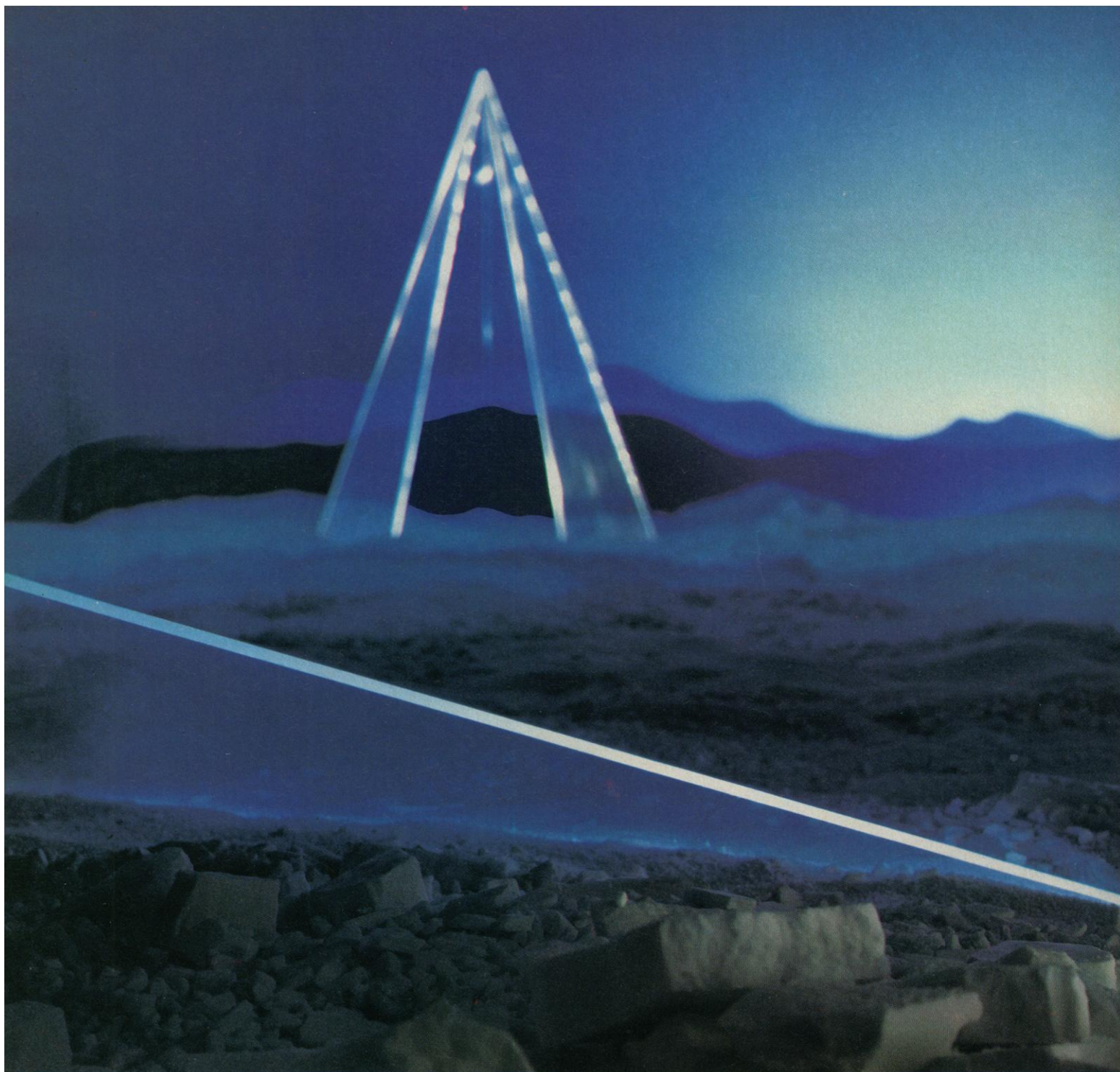
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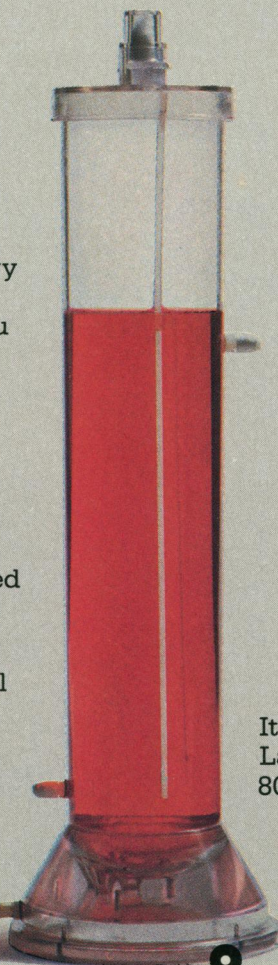
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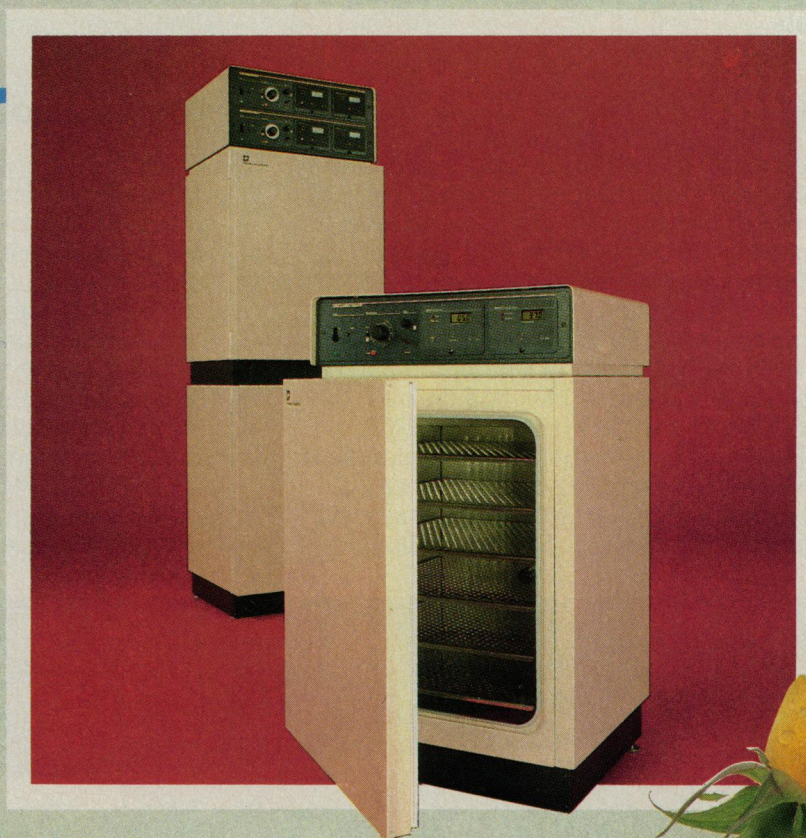
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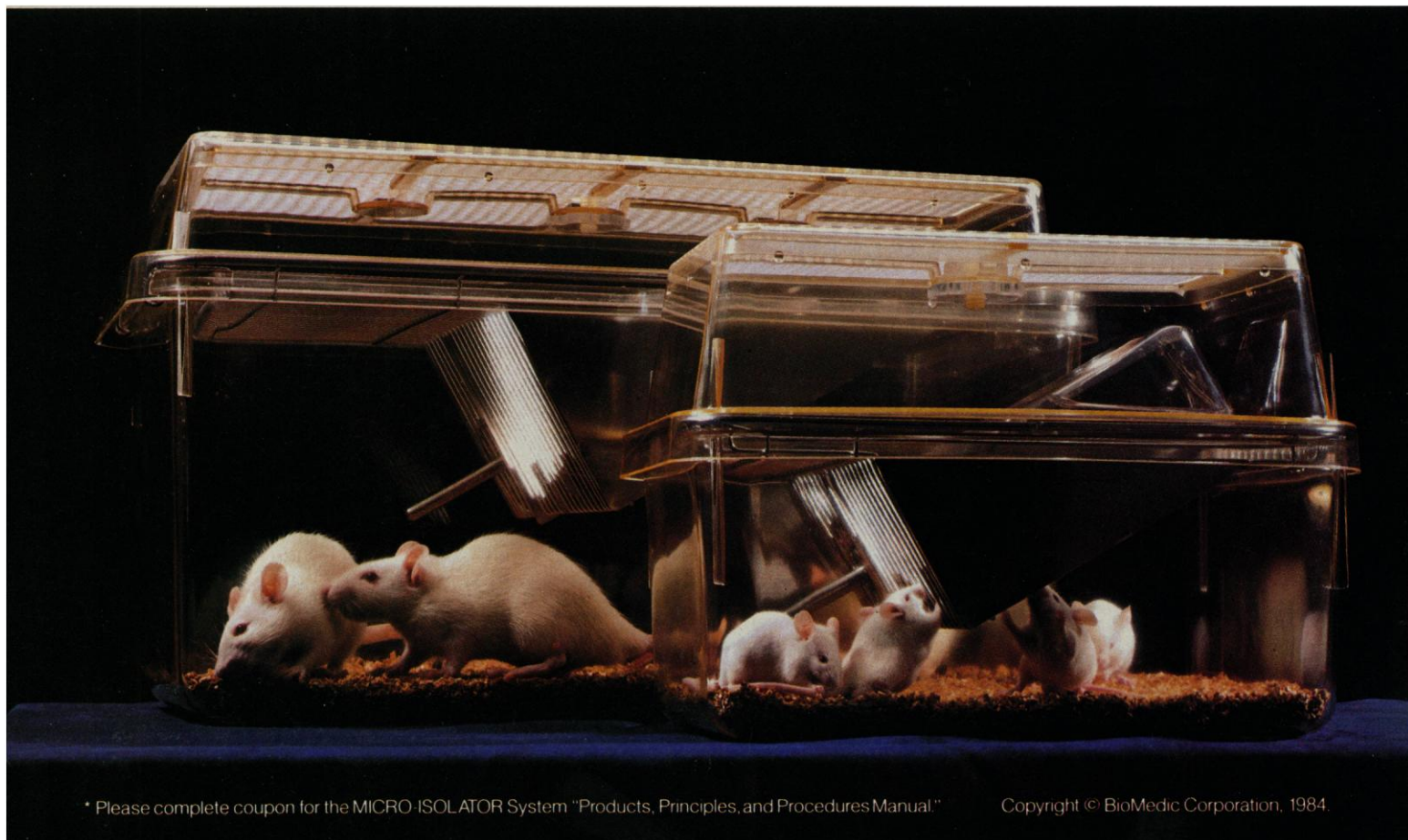
all manipulations are conducted in a Class 100 workbench, individuals allergic to animals are protected from dander and therefore are able to work in comfort.

The complete MICRO-ISOLATOR System consists of the individual MICRO-ISOLATOR housing units, the STAY-CLEAN™ Laminar Flow Workbench, and the service cart.

The MICRO-ISOLATOR Units

This system consists of an autoclavable plastic cage and plastic filter frame with a static filter (now designed for rapid replacement of the filter material), plus the usual cage accessories. The plastic filter frame overlaps the bottom portion of the cage and effectively forms a giant Petri dish-like structure. Result: there is an effective protection against microbial contamination while still allowing for substantial gaseous interchange. The MICRO-ISOLATOR is, in other words, a protected microenvironment within any insect-controlled macroenvironment.

MICRO-ISOLATOR units, fabricated of autoclavable plastic material, are now available for mice, rats, hamsters, and guinea pigs.



* Please complete coupon for the MICRO-ISOLATOR System "Products, Principles, and Procedures Manual"



The STAY-CLEAN Laminar Flow Workbench

Whenever a MICRO-ISOLATOR unit is being serviced (that is, when animals or the contents of the unit are being manipulated), these activities must take place within a Class 100 environment. The STAY-CLEAN Laminar Flow Workbench is a specialized unit developed for such cage and animal manipulation. It has been designed to achieve two goals: (1) to prevent ambient contagion from entering the workbench and any of the components, and (2) to limit the escape of animal dander and other particulate matter from the work area.

The STAY-CLEAN Laminar Flow Workbench is compact, moveable, and includes state-of-the-art monitoring instrumentation to assure proper operation.

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Patents applied for on the MICRO-ISOLATOR units and other elements of the complete system.

MICRO-ISOLATOR and STAY-CLEAN are trademarks of Lab Products, Inc.

The Service Cart

The service cart completes the MICRO-ISOLATOR System by simplifying the movement of all necessary supplies to the laminar flow workbench for servicing the MICRO-ISOLATOR units.



For More Information

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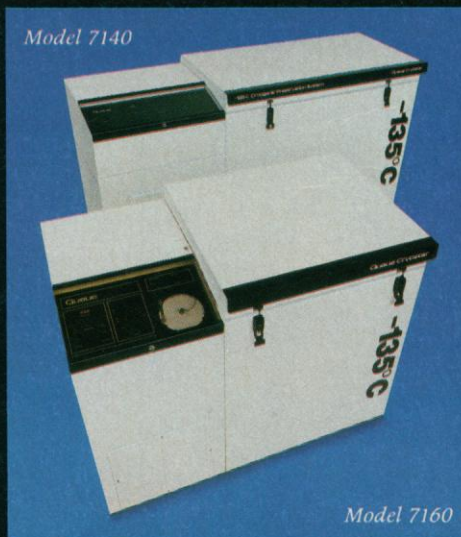
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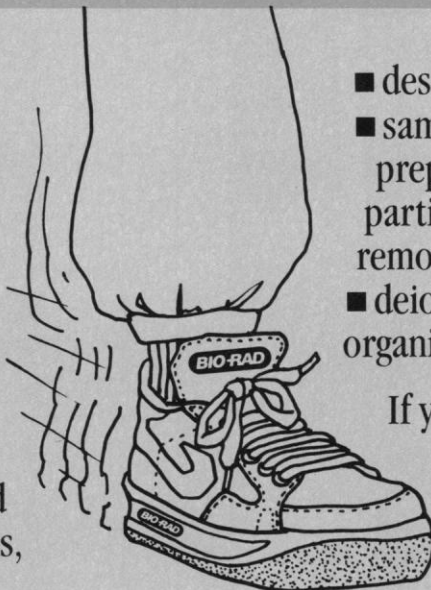
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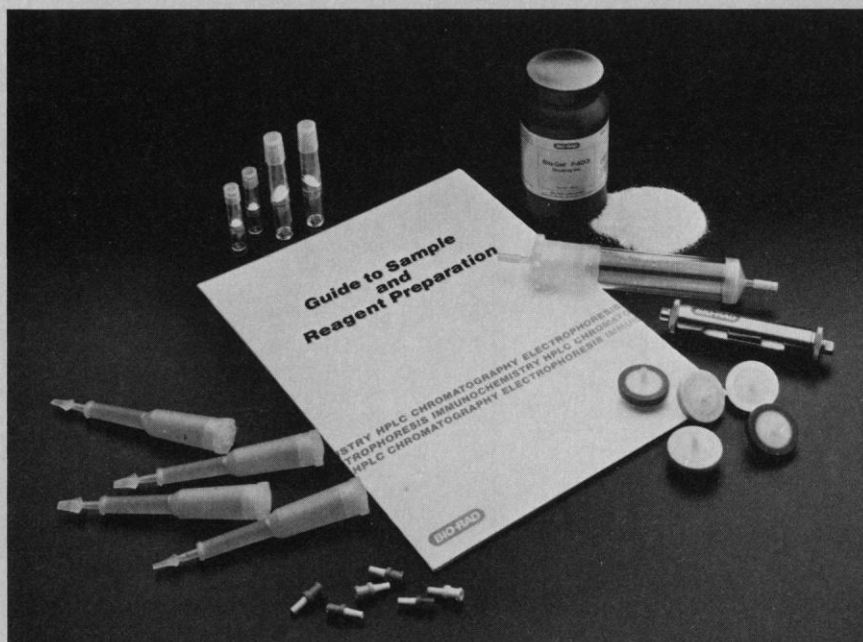
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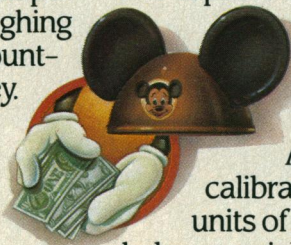
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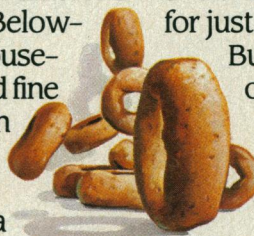
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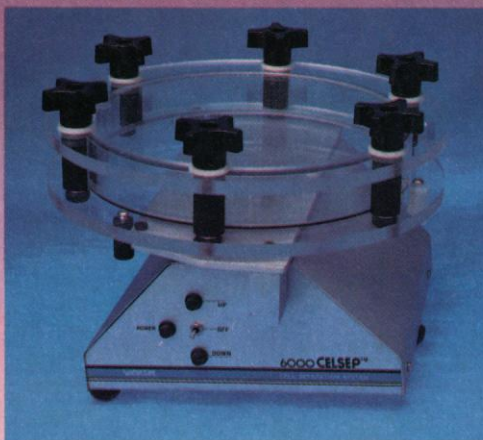
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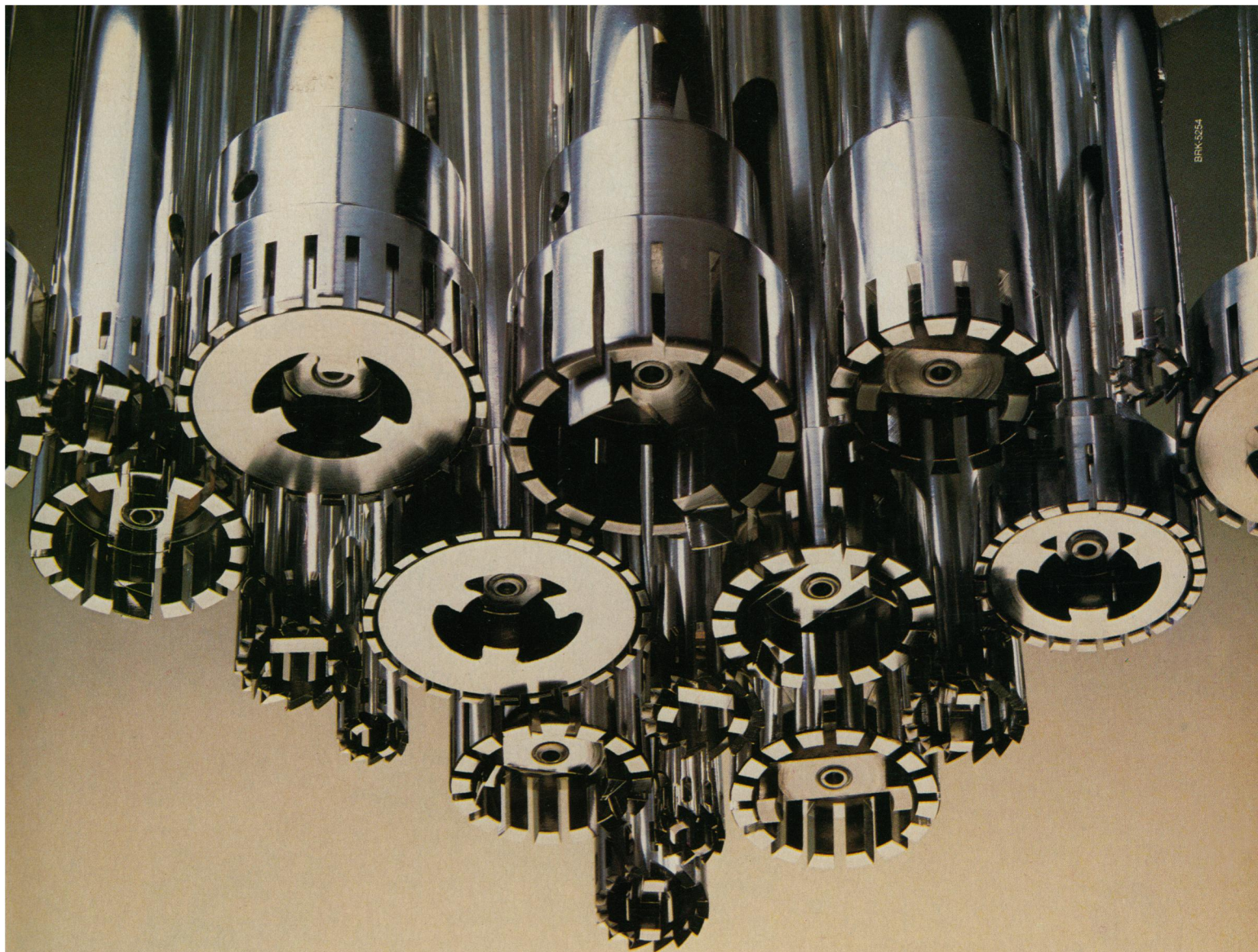
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Homogenizers

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Brinkmann
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Press Release

March 1, 1986

FOR IMMEDIATE RELEASE

Pharmacia has released a limited amount of information concerning a major new product to be announced at the 1986 ASM meeting. This biotechnology concern states, "with this new group of products, we address the growing need of life science researchers for fast, reliable and reproducible analytical tools."

In 1981, using the established principles and methods of ion exchange chromatography and the newly discovered MonoBeads™, Pharmacia firmly established FPLC® the first high performance, preparative separation technology for biological molecules. Now, with this announcement, the company claims to have engineered an analogous achievement for analytical studies using the well established principles of electrophoresis.

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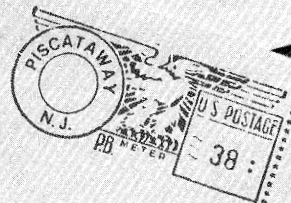
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Pharmacia

Laboratory Separation Division
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New From Pharmacia!



See PhastSystem™ and PhastGel™ at the Pharmacia booth numbers 123-128, American Society of Microbiologists, Washington, D.C., March 24-26, 1986 and at major scientific exhibits throughout the year.

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Pharmacia products will be on display at FASEB Booth L51, L53, M54

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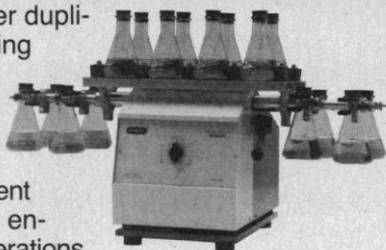
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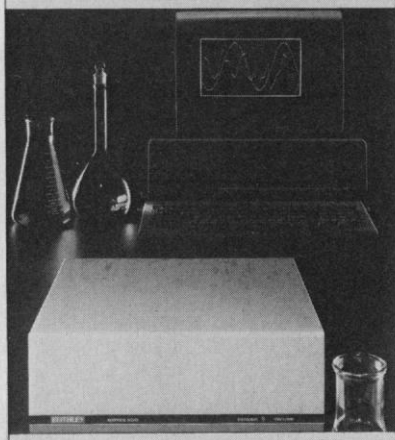
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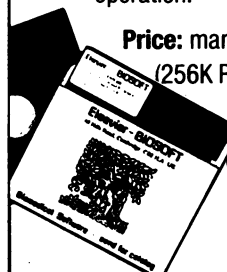
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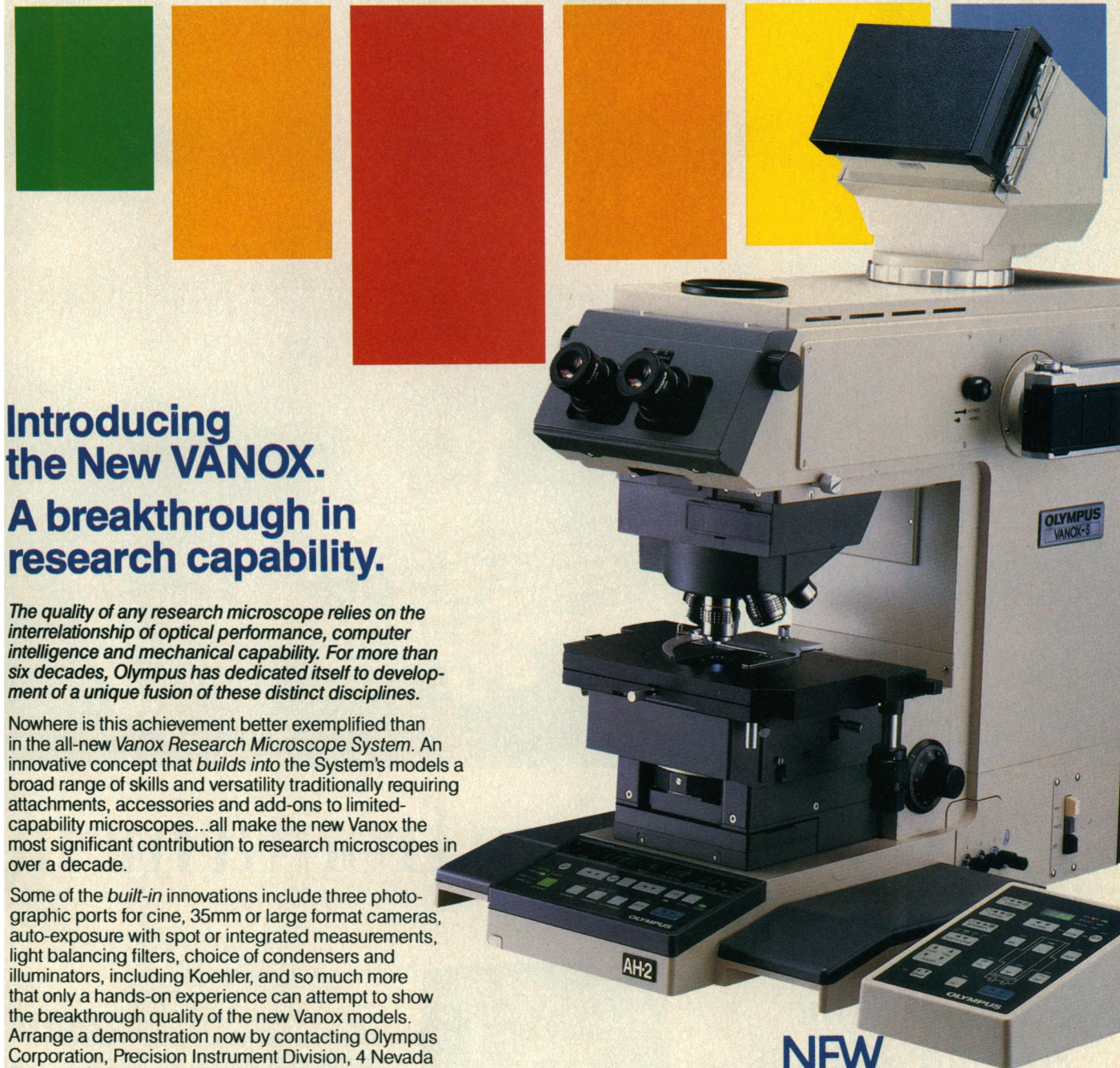
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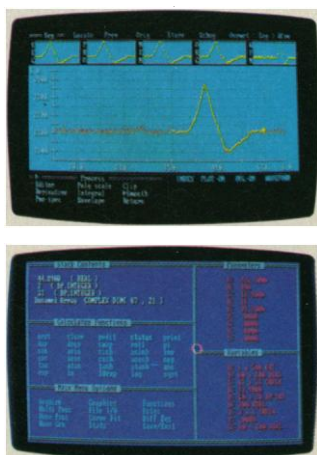
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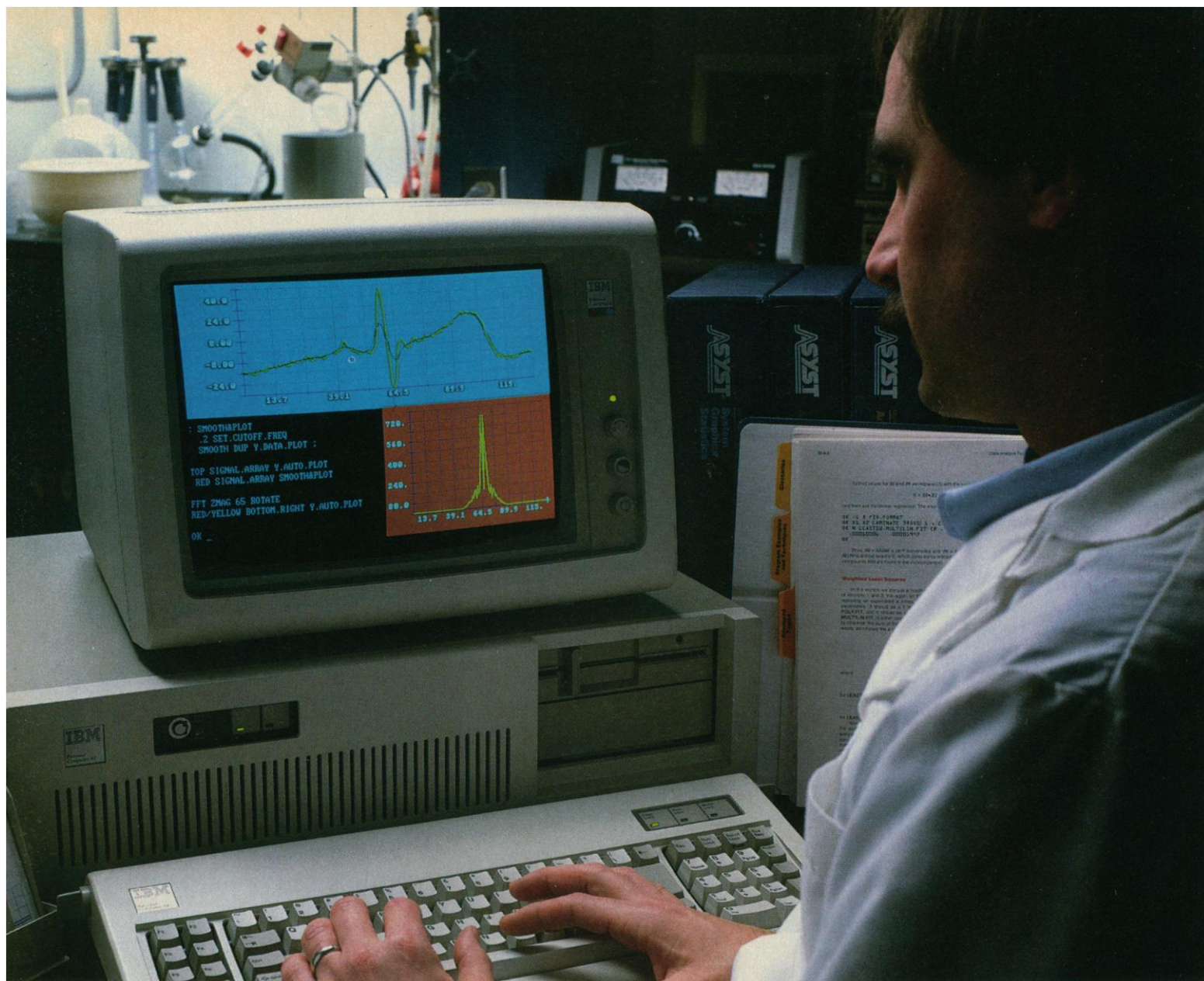
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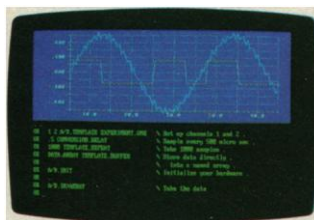
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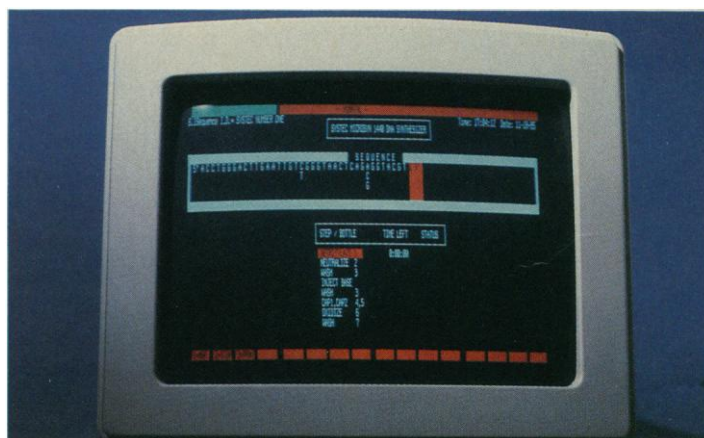


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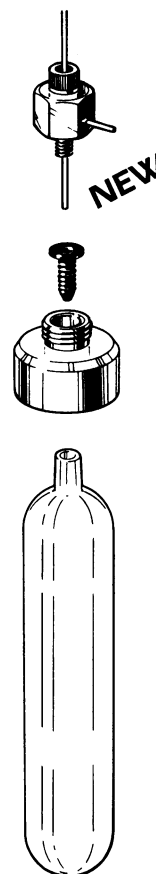
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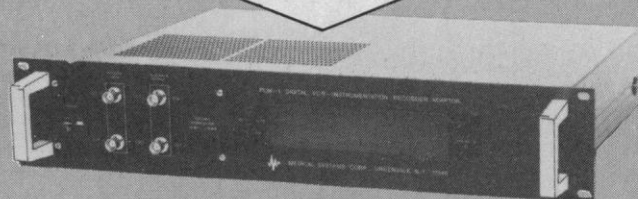
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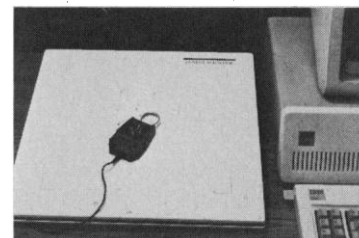
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Book Reviews

Peculiar Red Giants

Cool Stars with Excesses of Heavy Elements.

MERCEDES JASCHEK and PHILIP C. KEENAN, Eds. Reidel, Boston, 1985 (distributor, Kluwer, Hingham, MA). xvi, 398 pp., illus. \$54. Astrophysics and Space Science Library, vol. 114. From a colloquium, Strasbourg, France, July 1984.

Since Secchi first singled out the carbon stars in 1868 for the odd appearance of their spectra, the peculiar red giant stars have played a central role in the development of theories of stellar evolution. Red giant stars with excesses of heavy elements, elements such as yttrium, zirconium, strontium, barium, and the lanthanides, have challenged and often defied theorists attempting to explain their unusual chemical compositions. These same stars have challenged stellar spectroscopists as well, for their cool, extended atmospheres produce spectra of baffling complexity, rich with molecular features. Such stars are rare among the red giants, but their striking compositional differences from normal stars offer direct evidence of the nuclear processes occurring deep in the stellar interior.

Following Secchi's identification of the carbon stars, Merrill in 1922 noted a second group of peculiar red giants—the S stars—which display molecular bands of zirconium oxide rather than the titanium oxide of normal cool stars, or the CN, CH, and C₂ bands of the carbon stars. Bidelman and Keenan in 1951 defined yet a third group of peculiar red giants—the barium stars—which show strong atomic lines of barium and strontium and modest enhancements of the C₂ bands. Since the early '50's numerous additional groups and subgroups of peculiar red giants with excesses of heavy elements have been identified. The origins of these peculiar red giants, and the relationships between them, are the subject of *Cool Stars with Excesses of Heavy Elements*, the proceedings of the colloquium held at Strasbourg Observatory.

The volume provides a comprehensive summary of the observational data concerning the peculiar red giants—their spectroscopic and photometric properties, their chemical compositions, their distributions and motions in the Milky Way galaxy, and their membership in binary systems, in star clusters, in the Magellanic Clouds, and in other nearby galaxies. Of particular value are seven review papers, which are organized by topic rather than by stellar type, so that the reader views the peculiar red giants as a whole and can easily identify the similarities

and differences among the groups of stars. Jaschek first identifies who the players are, where they are located in the Hertzsprung-Russell diagram, and how they compare in overall characteristics, providing a vital overview of the cast of peculiar red giants. In a review of the photometric properties of cool stars, Wing stresses a physical understanding of the use of stellar photometry in interpreting cool stellar atmospheres. In an important contributed paper, Tsuji has computed

theoretical stellar atmospheres and flux distributions with molecular opacities for carbon stars, which show how difficult spectral classification can be. He finds that the temperature of the region in which spectral lines are formed changes only slowly for a large decrease in stellar effective temperature. Johnson reviews the status of model atmosphere calculations for cool stars, with attention to those cases in which the models appear to work well and to such problem

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