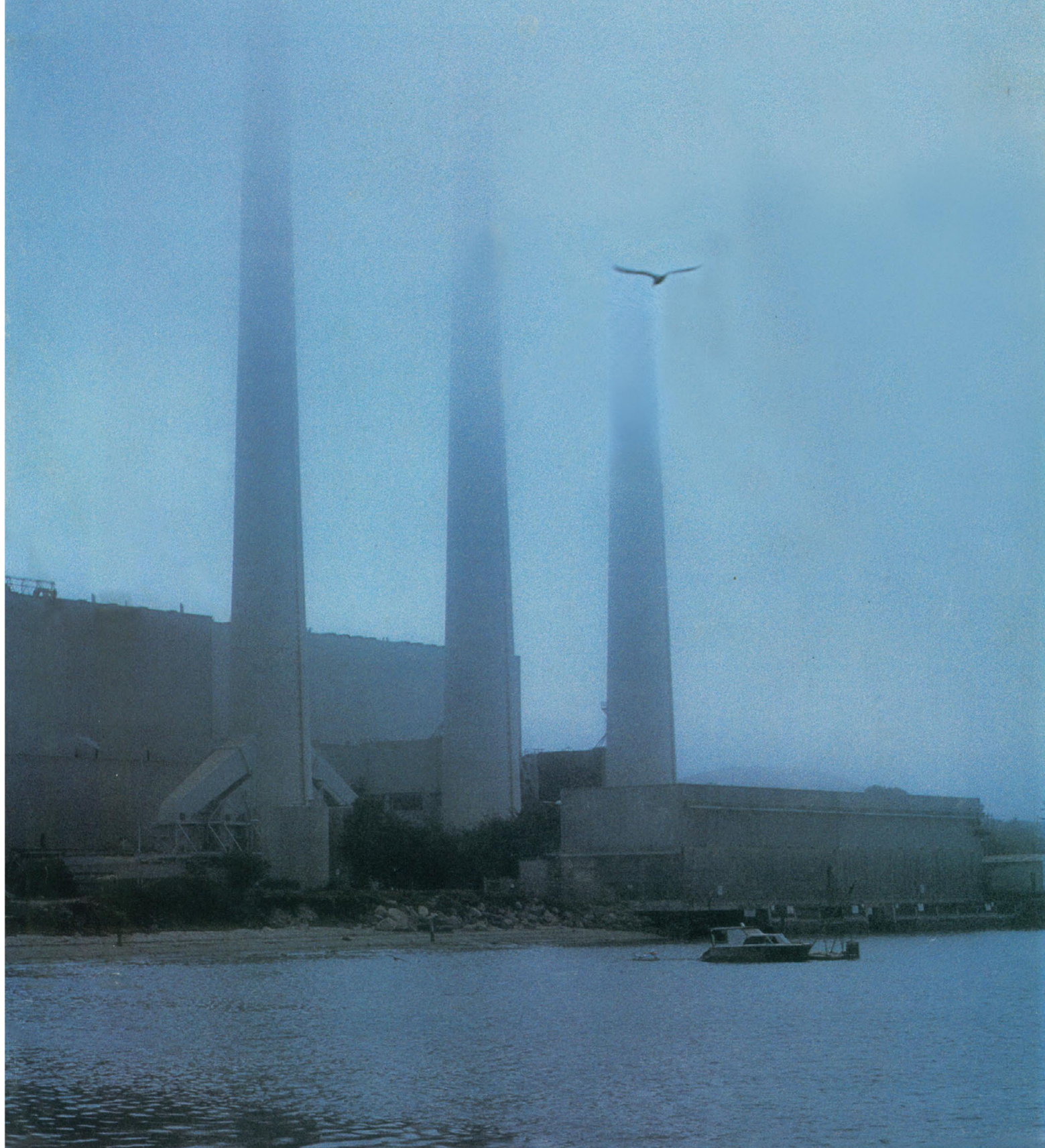


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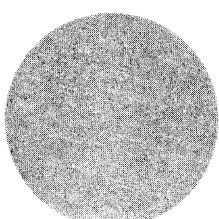
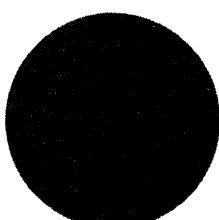
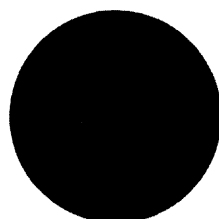
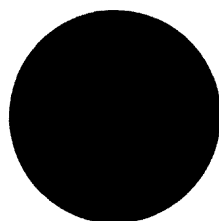
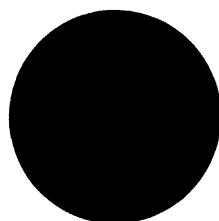
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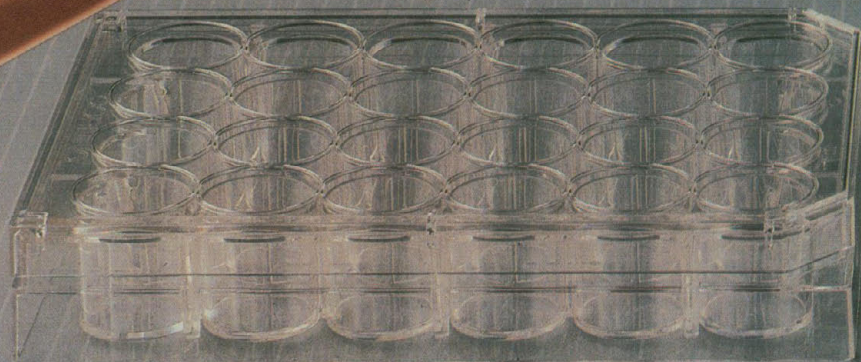
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Traditionally, scientists evaluated a catalytic material simply by placing it in a reactor, admitting feed under suitable conditions of temperature and pressure, and examining the resultant products. This "black box" approach rendered it virtually impossible to link catalyst structure with reactivity. Hence, in years past the finding of a new catalyst owed more

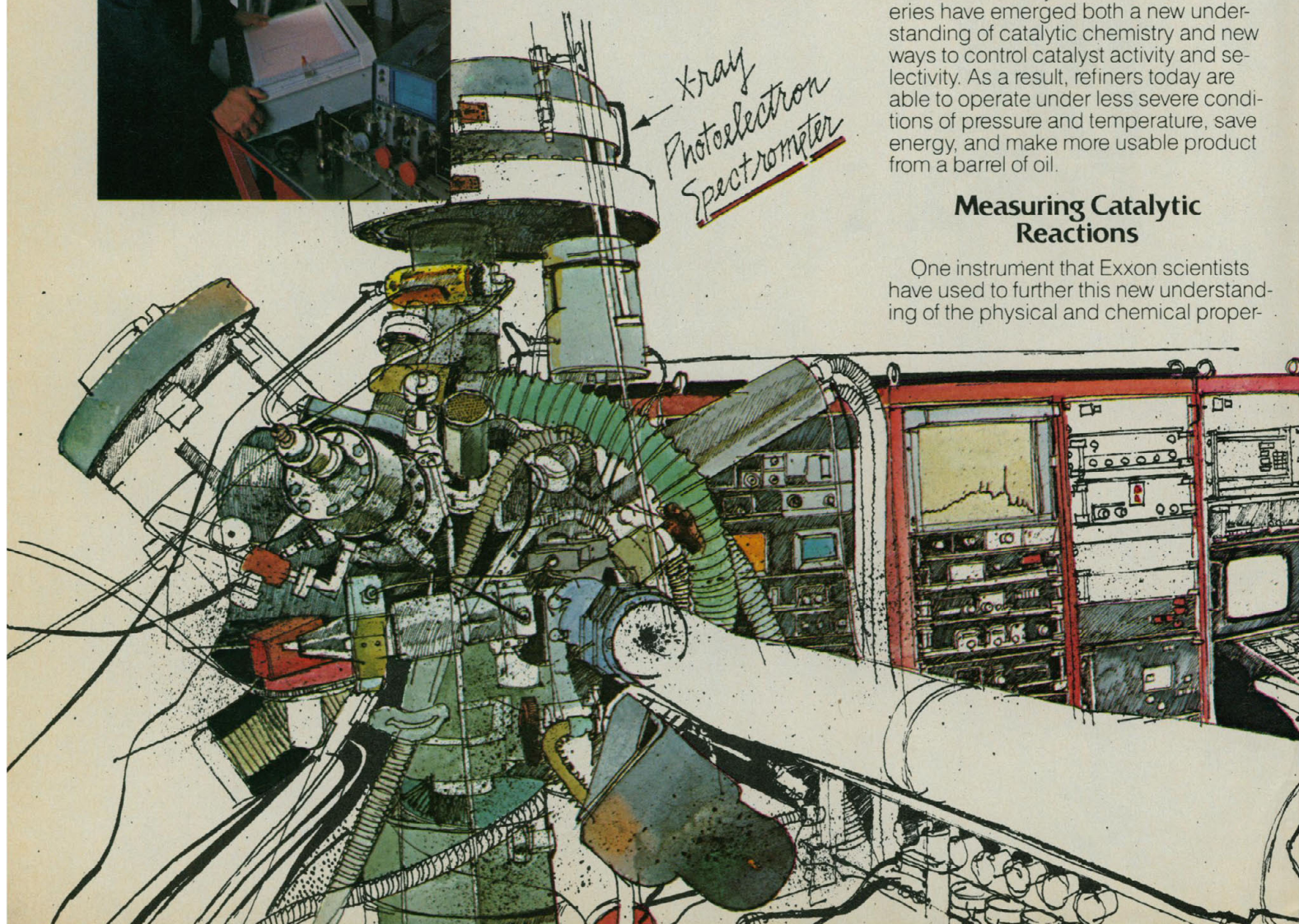
to art than to science. But today, scientists at Exxon are using advanced instrumentation with extraordinary capabilities to examine catalysts at work at the atomic level.

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In the mid-1960s, scientists at Exxon Research and Engineering Company (ER&E) made the fundamental discovery that supported bimetallic catalysts were vastly superior to supported single metallic catalysts. These catalysts, for example, have made it possible to produce high-octane gasoline without tetraethyl lead. Further research by ER&E led to the realization that all catalyst support materials modify to some extent the structure, electronic properties and chemical behavior of catalysts. From these discoveries have emerged both a new understanding of catalytic chemistry and new ways to control catalyst activity and selectivity. As a result, refiners today are able to operate under less severe conditions of pressure and temperature, save energy, and make more usable product from a barrel of oil.

## Measuring Catalytic Reactions

One instrument that Exxon scientists have used to further this new understanding of the physical and chemical proper-



# is solving of catalysis.

ties of catalysis is an x-ray photoelectron spectrometer coupled to a high-pressure catalytic reactor. Operating either under ultrahigh vacuum or pressure conditions, this novel device—one of only a handful in the world—not only measures the presence and strength of a metal support interaction, but also tests catalytic activity. Using a dedicated computer to analyze the tremendous amount of information generated in these reaction studies, researchers are unraveling the structure and reactivity of the catalytically active site.

## Watching Catalysts at Work

As a second approach to the study of catalysis, scientists at ER&E are using advanced surface analysis techniques to observe a catalyst at work. A specially equipped Controlled Atmosphere Electron Microscope is enabling researchers to examine, at the atomic level, the rela-

tionship between the structures of catalytic surfaces and the chemistries that occur there. This instrument, too, is one of only a few in the world, and the only one being used in private research. It has proved vital to our understanding of the kinetics and mechanisms of coal gasification.

Recognizing the importance of such *in situ* characterization, Exxon is further developing analytical instrumentation to probe both the catalyst and the reacting molecules while the catalytic reaction is in process. Using infrared, visible, ultraviolet and x-ray radiation, this sophisticated equipment could dramatically widen the horizons of catalysis, and one day enable us to design catalysts to order.

## Exxon Research and Engineering Company

Catalysis is but one example of the research and engineering programs under way at Exxon Research and Engineering Company. A wholly owned subsidiary of Exxon Corporation, ER&E employs more than 2,000 scientists and engineers working on petroleum products and processing, synthetic fuels, pioneering science and the engineering required to develop and apply new technology in the manufacture of fuels and other products. For more information on catalysis or ER&E, write Ed David, President, Exxon Research & Engineering Company, Room 603 PO Box 101, Florham Park, New Jersey 07932.





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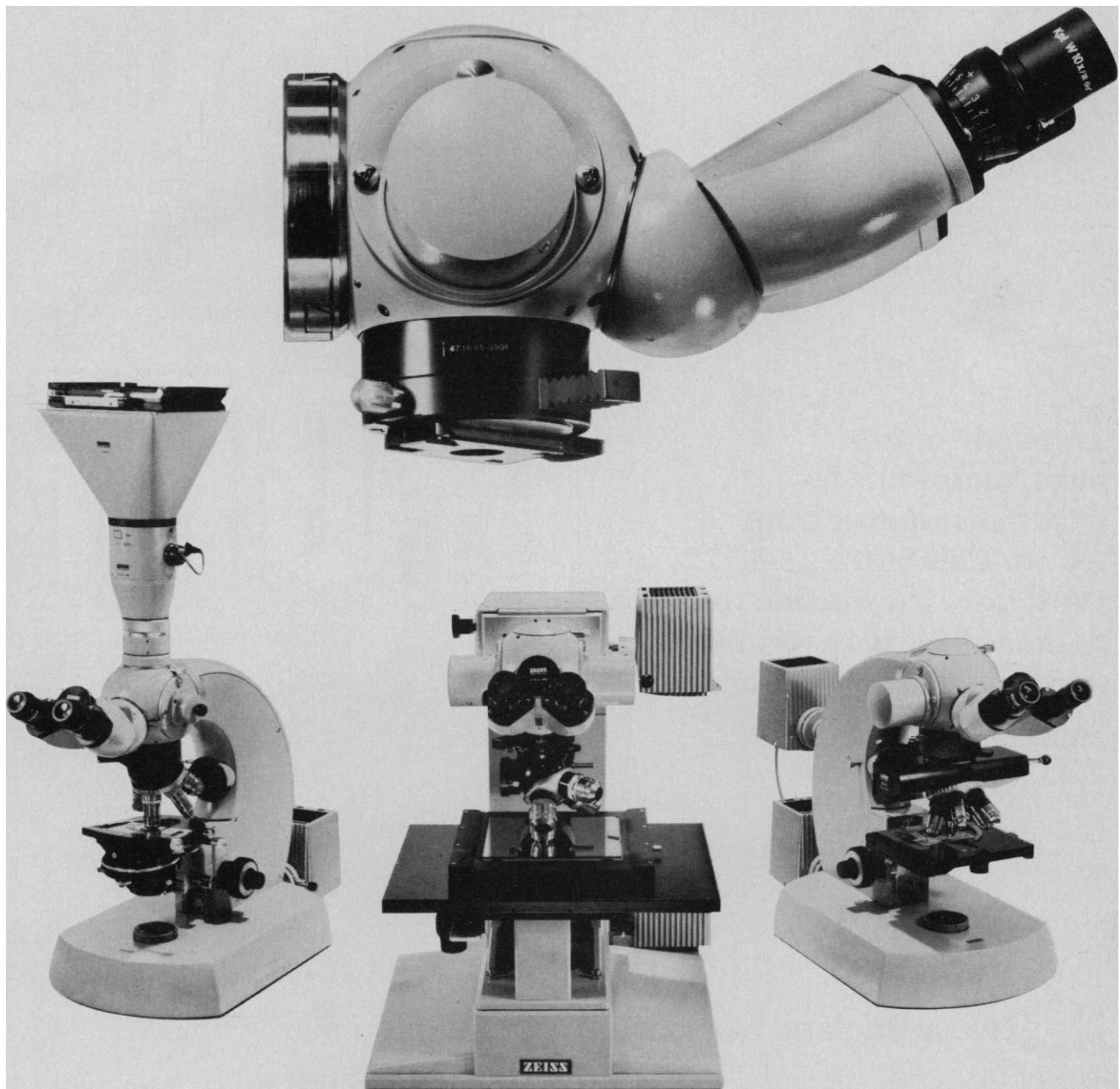
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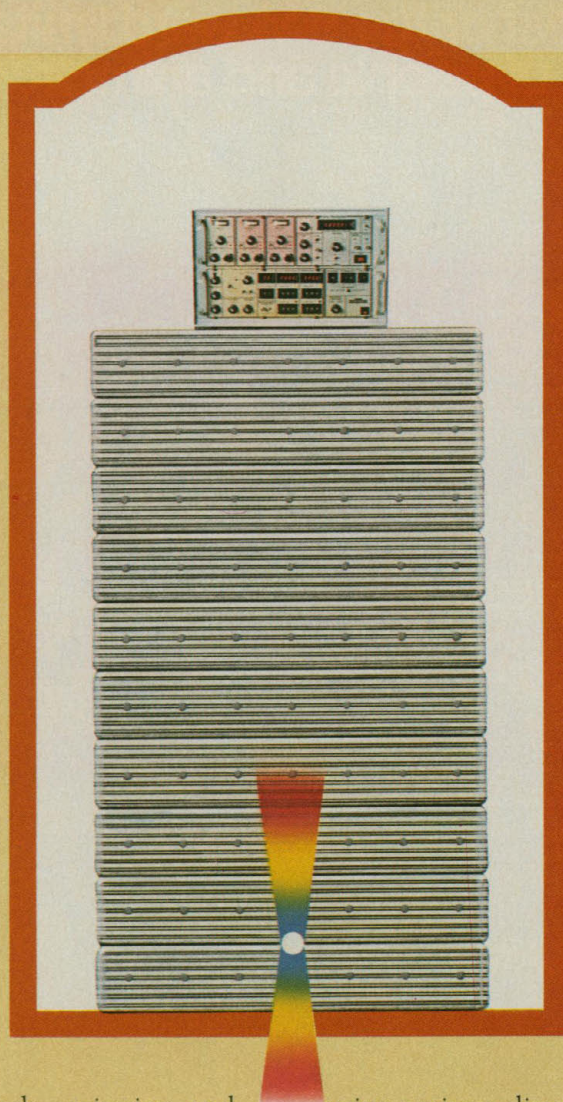
Guilleimin et al., Science (in press)



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# The new MICRO-ISOLATOR™ System:

**A remarkably simple caging system that has the microbiological integrity of a complex isolator... without its high cost or the awkward limitations on the movement of people and animals.**

## What's different about the MICRO-ISOLATOR System?

At first glance, it looks as though we've just put a polycarbonate cage on top of a standard mouse cage with the "roof" of the top cage vented. Right... but there's more. The recessed roof functions as a static filter by virtue of a special filter material that's protected by a perforated aluminum sheet. And, most importantly, the top cage overlaps the bottom cage and effectively forms a giant Petri dish-like structure. Result: There is a substantial interchange of gases *and* an effective microbiological barrier.

## How effective is all this?

This system, when incorporated into most existing facilities (with only minor facility modification), can maintain axenic mice in the gnotobiotic state. The static filter and the cage overlapping effectively keep dust particles—which are the "microbiological taxis"—out of the system. Accordingly, this is really a miniature isolator, an "island," a protected microenvironment within any macroenvironment.

Does it really work? Even immune-suppressed mice have been successfully maintained in this system *adjacent* to mice contaminated with *Pseudomonas*, *Pasteurella*, *Citrobacter*, *Aerobacter*, *Klebsiella*, and *Staphylococcus aureus* without any transfer of organisms.

## What are the applications of the MICRO-ISOLATOR System?

It's ideal for the maintenance of a stable limited defined-flora mouse colony... for either animal production or research. It is also a first-rate quarantine housing system because animals from different sources with differing microbiological profiles can be quarantined in the same room without cross-contamination. (The barrier works in both directions: keeps contaminants in or out.)

## What are the other advantages?

This caging system is rigid, durable, easy to handle, uses minimal rack space, is easy to sterilize, and because the top fits snugly on a standard 29.2 x 19 x 12.7 cm mouse cage, it doesn't dislodge when cages are pushed together (the way other filter caps sometimes do).

The system eliminates the expense and inconvenience of starting or maintaining a complex SPF barrier type facility. Simple, inexpensive, and no time-consuming "entry" procedures.

Finally, the colony odor is significantly minimized; allergic responses are substantially reduced through containment of animal dander.

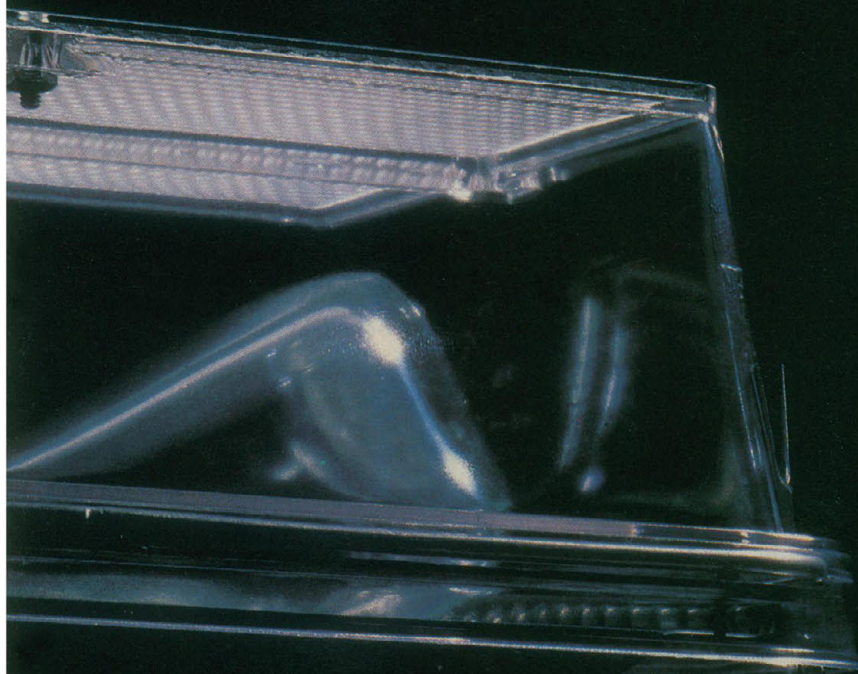


## But is the air interchange really adequate?

Institutions now using this system report that hypoxia is not a problem. Additionally, ammonia level is not a problem if the population density per cage is kept at three to four mice and bedding changed every three or four days... especially when relative humidity can not be well controlled. (Ammonia can be totally eliminated from the colony if defined-flora mice without urease-positive aerobic bacteria are used.)

## What else do I need to make the MICRO-ISOLATOR System work?

To effectively maintain the isolation of the animals at all times, cages must be opened and serviced within a Class II Biohazard Hood and aseptically supplied with sterile feed, bedding, and water. (For additional guidance on the use of this system, please consult the references below.)



## From Lab Products, Inc.—the leader in environmental control products

Lab Products now offers the widest selection of systems for environmental protection: the new MICRO-ISOLATOR System; the VR-1 Ventilated Animal Rack; five Stay-Clean™ laminar flow systems; Isosystem™ housing system consisting of a disposable filter cap, cage cover, and plastic cage; Enviro-Gard™ filter system with permanent filter bonnets; and See-Through™ suspended cage systems with a special filtering system. We are now likely to have at hand solutions to virtually all of your environmental problems.

## Ordering Information

To order the new MICRO-ISOLATOR System, please refer to the following catalog number:

- 10209—Complete MICRO-ISOLATOR System consisting of:
    - 10272—Polycarbonate cage 29.2 x 19 x 12.7 cm
    - 10227—Stainless steel wire bar cover
    - 10204—Polycarbonate MICRO-ISOLATOR filter bonnet
- Above items may be ordered individually.

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- 10206—Replacement filter sheet
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Call Customer Service toll free 1-800-526-0469.

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Write or call Lab Products, Inc., 255 West Spring Valley Avenue, Maywood, New Jersey 07607 or complete the coupon. (Phone 201 / 843-4600)

### References

R. S. Sedlacek, H. D. Suit, K. A. Mason, and E. R. Rose, 7th ICLAS Symp., Utrecht, 1979, Gustav Fischer Verlag, Stuttgart, Germany, 1980, New York, 1980.

See also: abstracts of papers Nos. 32 and 35 of papers presented by R. S. Sedlacek and R. P. Orcutt at 32nd Annual Session AALAS, Salt Lake City, Sept. 20-25, 1981.

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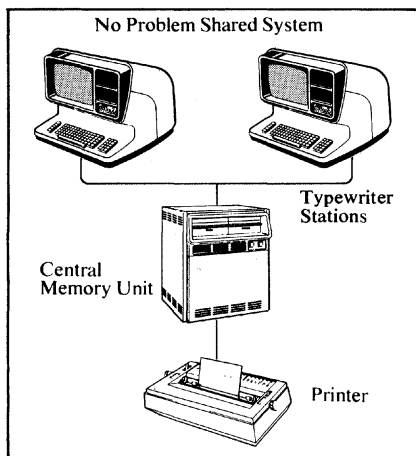


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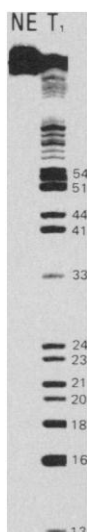
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An example of the quality and useful-



ness of P-L PNK is shown in this photograph of an autoradiogram from a RNA sequencing experiment. *E. coli* 5S ribosomal RNA was 5'-end labeled with  $^{32}\text{P}$ -ATP in the presence of P-L Cat. No. 0734 PNK and repurified on a polyacrylamide gel. The figure shows the electrophoretic pattern obtained from a  $T_1$  nuclease digestion of the labeled 5S RNA as described in a recent *P-L Analects* article on RNA sequencing. The success of the labeling step with PNK is underscored by the fact that the gel pattern indicated G residues only at the correct positions from the 5'-end of 5S RNA.

### P-L PNK Summary

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**Preparation:** Solution of nearly homogeneous protein in 50% glycerol containing 0.02 M potassium phosphate, 0.025 M KCl, 0.01 M 2-mercaptoethanol, and  $10^{-7}$  M ATP (pH 7.0).

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**Package sizes:** 100 units (200 Richardson units); 500 units (1000 Richardson units).

For more information contact: P-L Biochemicals, Inc., 1037 West McKinley Avenue, Milwaukee, WI 53205. Call toll free (800) 558-7110. In Wis. call collect (414) 347-7442.

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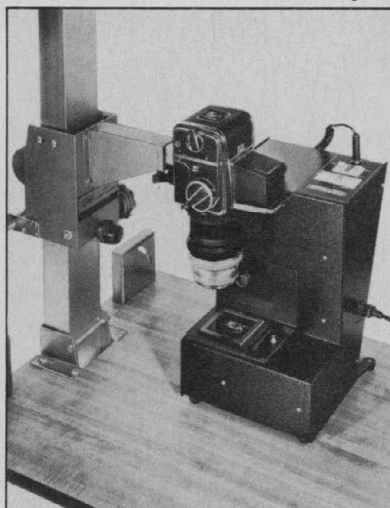
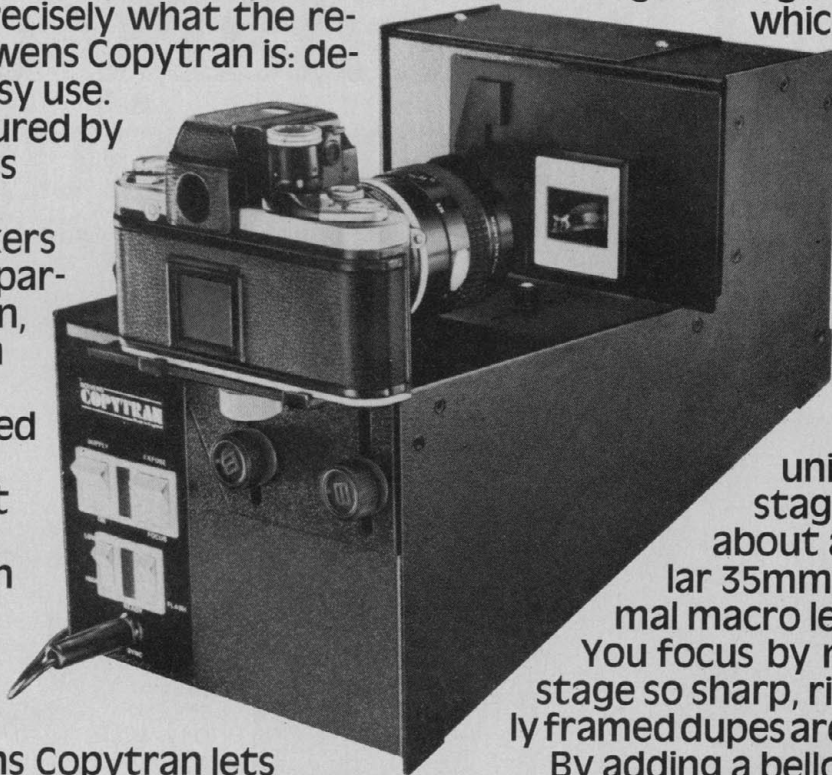
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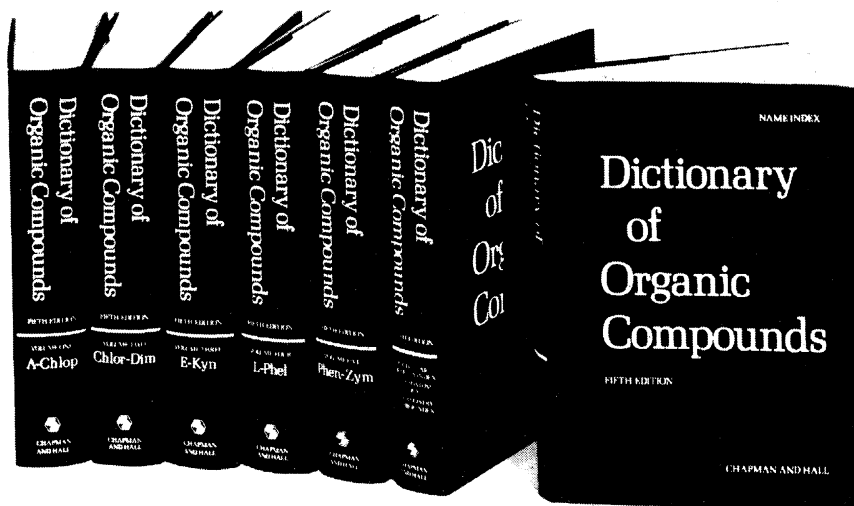
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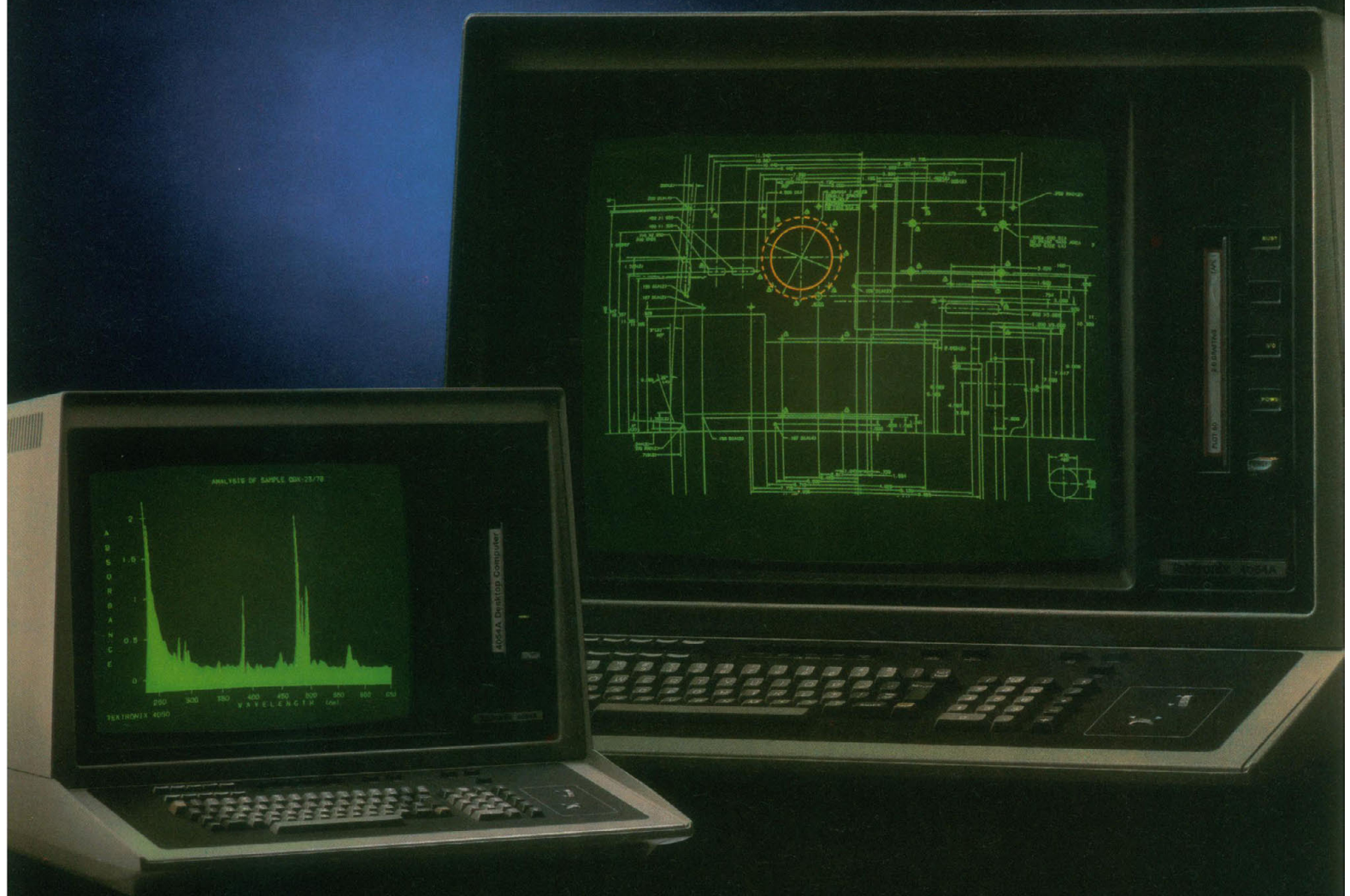
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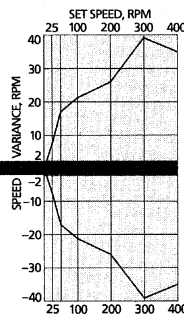
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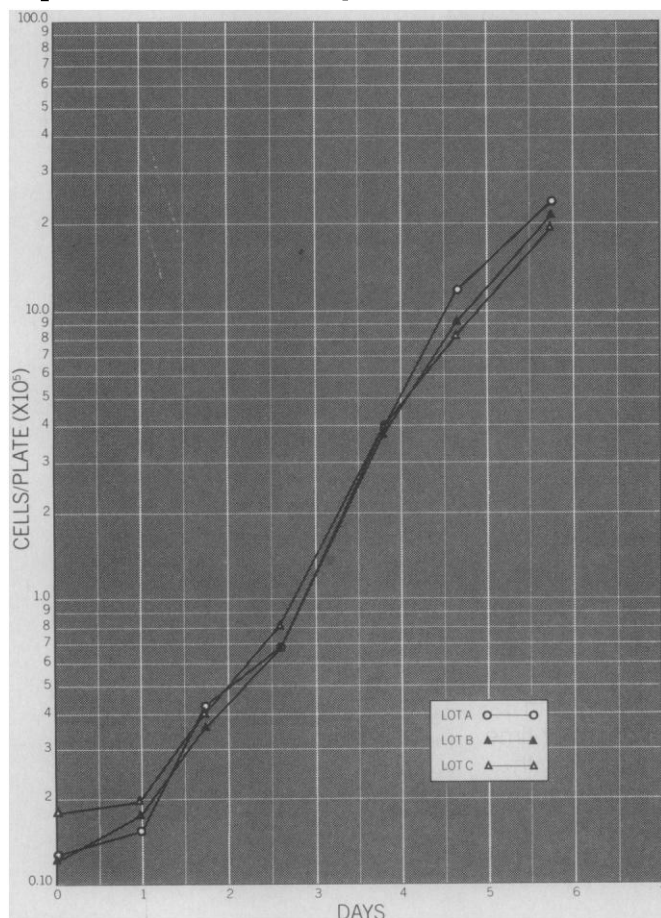
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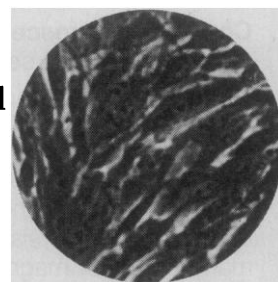
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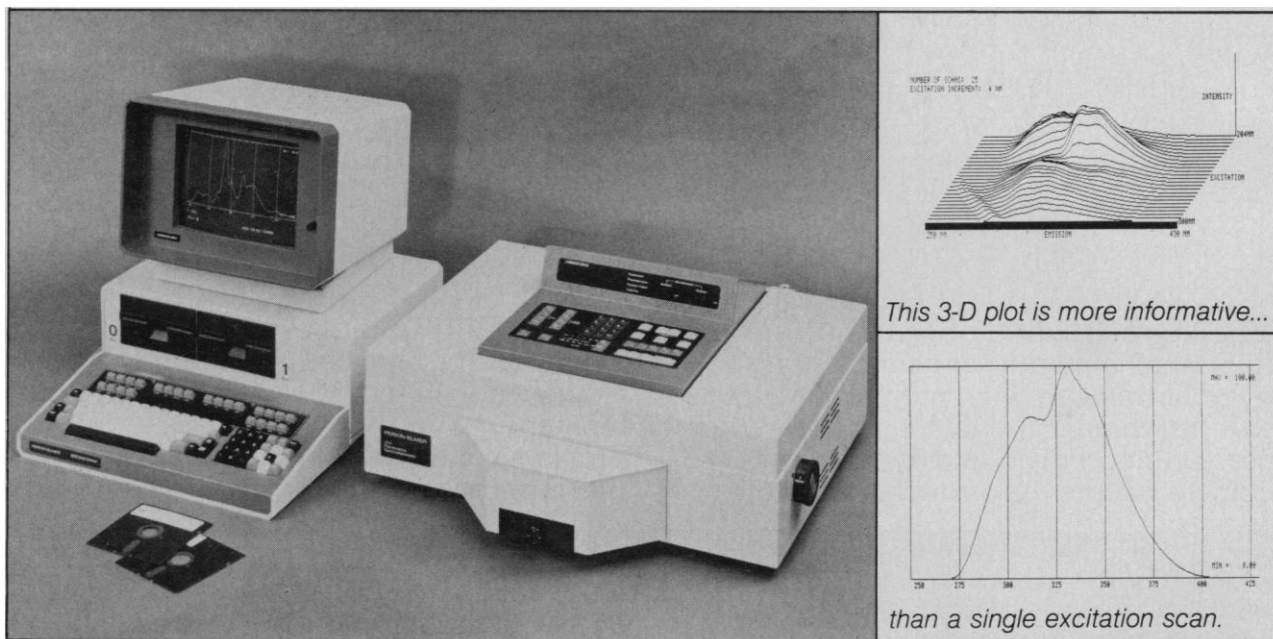
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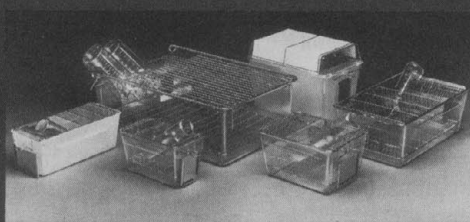
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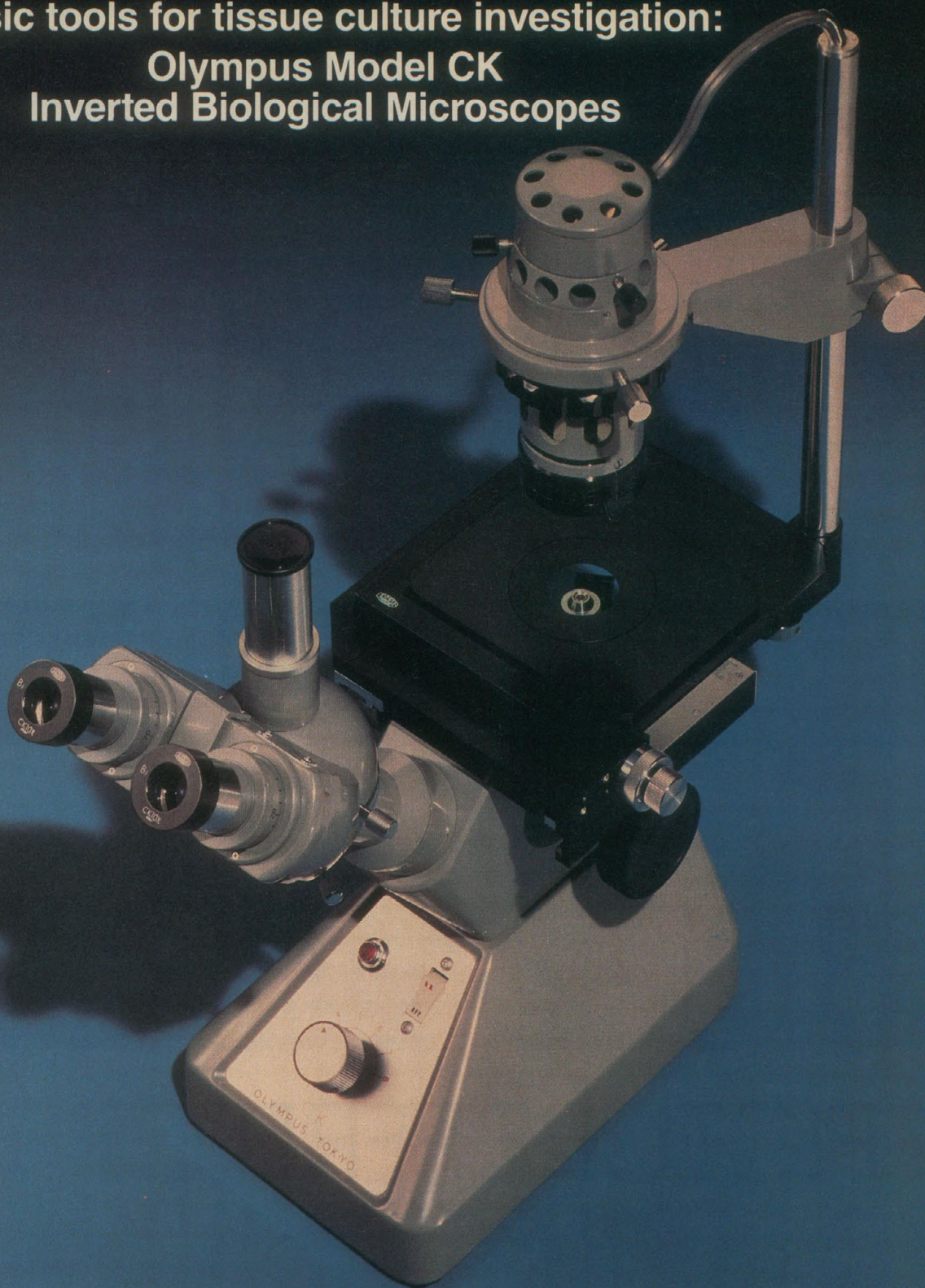
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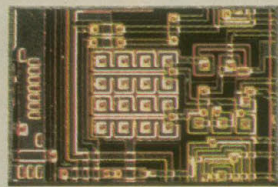
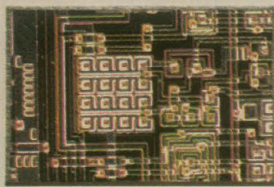
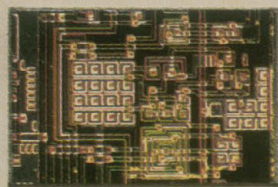
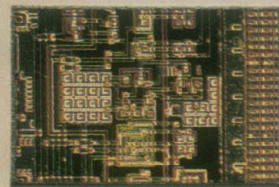
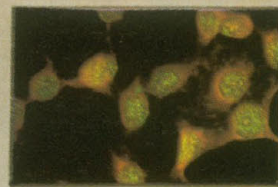
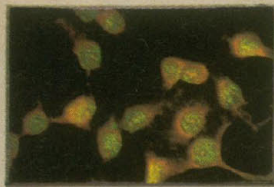
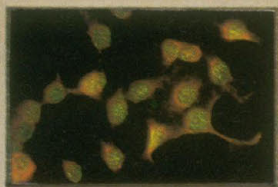
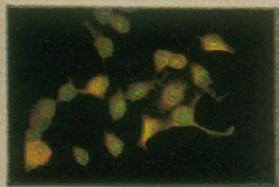
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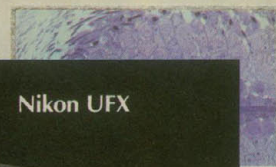
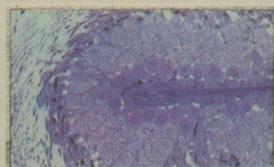
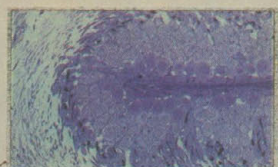
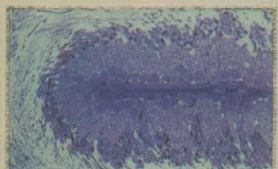
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## Methane: A Motor Fuel

When oil becomes scarce and even more costly, other fuels will replace it in motor vehicles. Already a start has been made with ethyl alcohol and there has been talk of employing methanol as a motor fuel. But little attention has been focused on methane. This lack will be partly met by a book entitled *Methane: Fuel for the Future*.\*

The earth's crust contains large amounts of methane. The gas can also be obtained from biomass and from synthesis gas derived from coal. In the United States, a million-mile pipeline network exists for distribution of the gas. Methane is already being used in about 400,000 vehicles around the world, including 250,000 in Italy and 20,000 to 30,000 in the United States. Users have found that engine wear is reduced: lubricating oil is not diluted as it is when gasoline is used. Exhaust gases are relatively nonpolluting. Start-up of motors is not affected by cold weather. An engine designed especially for methane has an energy efficiency greater than that of ordinary automobiles. Conventional cars and trucks can be modified at a cost of \$1500 to burn either methane or liquid fuels. When they burn methane, such engines are about 10 percent less efficient and, for the same piston displacement, generates 25 percent less power than with gasoline.

A major consideration in the use of methane is the need to employ high pressures—typically 160 to 200 atmospheres—to store the gas in the vehicle. Steel vessels used for this purpose add about 10 percent to the weight of the vehicle. Light tanks made of composite materials are under development. Riding around in a vehicle with tanks at 200 atmospheres might seem hazardous; however, the vessels are built to withstand about three times that pressure and are tested at pressures considerably above those in standard use. Such vessels would withstand a crash far better than a conventional gasoline tank. To obtain the high pressures for filling the methane tanks, compressors are employed. At present, these are too costly for individual home use. Thus, the principal present use of methane-fueled vehicles is in fleet operations, where a single compressor and accompanying storage tanks can serve many cars or trucks. A substantial number of natural gas distribution companies maintain such fleets. One Kansas City company has 700 vehicles that operate with natural gas.

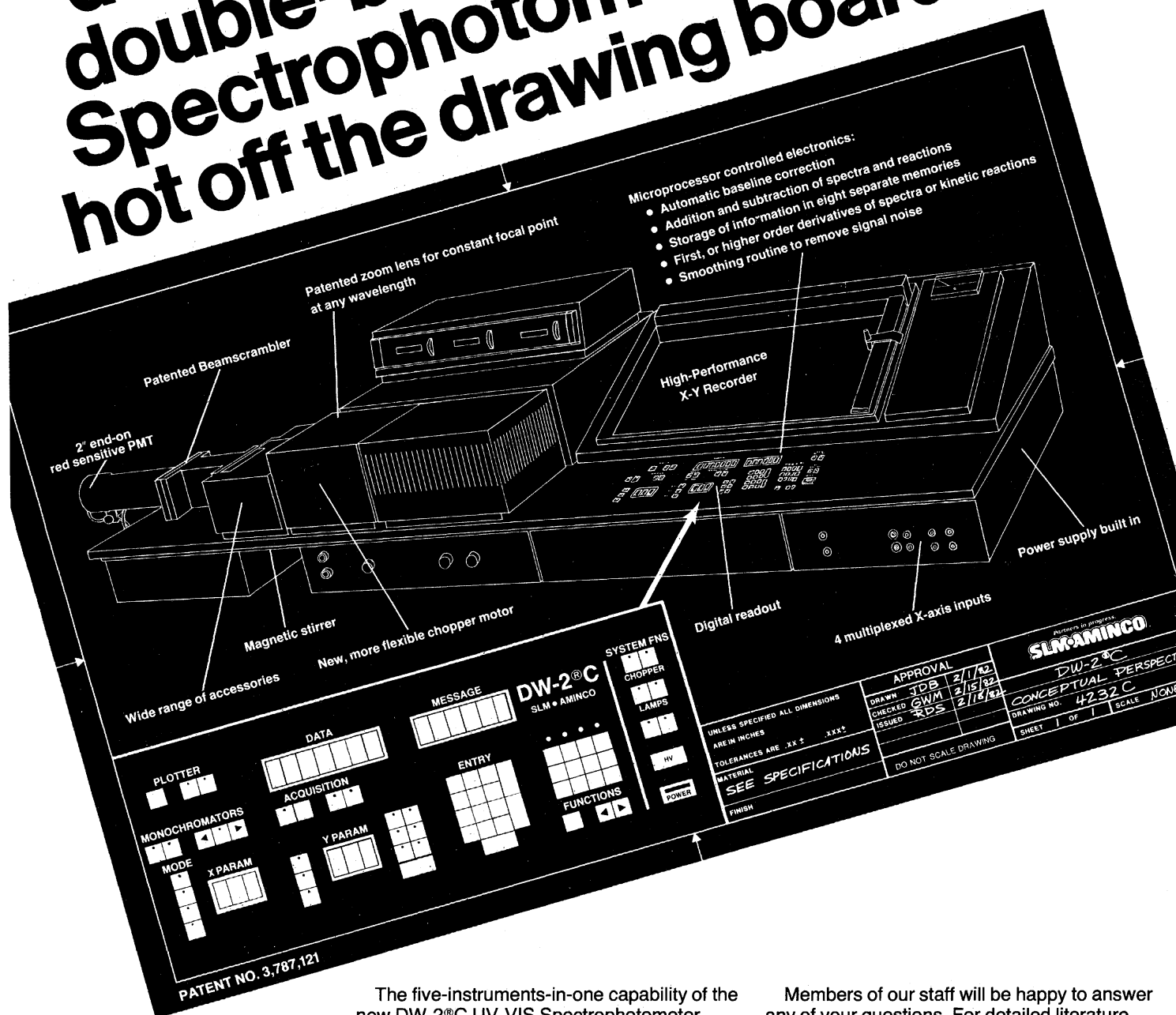
Of all the alternatives to gasoline from petroleum, methane is the one source that could displace much of it relatively rapidly. For example, shale oil in quantity is decades away, as are liquid fuels from coal. But methane is available and conversion of cars to use it is not difficult. At the moment, proved reserves of natural gas are limited, but the National Petroleum Council and the American Gas Association are confident that much more will be found and tapped. They point to methane in the Devonian shales of the Appalachian Basin, to methane associated with coal, and to natural gas in western tight gas sands. In addition, many other horizons have not been explored. Once successful wells are drilled, processing equipment can be quickly installed and the production channeled into the pipeline network. Thus, the nation has an answer to a prolonged attenuation of oil imports.

As long as liquid fuels are readily available, motorists will probably pay a premium price for them. Operators of large fleets will make their decisions on the basis of relative costs. The cost of gasoline per unit of energy is now about twice that of methane, and if present prices continue, fleet operators making heavy use of vehicles could afford to make the investments necessary to convert to methane. In the United States, there is uncertainty about the effects of deregulation on the price of natural gas. In the short term, it may rise. However, potential future supplies of methane have an energy content considerably greater than that of petroleum, and ultimately the contrast in price of the two fuels must increase. Hence, it is likely that in the long term methane will have an increasing role as a motor fuel.

—PHILIP H. ABELSON

\*P. McGeer and E. Durbin, Eds., *Methane: Fuel for the Future* (Plenum, New York, 1982).

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