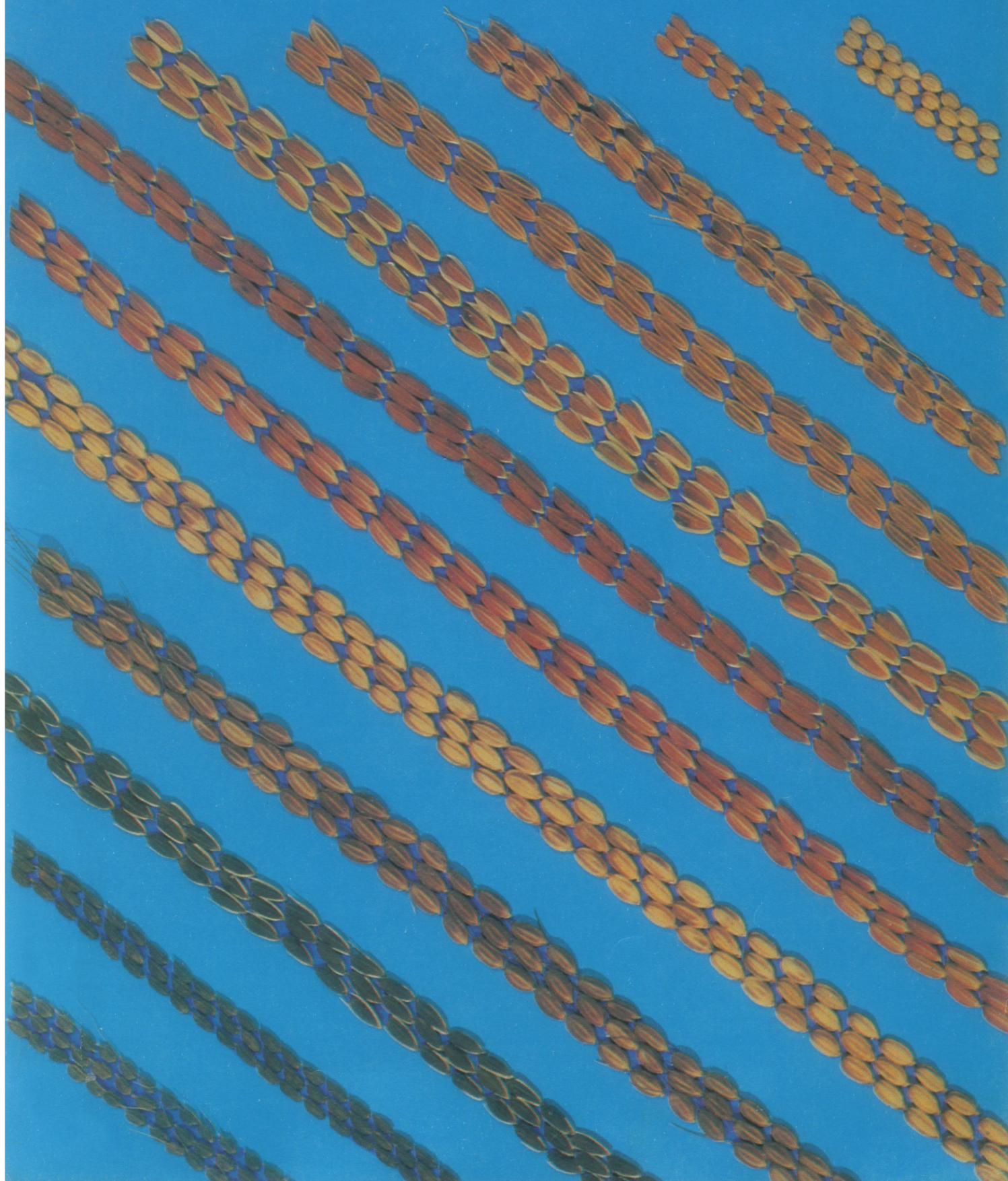


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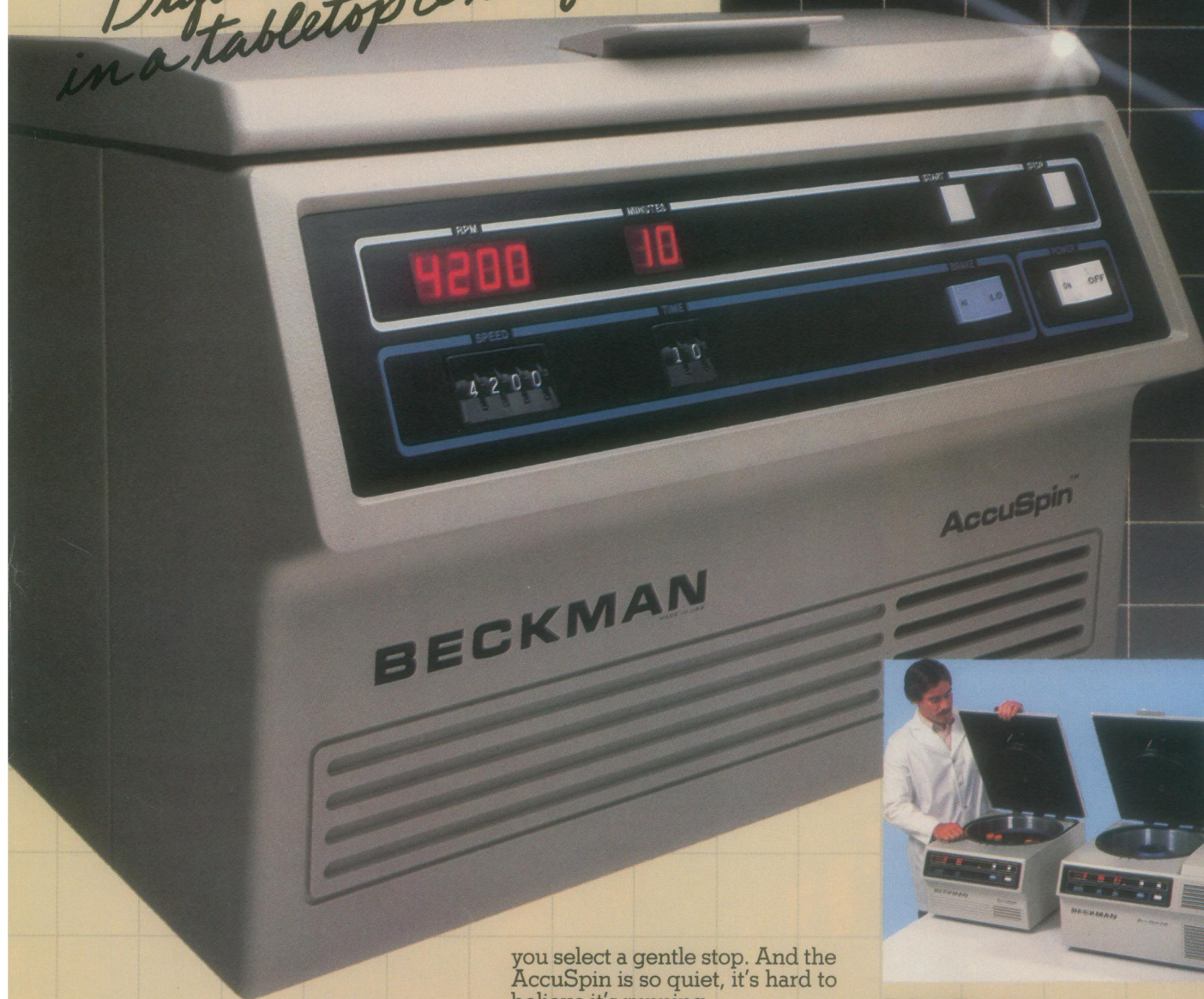
SCIENCE

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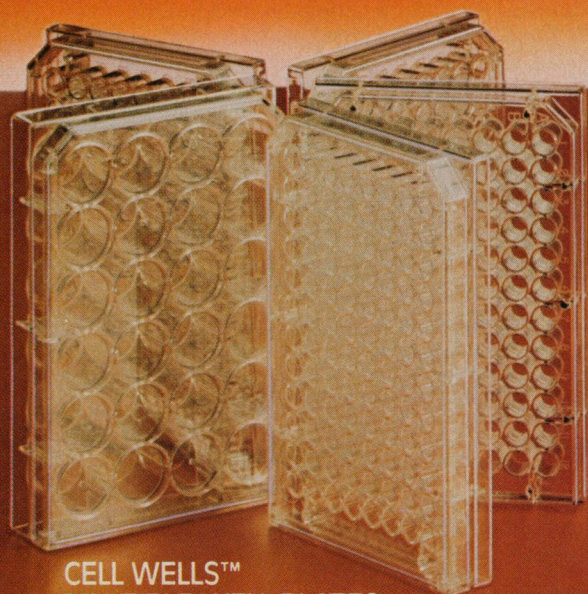
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COVER

Strands of rice grains, showing the rich diversity present in this staple food crop. Improved conservation and preservation of rice germplasm are essential to sustain production increases. See page 251. [T. T. Chang, International Rice Research Institute, Manila, Philippines]

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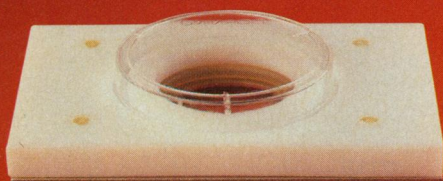
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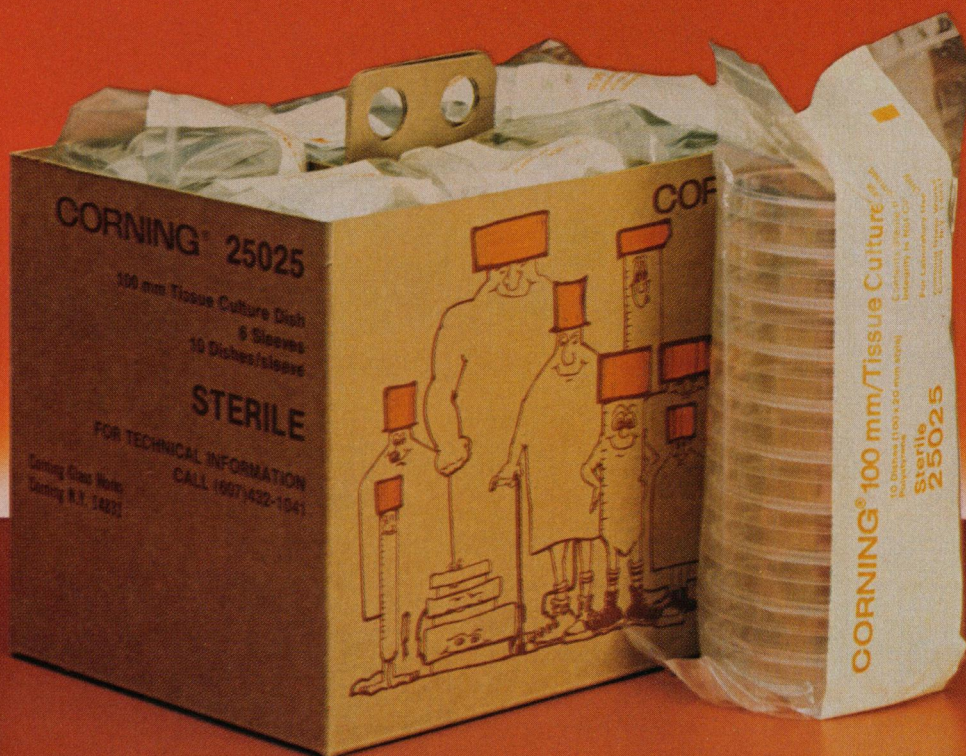


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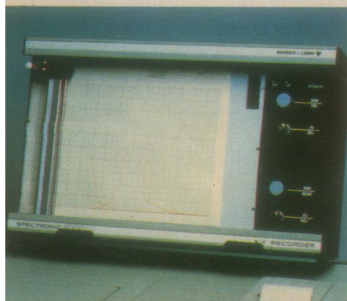
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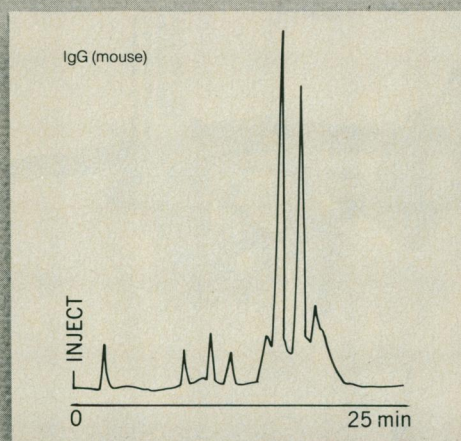
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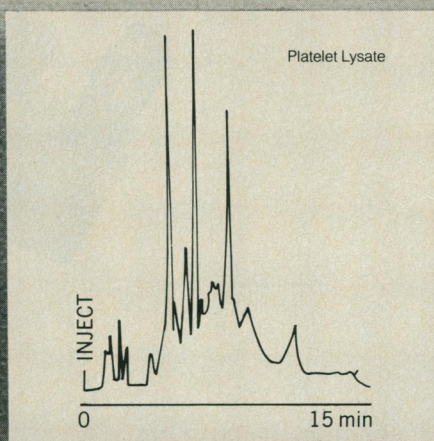
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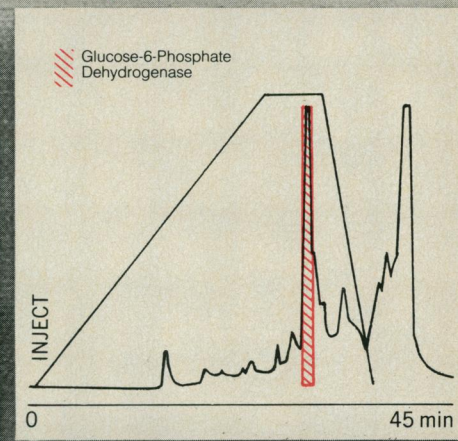
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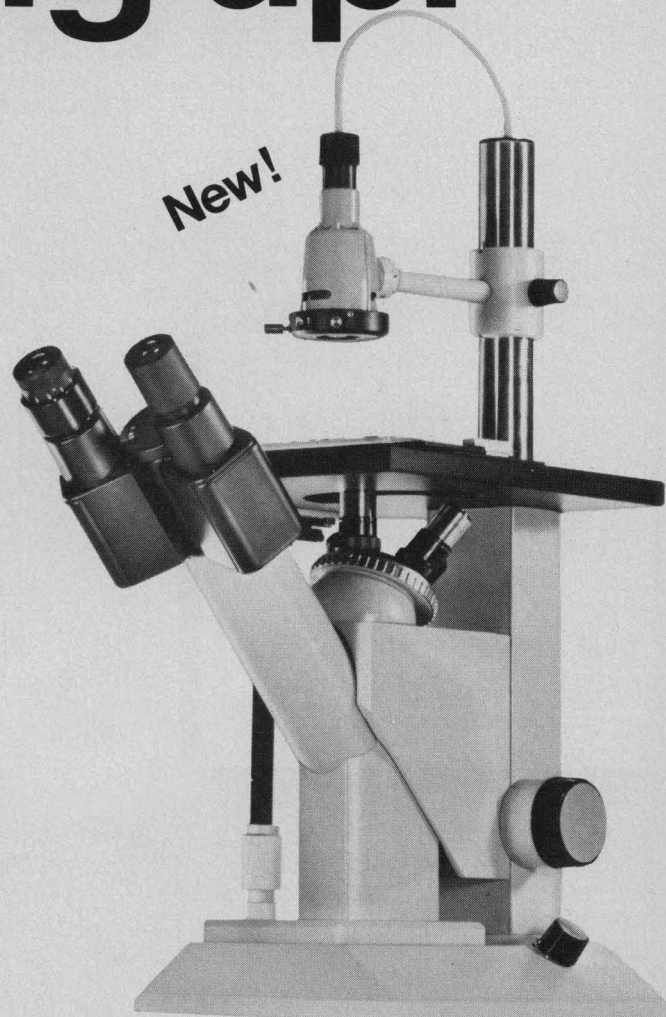


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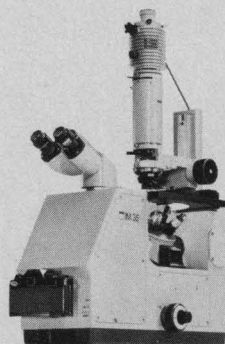


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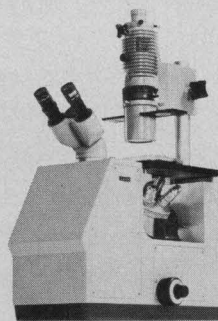
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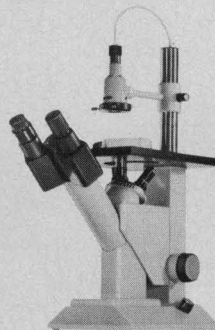
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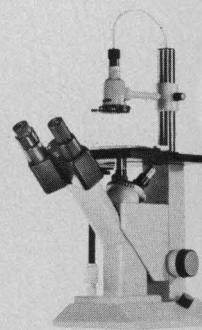
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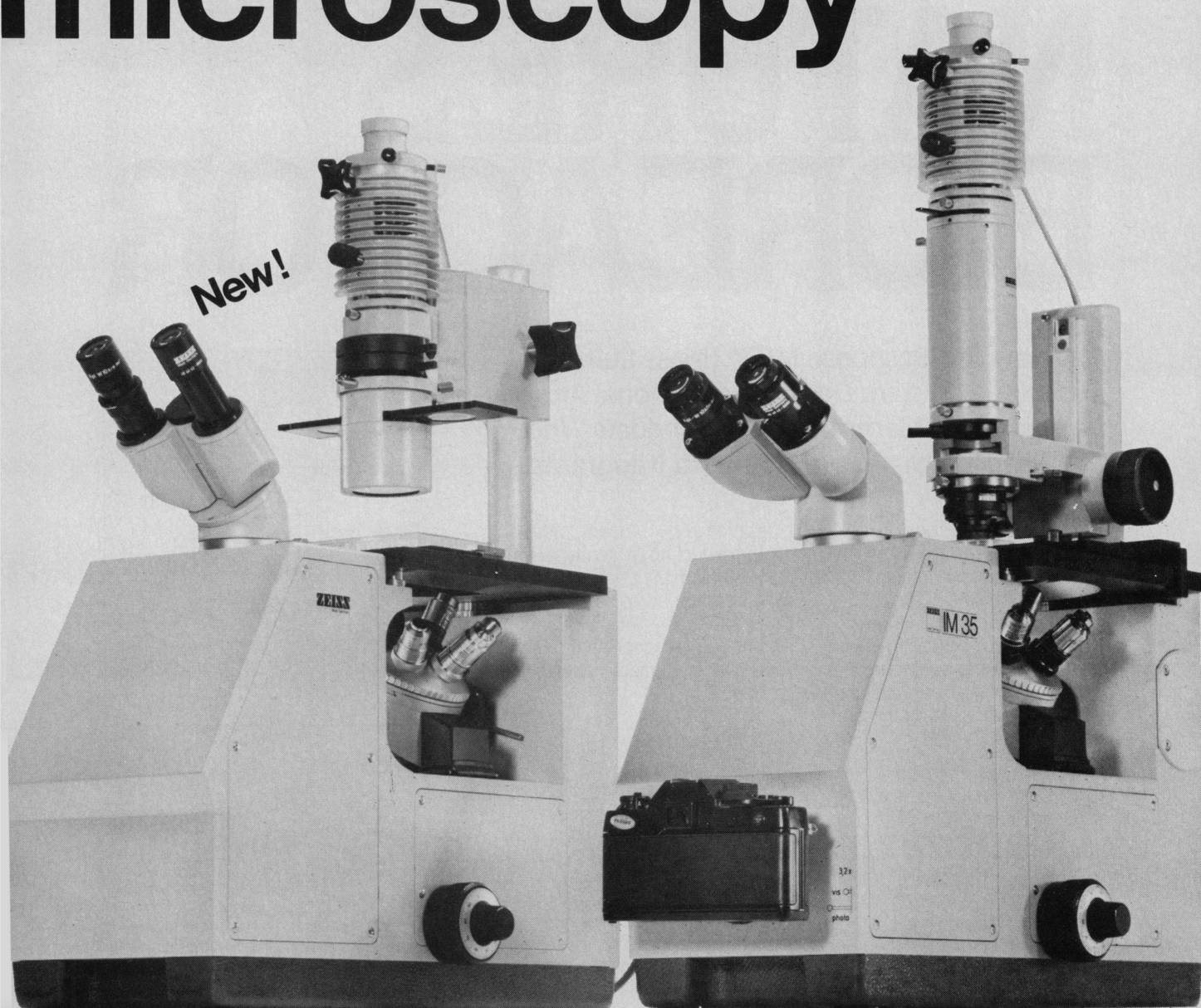


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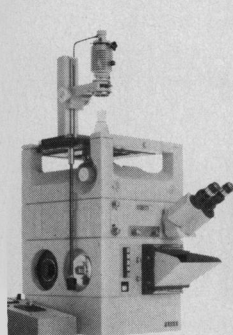


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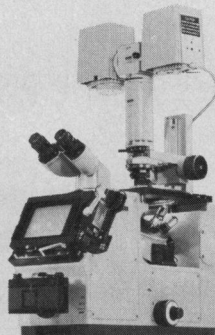
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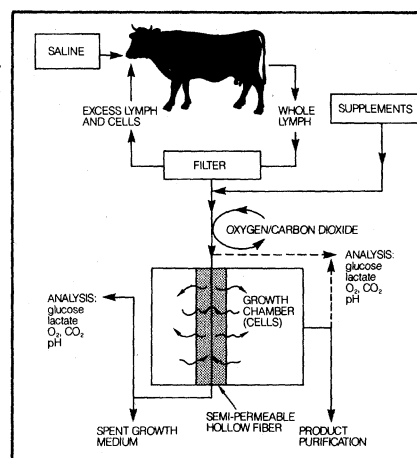
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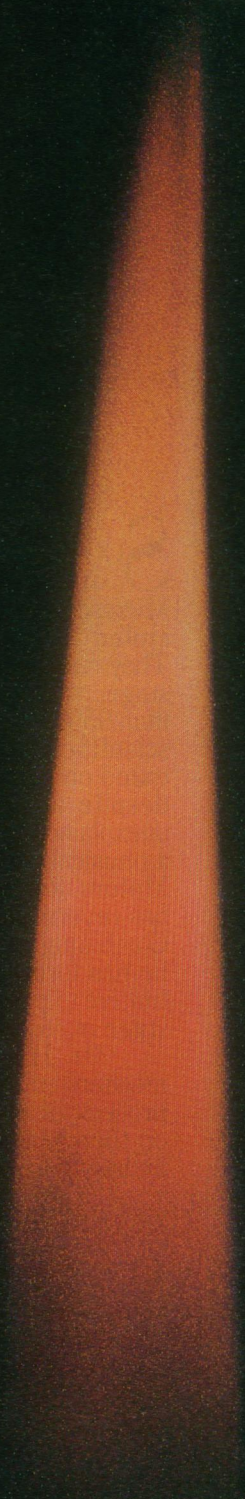
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The Logical Suspect



The Logical Suspect

Soot particle growth as it takes place in wood-burning fireplaces, diesel engines, and industrial furnaces, has been attributed to a complex set of interdependent chemical reactions.

A researcher at the General Motors Research Laboratories has demonstrated that the decomposition of a single species is primarily responsible.

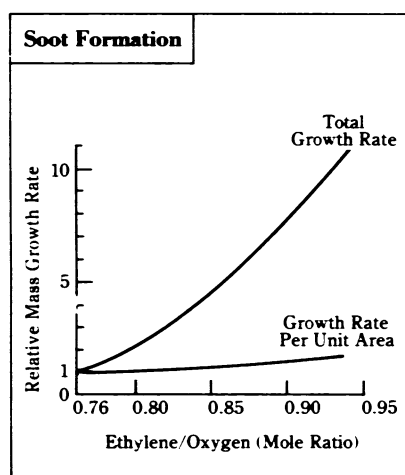
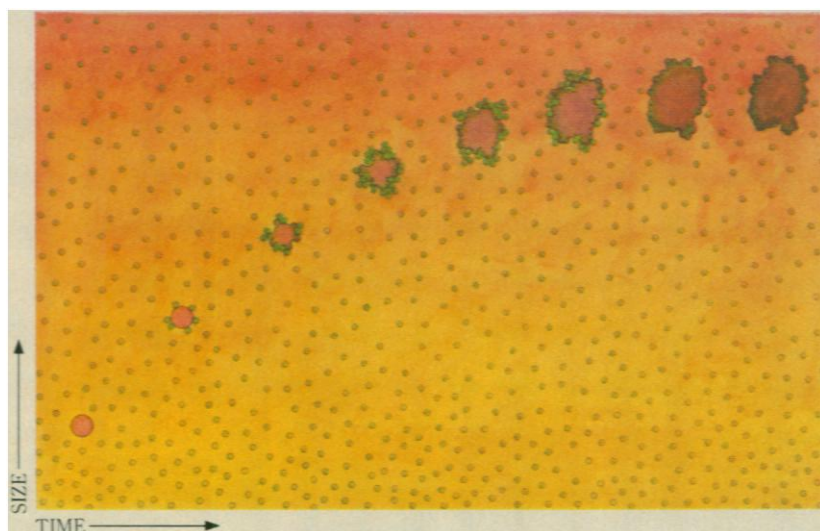


Figure 1: Total growth rate contrasted with growth rate per unit area plotted as a function of ethylene/oxygen mole ratio measured at a given height above the burner face.

Figure 2: Artist's rendition of the surface growth of a single soot particle by the incorporation of acetylene molecules.



SOOT FORMATION may be divided into two stages. Microscopic soot particles are generated in the "inception" stage. They reach full size in the "growth" stage, which accounts for more than 95% of their final mass. Most scientific exploration has concentrated on particle inception which, despite all the effort, remains unexplained. Dr. Stephen J. Harris, a physical chemist at the General Motors Research Laboratories, has reversed traditional priorities. Combining experiment with logic, he has formulated the first quantitative explanation of the growth stage in soot formation.

Dr. Harris arrived at his mechanism through an elaborate process of elimination. To focus on the chemistry of soot growth, he began by eliminating from his

investigation the complexities introduced by turbulence and mixing. He limited his research to premixed, ethylene/oxygen, laminar flames with one-dimensional flow.

Previous descriptions in the literature told him that two processes take place simultaneously during growth. Incipient particles collide and coalesce into larger particles, while growing at the same time by incorporating hydrocarbon molecules from the burned gases.

The first process reduces total surface area without changing total mass, while the second, called "surface growth," increases both total surface area and total mass. Hence, the increase in the total mass of soot can be entirely attributed to surface growth.

Dr. Harris set out to identify the hydrocarbon molecules—or "growth species"—responsible for surface growth. Increasing by increments the richness of the flame, he made the key discovery that although the total mass growth rate (gm/sec) increases strongly when the ratio of ethylene to oxygen is increased, the mass growth rate per unit surface area (gm/cm²/sec) increases only slightly (see Figure 1). Thus, the controlling variable for how much soot is formed is not the concentration of growth species, but the surface area available for growth.

This finding led him to conclude that richer flames produce more total soot because they gen-

erate more particles in the inception stage. More incipient particles offer greater initial surface area for the incorporation of hydrocarbons.

Since the growth rate per unit area must depend on growth species concentration, this concentration must be similar from flame to flame. Dr. Harris went on to reason that there must either be enough growth species at the outset to account for the total soot growth in the richest flame, or the species must be rapidly formed within the flame from another hydrocarbon present in high enough concentration.

HE NARROWED his search to the four most abundant classes of hydrocarbons found in flames: acetylene, polyacetylenes, polycyclic aromatic hydrocarbons (PAH), and methane. Methane can be eliminated, because its concentration does not decrease as soot is produced. There is not enough PAH to account for soot formation in any flame. Neither of these two hydrocarbons can be readily formed from the other major species present. That left only acetylene and the polyacetylenes.

Acetylene contains enough hydrogen to account for the hydrogen content of soot measured in the early stages of growth. But among the polyacetylenes, only diacetylene could possibly supply enough hydrogen. That left acetylene and diacetylene.

There is more than enough acetylene to account for the mass of soot produced. There is not enough diacetylene, and while diacetylene can be formed from the abundant supply of acetylene, the reported rate of conversion is too slow for diacetylene to play a significant role. That left only acetylene.

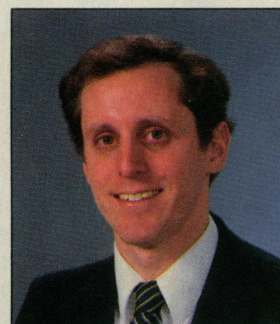
Dr. Harris verified that acetylene is the growth species by determining that the slight increase in growth rate per unit area is proportional to the increase in acetylene concentration (see Figure 1). He also found that the rate constant he measured was in agreement with the reported rate constant for the decomposition of acetylene on carbon. These findings confirmed his hypothesis that soot particles grow in flames by the incorporation and subsequent decomposition of acetylene.

"Now that we know how soot grows," says Dr. Harris, "we can examine how it begins with greater understanding. Then, perhaps our knowledge will be complete enough to suggest better ways to reduce soot."

General Motors



THE MAN BEHIND THE WORK



Dr. Stephen J. Harris is a Staff Research Chemist at the General Motors Research Laboratories. He is a member of the Physical Chemistry Department.

Dr. Harris graduated from UCLA in 1971. He received his Master's and Ph.D. degrees in physical chemistry from Harvard University. His doctoral thesis concerned Van der Waals forces between molecules. Following his Ph.D. in 1975, a Miller Institute Fellowship brought him back to the University of California, this time at Berkeley, where he spent two years studying laser-induced chemistry. He joined General Motors in 1977.

Dr. Harris conducted his investigation into soot particle growth with the aid of Senior Science Assistant Anita Weiner. His research interests at GM also include the use of laser diagnostic techniques in combustion analysis, with special emphasis on intracavity spectroscopy.

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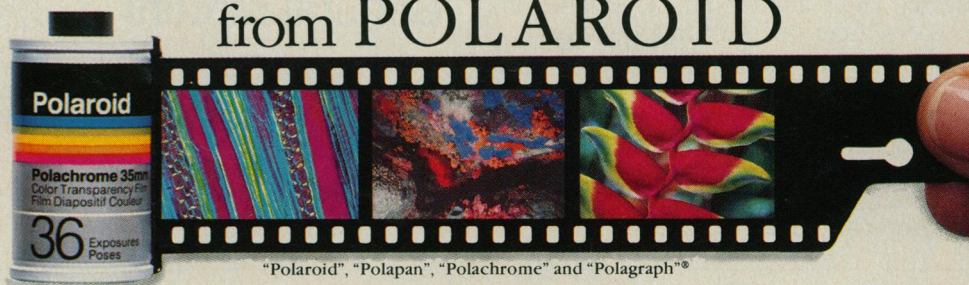
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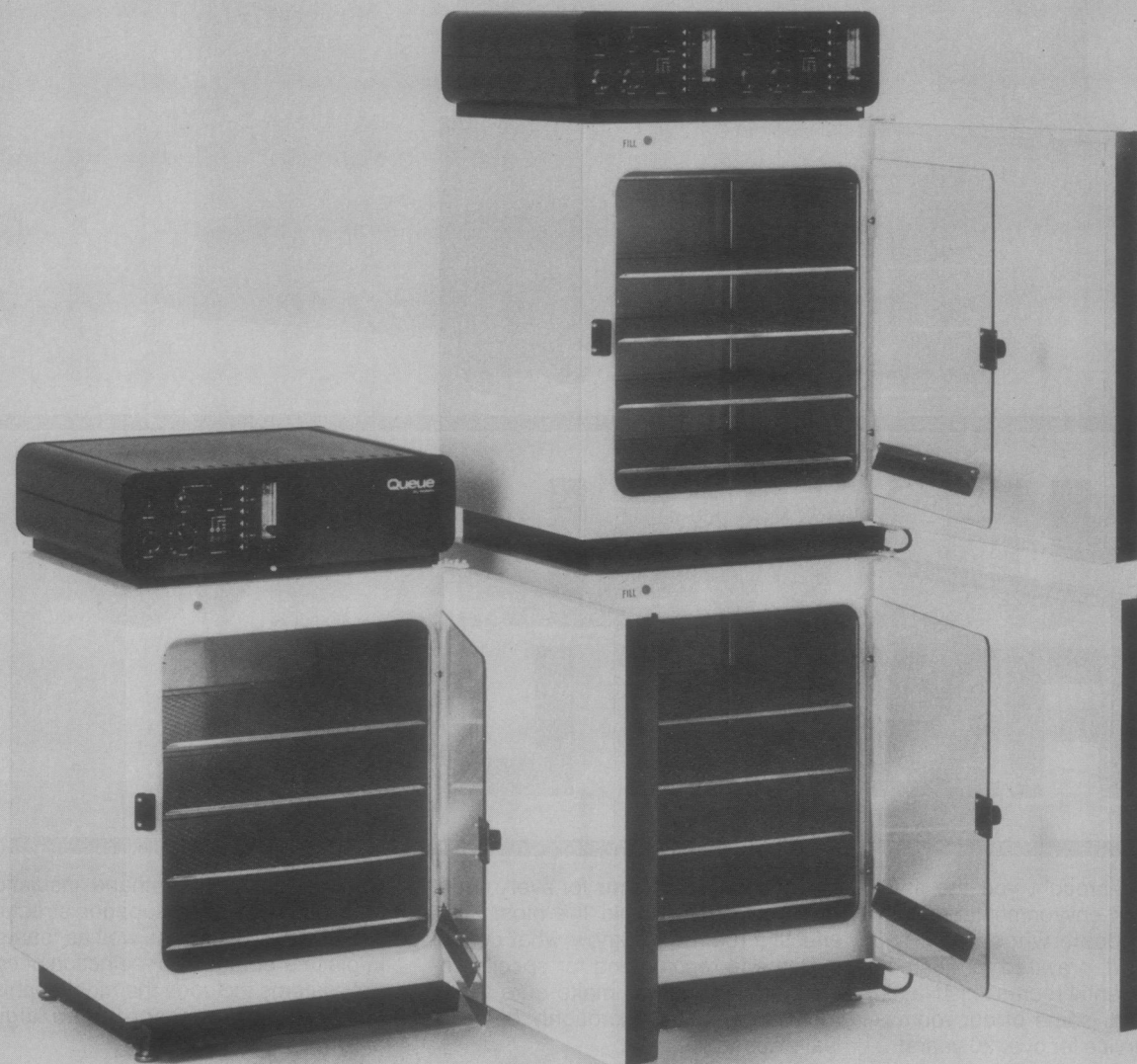
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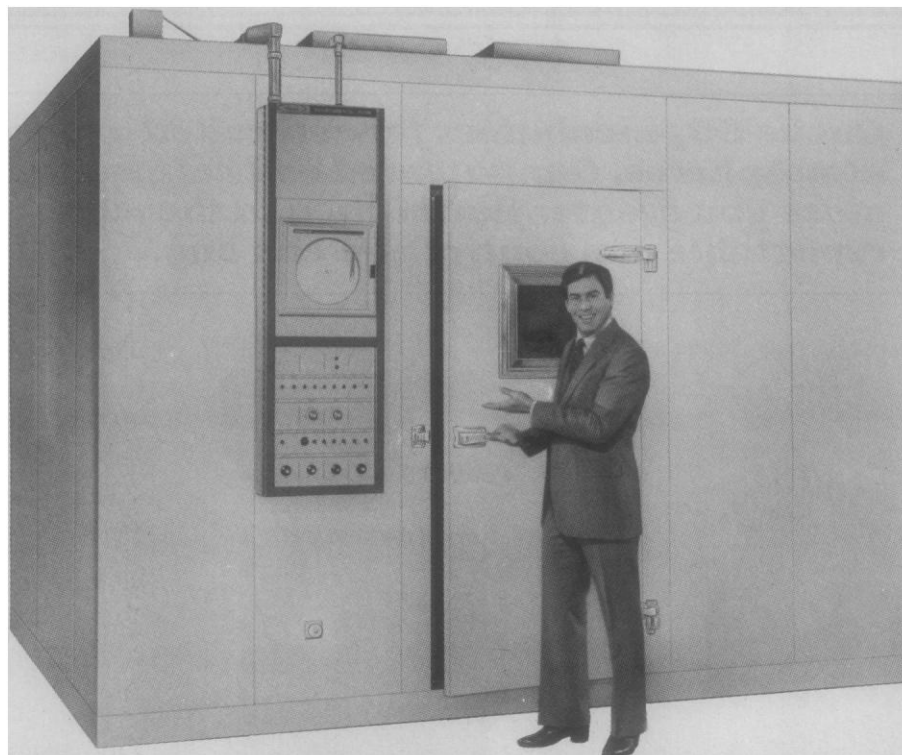
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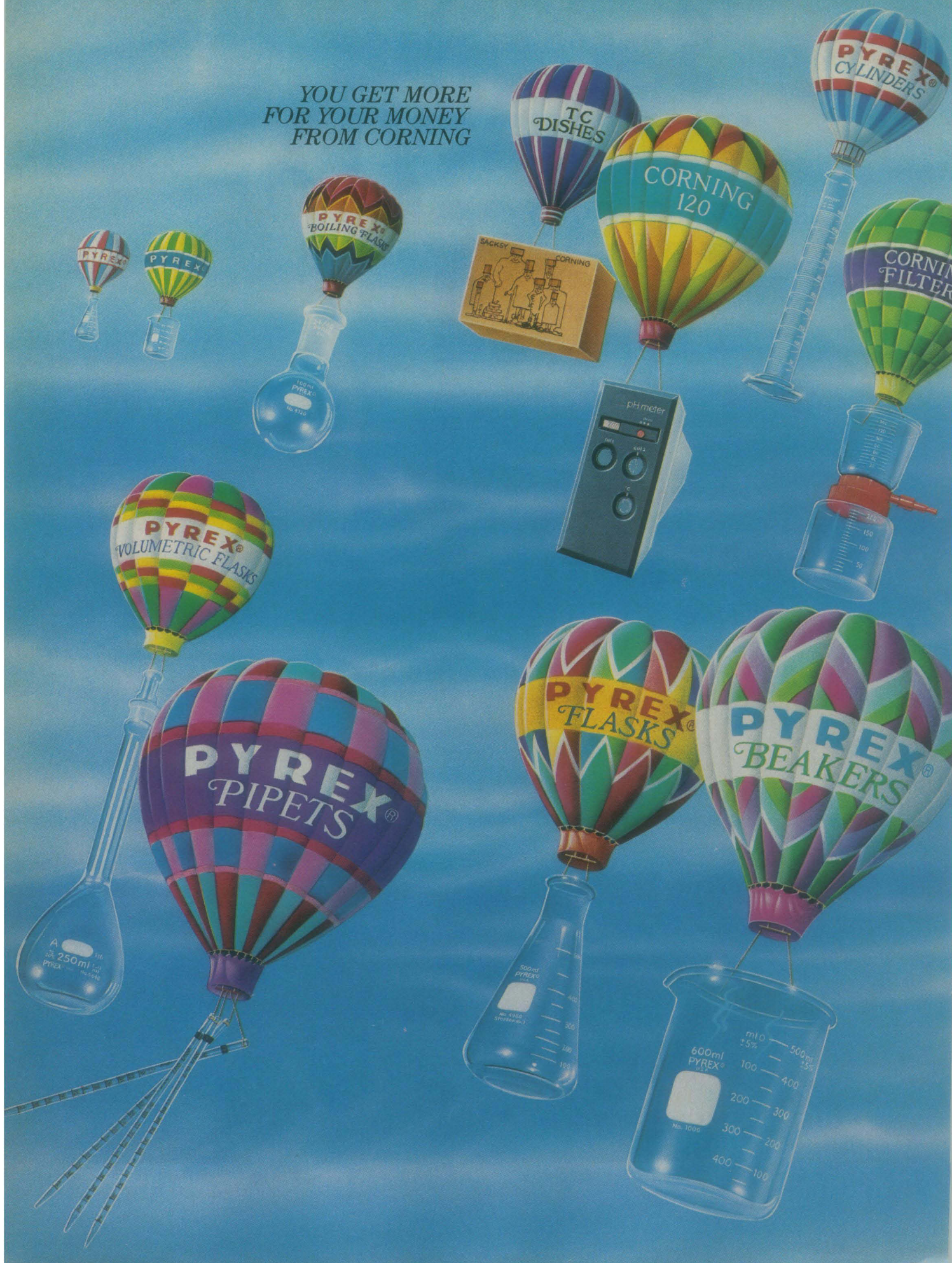
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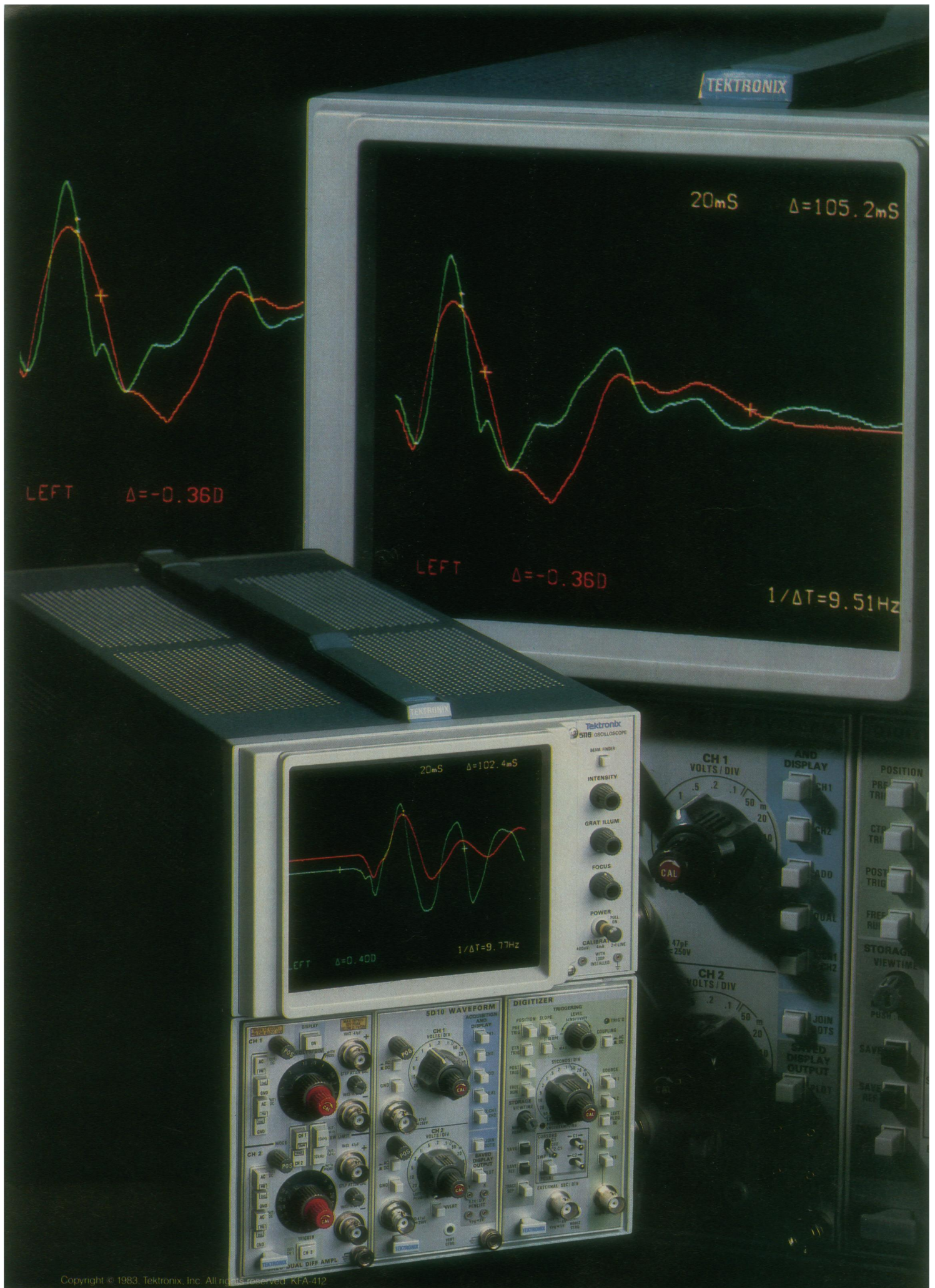
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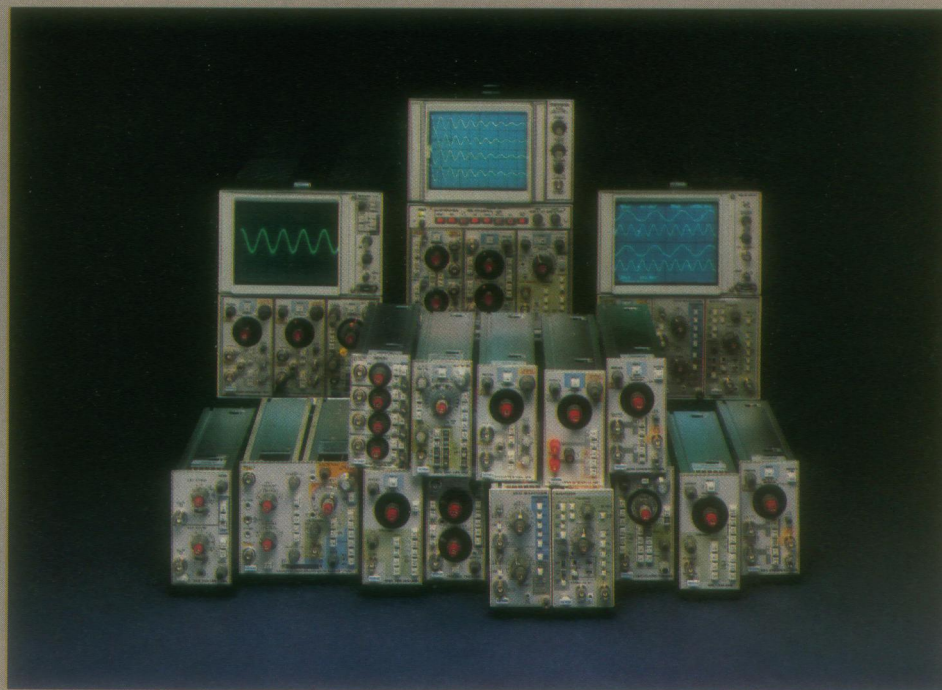
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With one of the broadest selections of measurement capabilities and storage techniques available, the 5000 Series lets you reconfigure your equipment for new and evolving measurement needs, without major reinvestment. Now with the addition of the first color shutter scope, it's

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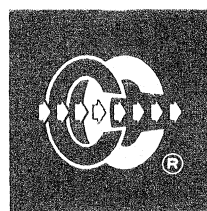
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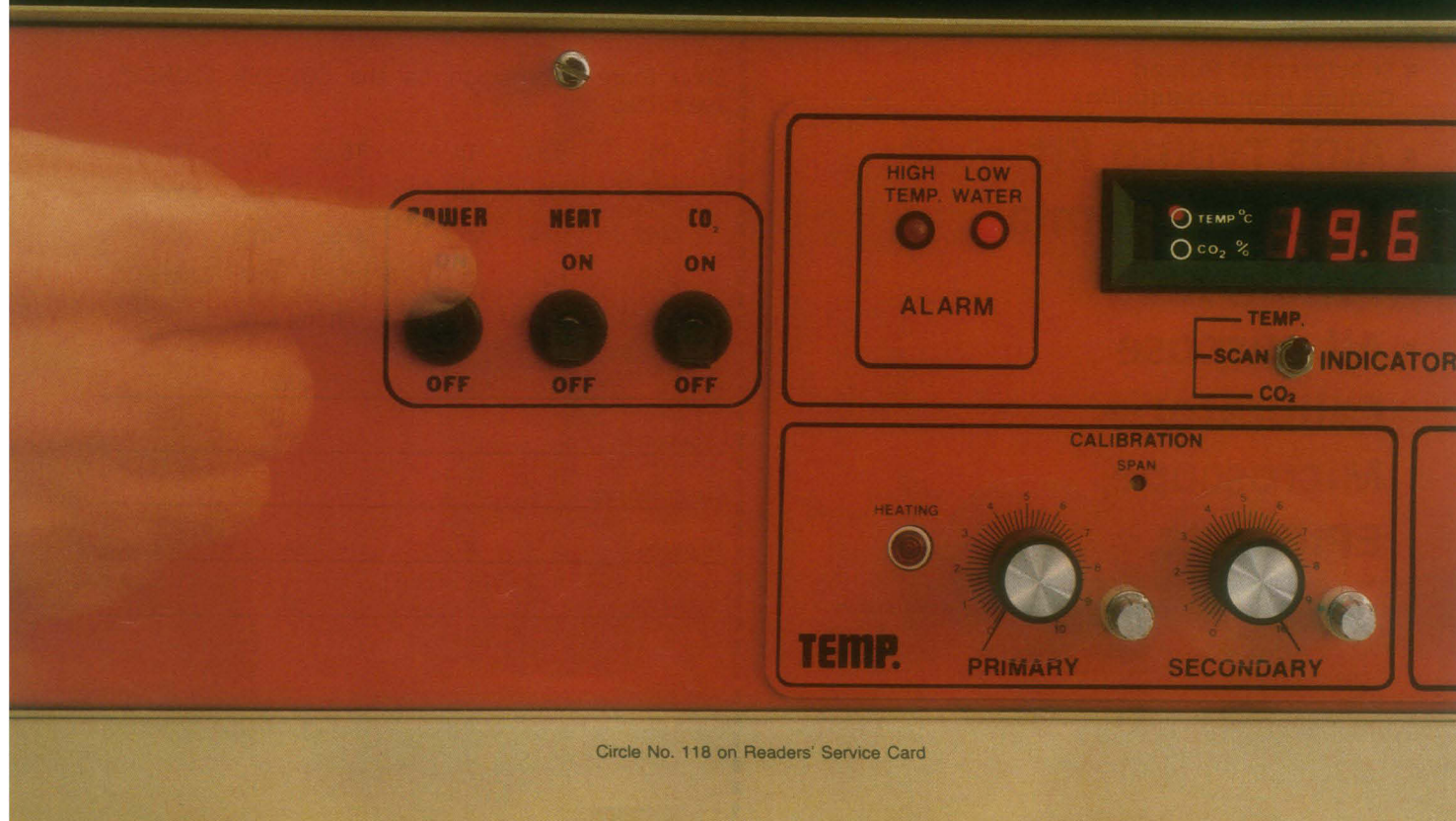
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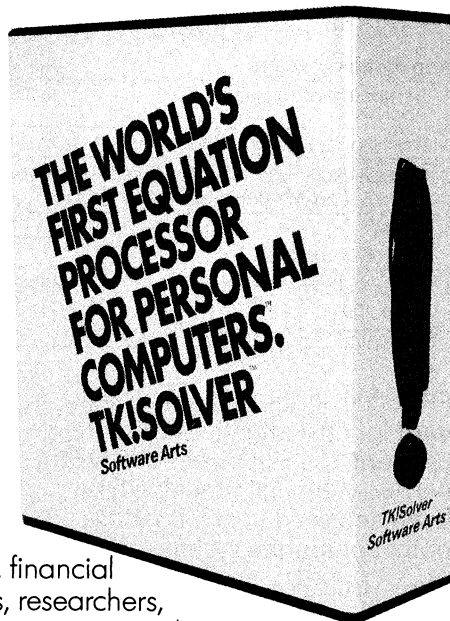
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The FPS-5000 Series from Floating Point Systems

Now, a new family of products from Floating Point Systems brings increased computing power and unmatched price/performance to the signal/image processing world.

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The FPS-5000 Series offers fast, accurate, flexible computing for the most demanding real-time, user-interactive, and production-oriented applications.

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By combining a distributed architecture concept with the latest VLSI technology, the

Typical performance examples of geophysical, medical imaging and signal/image processing applications.

Application Example	AP-120B	FPS-5410	5420	5430
1. Demodulation/Signal Analysis	13.8 msec.	6.5 msec.	N/A	N/A
2. Tomography Preprocessing	60 sec.	25 sec.	16 sec.	12 sec.
3. Multispectral Image Classification (512 x 512 pixels 8 Bands, 4 classes)	49 sec.	25 sec.	13.3 sec.	10.5 sec.
4. 2D FFT (512 x 512 complex)	3.4 sec.	1.4 sec.	.7 sec.	.5 sec.
5. Matrix Multiply (100 x 100)	439 msec.	177 msec.	96 msec.	71 msec.

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FPS-5000 Series sets a new standard for cost-effective computing, breaking the \$2,000 per MFLOP* barrier—the first time this has been achieved in any floating-point computing system.

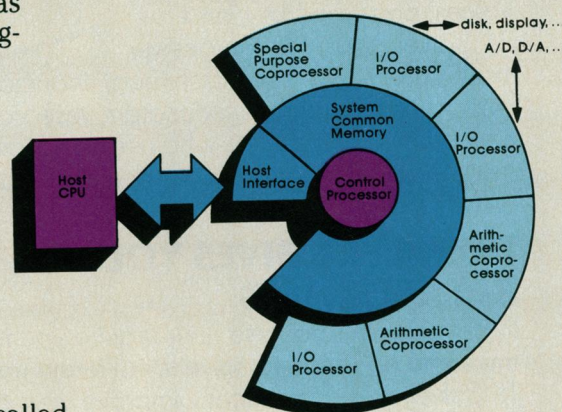
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Distributed processing architecture

The FPS-5000 Series is a distributed processing system that maximizes throughput by allocating the computational load to a set of high-performance, independent, floating-point processing elements called

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FPS-5000 Series Architecture



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by a combination of independent I/O Processors and the central Control Processor.

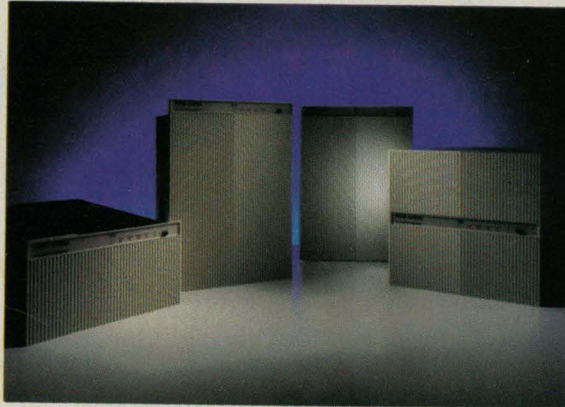
Each Arithmetic Coprocessor, with synchronous architecture to allow simple application debugging, functions as a self-contained unit.

The new Multiple Array Processor Execution Language (MAXL), based upon FORTRAN 77, allows the user to construct an integrated system environment which can be tuned to application requirements.

Increased performance can be achieved by adding Arithmetic Coprocessors as a field-installable upgrade as the user's requirements evolve.

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The FPS-5000 Series maintains software compatibility with previous FPS 38-bit processors and is supported on a range of host computers. Thus, the extensive



software support developed for FPS-100 and AP-120B products is maintained and users are able to move existing applications onto the FPS-5000 Series with minimal effort.

Quality and Reliability

The FPS-5000 Series was designed and built with the same quality standards inherent in all of the previous Floating Point Systems products—standards that have earned those products a reputation for unprecedented reliability and one of the best

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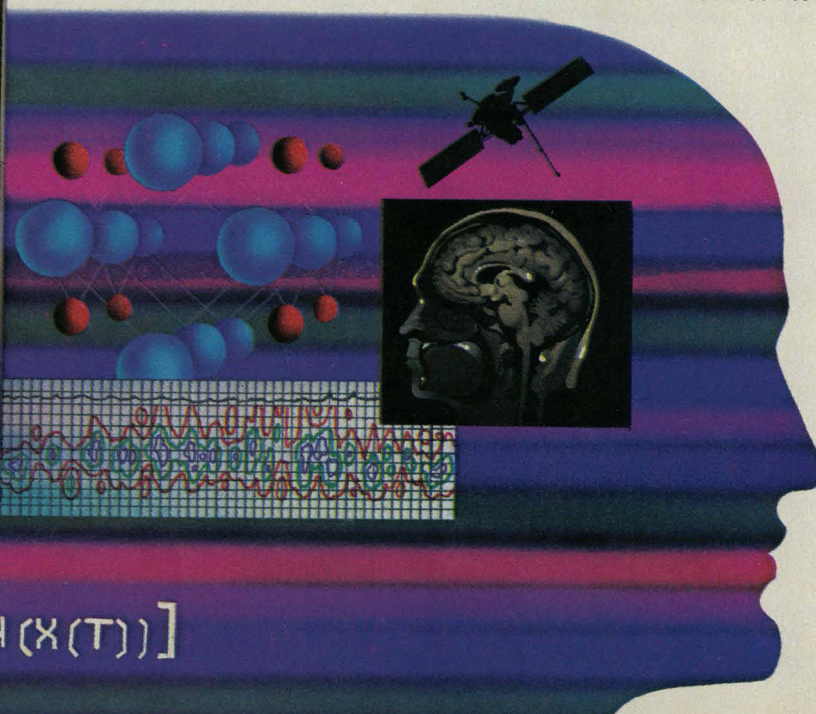
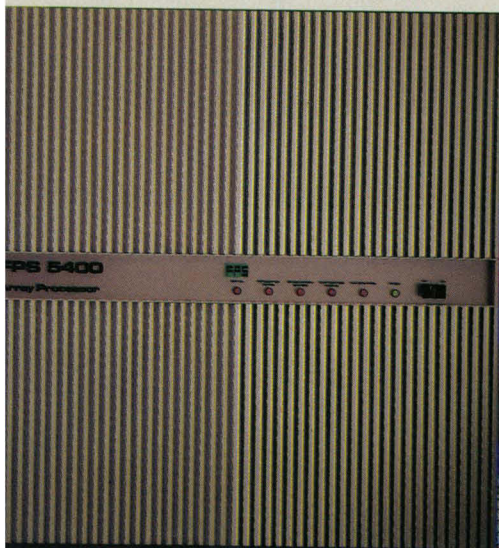
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The new MICRO-ISOLATOR™ System:

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.)



MICRO-ISOLATOR is a trademark of Lab Products, Inc.

LP81-1708

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

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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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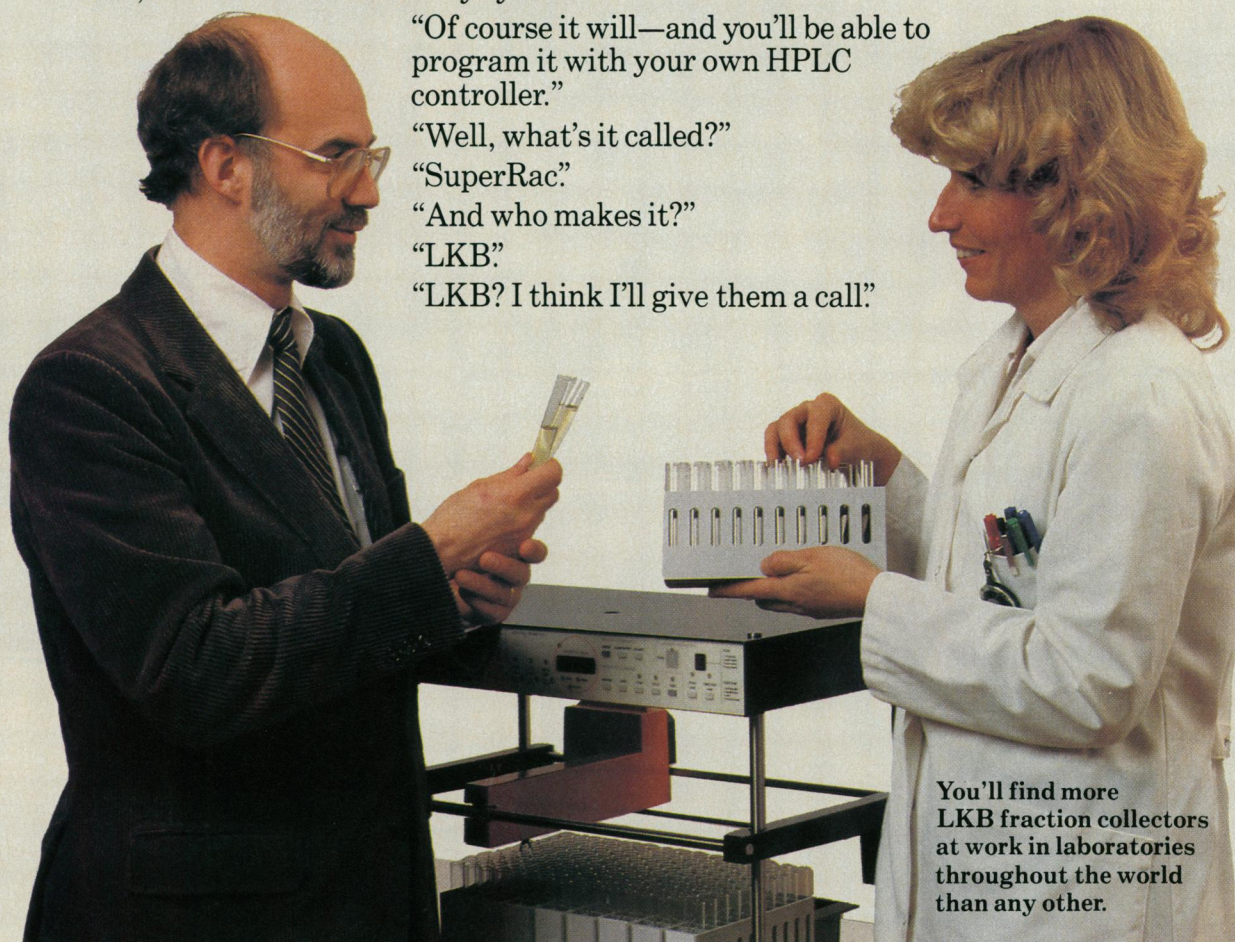
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A new video graphics projector that's brighter and sharper than conventional projection TV may be the next addition to office computer systems. The Hughes projector displays monochromatic computer-generated alphanumerics, symbols, and graphics. It could be used for displaying dynamic computer data and facsimile video pictures in board rooms and other areas, and for teleconferencing. The projector uses a device called a liquid-crystal light valve, a cousin of displays in digital watches. This device intensifies the image from a cathode-ray tube and projects it onto a screen up to 12 feet wide. The picture is so bright and has such high resolution that the viewing room needn't be darkened.

A novel engineering tool for producing the AMRAAM missile is expected to save the U.S. government and Hughes millions of dollars and months of work. A full-scale prototype of the Advanced Medium-Range Air-to-Air Missile has been completed using actual engineering drawings, materials, and processes. The purpose of this "precision physical model" is to refine AMRAAM's design and detect potential manufacturing problems, especially those stemming from late improvements. Among other things, the model has been used to determine routes and lengths for wire harnesses so that mating connectors will line up. It also was used in designing handling and test fixtures, and to show how its components react to vibration. AMRAAM is in full-scale development for the U.S. Air Force and Navy.

NATO early-warning aircraft are being equipped with a communications system that uses four primary encoding techniques to hamper enemy eavesdropping or jamming. The Joint Tactical Information Distribution System (JTIDS) provides E3A AWACS aircraft and NATO ground command centers with secure voice and digital communications. One JTIDS encryption technique is spread spectrum, in which a signal is expanded over a large bandwidth. With frequency hopping, a second method, frequencies are changed many times a second. Another technique, time division multiple access, assigns certain users to specific time slots no longer than a fraction of a second. Finally, to verify messages, JTIDS repeats messages automatically. Hughes is supplying JTIDS to NATO and the U.S. Air Force.

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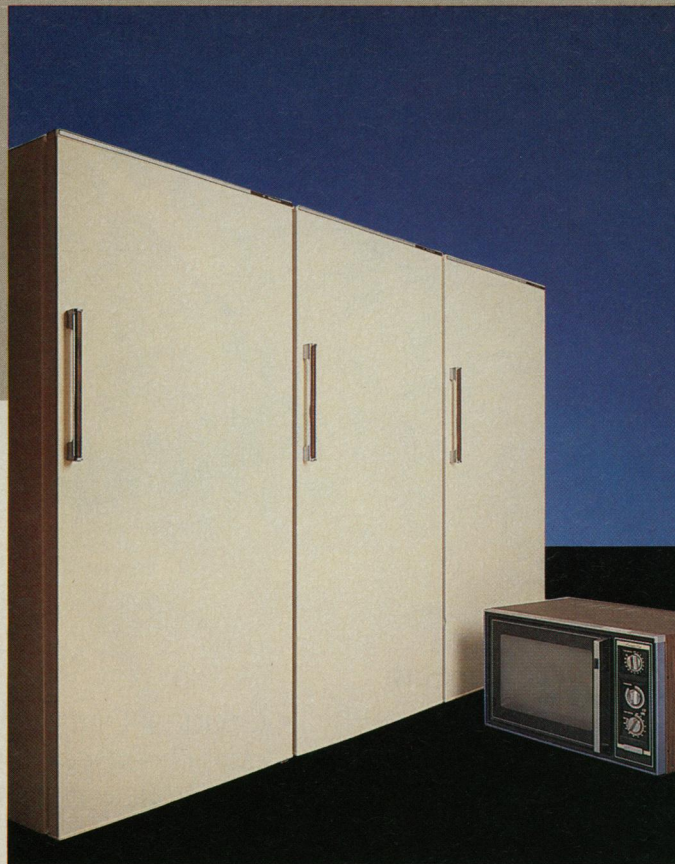
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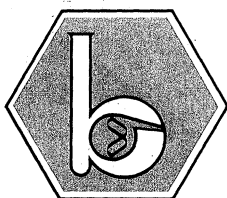
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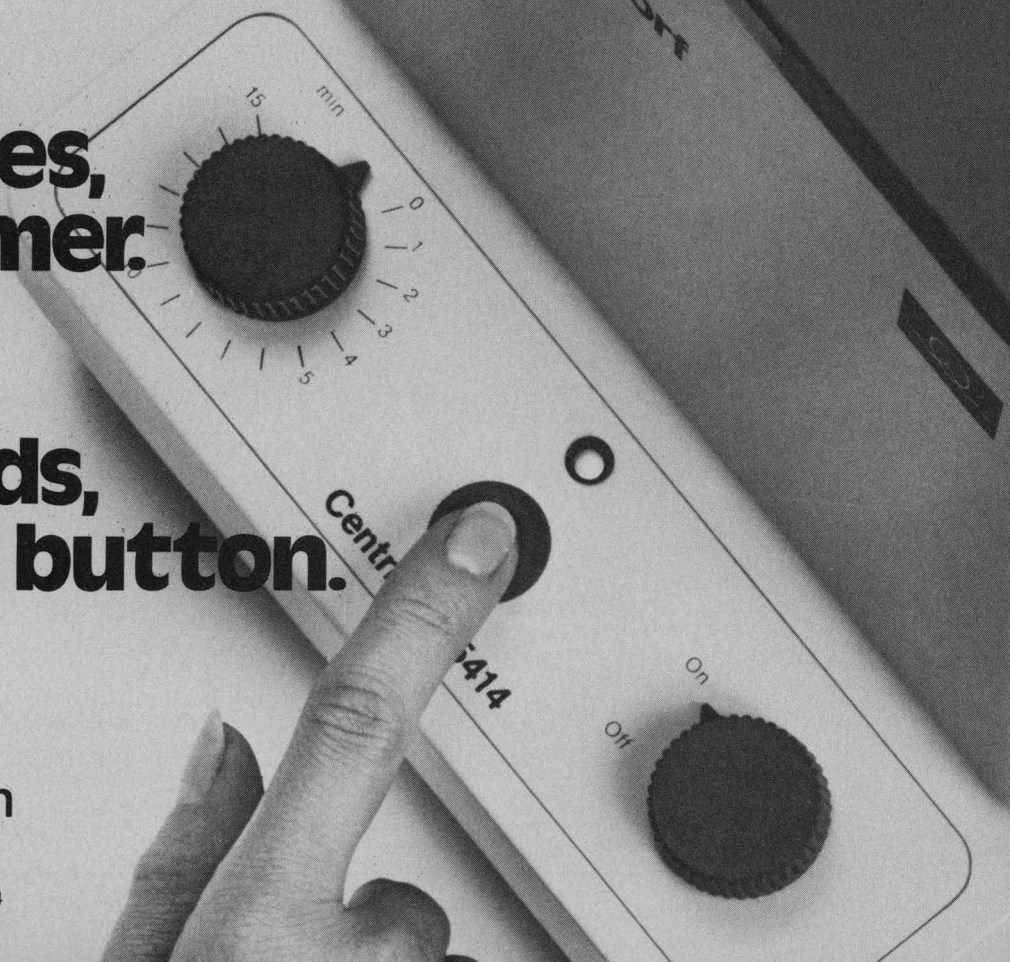
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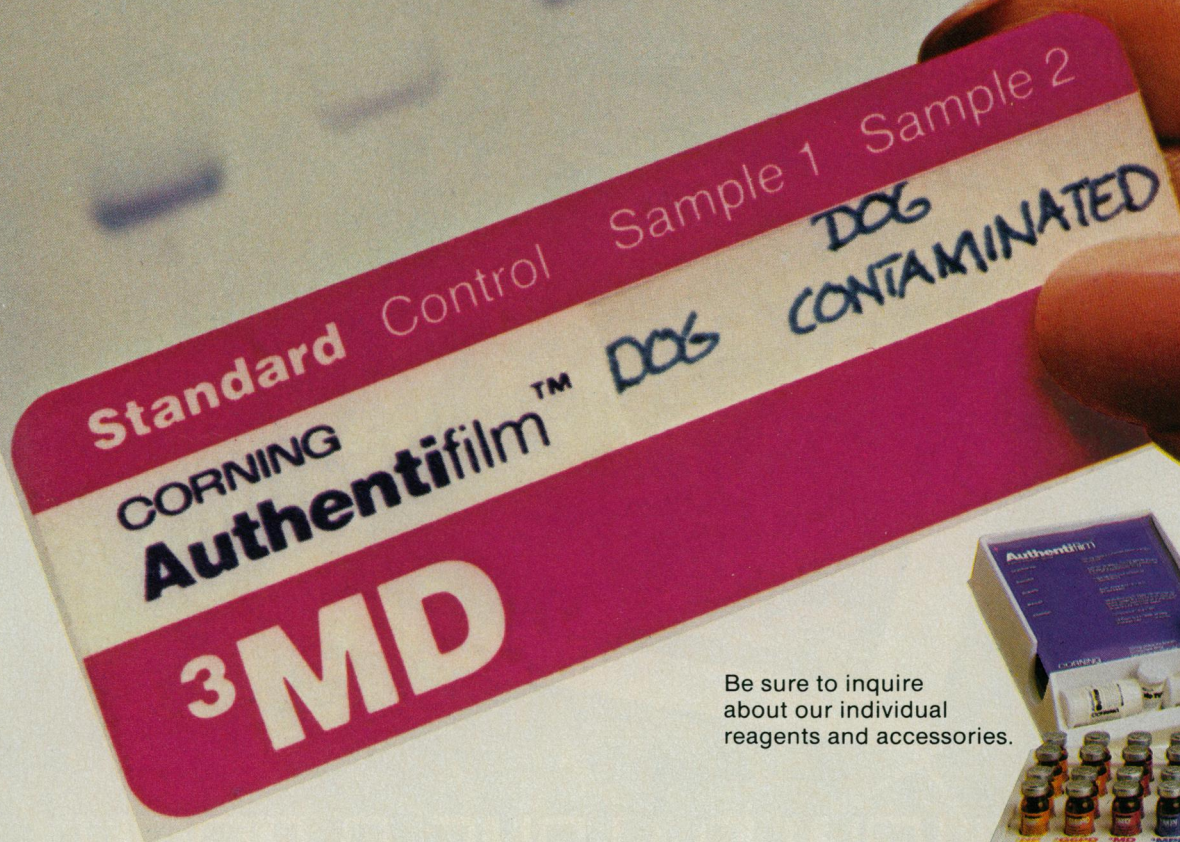
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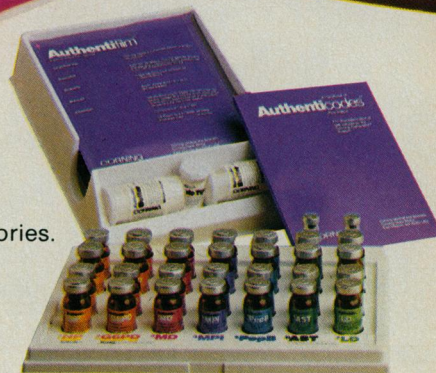
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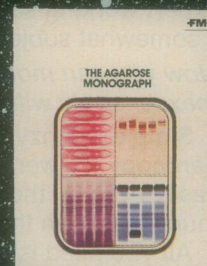


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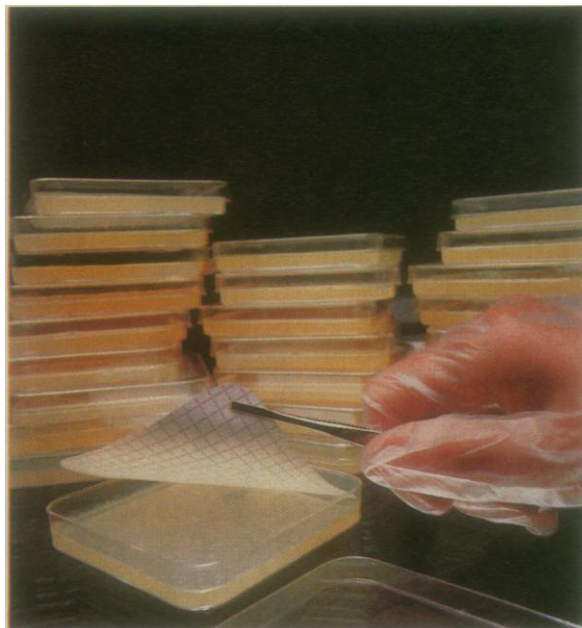
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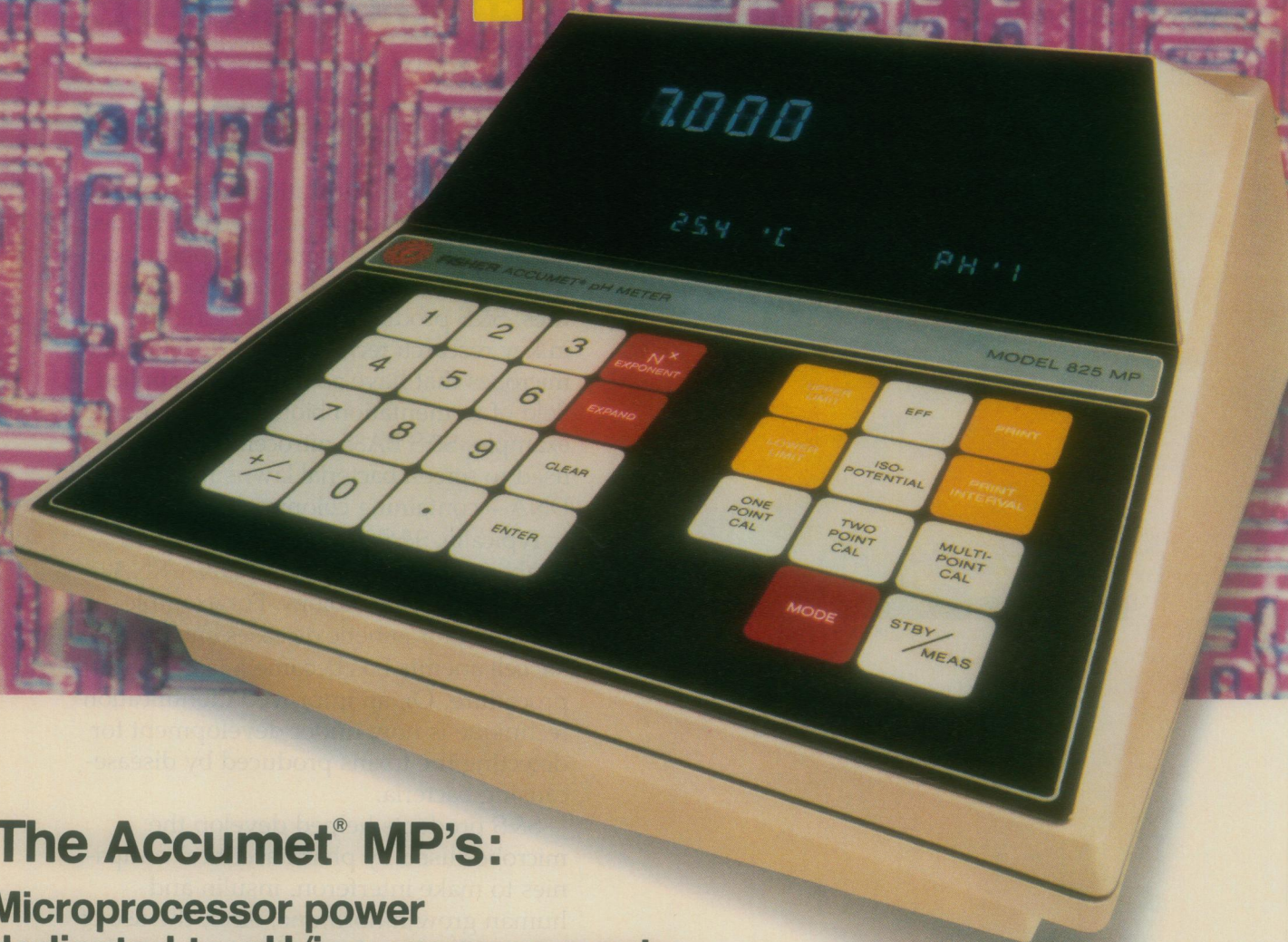
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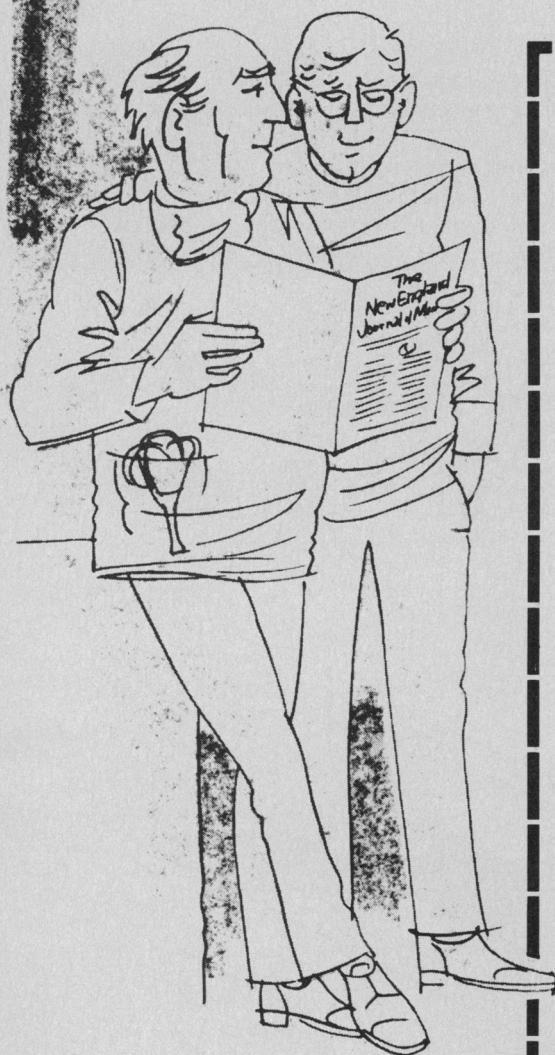
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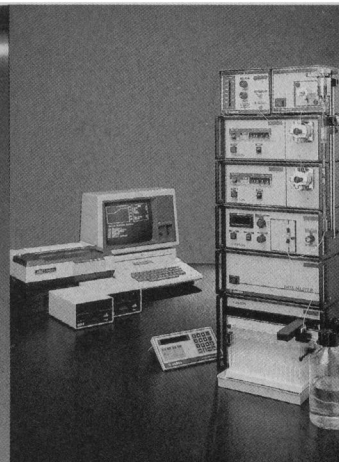
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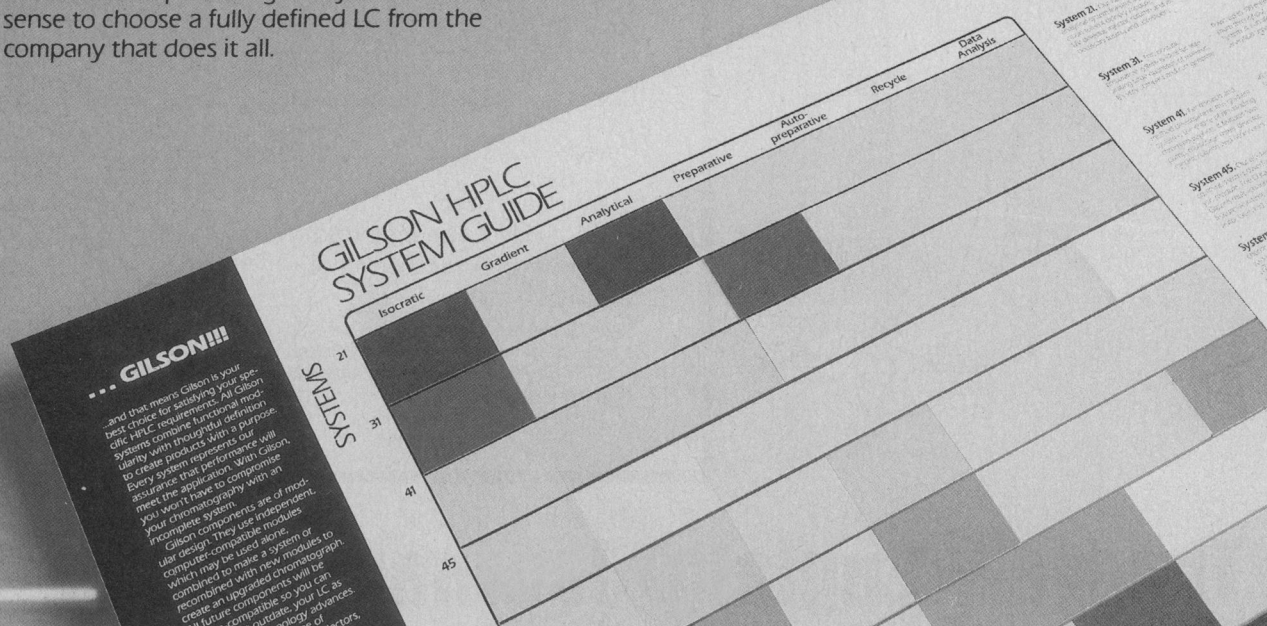
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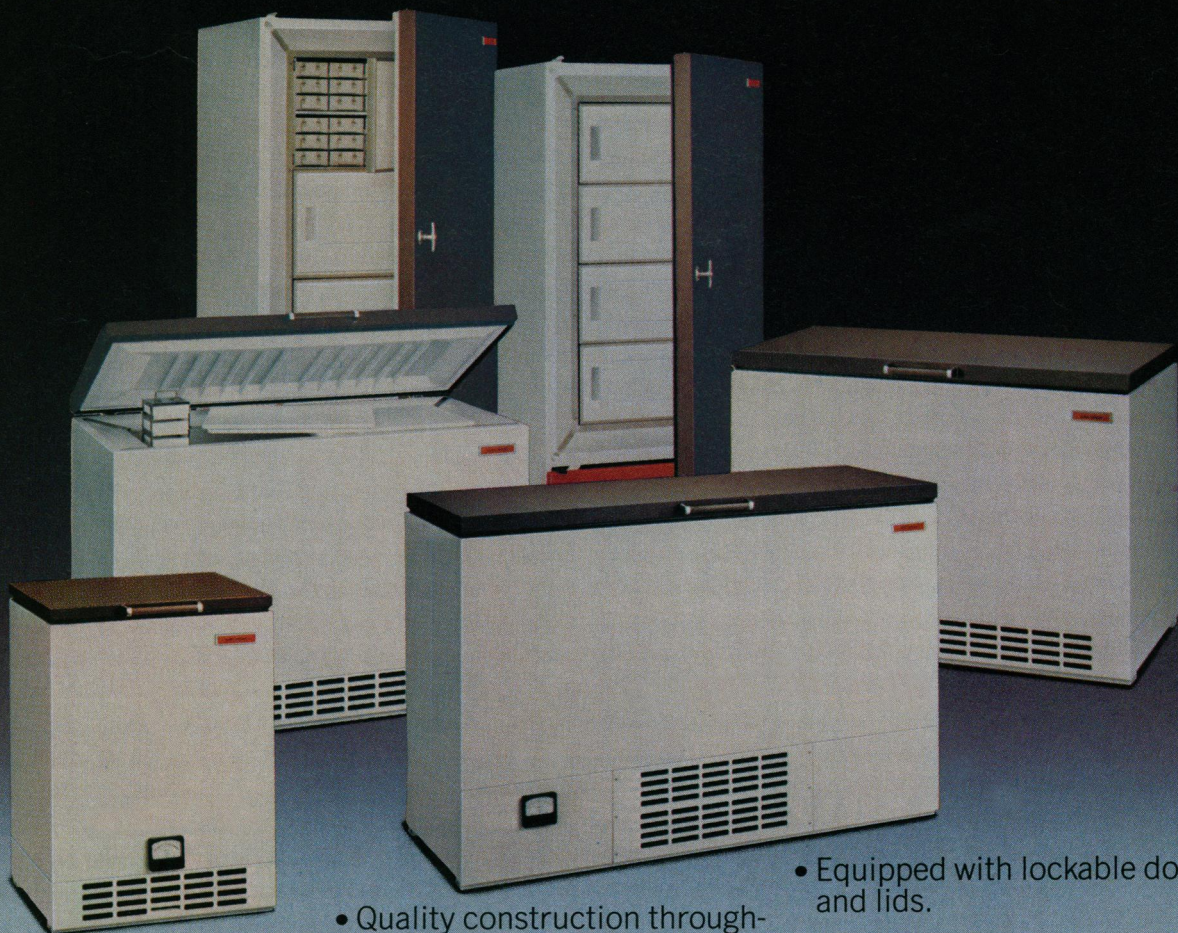


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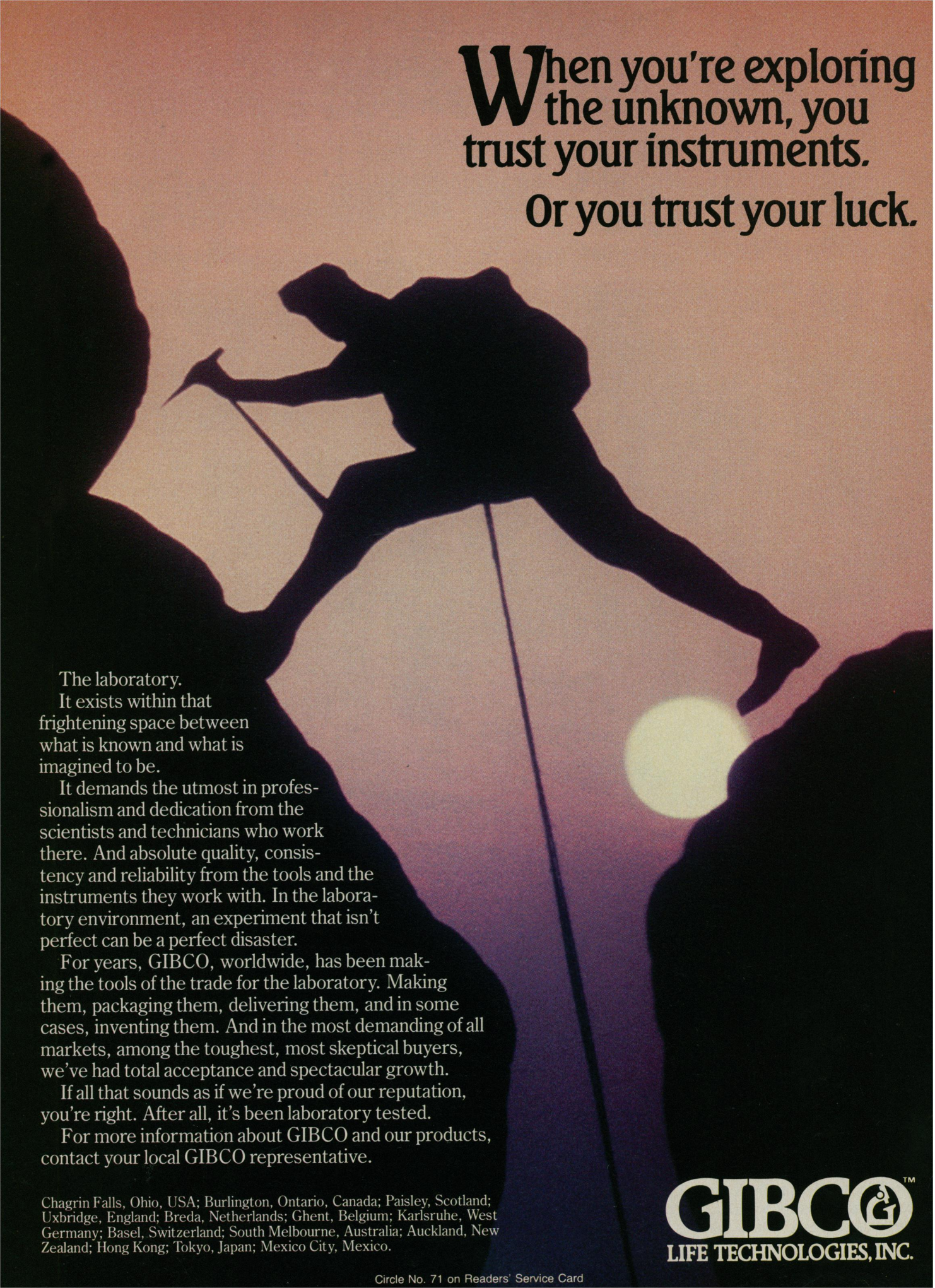
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Role of the Recombinant Advisory Committee

Recombinant DNA technology has been developing in an unprecedented scientific-public forum atmosphere in which the transfer of new basic scientific knowledge to the realm of practical commercial use has been extremely rapid. During this time, the scientific community has turned to the National Institutes of Health for help in organizing a Recombinant Advisory Committee (RAC) with the expertise to deal with the scientific and technical questions raised by the research as well as to ensure that the public interest is responsibly represented. In its several years of existence, RAC has established expertise among its members, advisers, and consultants that is unparalleled in its ability to deal with the complex problems in recombinant DNA technology.

The high level of public service rendered by the committee in its consideration of recombinant DNA applications has provided for protection of the public health and the environment. In addition, current public policy which blends scientific oversight through RAC with voluntary adherence by industry and other non-NIH funded parties has fostered technological innovation and U.S. leadership in genetic research. Starting in 1979, RAC reviewed complex industrial submissions in closed sessions, much as NIH continues to do with research grant proposals. This practice has decreased since most recombinant DNA research no longer falls under the guidelines as they have evolved. This diminished requirement for RAC oversight hardly justifies a need for redundant statutory regulation. Furthermore, deemphasizing the contribution of NIH and RAC in oversight and review could create public concern and lead to controls inconsistent with public health needs, scientific progress, and the national interest.

A number of firms and all regulatory agencies and Cabinet-level departments have commented in support of the current activities of RAC; so, too, has the American Society for Microbiology, which probably includes the majority of the individual practitioners of the technology. Too frequently, government and industry become adversaries. RAC's review procedures enable industry, government, and academia to work together effectively and to produce fruitful research without encumbering those involved in the research with a regulatory process that is not needed to preserve public safety. This, too, is in the public and national interest.

If a significant concern is the need for more direct input from the regulatory federal agencies, their nonvoting representatives on the committee could be charged with submitting formal comments on proposals whose implementation would fall within the jurisdiction of their agencies. Duplication of the functions of RAC among several federal agencies has thus far been avoided. The public interest is well served by continuing to have a single review group with the demonstrated capability to deal with the complex but assessable problems presented by recombinant DNA research.

Because of the universal applicability of the basic concepts of recombinant DNA, the activities of RAC should not be confined to the biomedical field. Members to the committee with expertise in areas such as epidemiology and microbial ecology could be added to the committee as needed. To create additional independent committees would simply increase communication difficulties; the organizational redundancy would place further strain on our available intellectual resources. Additional structures would only create delays in a scientific endeavor that requires a highly efficient review process to keep up with the expanding knowledge base as well as to maintain a fragile competitive advantage internationally.

The track record of the RAC clearly shows its usefulness to the scientific community and to the public. Moreover, the universality of recombinant DNA research—like that of the genetic code upon which it is based—argues for a single and unified oversight system. RAC's oversight should continue until that time in the not too distant future when there will be little left for it to oversee.—IRVING S. JOHNSON, *Lilly Research Laboratories, Indianapolis, Indiana 46285*

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