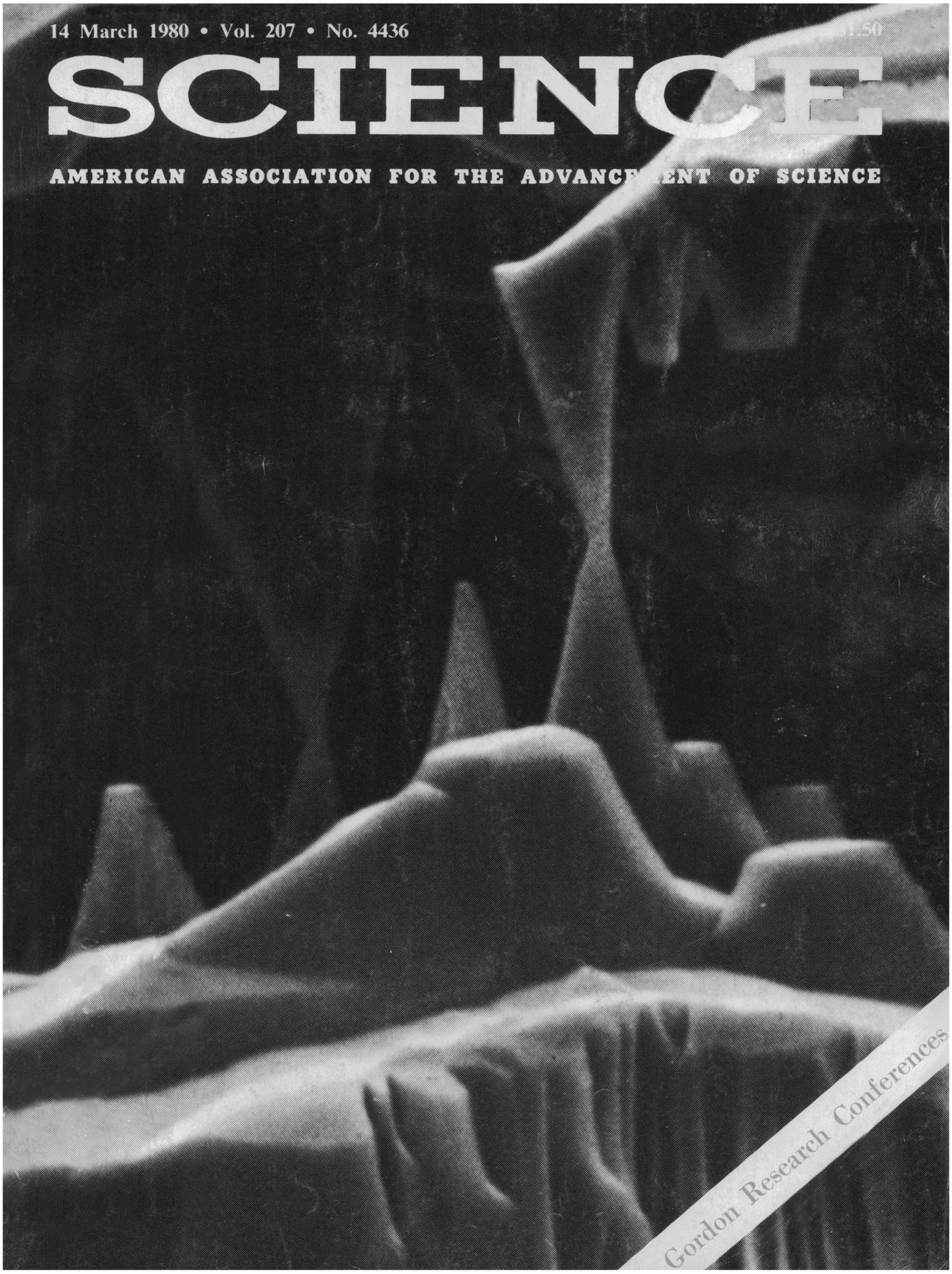
14 March 1980 • Vol. 207 • No. 4436

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Now you can choose from two series of Beckman ultracentrifuges.

L8's–The Most Advanced

The results of six years of intensive research, the Model L8's are so remarkable, so advanced that they introduce a new era in preparative ultracentrifugation.

Discover features like the Ultra-8™ drive, a frequency-controlled induction motor that drives the rotor directly from *inside* the vacuum system. We warrant the complete Ultra-8 drive for 16 billion revolutions!

Microprocessor Control lets you select rotor speed, run time, and other parameters by a finger touch control panel—no knobs or switches.

The Memory-Pac™ Programmable Module is the ultimate in automation. You can program/reprogram it in seconds. For duplicate runs using the same rotor speed, temperature, etc., just insert it in the L8: you get error-free runs with no time spent in setups.

There's a Dry Cycle to remove moisture from the chamber, an $\omega^2 t$ Integrator with recall capability, built-in slow-start programs, and internal diagnostic systems for simple servicing.

Choose from three models up to 80,000 rpm—only available in the Beckman L8 series.

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The Model L5B's have a host of proven features for separating your samples rapidly and economically. They give you convenience in the Automatic mode, with flexibility in the Manual mode.

A Dry Cycle keeps moisture out of the rotor chamber keeping your ultracentrifuge always ready to run—the next hour or the next day.

0 to 40°C operation lets you run physiological samples at body temperature, increasingly important in a variety of research. And the L-5B drive is powerful and efficient with its DC electric design.

Four models are available, from 50,000 rpm to 75,000 rpm.

For information on the L8, write for Brochure SB-580; for the L-5B, write for Brochure SB-540—to Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, CA 94304.

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NEG-026 500μCi 1mCi

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Thio-ATP [^{35}S]

Adenosine 5′-(γ-thio) triphosphate, tetrasodium salt, [^{35}S]-
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Arachidonic acid, [5,6,8,9,11,12,14,15-^{3}H(N)]-
60-100Ci/mmol

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For labeling glycoproteins in solution and on cell surfaces

30-40μCi/μg, ~100μCi/ml

Each lot biologically tested

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30-40μCi/μg
0.05M phosphate buffer (pH 7.5) containing a stabilizer and a proteolytic enzyme inhibitor, in dry ice
NEX-145 10μCi 2x10μCi 50μCi 2x50μCi
Prepared fresh for stock on the 4th Monday of each month

ALSO AVAILABLE:
Concanavalin A, [^{3}H(G)]-
>30Ci/mmol
0.01M sodium phosphate buffer (pH 6.8) in silanized combi-vial, in dry ice
NET-491 50μCi 250μCi

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PROTEIN A [^{125}I]

For labeling antibodies

70-100μCi/μg, ~100μCi/ml

Each lot biologically tested

Protein A, [^{125}I]-
70-100μCi/μg
0.03M phosphate buffer containing 40% ethanol and acetic acid (pH 4.0)
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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

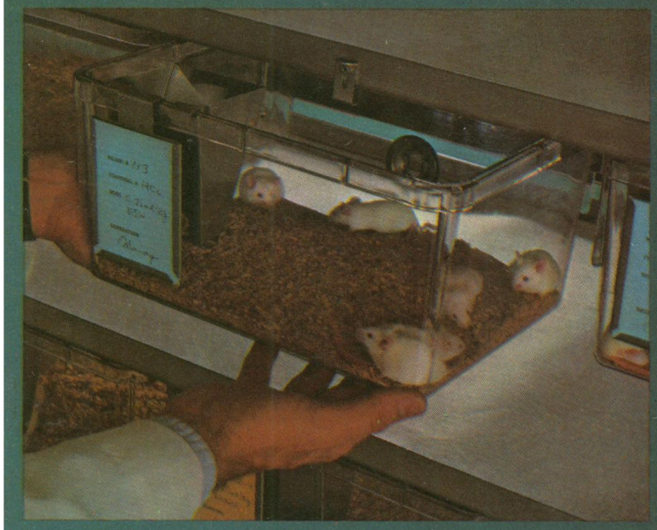
COVER

Scanning electron photomicrograph of a dissolution "micro-cave" in the mineral augite. The "stalactites" (which are 2 to 5 micrometers long) are actually undissolved augite remaining between coalesced, lens-shaped etch pits. Similar etch features are characteristic of pyroxene dissolution in nature and in the laboratory. See page 1205. [Alan S. Pooley, Peabody Museum, Yale University, New Haven, Connecticut]


A See-Through™ suspended cage system...
...one of the 16 most flexible small animal housing systems available from the leader in suspended caging systems.*
*Please note that the unit shown above is merely a demonstration model assembled to show that the rack can accommodate a single large cage in each position . . . or, alternatively, two small ones.

Why "hang" cages, anyway?

Suspending cages from the shelf above yields many benefits:



No "cover charge"
A hanging cage needs no separate cover since the perforated shelf above it serves as its cover. Saves time, saves money: no initial lid cost, no subsequent lid handling, no lid replacement.

Easy to filter
An entire shelf of cages can be easily filtered by simply placing a single filter on the perforated shelf above. Saves time, saves money.

Rack easily movable without cage disruption
Since cages are fixed in position, the racks can be readily moved.

Maximum animal visibility
Visibility unimpaired, as the photos show.

Why these suspended cage systems?

Primarily because you can tailor your system to match your specific requirements: 16 separate See-Through systems are available providing a wealth of options for housing rats, mice, hamsters, and guinea pigs.

Racks: Mobile, stainless steel, two sizes available.

Cages: Clear polycarbonate, four sizes available (including sizes that meet new ILAR housing recommendations).

Cage bottoms: Either solid or open bottom with stainless steel wire mesh walkfloors (two mesh sizes available).

Food hoppers: Choice of four styles.

Watering systems: Bottle or automatic (with many variations available).

Filters: Flat, disposable or reusable.

Important note
See-Through systems can be easily changed from one configuration to another to accommodate changing needs. These exceptionally versatile housing systems provide maximum flexibility.

New product
See-Through III meets ILAR standards for housing mice in individual cages.

For additional information
Write Lab Products Inc., 365 W. Passaic Street, Rochelle Park, New Jersey 07662.
Phone: 201/843-4600

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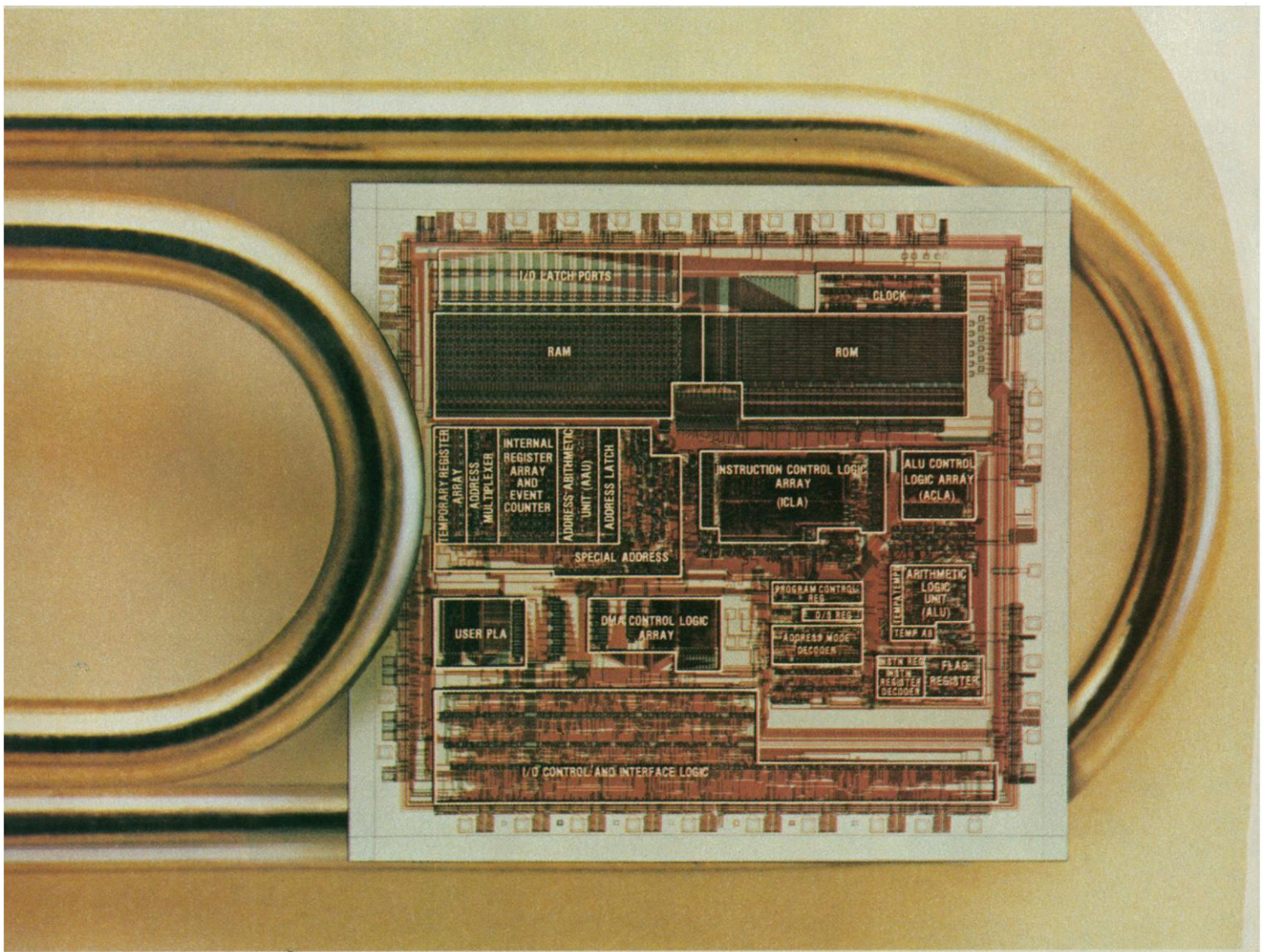
LP79-1436

The one-chip computer: offspring of the transistor



The MAC-4 one-chip computer, developed for a variety of telecommunications applications, is compared to a standard-sized paper clip. The chip's numerous functional areas are labeled.

One of the transistor's latest descendants is the Bell System's 30,000-element MAC-4 "computer-on-a-chip." It's another in a long line of microelectronic developments that have come from Bell Laboratories.

The MAC-4 is so efficient that a program written on it takes 25 percent less storage space than that required by most other microcomputers. Its assembler language, C, also developed at Bell Labs, has features that make MAC-4 easier to program, debug and maintain. And the MAC-4 can handle anything from nibbles to bytes to words with its 4-, 8-, 12-, and 16-bit operations capacity.

Like other one-chip computers, the MAC-4 has sufficient memory to support its varied tasks—3000 nibbles of read-only memory and 200 nibbles of random access memory coupled to 34 input/output ports.

Fabricated with the latest CMOS technology, the MAC-4 needs little power. Thus it is well matched to a variety of telecommunications applications.

It started with the transistor

MAC-4 is just one current example of the many microelectronic devices to come from Bell Labs since we started the solid-state revolution with the invention of the transistor in 1947.

Over the past three decades, our advances in materials, processing, and devices have been vital to solid-state technology. These include:

- The Junction Transistor
- Crystal Pulling
- Zone Refining
- Field-Effect Transistor
- Diffusion
- Solar Cell
- Oxide Masking
- Thermocompression Bonding
- Photolithography
- Epitaxial Film Process
- Magnetic Bubble Memory
- Charge-Coupled Device
- Semiconductor Heterostructure Laser Used in Lightwave Communications
- Electron-Beam Exposure System

Today and tomorrow

Today, we continue to make important contributions to solid-state technology. For example, we've developed a rugged 65,536-bit RAM that can tolerate processing faults. Corrections can be made on the chip itself, so we can get more usable chips out of each manufacturing batch—and thus lower unit costs.

In materials processing, we've developed a technique for precisely controlling the growth of successive atomic layers of single crystal materials. This "molecular beam epitaxy" process is finding increasing use within Bell Labs and elsewhere in the electronics industry. We've used it to fabricate a device that permits us to double the speed of electrons by channeling them into crystal layers where they meet less resistance.

Other advances, in X-ray lithography and new resist materials, for example, promise to help place more elements on microelectronic devices and thus enhance their ability to perform important tasks.

As the solid-state revolution continues, these and other developments from Bell Labs will play an important part in it. What's important to us is the promise these advances offer for new telecommunications products and services. Like the transistor, MAC-4 and its solid-state relatives will find more and more applications in the nationwide telecommunications network.

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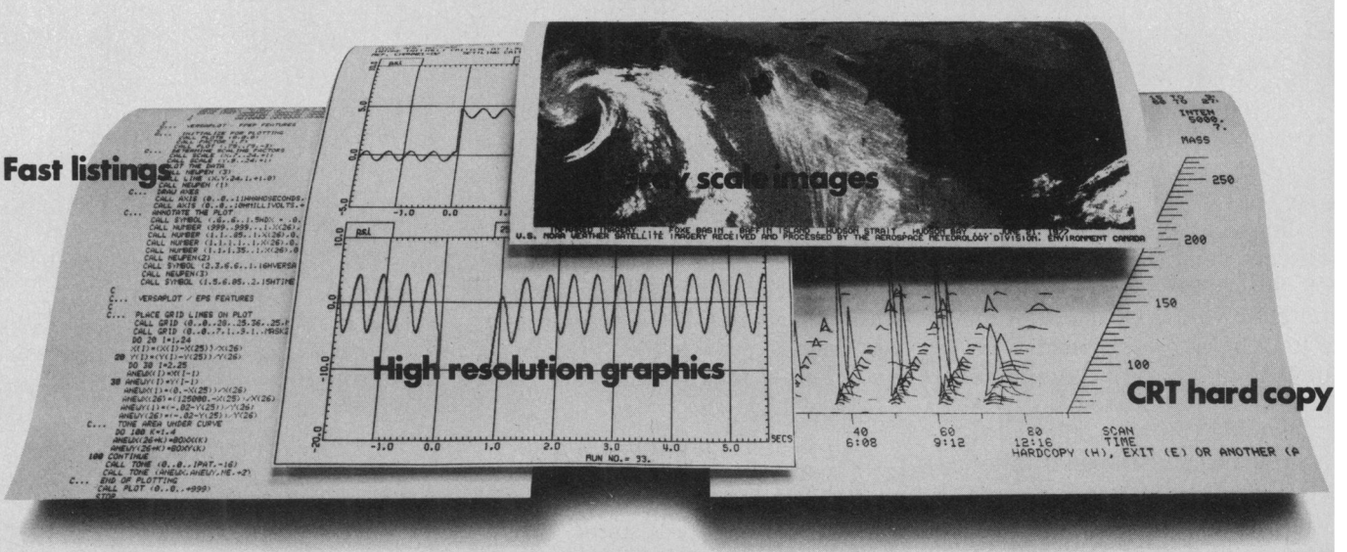

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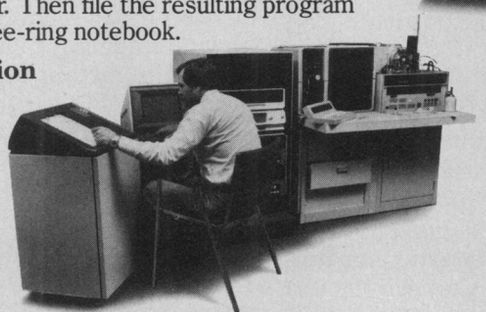

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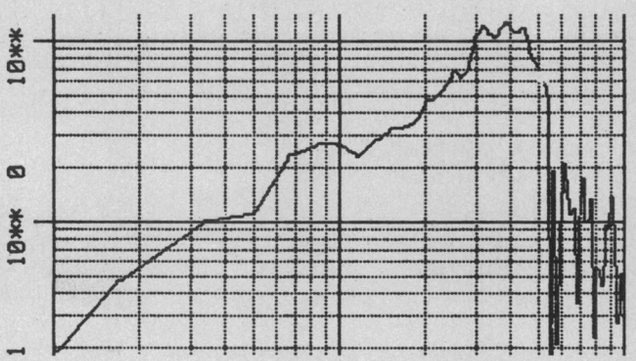

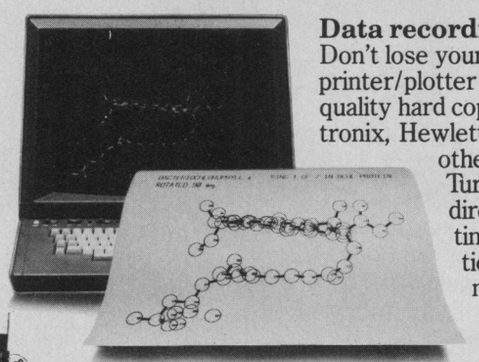

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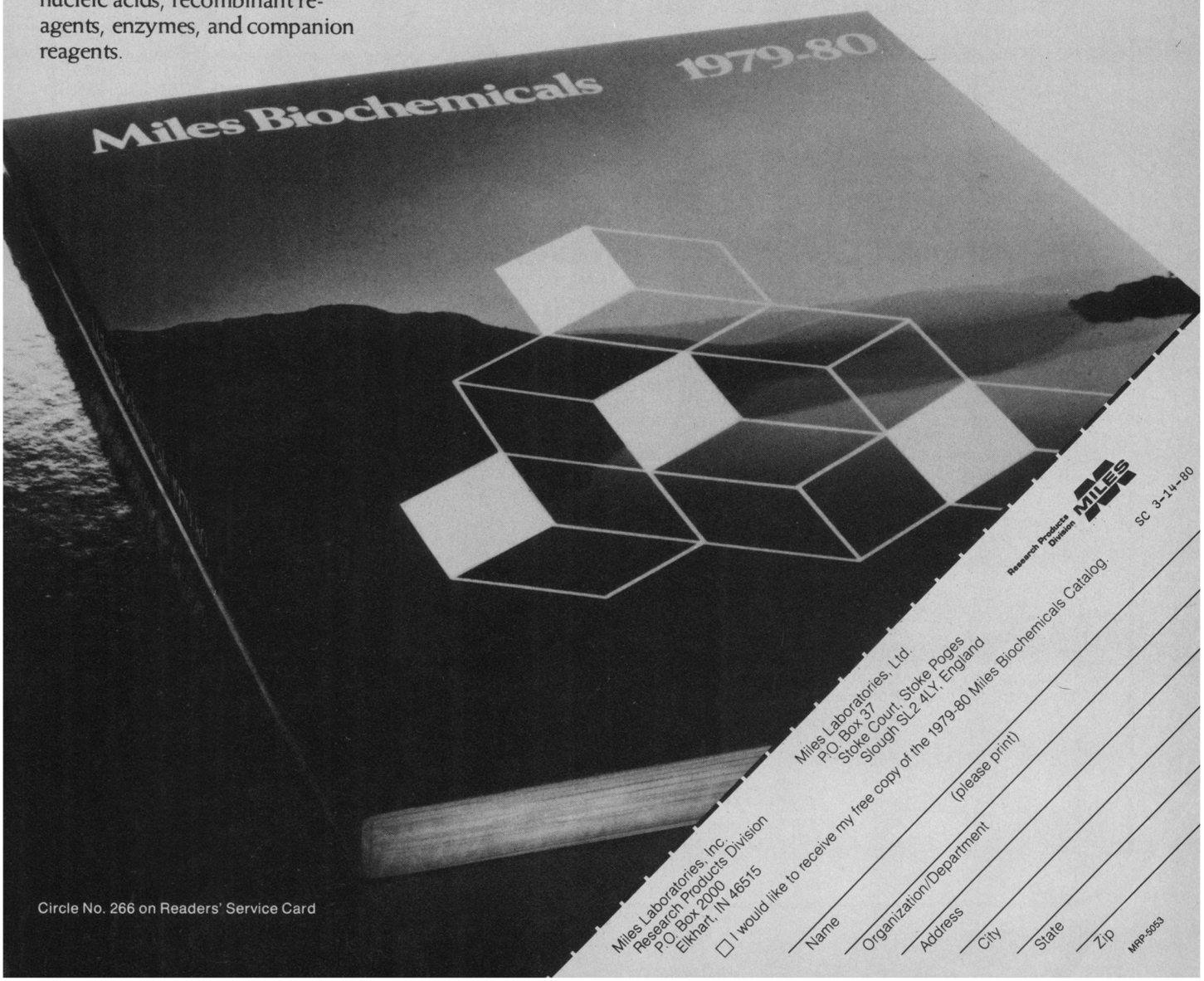

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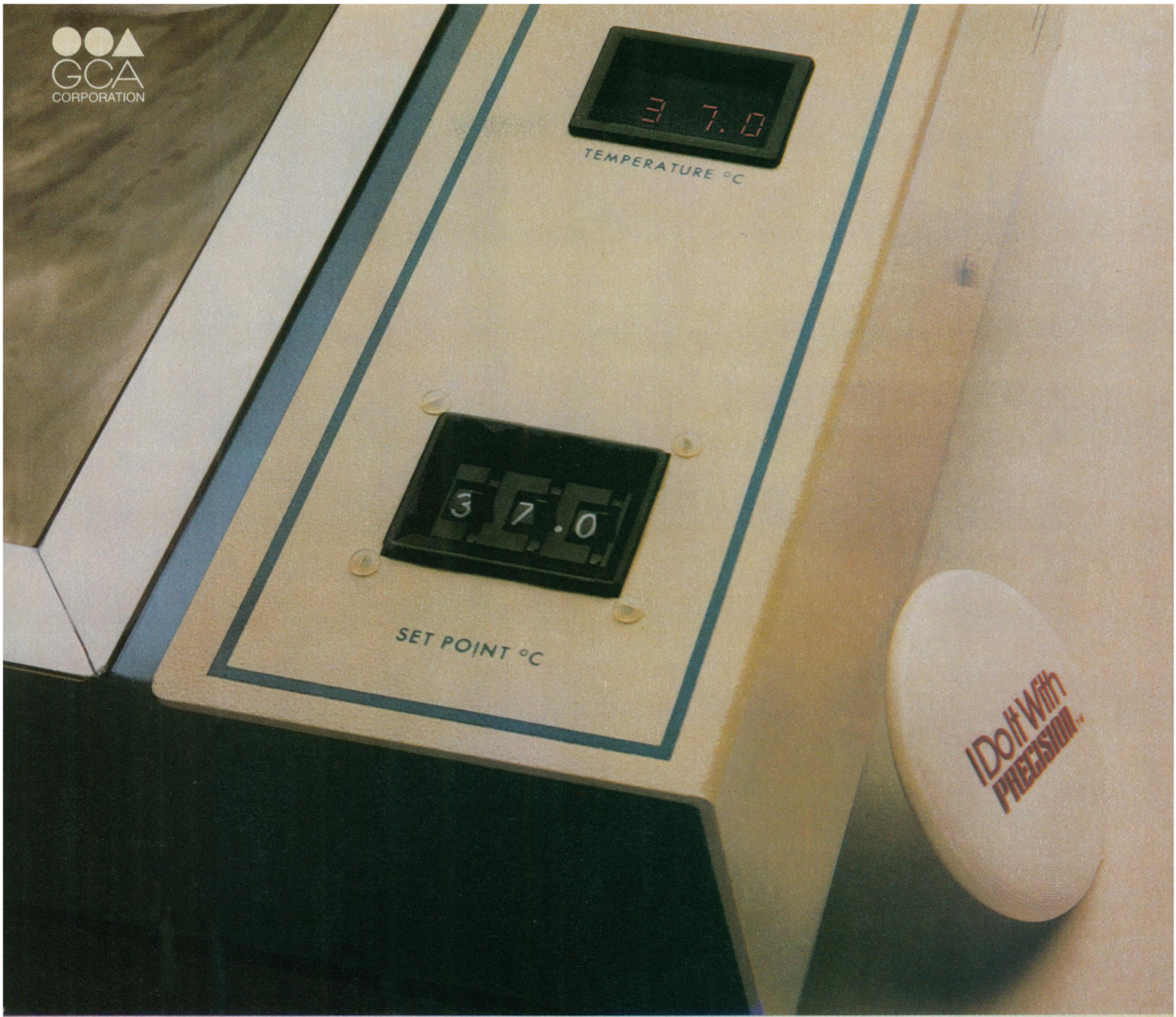

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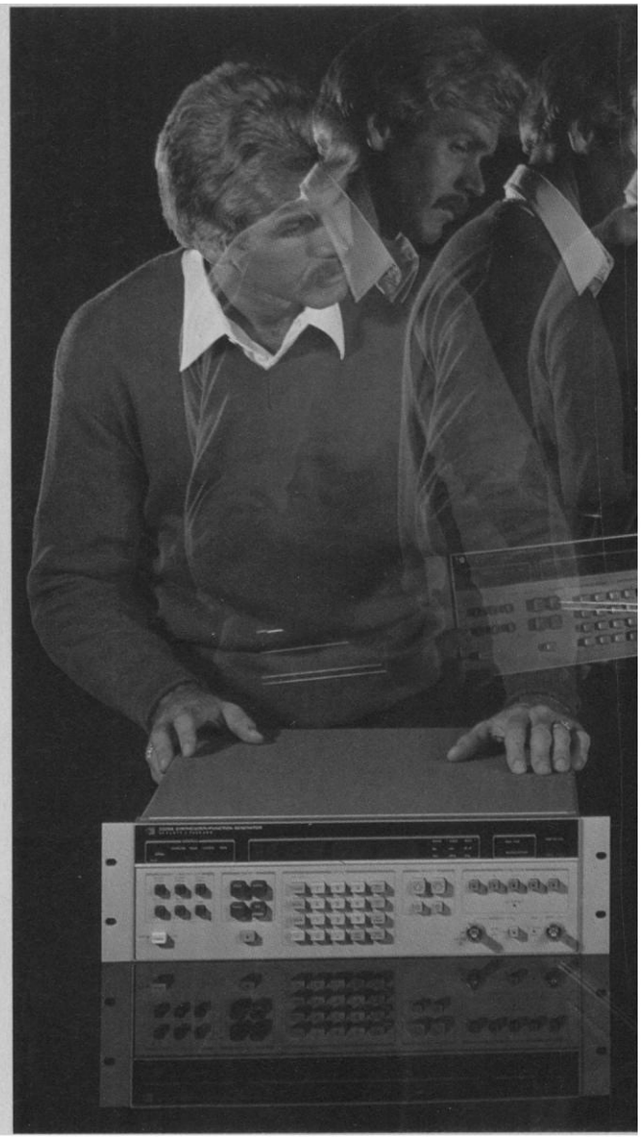

You can take months to design and assemble your own bus-compatible measurement system, and get just the system you need.

Or now, you can use HP system-designed instruments and computers, and get to your application in just a few weeks.

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For example, HP has been designing and building HP-IB compatible products for more than a decade. We've put these 10-plus years of experience into bus architecture, and how it can best be designed into instruments and computers. Quickly and easily. Which means that when you choose HP-IB compatible system components, chances are you'll get your measurement system up and running weeks faster than if you were to configure it the conventional way.

Because HP offers 119 different HP-IB instruments and computers, you choose just the bus compatible hardware that best fits your system needs.

HP also has developed over 104 application notes on HP-IB compatible products. One of these may be just what you need to get to your application. Quickly and effortlessly.

For that matter, every HP-IB compatible product comes with complete and comprehensive documentation. Many of our computers feature high-level I/O language that eliminates the need for an I/O driver.

Choosing to assemble your own bus-compatible system with HP-IB products also means that if you ever need service on your system, just call HP. One of our hundreds of field service people will respond to your need.

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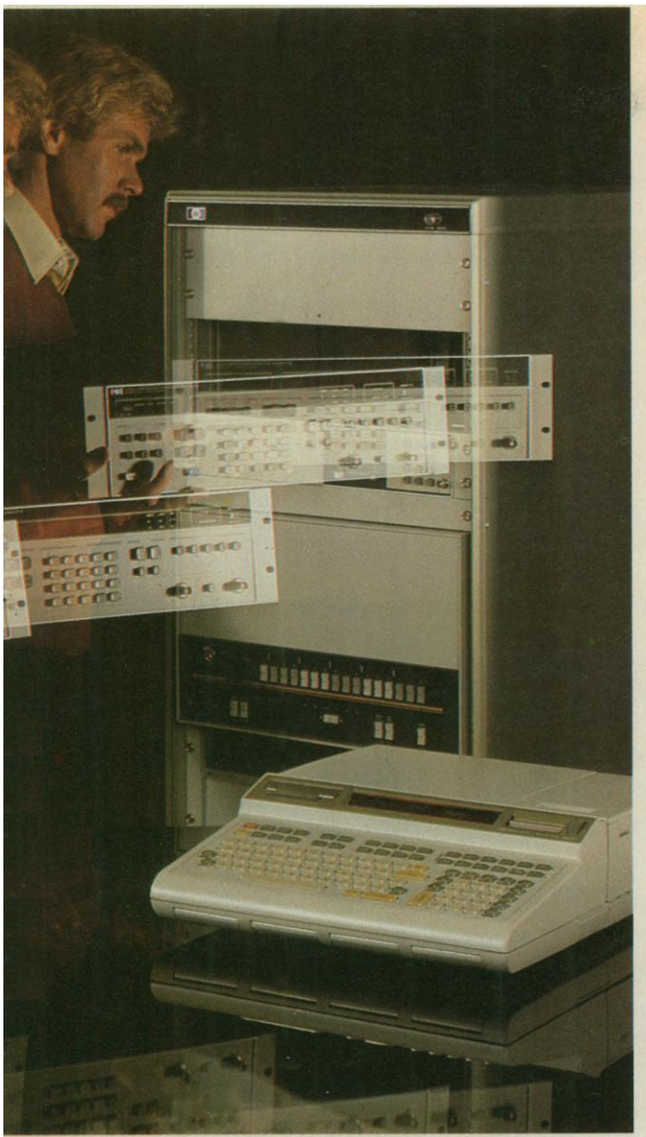

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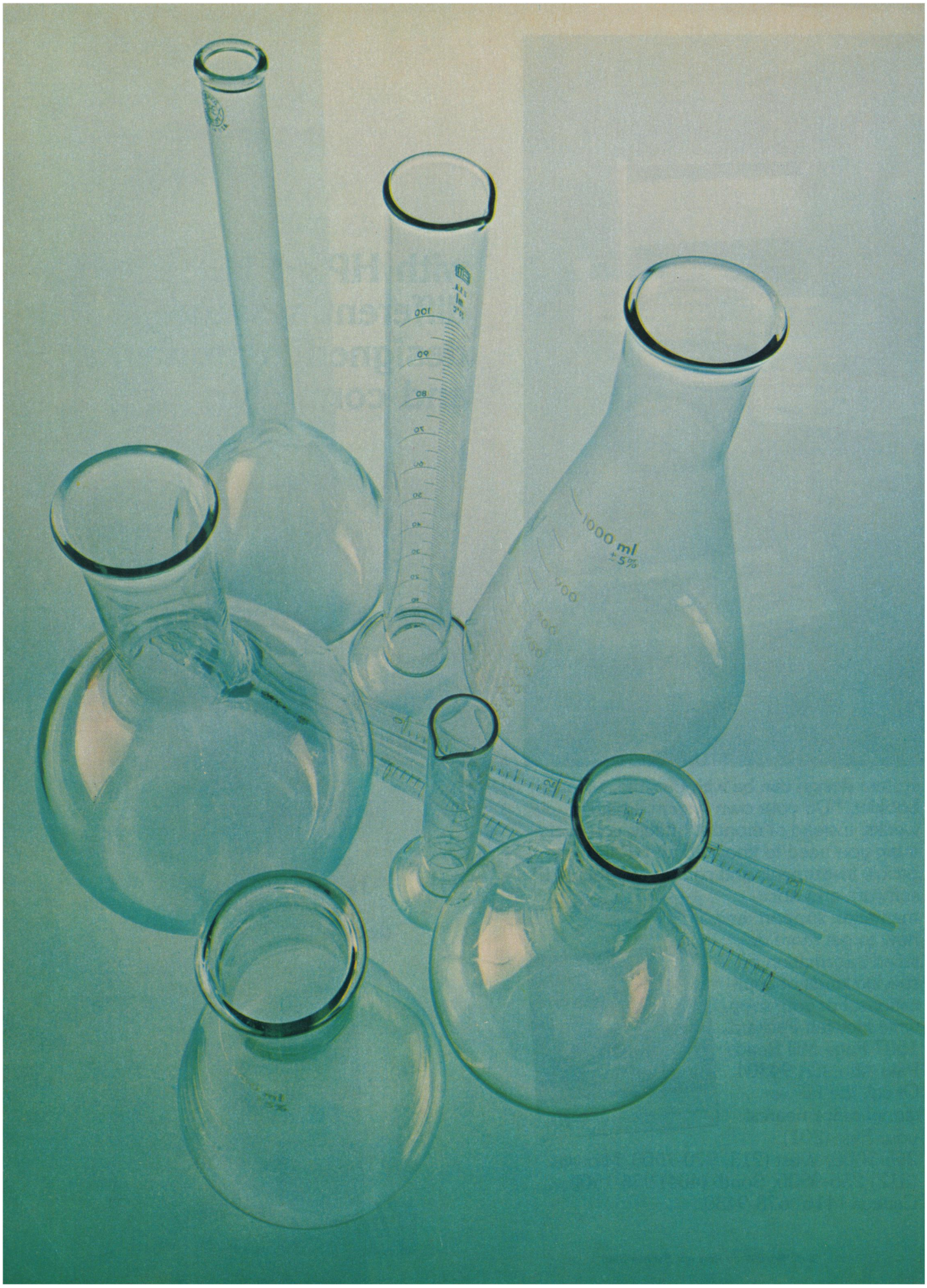
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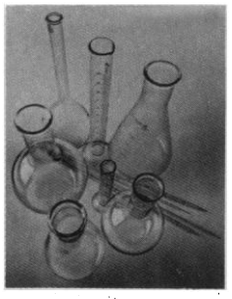

Laboratory assignments demand a great deal of a microscope in terms of performance. It must operate quickly and conveniently, yet consistently deliver accurate images for interpretation. Developing the technology to achieve these seemingly exclusive goals is Nikon's concern.

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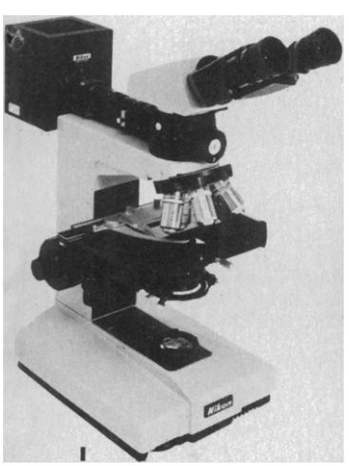

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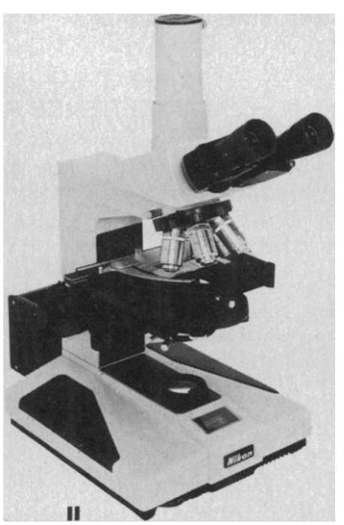

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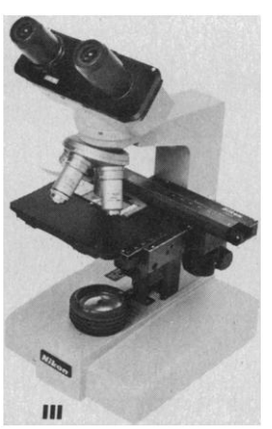

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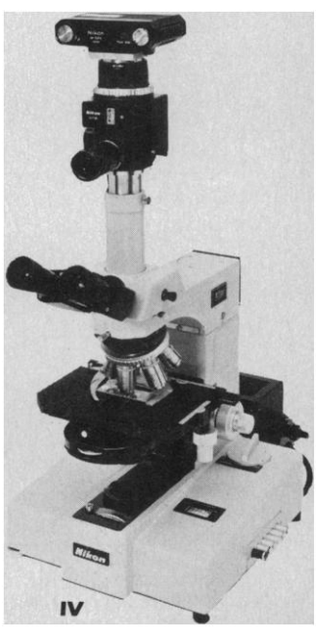

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Harvesting the Sun

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BIO-ENERGY'80

PROGRAM

- An opening **global overview**
- Survey seminars on **biomass sources** (residues and energy crops), **conversion processes** (biological and thermochemical) and **end uses** (for fuels, feeds/foods, fertilizers, feedstocks and fibers)—with one general track covering the main elements and four specific tracks covering the detailed components
- Intensive seminars on practical **integrated systems** (wood to electricity, manure to methane and feed, sugar/starch crops to alcohol and feed, water weeds to methane and fertilizer, etc.)
- Broad seminars on **commercialization incentives, basic research, impact analysis** and **overall coordination**
- A final summary and action-oriented conclusion

EXPOSITION

- Over 100 exhibits of **bio-energy techniques, equipment, services and publications** closely related to the Congress program—showing the many specific ways in which bio-energy can be produced and used **today,** and the exciting prospects for **increased use,** and including major **government/industry exhibits** by **Brazil, Canada, France** and **Sweden,** and a dramatic coordinated exhibit by **14 U.S. Agencies.**

SPEAKERS

Major Speakers and Seminar Chairmen include:

- Leaders of Brazilian, Chinese, English, French, Israeli, Swedish and U.S. scientific, academic, research and environmental organizations
- Top officials from the United Nations, International Energy Agency, Inter-American Development Bank, and others
- Key U.S. officials of the National Science Foundation, Environmental Protection Agency and the Departments of Energy and Agriculture

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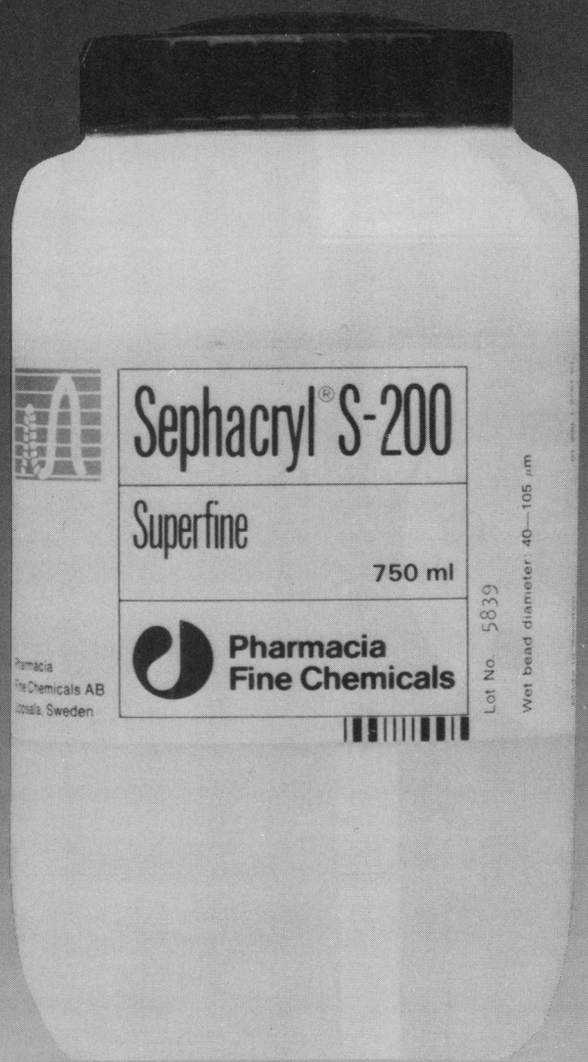

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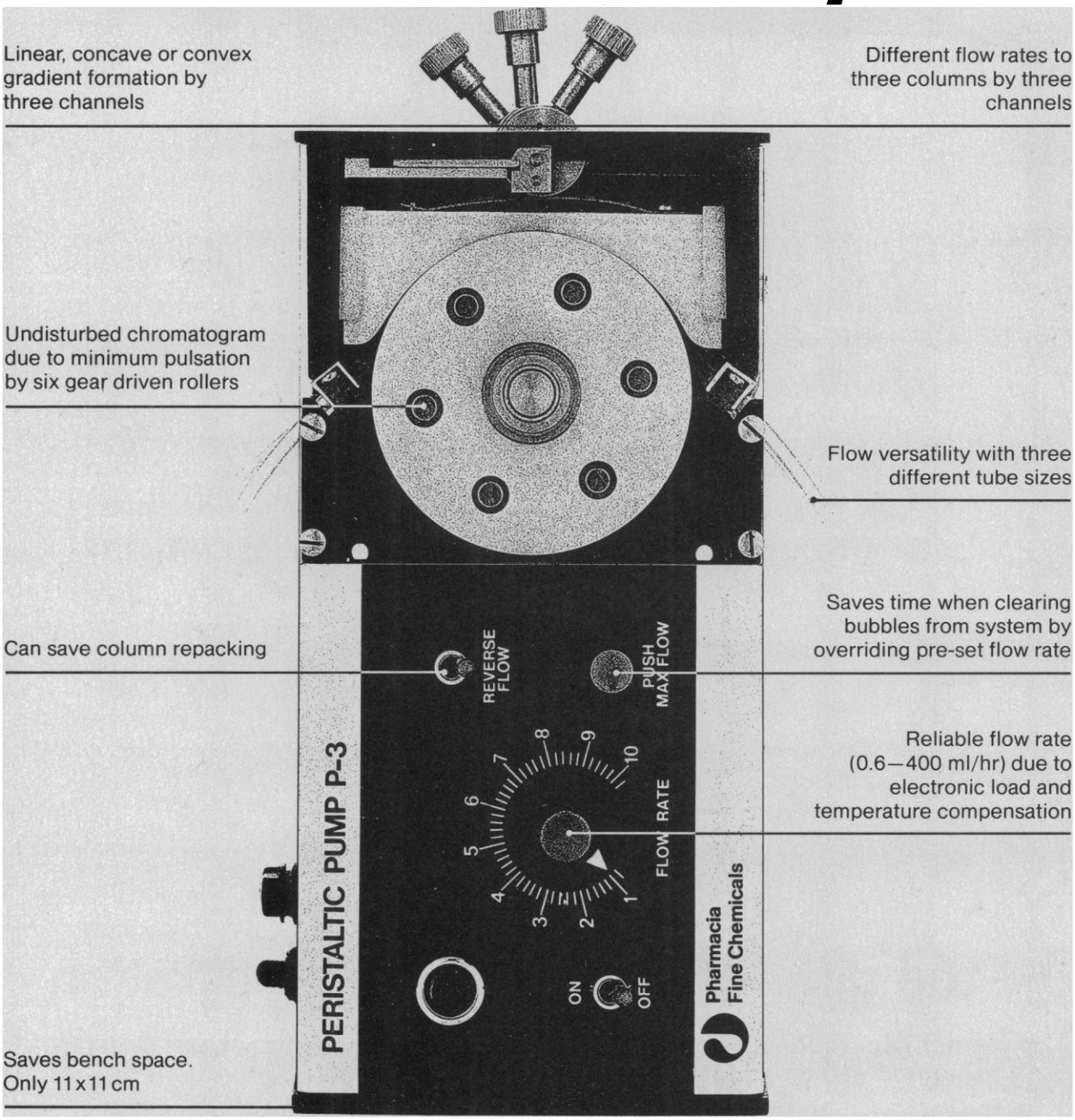

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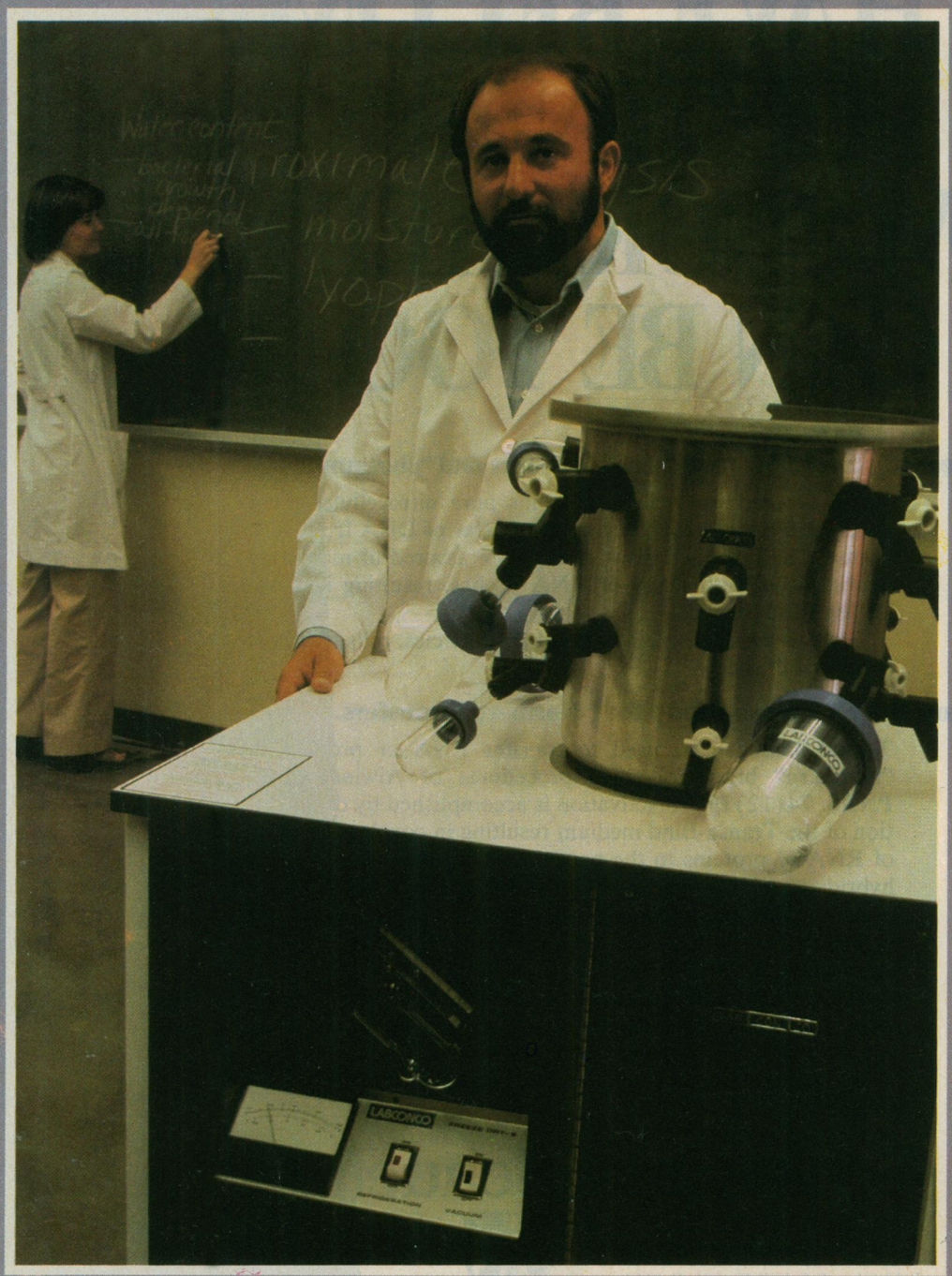

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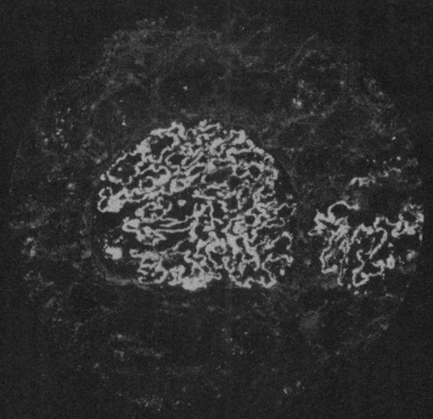

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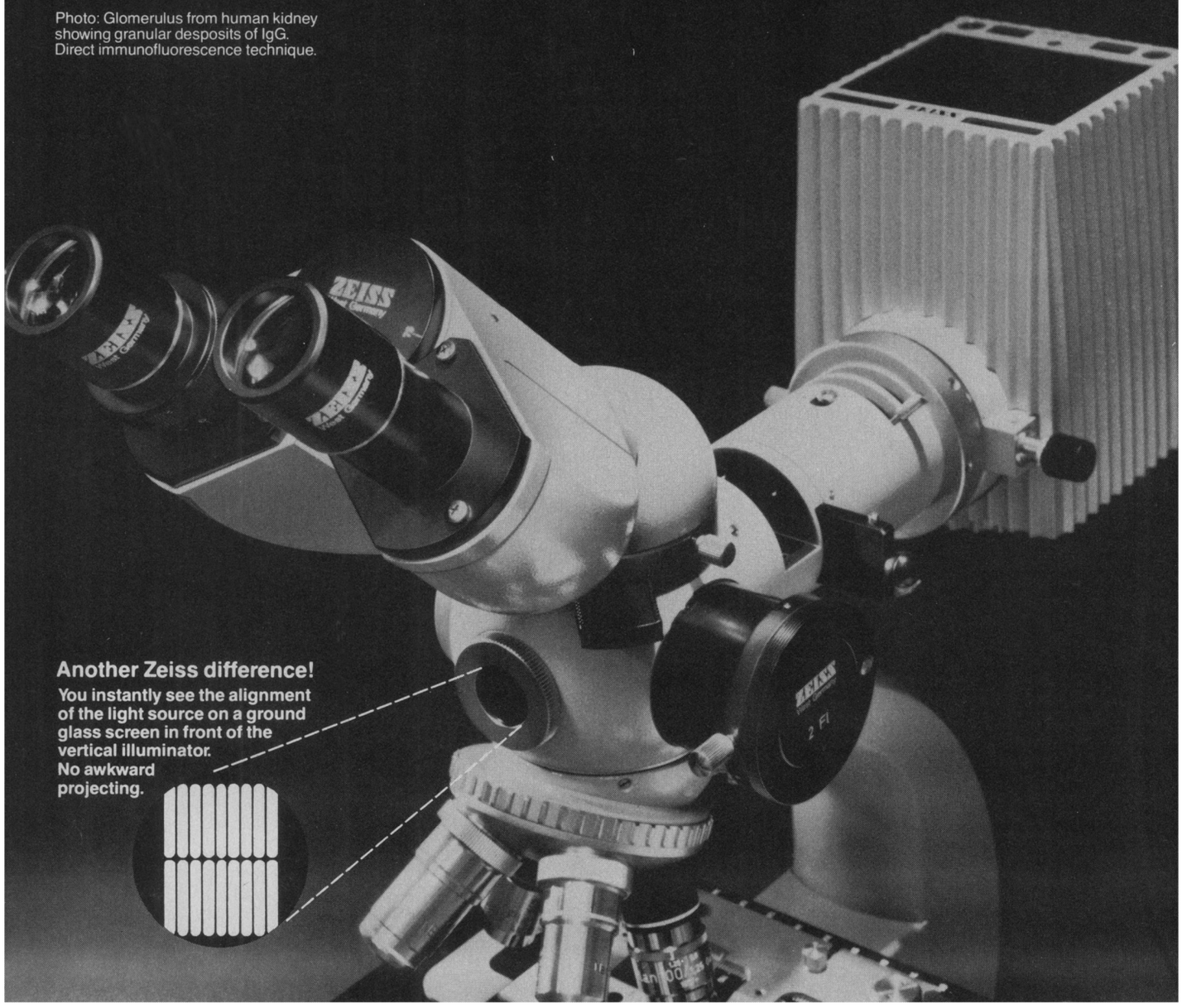

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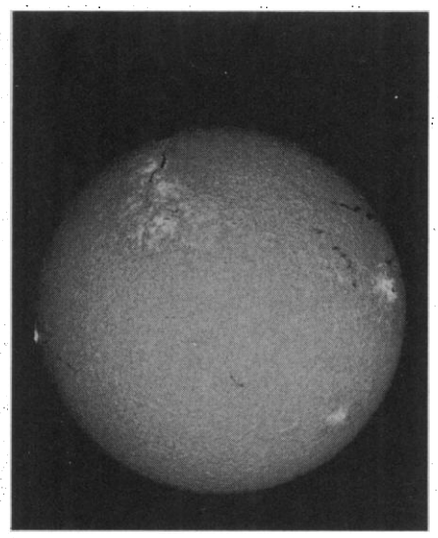
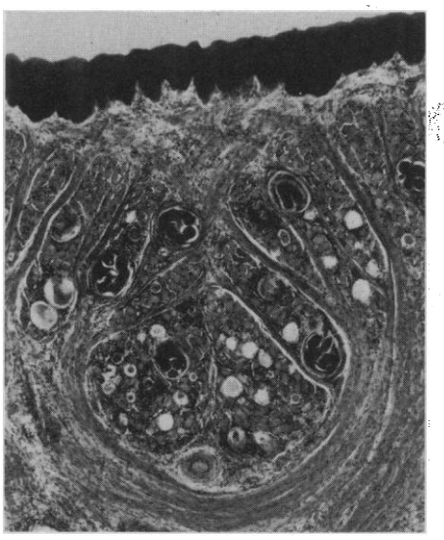


Hydrogen-alpha photograph of solar flares. Sacramento Peak Observatory, Sunspot, N.M.



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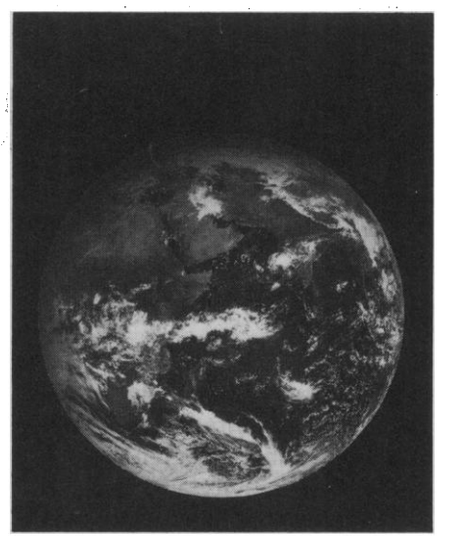

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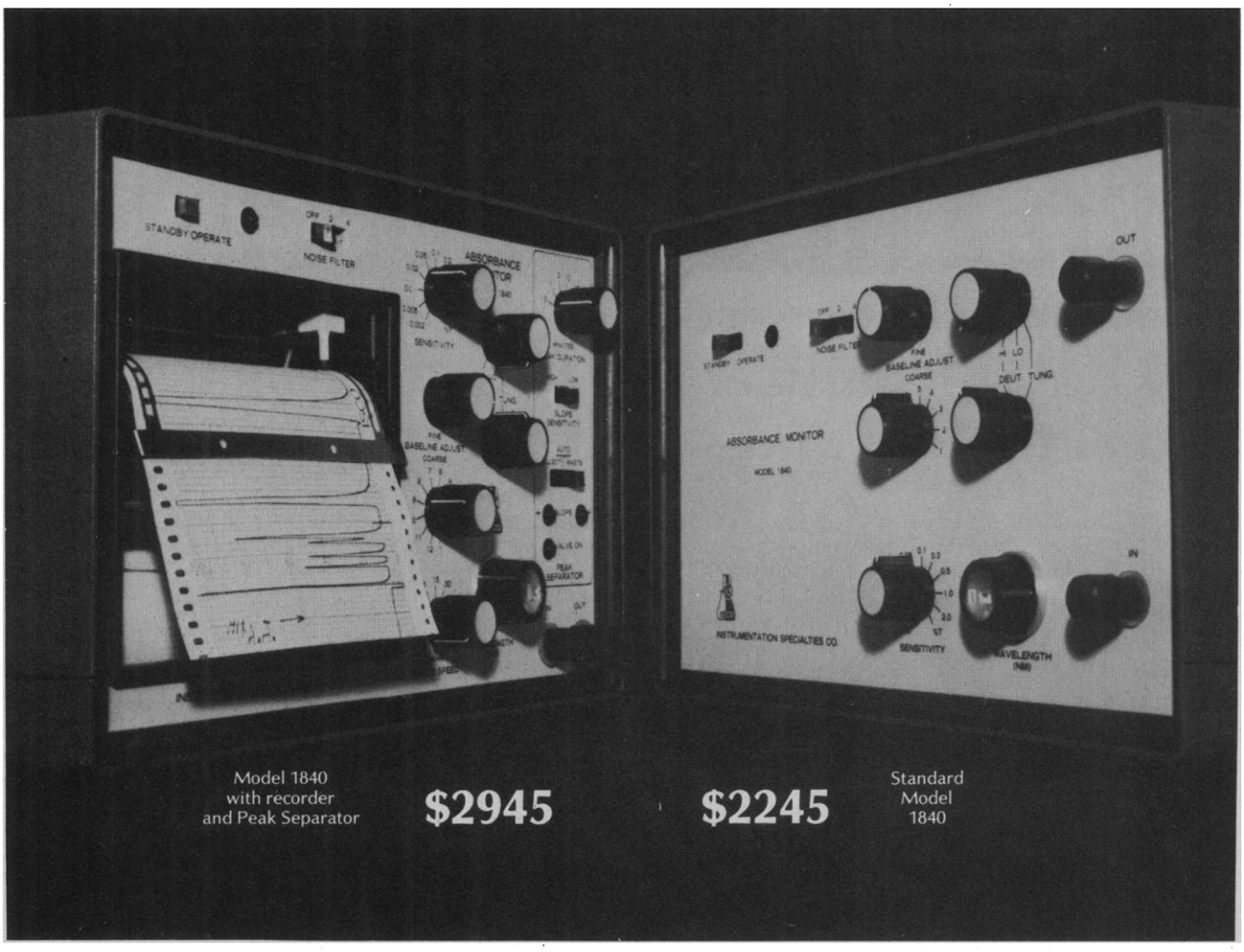

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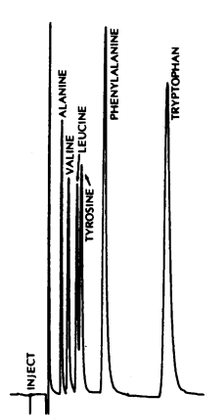

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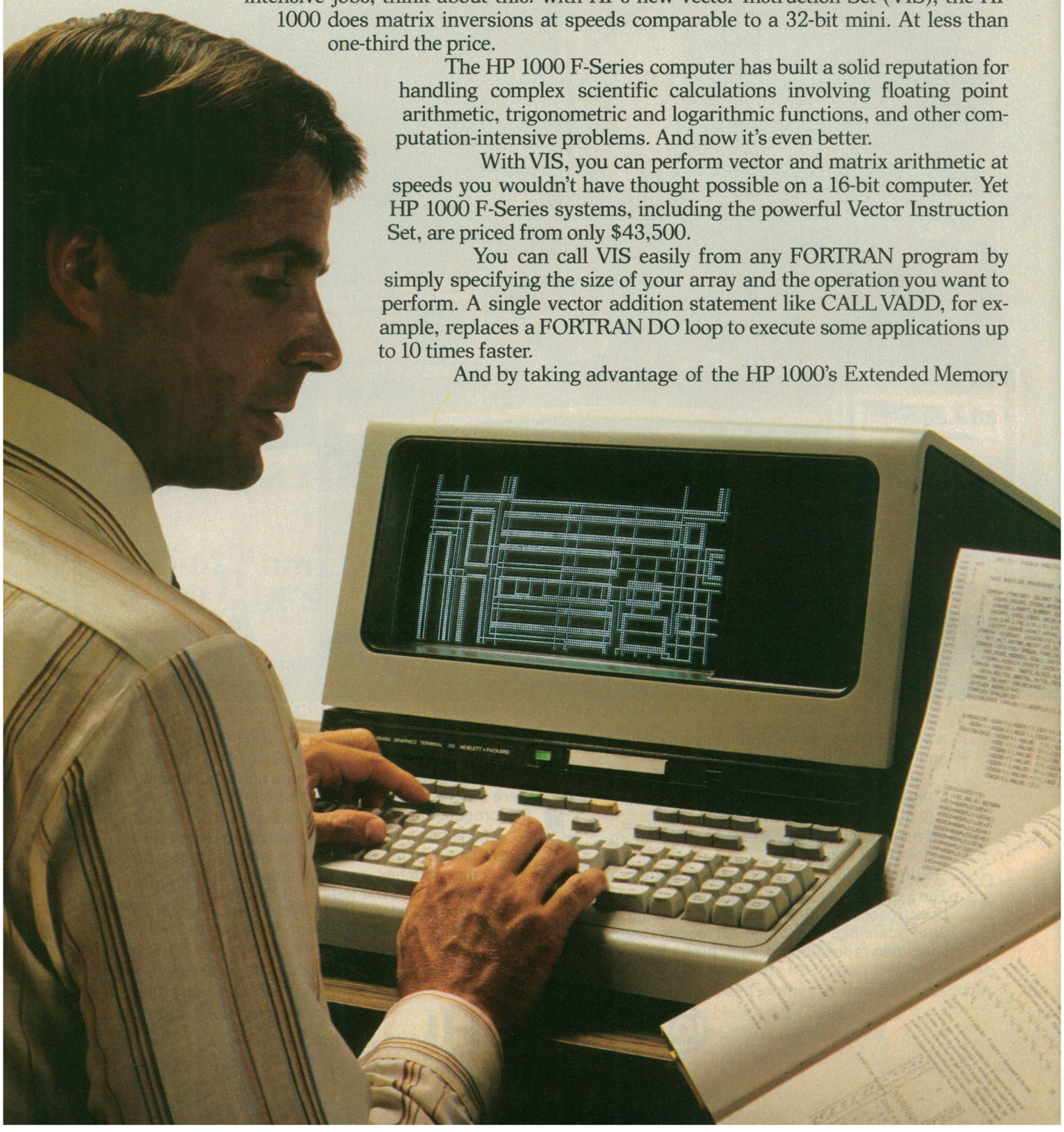

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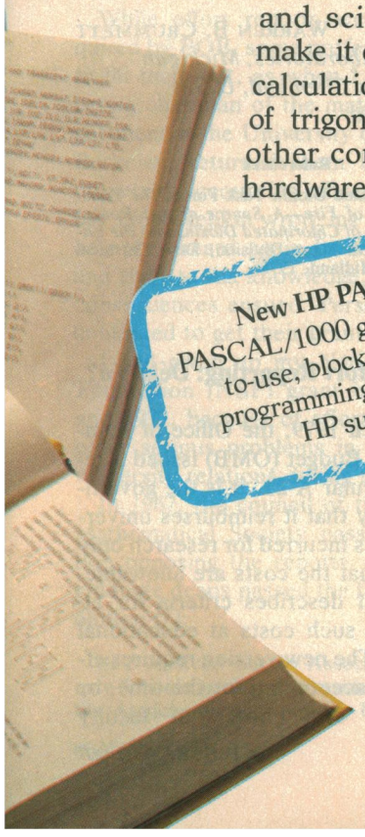

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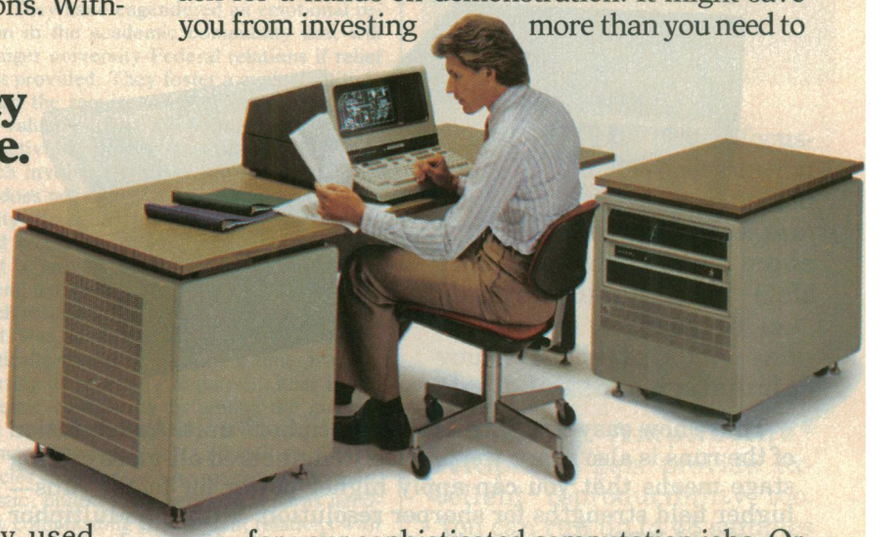

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LETTERS

TCDD in Coal Fly Ash

Scientists at the Dow Chemical Company are naturally interested in the report by B. J. Kimble and M. L. Gross (4 Jan., p 59) "Tetrachlorodibenzo-*p*-dioxin [TCDD] quantitation in stack-collected coal fly ash," in which the authors extrapolate one data point to show that 2,3,7,8-TCDD was not present in fly ash from a "modern power plant." They then extrapolate this result to support a statement that a conclusion reached by Dow scientists in an earlier report (*1*) was "invalid." To resolve the apparent differences we asked the authors to collaborate with us in sampling and analyzing fly ash from the same power plant. We were told that they were not free to disclose the name or location of the powerhouse. We then attempted to obtain the information using the Freedom of Information Act through the Department of Energy (DOE), which operates the Laboratory for Energy-Related Health Research (ERHR) at the University of California, Davis. The reply from DOE states that they checked with the director of ERHR at Davis and conclude that "we have no document or record of any kind which gives the location of the 'commercial coal combustion facility' and I [David A. Smith] do not know its location." Regardless of the quality of the work, the integrity of the report is thus placed in jeopardy, since the source of the sample cannot be identified, and confirmation of the result cannot be made.

WARREN B. CRUMMETT
Analytical Laboratories, Michigan Division, Dow Chemical, U.S.A., Midland 48640

References

1. The Chlorinated Dioxin Task Force, *The Trace Chemistries of Fire—A Source of and Routes for the Entry of Chlorinated Dioxins into the Environment* (Michigan Division, Dow Chemical Company, Midland, 1978).

Time and Effort Reporting: Déjà Vu?

On 6 March 1979, the Office of Management and Budget (OMB) issued a revision of circular A-21. It is the government's theory that it reimburses universities for costs incurred for research only if it agrees that the costs are allowable. Circular A-21 describes criteria for allowability of such costs at educational institutions. The new version requires effort reports, accounting for the time, or "workload," or "effort" of faculty

members, and requires a breakdown of these into different categories, such as sponsored research, unsponsored research, teaching, administration, and so forth. The percentages for each must add up exactly to 100. These new regulations are to go into effect on 1 October 1980.

This situation duplicates one that arose in March 1965, but in some respects is worse because the new effort reports must include even more categories. Time and effort reports are meaningless. The battle against them was fought from 1966 to 1968, and won after a vigorous wave of protest at the grass roots. This protest included letters addressed directly to the Bureau of the Budget (BOB) and letters published in *Science* from, for example, George Mackey, former chairman of the mathematics department at Harvard University (2 Sept. 1966, p. 1057) and me (17 Feb. 1967, p. 773; 8 Dec. 1967, p. 1268), and other direct action concerning the reports.

For example, at Brandeis University, a university administrator admitted that the objections against the effort reports were justified but claimed that if professors did not fill them out, then Brandeis would be exposed to the danger of heavy financial loss. Faced with this position, R. Palais and his colleagues felt they had to fill out the reports retroactively, while doing this under strong protest. They specified that this did not imply on their part an acquiescence to the principle of effort reporting, or even an admission that in the academic setting one can be truly honest or meaningful in filling out these forms.

While effort reports were being required by BOB, some professors refused to fill them out, as when Leon Henkin, acting chairman of the mathematics department at the University of California, Berkeley, returned them blank to the university accounting officer on 21 October 1966. Henkin wrote me recently that he never heard again from that officer, and that, to his knowledge, no financial consequences ensued. Persons involved continued to get their grants.

I had given up my National Science Foundation (NSF) grant between 1966 and 1972, because of effort reports and other serious problems in government-university relations during that period.

In 1967, the council of the American Mathematical Society passed a resolution opposing the reports. In 1966, the graduate deans passed the following resolution (*1*):

> Be it resolved that the Association of Graduate Schools instruct its President to call upon the Association of American Universities to join in addressing the President of the United States our respectful requests: 1. that the present requirement for reporting of effort by individual members of the professional staff be suspended immediately because it admits no meaningful compliance.

As a result of the protest, BOB sent a task force out into the academic world to talk directly with the professors. It was headed by Cecil Goode, who wrote me on 5 February 1968: "I hope your confidence in us will prove well founded." The task force ultimately understood our complaints and made recommendations in accord with our point of view (*2*).

> Time and effort reports now required of faculty members are meaningless and a waste of time. They have engendered an emotional reaction in the academic community that will endanger university-Federal relations if relief is not provided. They foster a cynical attitude toward the requirements of government and take valuable effort away from more important activities, not the least of which is the research involved. We need to go to a system that does not require documentary support of faculty time devoted to government-sponsored research. No real evidence of faculty effort is provided anyway under the present system, and there is no way other than the research results themselves to prove how much effort was in fact expended. . . . There is practically no satisfaction with time or effort reporting as presently required, either in the academic community or among the government agencies principally involved in supporting research at universities. Most agencies consider the present requirement unrealistic, unnecessary red tape, and as needlessly complicating government relations with universities. The academic community is virtually unanimous in the opinion that effort reporting is:
>
> —impossible to do in a meaningful way;
>
> —burdensome, taking valuable professional time away from the major tasks at hand;
>
> —useless, in that it is inaccurate and bears little relationship to truth; and
>
> —a dis-incentive to quality research and engenders a cynical attitude toward Government.

Some of the task force's conclusions are also quoted in the *Report of the Commission on Government Paperwork* (*3*), chaired by Representative Frank Horton (R-N.Y.) and Senator Thomas J. McIntyre (D-N.H.).

The Goode task force and its conclusions provided a splendid example of cooperation between the government and the professors. As a result, effort reports, as they had been set forth in 1965, were eliminated on 1 June 1968.

Both in 1965 and in 1979, revision of circular A-21 to include effort reports resulted from pressure by the universities to recover more money from the government for the direct and indirect costs of research. It followed long negotiations (about 2 years) between government officials (from BOB in 1965 and OMB in

1979) and business officers of universities. Both times it appears that the business officers were unable to achieve appropriate results or properly represent the professorial position, for whatever reason. I have received contradictory accounts of the negotiations, both in 1965 and in the more recent period. One states that the business officers apparently did not realize the implications of the effort reports for academic personnel (or even worse, sold out the professors); another states that effort reports were imposed unilaterally by the government, and (in 1967) that I was naïve if I thought that the business officers, the presidents, or the mathematicians could have prevented the inclusion of some kind of time and effort reporting in circular A-21. Although I grant the best motivation on the part of the business officers, I was and am again concerned with the results of the negotiations.

The position that the government is entitled to accounting for its support is entirely legitimate; neither I nor my colleagues who object to effort reports have ever been against proper accounting. The objections are against meaningless accounting, or accounting improper in the academic setting. For example, several different government agencies may support a research project together. Accountants may think it reasonable to know precisely which parts have been funded by which agency. However, researchers cannot compartmentalize their work in that fashion, and they are sometimes led to transfer charges between closely related grants. Accountants may then see "abuse" when none exists according to the soundest research practices. On the other hand, over the last few years, there have been a few documented cases of abuse or errors, as when a university has charged erroneously a faculty or staff member's salary to a grant when the individual was not working on that project. I am informed that the total amount of money involved in such cases is extremely small compared to the total amount invested by the government in the universities. But if there is some need to reimburse, why impose meaningless requirements on others? In addition, the audit of new meaningless reports will open the door to further misunderstandings, a vicious circle which should not be allowed to develop.

As in 1968, the government should acknowledge that it is supporting intellectual activities which cannot be measured or accounted for in the same way as, say, the production of material items. In his letter to *Science* in 1966, Mackey observed that the act of signing

effort or time reports causes a professor to ratify a change of his status from that of "independent thinker, partially subsidized so as to have the leisure to think, to that of a professional, employed to do a job." He wrote further:

> One can sympathize with the desires of men charged with the supervision of vast sums of money to see that the money is well spent. However, I believe that vigorous protests are in order when their well meant efforts are insensitive to important differences between an academic appointment and most kinds of employment and when this insensitivity puts men into impossible positions and threatens delicate but valuable institutions.

On 14 December 1979, Yale University's Deputy Provost Charles Bockelman wrote me:

> When we were apprised of the pressure for efforts reporting, Yale tried in a variety of forms to express its vigorous opposition. . . . It does seem to me Yale has done all it can through institutional channels. The voices of individual professors may be more effective.

Furthermore, on 19 February 1980, NSF Director Richard C. Atkinson wrote me:

> I have followed your correspondence on "effort reporting" with great interest. The government bureaucracy is educable, if one can get their attention. Your approach and tenacity may be what is required to have an effect on these issues.

I hope that many professors will contact OMB Director James McIntyre (Executive Office Building, Washington, D.C. 20503) or Presidential Science Adviser Frank Press (same address) to make themselves properly understood. Such direct appeals are not "naïve." I have no reason to doubt that a result similar to that achieved with the Goode task force will be obtained, except that instead of taking 2 years as it did in 1966–1968, it will take only a brief period because of the past experience, precedent, and mutual understanding.

SERGE LANG
Department of Mathematics,
Yale University,
New Haven, Connecticut 06520

References

1. *J. Proc. Assoc. Grad. Schools* (1966), p. 126.
2. "Time or effort reporting by colleges and universities in support of research grants and contracts: A report by a task force comprised of representatives from the Bureau of the Budget, the General Accounting Office, the Department of Defense, the National Science Foundation, and the Department of Health, Education, and Welfare" (available from the Office of Management and Budget, Washington, D.C., 1968).
3. *Report of the Commission on Government Paperwork* (Government Printing Office, Washington, D.C., 1977), pp. 19–20.

Erratum: In the article "The business of science" (News and Comment, 1 Feb., p. 507), on line 19, the turnover of Schering-Plough stock on 17 January was cited as having been "better than 128 million" shares. The correct figure is 1.29 million shares.

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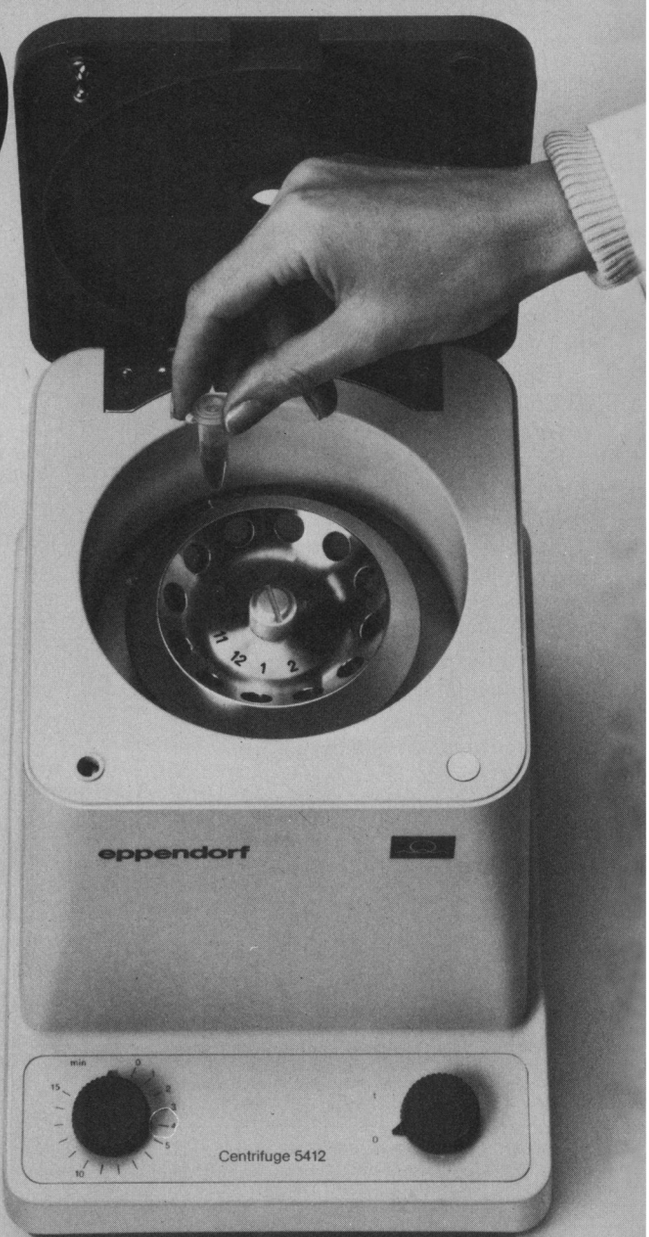
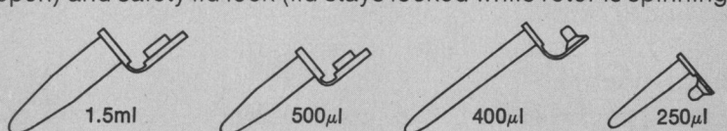
With some micro centrifuges, constant speed is a constant problem, but not with an Eppendorf.®



Within ten seconds, the Eppendorf 5412 attains 15,000 rpm, generating a force of 12,800xG, regardless of load. Performance like this means rapid sample separation, in most cases within 60 seconds or less. An angled rotor accommodates twelve disposable Eppendorf 1.5ml micro test tubes, or twelve 500μl, 400μl or 250μl tubes using adapters. (For higher capacity requirements, the Eppendorf Model 5413 accepts forty 1.5ml, 400μl or 250μl disposable test tubes in four carriers, but operates at lower speeds.) Eppendorf Micro Centrifuges are equipped with automatic 15 min. timer, safety switch (prevents operation with lid open) and safety lid lock (lid stays locked while rotor is spinning).



Eppendorf Micro Test Tubes have attached caps and are ideal for centrifuging, mixing, or storing reagents. Economically priced, they are available in the following sizes: polypropylene — 1.5ml, 500μl, 400μl; polyethylene — 400μl, 250μl.

For complete literature, write: Eppendorf Division, Brinkmann Instruments, Inc., Cantiague Road, Westbury, N.Y. 11590.
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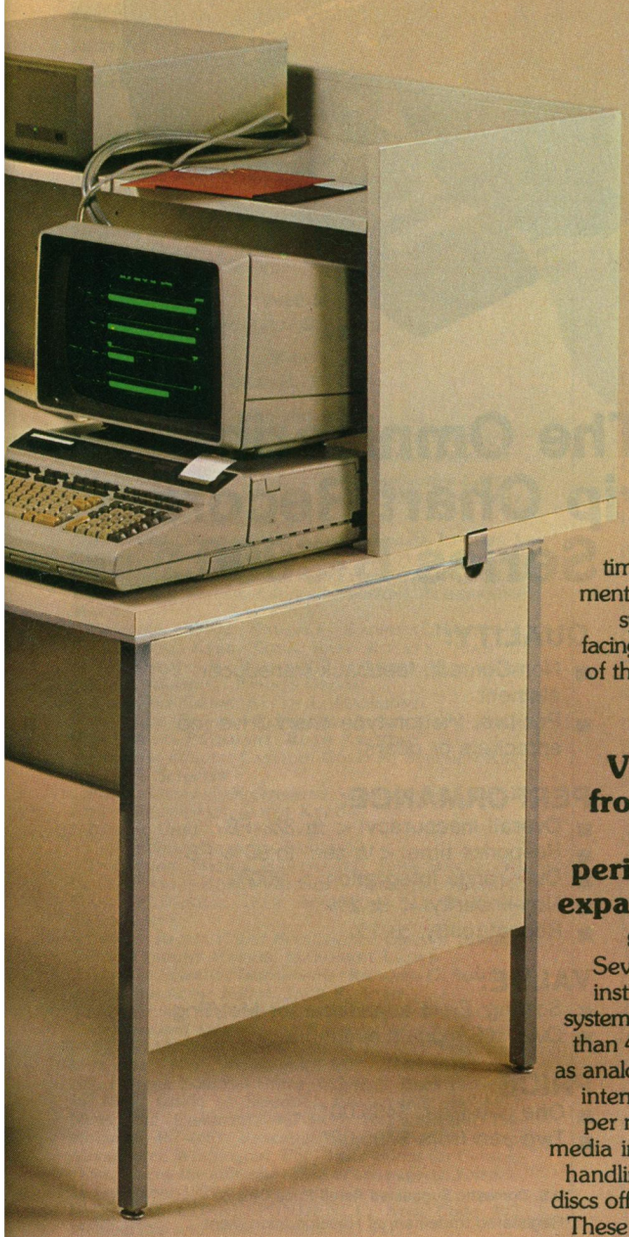
today's desktop for data acquisition



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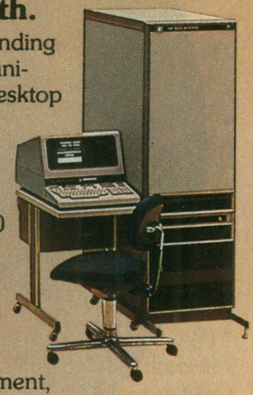

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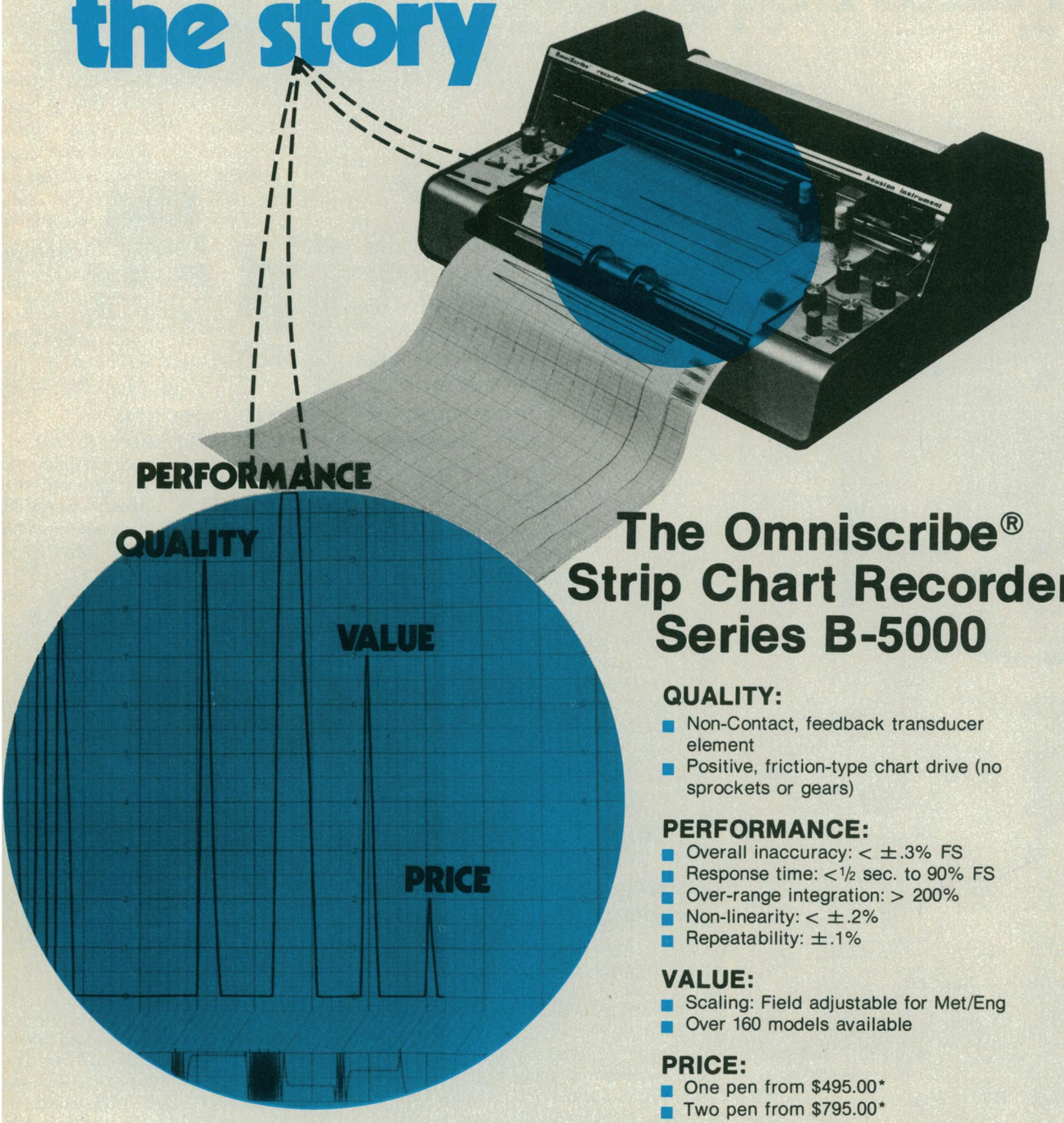

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14 March 1980, Volume 207, Number 4436

SCIENCE

Metallogenesis in Latin America

The mines of Latin America have contributed to the economies of other regions for more than 400 years. At first the treasures were silver and gold; today they include copper, iron, aluminum, tin, molybdenum, lead, zinc, and other substances. The flow will continue for a long time. For example, Chile is known to have as much as 30 percent of the world's copper reserves. The great mine at Chuquicamata has 8000 million tons of copper ore with a cutoff grade of 0.5 percent copper. How this and other ore deposits were formed and how this knowledge can be used to guide further exploration were the subjects of a symposium held in Mexico City on 4 to 6 February.* The occasion brought together about 150 experts from the Western Hemisphere and included leading geologists from most of the Latin American countries. The meeting provided an opportunity to assess the quality of the scientists involved and the state of development of their science.

Most of the valuable elements of the earth's crust are present with an average abundance of some parts per million or less. But during billions of years the earth has acted as a great chemical laboratory. Each major process such as creation of magma, spreading of tectonic plates, mountain building, weathering, erosion, and sedimentation has been accompanied by chemical separations leading to concentration factors of as much as 1000 or more over the earth's average abundance. Because of the complexity of events, a good understanding of how ore deposits formed has been long in coming. Most ore has been discovered by noting surface indications of the presence of an ore body.

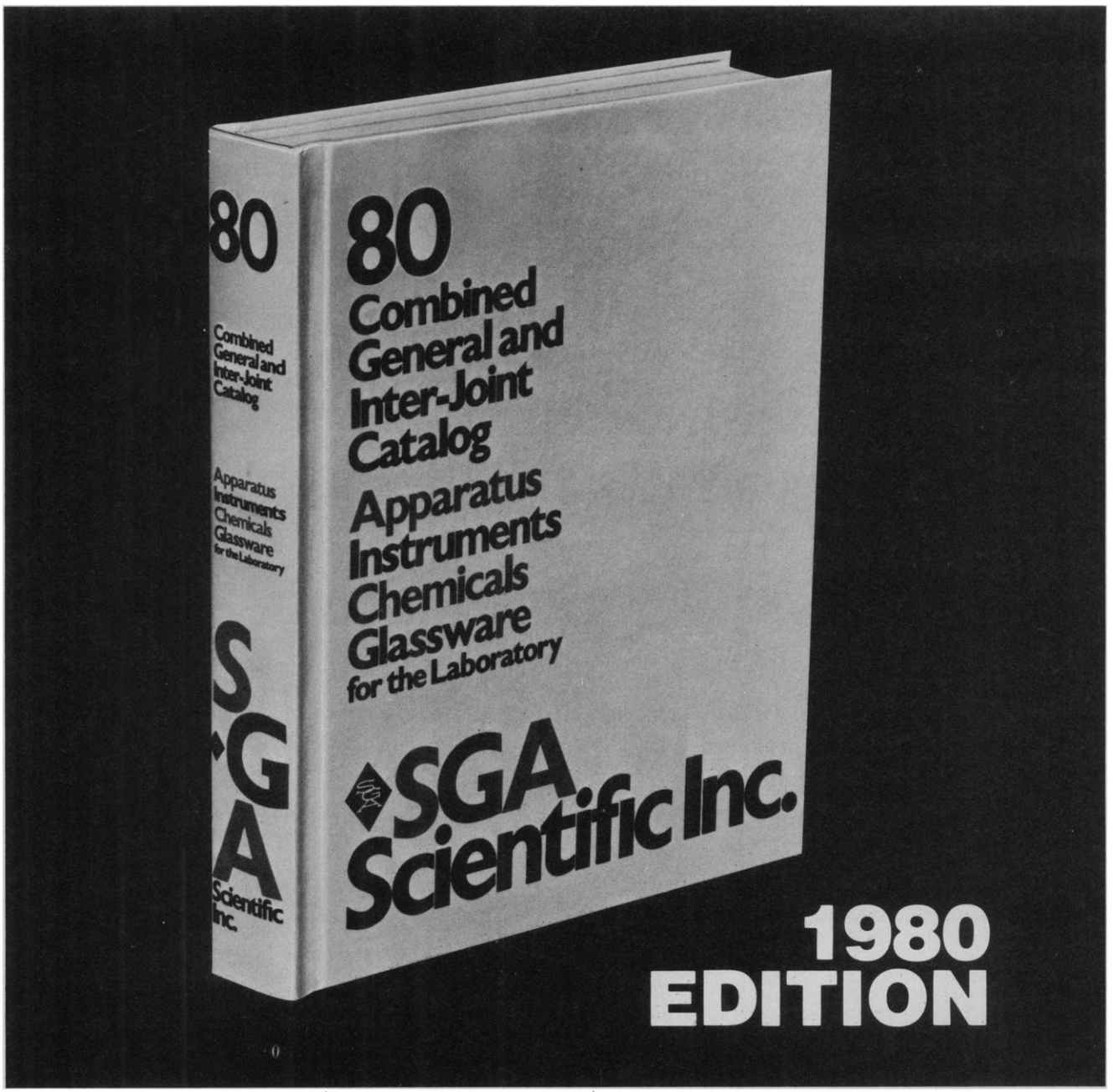
During the symposium two themes were repeatedly mentioned. One was the correlation of type of ore deposit with geological province and the second was the role of geological events. These are not novel ideas but they are proving to be very useful guides in finding and interpreting occurrences of specific kinds of ores. Six metallogenetic provinces in Mexico are recognized that represent different intervals in time and space. For example, in Baja California the rocks are granitic; their age is 93 million years. To the north they have ores containing tungsten, iron, lead, and copper. In the southern half of the peninsula most ore deposits contain gold, silver, and arsenic. An east-west belt of neovolcanic rocks that lie just north of Mexico City has ore deposits that contain lead, zinc, silver, gold, and mercury.

South America has many provinces and major mineral resources. Perhaps the most striking feature is the mineralization associated with the Andes. These mountains were emplaced in a series of events that took place over about 180 million years. Within the Andes different provinces have different ages and different mineral assemblages. In Chile copper is important, while in Bolivia tin is unusually abundant and much silver has been found in Peru. Although most of the vast area of Brazil is comparatively unexplored, great reserves of ores have been discovered by Brazilian and North American geologists in rocks that range in age from earliest Precambrian to Recent. Again, there are striking correlations of composition with age and geological province. Similar comments are applicable to occurrences in Venezuela, Guyana, the Caribbean islands, and Central America.

Attendance at the symposium led to the following observations. (i) Latin American geologists are competent and they are likely to find additional reserves of minerals. (ii) Economic geology is rapidly becoming a science rather than an art. (iii) Through use of tools such as remote sensing, isotope measurements, radiometric dating, and geochemistry, hidden ore bodies of great importance are likely to be discovered. Although the United States may have problems in paying for imports, the prognosis is good that most elements will be adequately available for decades to come.

—PHILIP H. ABELSON

*The symposium was cosponsored by the International Union of Geological Sciences, the Consejo de Recursos Minerales, Mexico, and the Consejo Consultivo de Directores de Servicios Geologicos de Latinoamerica.



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transfer"; G. Hertz, "Application of the linear response theory to transport properties of aqueous acid systems: are the onsager reciprocal relations generally valid?" Round table on methods of and prospects for computer simulation solutions of basic water problems. Introductory remarks: D. Chandler; Animator, M. Klein; A. Rahman, B. Berne, J. Valleau, I. McDonald, P. Barnes Film on M.D. simulation of aqueous systems: K. Wilson.

8 August. Water protein interactions (J. L. Finney, session chairman): H. J. C. Berendson, "Molecular dynamics of water and hydrated proteins."

Water and Solute Exchange in the Microvasculature

Plymouth State College

Aubrey E. Taylor, chairman; H. Granger and T. C. Laurent, co-vice chairmen.

Water and solute exchange in the microvasculature will be presented using an organ approach. Individual sessions will be devoted to lung, intestine, kidney, brain, peripheral, heart, microscopic (mesentery, and so forth), liver and thermo dynamics as applied to capillary transport processes. In each session, "capillary" structure, flow, volume movement and molecular exchange will be discussed. In addition, a poster session will be arranged and all interested participants should contact the conference chairman concerning their suggestion for the poster session, which should greatly enhance attendee participation.

9 June. Lung, (N.C. Staub, discussion leader): Invited discussants: J. Hogg, K. Brigham, R. Olver and M. Gee. Intestine, (J. Barrowman, discussion leader): Invited discussants: J. Casley-Smith, P. Shepherd and D. N. Granger.

10 June. Kidney, (G. Navar, discussion leader): Invited discussants: M. Venkatachalam, H. Rennke and B. Brenner. Brain, (S. Rapoport, discussion leader): Invited speakers: N. Brightman, H. Kontos and J. Fenstermacher.

11 June. Peripheral circulation, (F. Haddy, discussion leader): Invited speakers: S. Wissig, H. Sparks, J. Diana and P. Watson. Heart, (R. Berne, discussion leader): Invited speakers: J. Bassingthwaighte, F. Vargas, J. Johnson.

12 June. Microscopic, (H. Granger, discussion leader): Invited speakers: A. Hargens, R. Curry and J. Bhattacharya. Liver, (C. Goresky, discussion leader): Invited speakers: W. Lautt and G. Laine.

13 June. Mathematical approaches to solute and solvent movement, (E. Bressler and C. Patlak, discussion leaders).