14 JANUARY 1983 · VOL. 219 · NO. 4581

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SCIENCE

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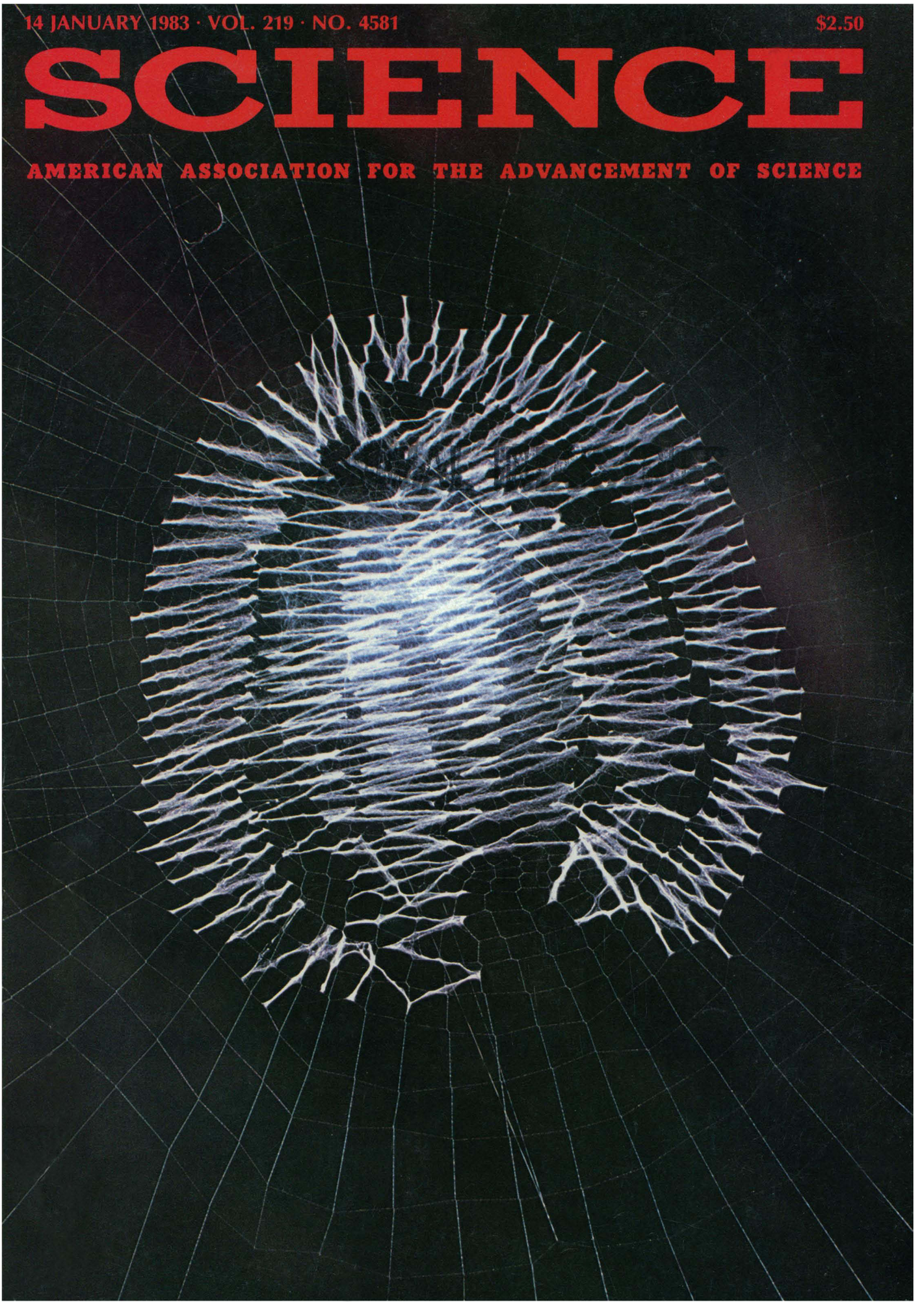

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The Beckman TJ-6 tabletop centrifuge. It tops them all. For details ask your Beckman sales rep, or write: Beckman Instruments, Inc., Spinco Division, P.O. Box 10200, Palo Alto, CA 94304.

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For easier DNA sequencing, you can't beat The Systems.

We've pretested and packaged all of the reagents you'll need to end label and sequence DNA fragments. The Systems will greatly simplify your work and give you more reliable, reproducible results. What's more, they'll eliminate all the telephone ordering you'll have to do, except for one call — to us.

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Volume 219, No. 4581

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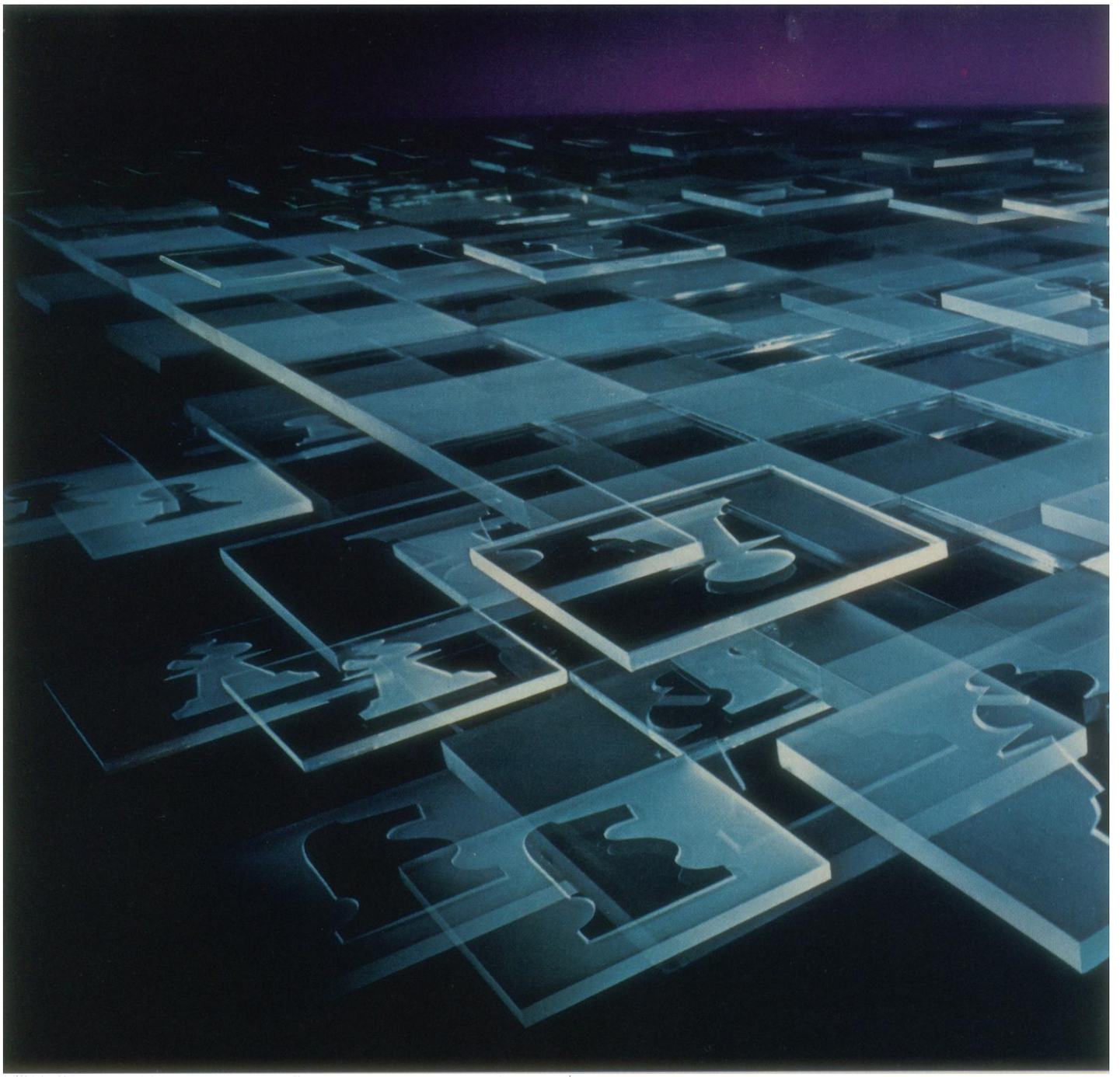
COVER

Spider web "stabilimentum." These silken adornments, commonly found in the hub of diurnal webs, visually warn birds of the presence of webs in their flight path. See page 185. [Thomas Eisner and Stephen Nowicki, Cornell University, Ithaca, New York 14853]

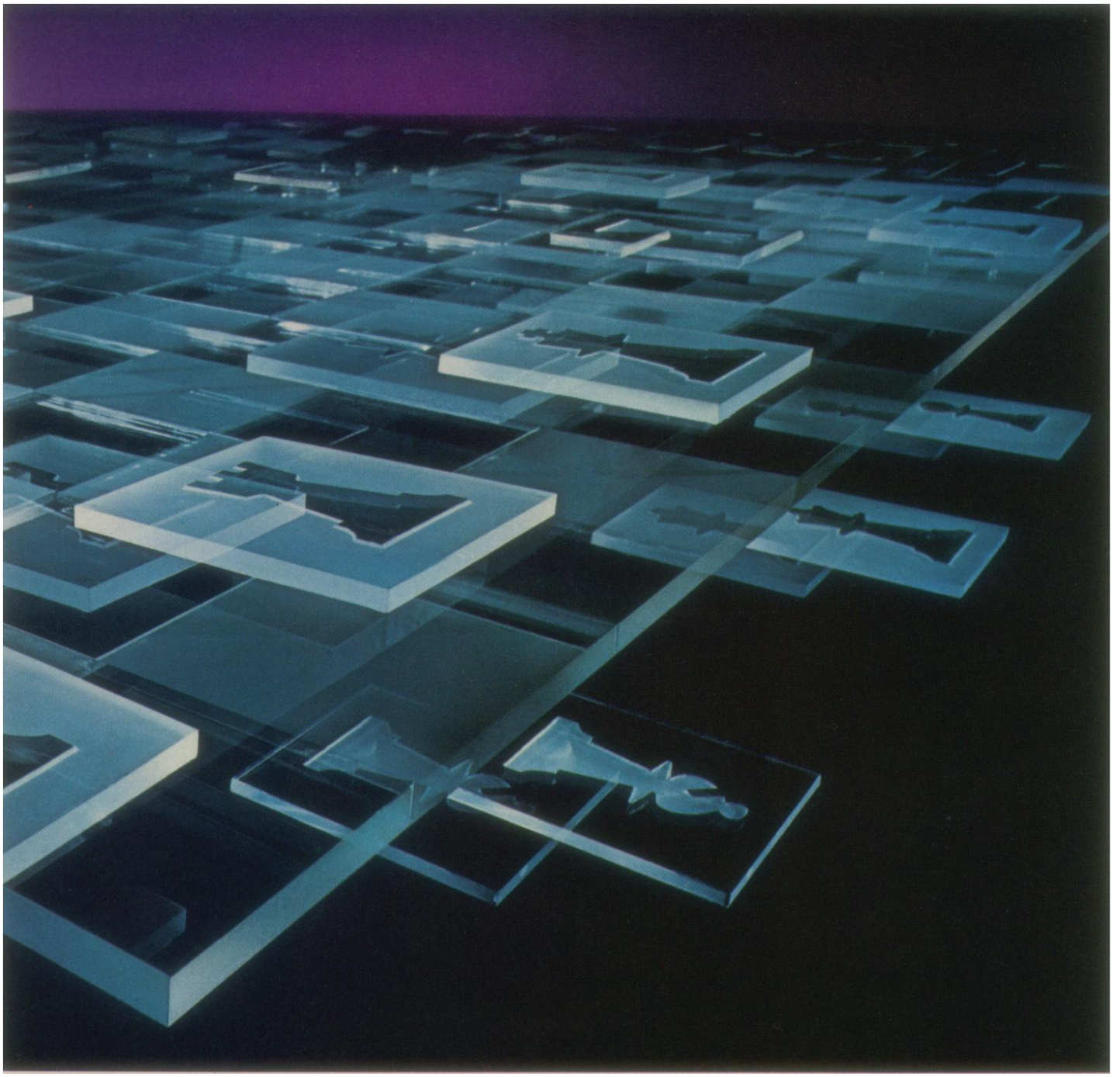


An IBM 4341 super-mini: chip design at Hughes

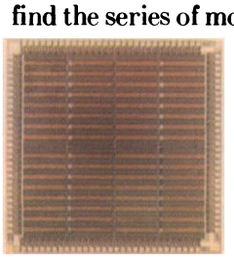
The board's half the size of a thumbnail, with 100,000 pieces. And it's your move.

Finding paths for new interconnections on an integrated circuit is like no chess game you have ever seen. The first few moves are easy, but with up to 100,000 electronic devices crammed onto a minuscule silicon chip, the possibilities soon become astronomical. That's why engineers at Hughes Solid State Products in Newport Beach, California use an IBM 4341 super-mini.

Brian Tien, head of design automation, says, "Without the IBM 4341 we couldn't get this much function on a chip. With it, we can finish a circuit in a few weeks instead of many months."



The engineers work interactively with the system, assigning logical functions to devices on the chip. Then, using software, they route conductors—deposited strips of metal—to connect the logic gates. If a pathway becomes too crowded, another layout is automatically provided. And another. Until they find the series of moves that works.



This Hughes integrated circuit is a high-density gate array with two-level metal interconnections. Actual size is only 0.3 inches square.

They can think about the problem, and not worry about the computer, with microcode-assisted IBM software called VM/CMS. "Our people find VM ideal for interactive computing," Tien says. "As many as 40 design engineers make demanding use of the 4341 at once. Response time is excellent. The full-screen editor speeds up programming. And the executive language is simple, yet powerful."

The 4341 is an excellent example of IBM technological leadership. Internal data paths, and the arithmetic and logic unit, are 64-bits wide, built of 64K-bit chips that IBM has been mass producing since 1978. Real memory goes to 16 megabytes. The multiple, semi-autonomous processing units use high-density, large-scale-integration technology.

IBM offers engineering and scientific users extensive support: consultants, education and access to professionals. Tap into our many years of experience.

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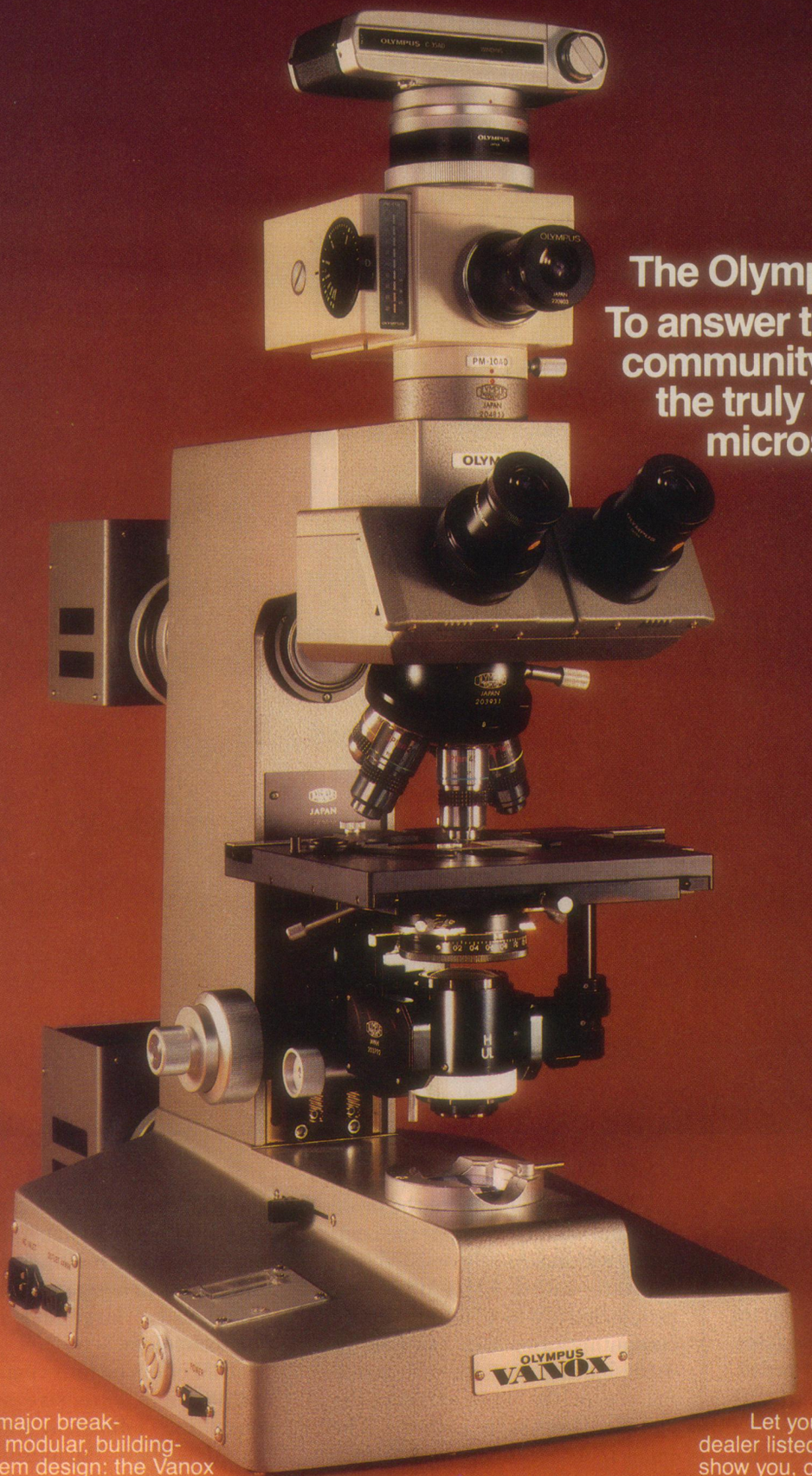

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SCIENCE/SCOPE

High efficiency solar cells now being developed could cut substantially the weight and area of some satellite solar panels. These cells, made with gallium arsenide by a special liquid-phase epitaxial growth process developed by Hughes Aircraft Company scientists, have shown efficiencies higher than 19% in converting sunlight into electricity. This compares with efficiencies between 15% and 16% for the best available silicon solar cells. In addition, the gallium arsenide cells can operate at higher temperatures and can tolerate more high-energy proton irradiation in space than silicon solar cells.

A new wireless entertainment system will use infrared light to carry music and movie soundtracks to passengers on commercial and corporate jet aircraft. The system, under development at Hughes, transmits a digital infrared signal that is received and decoded by a passenger's headset. The signal is completely harmless to people and won't interfere with other aircraft equipment. The infrared system transmits 16 channels. It would weigh less than half of a conventional wired system and would cost a third less. Since there are no wires with this system, it is particularly suited for aircraft with changeable seating.

Communications among Brazil's cities and remote villages will be improved when the first domestic communications satellite system in Latin America goes into operation in 1985. The primary function of the two Brazilian satellites will be to improve telephone and television services. The spacecraft are based on a Hughes model that is the world's most widely purchased commercial communications satellite. Now 27 are under contract. Hughes will serve as major subcontractor to Spar Aerospace of Canada. Embratel, Brazil's government-owned telecommunications company, will buy and operate the satellite system.

Now in its 17th year, Science/Scope remains among the best-read corporate advertising campaigns in history. The campaign was created to explain what Hughes does and how. About 160 different ads are produced each year, with a mix of over 175 paragraphs for use in over 80 publications serving over 60 nations. It is translated into Arabic, Chinese, French, German, Italian, Japanese, Korean, Portuguese, and Spanish -- 10 languages in all, including English. It consistently scores in the top 5% to 10% in readership surveys.

Career growth opportunities exist at all levels at Hughes Support Systems for a variety of engineers qualified by degree or extensive work experience. They include systems engineers, applications engineers, software and hardware design engineers for major simulation and test equipment programs, and automatic test equipment engineers. Also, field engineering posts throughout the U.S. and the world offer travel, autonomy, and responsibility. Call collect (213) 513-5238. Or send your resume to Professional Employment, Dept. SE, Hughes Aircraft Company, P.O. Box 9399, Long Beach, CA 90810-0463. Equal opportunity employer.

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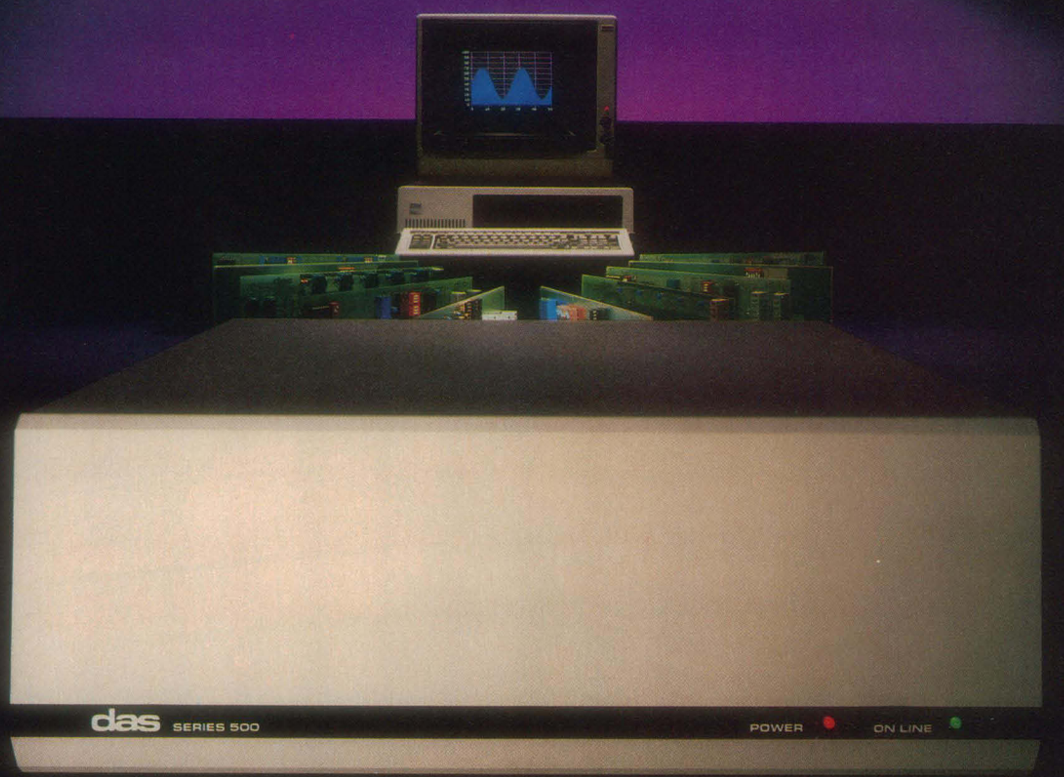

THE DATA ACQUISITION & CONTROL SYSTEM YOU SHOULD CONSIDER OVER A MINI. EVEN IF MONEY IS NO OBJECT.

Let's say you have enough money to buy nearly any data acquisition and control system you might want. What will you choose?

If sheer power is your main requirement, you might choose an expensive minicomputer system. But, then again, you might just as well choose the new DAS Series 500.

Simply plug the Series 500 into any off-the-shelf IBM Personal Computer and you'll have up to 336 channels of analog input, 60 channels of analog output and 192 channels of digital I/O (even AC/DC device control). And with measurement speeds as high as 25,000 analog data points per second, and true 12 or 14 bit precision, you'll have enough power and accuracy for the most demanding applications.

If you need flexibility, you'll want to compare other, more costly systems to the fully modular Series 500. It comes supported by an extensive library of integrated plug-in modules that let you custom tailor almost any combination of inputs and outputs, digital or analog. And do so almost instantly.

So the Series 500 is ideal for hundreds of applications in product test, process control and energy management; in psychology, biology, analytical chemistry and neuroscience.

If ease of use is high on your list, consider this: Only the Series 500 comes equipped with the advanced, integrated Soft500 software package. With it, you can set up, collect, store, control, display and analyze, all with a few simple BASIC commands.

In fact, Soft500 makes programming so easy, you can be up and running with your Series 500 the same day you get it. Even if you're not a computer expert.

Now compare advanced features. Like exclusive foreground/background software architecture that lets you analyze data while you collect it. Like the real-time clock/calendar and precision interval timer. Or the tremendous range of signal conditioning options, including software selected gain and offset, amplification from millivolt levels, and provision for direct connection of thermocouples, strain gauges and RTDs.

These are features you might not get elsewhere, no matter how much money you spend. But then, why spend all that money?

Because for less than $6000 you get both the advanced capabilities of the DAS Series 500, plus an IBM PC* (which incidentally, you can still use to do all the other things a PC does so well).

For complete information on the DAS Series 500 data acquisition and control system, write to us at Data Acquisition Systems, Inc., 349 Congress Street, Boston, Massachusetts 02210. Or call us at 617 423-7691.

das

*IBM PC purchased separately. Also available for the Apple II. IBM PC & Apple II are registered trademarks.

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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.

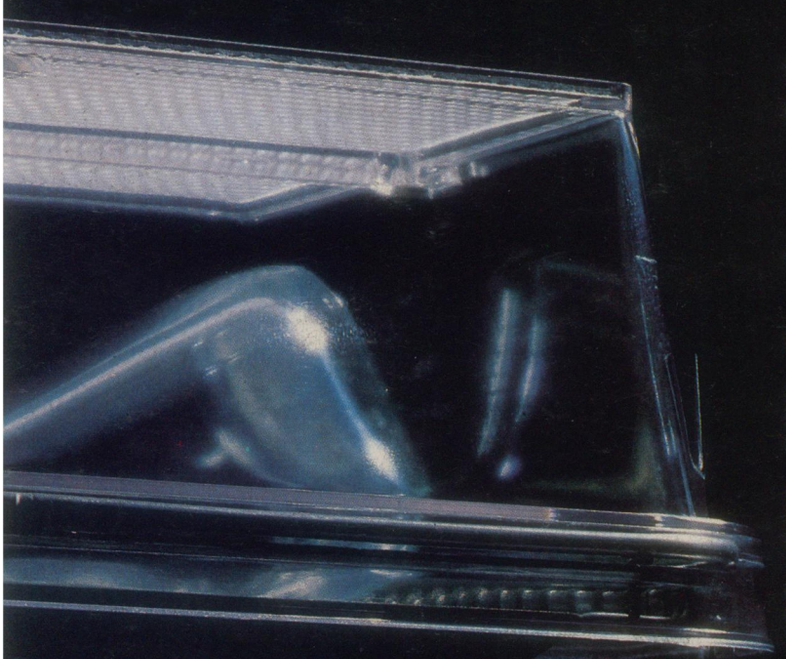
Finally, the colony odor is significantly minimized; allergic responses are substantially reduced through containment of animal dander.

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

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.

Other components and accessories also available:
- 10206—Replacement filter sheet
- 30160—16 oz. glass water bottle
- 30008— # 8 rubber stopper
- 30135—Stainless steel sipper tube

Call Customer Service toll free 1-800-526-0469.

For more information

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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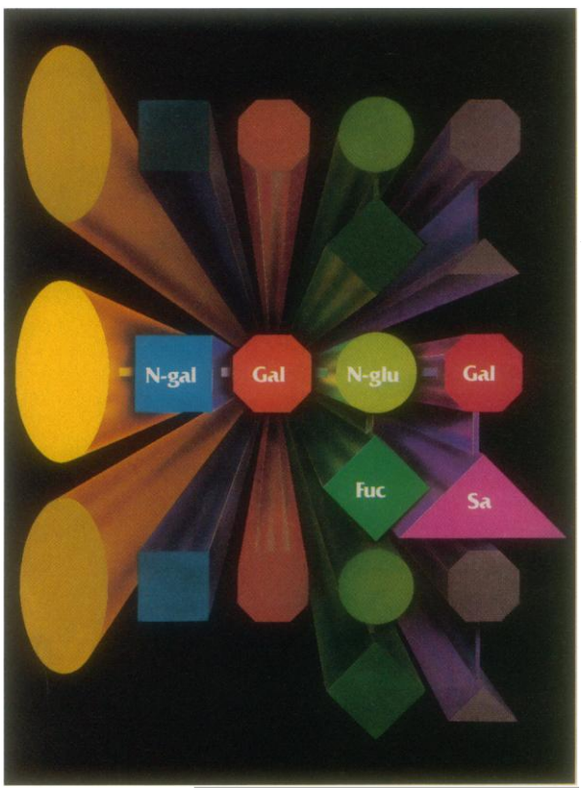

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Announcing

A Special issue of *Science*, 11 February 1983 on Biotechnology

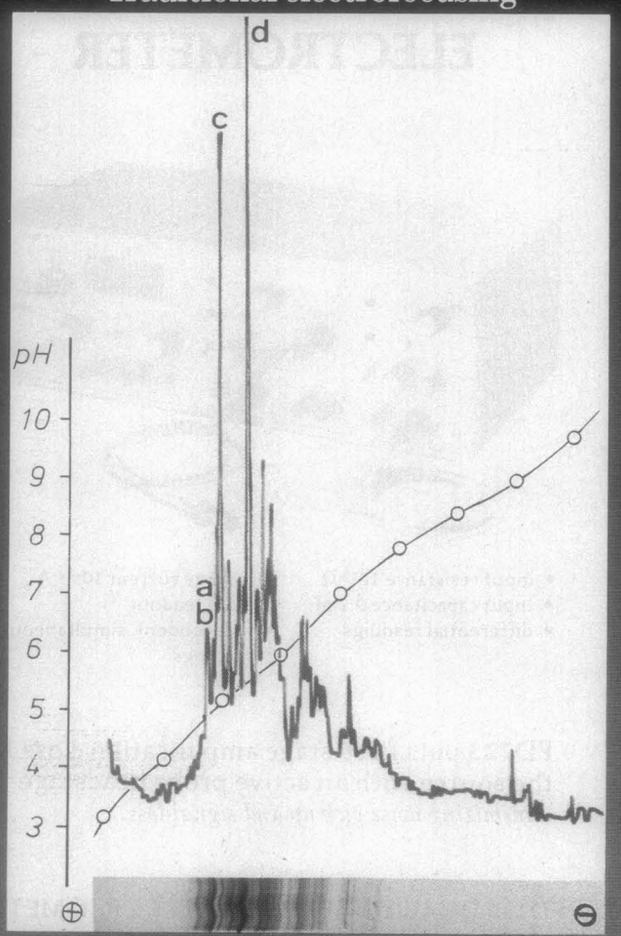
This issue will portray some of the many ways in which biochemistry, biology, and microbiology are being applied in medicine, pharmacology, agriculture, and the production of chemicals.

Contents

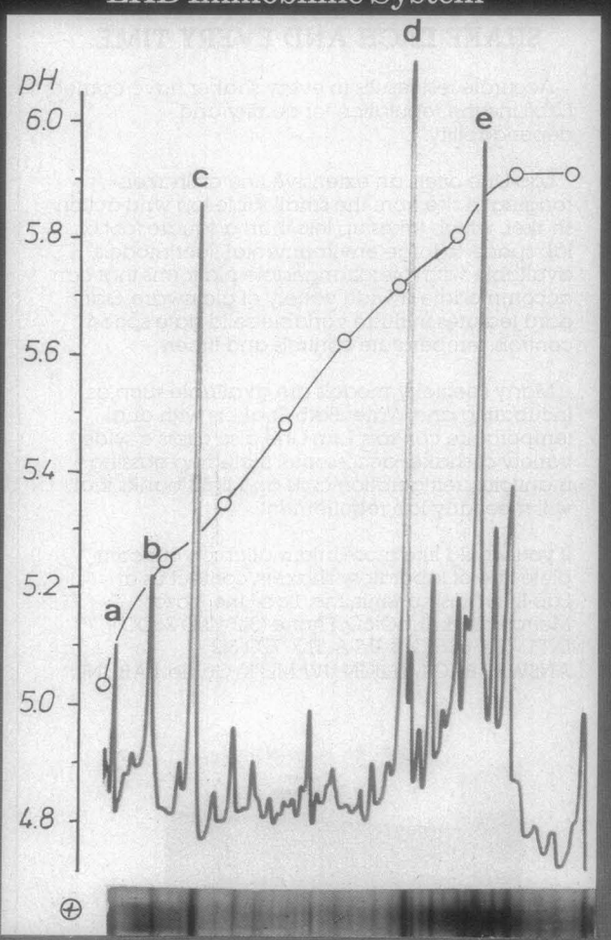
American Association for the Advancement of Science

Explore beyond the electrofocusing resolution barrier with LKB's new Immobiline System!

Traditional electrofocusing



LKB Immobiline System



Courtesy of Dr. A. Görg et al., Technische Universität, München.

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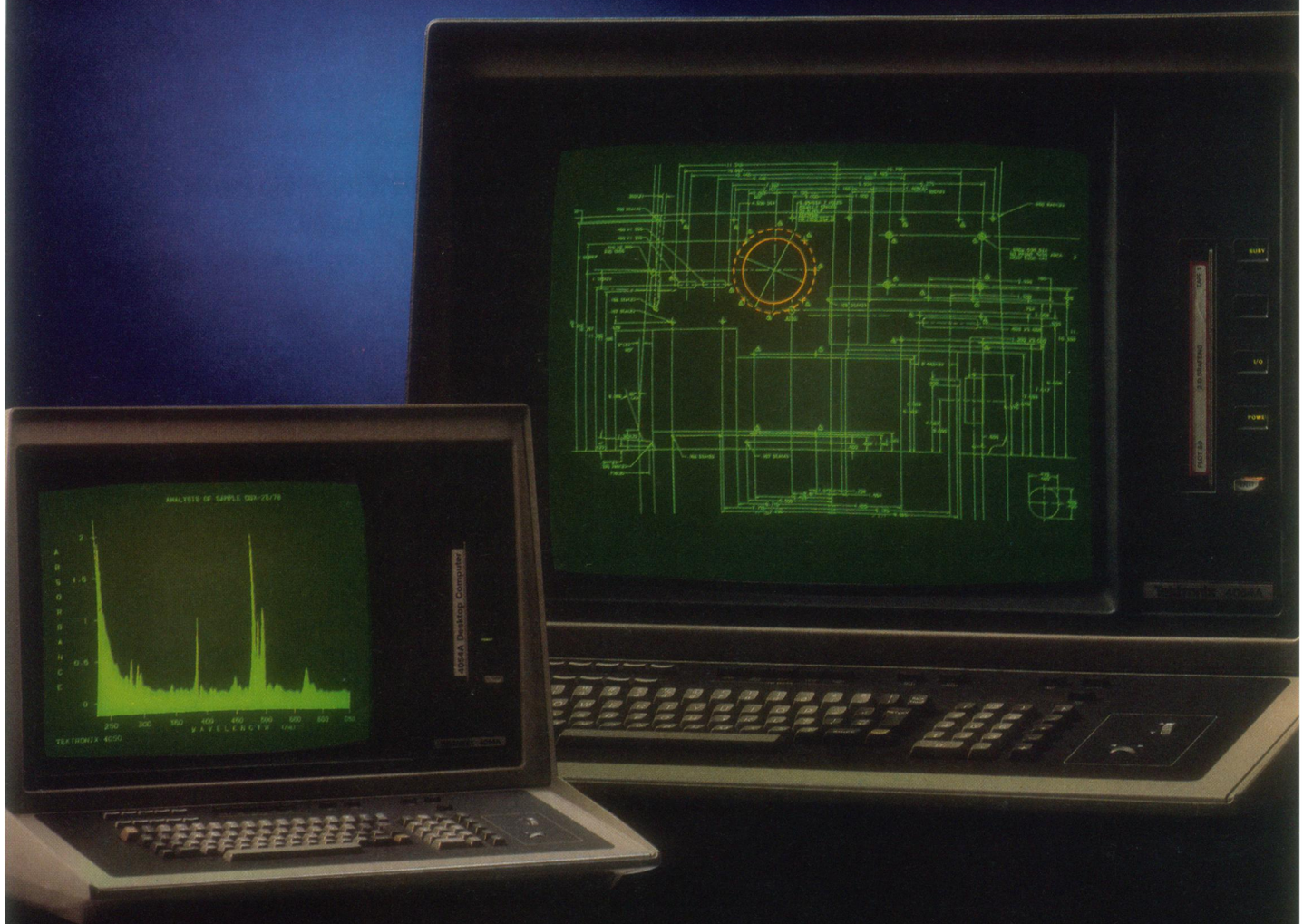

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Regular Registration: $350 (includes Subscription to the Journal, DNA
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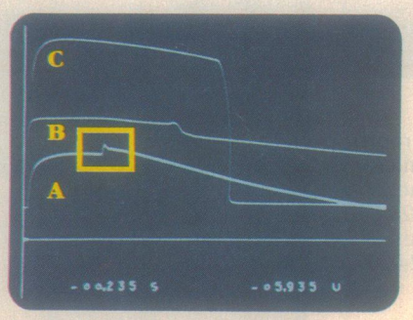

Fig. 1—Tetanic response in avian embryonic muscle after 15 days (A), 17 days (B), and 19 days (C) in ovo.

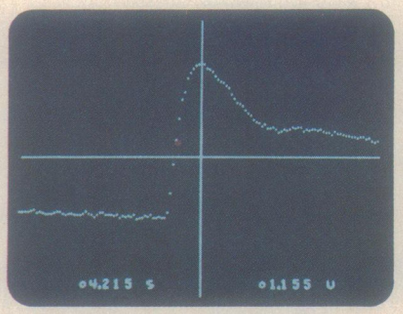

Fig. 2—Expansion of selected area for detailed analysis (up to X 256)

can be viewed live, compared to a reference waveform or stored in both report-ready and computer-compatible formats.

Figure 1 shows tetanic responses from an embryonic chicken muscle after 15, 17 and 19 days in ovo. These responses were captured and stored on a Nicolet digital oscilloscope then recombined on the screen for comparison. The high resolution and expansion capabilities allow detailed examination of small changes as shown in Figure 2. Cursor-interactive coordinate display eliminates the need to estimate amplitude or latency values of a waveform feature. Stored waveforms can be displayed or plotted in XY or YT format, transferred to internal disk memory for permanent storage or output to other computing devices via industry standard interfaces.

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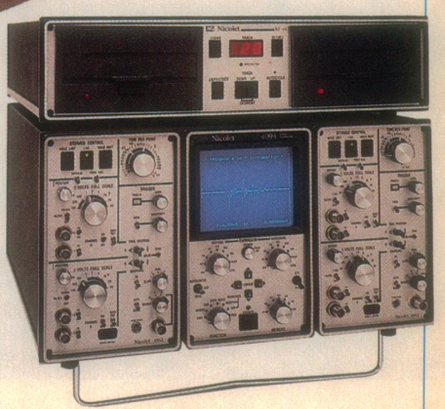

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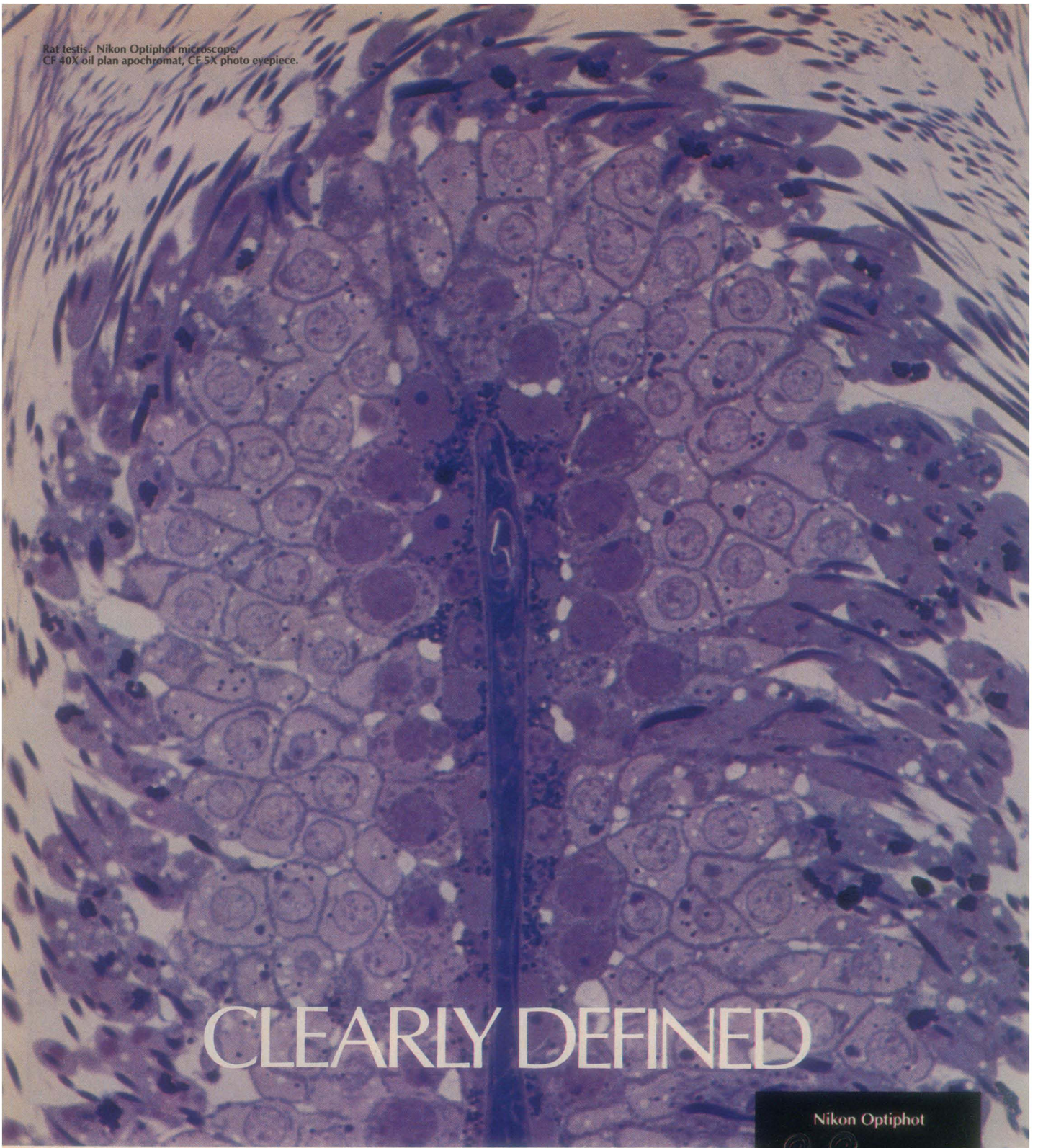

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14 January 1983, Volume 219, Number 4581 **SCIENCE**

Protectionism and the Universities

There are many good reasons for the great current attention to university-industry relations, but there are troublesome reasons as well. One is that universities are now unusually hungry. There is nothing wrong with hunger. But a hungry man may cut corners in his rush to nourishment, and he may be taken advantage of in negotiations. Fear of this is leading to the threat of protectionism, as exemplified by recent attempts to classify or otherwise control access to university research, including that joint with industry.

In designing university-industry connections, protecting interests by high-level negotiations is wrong. The adversary process, and the proliferation of lawyers to manipulate it, was never intended to apply to joint programs, where the output is also joint, where it is by no means a zero-sum game, and where the accomplishments for all participants are far greater if speed and simplicity of negotiations take the place of exquisitely detailed legal contracts. Protectionism is dangerous and habit-forming. Circumstances exist where it is appropriate, but only for a short time. One of the few essentials of agreements is that any secrecy or inteference with open publication or student interaction should be strictly temporary.

The dominant problem of supporting enough basic research in universities will remain. This must continue to be a federal responsibility; no company or industry can harvest the results soon enough to justify any investment larger than keeping a window on basic research and a conduit for the movement of bright young people into the company. Hard work in the universities will lead to important cooperative research agreements with industry, but unremitting effort will be required to maintain or enlarge the basic research on which all else rests.

But there is far more at stake than support for universities. University-industry interaction should not be looked upon as support at all, but as an absolutely necessary part of the survival both of American institutions and of the American economy. As the economy stumbles, protectionism of all kinds becomes rampant, and everyone loses. From the university's standpoint, cooperative projects with industry affect graduate (and even undergraduate) work in healthy ways. To use Harvey Brooks's phrase, giving students "respect for applied problems" is an important part of their education. Wisdom begins when students (and even professors) realize that an invention is not a product and a product is not an industry. What is perhaps most at stake is attracting some of the ablest young people to those fields that can make a difference in the survival of our society. Particle physics ought to be done, just as art galleries ought to be maintained, and the richer the country is the more particle physics and art galleries it should support. But it would be a disaster if protectionism, of either the government or the industry variety, were to discourage some of the best young people from going into applied fields.

Universities are resilient institutions. We are sufficiently strong in depth that we can afford to experiment. If we move too fast or in an inappropriate direction, we can pull back. Our resilience means that we do not have to be so protectionist that we become precious. After all, what we properly call "integrity" the rest of the world calls "selfishness." Incidentally, I prefer Eric Ashby's words "inner logic" to "integrity." We must be careful to preserve our inner logic, certainly, and incidentally our 501(c)3 status (or the similar tax-exempt status of our affiliated foundations). But the public at large is less interested in the precise boundaries between universities and industry or universities and government; after all, the public is paying for *all* of these entities. Above all we should indulge in protectionism of a higher sort: We should protect our willingness and ability to take risks, to experiment, to undertake new directions, and to help a new generation prepare themselves for lives of service.—ROBERT L. SPROULL, *President, University of Rochester, Rochester, New York 14627*

Adapted from an address at the Conference on University-Industry Relations, Madison, Wisconsin, 16 November 1982.

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