SCIENCE
4 December 1970
Vol. 170, No. 3962

# If the Beckman Sequencer is so automatic, why is Dr. Avery here past midnight?

He has *Sequencer Syndrome*—characterized by extreme excitement over what amino acid in his peptide chain will be identified in the next 90 minutes, and the next, and the next.

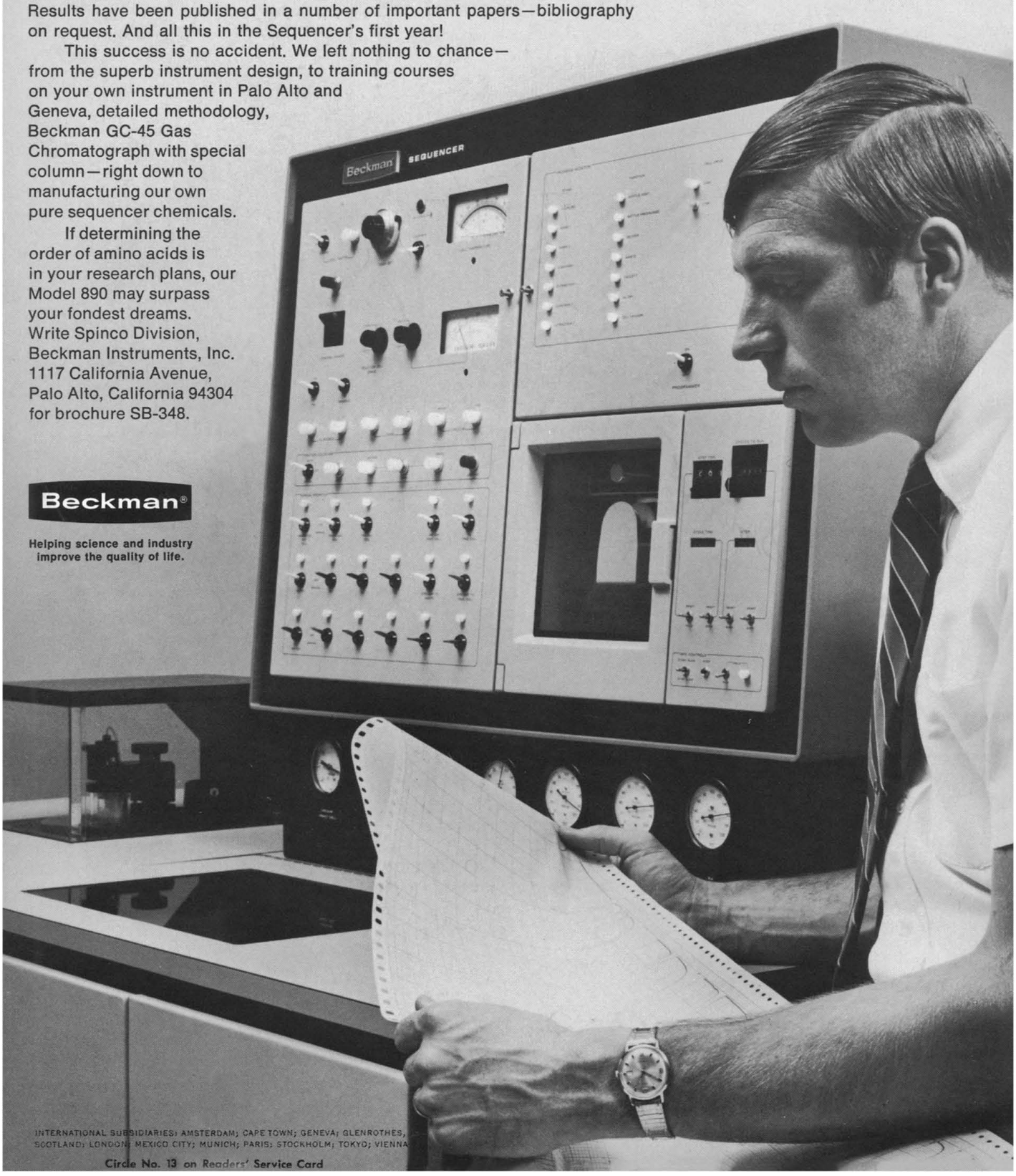
As our dozens of customers can attest, Model 890 Sequencers turn out results from the day we install them. They have been used to sequence a variety of globular proteins, at least one fibrous protein, and fragments as small as a dipeptide. Results have been published in a number of important papers—bibliography on request. And all this in the Sequencer's first year!

This success is no accident. We left nothing to chance—from the superb instrument design, to training courses on your own instrument in Palo Alto and Geneva, detailed methodology, Beckman GC-45 Gas Chromatograph with special column—right down to manufacturing our own pure sequencer chemicals.

If determining the order of amino acids is in your research plans, our Model 890 may surpass your fondest dreams. Write Spinco Division, Beckman Instruments, Inc. 1117 California Avenue, Palo Alto, California 94304 for brochure SB-348.

**Beckman®**

**Helping science and industry improve the quality of life.**

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ANALYTICAL SYSTEMS DIVISION

# high performance analytical instrumentation

## SPECTRONIC® 100

Automated simplicity . . . set wavelength (325-925nm)—automatic system drives grating, interchange phototubes and filters. Four place readout in three modes —000.0% to 100.0%T, 0.000A to 2.000A, 0000 to 2000 in concentration, with selectable positioning of decimal point. Options of single, multiple and micro flow-thru cell compartments—accept test tubes, standard rectangular or cylindrical cells, or micro flow-thru cells. Has 8.0nm optical resolution. BCD output for recording and printout devices—analog or digital. Catalog 33-6031.

## SPECTRONIC® 70

Easy operation—set wavelength, adjust for 100% T or 0.0A with reference, introduce sample and read. Wide, continuous 325-925nm range. All solid-state electronics with latest integrated circuit technology assure high stability, reliability, exceptional precision. Broad sampling flexibility for up-to-50 mm path length cylindrical cells and rectangular cells—semi-micro, short path or constant temperature. Takes a variety of readouts. Catalog 33-6030.

## SPECTRONIC® 20 WITH NEW WIDE METER

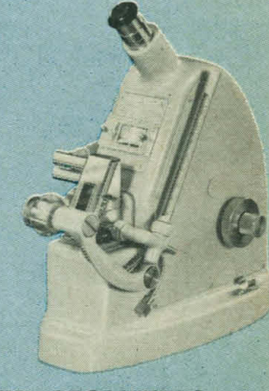
All current transistor regulated models of the world's most widely used spectrophotometer now have a *wide* meter that improves readability. Spectronic 20 offers extremely easy operation, wide 340-950nm range, remarkable stability, low stray light, high sensitivity. Versatility further extended by a variety of accessories including the Concentration Computer for *direct* concentration readings and an easy-to-use stray light and 2nd order Accessory Filter Kit. There are over 80,000 in use all over the world. Catalog 33-266.

## SPECTRONIC® SYSTEM 400

Semi-automated spectrophotometric system combines the Spectronic 100 Spectrophotometer with a data processor-printer, the DP 100. Instant selection of 4 operating modes: manual, semi-automatic, fixed time-rate and variable time-rate. The DP 100 controls the constant temperature micro-flow-thru system, accepts BCD output from the Spectronic 100 and has 8 column printout. Controls include sequential sample identification, accessory input and keyboard for manual data entry. Error-proof with built-in over-and-under range detector. Analyzes up to 400 samples/hour. Catalog 34-6032.

## AC 2-20 ATOMIC ABSORPTION SPECTROPHOTOMETER

The AC 2-20 combines all the best features of up-to-the-minute AA technology. Delivers top sensitivity and accuracy; combines safety, versatility, operator convenience with exceptional performance. The finest monochromator (two 1200 grooves/mm Certified-Precision Gratings) assures superior linear dispersion, eliminates adjacent interference lines. Triple-purpose instrument can be used for UV-visible spectrophotometry, flame emission photometry and AA. Catalog 33-2225.



## REFRACTOMETERS

World's most complete line for precision testing in every index range from $n_D$ 1.20 to $n_D$ 1.71, or percent total solids from 0-85%. Operation is fast, easy and so comfortable there's no fatigue . . . even after all day production use. Abbe 3-L, High Range Abbe 3-L, Precision, Hand, and Juice models. Catalog 33-202.

Analytical Systems, Division, Bausch & Lomb, 9012-06 Linden Avenue, Rochester, New York 14625.

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4 December 1970
Vol. 170, No. 3962

# SCIENCE





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**COVER**

Aerial view of the ruins of the ancient city of Teotihuacán in the Valley of Mexico near Mexico City, showing the ancient city's principal avenue, the "Street of the Dead," and its four principal structures: the Pyramid of the Moon (foreground); the pyramid of the Sun (at center, left); the Ciudadela enclosure (beyond the Pyramid of the Sun, left); and opposite the Ciudadela, the Great Compound (largely unexcavated). The city extended to the foothills in the distance. See page 1077. [Roger Millon, University of Rochester]

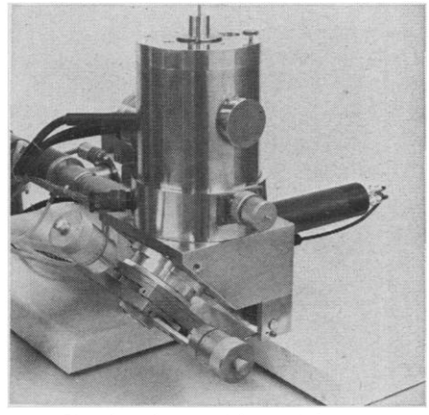
Introducing

# Super SEM

# CWIKSCAN/100: The world's first commercial field emission Scanning Electron Microscope.

The scientific world has been eagerly waiting for a high-resolution electron microscope which is as simple, ready-to-use and universal in application as the optical microscope. Coates and Welter Instrument Corporation has now designed such a microscope. With our CWIKSCAN/100 you can view your specimen at magnifications up to 100,000X directly on TV at 30 frames per second, flicker-free, *and see 200 angstrom detail.* (Optical microscopes are limited to about 10,000 angstroms.)

The CWIKSCAN/100 does this because it uses a field emission electron gun[1], an extremely bright source, developed first at The University of Chicago and The Argonne National Laboratory. This gun can focus an intense electron beam to a spot less than 200 angstroms in diameter. This spot is then scanned over the specimen in TV raster form to produce a bright, sharp image. No additional lenses are required. Microscope alignment and operation are simple and foolproof.



Simple column with special stage.

Anyone can use the CWIKSCAN/100 and get excellent results quickly. It is a great instrument for research, inspection or teaching.

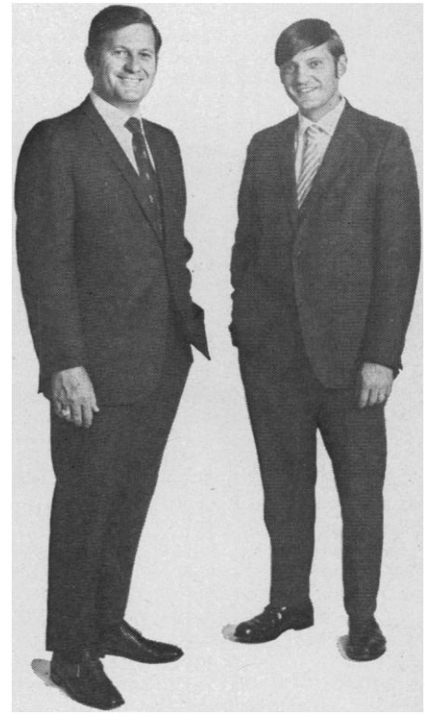
**CWIKSCAN/100's features:**

- Highest performance at lowest cost.
- Immediate television presentation of high resolution and high magnification images at flicker-free rates.
- Easy to operate, compact, foolproof.
- Automatic, ion-pumped vacuum system for clear, contamination-free pictures.
- Modular design for easy add-on attachments.
- Magnification range from 15X to 100,000X with zoom control.
- Large depth-of-focus gives stereo effect.
- Handles a wide range of specimens.
- Pictures can be videotaped for playback or photographed for publication.

The CWIKSCAN/100 is designed to do a better job in all areas of microscopy. It is useful for fracture analysis, cell biology, bacteriology, inspection of sharp needles and blades, failure analysis, micro-circuit inspection, forensic science, surface finish, and air pollutant identification. Wherever the optical microscope has been, the CWIKSCAN/100 can follow.

For more information call or write:
Coates and Welter Instrument Corporation, 2191 Ronald Street, Santa Clara, California 95050. Telephone (408) 296-3362

CWIC



# Coates & Welter: the new breed of American Instrument Makers.

(1) **Electron Gun Using a Field Emission Source.**
A. V. Crewe, D. N. Eggenberger, J. Wall, L. M. Welter
Rev. Sci. Inst., **39**, 579 (1968).

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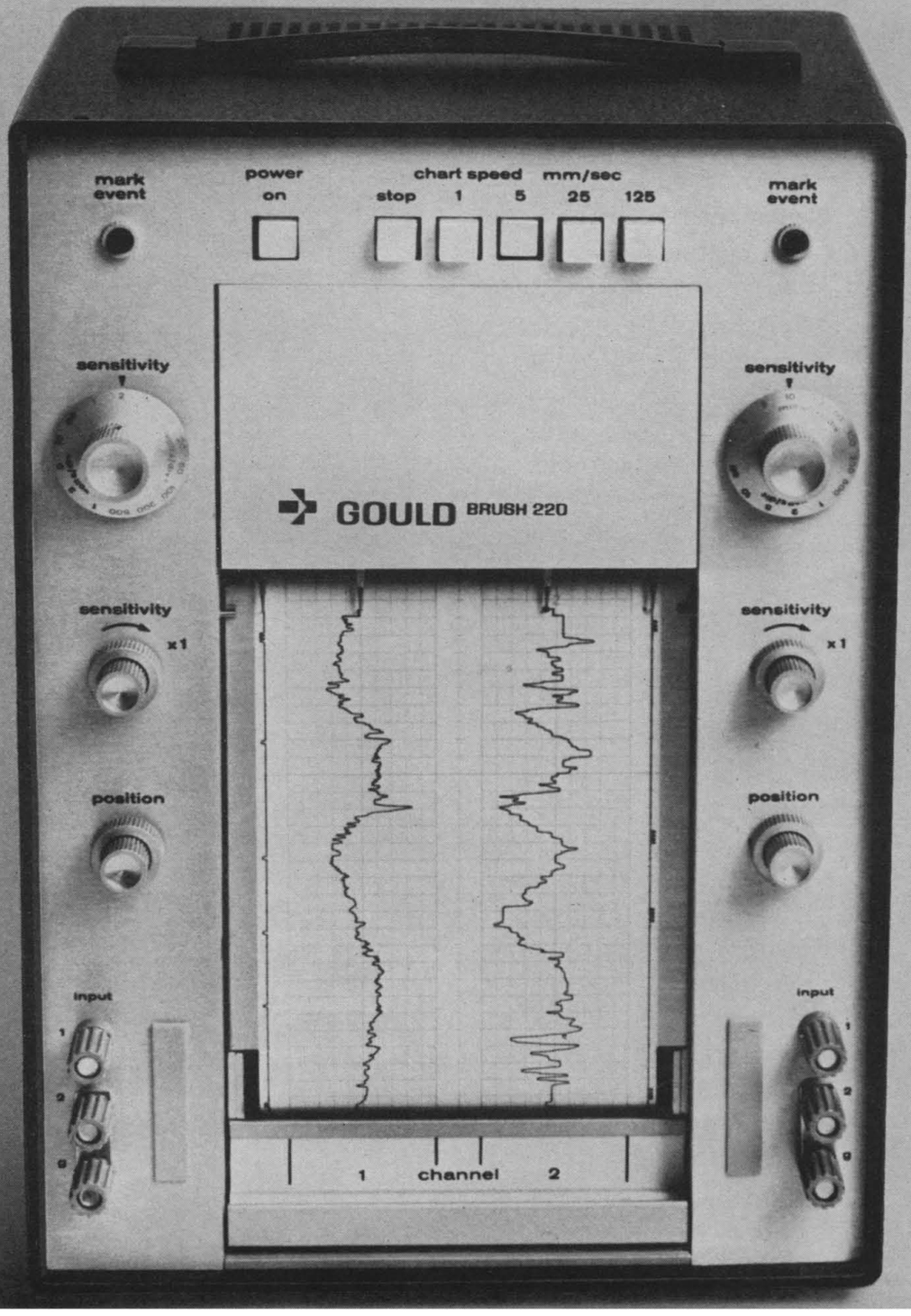
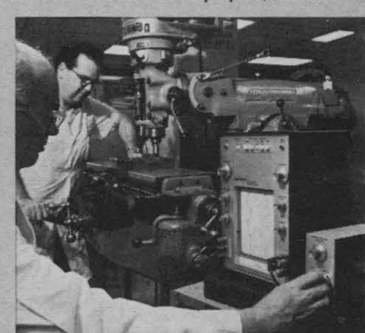
# This portable will record more facts in less time, at less cost than any other 2-channel recorder on the market.




We call it the Brush 220.

And once we put it through its paces for you, you'll call it the most amazing piece of recording gear around.

To begin with, we *guarantee* 99½% linearity. Which is a good deal better than almost anything else on the market . . . regardless of size or price. The pressurized ink-writing system is the same one you'll find in our six and eight channel systems. Instead of laying the trace *on* the paper, it forces



it *in*. Run your finger over it. There's no smear, no smudge. And trace crispness and uniformity is in a class by itself.

Built-in preamplifiers give you measurement range from 1 mV per division to 500 full scale—and you never have to re-calibrate. Pushbutton controlled chart speeds. Two handy event markers. Ink supply is a disposable cartridge, good for a year.

Yes, for a 25 pound portable that's no bigger than a breadbox, the Brush 220 is quite a recorder. Ask your Brush representative for a demonstration. Or, write for complete details. Brush Division, Gould Inc., 3631 Perkins Avenue, Cleveland, Ohio 44114.

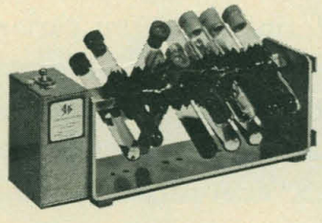
GOULD BRUSH

# What's amphibious, thinks for itself, rocks and rolls tubes, and won't scare a goldfish?

## *(The L/I LABQUAKE®, of course)*

The L/I LABQUAKE is an amazing creature. A true amphibian, it functions equally well in or out of the water. Rock and roll your tubes at room temperature, or submersed in any water bath at depressed or elevated temperatures. A bracket mounting keeps the motor safely out of the water.

The LABQUAKE *thinks* about what it's doing—so you don't have to watch over it. For instance, the LABQUAKE has the magical ability to reverse direction without being told. If it can't go one way, it will go another, and it can't be overloaded.



Although the LABQUAKE's motor speed is constant, you can adjust its rocking rate anywhere from 30 to 162 reversals per minute by turning the control lever. It handles any size tube from ¼ to 1½" in diameter. It rocks tubes of any length but rotates tubes 4½" or shorter. Tube clips can be changed or rearranged in seconds to accommodate different sized tubes.

Applications? They include mixing blood without cell damage • dialysis under agitation • preparing homogeneous dispersions of particulates • agitating tissue and bacterial growth at controlled temperature • antigen-antibody reactions, and all at ambient or controlled temperature.

Ordering information: L/I LABQUAKE, Cat. #400-110, for 110-120 VAC, complete with (14) 13 mm and (14) 16 mm clips, $59.50. Other size clips may be substituted at no charge. Max. capacity 250 ml. *Order from Labindustries or your distributor.*

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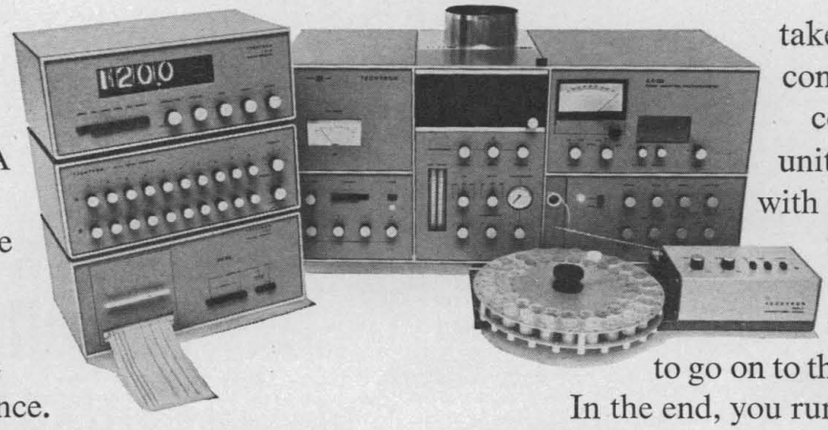
# The under-$10,000 automated AA system.

## It even whistles.




Like most automated atomic absorption systems, our AA-120A promises a lot.

*Unlike* the others, it delivers.

Take our automated sample changer, for instance. It's the only one designed and built by an AA company, so it does a lot more than a converted fraction collector ever could. It holds either 50 test tubes or 50 disposable plastic vials. It resets the baseline automatically between samples. And has three separate time delays built in. One sets the length of each reading and is variable. Another introduces a delay between the time sampling starts and the time the digital indicator is triggered to take a reading. And the third tells the instrument how long to wait between samples.

Our automated sample changer also turns itself off automatically. And whistles when it's done.

Then there's our digital printer with signal averaging capability. It saves you from having to mess with an unwieldy long strip chart. It automatically takes the data, converts it to concentration units, prints it out with the sample number and then signals the changer to go on to the next sample.

In the end, you run more samples, better. And save money to boot.

Finally, there's the AA-120 itself. The finest medium priced AA flame emission spectrophotometer ever to excite an atom. Designed with internal modularity, the AA-120 is very compact, extremely versatile and refreshingly easy to operate and install.

The Varian Techtron AA-120A. A complete, hard-working, automated AA lab assistant for under $10,000.

For complete, easy-to-get information, write Varian Techtron, Walnut Creek, California 94598; NEVA, Azabudai Bldg., Tokyo, Japan; Malton, Ontario, Canada; Crows Nest, N.S.W., Australia; or Zug, Switzerland.

**varian techtron**

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*SERIES 7620 GAS CHROMATOGRAPHS*

# Cryogenic Chromatography Easy and Effective

With the 7620 GC's cryogenic module, sub-ambient oven temperature control is as easy and effective as high-temperature control has been for years.

It's easy because the cryogenic module controls oven temperature continuously down to −70°C and holds it within 0.1°C, for isothermal or programmed operation. It's synchronized with programmer operation: a blinking light tells you when the oven has cooled to the starting temperature, whether cryogenic or near ambient. It operates either with economical liquid $CO_2$ down to −70°C or with compressed air in the trans-ambient range. And it's a standard option: you can order it installed on a new 7620 or install it yourself later, with relative ease, without modification to the programmer.

The most important characteristic of the 7620's cryogenic module is its effectiveness. As evidence, we show the chromatogram of a complete separation of Argon from Oxygen in a sample of air, performed in 8 minutes on a 6-foot column (Molecular Sieve 5A) in a 7620 oven operated isothermally at −30°C. Any GC that can do this is clearly performing well in the sub-ambient region.

Still more evidence of the 7620's precision at sub-ambient temperatures is presented in Bulletin 7620, yours on request. Prices start at $5150 for a dual TC detector instrument; the cryogenic option adds $350. Hewlett-Packard, Route 41, Avondale, Pa. 19311. In Europe: 1217 Meyrin-Geneva, Switzerland.

HEWLETT hp PACKARD

ANALYTICAL INSTRUMENTS

43004

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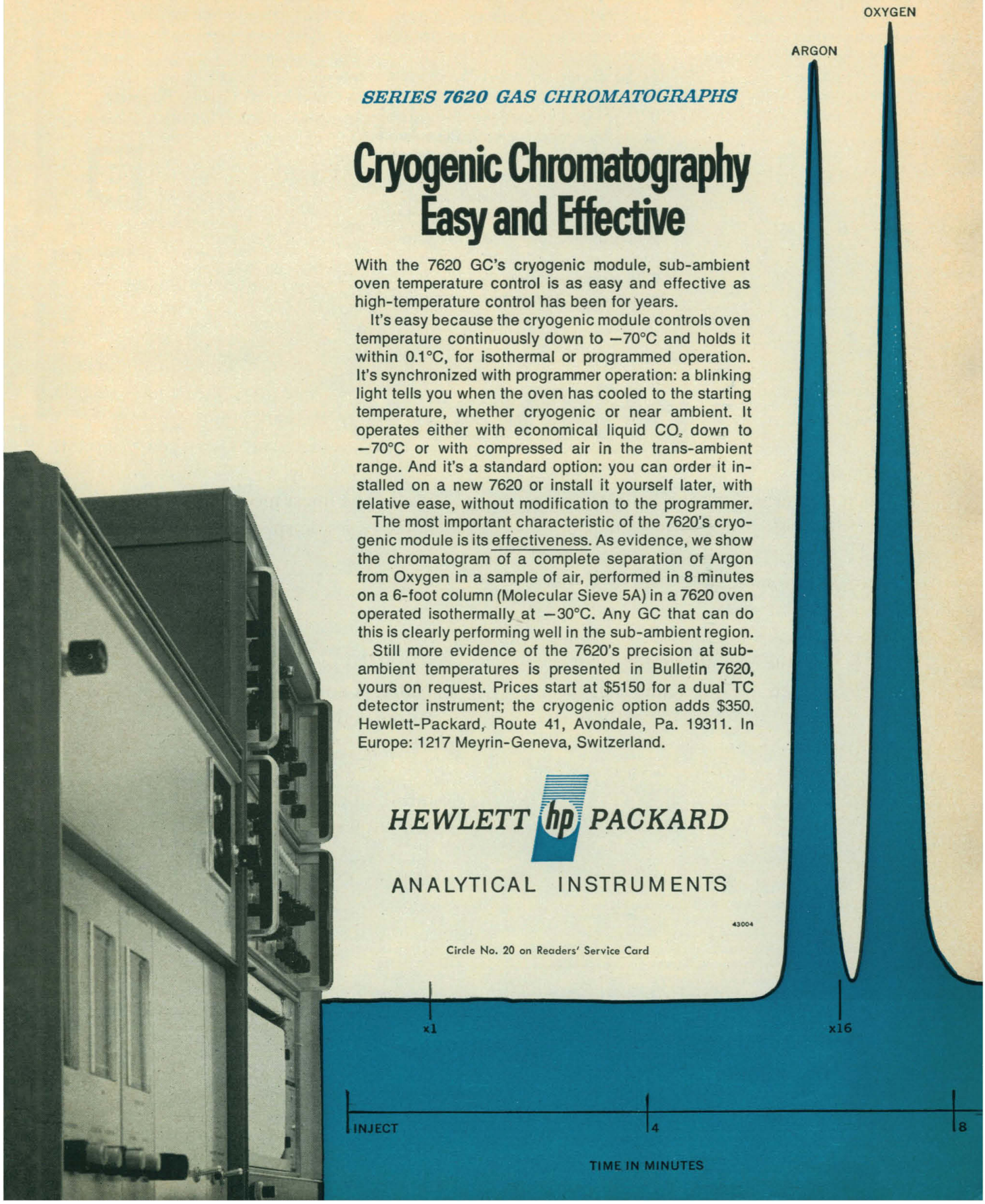


This sleek, sophisticated new instrument is a phenomenal value. It's the Brinkmann/Metrohm pH-102... the first—and only—digital pH meter in its price range that offers 0.001 pH/0.1 mV sensitivity throughout the full span of 0 to 14 pH and −1.399 to + 1.399 mV.

The price is just $850, complete... and we mean complete—because the price includes shock-resistant combination electrode and stainless steel rod with mounting hardware, buffer solution and KCl.

At $650, model pH-101, delivers the same outstanding features with 0.01 pH and 1.0 mV sensitivity. The luxury look and luxury features are standard equipment in both models:

- Stable, all solid-state circuitry with built-in BCD and recorder output.
- Large, easy-to-use controls for temperature compensation, function, range and slope integration.
- All-digital readout.
- Automatic temperature control

For high precision pH metering, these features, and more, make the Brinkmann/Metrohm pH-101 and pH-102 unique in their field.

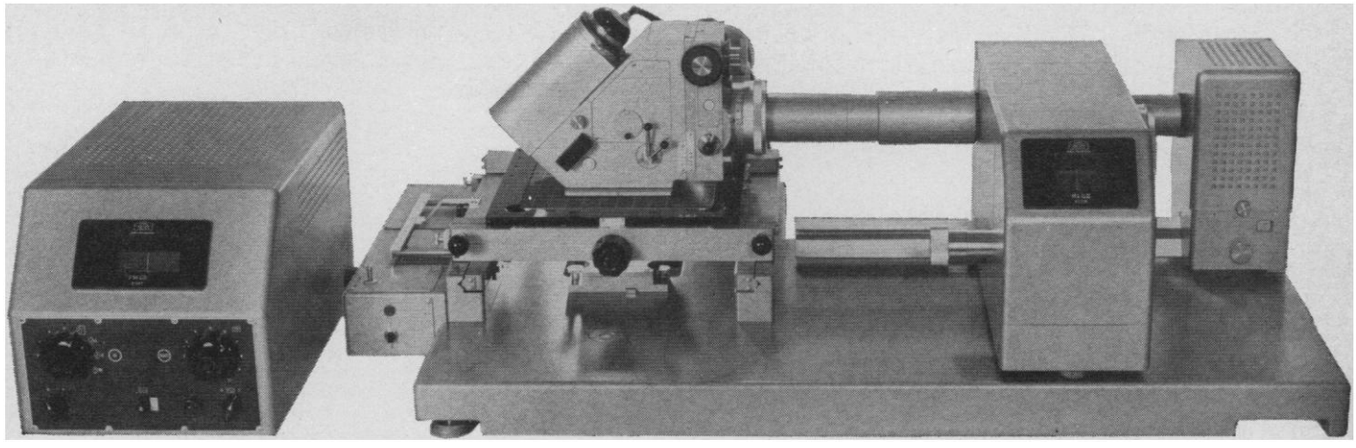
For all the facts, please write: Brinkmann Instruments, Cantiague Road, Westbury, N.Y. 11590.

In Canada: 50 Galaxy Boulevard, Rexdale (Toronto), Ontario.

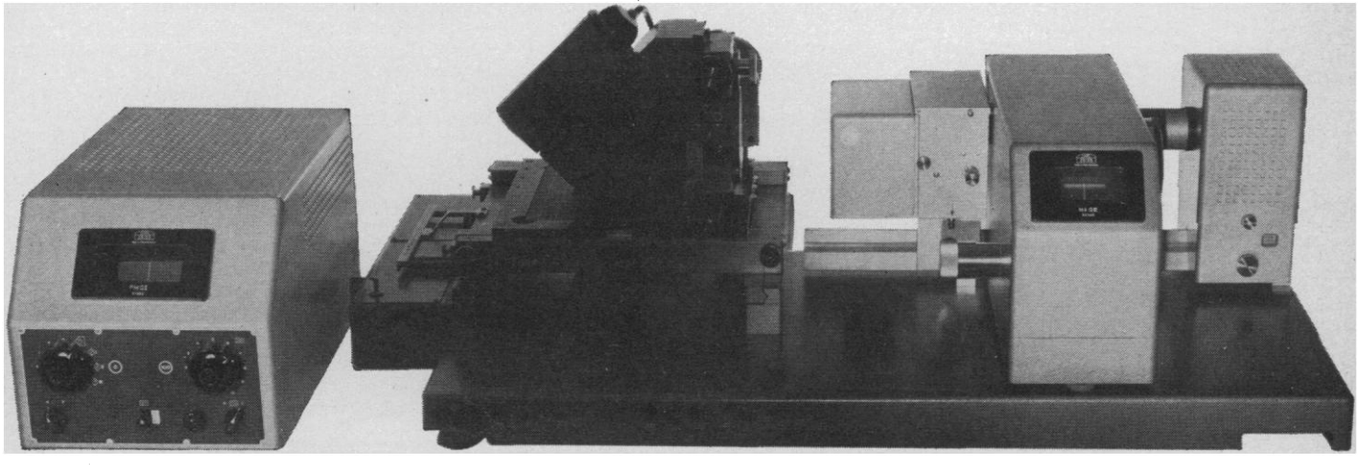
BRINKMANN

# pHantastic

# When money is tight—



**look for the extra value you get from the Zeiss Chromatogram Spectrophotometer for TLC...**



**...it can be converted easily to the universal PMQ II Spectrophotometer by the addition of units costing only $726. 2 instruments for just a little more than the price of 1.**

Just because funds are hard to come by is no reason not to have the best. And the Zeiss TLC Spectrophotometer *is* the best. It offers accuracy and sensitivity significantly better than you can find elsewhere. A demonstration will prove it, and we'll be glad to arrange one for you. But right now we'd like to emphasize its versatility—the versatility that gives it extra value in these cost-conscious times.

First, over a wavelength range of 200-2500 nm, this spectrophotometer measures chromatographic separations by transmission, reflectance or fluorescence. And not only can it accommodate larger TLC plates than any other instrument, but also paper chromatograms, electrophoresis strips and film negatives. Provision is also made to measure gel discs and slabs, and to attach the recorder of your choice.

Moreover, because it operates by direct examination in the UV range, it eliminates the need for staining. Resolution is infinitely high. And you have a choice of continuously variable round and rectangular apertures.

But that only begins the story of its versatility. Chapter 2 starts with our picture caption—please read it. With that slight extra investment, you'll reward yourself with the world's most reliable and accurate universal spectrophotometer, and have two great instruments for little more than the price of one. The arithmetic is simple, and it all adds up in your favor.

For complete data, or to arrange a demonstration, write Carl Zeiss, Inc., 444 Fifth Avenue, New York, N.Y. 10018.

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# The new IL 353[1]

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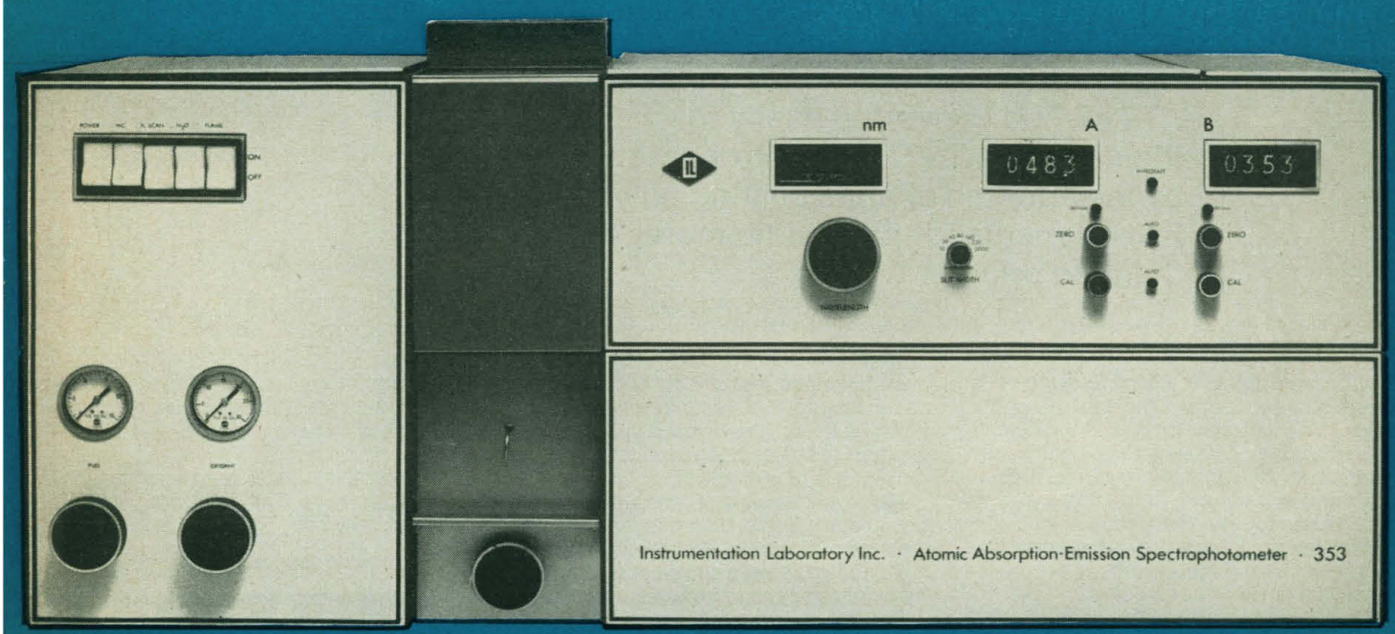
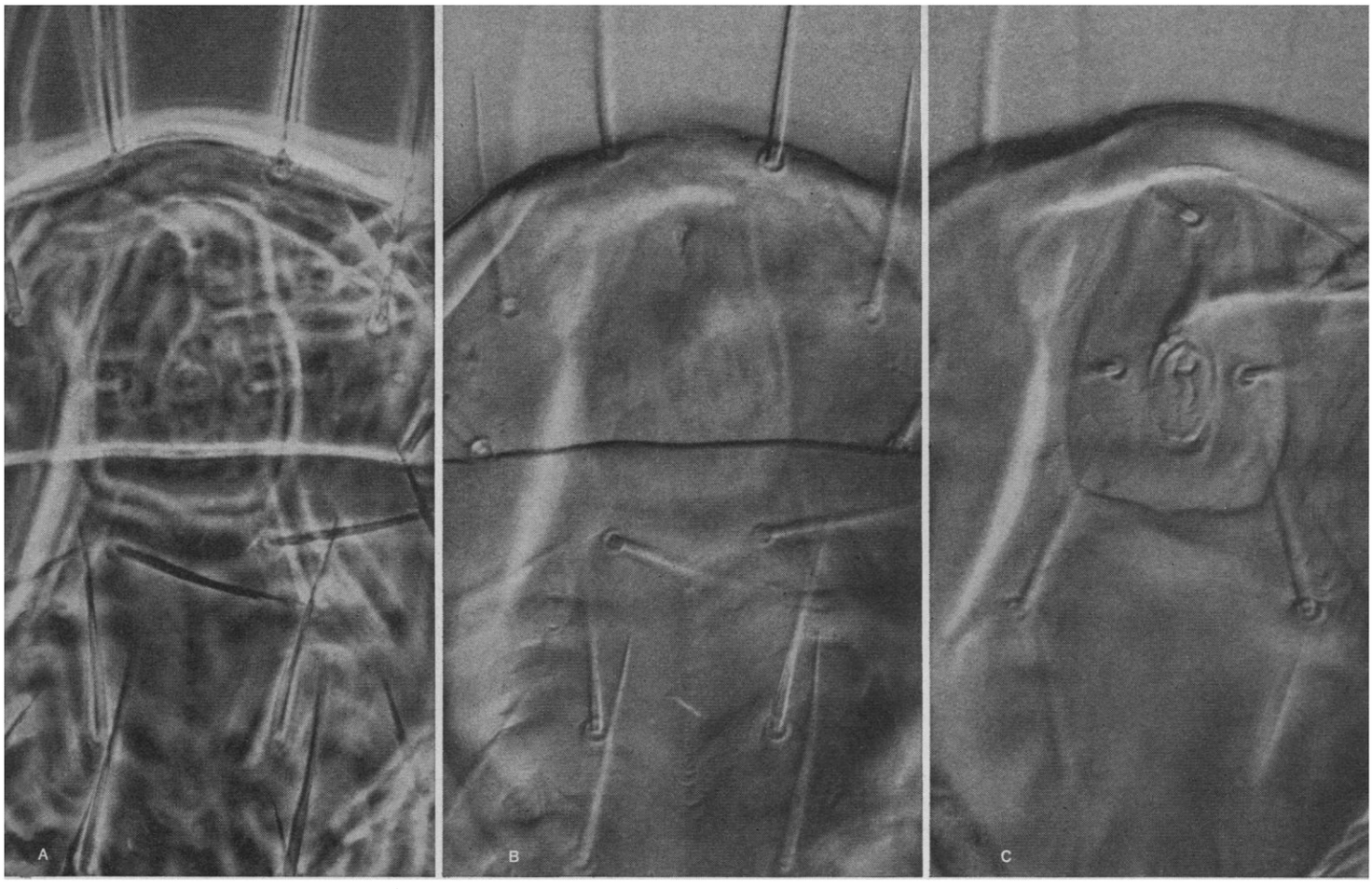



[1] A dual, double beam atomic absorption/emission spectrophotometer representing the best engineered instrument to be offered for use in the laboratory. Innovative features, well proven and often imitated, make it the standard of comparison. For complete details, send today for the new 353 brochure.

**Instrumentation Laboratory Inc. / 113 Hartwell Avenue / Lexington, Massachusetts 02173**




Ornithonyssus bacoti, taken with Zeiss Photomicroscope II, total magnification 1000X, no preparation. (A) Transmitted Phase Contrast; (B&C) Nomarski Interference Contrast in two different focal planes. Notice the 3-dimensional effect.

# How to make an optical slice of life.

You do it with Nomarski differential interference microscopy, a versatile phase- and amplitude-contrast system which vastly improves images both of unstained living cells and fixed and stained preparations of cells or tissues.

Like the phase-contrast and image-duplication interference microscopes, the Nomarski system generates contrast optically by interference of light waves traversing slightly different optical paths. What sets the Nomarski system apart is that differential interference produces an "optically shadow-cast" image relatively free from disturbance from out-of-focus details. Because contrast is developed only in a very thin depth of field (as little as 0.2 $\mu$m), it is possible to make "optical sections" for detailed non-destructive analysis of living material.

Easy to set up and easy to operate, Zeiss Nomarski equipment gives you a high-aperture, low-glare instrument capable of utilizing the full theoretical resolving power of the outstanding Zeiss Planachromat lenses. There is no other system like it.

Those who study stained material will find the amplitude-contrast feature of the Nomarski system very useful for bringing out weakly stained, minute details with improved resolution.

The world's best Nomarski interference equipment is available from Zeiss for Standard RA, WL and Universal Microscopes and for the camera microscopes, Photomicroscope II and Ultraphot. For complete details on Nomarski interference microscopy and equipment write Carl Zeiss, Inc., 444 Fifth Avenue, New York, N.Y. 10018.

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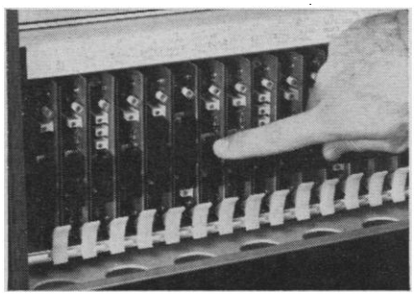
80,002

**For teaching some things, an analog computer is a natural.** Such as describing non-linear behavior in dynamic physical systems. We just made it more natural with MINIAC$^{T.M.}$, our new educational analog computer.

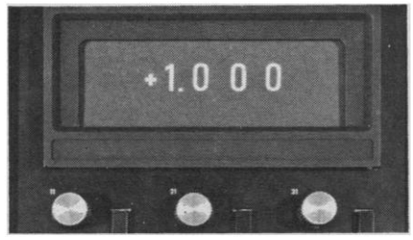
To begin with, you get handsome design . . . and controls that make small-scale analog programming easy. No component patching required . . . you select a mathematical function . . . you push a button, and you're in business. You get twelve selections — convert a summer to an integrator . . . or a multiplier to a divider . . . or a summer to track-store, or vice versa. All instantly selectable with a push-button switch.

It's desktop size. It offers operating convenience you expect to find in bigger, more expensive machines.



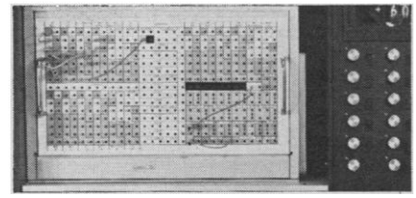
Many of the ideas come from the 2000 science and engineering educators who use our computers.

Digital readout and a dual select system allows you to control the monitoring of any two variables simultaneously. Without re-programming.

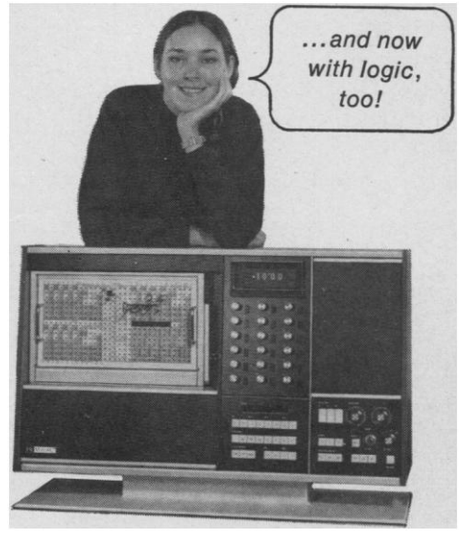



Overload features reduce troubleshooting time. An overload alarm with indicator lights, for one. A logic HOLD control which can be programmed to freeze all integrators for easy location of overload. And overload store for transient overloads without stopping the program solution.

You get smaller, removable program panels, labeled with universal math programming symbols. Inputs and outputs are color-coded. This allows fast, easy, programming. Logic expansion module, too. There is more to our new computer than we can show here. For more information, we have a new brochure. Yours for the asking.



Write or call Electronic Associates, Inc., 185 Monmouth Parkway, W. Long Branch, New Jersey 07764. Phone: 201-229-1100; in U.K.: Victoria Road, Burgess Hill, Sussex; in Europe: 116 rue des Palais, Brussels; in Canada: 6427 Northam Drive, Malton, Ontario.

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**Today. It's still Jeolco accomplishments vs. competition's good intentions.** ☐ Everyone knows a full range of accessories makes a good scanning electron microscope an even more valuable investment. ☐ Provided the accessories are really available. ☐ Jeolco's are. ☐ Take our JSM-U3. As you read this ad, 37% of all U3 owners have added our energy dispersive x-ray analyzers. 75% are using our TV scan. 10% are now heating specimens under test to 450° or 1100°C. 10% can apply stress to 10 kg or 200 kg. 25% are using a transmitted electron detector. ☐ And all enjoy the extraordinary reliability, 100 angstrom guaranteed resolution, universal goniometer stage, state-of-the-art 2 lens optical system, and automatic vacuum control that are proven U3 features. ☐ To find out more about the ways Jeolco accessories make your investment more productive, visit one of our demonstration centers and give the JSM-U3 a good workout yourself. Or just watch one of the TV tapes we've prepared on our dynamic accessories. ☐ Either way, you'll discover there's more to Jeolco than promises, promises. ☐ Jeolco delivers. ☐ Jeolco (U.S.A.) Inc., 477 Riverside Ave., Medford, Mass. 02155, Tel. (617) 396-6021.

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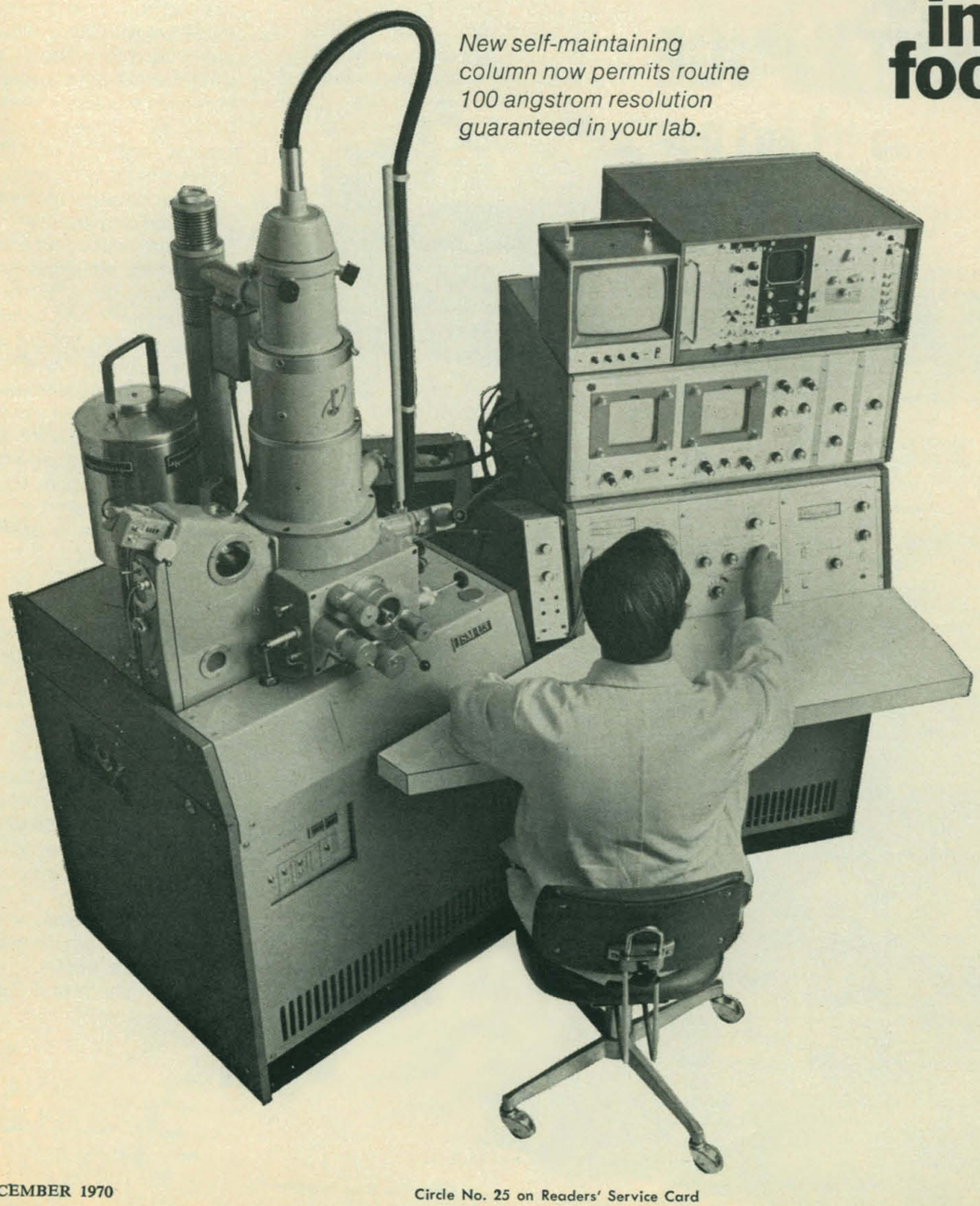

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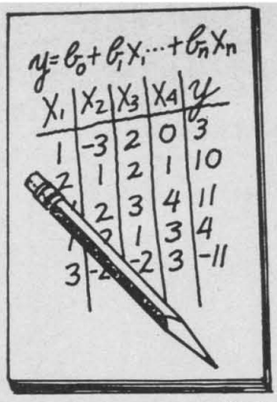


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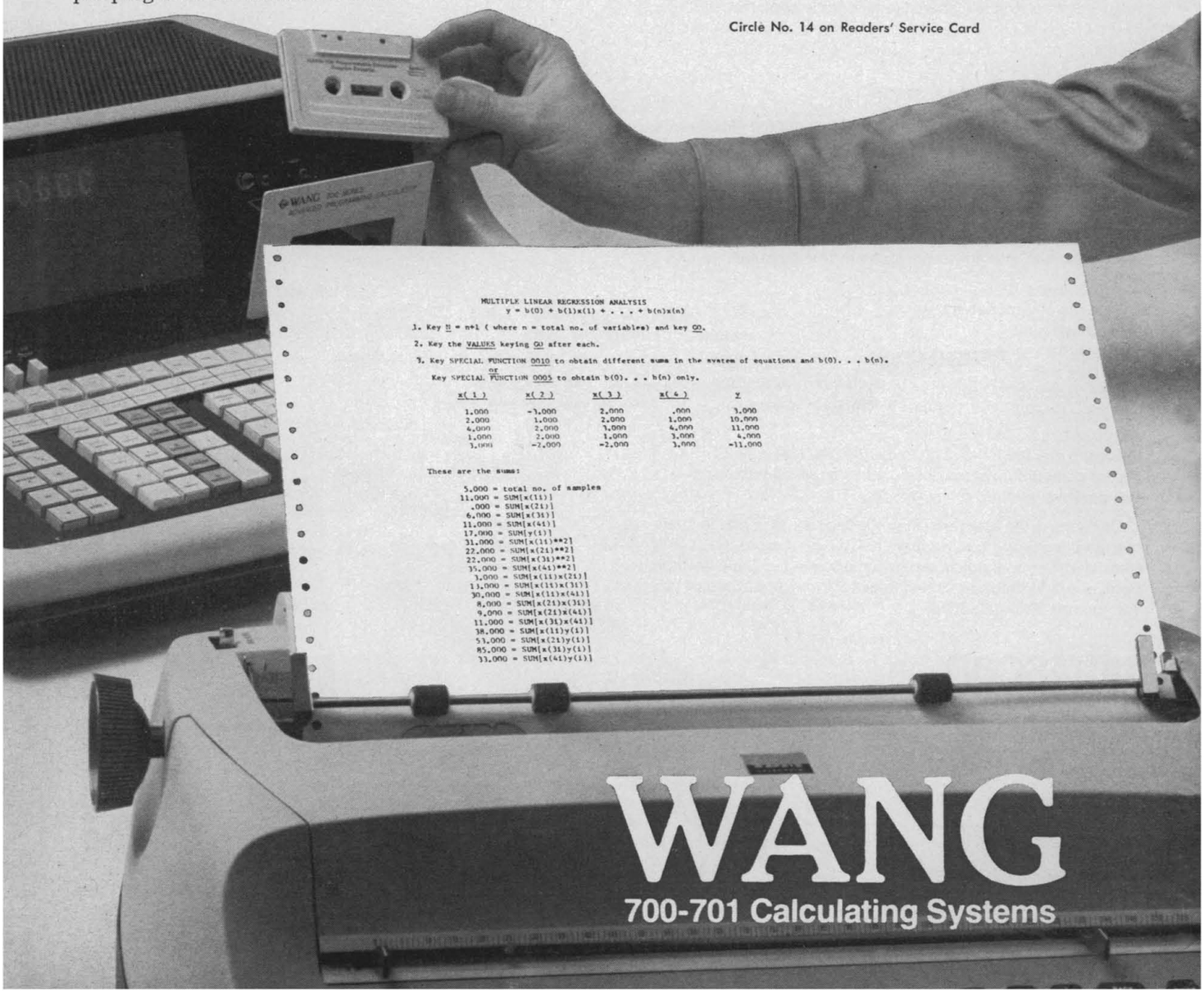



# WANG

## 700-701 Calculating Systems

NASA's space program has had more publicized federal financing, but its "giant leap for mankind" has produced data no one could derive from the earth's thin crust, which is almost certainly related to the moon's composition and age.

I suppose that a geologist can be excused for his ignorance of parts of the universe other than Planet Earth, such as the asteroids and comets that may have formed craters, mascons, and lunar maria, or the solar wind and geocorona that can be observed best from the moon, or the globules in interstellar material that we astronomers think may be forming other planetary systems, or the intergalactic material that may be detected by the Apollo lunar surface camera experiment. If he wants to understand Preston Cloud's editorial (18 Sept., p. 1159), he can get some help from the book *Origin of the Solar System* (Macmillan, New York, 1966), an elementary treatment edited by the undersigned.

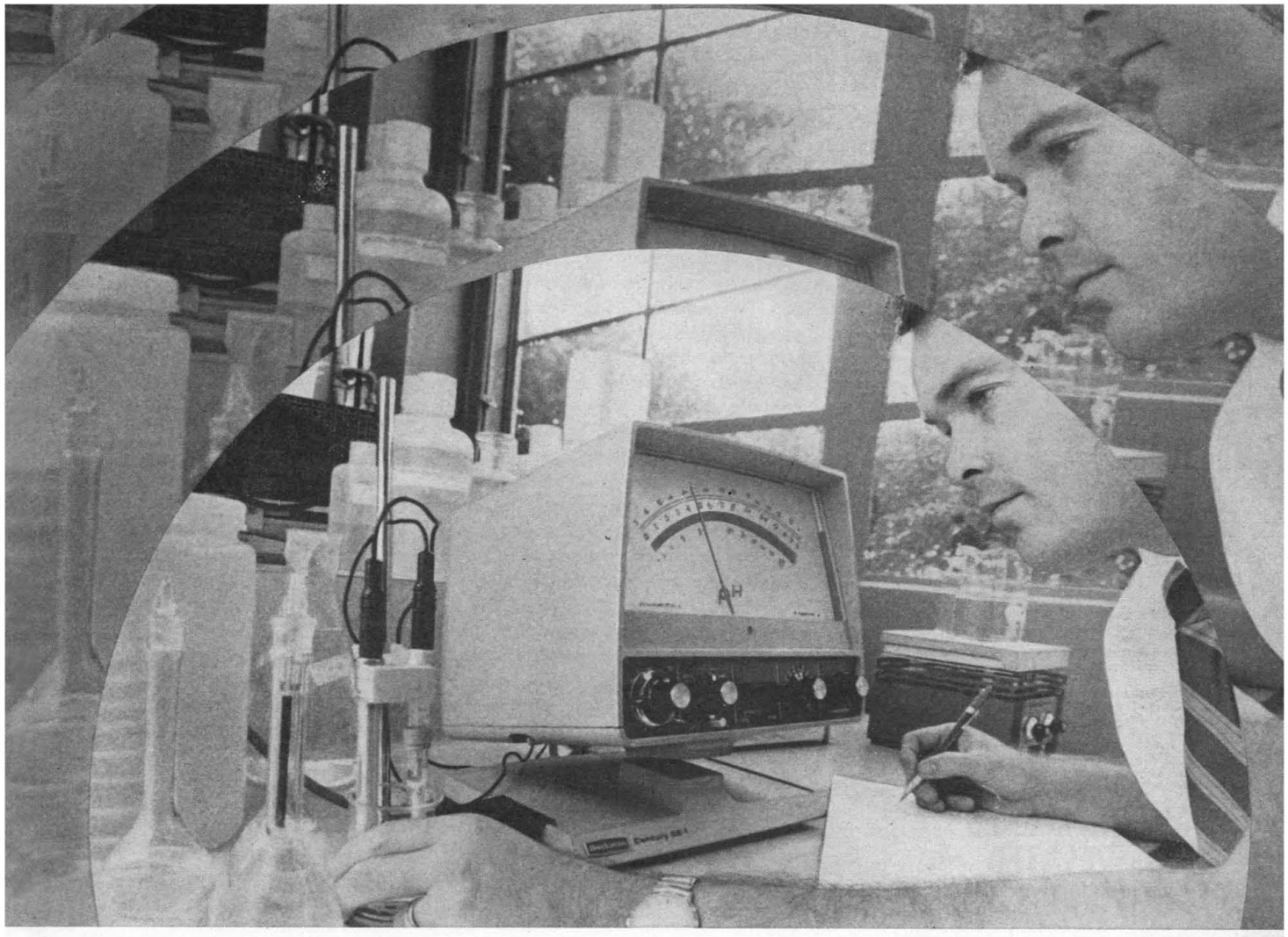
THORNTON PAGE
*Department of Astronomy,*
*Wesleyan Universtity,*
*Middletown, Connecticut 06457*

## Vietnam: AAAS Herbicide Study

Philip Boffey's account (2 Oct., p. 42) of the difficulties of the AAAS team investigating the effects of the military use of herbicides in Vietnam is fine as far as it goes. . . . I was at the Plant Science Laboratories, Fort Detrick, Maryland, when Arthur Westing, a member of the AAAS investigating team, appeared on 8 April to receive a briefing on the activities of the laboratories. His opening comment, made before 15 to 20 members of the laboratory, was "I am the enemy." Matters got worse as he went on to explain that his mission for the AAAS was to assess *damage* done by herbicides. When asked whether he thought that all changes caused by herbicides should be classified as damaging, he replied that he hadn't thought about possible beneficial effects. He stated that his committee's function was not to balance benefits, such as the prevention of ambush or the detection of enemy supplies in transit, against the deficits, such as the incursion of bamboo; the committee would not, in short, consider the fact that there was a war being fought nor that herbicides were probably the least lethal weapons in use. Before he had heard a word from the staff of the Plant Science Laboratories Westing made it clear that the committee was going all out to prevent the use of herbicides in Vietnam. Later on, during the briefing, he was very disappointed to learn that the military was not employing paraquat in Vietnam since that would have made his job (of proving that the United States was poisoning Vietnam) a lot easier.

Sometime after that encounter, I read a report prepared by A. H. Westing, E. W. Pfeiffer, J. Lavorel, and L. Matasso entitled "Report on Herbicidal Damage by the United States in Southeastern Cambodia" (*1*). The report, dated 31 December 1969, was based upon 4 days of "intensive field investigation" from 25 to 29 December. Their trip was within the areas bordering Vietnam, in particular the Parrot's Beak and Fishhook regions which were the prime targets of attack by United States and South Vietnamese forces in April–June 1970. They spent their second and last days at Chup and Mimot, respectively, where large caches of military supplies and a vast underground military headquarters were discovered. One must remember that in December 1969 Prince Sihanouk had not yet admitted that North Vietnamese forces occupied the Cambodian border areas despite 5 years of American and South Vietnamese protests against the Cambodian sanctuaries. Then early in 1970 Sihanouk demanded that Hanoi remove the 45,000 to 60,000 troops (the number varied) and supplies they had stationed in his country, and not very long after that Sihanouk was in exile and the Royal Government of Cambodia (now a republic) went to war against the North Vietnamese. It appears that Cambodia, for 5 years at least, was indeed a very vital sanctuary for the Communists, providing them with a supply and headquarters complex from which they could mount offensive actions in the provinces in the southern part of South Vietnam. It is no wonder then that some of the most intensive defoliation missions were on the heavily forested border in an attempt to create a zone where aerial, if not ground, reconnaissance was facilitated.

Against this background the concluding remarks from the report by Westing *et al.* make interesting reading: "We feel particularly grieved about the innumerable direct and indirect losses suffered by the innocent local populace. The extent of these losses can never be



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determined satisfactorily and will never be compensated adequately. We have seen at first hand how particularly drastic this type of military action is for people whose very existence is so closely tied to the land. Cambodia is a small nation attempting to remain neutral between East and West and to remain at peace with its neighbors despite enormous external pressures from all quarters. We cannot understand and we cannot condone the violations of Cambodian territory by the United States, for which the present report furnishes but one example. Despite a week of free and unhampered travel by automobile, on foot, and by low-flying aircraft along hundreds of kilometers of the border, we could find no evidence of Viet Cong activity in Cambodia; nor did our repeated conversations with Cambodians and Europeans living along the border suggest any such activity."

Westing and Pfeiffer may have written this report in all sincerity but they could have, and should have, gone to other authorities to find out just what was going on militarily at Chup and Mimot. They wrote a beautiful propaganda piece—regardless of their intentions and the ultimate value of their report in assessing 2,4-D and 2,4,5-T damage to rubber plantations—for the Communists. At least one other report on herbicide damage in Cambodia had already been prepared without such propagandistic overtones. . . .

Boffey stated that the AAAS study team "has been denied access to information that is important to the success of the study." We should not expect the military or any other governmental agencies to cooperate with all individuals simply because the AAAS has appointed them to a committee. The team should collectively and individually meet standards required of other government employees who have access to confidential information. An individual's past performance could determine that he was a risk. The "military roadblock" to which Boffey refers may have been Westing's creation, begun months earlier. The AAAS board appointed Matthew Meselson to head the study team and Westing was his first appointee. Nothing in Westing's behavior at Fort Detrick or in his prior writings on the use of herbicides in Vietnam suggests that he meets the minimum standards for objectivity and dispassionate concern for the truth which is the *sine qua non* for scientific inquiry. The AAAS, to maintain its credibility as an organization for the advancement of science, should reconsider appointments to this study team.

One last word about the AAAS study on herbicides in Vietnam: the full report of the dozens of experts who attended a special conference at Woods Hole last June should have been published in toto in *Science* so that all of us could have evaluated the advice they gave.


ROY M. SACHS

*Department of Environmental Horticulture, University of California, Davis 95616*


**Reference**


1. T. Whiteside, *Defoliation* (Ballantine, New York, 1970), appendix, pp. 117–132.


Sachs is correct in gathering from my informal remarks at Fort Detrick in April that the mandate from the AAAS to its ad hoc herbicide committee limited this group to an assessment of the *biological* effects of the herbicides used in Vietnam. He is wrong in suggesting that only potentially adverse effects would be looked into, although it was largely because of a concern over the possibility of such effects that the committee was established in the first place. He is absolutely wrong in claiming that I portrayed the committee as being intent on "going all out to prevent the use of herbicides in Vietnam." Rather the committee is and always has been committed to determining how best to study objectively the ecological and public health consequences of the military use of herbicides [*Science* **167**, 37 (1970); *AAAS Bull.* **15**, No. 3, 7 (1970)]. My obviously inept attempts at humor singled out by Sachs were intended to break the ice with a group that was in small part hostile to my visit. The subsequent cordial cooperation, assistance, and advice that I have continued to receive from the senior scientific personnel at Fort Detrick suggest to me that they did not share Sach's interpretation of my remarks. A report of the herbicide committee will be presented at the annual meeting of the AAAS in Chicago on 29 December and is to be published shortly thereafter.

I shall not comment on Sachs's lengthy critique of the report of my Cambodian trip (which predates my association with the AAAS committee). It is in the open literature and can be judged by anyone. A fuller account will appear in *Chemical Warfare in Indochina*, to be published by the Macmillan Free Press, in early 1971. For further insights into my personal opinions on

the military use of herbicides, Sachs and others are referred to another brief article of mine in the *Friends Journal* **16**, 193 (1970). It should be obvious, however, that my personal political and moral views are separate from and irrelevant to the AAAS study.

ARTHUR H. WESTING
*Department of Biology, Windham College, Putney, Vermont 05346*

### More Mislabeling—More Frustration

Letters by Goldman (16 Jan.) and Prescott (12 June) concerned the increasing unreliability of labels on radioactive biochemical products, even those obtained from the more reputable suppliers. Our recent experience indicates that the same complaint extends to the calibrated and certificated radioactive standard sources furnished by such "reputable suppliers." Not only do the standards differ widely, but there seems to be an increasing lack of understanding of the most fundamental definition of terms which at one time, at least, had been unequivocally defined.

We recently undertook some experiments requiring the use of $^{14}C$. In order to properly interpret some preliminary results involving planchet counting, we borrowed from our colleagues two $^{14}C$ reference disc sources obtained from different suppliers, each labeled as representing a specified number of microcuries. Since the resulting calibrations differed by more than 50 percent, we inquired of the suppliers as to the method of preparation. The first supplier provided full details on construction, indicating appropriate correction factors for absorption by the thin cover, and so forth. Repeated phone calls to the second supplier failed to uncover any details concerning our specific source, and provided conflicting stories concerning their $^{14}C$ sources in general.

Our attempt to purchase another reliable calibration standard proved disastrous. Unlike the "weightless" samples used by the first supplier, this third supplier prepares his $^{14}C$ sources by collecting $^{14}C$-labeled $BaCO_3$ on filter paper. He then calibrates the source and expresses the microcurie content "based upon emission rate and not contained activity." The first two standards shipped by this third supplier differed by a factor of 100, neither was near the catalog microcurie value, and both were more than a factor of 4 below their respectively certified microcurie

value by their own rather arbitrary definition. The third attempt to fill this order produced a source which seemed to be high by just a factor of 2. A telephone call to the supplier produced the information that the source had been "calibrated for $2\pi$ geometry" and that the listed microcurie value on the attached certificate should be corrected to so state. I must confess that had I seen such a statement on the certificate I would not have known whether to multiply or divide by 2 for $4\pi$ geometry.

I cannot help wondering what new theories have been reported in the literature based upon research results about which the authors were sufficiently naive to accept such "standards" at face value. I shudder to think of the possible consequences if a similar erroneous standard is sent to the radiology department of a hospital and is used to determine dosage of some radioisotope delivered to a patient.

A. BROIDO

*USDA Forest Service,*
*1960 Addison Street,*
*Berkeley, California 94701*

### Mutagens and Carcinogens

Although there is much public concern for the genetic and cancer hazards of a number of uncertain factors, little has been done to prevent the ignorant or inadvertent use of compounds produced primarily for the induction of mutation and cancer. The majority of these agents can be purchased from a number of supply houses without evidence of proper qualification. Generally, neither the catalogs nor the labels on the containers carry information about the biological danger involved in handling them. Rarely is it possible to locate information quickly concerning the half-life of these compounds in solution, and it is even more difficult to find answers to problems of spillage. How many users know what happens to these chemicals when they are disposed of through the sewer, and how many plumbers are aware of the danger they face performing routine work around research laboratories or in industry?

I am well aware that the biological effects of the majority of organic compounds cannot be determined or stated with certainty, but at least the few hundred proven mutagens and carcinogens should be identified as such on the label by the manufacturer or distributor.

Some can certainly be classified as highly dangerous, others as of medium effectiveness, while the rest can be grouped according to their lower activity. Maybe a simple color code on the container can provide sufficient warning. The label should provide information on volatility, solubility, and half-life under the conditions of treatments commonly used. Instructions for methods of safe disposal should also be included. None of these compounds should be shipped in single-walled glass containers, and efforts should be made to employ vessels which do not overturn easily when opened.

It takes months to reveal the consequences of human contamination with carcinogens, and several generations are needed for genetic damages to surface after exposure to mutagens in organisms with a breeding system similar to that of man. Since the majority of the research laboratories are associated with schools, the inexperienced, young, and most susceptible persons have the highest chance for dangerous exposure. Some of the hazards could be effectively minimized by the adoption of the simple and inexpensive measures suggested here.

No new legislative or governmental actions are needed; only the regulations of the federal Food, Drug and Cosmetic Act should be extended to a number of old and new chemicals and perhaps expanded. The user institutions should adapt and adopt rules for handling carcinogens and mutagens similar to those in existence for radioactive compounds.

G. P. REDEI
*Department of Agronomy,*
*University of Missouri,*
*Columbia 65201*

### Errors in Telegraphed Texts

With respect to my summary of the work of Katz and his colleagues, in the issue of 23 October which contained the article on the Nobel prizewinners (p. 423), readers will recognize easily that José del Castillo's name came out misspelled and that Merter Lectures are really the Herter Lectures, but many will not know that a quantum of acetylcholine probably contains something like $10^4$ molecules rather than 104.

A. R. MARTIN
*Department of Physiology,*
*University of Colorado Medical*
*Center, Denver 80220*

4 December 1970, Volume 170, Number 3962

SCIENCE



# Educational Obsolescence

The obsolescence of education in rapidly developing fields of knowledge has become about equal in rate to the obsolescence of an automobile. In 5 to 7 years it is due for a complete replacement. Consequently, our times, to a degree generally quite unrecognized, demand a major reconstitution of the educational process, which must become one of lifelong renewal. Perhaps a month out of every year, or 3 months every third year, might be an acceptable new pattern. Indeed, instead of cramming the educational years of life into adolescence and early maturity, a more efficient plan might be to interrupt education with work periods after elementary school, high school, and college. In any case, programs of continuing education for all professional people must become mandatory, and the educational effort and expenditures must be expanded by at least a third to permit adequate retraining and reeducation.

The obsolescence of education differs only in degree in the several sciences, and even in the humanities. . . . I recently heard a distinguished historian, who had been in university administration for only 5 years, say that his field had advanced so much in the interim that it would take him a year of concentrated study just to catch up with its development. In spite of a very general recognition of these hard facts, little is done to alter our pattern of education to cope with them. Physicians continue to practice medicine, although 50 years have elapsed since their youthful preparation. Dentists do the same. Lawyers and engineers live comfortably on their antiquated stock in trade. Teachers slide steadily downhill through failure to grasp new developments in their own subjects. Perhaps worse is the virtually universal ignorance, on the part of educated men and women, of any advancement of knowledge outside their own professional specialties. Surely we need a complete and thoroughgoing change in attitude toward "adult education," a careful planning of programs and courses appropriately designed for the intelligent adult who has become out of touch with his new world, and a mandatory, cyclic renewal of training for the professional specialist.

The cry of the student throughout the land is for "relevance" in the curriculum. What does he mean? Change has become the major feature of human civilization, driven by an increasingly rapid development of enormous powers to modify and control raw nature; and the advance of science is the principal factor in this technological revolution. Education must prepare each person to cope with changes that are unpredictable. As Heraclitus wisely said, "No man steps into the same river twice." The river flows, and the man ages. All is change. Yet the life of an ancient Greek was not so different from the life of Thomas Jefferson as Jefferson's life is from ours today. The content of the curriculum should therefore embrace both the timely and the timeless, for topical and social relevance and timeless natural law alike deepen our perspective and assist us to adapt ourselves to altered circumstances. Unfortunately, the timely and the timeless are both often displaced by the trivial, or the significance of the two former is left obscure, so that to the young mind they seem to be trivial. This must not be!—BENTLEY GLASS, *Vice President for Academic Affairs, State University of New York, Stony Brook*

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Adapted from *The Timely and the Timeless* (Basic Books, New York, 1970).

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**Sheraton-Blackstone:** AAAS Invited Lectures (RESA Annual Address and Panel Discussion); AAAS Committee on Council Affairs (Open Hearing); AAAS General Science Symposia ("Science and the Federal Government—1970"; "Science and Man: Values and Expectations"; "Crime, Violence, and Social Control"; "Contributions of U.S. Minority Groups to the Development of Science"; "Women in Science"); AAAS Sections—H-Anthropology; K-Social and Economic Sciences; L-History and Philosophy of Science; P-Industrial Sciences; T-Information and Communication; U-Statistics.

**Pick-Congress:** AAAS Invited Lectures (Special Lecture; Distinguished Lecture; Sigma Xi-Phi Beta Kappa Lecture); AAAS Science Film Theatre; AAAS Film Lectures; AAAS Commission and Committee Symposia (Commission on Population and Reproduction Control; Committee on Arid Lands; Committee on Environmental Alteration); AAAS General Science Symposia ("Public Policy for the Environment"; "Large-Scale Use of Defoliants"; "Scientific Organizations, War-Peace Issues, and the Public Policy Process"); AAAS Sections—B-Physics; D-Astronomy; E-Geology and Geography; FG-Biological Sciences; K-Social and Economic Sciences; M-Engineering; Np-Pharmaceutical Sciences; O-Agriculture; Q-Education; W-Atmospheric and Hydrospheric Sciences; Society for General Systems Research Office.

**Field Museum of Natural History:** AAAS Invited Lectures (Address of the Retiring AAAS President and following Reception; Frontiers of Science Lecture).

**Adler Planetarium:** AAAS Section D-Astronomy ("On Teaching Astronomy").

**University of Illinois Medical Center:** Alpha Epsilon Delta.

**Essex Inn:** Beta Beta Beta—Biennial National Meeting; Association of Academies of Science; American Junior Academy.

**Ascot House:** Beta Beta Beta—Biennial National Meeting.

## HOTEL RATES*
**(Per Day)**

The American Association for the Advancement of Science will hold its 1970 Annual Meeting in Chicago, Illinois, 26–31 December. The AAAS registration desk will be located at the Conrad Hilton Hotel. The following hotels will be used for housing.

| HOTEL | SINGLE | DOUBLE | TWIN | SUITES |
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| 1) Conrad Hilton | $15 | $21 | $21 | $55 and up |
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| 3) Sheraton-Blackstone | 15 | 21 | 21 | 40 and up |
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| | 19 | 25 | 25 | |
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*Illinois Room Tax, 6%; rates for suites: parlor plus one-, two-, three-bedrooms; $5.00–$8.00 additional charge for cots.

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Be sure to list definite arrival and departure date and time. Hotel reservations will be held *only* until 6 p.m. unless otherwise specified.

Number in party_____sharing this room will be (list name and address of each person, including your own):

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Two papers by Bouix followed in this session. The first one dealt with the formal theory of integral equations in determining current distributions on finite length antennas in homogeneous media. The second paper was concerned with the influence of a reflecting surface on the field of a dipole in an otherwise homogeneous media. The paper seemed rather classical, but it may provide analytical insight.

The final paper in this session, by G. Franceshetti, dealt with "The Influence of Excitation Gap on Antenna Performance." The main point of the paper was to establish the validity of quasi-state formulations in low-frequency antenna radiation in conducting media. On the basis of the oral presentation, it appeared that the actual analysis was only carried out for spherically shaped antennas with azimuthal gaps. As expected on intuitive grounds, the static results are valid provided the antenna dimensions are reasonably small compared with the skin depth in the conductor. In principle, the results can be generalized to other geometries, but much additional work needs to be done. The experimental work described was carried out in a scaled model tank. In the discussions, Wait emphasized the importance of accounting for induced polarization effects of metal-electrolyte interfaces. This can be particularly troublesome at audio frequencies.

The session on transmission was supposed to have been initiated by a paper entitled "Transmission of Radio-correlated Low Audio and Sub-audio Frequency Signals through Sea Water." The paper, with five authors, was withdrawn for unknown reasons by the sponsor (U.S. Army, Fort Monmouth). The abstract indicated that transmission experiments between shore and boat were carried out at a distance up to 1.6 nautical miles. Apparently, correlation of radio and conduction current signals was to be undertaken with a view to improved range coverage.

"Surface Wave Propagation from VLF Arrays in Polar Seas" was the title of a paper given by A. W. Biggs. This paper dealt mainly with mixed-path effects for ground-wave propagation over high-latitude terrain which is highly inhomogeneous. The semi-empirical formulation of Millington was used to estimate the gross nature of the expected field variation of coastlines between sea and arctic land. Surface wave effects in polar ice, and all the complicating factors such as brine content, pore volume, and surface rough-

ness, were also considered. The design of antenna arrays using up to five elements was described. The paper indicated that many unusual and perplexing effects could be expected.

The final paper in the session, presented by R. Lindquist, was entitled "Some Results in Connection with a Search for Maximum Underwater LF/VLF Coverage." This paper described a simple method to determine fields in seawater (in the seas around Sweden) from a fixed VLF station on land. The distribution of salinity and the coastline geometry was considered in the analysis. The final results displayed the frequency and range dependence for a wide variety of cases. No new analytical approaches were needed, but the author demonstrated a deep understanding of the problem and a capability to adapt known methods to the problem at hand.

The session on VLF/ELF electronic noise contained a group of four papers on naturally occurring signals in the ELF range. One, by H. L. Konig, dealt with the mechanical and electrical design of magnetic and electric dipole receiving antennas. The results should be of considerable value to experimenters and many practical hints in the construction and operation were generously supplied. The second paper, by G. Mattern, dealt with a rather qualitative discussion of VLF radio noise during a sea voyage between Germany and Ecuador. The noise was recorded with a 500-hz to 5-khz bandpass receiver using, apparently, a vertical whip antenna. It was concluded that, for below 40°N latitude, the principal contribution to the noise was lightning discharges in African and South American storms. The third paper, by E. Selzer, dealt in a very general fashion with the problems of doing EM noise studies at great depths in the ocean and in freshwater lakes. Many intriguing aspects, such as hydromagnetic propagation and ocean bottom noise, were briefly mentioned.

The fourth paper on noise, by E. F. Soderberg and M. Finkle, was a successful attempt to correlate measured ELF noise fields at the surface and beneath the sea. The experimental results were consistent with a straightforward theoretical calculation using a plane-wave and homogeneous half-space model.

The session on HF/VHF backscatter was probably the highlight of the whole conference. The contributors represented the leading workers in the field, and the audience was in a position to appreciate the impact of the results. Again, however, the lack of participa-

tion from physical oceanographers was noticed.

It was very fitting that the first paper was given by D. D. Crombie who, in 1955, had first identified Bragg-type resonant backscatter as the principal mechanism in determining the reflected ground-wave HF signal from a rough sea. Crombie's paper (coauthored by J. M. Watts and W. H. Beery), dealt with the spectral characteristics of the Doppler-shifted backscattered signal. He attributed differences from the "simple theory" to four factors: (i) nonlinear interaction between the waves causing the coherent backscatter and the rest of the sea spectrum; (ii) changes in phase velocities depending on wave amplitude (that is, Stokes effect); (iii) drifts duced by the wind; and (iv) tidal drifts.

An important contribution to this session was a theoretical analysis by D. E. Barrick who used a boundary perturbation treatment for interaction of an electromagnetic ground wave and the rough sea surface. The results provided a quantitative estimate of the effective ground-wave attenuation for an HF ground wave on a rough sea. Also included in his analysis was the special case of backscatter, and here his results were consistent with earlier calculations of others.

A third paper in this backscatter session was given by W. H. Shonfeld, who considered a semi-empirical analysis of microwave backscatter (that is, clutter) from the sea. Parameters such as range, wind, wave height, and antenna height were considered.

A rather controversial paper was given by R. K. Moore on the use of radar to determine oceanic winds (up to 50 knots). He suggested that the scattering coefficient at centimetric wavelengths is a well-determined function of wind speed and, with the use of satellites, this should open up a new field in oceanography. During the discussion, however, it was pointed out mainly by J. W. Wright (Naval Research Laboratories) that, for high wind speeds, the situation is very complicated. Thus wind speeds may not be deduced easily from such microwave data.

In his paper "Doppler Spectra in Microwave Scattering from Wind Waves," J. W. Wright used a laboratory wind-wave tank and obtained Doppler spectra on vertical polarization at X-band (3.2 cm) and K-band (1.25 cm) for depression angles between 15° and 80° and wind speeds between 2.25 and 8 m/sec. By Fourier-analyzing optical

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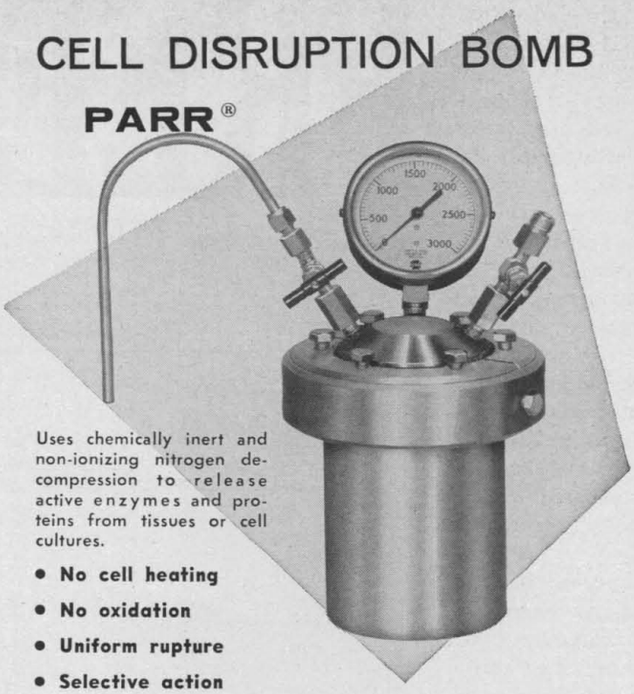

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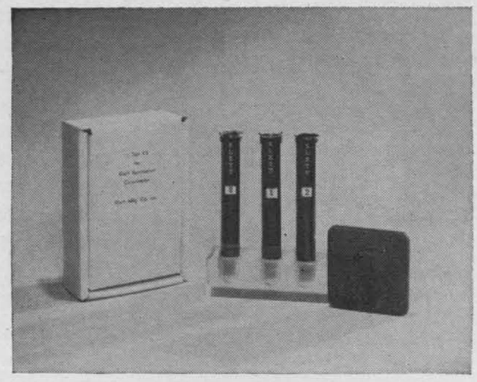

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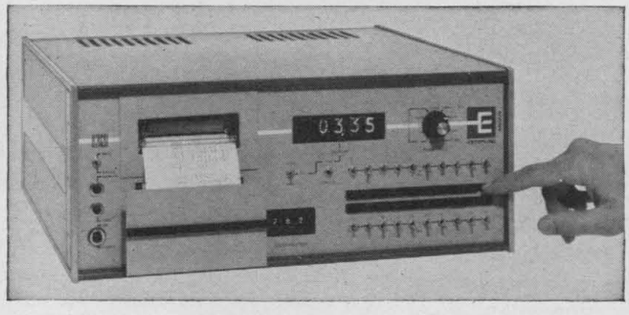

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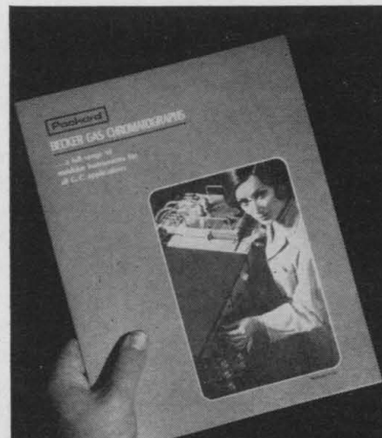

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data, he was able to obtain two-dimensional slope spectra of the wind waves. He concludes that microwave scattering from low-speed wind waves (in a short fetch tank) can be satisfactorily accounted for by low-order Bragg scattering. Wright conjectured that the Doppler bandwith is a kind of inverse lifetime for the Bragg resonant wind wave. This suggestion, attributed to Crombie, means that the currently accepted views by oceanographers on wind waves are incomplete at best. There was no rebuttal from any physical oceanographer in the audience!

An unscheduled but useful presentation was given by L. Wetzel on the signal characteristics received beneath a rough ocean. He compared several different models proposed on earlier occasions.

A round-table discussion on the Radio papers was held. An edited account of this is being prepared by A. W. Biggs. It served as a useful mechanism to extend the discussions which followed each of the papers above. Unfortunately, the format of the round-table session was not conducive to informal discussion. It may be better in future meetings of this kind to dispense with "round-table" discussions and instead allow more time for discussion after each paper.

This meeting, organized by the Electromagnetic-Wave Propagation Panel of the Advisory Group for Aerospace Research and Development (AGARD), was held at the Centre National de la Recherche Scientifique in Paris. The program chairman was P. Halley from Saclay, and the cochairman was T. Hodara (Tetra Tech, Inc., Pasadena, California). The EM Wave Propagation Panel is under the chairmanship of K. Davies (Environmental Science Services Administration, Boulder, Colorado), and the executive officer is C. R. Smith (U.S. Navy, AGARD staff, Paris).


JAMES R. WAIT

*Cooperative Institute for Research in Environmental Sciences, Boulder, Colorado 80302*


## Oral-Facial Sensory and Motor Mechanisms

The U.S.–Japan Cooperative Science Program has fostered an exchange of scientific information through joint seminars on subjects under intensive investigation in both countries. Neurobiological research on sensory and

motor function in the oral-facial regions was the subject of such a seminar held on 19 to 22 January 1970, in Honolulu, attended by 22 investigators, including nine representatives from Japan.

The major topics under consideration included thermoreceptor and mechanoreceptor activity, and central mechanisms of oral-facial sensation and movement. Basic neurophysiological mechanisms and correlated ultrastructure underlying sensory and motor function were emphasized.

There was considerable interest in thermoreceptor activity in the face area. A common finding was that specific thermoreceptive myelinated afferents were usually "cold" fibers; they increased their activity with cooling and decreased their activity with warming. "Warm" fibers were uncommon. However, a high density of warm spots confined to an area of skin across the bridge of the cat's nose was reported; electrical activity was recorded from myelinated fibers whose activity was approximately the reverse of that seen in "cold" fibers.

Units responding to both thermal and mechanical stimulation were found in the trigeminal ganglion, medulla, and thalamus of monkeys. These units responded to rapid cooling with increased dynamic discharge rates and had response profiles that increased linearly over the entire range of cooling temperatures. It was suggested that both the thermal and mechanical units and specific thermal units function in the central coding of temperature change.

In another study, the subjective responses to temperature changes in man were compared with the peripheral neural activity evoked in the rhesus monkey by a comparable series of thermal stimuli, on the assumption that the sensory capacities in the two systems were similar. It was found that the responses of A delta thermoreceptive fibers alone can transmit sufficient information centrally to account for man's subjective estimation of temperature change in the cooling direction over the range of 10°C. In light of the paucity of "warm" units found by various investigators, it was suggested that warming might be coded by the magnitude of the decrease or cessation of activity of "cold" units. However, in man, such changes in the activity of "cold" units did not transmit sufficient information centrally to account for the subjective estimation of warmth.

Another area which generated in-

tense discussion dealt with jaw-opening and jaw-closing reflexes. A number of participants reported that stimulation of cutaneous nerve fibers from the mouth (inferior alveolar, lingual, maxillary) resulted in inhibition of the jaw-closing reflex. It also was found that stimulation of these sensory nerves excited the digastric, a jaw-opening muscle. However, stimulation of sensory nerves evoking jaw closure had no effect on jaw openers. Thus, the reciprocal interaction of antagonistic sets of muscles controlling limb movements is incompletely present between muscle antagonists involved in jaw movement.

Intracellular recordings from masseter motoneurons revealed that there were two phases of inhibition evoked by sensory nerve stimulation, an early phase lasting about 15 msec, followed by a late phase enduring for approximately 100 msec. The early phase clearly had the characteristics of an inhibitory postsynaptic potential (IPSP). The late phase of inhibition had some of the characteristics of an IPSP, but presynaptic inhibitory mechanisms were not ruled out. It was shown that the early IPSP was evoked via a disynaptic pathway involving an inhibitory interneuron located in the supratrigeminal nucleus.

In another report, single unit activity was recorded from the face motor cortex in awake monkeys during voluntary jaw movement. Half of the units were correlated with jaw opening, and the other half with jaw closing. The level of maintained unit activity was not correlated with the force of muscle contraction, in contrast with previous reports on the activity of motor cortex neurons active during limb movements.

Much controversy centered about studies on presynaptic modification of afferent input in trigeminal brainstem and thalamic nuclei, and the morphological basis of such findings. In one study, stimulation of high-threshold proprioceptive afferents from the masseter muscle produced presynaptic depolarization of lingual afferent fiber terminals from tongue mechanoreceptors, and also suppressed the linguodigastric reflex. Other investigators studied the excitability changes in single primary afferent and corticofugal fibers projecting to trigeminal brainstem nuclei, and in thalamic afferents projecting to ventrobasal thalamus. Presynaptic depolarization was the predominant effect of conditioning stimulation on the excitability of primary afferent and corticofugal terminals. However, in thalamic afferent endings, conditioning stimuli usually produced an early presynaptic depolarization followed by presynaptic hyperpolarization at longer intervals between conditioning and testing. It was reported that, under barbiturate anesthesia, excitability increases and decreases rhythmically; the periodicity was similar to that of intrinsic thalamic spindle rhythms, suggesting that presynaptic hyperpolarization may be responsible, in part, for the facilitatory phases of thalamic rhythms.

Some earlier data suggests that axo-axonic synapses represent the morphological substrate for the presynaptic depolarization found in many parts of the somatic afferent system. Electron microscopic evidence presented at the conference revealed that such synapses occurred between axons in the spinal cord, trigeminal brainstem nuclei, and ventrobasal thalamus. However, corticofugal axons which projected to trigeminal brainstem nuclei and exhibited presynaptic depolarization of their terminals (see above) were not involved in axo-axonic synapses. In addition, medial lemniscal terminals in ventrobasal thalamus were always presynaptic to other axons, in disagreement with the postulated functional role of axo-axonic synapses in presynaptic depolarization. Thus, the relationship between axo-axonic synapses and presynaptic depolarization remains inconclusive.

The most fruitful discussions between Japanese and U.S. participants were on the central organization of the trigeminal brainstem nuclei and their role in sensory transmission and motor outflow. U.S. scientists were very interested in the techniques used by Japanese scientists to unravel the excitatory and inhibitory mechanisms controlling jaw movements. For their part, the Japanese scientists were particularly interested in the ultrastructural organization of trigeminal sensory and motor nuclei. The exchange of ideas should lead to new and exciting advances in our understanding of the trigeminal system.


R. DUBNER

*Neural Mechanisms Section,*
*National Institute of Dental Research,*
*Bethesda, Maryland*


### Note


1. In addition to sponsorship by the U.S.–Japan Cooperative Science Program, the seminar was supported by the National Institute of Dental Research, National Institutes of Health. The proceedings will be edited by R. Dubner and Y. Kawamura, cochairmen of the conference, and will be published by Appleton-Century-Crofts, New York. A list of the participants and a summary of each presentation can be obtained by writing to Dr. Dubner.

## BOOKS RECEIVED

*(Continued from page 1076)*

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**Chemical Control of Fibrinolysis-Thrombolysis.** Theory and Clinical Applications. Joseph M. Schor, Ed. Wiley-Interscience, New York, 1970. xviii, 328 pp., illus. $17.95.

**Chemistry of Complex Equilibria.** M. T. Beck. Translated from the Hungarian. R. A. Chalmers, Transl. Ed. Van Nostrand Reinhold, New York, 1970. 286 pp., illus. $12. Van Nostrand Reinhold Series in Analytical Chemistry.

**The Cibecue Apache.** Keith H. Basso. Holt, Rinehart and Winston, New York, 1970. xviii, 106 pp., illus. Paper, $2.25. Case Studies in Cultural Anthropology.

**Cognition and Affect.** Papers presented at a conference, June 1968. John S. Antrobus. Little, Brown, Boston, 1970. xii, 210 pp., illus. Cloth, $5.95; paper, $3.75.

**Communication in Development.** Proceedings of a symposium, Boulder, Colo., June 1969. Anton Lang, Ed. Academic Press, New York, 1970. xii, 272 pp., illus. $12. Developmental Biology, Supplement 3.

**Compilation of Reported $F^{19}$ NMR Chemical Shifts.** 1951 to Mid-1967. Claude H. Dungan and John R. Van Wazer. Wiley-Interscience, New York, 1970. Unpaged. $14.50.

**Computers, Chess and Long-Range Planning.** M. M. Botvinnik. Translated from the Russian by Arthur Brown. Springer-Verlag, New York, 1970. xiv, 90 pp., illus. Paper, $3.50. Heidelberg Science Library, vol. 11.

**Control of Energy Exchange.** Loren D. Carlson and Arnold C. L. Hsieh. Macmillan, New York, 1970. viii, 152 pp., illus. Cloth, $6.95; paper, $4.95. Modern Concepts in Medical Physiology.

**Crucifixion by Power.** Essays on Guatemalan National Social Structure, 1944–1966. Richard Newbold Adams. University of Texas Press, Austin, 1970. xiv, 554 pp., illus. $10.

**Culture Collections of Microorganisms.** Proceedings of an international conference, Tokyo, October 1968. Hiroshi Iizuka, Takezi Hasegawa, Yukinori Tsunematsu, Tokio Nei, Yoshiro Okami, Junichi Yasuda, and Eiko Yabuuchi, Eds. University Park Press, Baltimore, Md., 1970. xxxvi, 626 pp., illus. $29.50.

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**The Desmosomatidae (Isopoda, Asellota) of the Gay Head–Bermuda Transect.** Robert R. Hessler. University of California Press, Berkeley, 1970. vi, 186 pp., illus. Paper, $6. Bulletin of the Scripps Institution of Oceanography, University of

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**Dynamics for Process and System Control**. Wen-Jei Yang and Masami Masubuchi. Gordon and Breach, New York, 1970. viii, 448 pp., illus. $14.50; to libraries, $29.50.

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**Environmental Surveillance in the Vicinity of Nuclear Facilities**. Proceedings of a symposium, Augusta, Ga., January 1968. William C. Reinig, Ed. Thomas, Springfield, Ill., 1970. xvi, 466 pp., illus. $29.

**Essays in Physics**. Vol. 1, 1970. G. K. T. Conn and G. N. Fowler, Eds. Academic Press, New York, 1970. x, 164 pp., illus. Paper, 30s.

**Ethology**. The Biology of Behavior. Irenäus Eibl-Eibesfeldt. Translated from the German edition by Erich Klinghammer. Holt, Rinehart and Winston, New York, 1970. xiv, 530 pp., illus. + plates. $12.95.

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**Genetic Concepts and Neoplasia**. A collection of papers presented at an annual symposium, Houston, March 1969. Published for the University of Texas M. D. Anderson Hospital and Tumor Institute by Williams and Wilkins, Baltimore, Md., 1970. xvi, 620 pp., illus. $17.

**Germanides**. Grigorii V. Samsonov and Vladimir N. Bondarev. Translated from the Russian edition (Moscow, 1968) by Adolph Wald. Primary Sources, New York, 1970. vi, 234 pp., illus. $22.50.

**The Growth and Structure of Eutectics with Silicon and Germanium**. A. Hellawell. Pergamon, New York, 1970. ii, 78 pp., illus. Paper, $3.40. Progress in Materials Science, vol. 15, part 1.

**A Handbook of Alkaloids and Alkaloid-Containing Plants**. Robert F. Raffauf. Wiley-Interscience, New York, 1970. Unpaged. $50.

**The Health of Americans**. The American Assembly, Columbia University. Prentice-Hall, Englewood Cliffs, N.J., 1970. x, 214 pp. Cloth, $5.95; paper, $2.45.

**The History of Cardiac Surgery**. 1896–1955. Stephen L. Johnson. Johns Hopkins Press, Baltimore, Md., 1970. xviii, 202 pp., illus. $9.50.

**High Temperature Oxides**. Part 2, Oxides of Rare Earths, Titanium, Zirconium, Hafnium, Niobium and Tantalum. Allen M. Alper, Ed. Academic Press, New York, 1970. xviii, 276 pp., illus. $16.50. Refractory Materials.

**Homostatic Regulators**. A Ciba Foundation Symposium, London, January 1969. G. E. W. Wolstenholme and Julie Knight, Eds. Churchill, London, 1969. viii, 328 pp., illus. + plates. $13.75.

**Immunological Methods in Brucellosis Research**. Part 2, In Vivo Procedures. A. Olitzki. Karger, New York, 1970. x, 300 pp., illus. Paper, $21.25. Bibliotheca Microbiologica, No. 9.

**Infrared Spectra of Inorganic and Coordination Compounds**. Kazuo Nakamoto. Wiley-Interscience, New York, ed. 2, 1970. viii, 338 pp., illus. $14.95 .

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