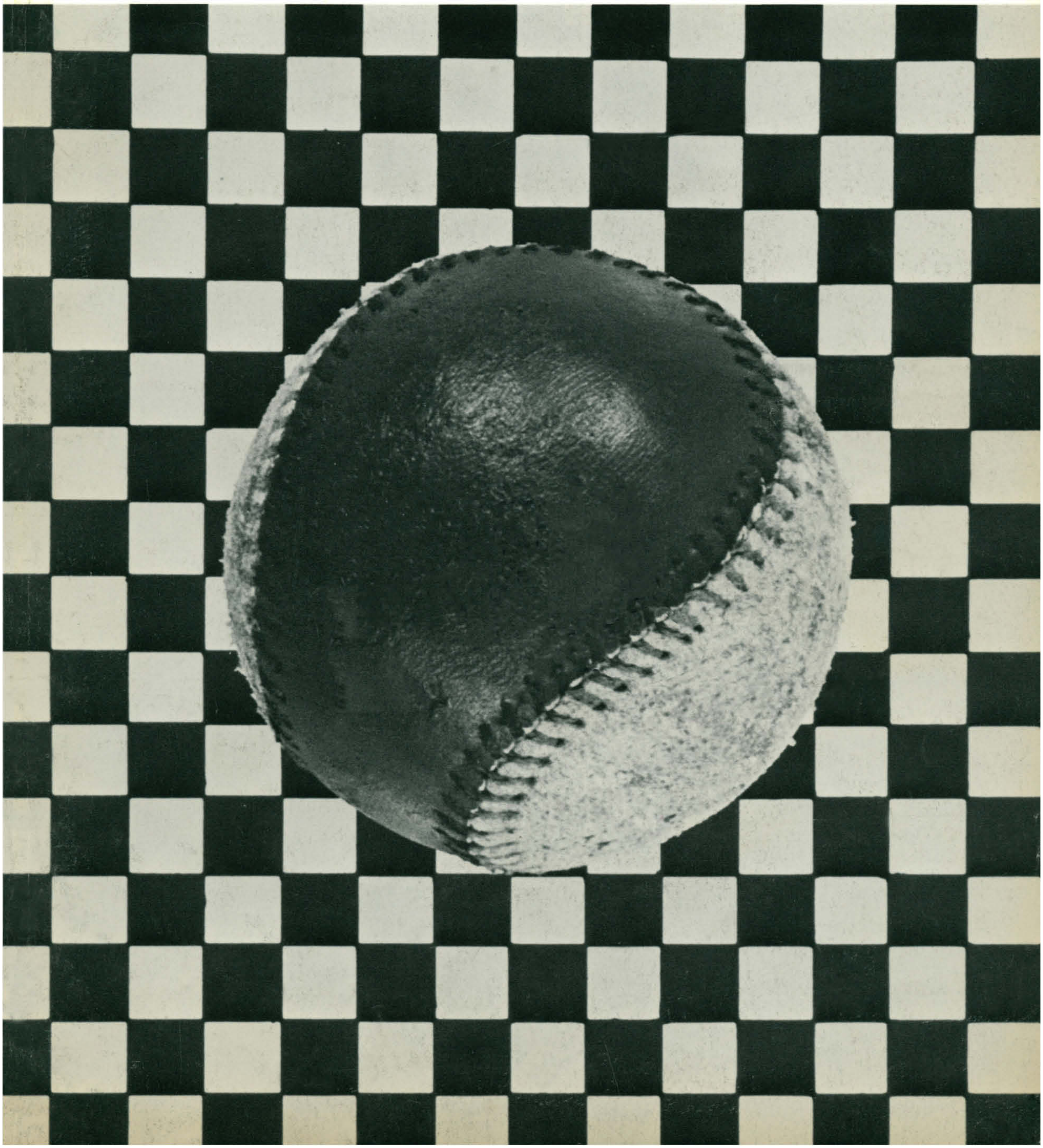
SCIENCE

25 May 1973

Vol. 180, No. 4088

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



THE NEXT GENERATION OF CO_2 INCUBATORS IS HERE

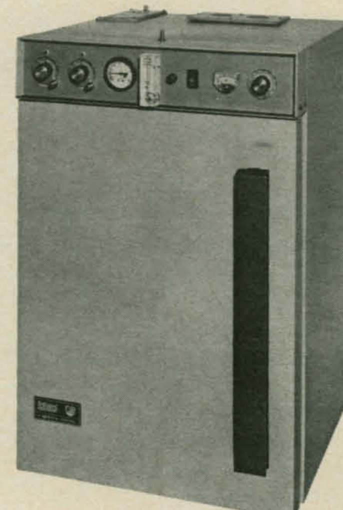
National Appliance Company's AUTOMATIC CO_2 CONTROL Water-Jacketed Incubators

National Appliance pioneered the water-jacketed incubator and, with these latest models, ushers in a new era of control never before attainable.

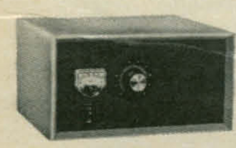
Check these all-new features:

- Automatic control of CO_2 concentration
- External air supply eliminated
- CO_2 consumption dramatically reduced
- Direct dialing of desired CO_2 level
- Direct meter readout of CO_2 percentage
- Automatic purge control
- Increased control of temperature/humidity

A new "closed-loop" CO_2 control system is the heart of the new series of National incubators. It permits a stable air/CO_2 environment; CO_2 is injected only when the concentration falls below the set level, thus reducing consumption and its attendant logistics problems.



MODEL 3241



MODEL 3636

Convert your current incubator into an automatic CO_2 control incubator with National's new CO_2 Control Master. It fits many makes of incubators and offers all the advantages of automatic CO_2 injection control and operation.

MODEL 3341

For more details, see your scientific dealer or write

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SCIENCE

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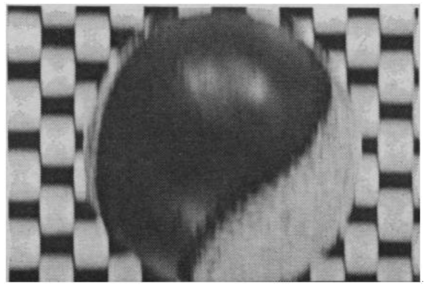
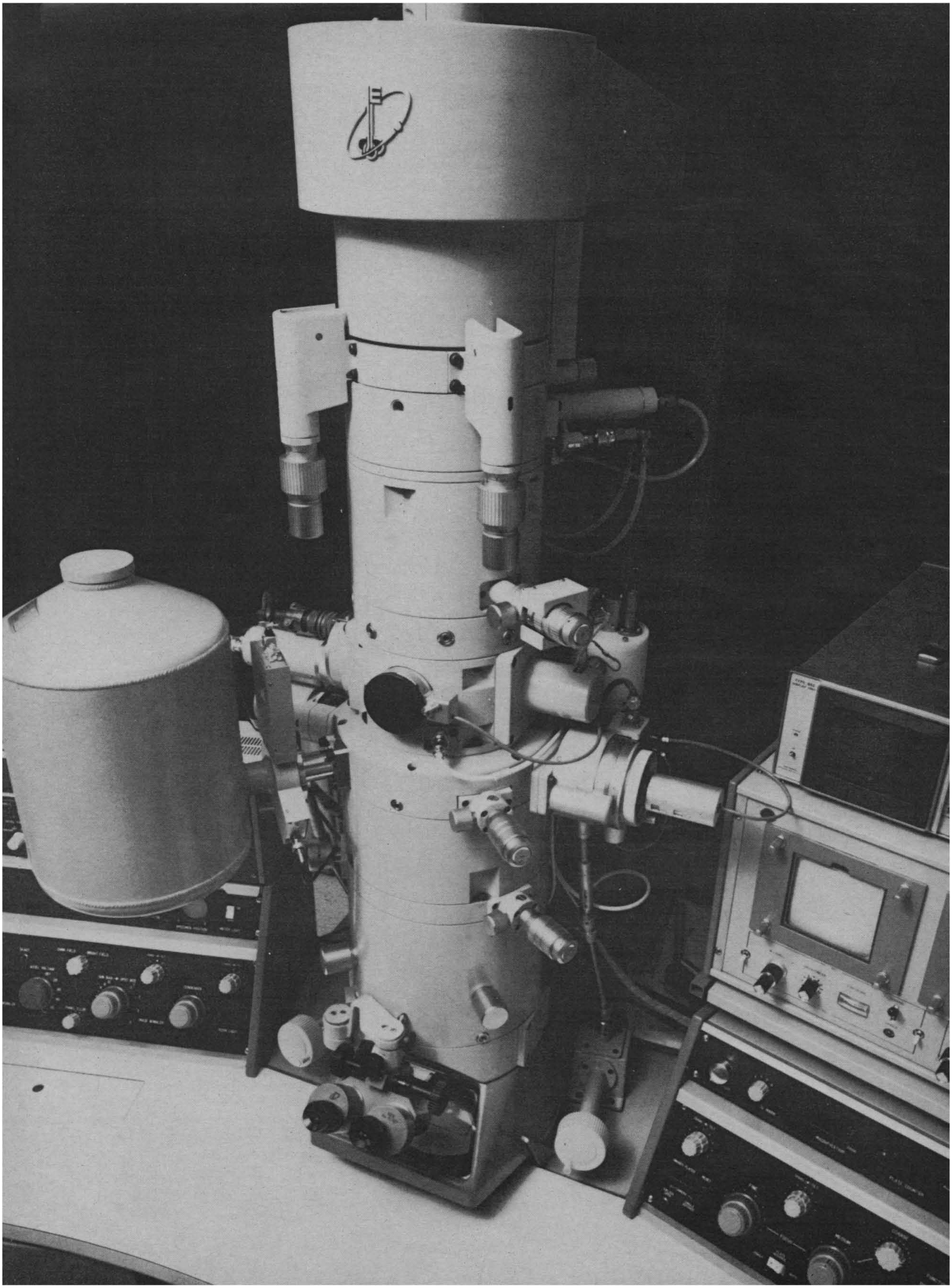
COVER

Baseball against a checkerboard background (below). Same view taken through a cylindrical lens indicates what an uncorrected astigmatic eye might see. See page 876. [Ralph D. Freeman, School of Optometry, University of California, Berkeley]





Roche Diagnostics announces...

a major breakthrough in biochemistry

made possible by NEW

FLURAM™

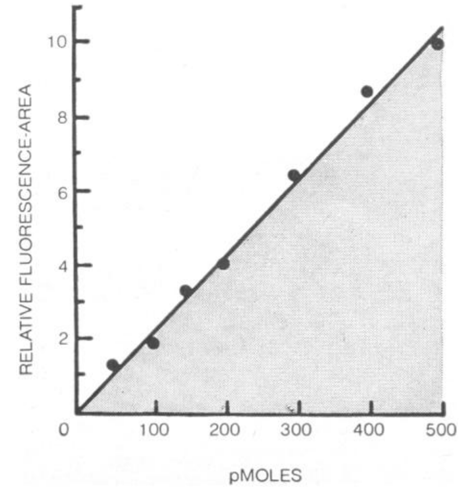
(fluorescamine)

reagent for assaying primary amines in the picomole range

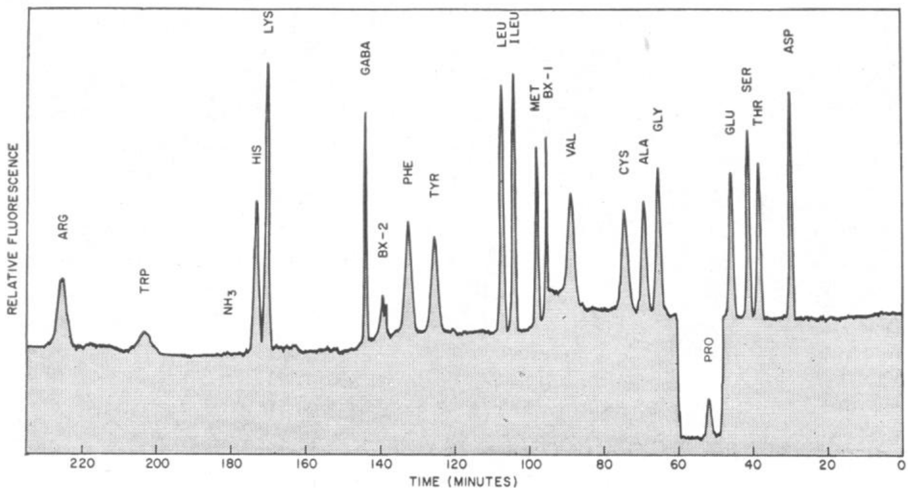
a reagent of great sensitivity For amino acid and peptide assay, FLURAM is approximately 500 times more sensitive than ninhydrin depending on methodology employed; it has detected as little as 50 picomoles of an amino acid. One obvious advantage of this degree of sensitivity is that very small amounts of material are needed for assay.

an assay of great simplicity Primary amine solutions are buffered appropriately; FLURAM, dissolved in acetone (or other water-miscible, nonhydroxylic solvents) is added; in seconds at room temperature the reaction is complete, and excess reagent is hydrolyzed rapidly; the fluorophors formed are stable for several hours under conditions of assay; fluorescence is proportional to amine concentration.

Linearity of fluorescence with various amounts of arginine applied to the short column of the amino acid analyzer



TOTAL FLUOROMETRIC AMINO ACID ANALYSIS (500 picomoles)



adapts readily to automation

Single column chromatographic separation of a standard amino acid mixture containing 500 picomoles each of neutral, acidic and basic amino acids. The fall and rise in baseline is due to the introduction and termination of N-chlorosuccinimide (1×10^{-4} M in 0.05 M HCl) into the stream for proline detection.

secondary amino acids are easily converted to detectable primary amines

Although FLURAM does not react directly with proline and other secondary amino acids, by introducing a simple intermediate step these substances can be converted to primary amines which are detectable with FLURAM.

adaptable to varied analytical procedures

FLURAM can be used in aqueous solution, in organic solvents and on solids. On thin layer chromatograms it has been used as a spray to detect amino acids and peptides.

present range of application is wide; potential unknown

Because FLURAM reacts with primary amines to yield highly fluorescent derivatives, it is uniquely suited for both manual and automated microanalysis of many biologically important compounds such as amino acids, peptides, proteins, catecholamines, amino sugars, oxytocin and vasopressin. Other applications of FLURAM currently being explored include peptide sequencing, genetic studies, assay of proteolytic activity of enzymes, monitoring for completeness of coupling reactions in peptide synthesis and labeling of proteins. The enormous range of potential applications for FLURAM should expand knowledge in the field of molecular biology and find eventual value in clinical medicine.

C

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SOME THINGS ARE CHANGING FOR THE BETTER:

A lot has happened to interferometry since Professor Michelson.

In 1892 Professor A. A. Michelson used his recently invented interferometer to determine the number of wavelengths of cadmium light in the standard meter. His error was 5 x 10^{-8} meter. It took another 70 years until the invention of the laser permitted the application of interferometry with this accuracy to everyday industrial measurements.

Today, HP's laser interferometer has found a place in metalworking and integrated circuit manufacturing as the tool to guarantee that a given dimension is precisely achieved. This modern version of Michelson's invention is enhancing accuracies of all types of new and existing machines and, as a consequence, lowering inspection costs and reducing rejection rates.

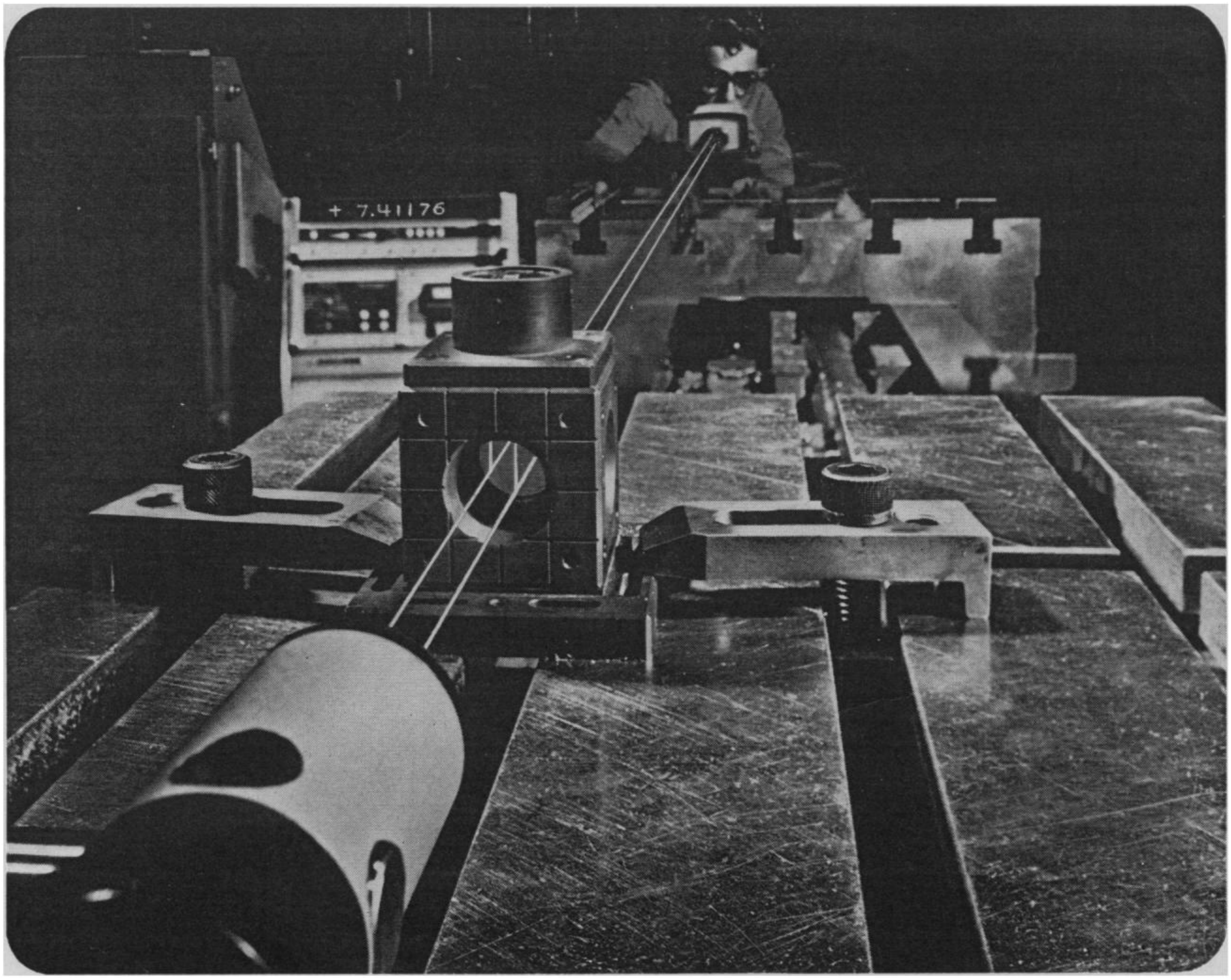
A little over a year ago, a group of HP engineers seeking to improve the quality and flexibility of this measurement technique developed the "HP Magic Cube." In essence, it is an interferometer that can have a laser beam aimed at it from some distance away.

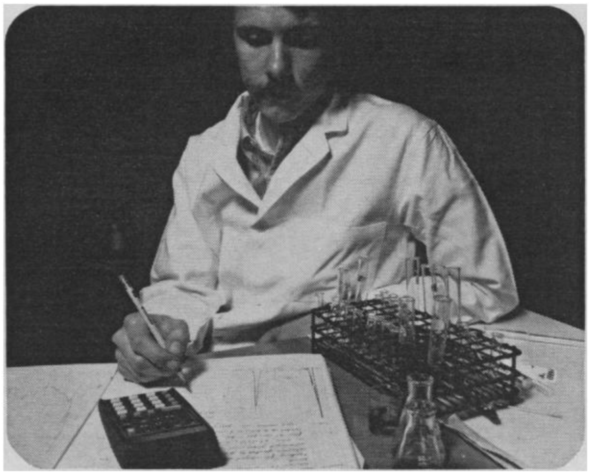
With it many kinds of measurements can now be taken without moving the laser head — pitch, yaw, flatness, straightness, squareness, and non-contact measurements — all that's needed to define a machine tool or measuring machine.

It can even make measurements around a corner, in tight places, or simultaneously measure x and y axes.

Moreover, it's portable. You can set it up, plug it in and start making error-free measurements in minutes wherever it's required in your metrology and quality control laboratories.

If you would like to know more about laser interferometry, we'll be glad to mail you our comprehensive brochure on the HP 5526A Laser Measurement System.





High-performance liquid chromatography: a new HP analytical tool for life scientists.

Gas chromatography (GC) has revolutionized analytical chemistry in practically every discipline. However, it has been of somewhat limited help to the life scientist because he works mostly with large molecules that cannot be vaporized for GC without breaking them down.

As a result, liquid chromatography (LC) has always been more attractive to the life scientist because it separates a sample in the liquid state at relatively low temperatures. But only recently has LC instrument technology advanced enough to give him the analytical speed and sensitivity that he also needs.

At the forefront of this new technology is HP's new Model 1010 Liquid Chromatograph. Already well established with European chromatographers, the 1010 is capable of performing all forms of LC, including ion-exchange and gel permeation. It delivers constant flow through the columns at pressures up to 3700 psig. A septum-less injector permits reproducible sample injection against full-column pressure; column change and solvent flush are exceptionally fast and convenient. Completely modular in design, the 1010 can be equipped for solvent programming, gradient elution and fully automatic preparative operation. Ask for full information.

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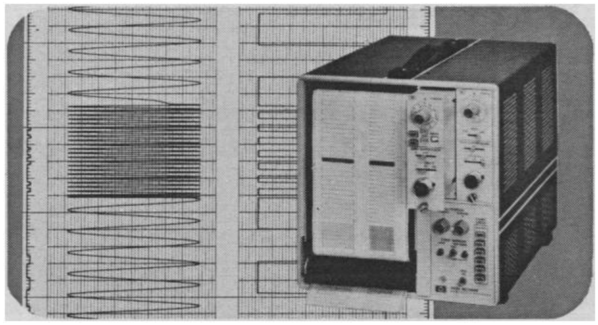
Just a better trace for your money. That's all.

There's a great temptation to talk about the features on our new HP 7402A two-channel oscillographic recorder as though they were the last word in recorder design. But as we both know, the field is in a great state of flux, with new technology appearing in every model.

Common sense prevails. We simply want you to understand that the HP 7402A delivers one of the clearest, most readable, traces you will find on any currently available machine irrespective of price. Yet the price of the HP 7402A can be as little as $1740 for a complete recorder.*



For your money, you get a big, wide, easy-to-read 50 mm trace on each channel. A high-pressure inking system puts down an instant drying, fine image with no overshoot, no skipping and no smear at any speed (in tests, the carbide tips showed no wear after 2,000 miles of travel over 80,000 feet of chart paper; you can expect them to last the life of the machine).

You also get the flexibility and economics of plug-in amplifier modules and a wide range of options to accommodate your exacting recording needs.

We'll be happy to send you more information on this sensible recorder.

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Varian, the optics company, makes NMR, GC, LC, and more!

First, a distinguished family of UV-Vis spectrophotometers

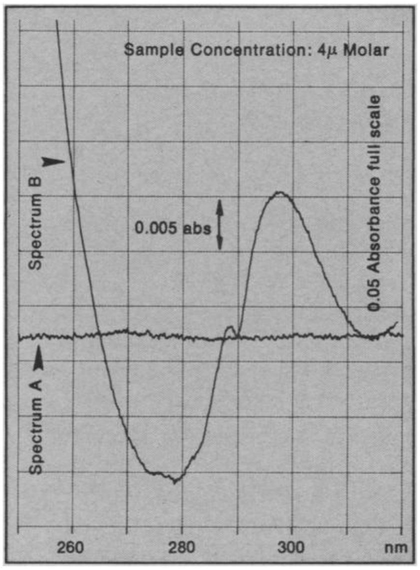
Protein difference spectroscopy needs the Cary 118's accuracy

With difference spectroscopy the life scientist has a valuable probe for investigating the structure of protein macromolecules. It is a very sensitive method for detecting small, discrete changes in a sample which could not be observed with standard absorption procedures, where strong overlapping bands obscure many weaker peaks.

To measure these small absorbance changes, the scientist must have a good spectrophotometer.

Because of its unmatched photometric accuracy, the Cary 118 Spectrophotometer is the ideal instrument for difference measurements (at 0.1 abs the accuracy is 0.00035 abs). Such performance is necessary, since even very small errors can sometimes lead to incorrect interpretation of the spectrum.

In practical terms the 118's exceptional performance frees the scientist from concern about the quality of the data. He knows that any peaks recorded on the spectrum result from sample absorption, and not from an instrument artifact.



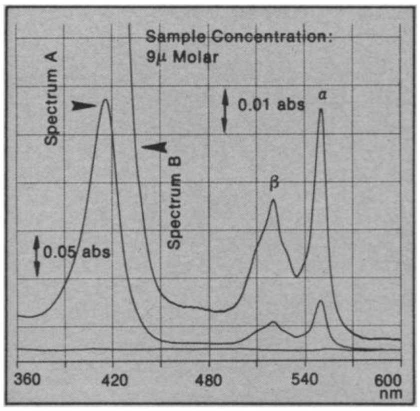
These spectra of oxidized cytochrome C, recorded on the Cary 118, illustrate one effect of pH on this protein. Spectrum A was recorded with identical sample and reference solutions (both pH 7). For Spectrum B the sample was increased to pH 11, while the reference was unchanged. Perturbation of the tyrosine residues becomes readily apparent.

To obtain further information about the Cary 118's capabilities for difference spectroscopy, kinetics, determining concentration in small-volume samples, quantitative analyses, or even recording derivative spectra, circle Reader Service No. 8.

With the Cary 17 changing absorbance ranges makes a mountain out of a mole hill

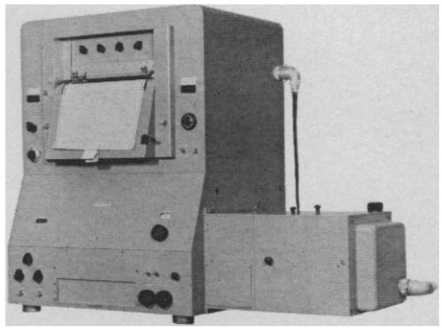
Often when recording a UV-Vis spectrum, a particular wavelength region of interest may produce only a small hump on the spectrum, because the sample's absorption is not very great in that area. In such a situation, changing the absorbance range expands the chart scale and makes it possible to see more spectral detail.

With the Cary 17 Spectrophotometer, switching absorbance ranges is convenient and rapid. The instrument is equipped with a universal absorbance/%T slidewire so that any of eight absorbance ranges or a 0-100 %T range may be selected. This feature, along with the coupled wavelength, scan and chart drive, makes it easy to back up the chart and rescan a particular area using expanded scale to increase the sensitivity of the recording. A small, smooth hump becomes a detailed peak.



To demonstrate the advantages of changing absorbance ranges, these spectra of cytochrome C reduced with ascorbic acid were recorded on the Cary 17. Spectrum A (0-0.5 abs range) fully resolves the Soret band at 415 nm, but shows little detail on the peaks at the longer wavelengths. The expanded presentation in Spectrum B (0-0.1 abs range) gives better detail of the α and β bands at 550 and 520 nm.

A second advantage of the range change capability is that absorbance bands with widely divergent molar absorptivities can be recorded on the same chart, a more convenient presentation for most purposes. Too, it requires less sample preparation because no sample dilution is necessary to bring absorbance values on scale.



Circle Reader Service No. 9 for more information on the Cary 17.

Techtron 635 Spectrophotometer

For life science projects such as gel scanning, kinetics, or thermal denaturation of DNA, the Techtron 635 UV-Vis Spectrophotometer offers exceptional performance at a very low cost. Its ease of operation, large sample compartment, and numerous accessories make it adaptable to almost any routine or research application.

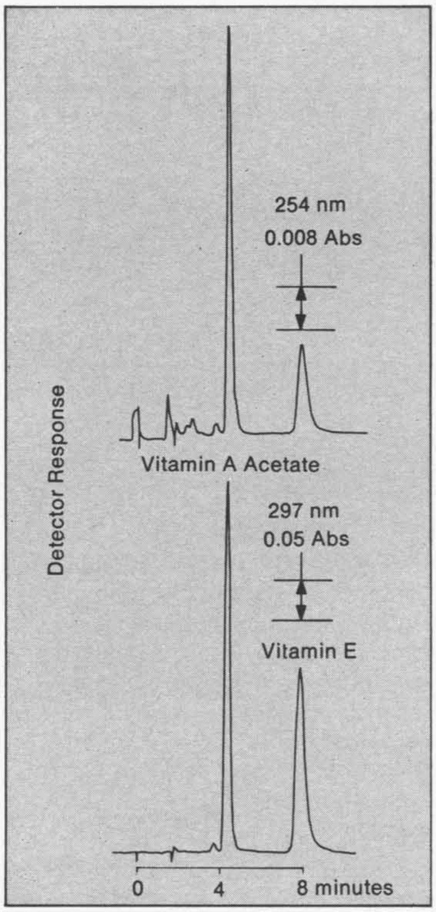
For more information, circle Reader Service No. 10.

The latest in liquid and gas chromatography

New LC/UV chromatograph features selectable detector wavelength

Now you can make LC measurements at the maximum absorption wavelength of virtually any compound, because the detector on this new system operates between 210-780 nm with no sacrifice in efficiency. Versatile, it is almost a universal detector that can be used with gradient elution. Minimum detectable quantities are nanogram amounts as shown in the adjacent chromatogram. Cell volume is small, only 8 microliters, so that peak spreading is minimized.

Two well proven instruments are combined in this LC-UV system. The liquid chromatograph may be one of Varian's high performance models such as the 4200, 4100, or 4000. The spectrophotometer portion of the system is a Varian Techtron 635 fitted with special thermostatted flow cells for HPLC. These cells are actually a matched pair, one containing the sample solution, the other the reference solution.



Analysis of Vitamin A Acetate and Vitamin E: Sample, vitamin A 1.5 x 10^{-6} gm; vitamin E 17.3 x 10^{-6} gm; MicroPak® column 0.24 x 50 cm; eluent, hexanes (98.8), CH_2Cl_2 (1.1), isopropanol (0.1); upper record detector, Varian 254 nm, 0.08 Abs; lower record detector, Techtron 635 at 297 nm, 0.5 Abs.

The Techtron 635 has a carefully matched optical path with a common plane focal point in both sample and reference beams. In addition to helping minimize noise and drift, this also allows wavelength scanning. Precise thermostatting with the water-jacketed cell is also important in decreasing noise and drift. Overall system noise is less than ±5 x 10^{-4} absorbance unit from 210 to 780 nm. Drift is lower than 10^{-2} absorbance unit/hour, highly respectable performance for any LC detector!

Wavelength scanning. An additional capability of the LC-UV system is the wavelength scanning provided by the Techtron 635. A chromatographic analysis can be stopped at a peak by placing the pump in idle without shutting off the system. The Techtron 635 can then be used as a scanning spectrophotometer to obtain an absorption spectrum which is adequate for positive qualitative analysis. When the scan is completed, the separation can be instantaneously started up as if there had been no interruption.

Systems synergism. This new LC-UV system is analogous to GC-MS (gas chromatography-mass spectrometry) where the sample separating ability of chromatography is supplemented by the higher sensitivity, flexibility and qualitative ability of the spectrometer.

Details, including chromatograms and instrument specifications, are yours for the asking. Just circle Reader Service No. 12.

Make your GC automatic with Varian's NOW generation, multi-mount sampler

... 60-sample capacity
... vertical or horizontal mounting
... mount two samplers on many GCs

Actually, we call this a second generation automatic sampler because the first generation died before it reached our drawing boards. Euthanasia. We knew scientists didn't need another "me-to" product, so we leap-frogged into the future.

Now, with this new automatic sampler, you can run your gas chromatograph overnight, unattended, and have chromatograms from 60 samples (contained in four 15-vial quadrant holders which fit into a carrousel unit) by morning. Or, if you'd like to run it continuously for longer periods, each 15-vial holder can be easily removed after its samples are analyzed and replaced with new samples—all while the unit is operating!

Reproducibility is excellent. For example, on the raw peak areas of a paraffin sample, percent standard deviations of 0.42% have been obtained. On normalized areas, percent standard deviations of better than 0.18% have been achieved. Precision which not even a skilled operator can attain.

Here are other reasons why the Aerograph sampler becomes the new standard:

Versatile mounting. Use the same unit for horizontal or vertical injection, right- or left-hand carrousel. Many GCs can accommodate two of these compact samplers (see photo).

Choice of sample sizes. You can inject either of two adjustable sample sizes.

Repetitive injections. Make 1, 2, or 3 injections from each sample vial.

The latest in electronics. Using second generation electronics for autosampling gives total automation capability, including external commands from computers or other sources.

And this new Autosampler fits the standard injector inlet of virtually all Aerograph gas chromatographs and many others also.

For details on this versatile new automatic sampler, circle Reader Service No. 13.

New, easiest-to-use digital integrator... Aerograph Model 485

With only four controls to adjust, the new Model 485 Integrator is the easiest one yet to use. It produces accurate and reliable peak area and retention time measurements with minimum set-up time and is designed for liquid as well as gas chromatography and for unattended automated analyses.

A built-in printer and extensive use of integrated circuits and state-of-the-art design combine reliability with convenience. Key features include: continuously variable filtering, 0.1 μV/sec slope sensitivity, 20mV (±10mV) baseline correction range, 4 digits of retention time, 8 digits of peak area, and 10 digits of total area for large peaks. Automatic separation of small peaks high on a solvent peak tail, area reject and integrate delays, and peak start and stop marks round out the 485's capability.

Analyze the easy way with the new Model 485. For details, circle Reader Service No. 14.

Additional Varian instruments include atomic absorption spectrophotometers, EPR spectrometers, laboratory research electromagnets, laser Raman spectrophotometers, spectropolarimeters, and accessories for major instruments. Write for more information.

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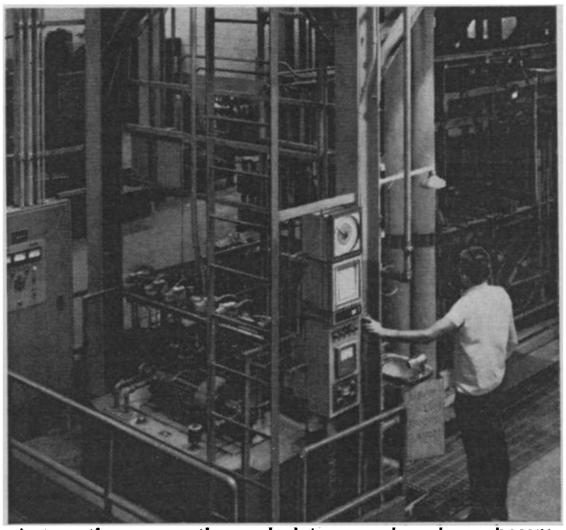
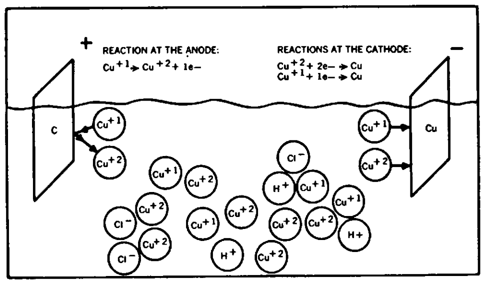
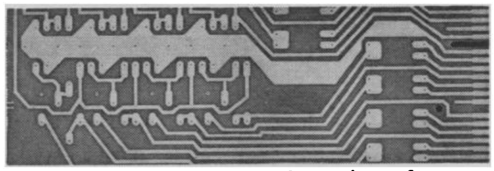
WESTERN ELECTRIC REPORTS



Automatic regeneration and plating machine has a heavy, rubber-lined tank with 22 stationary graphite anodes and 57 rod-like copper cathodes moving at the rate of 90 transfers an hour.



The action at the cathode. Electrochemical reversal of the etching reaction effecting etchant regeneration and copper recovery.



Typical printed wiring board consists of copper (only 0.0028 inch thick) laminated to a phenolic-resin panel. With the new process, unwanted metal is etched away with cupric chloride.

Creating an entirely new way to etch printed circuits.

One of the most common methods of printed circuit manufacturing is by batch-etching with ferric chloride. However, while batch-etching produces circuits of high quality, it also has some processing disadvantages.

For instance, it takes more and more etching time as the etchant is used. Then, to replace the spent etchant means considerable downtime. And the etching of 100,000 circuit boards produces 2000 pounds of copper in a non-recoverable form.

Engineers at our Columbus, Ohio plant set out to discover a better way to etch that would eliminate all of these inherent problems.

Their new process is the first closed-loop, spray-etching system that electrolytically reverses the chemical reaction of etching. It continuously recycles cupric chloride and has reduced the cost of etching wiring boards by over 90%.

Virtually all the problems of the old method have been overcome. No more machine downtime is required to change etchant. No more costly ferric chloride is needed. Etchant strength does not diminish. The etching rate is now constant and faster than the average ferric chloride rate. There's no more waste of etched copper. It is now recovered, about 20 pounds per hour, and resold.

Conclusion: The first completely closed-loop cupric chloride etching system in the printed circuit industry is a major innovation that has improved efficiency and quality, eliminated downtime and decreased costs by more than 90%. Furthermore, it has helped conserve a valuable natural resource.

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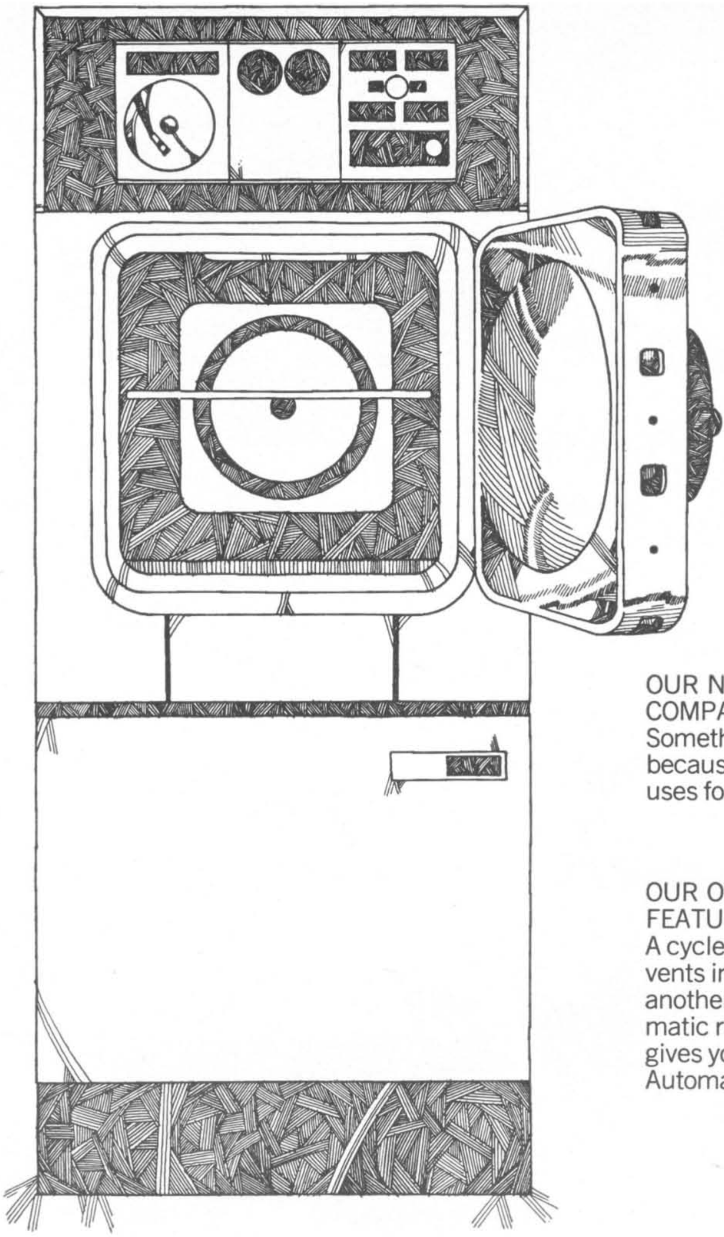
We make things that bring people closer.

OUR NEW CLUTCH-TYPE DOOR.
It audibly tells you it's closed when you close it. The new snap-in door gasket lasts longer and is easier to replace. And we added a door cover because it's easier to clean, reduces radiant heat, and looks better.

OUR PRACTICAL INTERIOR.
The shelves slide and are adjustable now because that makes it easier to use. And the shelves are made of corrosion resistant, electro-polished monel.

OUR MORE POWERFUL GENERATOR.
The 20 KW electric steam generator is 50% more powerful so it heats up faster and improves drying. And it now has an automatic-fill and feedwater pump. Also available for direct steam heat.

OUR SAFETY CODE COMPLIANCE.
Our new sterilizers are UL and CSA approved, ASME code stamped and have electrical systems that comply with NFPA requirements.



OUR NEW STORAGE COMPARTMENT.
Something else we've added because you'll find plenty of uses for it.

OUR OTHER EXTRA FEATURES.
A cycle control interlock prevents inadvertent change to another cycle. And our automatic recycling drying timer gives you repeat operation. Automatically.

Our new laboratory sterilizer. Just the way you'd have designed it yourself.

We think your laboratory equipment should help you with your work by making it easier to get ready to do your work. And that's why our new laboratory sterilizers are designed from your point of view.

Everything about them is practical and functional to help you process lab supplies, culture media, infant formulas, and any other heat and moisture-stable materials. At temperatures from 212°F to 270°F, or lower if you like.

Our rectangular sterilizers come in two sizes with either automatic or manual controls. With direct steam or electric steam heat. We also make a cylindrical model with most of the features described here.

Both are the newest and offer more improvements than any other sterilizer made for research and clinical laboratories. And both are competitively priced and available through your laboratory supply dealer.

If you have any reason to be interested in laboratory sterilizers, you have every reason to find out more about ours. Either from your lab dealer or from us through this magazine.

Barnstead. The people who know everything you need to know about sterilizers and water purification equipment.

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You won't really be sure about him till he's on film

You may not be too sure about him *after* he's on film, either. But at least you'll be able to study him leisurely, with clarity. That is, if you're as careful about photographing specimens as you are in preparing them for electron microscopy. (Besides, it makes things easier for whoever does the printing.)

Kodak gives you a choice of plates and films that lets you tailor your photography to subject and equipment stability. If you're using the SEM, we suggest using KODAK Commercial Film 4127 (ESTAR Thick Base). For transmission electron microscopes—KODAK Electron Image Plates and KODAK Electron Microscope Film 4489 (ESTAR Thick Base).

For print processing, look into the KODAK EKTAMATIC Processor, Model 214-K. It occupies only 12 x 30 inches of table space, and delivers ready-to-use prints on KODAK EKTAMATIC SC Paper in 15 seconds. Filters give you a choice of paper contrasts from one box. Less paper to stock. You never run out of the grade you want.

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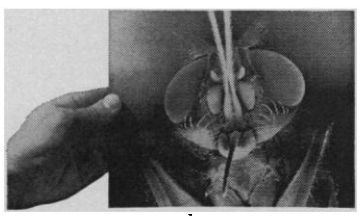

Tsetse fly, seen with a
scanning electron microscope, 60X

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mainline of conservation doctrine stems from Theodore Roosevelt and Gifford Pinchot and is now expounded in marginal economics; granted, also, that the "ecology movement" of the 1970's is a distinct social mutation. The need now is to recognize that these two movements are the obverse sides of the same coin, and that only ecological insight can join them in the service of man. Life is an art, but science is essential to keep our artistic and intellectual inventions functional and ecologically viable.

We have a lot of trouble with this because, as figurators, amateur or professional, we literally invent nature, or at least our quasi-mythological views of nature. Bronowski and Bellugi (*3*) made us aware of the self-reference involved in all our definitions, but we can retain perspective by remembering that the real world of nature, as Whitehead saw, is everything that exists whether we think of it or not (*4*).

The modern problem is that of achieving the objective awareness that we are not independent of the natural ecosystems which have always maintained us, even though we have built seemingly self-sufficient environments (town and country) within the natural environment. The need is to zone our world according to the human uses it will withstand. Instead, almost everywhere man is using technological tricks to overextend himself into life zones that will not maintain him adequately. The world and man become poorer. It is probably a temporary delusion that we in the United States have solved the problems of production. We are maintaining our standards of living by skimming the world's resources and causing other populations to overextend themselves in the process of supplying us. To write, as Krieger does, that "A poor nation is unlikely to destroy very much of its special environments," is to admit that one has never looked at Latin America, or Africa, or poor nations anywhere else.

As Holdridge (*5*) pointed out, a properly zoned world would leave all mountainous forested lands in forest, since these are too steep, too wet, or too dry to graze or farm; it would allow grazing on the gentler slopes and confine crop agriculture to the fertile lowlands. Since such disciplined exploitation would impose a limit on human numbers, it would have to be accepted as rational policy, just as the prudent stockman limits the number of cattle on each pasture he manages. Other sensitive zones, like the estuaries, would be reserved for the common property resources they produce, and not be sacrificed to the asocial greed of possessive individualism.

What is wrong with Krieger's and Disney's plastic trees, then, is that they perpetuate the delusion of man's independence from the life zones he occupies. The plastic tree is like the picture postcard of the Grand Canyon which the ecologically illiterate tourist uses as his standard of comparison. Until we begin to see the system behind the abstractions we invent, our future is tenuous indeed. No amount of incremental rationality, however clever, is likely to suffice to "save man from the catastrophic tricks of his own technology" if our basic strategy remains ecologically unsound. Krieger's faith in "our complex political and social organizations" is misplaced because, as Chamberlain (*6*) showed, growth itself is now a serious threat to these very organizations.

ROLAND C. CLEMENT
National Audubon Society,
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References

1. C. Jung, *Memories, Dreams, and Reflections* (Random House, New York, 1961), p. 256.
2. M. Buber, *The Knowledge of Man* (Harper, New York, 1965).
3. J. Bronowski and U. Bellugi, *Science* **168**, 669 (1970).
4. A. N. Whitehead, *The Concept of Nature* (Cambridge Univ. Press, New York, 1920).
5. L. R. Holdridge, *Life Zone Ecology* (Tropical Research Center, San José, Costa Rica, 1967).
6. N. W. Chamberlain, *Beyond Malthus* (Prentice-Hall, Englewood Cliffs, N.J., 1970).

I was pleased to find one of my very favorite trees on the cover of *Science* (2 Feb.). How well I remember standing in line to climb it with my children at Disneyland in 1969. How I marveled at the luck of finding such a huge tree right where the park was being built; what a good idea to build the Swiss Family Robinson treehouse there! In addition to being a second-rate botanist, I can be distracted by children until my powers of observation are deadened to the point of gross error. What a surprise when I finally asked, "What the hell kind of tree is this anyway?" I reached out to touch a leaf and tried to act nonchalant about my discovery. Soon I was touching all the plants in Disneyland to learn how they survived the strain so well.

I'm glad we saw Mammoth Cave and Grand Canyon before Disneyland, because I found myself touching leaves in places like Yosemite, Crater Lake, and the Olympic Mountains after the shock of unreal realism in plastic.

A national park whose beauties are not well known, but much beloved, is Shenandoah in Virginia. It is unique because the land there was pummeled, pounded, and denuded by men before the Department of the Interior came along to protect it. They could have built plastic trees there, but they didn't. They just let it grow and grow. The views have been much obscured by the real trees in the last 30 years, but owls perch in the branches and swoop down to prey on unsuspecting rodents, while bears scratch the trunks, and visitors from the city quake at the strength of their claws. Most important of all, the real trees fill the air with oxygen and help to overcome the stench of the factory in Front Royal that can't be fenced out.

What's the factory making in the valley? I don't know—maybe plastic leaves for Disneyland.

JAMES R. BRENNAN
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Apropos of plastic trees, Joni Mitchell has described, in a part of the literature with which some of Krieger's readers may not be familiar, the frightening possibilities which make his excellent article so important. Therefore, I pass along part of her observation, much diminished by the lack of instruments ("Big Yellow Taxi" from *Ladies of the Canyon*, Warner Stereo 6376, 1969):

They paved paradise
And put up a parking lot
With a pink hotel, a boutique
And a swinging hot spot.

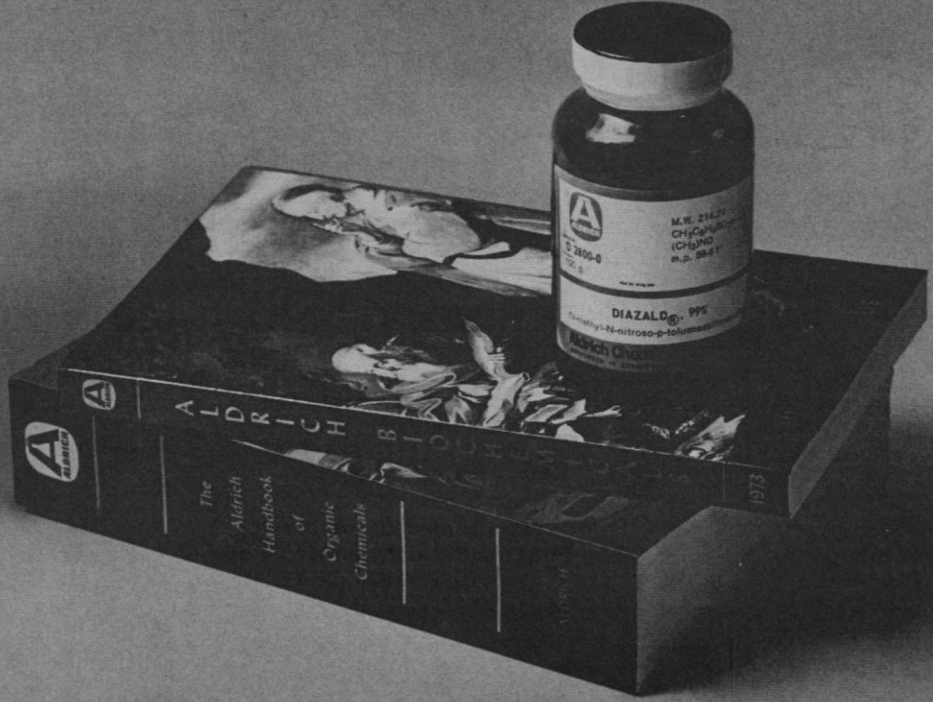
Don't it always seem to go
That you don't know what you've got
Till it's gone.
They paved paradise
And put up a parking lot.

They took all the trees
And put them in a tree museum
And they charged all the people
A dollar and a half just to see 'em.

Don't it always seem to go
That you don't know what you've got
Till it's gone.
They paved paradise
And put up a parking lot.

LEE S. HYDE
Committee on Interstate and Foreign Commerce, U.S. House of Representatives, Washington, D.C.

Ecology, per se, will not answer the questions that Clement brings up. They are appropriately dealt with by morals and politics, perhaps supplemented by scientific knowledge. Hence it still remains unclear whether ecology is bet-



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25 May 1973, Volume 180, Number 4088

SCIENCE

Observing and Predicting Earthquakes

We live on a restless planet. Continents are in motion, as they have been for at least 130 million years and as they are likely to be for a long, long time. These motions give rise to earthquakes, notably around the rim of the Pacific Ocean, but also in other areas. During this century, earthquakes have killed hundreds of thousands of people and caused tremendous property damage. Most are of small intensity, and these occur frequently. In a given locality, the really large events come at intervals of perhaps 50 years or more. Experts believe that, by the end of this century, California will probably experience a killer earthquake causing as much as $20 billion in damage.

After large earthquakes in the past, there have been in-depth studies of the event and its sequel (for example, the Alaskan earthquake). However, studies aimed at prediction have enjoyed relatively less attention. We have learned some lessons from past observations, but we must learn much more if we are to minimize future damage and loss of life.

One desirable goal is the ability to predict both the timing and the intensity of major earthquakes. Recent research has been moving us closer to this goal. Earlier work had indicated that premonitory events precede earthquakes. There have been reports of a change in frequency of occurrence of small local earthquakes preceding a large one. Other effects noted have included changes in tilt, fluid pressures, radon emission, and electric and magnetic fields. Japanese and Soviet scientists have been particularly active in observing these phenomena. In 1969, the Soviet scientists found an effect that seems especially important—a premonitory change in ratios of two seismic velocities, the compressional velocity (V_p) and the shear velocity (V_s). The ratio of V_p to V_s changed by about 15 percent in the periods preceding moderate-sized earthquakes in the Garm region of central Asia. American geophysicists attending the 1971 international meeting in Moscow learned of these findings and have now made similar observations in the United States.

American geophysicists have also developed a model to explain the premonitory phenomena (see p. 851). This involves the changes in strength and in velocities of seismic waves in rocks that are related to the presence or absence of water.

The new explanations tie in very well with field observations that have been made in Colorado. The Denver earthquakes of the 1960's were triggered by deep injection of waste fluids. More recently, experimental injections and withdrawals have been conducted in the Rangely Oil Field. These have demonstrated that stresses can be relieved by injections of water which trigger small, harmless events. On withdrawal of fluid, the earthquakes stopped.

These evidences of progress in prediction are important and interesting, but they are only a beginning. The new information seems applicable to shallow earthquakes but may not be relevant to deep events. Moreover, even with the shallow earthquakes, there may be differences in those that are strike-slip and those that represent overthrusting.

Moreover, the very large events could have features that are qualitatively different from the smaller earthquakes, which are readily studied. If we wish to understand and be able to predict the rare, large earthquakes, we should be seeking premonitory signals everywhere that earthquakes have been known to occur. We should invest in new ideas, development of new instrumentation, and in the establishment of observing networks. Other countries should be encouraged to do likewise, and we should assist them whenever feasible.

The task of minimizing earthquake disasters is a large one and may require decades to complete, but what are decades in a span of millions of years?—PHILIP H. ABELSON

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*Dr. Walter McCrone is President of McCrone Research Institute, Chicago.

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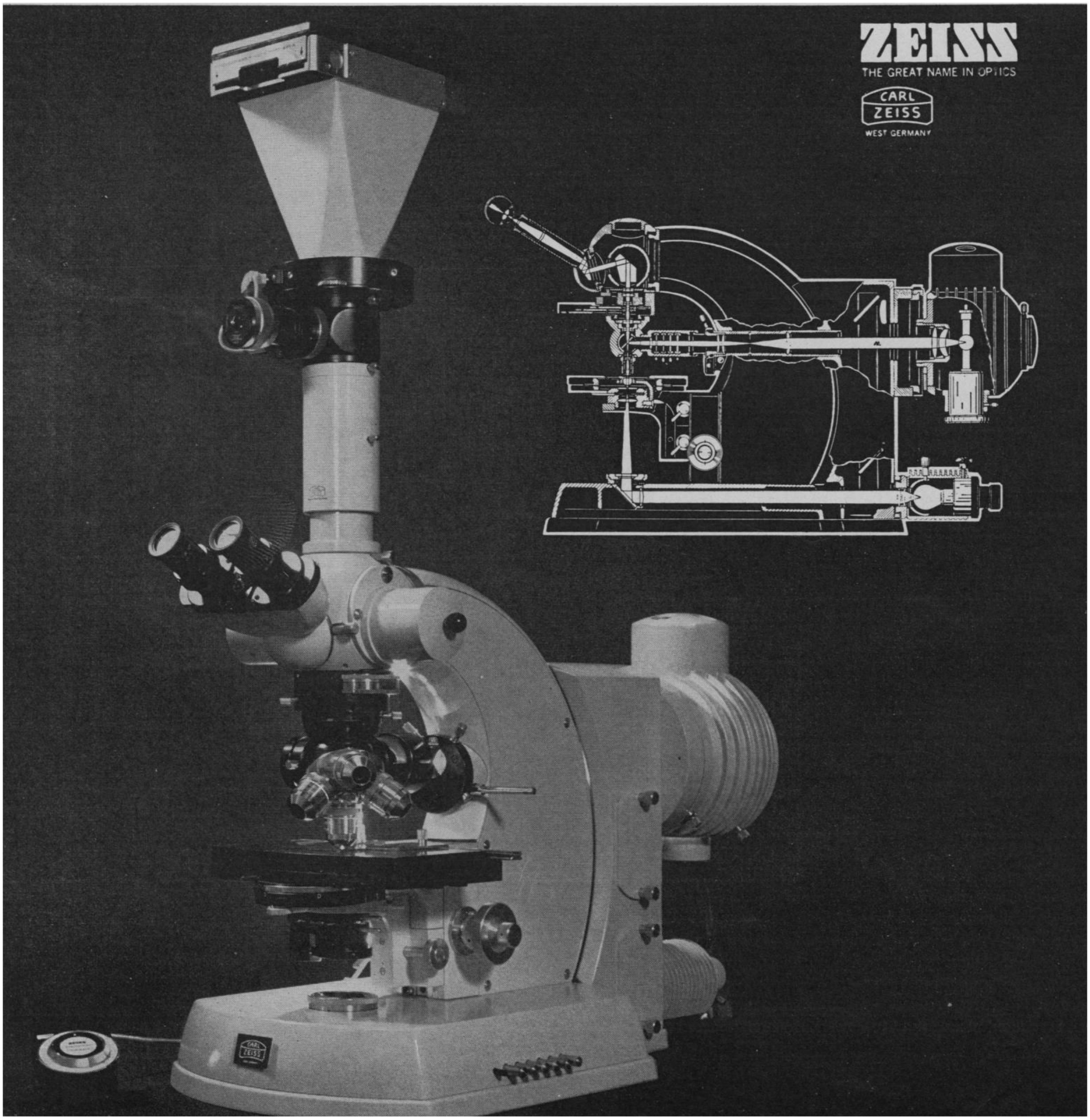

22–27. Symposium on **Man-Machine Communication for Scientific Data Handling**, CODATA Task Group on Computer Use, intern. and interdisciplinary mtg., Bresigau, Germany. (Secretary, CODATA Task Group on Computer Use, c/o M. K. Ward, Intern. Conf. Office, National Research Council of Canada, Ottawa K1A OR6, Canada)

22–27. Conference on **Performance of Full-Scale Structures**, Engineering Foundation, Henniker, N.H. (J. Janney, Wiss, Janney, Elstner & Associates, Northbrook, Ill.)

23–26. **Nuclear and Space Radiation Effects**, Inst. of Electrical and Electronics Engineers, Logan, Utah. (J. S. Nichols, AFWL/ELT, Kirtland Air Force Base, N.M. 87117)

23–26. **Rural Sociological** Soc., College Park, Md. (J. E. Bunkelberger, 306A Comer Hall, Auburn Univ., Auburn, Ala. 36830)

23–27. **Hydrology of Lakes**, intern. symp., Intern. Assoc. of Hydrological Science of the Intern. Union of Geodesy and Geophysics, Helsinki, Finland. (A. P. Pinsak, Lake Survey Center, National Oceanic and Atmospheric Administration, 630 Federal Bldg., Detroit, Mich. 48226)

23–28. **Global Impacts of Applied Microbiology**, 4th intern. conf., American Soc. for Microbiology, São Paulo, Brazil. (A. F. Langlykke, ASM, 1913 I St., NW, Washington, D.C. 20006)

24–28. National **Environmental Health** Assoc., 37th annual, Atlanta, Ga. (N. Pohlit, NEHA, 1600 Pennsylvania, Denver, Colo. 80203)

27–29. **Electronic Materials**, 15th conf., American Inst. of Mining, Metallurgical and Petroleum Engineers, Las Vegas, Nev. (A. J. Strauss, Lincoln Lab., Massachusetts Inst. of Technology, Lexington 02173)

27–31. **Nuclear Techniques in Comparative Studies of Food and Environmental Contamination** Conf., Intern. Atomic Energy Agency, Food and Agriculture Organization of the U.N., and World Health Organization, Otaniemi (near Helsinki), Finland. (J. H. Kane, Office of Information Services, U.S. Atomic Energy Commission, Washington, D.C. 20545)

30–2. American Soc. of **Animal Science**, Lincoln, Neb. (G. P. Lofgreen, Imperial Valley Field Station, 1004 East Holton Rd., El Centro, Calif. 92243)

30–2. American Assoc. of **Physicists in Medicine**, San Diego, Calif. (J. Hilbert, Dept. of Radiology, University Hospital, 220 Dickenson St., San Diego 92103)

30–4. **Observation and Measurement of Atmospheric Pollution**, World Meteorological Organization and World Health Organization, Helsinki, Finland. (V. D. Rockney, Code W13, U.S. National Weather Service, 8060 13th St., Silver Spring, Md. 20910)

August

4–11. **Systematic and Evolutionary Biology**, intern. congr., Boulder, Colo. (J. L. Reveal, Dept. of Botany, Univ. of Maryland, College Park 20742)

4–12. American Soc. of **Plant Taxonomists**, Boulder, Colo. (D. M. Porter, Dept. of Botany, Natl. Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560)

AAAS SOCIO-PSYCHOLOGICAL PRIZE

Through the generosity of the late Arthur F. Bentley, the AAAS offers an annual prize of $1000 for a meritorious essay that furthers understanding of the psychological-social-cultural behavior of human beings.

The AAAS Socio-Psychological Prize is intended to encourage studies and analyses of social behavior based on explicitly stated assumptions or postulates leading to conclusions or deductions that are tested by systematic empirical research or, stated in other terms, to encourage in social inquiry the development and application of the kind of dependable methodology that has proved so fruitful in the natural sciences.

Entries should present a completed analysis of a problem, the relevant data, and an interpretation of the data in terms of the postulates with which the study began.

Unpublished manuscripts and manuscripts published after 1 January 1972 are eligible. The deadline for receipt of entries in the 1973 contest is 1 September. For instructions on how to submit an entry, write to: **Socio-Psychological Prize Contest, 1515 Massachusetts Ave., NW, Washington, D.C. 20005.**

4–12. Society of **Systematic Zoology**, Boulder, Colo. (T. L. Erwin, Dept. of Entomology, Natl. Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560)

5–10. **Engineering Foundation** Conf., Henniker, N.H. (L. B. Wingard, Jr., EF, 345 E. 47 St., New York 10017)

6–10. **Poultry Science** Assoc., Brookings, S.D. (C. B. Ryan, Texas A&M Univ., College Station 77843)

7–10. **Phi Beta Kappa**, Nashville, Tenn. (C. Billman, PBK, 1811 Q St., NW, Washington, D.C. 20009)

8–10. **Cryogenic Engineering**, Atlanta, Ga. (J. E. Jensen, Brookhaven Natl. Lab., 1 E. Fourth, Upton, N.Y. 11973)

9–11. **Salinity:** A Critical Review of Causes and Control, 15th western resources conf., Boulder, Colo. (Bureau of Conferences and Institutes, Div. of Continuing Education, Univ. of Colorado, Boulder 80302)

12–15. American Soc. for **Horticultural Science**, Raleigh, N.C. (C. Blackwell, ASHS, P.O. Box 109, 914 Main St., St. Joseph, Mich. 49085)

12–17. Conference on **Making Service Industries More Productive through Computers and Automation**, Engineering Foundation, Henniker, N.H. (A. McAdams, Chairman, Cornell Univ., Ithaca, N.Y.)

12–17. **Organometallic Chemistry**, 6th intern. conf., Amherst, Mass. (M. D. Rausch, Univ. of Massachusetts, Amherst 01002)

12–17. International **Ornithological** Congr., 16th, Canberra, Australia. (Secretary-General, IOC, P.O. Box 84, Lyneham, A.C.T., Australia 2602)

12–18. **Mechanical, Electrical, and Allied Engineering Branches**, 5th Pan American Congr., Bogotá, Colombia. (E. T. B. Gross, Rensselaer Polytechnic Inst., Troy, N.Y. 12181)

13–16. **Potato** Assoc. of America, Guelph, Ont., Canada. (H. J. Murphy, 114 Deering Hall, Univ. of Maine, Orono 04473)

13–16. Society for the **Study of Reproduction**, 6th annual, Athens, Ga. (C. Cruse, 113 N. Neil St., Champaign, Ill. 61820)

13–17. Australian and New Zealand Assoc. for the **Advancement of Science**, 45th congr., Perth, Western Australia. (E. Underwood, 45th ANZAAS Congr., Univ. of Western Australia, Nedlands 6009)

13–17. **Physics and Chemistry of Fission**, 3rd, Intern. Atomic Energy Agency, Rochester, N.Y. (J. H. Kane, Office of Information Services, Atomic Energy Commission, Washington, D.C. 20545)

13–17. National Council of **Teachers of English** (college section summer conf.), Kalamazoo, Mich. (J. Malmstrom, Dept. of English, Western Michigan Univ., Kalamazoo 49001)

13–18. **Mechanisms of Regulation of Plant Growth**, intern. plant physiology symp., Royal Soc. of New Zealand, Palmerston North. (G. W. Markham, RSNZ, 6 Halswell St., P.O. Box 12249, Wellington, N.Z.)

15–17. **Canadian High Polymer Forum**, 17th, St. Jean, P.Q., Canada. (E. G. Lovering, Pharmaceutical Chemistry Div., Health Protection Branch, Tunney's Pasture, Ottawa, Ont., K1A OL2, Canada)

15–18. National Council of **Teachers of Mathematics**, Fargo, N.D. (NCTM, 1201 16th St., NW, Washington, D.C. 20036)

16–18. National **Wildlife Federation**, Washington, D.C. (T. L. Kimball, NWF, 1412 16th St., NW, Washington, D.C. 20036)

16–30. **Cosmic Ray** Conf., 13th intern., Denver, Colo. (R. L. Chasson, Dept. of Physics, Univ. of Denver, Denver 80210)

19–21. **Symmetry, Similarity and Group-Theoretic Methods in Mechanics**, conf., American Acad. of Mechanics, Calgary, Alberta, Canada. (P. G. Glockner, Dept. of Civil Engineering, Univ. of Calgary, Calgary T2N 1N4)

19–23. American Soc. for **Pharmacology and Experimental Therapeutics**, East Lansing, Mich. (E. B. Cook, ASPET, 9650 Rockville Pike, Bethesda, Md. 20014)

19–24. **Career Guidance for Women Entering Engineering**, Conf., Engineering Foundation, Henniker, N.H. (N. Fitzroy, General Electric Co., Schenectady, N.Y.)

19–24. Society for **Industrial Microbiology**, Evanston, Ill. (W. M. Stark, Lilly Research Labs., Eli Lilly & Co., Indianapolis, Ind. 46206)

19–24. International Symp. on **Microchemical Techniques**, sponsored by American Microchemical Soc., Intern. Union of Pure and Applied Chemistry, Commission on Microchemical Techniques, and Div.

of Analytical Chemistry, University Park, Pa. (H. J. Francis, Jr., Pennwalt Corp., 900 First Ave., King of Prussia, Pa. 19406)

19–29. International Assoc. of **Agricultural Economists**, 15th intern. congr., São Paulo, Brazil. (V. J. Pellegrini, Rua Xavier Silveria H 57, Apr 102, Copacabana, Rio de Janeiro, Brazil)

20–21. **Spectroscopy**, 15th, Soc. for Applied Spectroscopy, Denver, Colo. (R. H. Heidel, U.S. Geological Survey, Bldg. 25, Denver Federal Center, Denver 80225)

20–24. **Texturization Theory, Determination and Control of Physical Properties of Food Materials**, Amherst, Mass. (C. Rha, Agricultural Engineering Bldg., Univ. of Massachusetts, Amherst 01002)

20–25. American **Physiological** Soc., Rochester, N.Y. (Mrs. G. Hamilton, APS, 9650 Rockville Pike, Bethesda, Md. 20014)

20–26. **Leprosy** Congr., 10th intern., Bergen, Norway. (S. G. Browne, 16 Bridgefield Rd., Sutton, Surrey, England)

20–29. **Genetics**, 13th intern. congr., Berkeley, Calif. (S. W. Brown, Dept. of Genetics, 345 Mulford Hall, Univ. of California, Berkeley 94720)

21–24. International **Chemistry Teachers** Conf., Chemical Education Divs., of the Chemical Inst. of Canada and the American Chemical Soc., Waterloo, Ont. (L. H. Sibley, St. Catharines Collegiate Inst. and Vocational School, 34 Catherine St., St. Catharines, Ontario, Canada)

22–24. **Applications of X-ray Analysis**, 22nd annual conf., Denver, Colo. (C. O. Rudd, Metallurgy and Materials Science Div., Denver Research Inst., Univ. of Denver, Denver 80210)

22–25. National Council of **Teachers of Mathematics**, Fort Worth, Texas. (NCTM, 1201 16th St., NW, Washington, D.C. 20036)

25–26. **Mathematical Psychologists**, 6th annual, Montreal, Canada. (A. A. J. Marley, Dept. of Psychology, P.O. Box 6070, Montreal 101, P.Q.)

25–28. American **Astronomical** Soc., Columbus, Ohio. (H. M. Gurin, AAS, 211 FitzRandolph Rd., Princeton, N.J. 08540)

27–29. **Comparative Virology**, 2nd intern. conf., Mont Gabriel, P.Q., Canada. (E. Kurstak, Univ. of Montreal, P.O. Box 6128, Montreal 101, P.Q., Canada)

27–30. American **Sociological** Assoc., New York, N.Y. (N. J. Demerath, ASA, 1001 Connecticut Ave., NW, Washington, D.C. 20036)

27–31. NATO Conf. on **Cybernetic Modeling of Adaptive Organizations**, Porto, Portugal. (D. Howland, College of Administrative Science, Ohio State Univ., 1775 S. College Rd., Columbus 43210)

27–1. **Leucocyte Culture** Conf., 8th, Uppsala, Sweden. (K. Lindahl-Kiessling, Inst. for Medical Genetics, Univ. of Uppsala, V. Agatan 24, S-752-20 Uppsala)

28–30. Association for **Computing Machinery**, Atlanta, Ga. (G. Smith, ACM, 1133 Ave. of the Americas, New York 10036)

September

1–7. **Electroencephalography and Clinical Neurophysiology**, 8th intern. congr., Marseille, France. (G.-C. Lairy, Laboratoire d'EEG, Hôpital Henri Rousselle, 1, rue Cabanis, Paris 14e France)

2–6. **Victimology**, intern. symp., World Psychiatric Assoc., Jerusalem, Israel. (I. Drapkin, Organizing Committee of Criminology, Faculty of Law, Hebrew Univ. of Jerusalem, P.O. Box 4051, Jerusalem)

2–7. **Bacteriology**, intern. congr., American Soc. for Microbiology, Jerusalem, Israel. (A. F. Langlykke, ASM, 1913 I St., NW, Washington, D.C. 20006)

2–7. International Congr. on **Mercury**, sponsored by the Inst. Tecnologico Metalurgico Emilio Jimeno–Univ. of Barcelona, and the Consejo de Administracion de las Minas de Almaden y Arrayanes, Barcelona, Spain. [Secretaria del Congreso, Facultad de Ciencias (Pedralbes), Univ. of Barcelona, Barcelona-14]

2–8. **Birth Defects**, 4th intern. conf., National Foundation–March of Dimes, Vienna, Austria. (Intern. Medical Congr., Ltd., c/o National Foundation, 1275 Mamaroneck Ave., White Plains, N.Y. 10605)

2–10. Society of **Protozoologists**, Clermont-Ferrand, France. (D. M. Hammond, Dept. of Zoology, Utah State Univ., Logan 84321)

2–14. **Tropical Medicine and Malaria**, 9th intern. congr., Athens, Greece. (E. M. H. Mofidi, School of Public Health, Univ. of Tehran, Tehran, Iran)

3–6. **Chemical Thermodynamics**, 3rd intern. conf., Intern. Union of Pure and Applied Chemistry, Baden, Vienna, Austria. (F. Kohler, Inst. of Physical Chemistry, Univ. of Vienna, Wahringerstr. 42, A-1090 Vienna)

3–6. **Stress Analysis** Group, annual conf., Inst. of Physics, Bath, England. (Meetings Officer, IP, 47 Belgrave Sq., London, SWIX 8QX, England)

3–7. Symposium on **Isotopes and Radiation Techniques in Studies of Soil Physics, Irrigation and Drainage in Relation to Crop Production**, Intern. Atomic Energy Agency, Nicosia, Cyprus. (J. H. Kane, Office of Information Services, U.S. Atomic Energy Commission, Washington, D.C. 20545)

3–7. **Molecular Sieves**, 3rd intern. conf., Eidgenossische Technische Hochschule and the Swiss Chemical Soc., Zurich, Switzerland. (W. M. Meier, Inst. fur Kristallographie der ETH, Sonneggstr. 5. 8006 Zurich)

3–7. **Pharmaceutical Sciences**, 33rd intern. congr., Stockholm, Sweden. (FIP-Congr. 1973, Box 1142, S-111 81 Stockholm)

3–7. International Union of **Pure and Applied Chemistry**, 24th intern. congr., Hamburg, Germany. (Secretariat, 7 Via Cornelio Celso, 00161 Rome, Italy)

3–9. Symposium on **Photoelastic Effects and Its Applications**, Intern. Union of Theoretical and Applied Mechanics, Brussels, Belgium. (J. Kestens, Laboratoire d'analyse des Contraintes, Universite Libre de Bruxelles 87, Avenue Ad. Buyl, Brussels 5)

4–8. American **Political Science** Assoc., New Orleans, La. (E. M. Kirkpatrick, APSA, 1527 New Hampshire Ave., NW, Washington, D.C. 20036)

4–12. International Assoc. for the **Scientific Study of Mental Deficiency**, 3rd congr., The Hague, Netherlands. (M. I. I. Goldberg, Box 83, Teachers College, Columbia Univ., New York 10027)

4–14. International **Radiation Protection**

Assoc., 3rd intern. congr., Washington, D.C. (R. J. Catlin, U.S. Atomic Energy Commission, Washington, D.C. 20545)

5–7. **Marine Technology** Soc., Washington, D.C. (R. W. Niblock, MTS, 1730 M St., NW, Washington, D.C. 20036)

5–7. **Nuclear Structure: Heavy Ions** Conf., Inst. of Physics, Manchester, England. (Meetings Officer, IP, 47 Belgrave Sq., London, SWIX 8QX, England)

5–8. Society of **General Physiologists**, Woods Hole, Mass. (C. Edwards, Dept. of Biological Sciences, State Univ. of New York, Albany 12222)

5–8. International Conf. on **Magnetic Structures in Superconductors**, American Physical Soc., Argonne Natl. Lab., Intern. Inst. of Refrigeration, Intern. Union of Pure and Applied Physics, and Natl. Science Foundation, Argonne, Ill. (R. P. Huebener, Solid State Science Div., Argonne Natl. Lab., Argonne 60439)

5–12. American **Phytopathological** Soc., 65th mtg., Minneapolis, Minn. (R. J. Green, Jr., Dept. of Botany and Plant Pathology, Purdue Univ., Lafayette, Ind. 47907)

5–12. **Plant Pathology**, 2nd intern. congr., Intern. Soc. for Plant Pathology, Minneapolis, Minn. (J. E. Mitchell, Dept. of Plant Pathology, Univ. of Wisconsin, Madison 53706)

6–8. **Parapsychological** Assoc., 16th mtg., Charlottesville, Va. (R. L. Morris, Psychical Research Foundation, Duke Station, Durham, N.C. 27706)

6–10. **Plasma Chemistry** Symp., Intern. Union of Pure and Applied Chemistry, Kiel, Germany. (J. R. Hollahan, NASA-Ames Research Center, M/S 239-4 Moffett Field, Calif. 94035)

7–9. **More Learning: Less Teaching** Conf., Inst. of Physics, Guildford, England. (Meetings Officer, IP, 47 Belgrave Sq., London, SWIX 8QX, England)

8–11. American **Fisheries** Soc., Orlando, Fla. (R. A. Wade, AFS, 1319 18th St., NW, Washington, D.C. 20036)

8–15. **Chemotherapy**, 8th intern. congr., Athens, Greece. (P. Kontomichalou, P.O. Box 1554, Athens)

8–15. **Neurology**, 10th intern. congr., Barcelona, Spain. (J. M. Espadaler, Consejo de Ciento, 318, Barcelona-7)

9–12. American **Ceramic** Soc. (Electronics Div.), Atlanta, Ga. (F. P. Reid, ACS, 4055 North High St., Columbus, Ohio 43214)

9–13. **Marine Plankton and Sediments**, 3rd planktonic conf., Intern. Council of Scientific Unions, Scientific Committee on Oceanic Research, Working Group 37, Kiel, Germany. (E. Seibold, Geologisches Institut der Universitat, Olshausenstr. 40/60, 23 Kiel)

9–13. International Assoc. on **Water Pollution Research**, 7th, Paris, France. (B. B. Berger, Room 211, Graduate Research Center, Water Resources Research Center, Univ. of Massachusetts, Amherst 01002)

9–14. American **Chemical** Soc., 166th natl. mtg., Chicago, Ill. (Meetings Manager, ACS, 1155 16th St., NW, Washington, D.C. 20036)

9–21. International Assoc. of **Geomagnetism and Aeronomy**, Kyoto, Japan. (Prof. Rikitake, Earthquake Research Inst., Univ. of Tokyo, 2-11-16, Yayoi, Bunkyo-ku, Tokyo, Japan)

PRODUCTS and MATERIALS

Spectral Interpretation Materials

Mass spectrometry is the subject of a program produced for laboratory technicians, researchers, and students of analytic techniques. The material is authored by Dr. Cathryn Fenselau of Johns Hopkins University School of Medicine. It includes a set of 50 spectra in the form of transparencies for slide projection or for overhead projection, a student workbook which includes reproductions of 40 identified spectra and 10 unknowns and ample space for notation in a vinyl three-ring binder, and samples of substances for analysis (unknowns whose spectra are included among the transparencies). The written material is also available on tape cassette for use at home with the workbook. The mass spectrometry materials parallel materials for interpretation of infrared, Raman, and nuclear magnetic resonance spectra. The programs are well designed for visually oriented courses or for individual study. They cover effects of most of the functional groups encountered in chemical analysis whether it be for physical or biological applications. J. Huley Associates. Circle No. 121 on Readers' Service Card.

Speech Prosthesis

VoiceBak (Fig. 1) is a prosthesis that restores speech to the laryngectomee. The device can be easily installed, worn, and removed for cleaning each day. It does not interfere with eating, drinking, or swallowing and there is no danger of aspiration. Operation is automatic with no finger control. Air from the lungs is directed through a tracheostoma into a valve that redirects the air through a fistula valve into the esophagus. The air passes over vibratory tissues in the throat and up into the mouth where articulation takes place. VoiceBak weighs only 3 ounces and may be concealed by a scarf and blouse or shirt and tie. Materials used in its manufacture include Cycolac X-27 ABS plastic, surgical trade latex and Silastic, and sterling silver. The speech produced with the device was judged preferable and more intelligible than that produced by an electric larynx and was judged to be as intelligible and acceptable as speech produced by superior esophageal speakers. Little training is required to master its use. LaBarge, Incorporated. Circle No. 122 on Readers' Service Card.

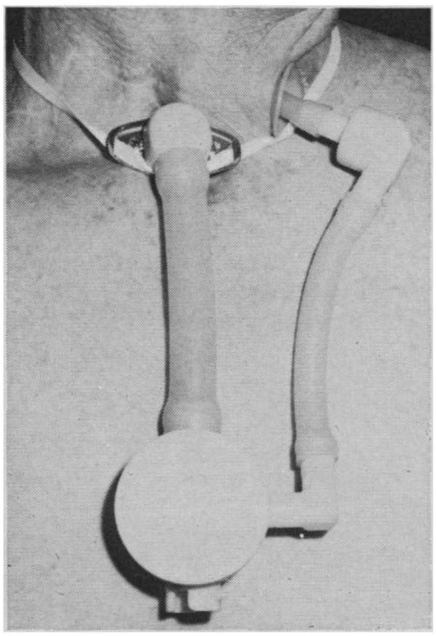

Fig. 1. A laryngectomee with the LaBarge VoiceBak prosthesis in place. The device enables speech with little training in its use and simple care and it is fully automatic but not electric. The device is lightweight and easily worn under a scarf and blouse or shirt and tie.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (see pages 806A and 878C) and placing it in the mailbox. Postage is free.—Richard G. Sommer

Glaucoma Diagnosis

The noncontact tonometer measures intraocular pressure without mechanical contact with the eye. This enables the diagnosis of glaucoma with far less discomfort to the patient and without the use of a topical anesthetic. The device utilizes a brief, controlled air pulse and displays the intraocular pressure instantly on a digital readout. The measurement is completed in milliseconds; the patient experiences only a blink reflex. The danger of infection through contamination of contact devices is eliminated. Operator error is minimized and little training is required. Replicate measurements may be made without modification of the intraocular pressure or of the cornea. Solid state circuitry contributes to the accuracy and reliability of the device. American Optical. Circle No. 123 on Readers' Service Card.

Quantitative Cytotoxic Assay

The Cytograf permits rapid assays in which live and dead cells are distinguished by trypan blue exclusion and uptake, respectively. The instrument replaces subjective estimation of viability based upon observation with a microscope. Cells are measured individually at rates up to several thousand per second. The Cytograf is also a cell counter in the conventional sense. Bio/Physics Systems Incorporated. Circle No. 124 on Readers' Service Card.

Graphic Display of Data

Direct digital graphics is a method of presenting data simultaneously in a digital and an analog mode. The basis of the system is a group of characters from 0 to 15 collectively termed Opti-Font (Fig. 2). Each character is clearly readable as a number. Each is weighted differently in the amount of space it occupies and there are four different printing intensities from light gray to full black. The intensities may be used in combination with the 16 Opti-Font characters to give 64 different "characters" or they may be used separately for another parameter. Thus, when data is displayed, there is a readily visible graphic pattern in addition to the specific values represented (Fig. 3). The device that utilizes Opti-Font is the Digicoder. This is a solid state processor/controller that utilizes

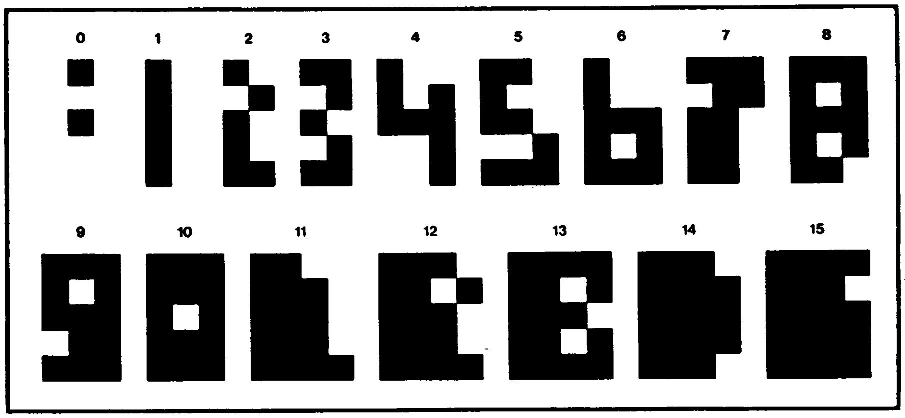

Fig. 2. The 16 characters of the Opti-Font system are unique numerals and they occupy different amounts of space on the page. In addition, they may be printed at four different intensities. The Opti-Font characters are utilized by a processor/controller in generating displays of data in combined analog and digital modes.

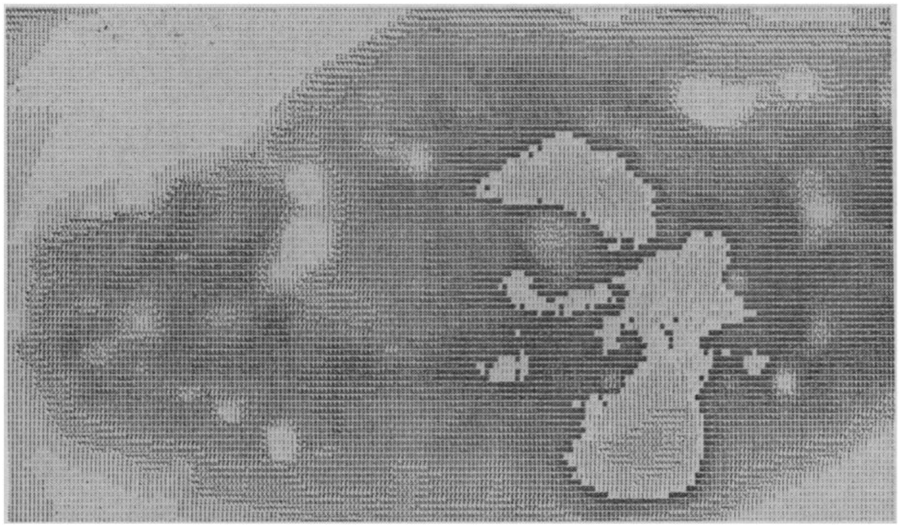

Fig. 3. Scanned proton radiograph of human brain. A sample of data displayed by the Digicoder with the Opti-Font character system. Although the digital values are preserved and available on close inspection of a display or printout, there is also a readily visible analog pattern to the data. The device and character system are products of Digicom, Incorporated.

raw digital data to generate displays. The Digicoder interfaces with on-line systems, cathode-ray tube terminals, facsimile printers, and other data processing devices. Digicom, Incorporated. Circle No. 120 on Readers' Service Card.

Literature

1973 New Product Catalog I lists pH meters, membrane and filtration systems, plastic ware, immunoelectrophoresis apparatus, pumps, ultrasonic cleaners, pipettes, and other products of eight manufacturers: Beckman, Sartorius, Bel-Art, Bioware, Manostat, Branson, Sherwood, and Labindustries. Science Essentials Co. Circle No. 134 on Readers' Service Card.

Precision Components for Analytical Instrumentation summarizes a line of controllers, regulators, flowmeters, and valves. Brooks Instrument Division, Emerson Electric Co. Circle No. 135 on Readers' Service Card.

Spectrophotometers describes a line of direct-reading instruments and test sets for a variety of water and wastewater analysis. The brochure also describes a 200-page *Handbook for Water Analysis* provided with each instrument. Hach Chemical. Circle No. 129 on Readers' Service Card.

Fiberglass Pumps is a bulletin illustrating devices for handling corrosive liquids. Sethco Pump. Circle No. 130 on Readers' Service Card.

Compact High Sensitivity Double Focusing Mass Spectrometer describes the JMS-D100 line of apparatus. JEOL (USA). Circle No. 132 on Readers' Service Card.