SCIENCE

3 April 1970

Vol. 168, No. 3927

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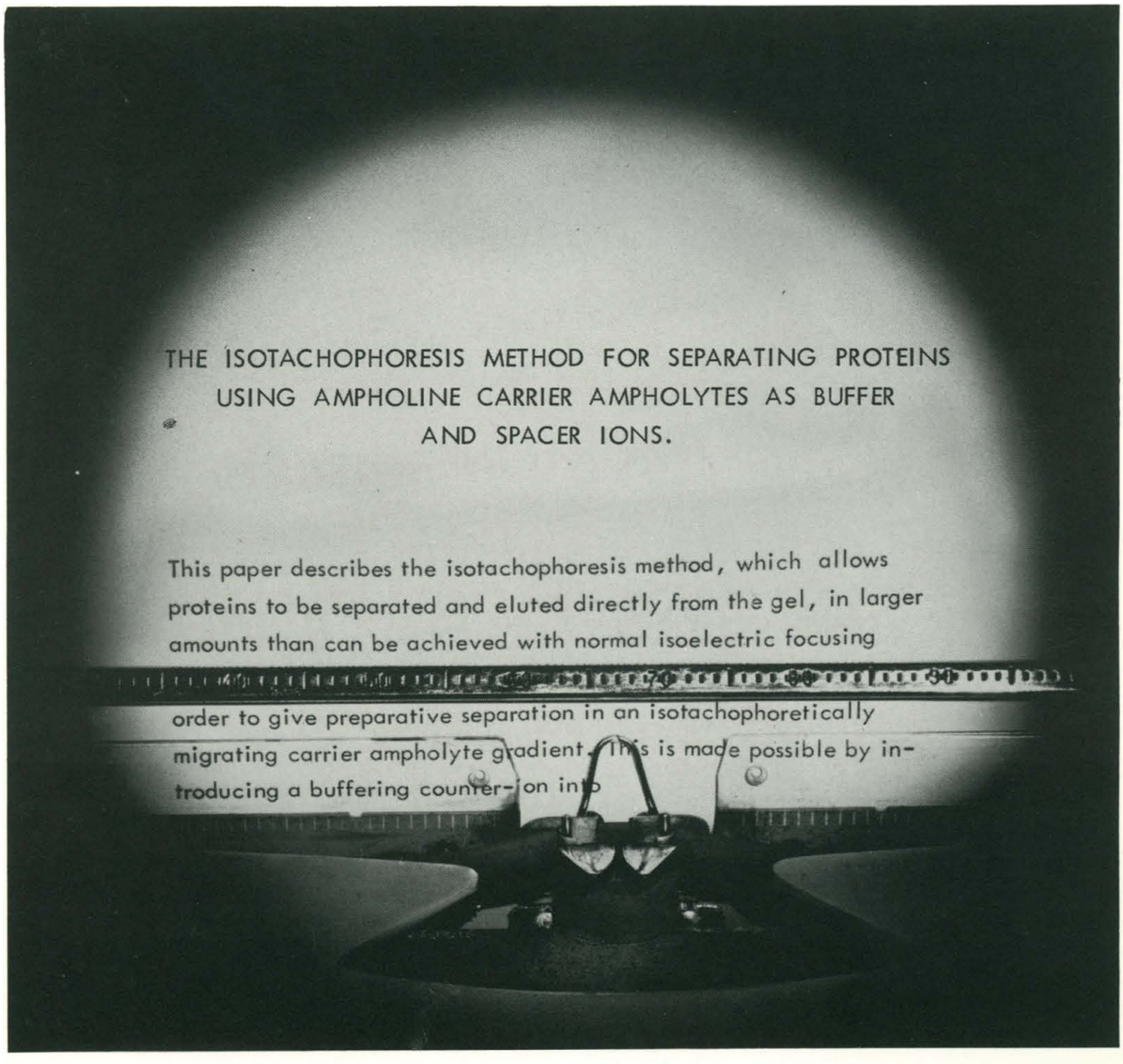

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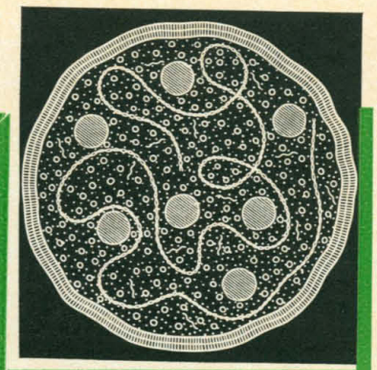

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COVER

The process of a child's separating himself from his mother commences at infancy when a child creeps away from his mother's side. Such separation progresses through many stages—leaving the house to play; going off to school and college; and finally becoming a parent. See page 78. [Gary Laurish Photography, Washington]

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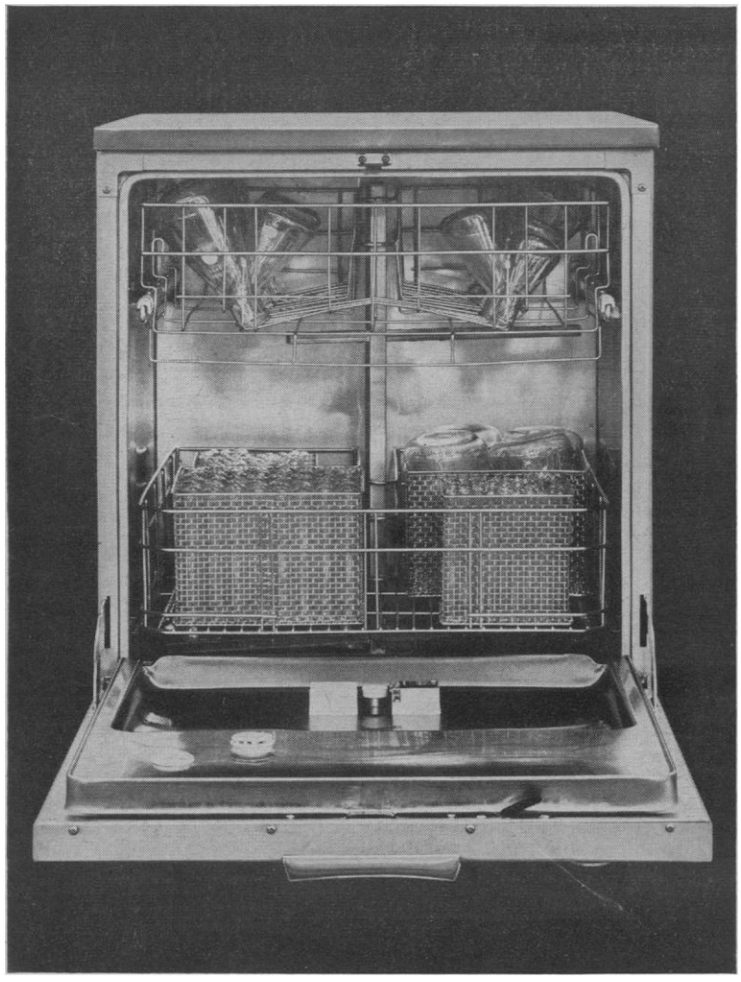

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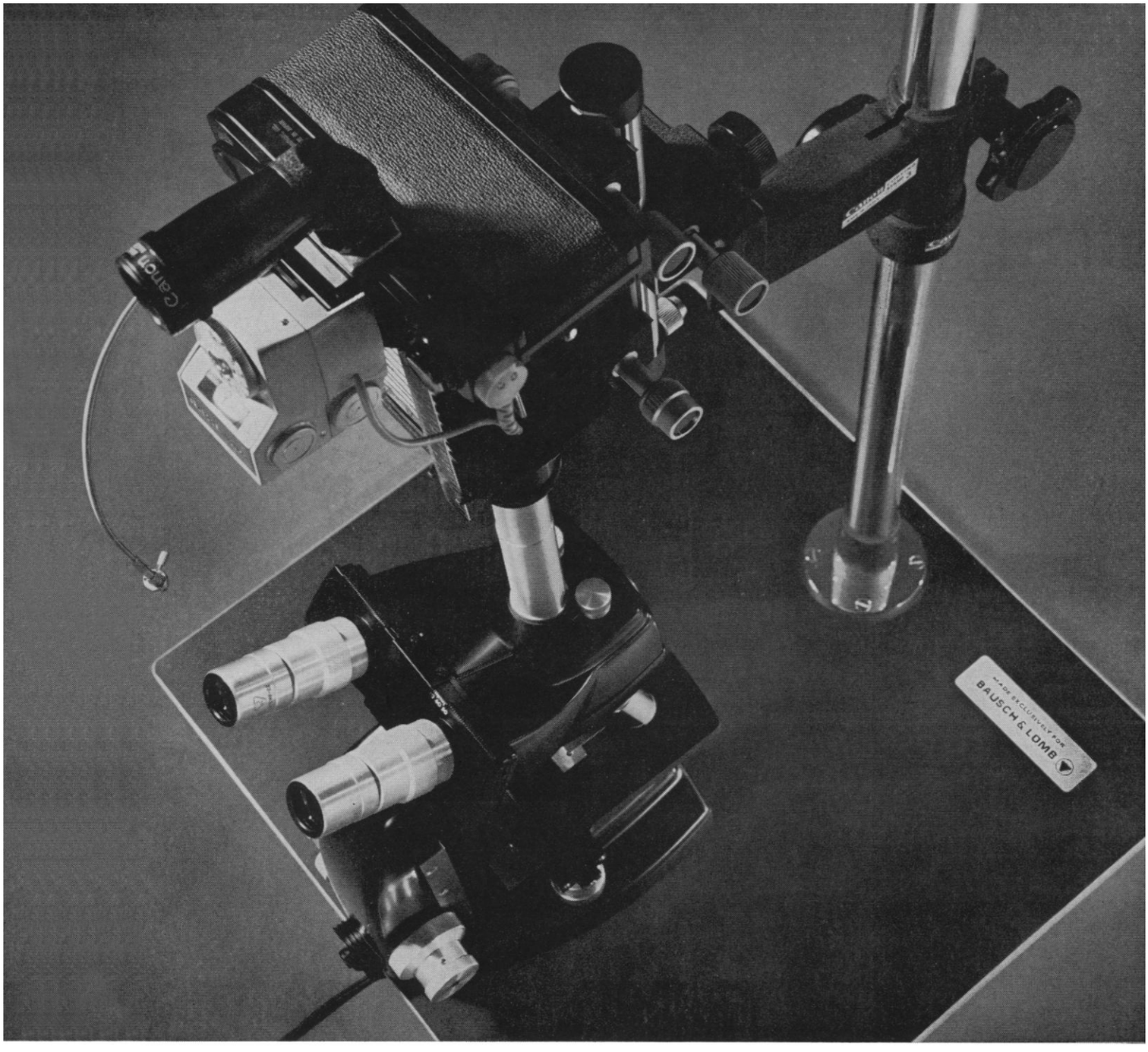

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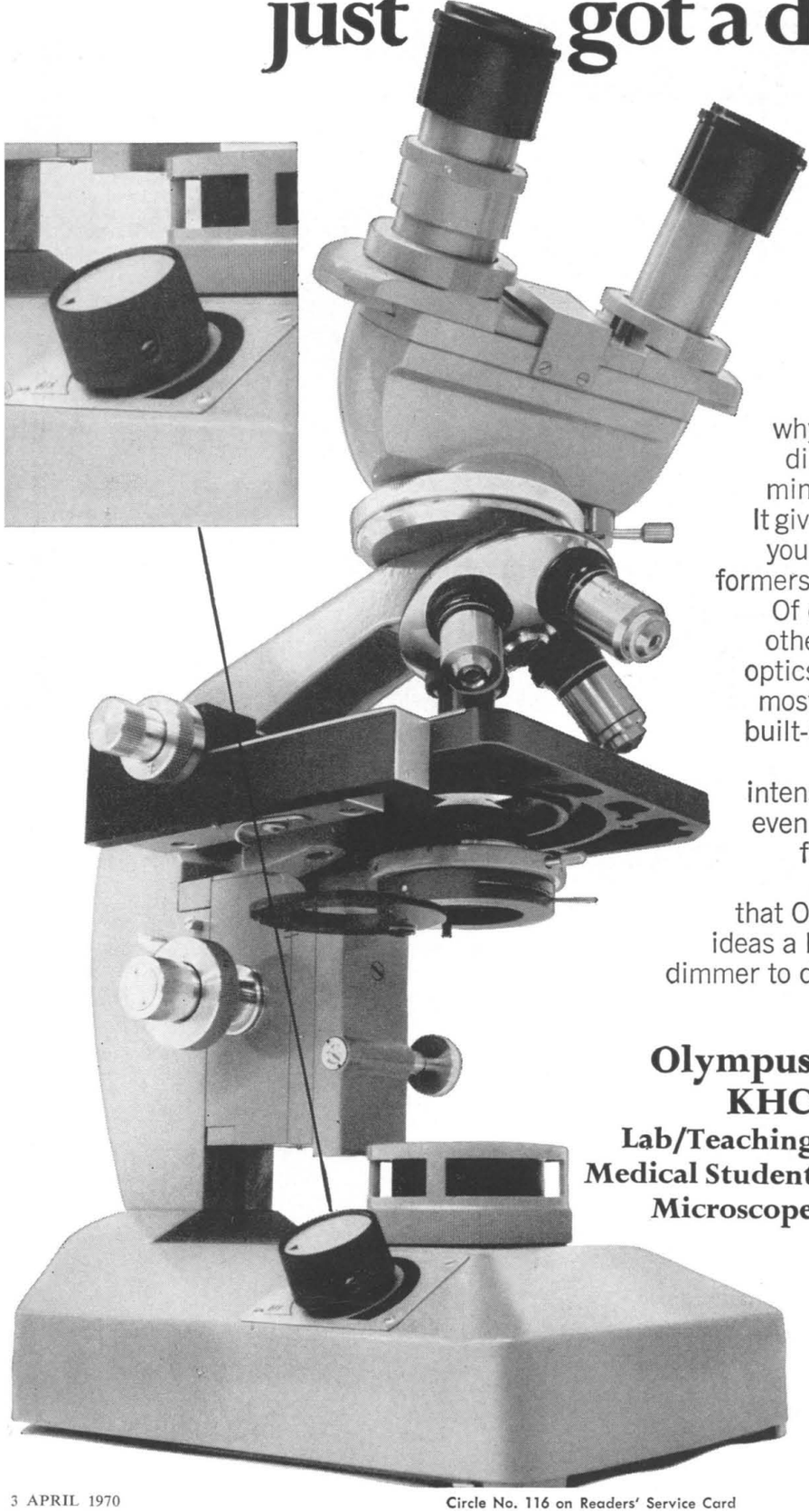

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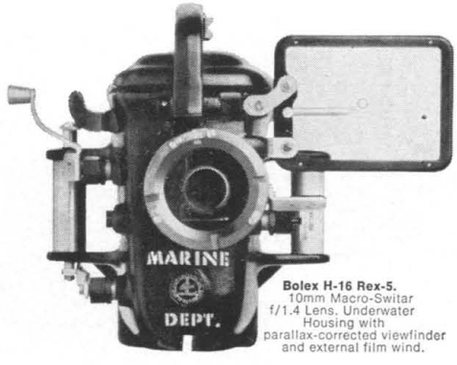

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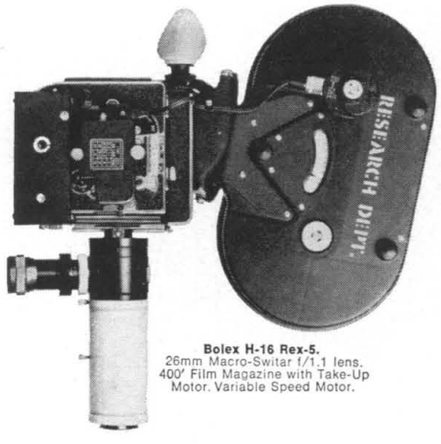

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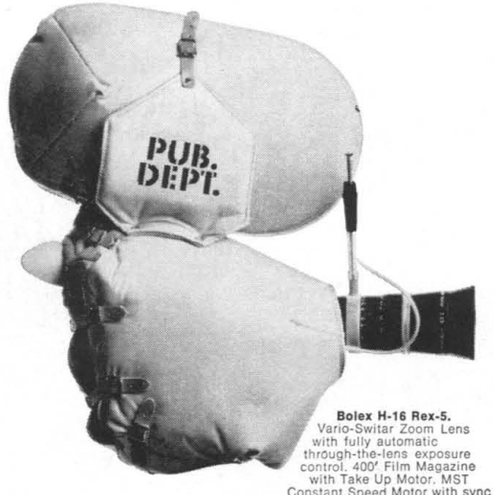

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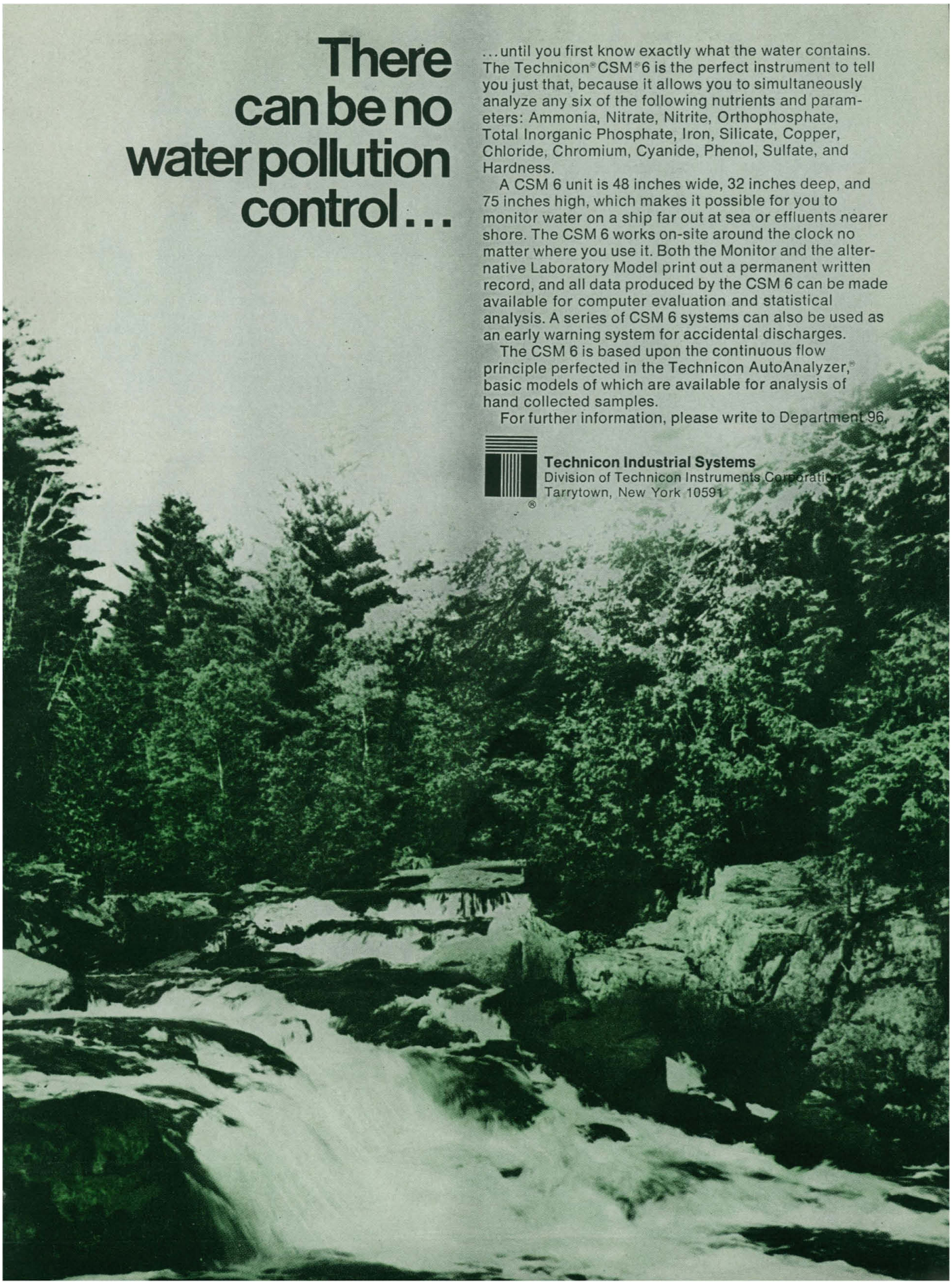

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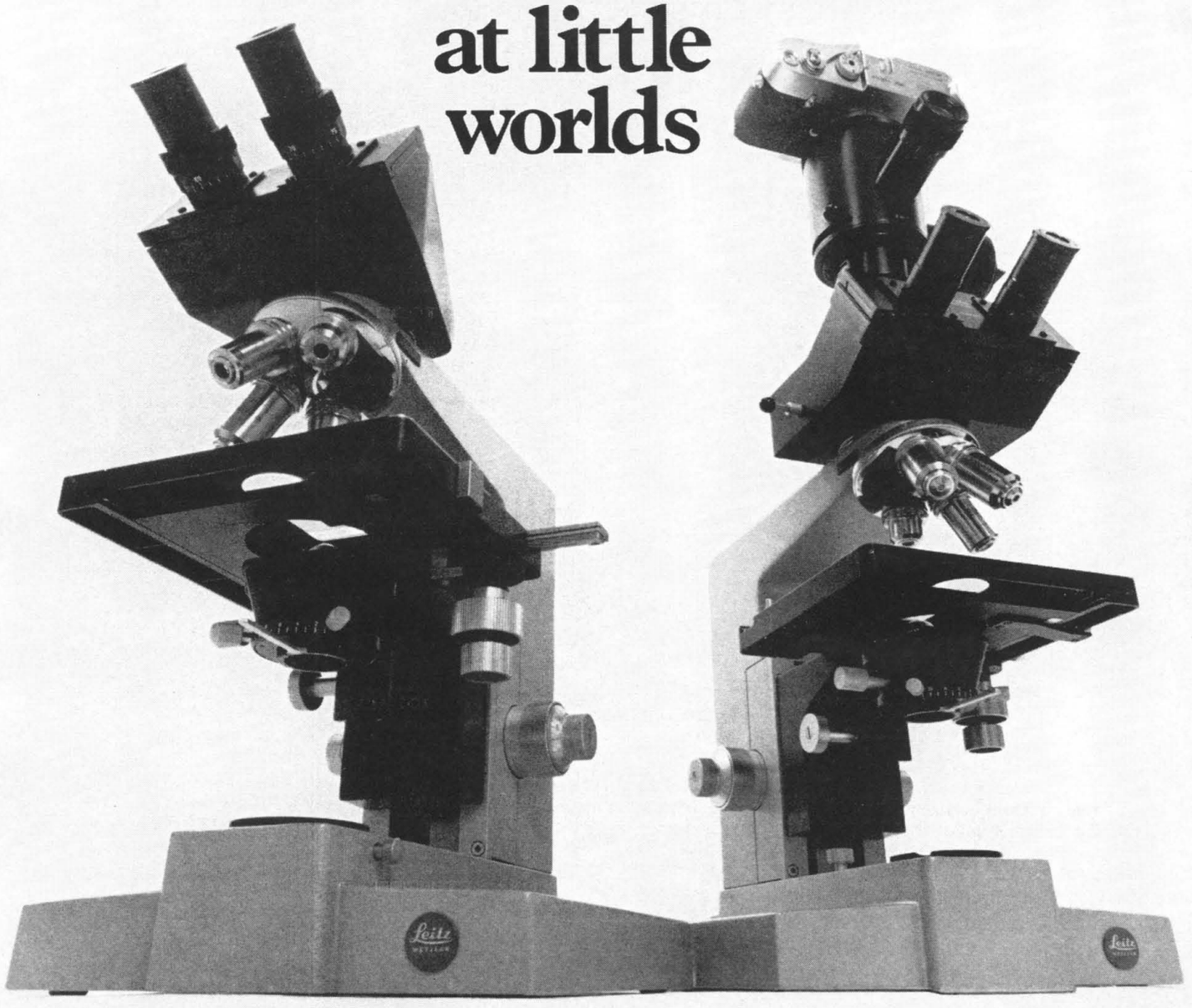

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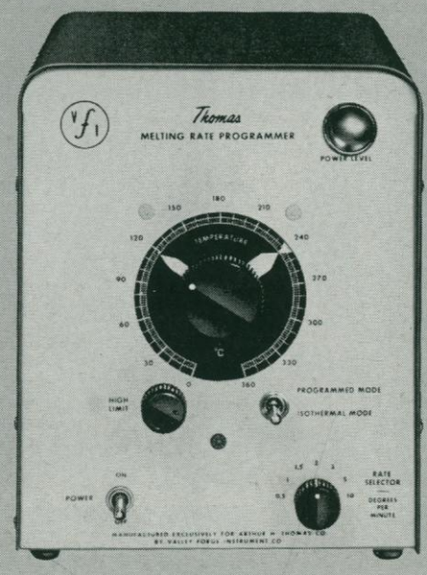

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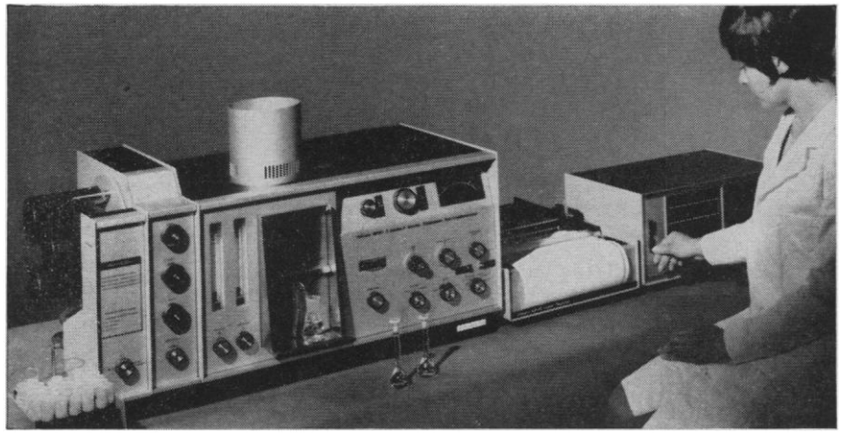

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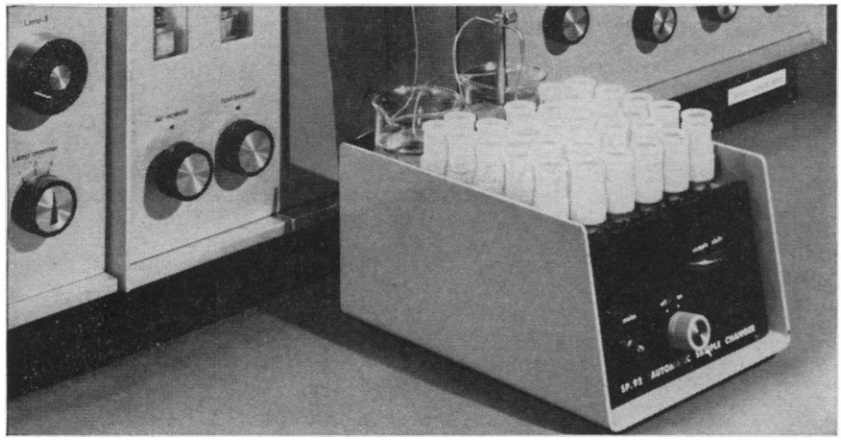

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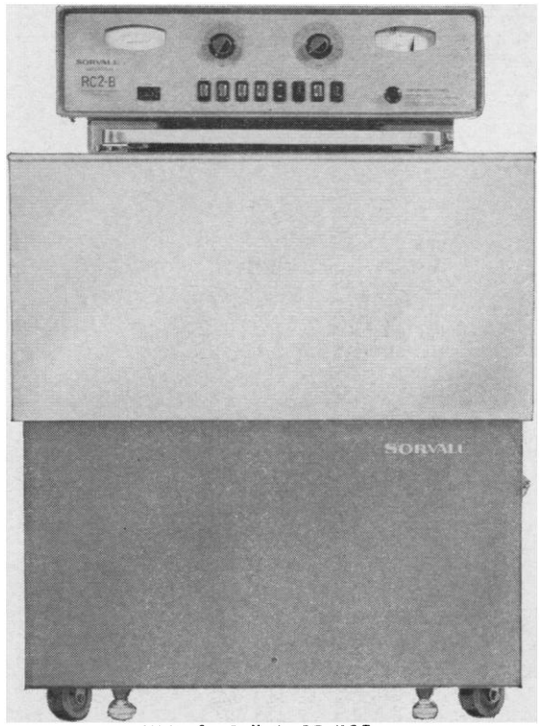

Write for Bulletin SC-4LSC

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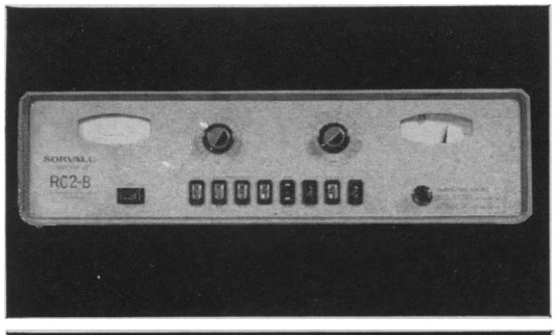

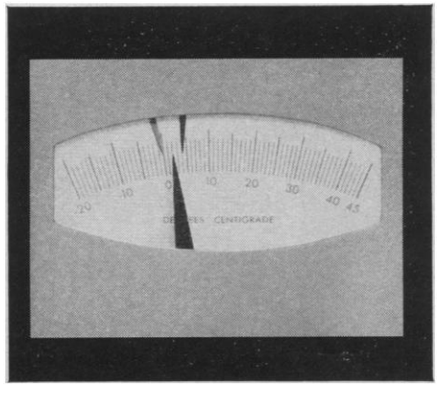

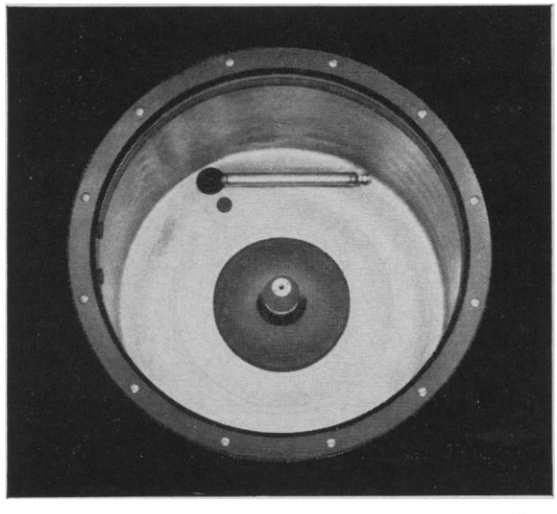

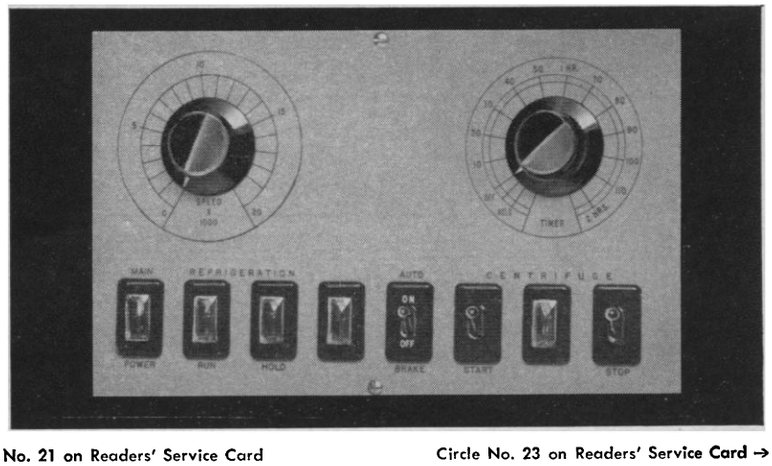

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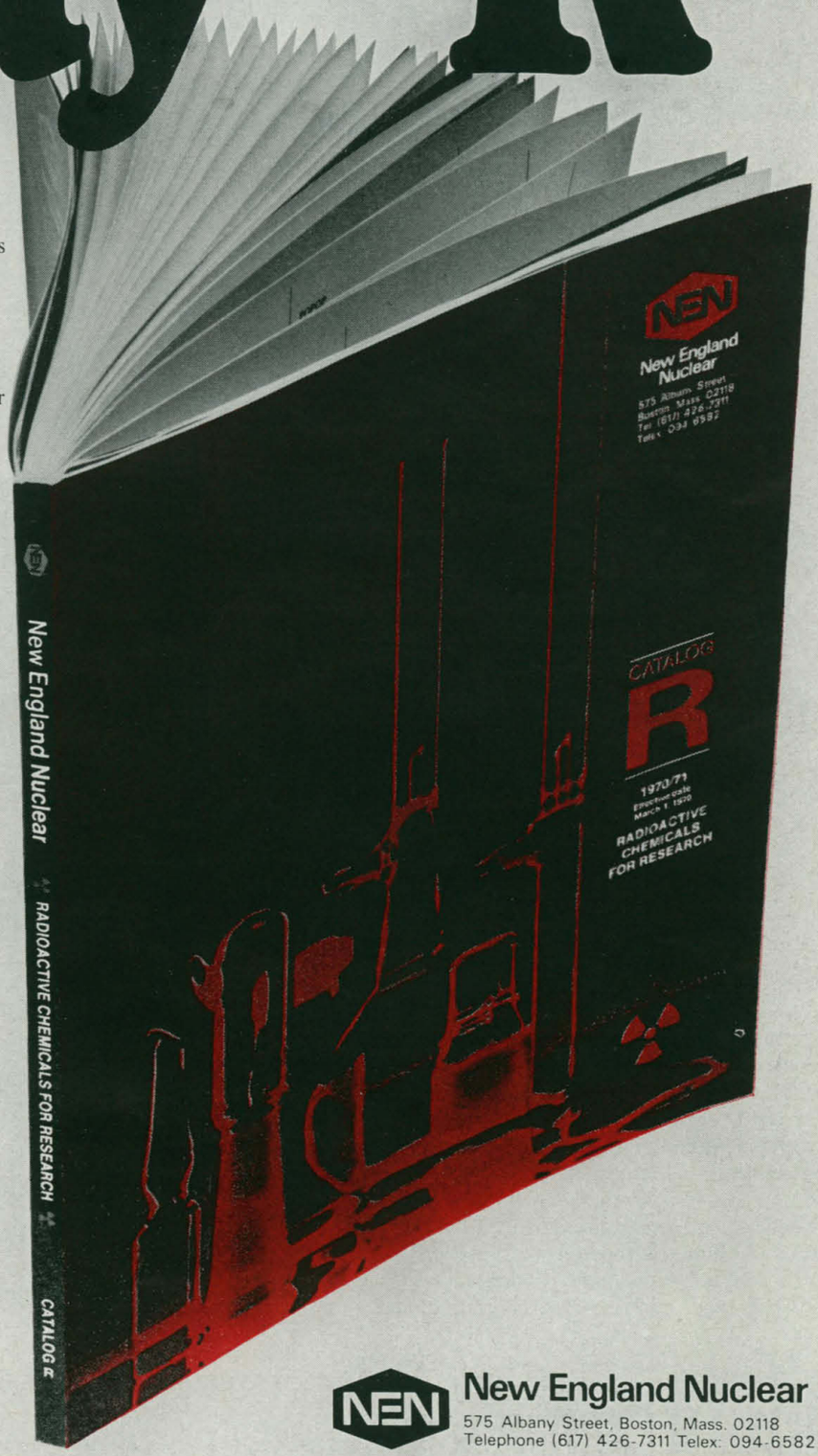

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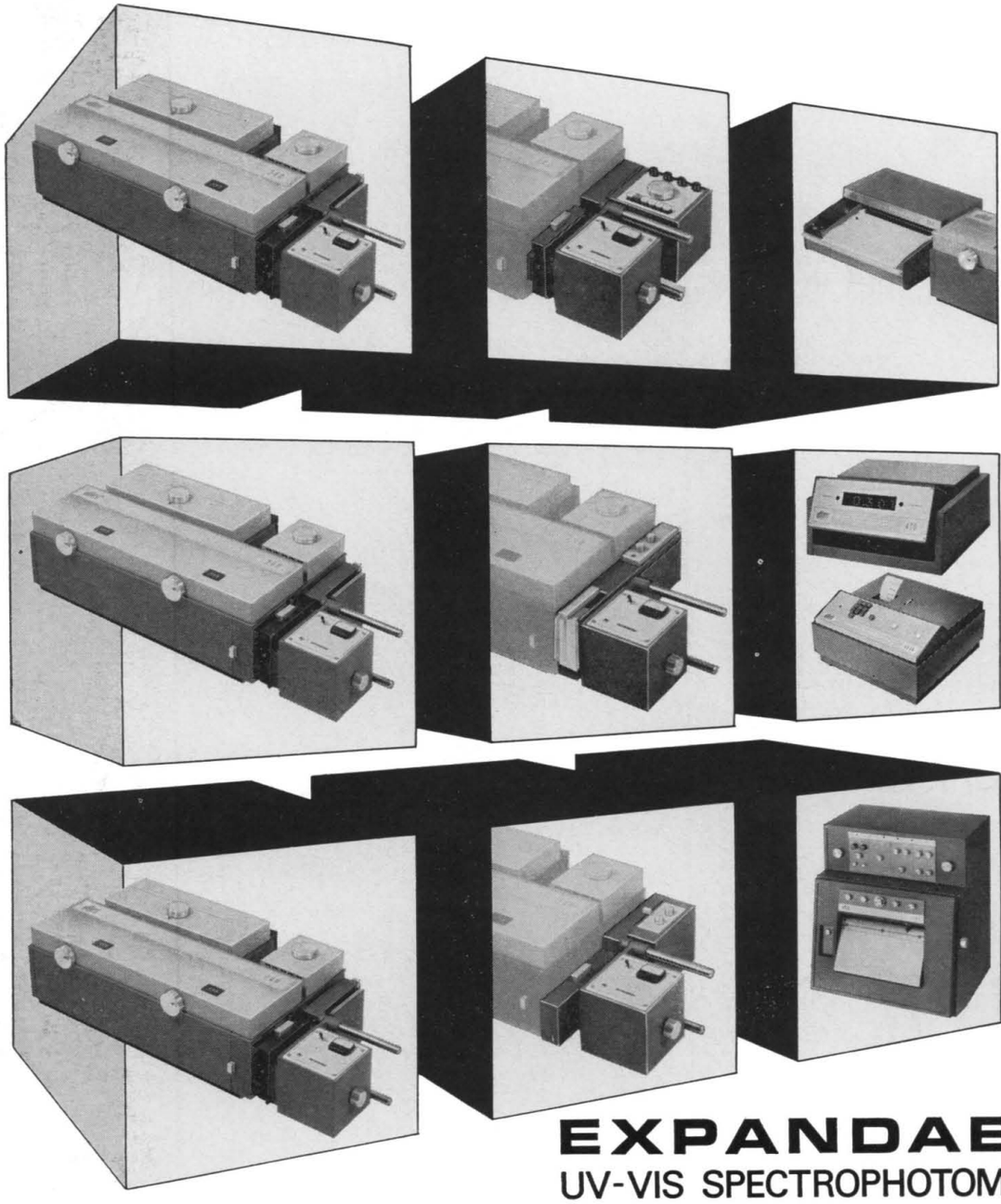

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The photometric accuracy, range, and resolution of the Gilford true linear absorbance photometer have made Gilford spectrophotometric systems indispensable "workhorse" instruments in laboratories throughout the world.

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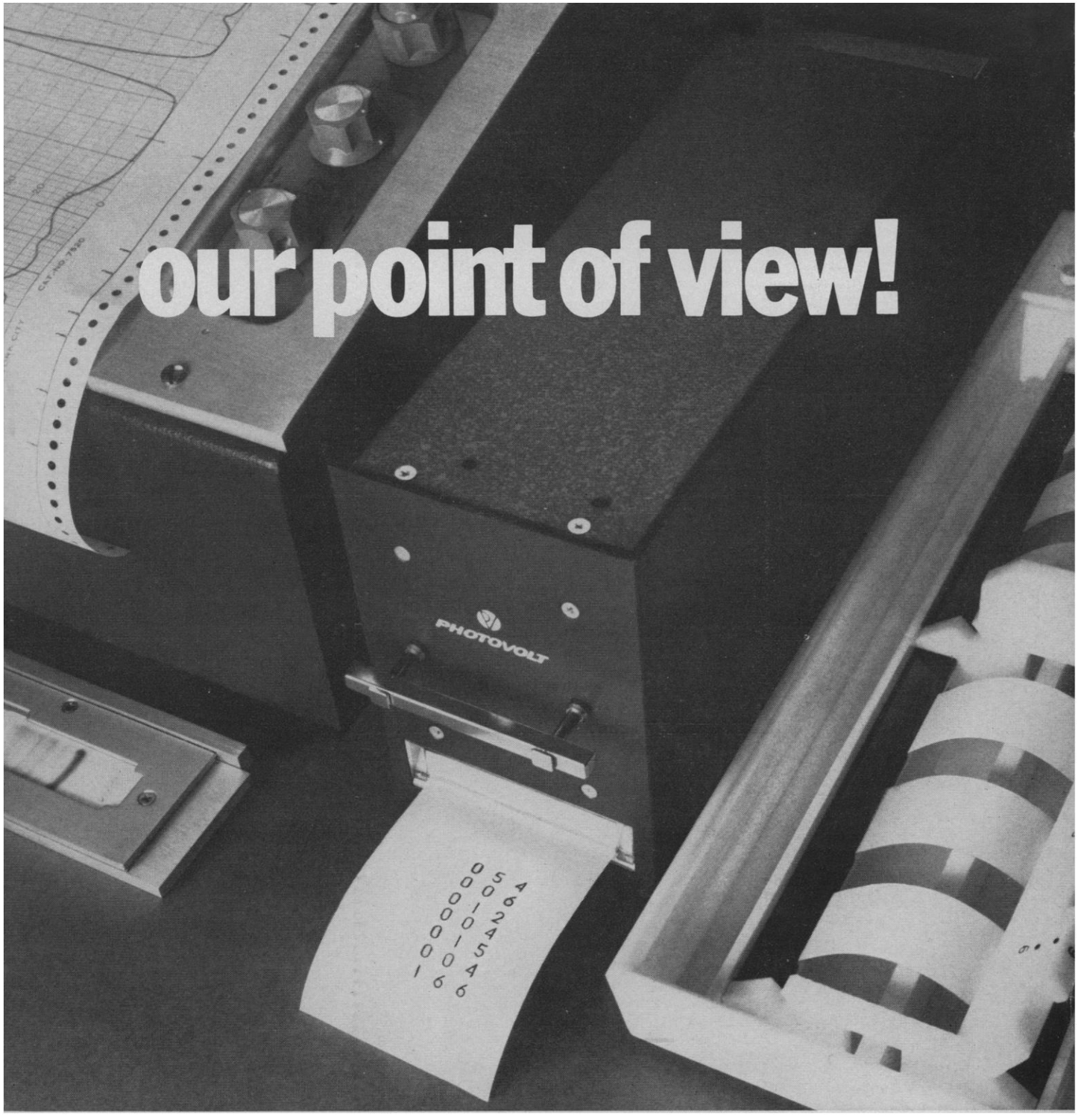

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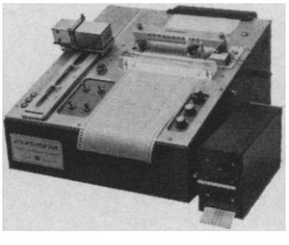

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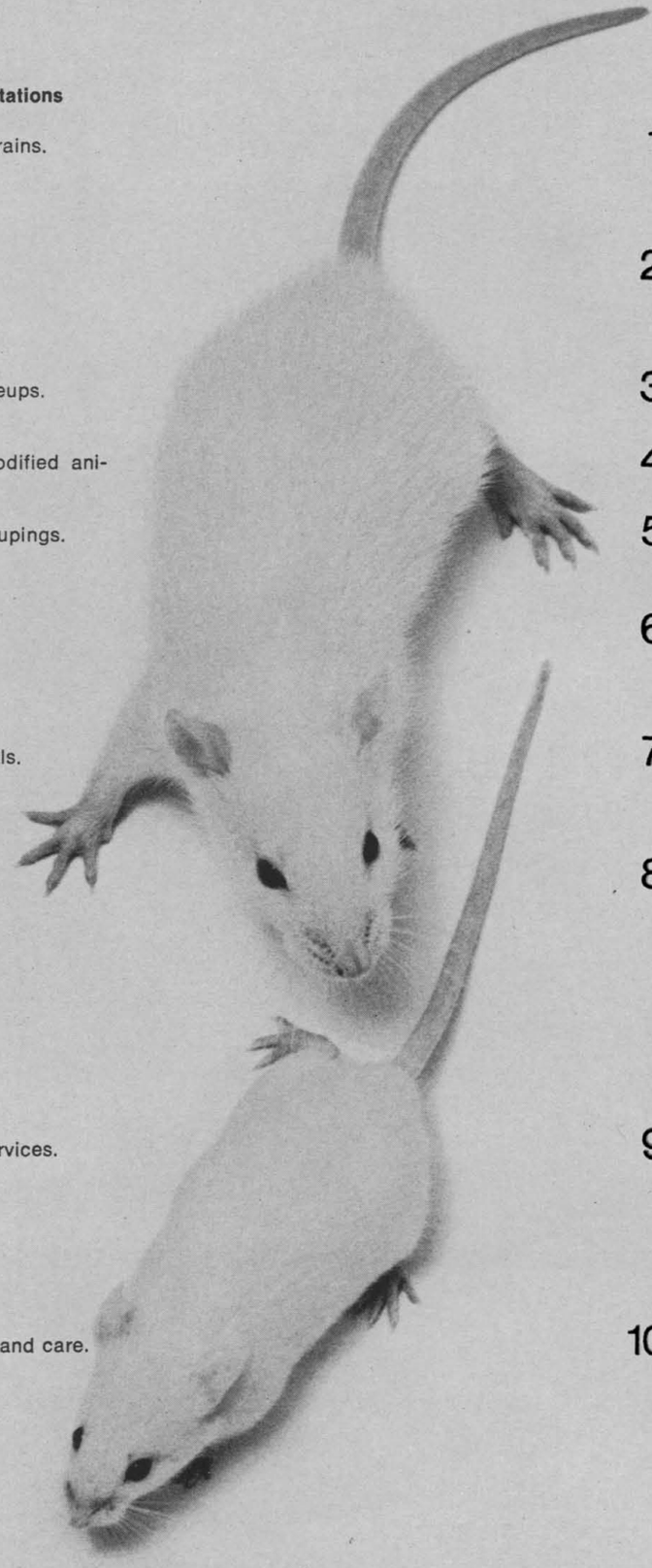
What should you expect from your supplier of laboratory animals?

(A useful checklist for future reference.)



User's Reasonable Expectations	Carworth's Response
1 A choice of species and strains.	1 Carworth supplies two strains of rats (CFN and CFE) and two of mice (CF #1 and CFW). Plus special strains; write for details.
2 A choice of either gender.	2 Carworth supplies male and female rats and mice. (But note: female rats are more likely to be immediately available at *any moment*.)
3 A choice of microbial makeups.	3 Carworth supplies SPF, gnotobiotic, and axenic rats and mice.
4 A choice of surgically-modified animals.	4 Carworth performs many surgical procedures. Please write for details.
5 A choice of age or size groupings.	5 Carworth supplies rats in 13 weight groupings, and mice from weanling up to maturity.
6 A choice of other options.	6 Carworth supplies pregnant animals (rats with exact conception days), birth-dated animals, mothers and litters. And others at your request.
7 Uniform and healthy animals.	7 Carworth quality control assures uniformity with respect to genetic make-up, colony environment, and microbial makeup.
8 Dependable delivery.	8 Carworth has the widest delivery network in the animal field (shipments made from: New City, N.Y.; Kingston, N.Y.; and Portage, Michigan.) About 70% of our shipments are delivered by our own air-conditioned trucks—almost always on time. And we guarantee delivery of live, usable animals whether or not we actually make the delivery.
9 Consultative and other services.	9 Carworth provides help with respect to: facility design, animal selection appropriate to specific needs, coordination of animal shipments with experimental design requirements, and in many other ways as users' needs dictate. (Tell us your problem.)
10 Help with animal housing and care.	10 Carworth is the only animal supplier that also provides virtually everything needed to house and care for laboratory animals. We offer the *widest* selection of plastic and metal housing systems in the world.

Now for further details on what you can expect from Carworth, write for our extensive catalog on our animals, housing systems, and accessories and supplies. Write to Carworth, New City, New York 10956.

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The surest way to test the overall stability of your gas chromatograph is to observe the detector baseline while you rapidly program the oven to a high temperature and back down again. We do it to every new HP Series 7620 GC during checkout. Results are typically like the trace shown here: less than 1% detector baseline deviation during a 20°C/minute program from 100°C to 300°C and back to 100°C. In these days of almost universal use of electronic integrators and computers, this kind of GC system stability is more than just comforting. It's your assurance of qualitative and quantitative precision every time you run a sample . . . and that's the name of the game. Write for our new 18-page bulletin on the 7620: after you've read it, you'll know why the 7620 performs the way it does. Prices start at $5150 for a dual TC detector instrument. Hewlett-Packard, Route 41, Avondale, Pa. 19311. In Europe: 1217 Meyrin-Geneva, Switzerland.

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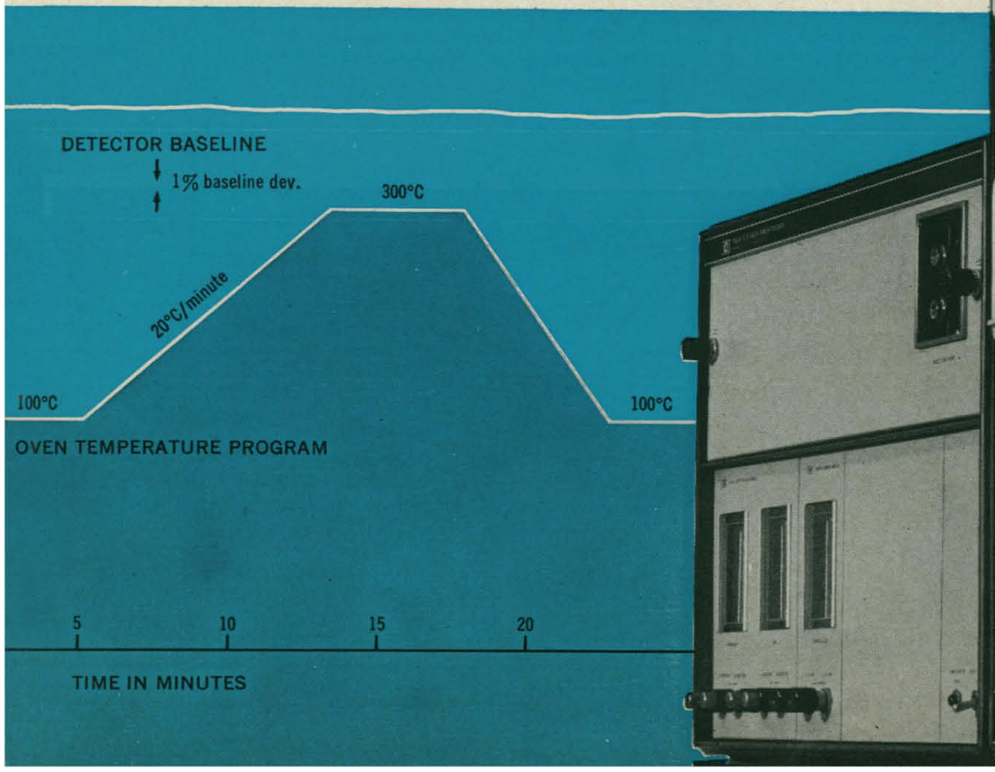
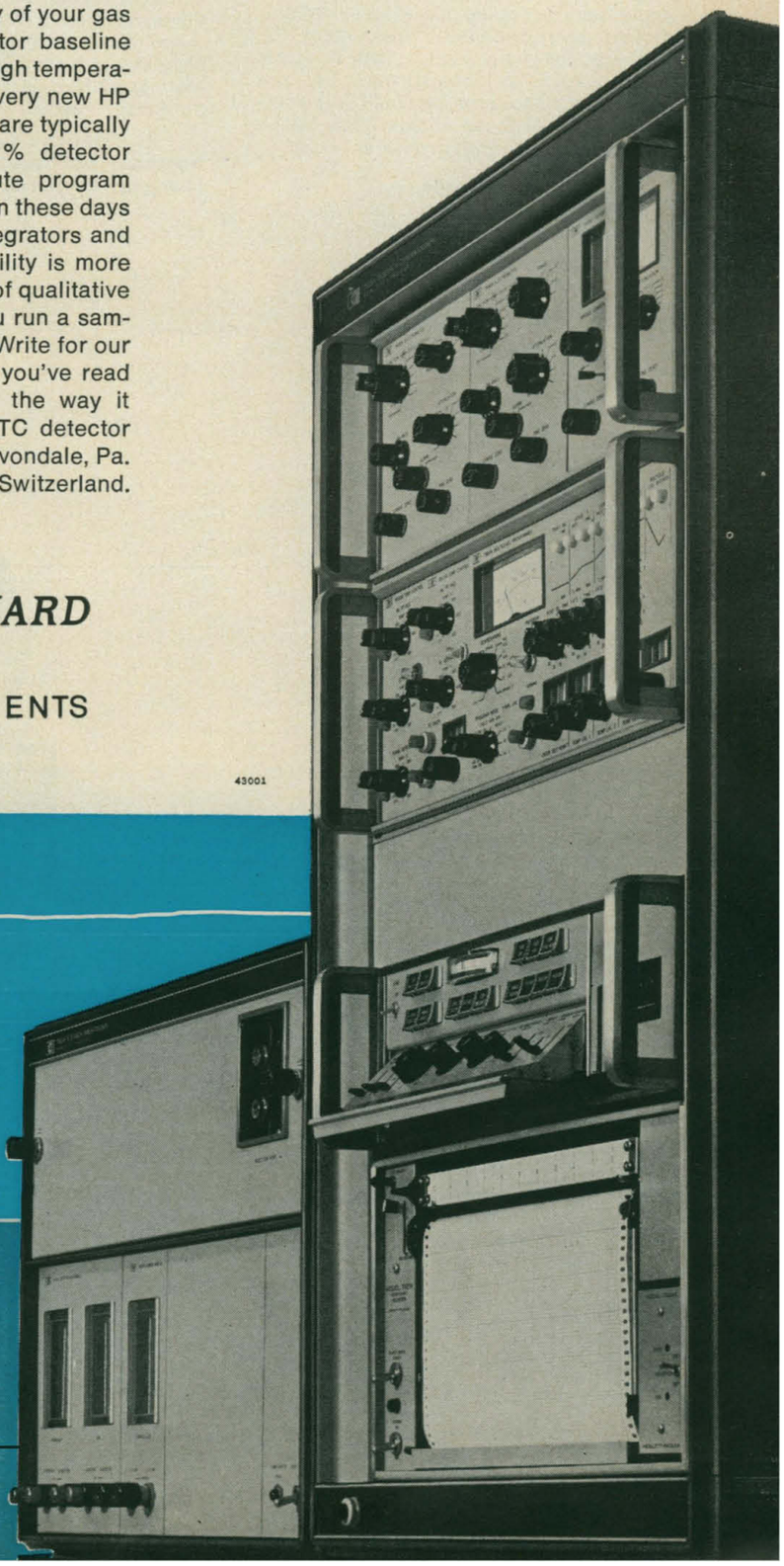




If everyone were easily satisfied,

Zeiss microscopes are made for the microscopist who demands the best. Regardless of what Zeiss microscope you buy, you get the world's finest optics. And you get the ultimate in mechanical precision. Simply to look through the optics and to touch the focusing knobs on any Zeiss instrument is proof enough.

Our Universal Microscope is exactly what its name states—it is universal, and universally accepted for all applications. But we also offer another instrument, the WL, that for many applications is in the same class. Even if you normally find satisfaction hard to come by, you'll find it easily with one of these microscopes. Which one depends upon what you want to do.

The Zeiss WL Microscope
The WL is an outstanding instrument for most transmitted-light applications, including: brightfield, darkfield, phase contrast, Nomarski interference contrast, fluorescence, polarization, microprojection, photomicrography.

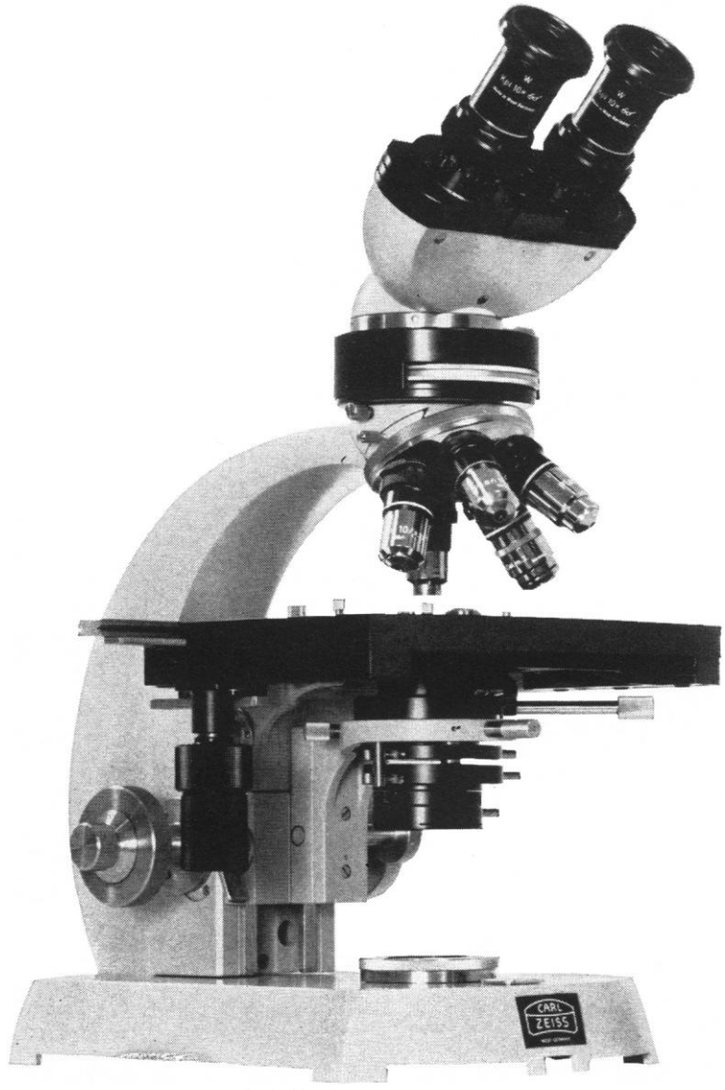
A look at just a few of its key features will give you an idea of its excellence:

1. Objectives—the most essential component of any microscope. Zeiss objectives are world-famous for their quality. Available for the WL is a complete line of Planapochromats from 4/0.16 to 100/1.3—and *only* Zeiss can offer so many. Complete lines, too, of Neofluars, Planachromats and Achromats. Each, in its class, is the world's best.

2. Brightfield—Phase Contrast—Nomarski Interference Contrast without changing condensers or objectives. And there's no need for a centering telescope either, because the exclusive OPTOVAR Magnification Changer has an auxiliary lens for centering the light ring on the phase ring. The OPTOVAR also lets you easily change magnifications without changing eyepieces.

3. Stages—Rotating and Centering, Mechanical and Gliding, Polarizing—the most versatile, the sturdiest and smoothest made. Even if you exert pressure on these stages, they won't slip .

4. Attachments—There are cameras (35mm, 4 x 5, Polaroid®, motion picture and video), auxiliary binocular and monocular tubes, projection screens, drawing attachments, a refractometer, etc., etc.—just about anything you might ever want.



The Zeiss WL Microscope

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there would be no need for Zeiss.

The Zeiss Universal Microscope
With the Universal, you can do all the things in transmitted light you can do with the WL—plus a few others. What's more, this is a truly great instrument for reflected light. Perhaps its outstanding feature (aside from the magnificent optics and extra-sturdy stand) is the fact that you can switch from reflected to transmitted light, or vice-versa, just by flipping a lever, *without changing light sources.*

Let's take a closer look at the Zeiss Universal Microscope:

1. Objectives—the same great objectives as the WL has. And, in addition, a full line of Epiplans for reflected light work, and famous LUMINARS for photomacrography.

2. The Microscope Stand—the sturdiest stand of any desk-top microscope. This extra stability allows use of the Microscope Photometer for both reflected and transmitted light, and is of benefit if a great deal of 4 x 5 or motion picture photography is employed.

For reflected light, more intense light, or fluorescent illumination (including phase-fluorescence), the special illuminators, rather than being accessories, become *part* of the instrument, contributing to its ease-of-operation, compactness and sturdiness.

3. Attachments—The same cameras, projection screens, drawing attachments, etc., as for the WL—plus the Microscope Photometer and the Microhardness Tester.

To sum up, the Universal is the instrument to buy when your applications are truly *universal,* when you have to switch from one mode to another during your work. The WL is superb if you are mainly concerned with transmitted-light microscopy. But no matter which Zeiss microscope you choose, we know you'll be satisfied. Because both are made specifically for the microscopist who is *hard* to satisfy.

For more information on the WL or Universal (or on any of the others in our line) write Carl Zeiss, Inc., 444 Fifth Avenue, New York, New York 10018.

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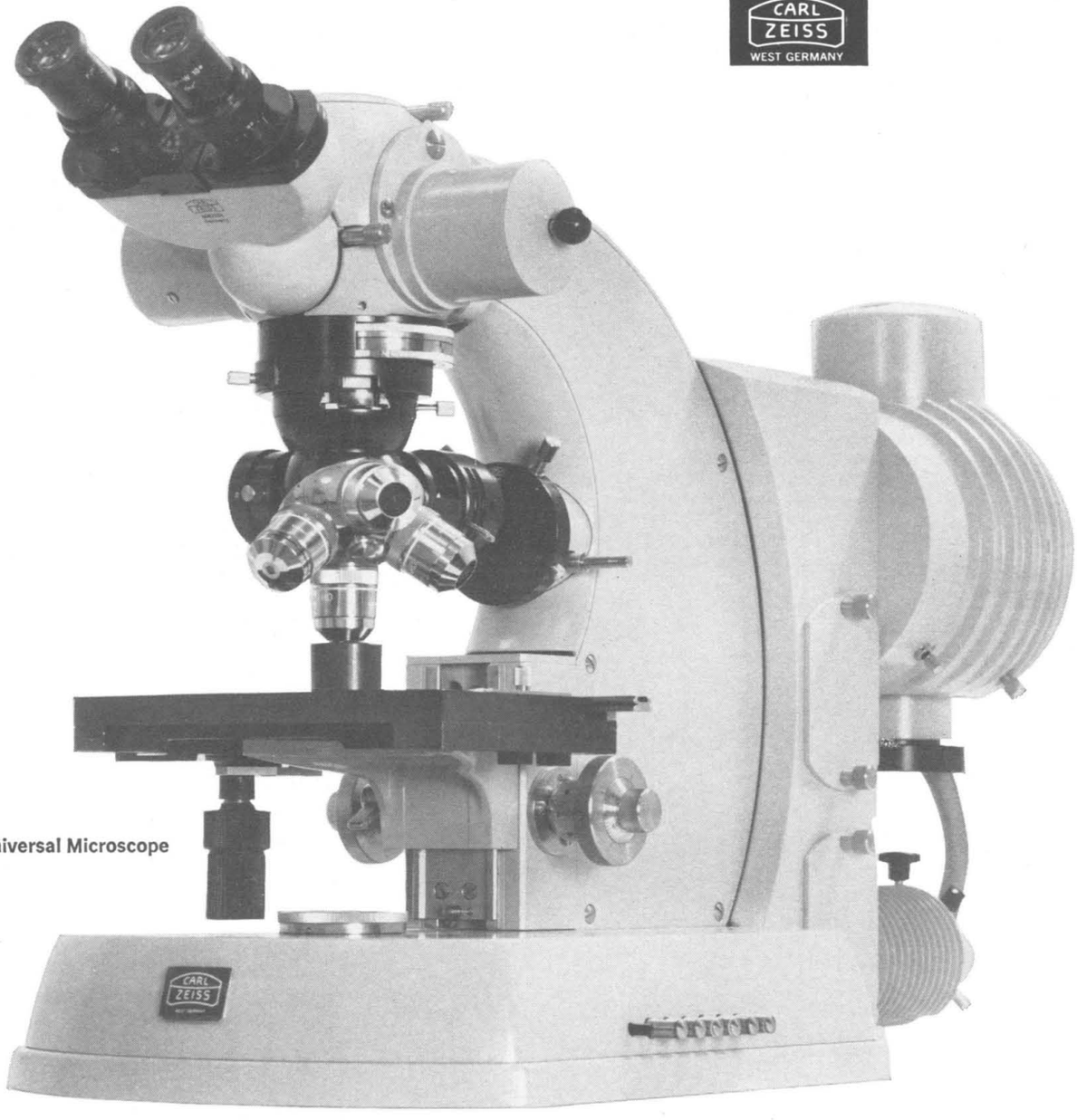

The Zeiss Universal Microscope

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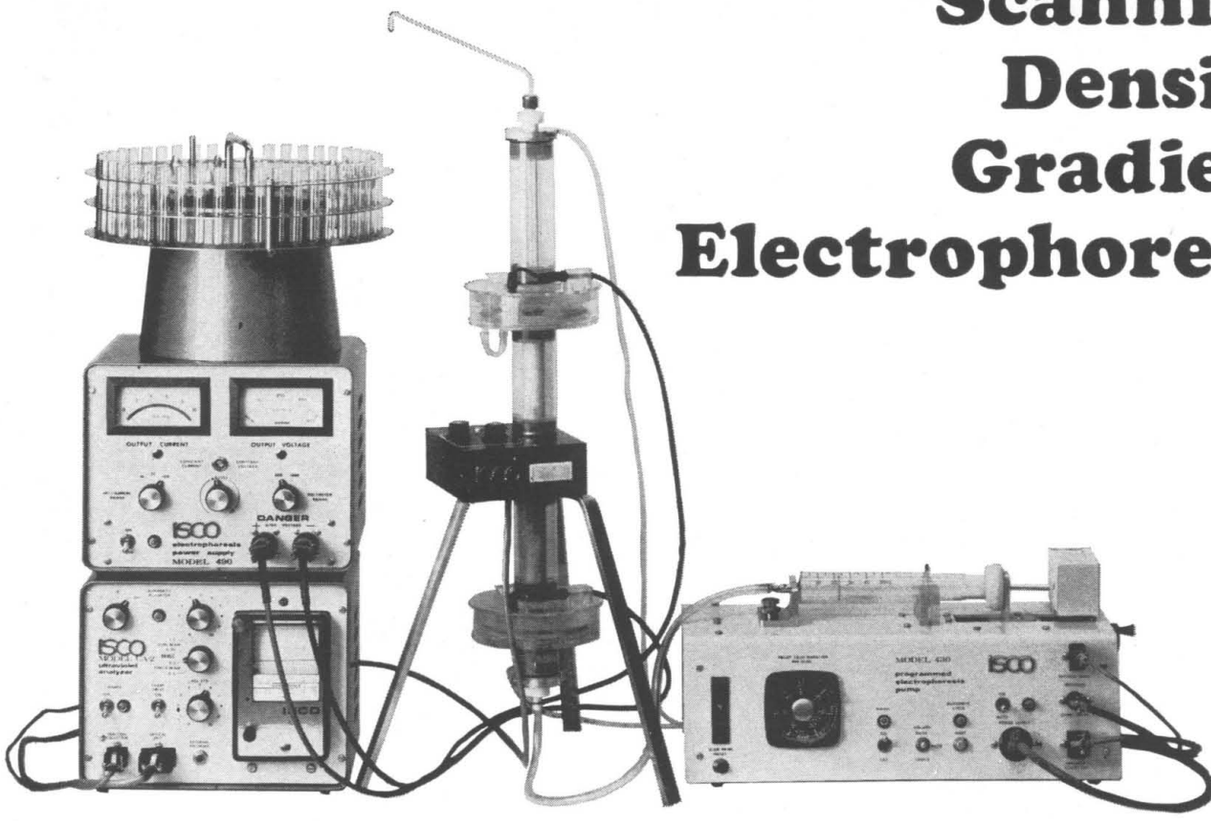
Scanning Density Gradient Electrophoresis



Top: Model 270 Fraction Collector
Center: Electrophoresis Power Supply
Bottom: Model UA-2 UV Monitor

Model 210 Density Gradient Electrophoresis Apparatus

Model 430 Programmed Electrophoresis Pump

Accurate analysis and fractionation of mixtures has been possible for some time with conventional density gradient electrophoresis equipment. Now easy determination of electrophoretic mobilities as well as physical separation of mixtures and quantitative microanalytical results can be obtained with the new ISCO Model 210 Density Gradient Electrophoresis apparatus. Microgram size samples can readily be separated. Low sample concentration permits the use of dilute buffers, resulting in a wide operational temperature range of from 0 to 25° C.

The Model 210 makes repeated scans of zones during migration through a density gradient column. A water-jacketed Teflon central tube contains a gradient which is raised and lowered past a narrow-bandwidth UV-absorbance (O.D.) monitor at programmed intervals. Recorded scans during migration provide data to confirm uniform migration rates or to plot changing migration rates for the purpose of determining electrophoretic mobilities. Quantitative results can be obtained from these scans or from a final chart record made automatically at the conclusion of migration as separated specimen components are discharged into a fraction collector for further assay. Figure 1 is a profile of a typical run showing the relative positions of the same peak during the first and eighth scans. Note that repeated scans have not resulted in loss of resolution.

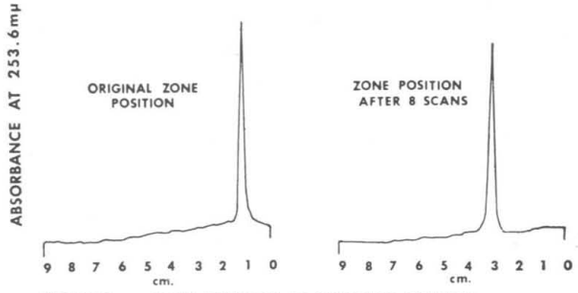


FIGURE 1. ZONE POSITION IN GRADIENT COLUMN

Semipermeable membranes between the buffer and electrode chambers and the gradient column eliminate the difficulties normally associated with loading density gradient electrophoresis equipment. There is no need to maintain hydrostatic equilibrium: the gradient may be pipetted directly into the column. The separating membranes also prevent pH changes at the electrodes from reaching the gradient column.

The Model 430 programmed electrophoresis pump controls the number and timing of scans, the timing of electric field applications, and finally discharges the entire gradient column into a fraction collector. The apparatus need not be attended after setup.

A similar preparative apparatus which has a larger capacity but can monitor the gradient only during discharge is also available. Much of this electrophoresis apparatus can also be used for monitoring column chromatographic eluants or for fractionating centrifuged density gradients.

For more information, please request brochure E121.

Patent Pending

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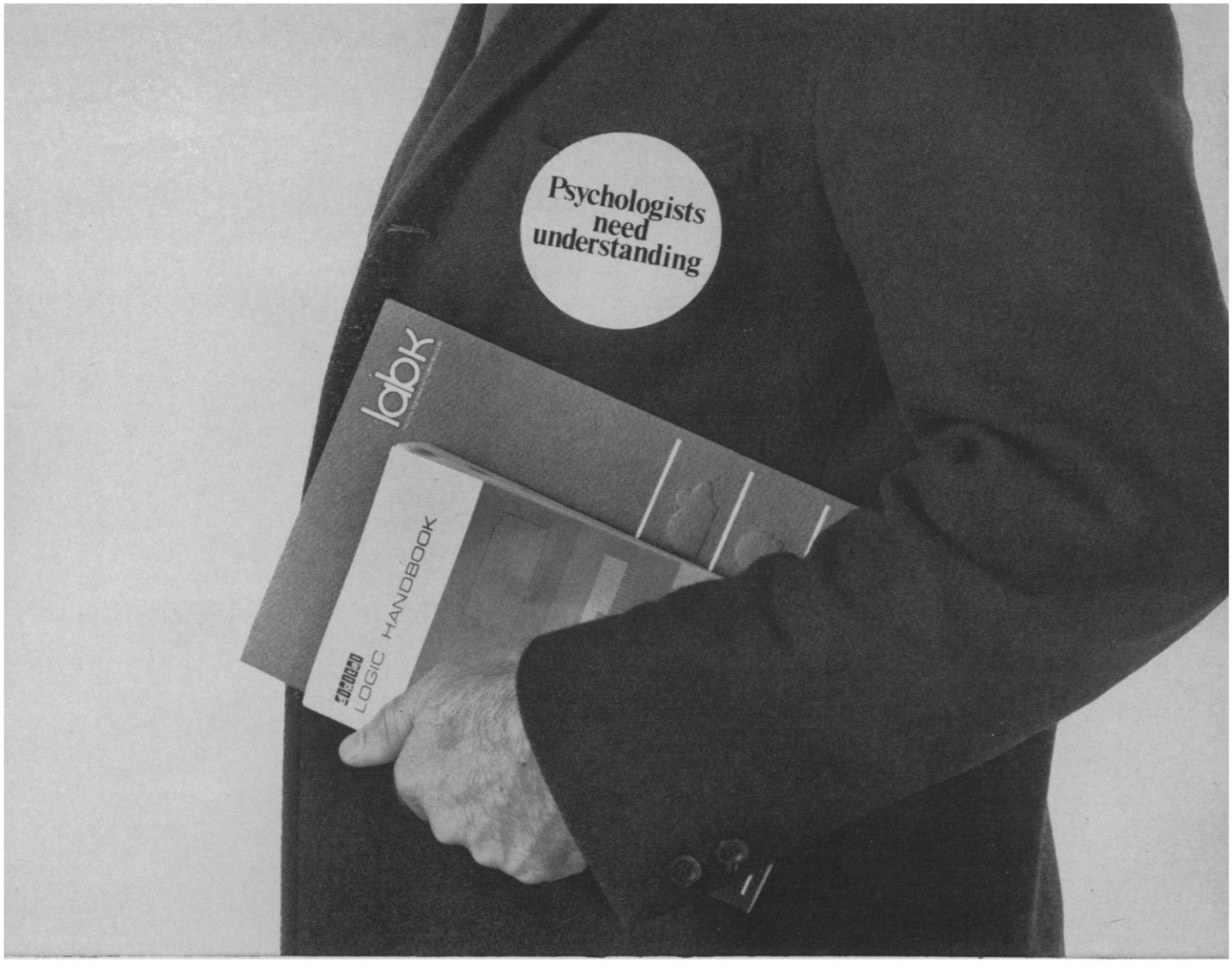

The LAB-K Pre-computer with plug-in programming

LAB-K is a new, all solid state controller kit for the psychology laboratory. It stands alone, works alone, controls alone. In its basic $2,700 configuration, it will do most of the time and event control functions that you would want done, all by itself.

In the building block kit is a hardware programmer. A 200-position plug board provides all the functional control capabilities that the most expanded configuration of LAB-K requires . . . the patch board receiver prewired by printed circuit board techniques. Setting up an experiment, or changing to another experiment, is a simple matter of plugging in. And expanding is simply a matter of plugging in.

But beyond all that, LAB-K is also a pre-computer. It is designed to interface easily with the computer that you may acquire in the future, and will back up that computer through the life of an experiment. (Remember it stands alone.)

LAB-K is made with K-Series solid state modules that are ultra-reliable, easy to use, and designed to be immune to the electrical noise generated by other apparatus in the laboratory. Furthermore, the modules are compatible with the complete K-Series module line that was first designed for the industrial factory environment. They are that rugged.

Write for the LAB-K brochure and the "Positive Logic Handbook". The button will be sent along too.

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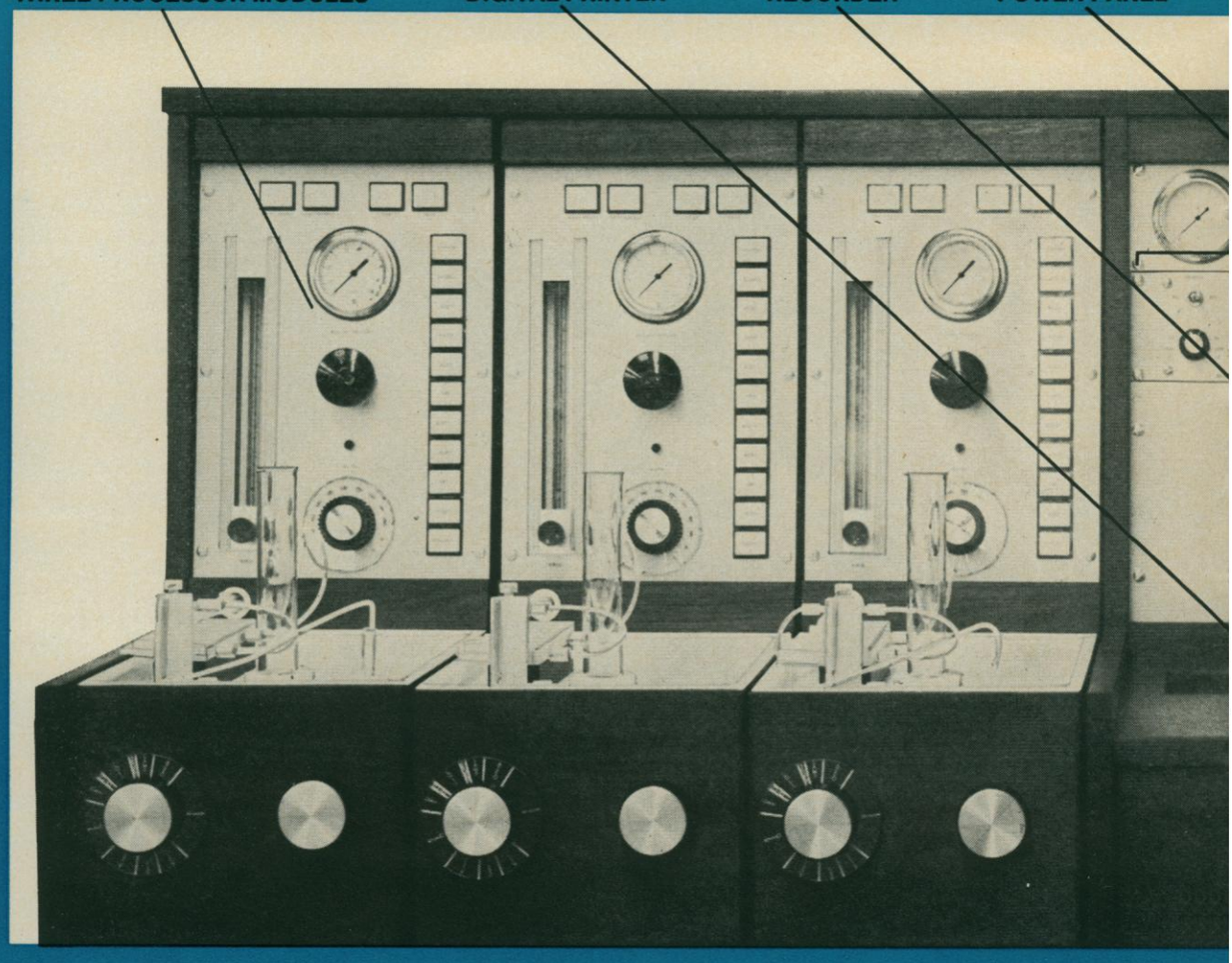

The VIVONEX AMINO ACID ANALYZER, Model 10V provides:

1 **Rapid Analysis** —Three samples per hour.

2 **Precise Quantitation**—Typical error less than ± 5%.

3 **Simple Operation** —Requires no intensive training.

4 **Broad Spectrum of Amino Acids** —Resolves protein and non-protein amino acids.

A REVOLUTIONARY CLINICAL AND RESEARCH TOOL:

Quantitative, Automated Amino-Acid Analysis by Gas-Liquid Chromatography at Unprecedented Speed

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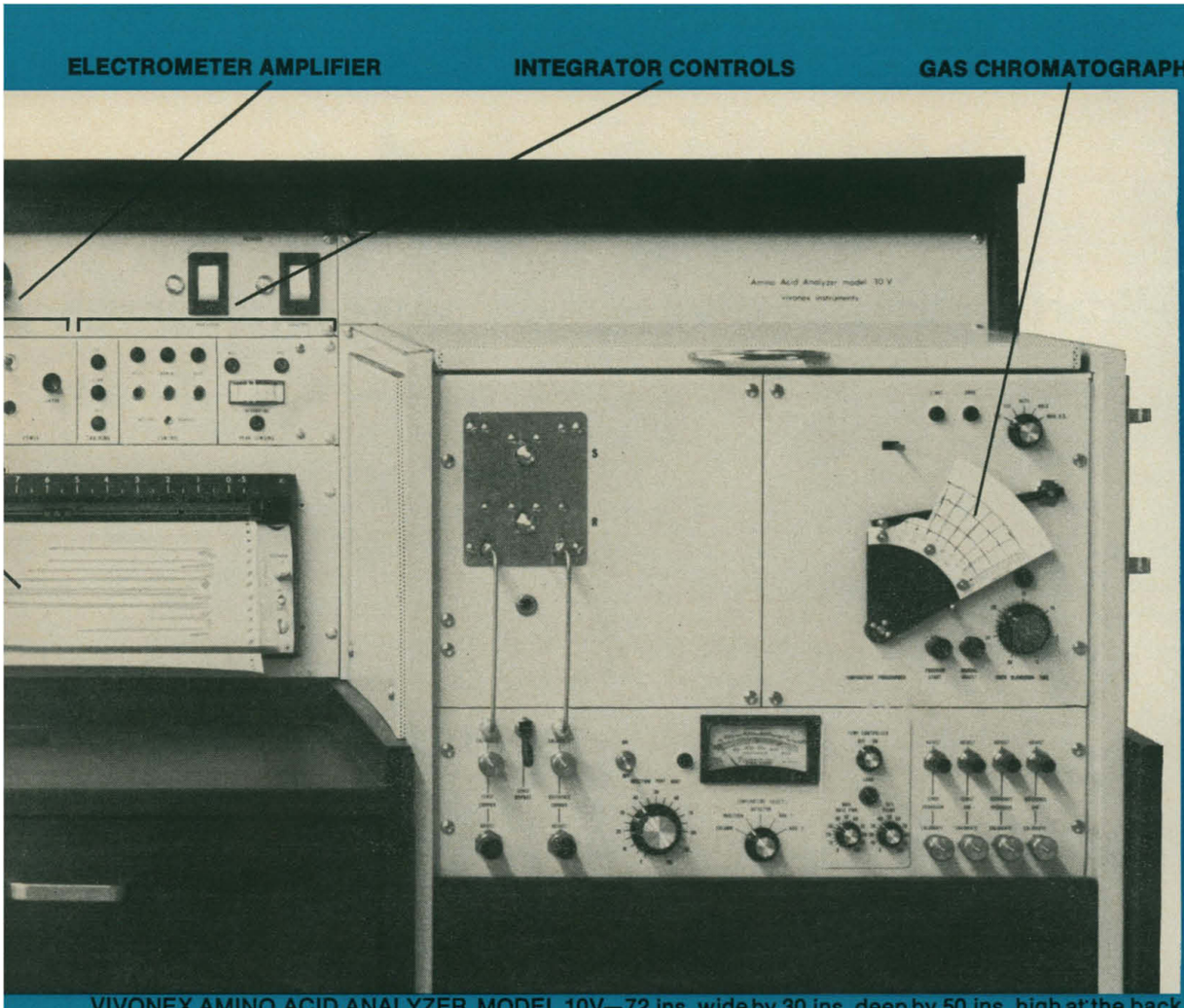

VIVONEX AMINO ACID ANALYZER, MODEL 10V—72 ins. wide by 30 ins. deep by 50 ins. high at the back.

5 **Digital Readout**—Automated integration and printout avoids tedious calculations.

6 **Swift Sample Separation**—No need for cumbersome separations from interfering substances.

7 **Versatility**—For routine clinical sample analysis and for amino-acid analysis in research on plasma, urine, protein hydrolysates, food, tissue and other biologic materials.

8 **Reliability**—Simple, unitized construction reduces down-time to the minimum.

The *Vivonex Amino Acid Analyzer, Model 10V,* is the first and only instrument that will *quantitatively* and *automatically* convert amino acids to volatile derivatives and analyze them accurately by gas-liquid chromatography. Precision is substantially higher than that achieved with cumbersome column chromatography techniques employing resins.

Now, amino acid determinations on a limitless number of biological materials can be made by laboratory or clinical personnel with limited training.

The automated, digital printout feature substantially decreases the time required for data reduction. Precise analysis can be achieved with samples containing as little as 0.02 micromole of a given amino acid.

For complete information on this unique instrument write or phone Mike Beigler:

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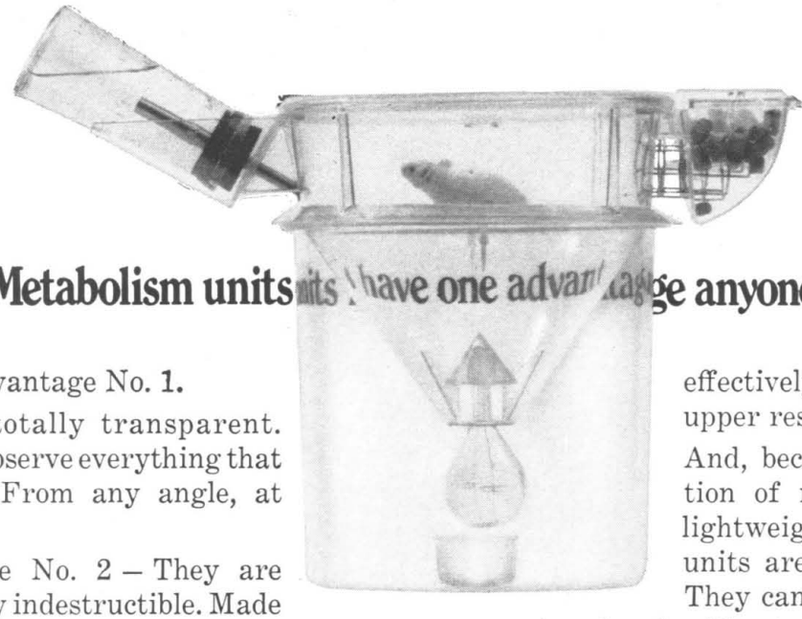
Visit the *Vivonex* exhibit at the 54th annual FASEB meeting in Atlantic City, 13-17 April 1970, booth Nos. K-102 and K-103.



Econo-Metabolism units have one advantage anyone can see through

That's advantage No. **1.**

They're totally transparent. You can observe everything that happens. From any angle, at any time.

Advantage No. 2 – They are practically indestructible. Made from crystal polycarbonate they won't dent or break, resist most chemicals and wastes, are highly resistant to contamination by most toxic substances, and can be autoclaved up to 290°F.

Advantage No. 3 – They are simple in operation but positive in results. The separation mechanism for feces and urine assures efficient collection without contamination of urine or leaching of feces. The top portion of the cage can be removed to collect samples without disturbing the animal. The urine collection receptacle can be removed for easier, more efficient cleaning.

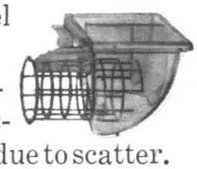
These are only some of the advantages of the only plastic metabolism unit on the market. The patented Econo Model E-1100. We developed it in cooperation with research personnel of Southern Illinois University. At its unusually low price it is an exceptional value for any research, college, or university laboratory in which nutritional, toxicological, trace element or metabolism studies may be performed.

As we've already said, certain advantages of transparent plastic construction are readily apparent . . . observability, economy and indestructibility. But other features are worth much closer examination.

The fact is that the animals will be healthier and safer. Why? The solid sides practically eliminate drafts. The low thermal conductivity of polycarbonate effectively reduces chills and upper respiratory diseases.

And, because of the combination of material and design, lightweight E-1100 Metabolism units are completely portable. They can be used on any laboratory bench without special support. Standing 12-in. high they are only 8–5/16-in. in diameter.

The feed hopper (but not the water bottle) is a standard component of the E-1100 Metabolism unit. A stainless steel wire insert provides access to the feed hopper, which is designed to increase analytical accuracy by minimizing feed-loss due to scatter.



A critical element in the design is the deflection system. A unique outside shelving ring deflects food and water. This assures that anything escaping from the hopper or water tube is drained off *outside* the urine collection system.

Lastly, the Model E-1100 does not impose severe size limitations on the animals to be studied. The standard Model E-1100 accepts all types of animals, including mice, small rats and hamsters, as large as 200 grams, or as small as 15 grams. A special stainless steel insert-adapter can be easily installed in the food hopper access unit to make it suitable for the smaller animals.

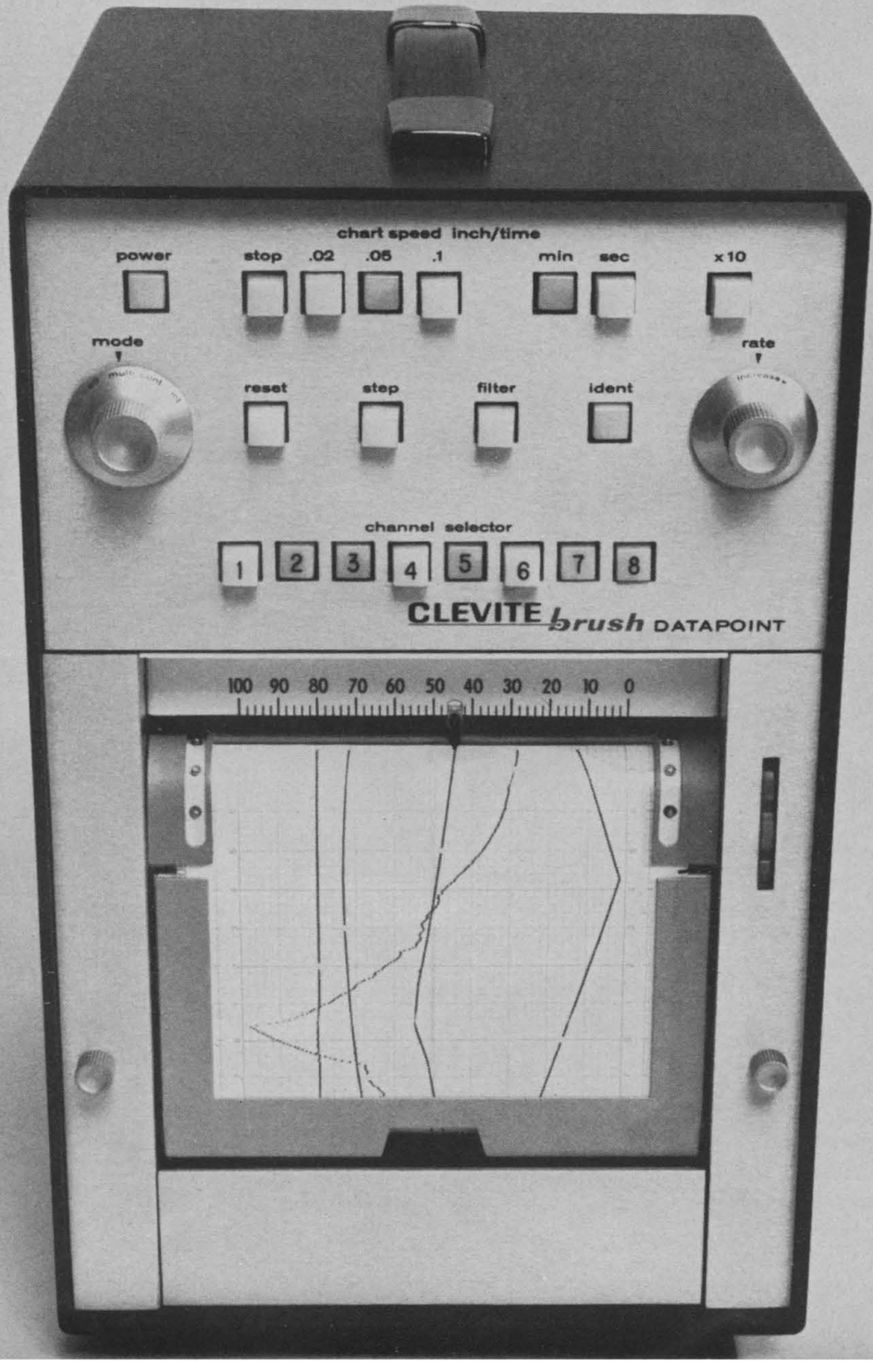
No matter how you look at it, the fully transparent, plastic Econo-Metabolism unit Model E-1100 offers many advantages to every laboratory. We detail them all in our new catalog. Just ask for it. We haven't got a thing to hide. Write the Scientific Division, Maryland Plastics, Inc., 9 East 37th Street, New York, New York 10016.

MP

EC-M-8

Meet Datapoint. It's 20 times faster than other multipoint recorders.

And infinitely more versatile.



This new high-speed multipoint recorder by Brush runs off as many as 20 samples per second on 2 to 8 patients. So it's great for monitoring fast-changing variables in systemic and wound temperature, heart rate, ECG and the like.

Datapoint handles mixed inputs from high and low level inputs. All on one chart. Recordings come out clear, crisp, uncluttered. And Z-folded. You've got a choice of 12 chart speeds, pushbutton controlled.

About that versatility. Datapoint works in three modes: multipoint sampling, intensified sampling, for channels of high dynamic content, or continuous single channel recording. So you get much more than just a fast multipoint recorder. Without paying more to get it.

And Datapoint is accurate, too. A full 99.5%, enforced by a non-contact position-feedback system. It's a first in this type of recorder. (But a proven success in countless Brush direct writing oscillographs.)

Speed. Versatility. Accuracy. These make Datapoint a new concept in recording. There's never been anything like it. You'll find more proof in the Datapoint brochure. Send for your copy today. Brush Instruments Division, Gould Inc., 3631 Perkins Avenue, Cleveland, Ohio 44114.

GOULD BRUSH

What makes one constant temperature circulator better than another?

For one thing, the Lauda Duplex Pump.

All constant temperature circulators heat. Some, like the Lauda K-2/RD shown here, also cool. But this Lauda model can do even more. Its duplex pump enables it to circulate liquid to and from an external open bath, no matter whether the bath is positioned higher, lower or level with the circulator. Liquid will always return to the K-2/RD because its duplex pump provides simultaneous pressure and suction. You won't find this feature on many constant temperature circulators.

Another nice thing about this Lauda is its automatic liquid level control. It prevents accidental emptying of the bath by balancing pressure and suction, thereby keeping liquid levels constant in all parts of the system. These features add up to a better, more versatile circulator.

Besides the K-2/RD, which circulates liquids at temperatures from −10°C to 150°C, duplex pumps and the automatic liquid level control are also available in our N and WB series models. Some of these heat up to 330°C, or cool down to −130°C. Of course, solid state relays, excess load protection, drainage and flow control valves and stainless steel construction of all immersed components are standard on all Lauda Circulators.

Which Lauda is best for you? Get our free catalog to help you decide.

Write: Lauda Circulators, Division of Brinkmann Instruments
Cantiague Rd., Westbury, N.Y. 11590.
In Canada, write: Brinkmann Instruments (Canada) Ltd.,
50 Galaxy Boulevard, Rexdale (Toronto) Ont.

LAUDA Circulators

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WORTHINGTON

Radioactive enzymes . . . new tools for biochemical research from Worthington

The first radioactive enzymes in other-than-custom quantities now are available from Worthington Biochemical Corporation. They give the life scientist some new, precise, and versatile tools for his investigative work.

The Worthington group of radioactive biochemicals is comprised at present of seven hydrolytic enzymes which are currently receiving considerable investigative attention. They include radioactive ribonuclease, pepsin, chymotrypsin, lysozyme, deoxyribonuclease, trypsin, and collagenase. Four radioactive substrates—deoxyribonucleic acid, ribonucleic acid, soybean trypsin inhibitor and α-casein—also are included in the product line.

The Worthington radioactive enzymes offer the researcher advantages of sensitivity, specificity, and convenience:

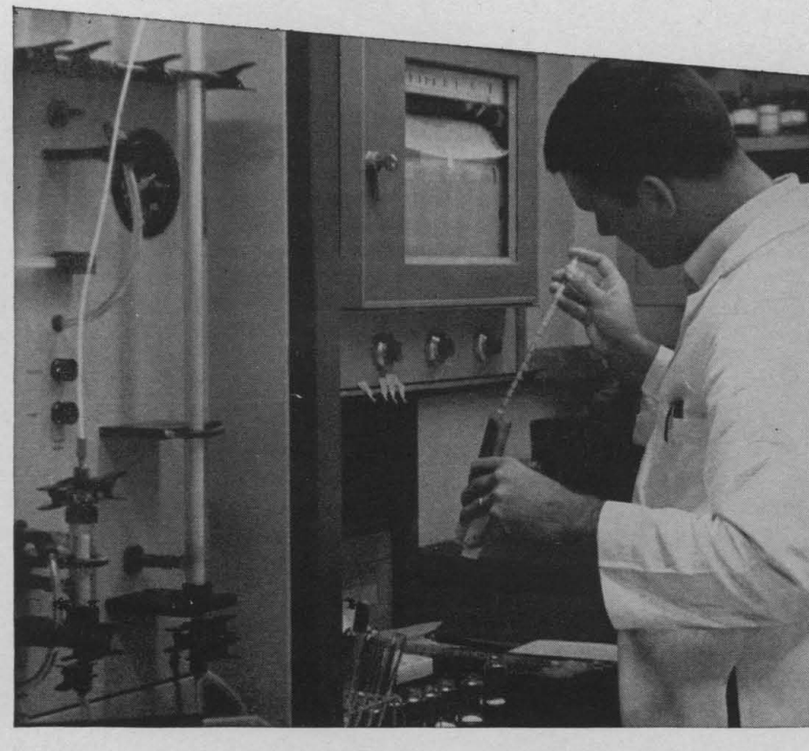
—with radioactivity levels ranging from 3 to 30 μc/mg, the enzymes can be detected with much greater sensitivity than is allowed by current procedures.

—radiation detection and quantitation with standard laboratory scintillation counters is simple and rapid.

—the presence of radioactive enzymes can be detected despite their being inactivated or inhibited.

Worthington assay data indicate that the radioactive label is on the individual amino acid molecules making up the enzyme. This avoids complications of using iodination or other "external" labels. That the enzyme remains catalytically active is analytically established.

See what impact internally-labeled enzymes can have on your work. Write for product literature, technical data and working sample.



Worthington Biochemical Corporation
Freehold, New Jersey 07728

Please send information on radioactive enzymes.

Name _____

Title _____

Institution _____

Address _____

City _____

State _____ Zip _____

The Reichert Diapan Microscope:

for people who don't want to get too involved.

The Diapan demands minimum effort for outstanding results in routine research applications. It is a compact, easy-to-use stand with built-in illumination and filter control. Lamp housing is fitted with 100W halogen lamp. Microflash insert is also available.

Coarse and fine focusing adjustments are controlled from a single knob.

Best of all, it offers the unmatched quality of Reichert instruments plus the reliability of AO.

Ask your AO Representative for a demonstration or write for detailed information.

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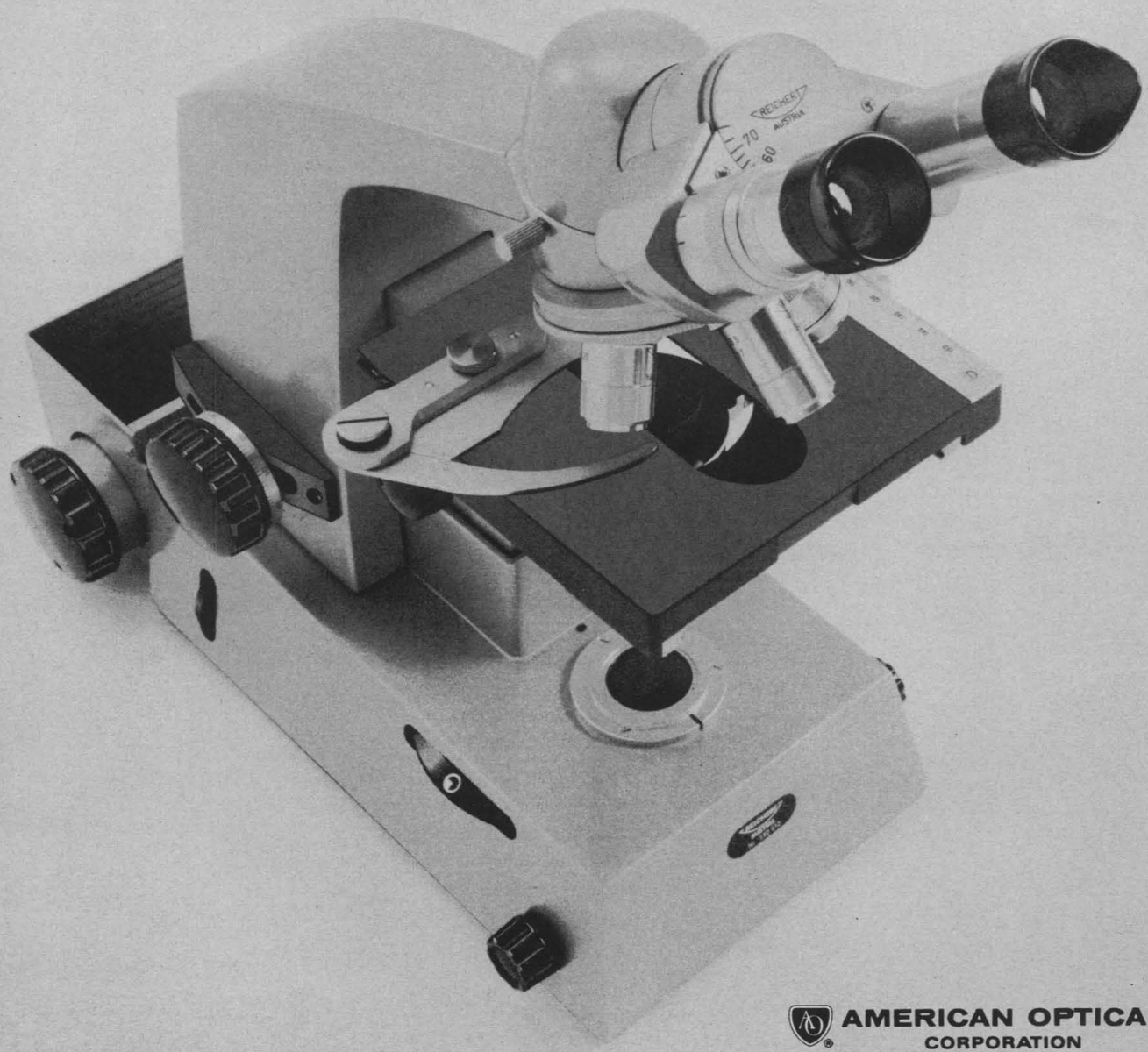

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SCIENTIFIC INSTRUMENT DIVISION • BUFFALO, N.Y. 14215

Now, for the first time, you can obtain a complete package for nuclear monitoring of flowing samples. How? Through a combination of the Beckman β-Mate™ liquid scintillation counter and the new Flow Cell flow accessory.

For research and industrial use, the combination permits analysis of **continuous flow** in column monitoring, in tracer analysis and in nuclear water pollution (streams, sewage, reactor centers).

Flow Cell, with its own mixing chamber, virtually eliminates the need for vials; it also reduces excessive personnel sample handling, and human error. Once set up, Flow Cell will take a sample; add and mix cocktail; transport the mix to the counting chamber; count the mix to a preset time; empty the chamber; and repeat the entire cycle. An auxiliary timer on Flow Cell counts each sample between increments of 6 seconds, 6 minutes, 60 minutes, or 6 hours. A strip-chart recorder and digital printer are available as optional accessories.

Write for Data File 407 and find out how Beckman provides the best in liquid scintillation counting. Scientific Instruments Division, Beckman Instruments, Inc., 2500 Harbor Blvd., Fullerton, Calif. 92634.

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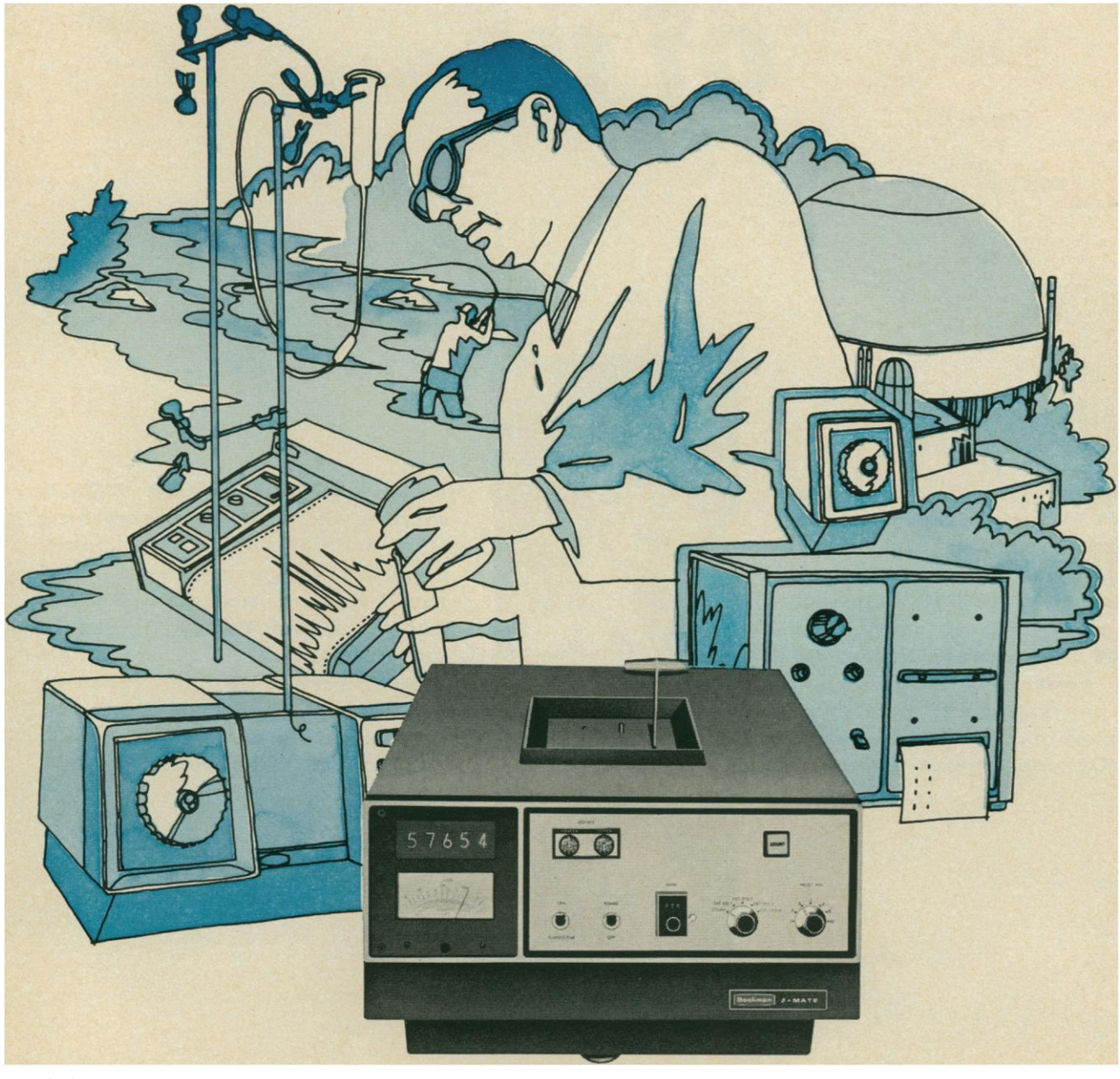
INTERNATIONAL SUBSIDIARIES: AMSTERDAM; CAPE TOWN; GENEVA; GLENROTHES; SCOTLAND; LONDON; MEXICO CITY; MUNICH; PARIS; STOCKHOLM; TOKYO; VIENNA

Nuclear monitor of continuous flow- only Beckman has it packaged.



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S/P has no traveling salesmen. Our 230-man field representative organization virtually blankets the laboratory equipment and supply industry. So your S/P Representative never has to stray more than 50 miles from home. Of course, your local laboratory supply companies can say the same thing. But there's a lot they can't do. Like stocking 100,000 items. Or ordering out-of-stock items in one minute via super-speed TWX-T service. Or servicing everything they sell. If, like the farmer's daughter, you never heard of us, you'll find our nearest S/P office listed in the Yellow Pages in major cities. S/P . . . the single source for all laboratory equipment, supplies, scientific instruments. Scientific Products, a division of American Hospital Supply Corporation, 1210 Leon Pl., Evanston, Ill. 60201.

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Even more versatile: Sargent's new Model XVI Recording Polarograph®

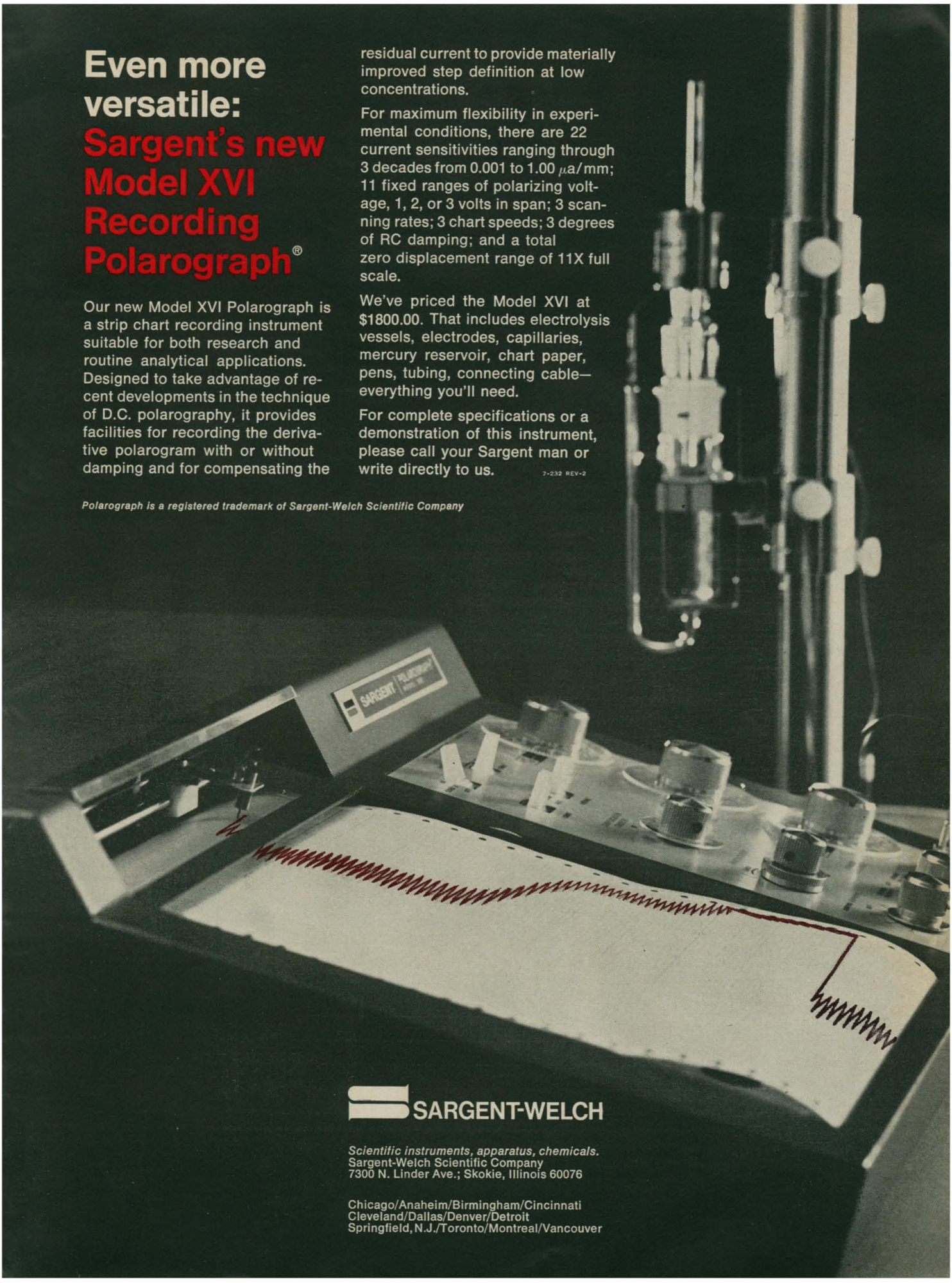
Our new Model XVI Polarograph is a strip chart recording instrument suitable for both research and routine analytical applications. Designed to take advantage of recent developments in the technique of D.C. polarography, it provides facilities for recording the derivative polarogram with or without damping and for compensating the residual current to provide materially improved step definition at low concentrations.

For maximum flexibility in experimental conditions, there are 22 current sensitivities ranging through 3 decades from 0.001 to 1.00 μa/mm; 11 fixed ranges of polarizing voltage, 1, 2, or 3 volts in span; 3 scanning rates; 3 chart speeds; 3 degrees of RC damping; and a total zero displacement range of 11X full scale.

We've priced the Model XVI at $1800.00. That includes electrolysis vessels, electrodes, capillaries, mercury reservoir, chart paper, pens, tubing, connecting cable—everything you'll need.

For complete specifications or a demonstration of this instrument, please call your Sargent man or write directly to us. 7-232 REV-2

Polarograph is a registered trademark of Sargent-Welch Scientific Company



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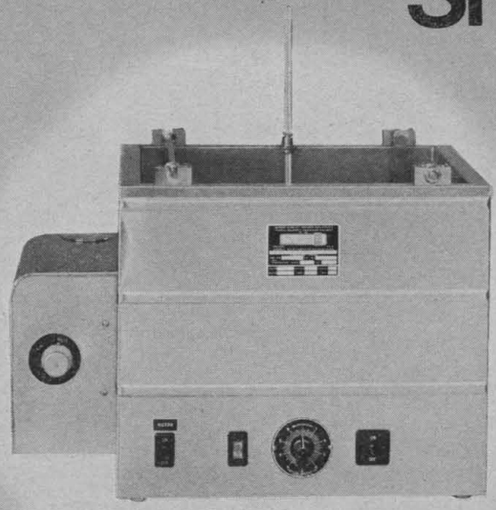

Shaking Incubators—3 sizes, 7 interchangeable racks to fit your exact needs.

Exceptional durability for lasting service year after year and a choice of instruments for a wide variety of research techniques — that's what you get with Precision Shaking Incubators.

Precision's basic design concepts bring you convenience of operation, materials and components that minimize maintenance, accessories for flexibility and versatility, and dependable uniformity and accuracy, of course.

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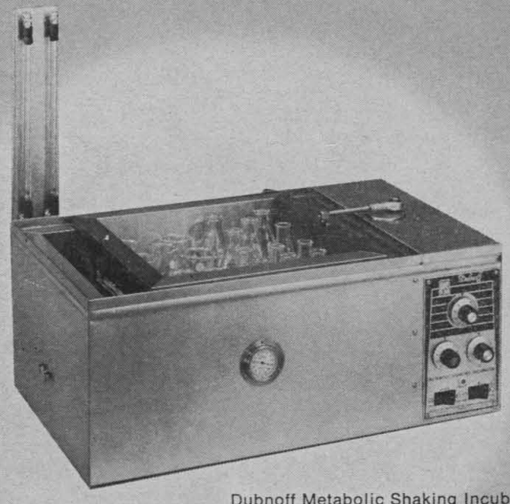
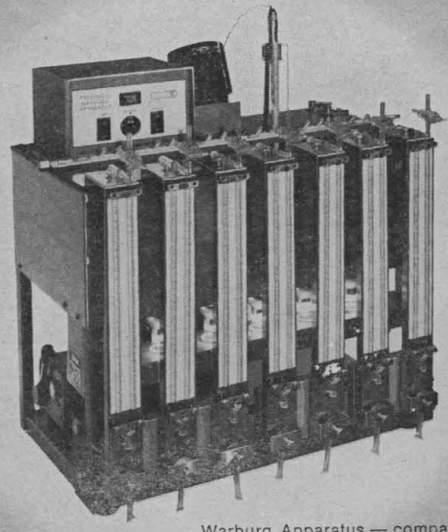


Dubnoff Metabolic Shaking Incubator — handles 20ML beakers, 25ML and 50ML flasks simultaneously.



Warburg Apparatus — compact, economical 7-unit model shown. Also 18-unit model.

Time to order a Mettler

When an employee grits his teeth, clinches his fists and generally loses his "cool" over milligrams, don't replace him. Replace the lazy, unreliable and sluggish balance he is using. Order a Mettler.

If you buy him a new Mettler H20T analytical balance, he will find it a pleasure to weigh milligrams again. A Mettler is fast, reliable, hard-working, and accommodating. It saves time and eliminates jangled nerves.

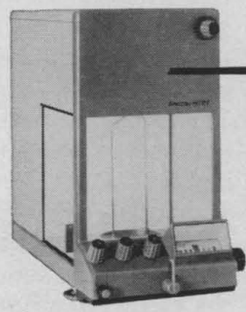
The ring weights, arranged in a concentric pattern, are rapidly and smoothly removed from the hanger without any "hang ups". The Mettler air damping system annuls the time required for the optical scale to come to rest. Weighing-in is fast and accurate with the filling guide. The net weight is read directly without any erroneous arithmetical calculations, thanks to rapid taring throughout the full weighing range and the separate tare weight indicator. The weighing result is registered in a compact row of figures.

The nicest thing about the H20T, however, is its "schizophrenia". It is actually two analytical balances in one: a semi-micro balance with a macro capacity (0.01-mg readability and 160-g weighing range).

So when you see an employee coming "unglued" over his balance, why not order a Mettler for him... the balance that gets along with people.

If he gets upset with a Mettler, it's time to give him a vacation!

12.6021.72



Mettler

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Giessen, West Germany
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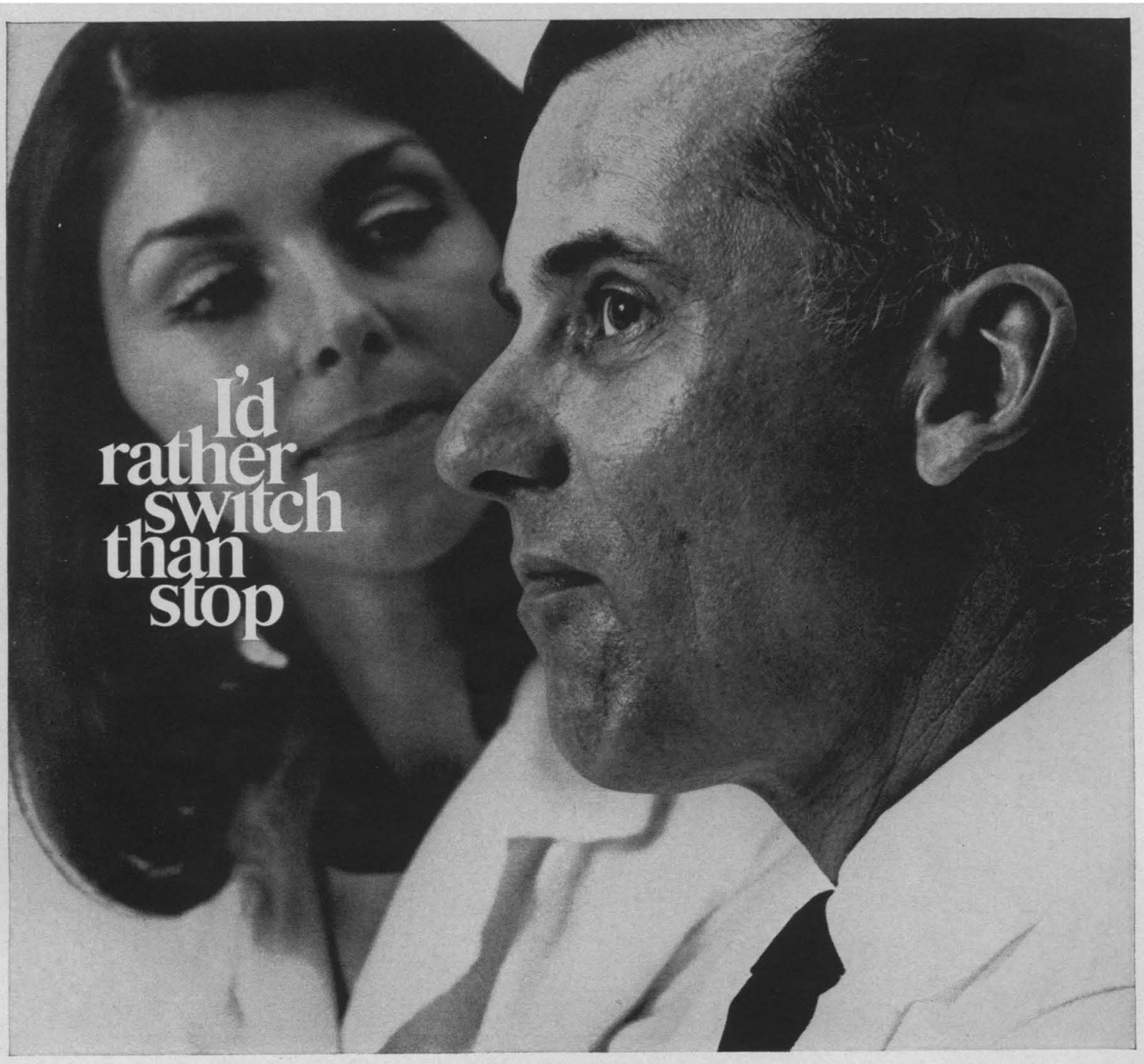
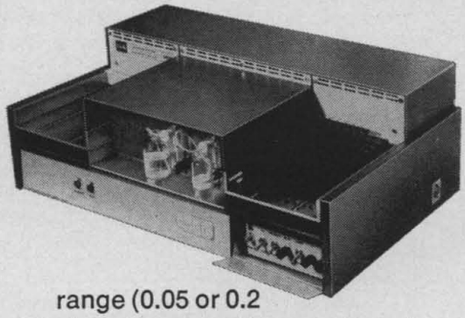


With the **LKB 8600 Reaction Rate Analyzer,** you won't have to STOP in the middle of things when you're running multiple enzyme activity analyses. The LKB 8600 keeps operating even when you SWITCH from one reagent to another.

While one determination is being processed, you can connect another reagent bottle to the second independent pumping system and ready the analyzer for the next determination — whether it be GOT, GPT, LDH, or any other enzyme determination made at 340 nm. Obviously, that's a savings in time.

Once the measuring time (1 to 9 minutes) and recording range (0.05 or 0.2 absorbance unit) are selected, the analyzer automatically feeds and processes up to 100 samples. The LKB 8600 Analyzer thermostatically heats the sample at 35° C . . . adds a pre-measured volume of reagent . . . measures the change in absorbance during the reaction . . . and records the results in strip-chart form.



Then too, the LKB 8600 promises to increase your output and to reduce your cost per test for a number of key enzyme activity analyses.

For more information, contact your Fisher Med-Lab Representative or write Fisher Scientific Company 1020 Fisher Building Pittsburgh, Pa. 15219

Fisher Scientific Co.

F-794

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EAI datalinks

A Newsworthy Compendium of How EAI Hybrid, Digital and Analog systems help make a complex world relatively simpler.

SO OTHERS MAY BREATHE EASIER

Breathing is a pretty-much taken-for-granted activity. Until it stops. Or until you look into the efforts of researchers and physicians in that field. Measuring respiratory pressure and volumetric-flow rate is pretty straight-forwardly accomplished with conventional transducers. But there are other important parameters that are determined by these characteristics: total inspired volume and breath-by-breath volume. Then there's total work, compliance and respiratory resistance. All of these values used to have to be calculated by hand. Tedious and time consuming. More lately they were cranked into a digital computer. Less tedium, but still a delay. Now, thanks to EAI analog computers, all calculations can be accomplished instantaneously and presented simultaneously with the original measurements on a strip chart. Besides the obvious value of showing a researcher what's happening when it's happening, our lower-cost machines also open new doors to monitoring patients. We've got some dramatic stories on how EAI analog computers are helping in other areas of research into physiological dynamics. By writing to "Bio-medical", Dept. 206R, you'll get them by return mail.

GC PEAKS AND THE SOFTWARE DEMON

As with motherhood and the flag, consensus holds that computerized data acquisition is with us to stay. But, in practice, it all can get a bit sticky. Take data from an analytical instrument like a GC. A few giants in the industry continue to stumble over problems in GC like noise, signal processing, or really useful software. EAI is still the pioneer here in its PACE analytical data system. One seemingly small thing is a software technique for resolving complex GC peaks. It consistently and accurately apportions complex areas, ranging from overlapping components to poorly resolved shoulder peaks. Part of the technique accommodates the usual "skew" in component elution to give consistent improvement in accuracy of quantitative analysis. (Our research people gave a paper on it at the 158th National ACS meeting.) It's all part of the whole PACE system--a turnkey data system for many analytical instruments--GC, mass spec, and the like. For a copy of the paper and a detailed booklet write to "PACE", Dept. 206R.

IMITATION POLLUTION CAN BE A SOLUTION

A topic certain to stir up the citizenry these days is pollution--any kind of pollution. Take a simple thing like free oxygen in water. Overload the water with oxygen-hungry chemicals--no oxygen. Or develop too many organisms--plant life prospers (called eutrophication) and no oxygen. Either way, no fish. And with no fish, you've upset the water ecology. Pragmatic scrutiny tells us we can't shut down our industries to bring back pristine, airy waters. Fortunately, we can imitate these conditions by computer simulation, and get a grip on the ameliorative aspects of a solution.

Recently, EAI provided the HEW with a hybrid-computer simulation of the Delaware River Estuary. From this simulation engineers can tell where to best locate stand-by reservoirs, what flow rates to employ, and when to use them. We've written this one up. A request to "Delaware", Dept. 206R, will get you a copy, and get us both cracking on another solution.

KINETIC DATA MEANINGFULLY SHAPED BY COMPUTER

In olden times petrochemical-process design involved finding rate and equilibrium constants for several reactions required a trial-and-error method. Much trial. Much error.

Most process designs involve the solution of ordinary differential equations --in a lumped-parameter system where changes are taking place in time but not space. With the use of analog computers, solutions poured forth. However, distributed parameter systems involve changes in time and space simultaneously--expressed by partial differential equations. Many approaches to PDE solution have evolved for digital computers. But such solutions consume more and more hardware, with ever-present error creeping back in as problem complexity increases.

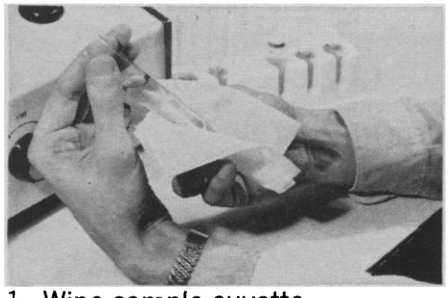
Hybrid computers clear this difficulty up. Kinetic data are programmed into the analog portion, actual results go into digital computer memory. The analog makes a series of process condition runs, the digital stores the data, matches the results from the plant and computes least mean-square deviations. The "solution" has been found when results of simulation most closely match actual conditions, and no further reductions can be made in mean square deviation values. Optimization is achieved--in time, money and results.

After much struggle, EAI is pleased to offer a software package in this arcane speciality--write to "Kinetic", Dept. 206R. Electronic Associates, Inc. West Long Branch, N.J. 07764.

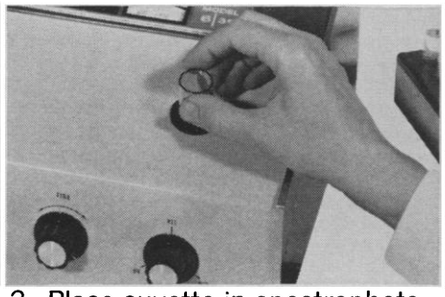
EAI®

COMPARE THE NOW

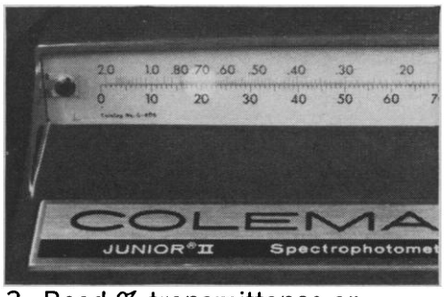
PRESENT METHOD OF CLINICAL SPECTROPHOTOMETRIC ANALYSIS



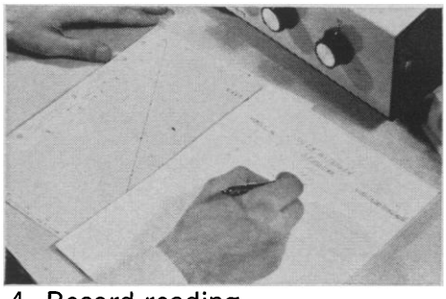
1. Wipe sample cuvette.



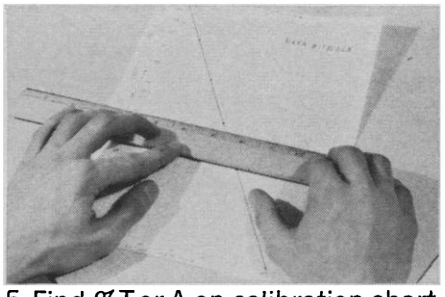
2. Place cuvette in spectrophotometer and align index mark.



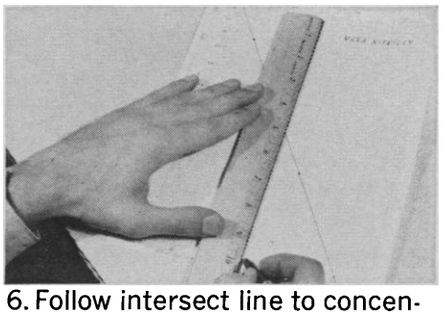
3. Read % transmittance or log absorbance.



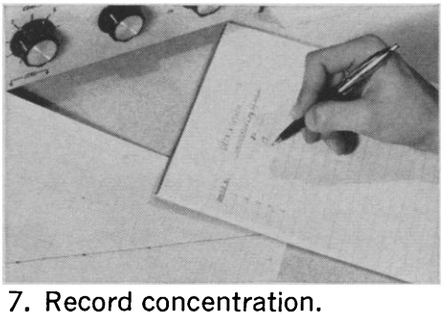
4. Record reading.



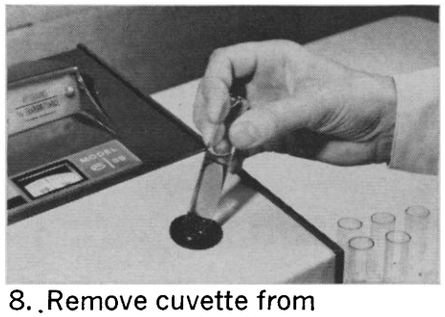
5. Find %T or A on calibration chart . . . follow line to intersect curve.



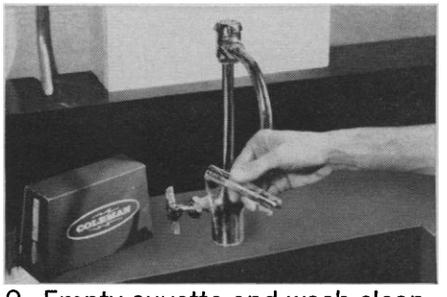
6. Follow intersect line to concentration axis. Read concentration.



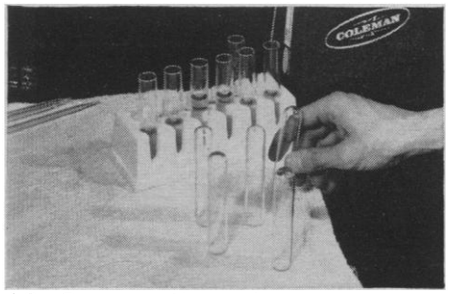
7. Record concentration.



8. Remove cuvette from spectrophotometer.



9. Empty cuvette and wash clean.



10. Dry cuvette and store for next use.

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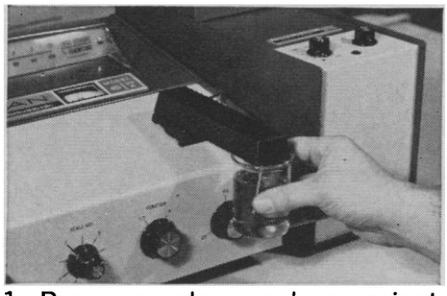
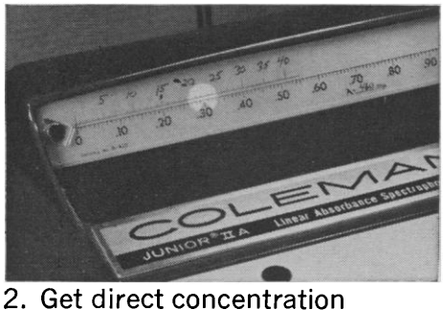
WITH THE NEW

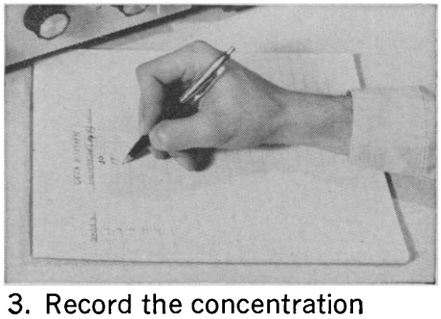
A FAST SAMPLING, LINEAR READOUT "SYSTEM" FOR CLINICAL ANALYSIS



1. Press sample vessel up against Autofill intake trigger.



2. Get direct concentration readout.



3. Record the concentration value.

The new Coleman "System" for clinical spectrophotometric analysis is made possible by—

- New Junior® IIA Spectrophotometer, the third generation successor to the Coleman Junior and Junior II—with built-in electronic converter which provides direct linear absorbance or concentration readout. Eliminates the need for working with logarithmic scales and charts. Reduces reading errors and inaccuracies.
- Unique, snap-in linear scales which provide a choice of direct concentration or absorbance readout and eliminate conversion errors.
- The Autofill™ Cell Assembly, a new breakthrough in sample handling—improves accuracy, speeds analysis, eliminates the need for expensive optical grade cuvettes. Cost savings achieved by the Autofill will more than pay for the entire Coleman "System."

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☐ Please call me to arrange a demonstration of the new System.

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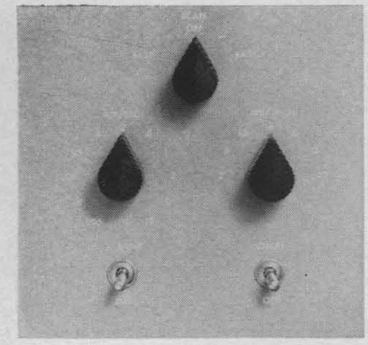
The new Cary 17. Very simply, it makes absorption spectroscopy.

The Cary 17 is more than just another new recording spectrophotometer. It's far and away the best, easiest to use, most versatile spectrophotometer we've ever built. Or anybody else for that matter. The Cary 17 puts spectroscopy on a whole new level. Its own.

A CLOSER LOOK

One of the first things you'll notice about the 17 is its striking visual similarity to the Cary 14. This is no accident. We simply made use of design and performance features which have gone unmatched for almost 15 years.

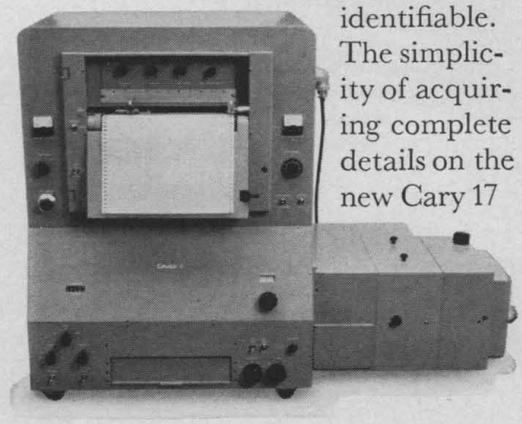
But it's the new features that make the Cary 17. Solid state electronics, for instance. Accurate, forward-beam near infrared operation. Coupled scan and chart drive with digital scanning so you can—for the first time—actually control the digital scanning mechanism of your spectrophotometer with a computer. And optimum parameters indicators which let you get the best performance in the shortest time.



The Cary 17 is also equipped with a powerful tungsten-halogen high intensity source. Pen period control. A unique wide-range slidewire which does the work of four separate slidewires. And multipots. Without having to purchase another accessory, you can perform an infinite variety of highly accurate routine spectrophotometric measurements. Two standard modifications are also available. One for high temperature studies such as fused salts. The other for infrared work out to 3.0 microns, even on heat or photosensitive samples.

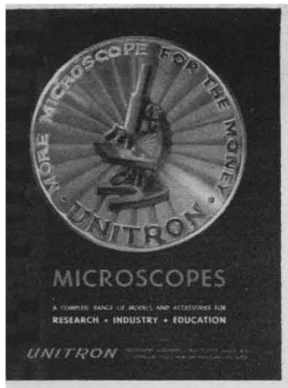
YOUR EASY LIFE

The simplicity of the Cary 17's control panel is the result of many years actual working experience. Each switch, knob, dial and button is placed precisely where it should be. And each is clearly identifiable. The simplicity of acquiring complete details on the new Cary 17



has also been carefully planned. For a brochure, just write Cary Instruments, a Varian subsidiary, 2724 South Peck Road, Monrovia, California 91016. Ask for data file E-002-40.

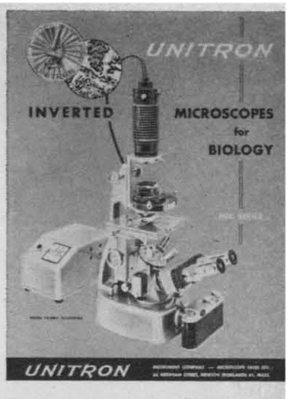
cary instruments

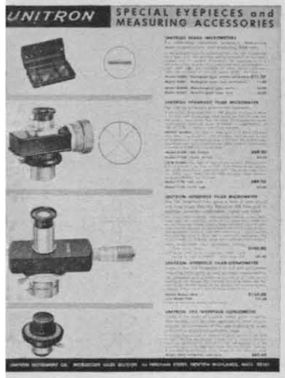


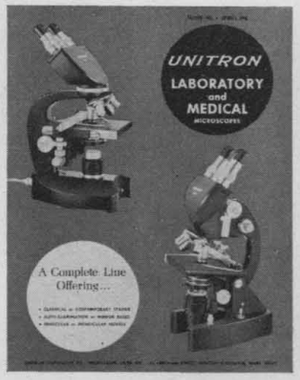
FREE MICROSCOPE BUYING GUIDE

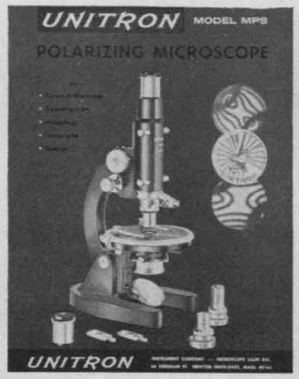
Shown here in miniature are just some of the informative brochures which comprise the UNITRON Catalog . . . your buying guide to quality microscopes at prices within your budget. Whether your application is routine laboratory analysis, advanced biological research, or industrial quality control, you will find the instrument you need in UNITRON's complete line.

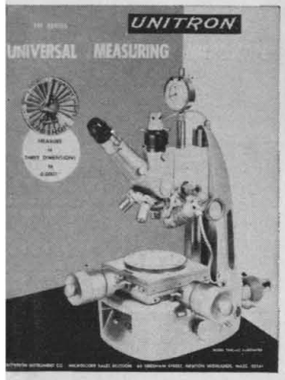
A UNITRON MICROSCOPE CATALOG is Yours for the Asking.







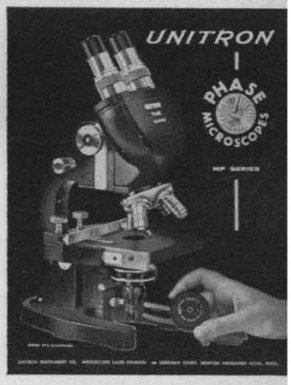


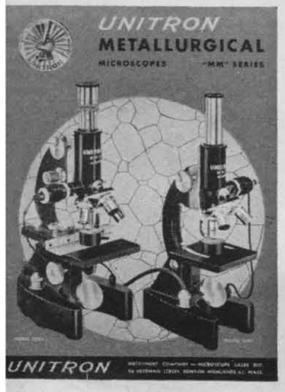


TRY ANY UNITRON MICROSCOPE FREE FOR 10 DAYS

A salesman's demonstration gives you only about 30 minutes to examine a microscope, hardly the best conditions for a critical appraisal. But UNITRON's Free 10 Day Trial gives you the opportunity to evaluate any model in your own laboratory and prove its value in your own application before you decide to purchase. See for yourself, as have thousands of other buyers, why . . .

UNITRON Means More Microscope for the Money.





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MICROSCOPE SALES DIVISION
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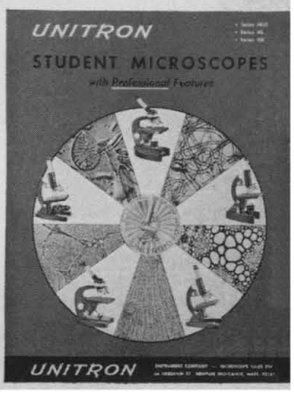


The Polaroid MP-3 Multipurpose Land Camera

Our MP-3 camera system turns out work it normally takes a whole slew of special cameras to do.

1. It can copy beautifully in black-and-white or color.
2. It can do photomicrography.
3. And close-ups.
4. And macrophotography.
5. It can make slides.
6. And copy them in print form.
7. It can copy X-rays.
8. And make ultra-high-contrast line copy prints to size.
9. It's a process camera. You can make screened prints to size, too.
10. It's a studio camera. Turn the whole camera sideways and aim it at people or things.

You don't need a darkroom. (Goodbye chemicals, mixing, washing and all that.)

You can knock off jobs at dizzying speeds—some as fast as 15 seconds. Others take an agonizing two minutes.

And—not least—you can also save money.

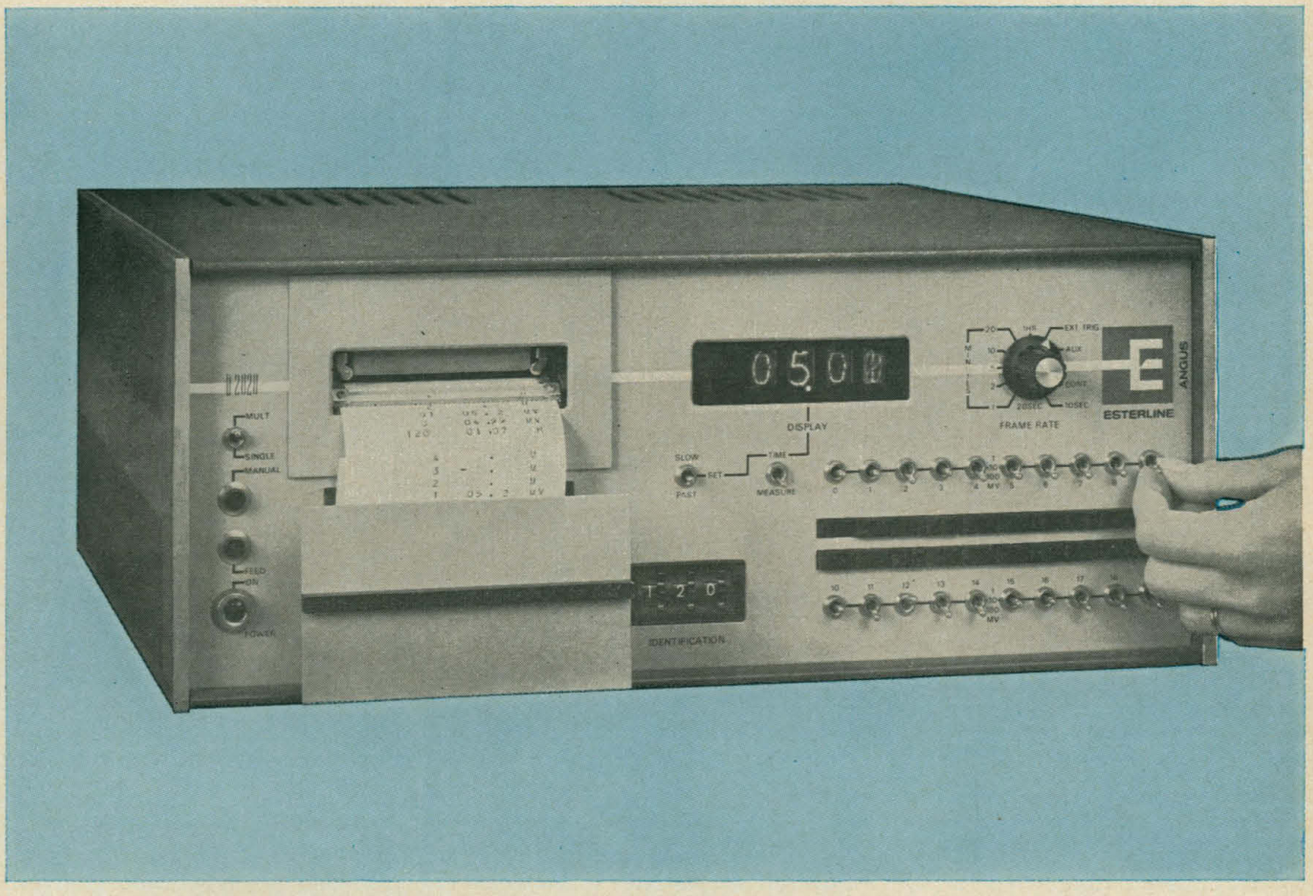
The MP-3 is easy to operate and allows you a wide range of films and accessories (lenses, camera backs, etc.). It will handle all 13 Polaroid Land films and most wet process films.

A basic system costs as little as $684. Naturally, the more you add, the more it costs. If you want everything, it can go as high as $1647.

Which is still a bargain compared to 10 cameras, a studio and a darkroom.

For our new brochure on applications or a demonstration, write to Polaroid Corp., Dept. 26-179, Cambridge, Mass. 02139.

A Digital Data Acquisition System priced at $3,790*?



Esterline Angus must be kidding.

Not at all! We've got the most compact, feature-packed 5 to 20 channel Digital Data Acquisition System available today.

Our Model D-2020 has low level signal conditioning available for each channel. You can switch select 1, 10 or 100 MV full scale with 200% overrange. Compare our 1 MV signal conditioning with the high level signal conditioning of much more expensive units.

We've also got a real time, solid state clock (nixie tube display); a 20 column printer with floating decimal; adjustable frame scan rates, and 1,000 megohm input impedance.

The entire Esterline Angus Digital Data Acquisition System is contained in an attractive housing that's 17⅛" wide, 7" high, 16⅛" deep.

For more information, call or write for our colorful catalog.

*Price of 10 channel system. Optional plug-in boards provide up to 10 additional channels in five channel increments. For five additional channels you pay only $250. You can add 10 channels for $500.

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Ten directly addressable storage registers

Programming: Up to 128 steps. Conditional branching and automatic entry of programs with card reader.

Model 1655. Size: 13″ x 13½″ x 6½″.

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Dynamic range: 10^{-99} to 10^{+99}

Automatic special functions:
a^x, $\text{Log}_{10}/\text{Log}_e$, SIN/COS,
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Radians to Degrees,
Single key Σx, Σx^2, N,
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Just plug in
and put it to work.

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Monroe men who know everything there is to know about calculators.
Because calculators are our only business.
That's how we got our name.
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CalComp presents a brilliant new film producer.

Up until now, you could buy your computer either a brilliant and versatile microfilm plotter.

Or a brilliant and high speed microfilm printer.

But you couldn't buy, for any reasonable amount of money, one film output system that was both.

Now you can.

CalComp presents the 1670 COM system. It's a plotter.

CalComp's new offline 1670 COM system is the finest Computer Output Microfilm plotter you can buy.

It draws at a rate of 500,000 increments a second.

Features a programmable raster of 16,384 by 16,384 positions. The finest resolution available.

And cuts tape write time to a tenth or better over previous microfilm systems.

With twenty usable line widths, the 1670 COM system is ready to draw practically anything.

And with the support of CalComp's extensive library of basic, functional and application software, it practically can.

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If your primary need is for a high speed printer, the CalComp 1670 COM system is that, too.

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And take your choice of cameras. 16 or 35mm. Sprocketed or unsprocketed. Even a 105mm microfiche option.

So if you haven't been able to decide between a microfilm system that *plots* or one that *prints,* call your nearest CalComp man today. (CalComp has offices in 34 cities.)

And tell him you want to discuss the brilliant new producer that produces both.

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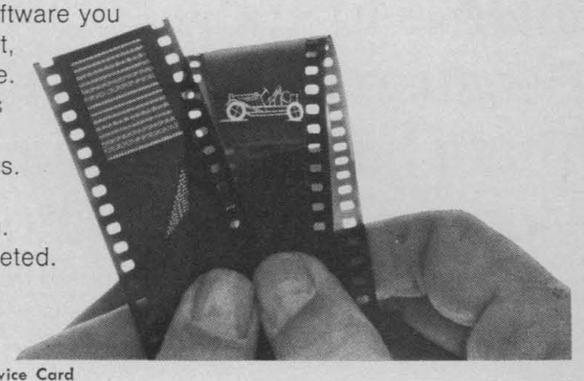

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Concepts from Union Carbide:

Cryogenic freezing of red blood cells

Probably no single problem has received more attention from cryobiologists than the preservation of the human red cell. And with good reason. Procedures that extend the supply of erythrocytes for transfusion have meaning in terms of human lives.

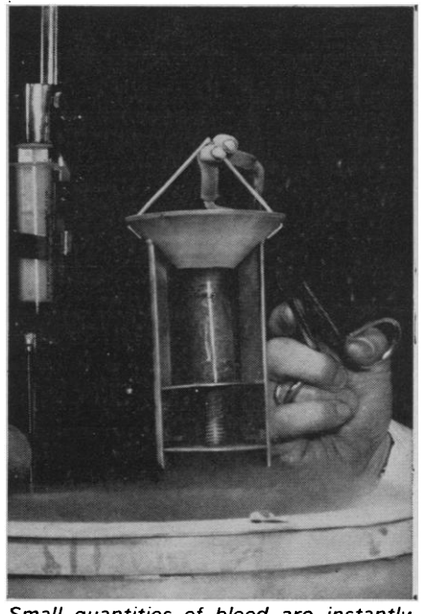
The prospect of a frozen blood reserve has been a matter of intensive interest to the blood banking agencies for the past twenty years; some have played a major role in the scientific attack on the problem. It has not been easy. It was observed in 1941 that red cells (suitably protected with additive substances) could survive the drastic environmental changes induced by freezing. Since then, processes have been sought for the preservation of blood in the frozen state that would provide a useful and acceptable product for transfusion. As evidenced over the past decade by the successful transfusion of thousands of units of blood preserved in the frozen state, that goal seems to have been reached.

The current limitation of twenty-one to twenty-eight days for blood preserved by conventional methods in the liquid state has often taxed the resources of the organizations that undertake to provide our communities with supplies of this indispensable agent. The relatively short shelf life of the cellular components of blood adds to the problem of coordinating supply with demand. The less common blood types sometimes are difficult to procure, but even the more common types may vary in supply at any given time.

Red cell wastage is an inevitable consequence of the dating period necessarily imposed on blood stored at 4°C. A primary objective of agencies interested in preserving blood at low temperatures is to prevent this wastage. Another, of course, is to assure adequate reserves of all types of blood at all times for each community. Conceivably then, as frozen blood banks become established in various parts of the country, an integrated and computerized inventory system could be developed that would result in an effective national reserve.

Several practical approaches to the preservation of blood at low temperatures have evolved. All have some elements in common. A solution of additives, often called cryoprotective agents—glycerol is the outstanding example—is combined with the red cells from which most of the plasma and much of the other cellular components of blood (leukocytes and thrombocytes) have been removed. This is done in special containers in which the erythrocytes are cooled and placed in long-term storage. When needed, the erythrocytes are withdrawn from storage, warmed, and subjected to a washing procedure to remove the protective agent before transfusion.

The heart of a frozen blood reserve is the storage facility. Storage equipment is of two general types: cryogenic and noncryogenic. The latter provides temperatures down to about −85°C and depends on electric power. The cryogenic equipment is independent of a power source and provides lower storage temperatures—down to −196°C—with liquid nitrogen, the most commonly used refrigerant. Associated with such storage equipment are cryogenic shipping units that permit transport of blood in the frozen state without danger of a destructive rise in temperature that might render the blood cells unfit for transfusion.



Small quantities of blood are instantly frozen for long-term storage in the droplet freezer. A mechanically vibrated syringe releases droplets into a revolving drum of liquid nitrogen. The frozen droplets are collected in the base. Thousands of droplets can be collected from each sample for use as reference specimens.

The banking of frozen blood with longer shelf life should considerably enhance the ability of the blood supply agencies to meet demand and might influence current procurement practices. The use of cryogenic storage equipment would provide a margin of safety for autologous blood banking in which individuals of rare blood type would establish a reserve of their own blood in anticipation of later need. Probably most important in terms of medical need, the availability of banks of frozen red cells would seem likely to lead to the development of banks of the other cellular components of blood. With current liquid state storage procedures, platelets and leukocytes—far less stable than the red cell—are without transfusion value within about three days or less after donation. At present, the only prospect for establishing a large-scale reserve of these invaluable components is to preserve them in the frozen state. Although low temperature preservation procedures for these cells are not technically as far advanced as for the red cell, several blood laboratories are fully aware of the need and are attacking the problem vigorously.

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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.

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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.

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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.

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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.

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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.

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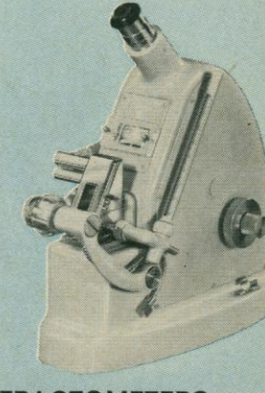

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World's most complete line for precision testing in every index range from n_D 1.20 to n_D 1.71, or percent total solids from 0-85%. Operation is fast, easy and so comfortable there's no fatigue . . . even after all day production use. Abbe 3-L, High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

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The EMU-4B, a high-resolution transmission Electron Microscope—the instrument known as the workhorse in the field—offering versatility and total ease of operation.

FORGFLO HAS IT.

A goniometer stage—totally new to the industry—permitting many degrees of specimen orientation. This component is usable in all EMU-4As and EMU-4Bs, and is adaptable to any EMU-3 equipped with a universal specimen chamber.

FORGFLO HAS IT.

New and complete facilities for training of technical personnel who study under the guidance of Forgflo instructors familiar with the latest developments in Electron Microscopy.

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A wide range of accessories—devices to subject Electron Microscope specimens to extremes in temperatures, high stresses, magnetic fields, diffraction studies, goniometric positioning, and other applications.

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A custom systems engineering staff, heavily backgrounded in high-voltage Microscopy, ultra-high vacuum systems, image processing, special specimen techniques—virtually any problem's solution.

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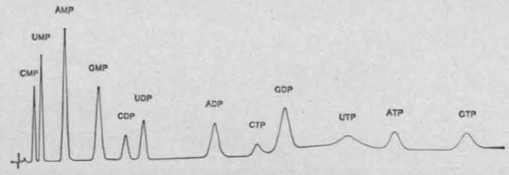
If you're not studying nucleotides with a high pressure, ion-exchange LC, you're not studying nucleotides.

No ion-exchange liquid chromatography analysis would be complete without our new LCS 1000: a self-contained, high pressure, ion-exchange system designed to perform quantitative separations of water soluble, ionizable compounds quickly and accurately.

The LCS 1000 comes equipped with a hot-air heated oven with circulation fan and thermostatic controls; a high pressure (up to 3000 psi) column pump; and a stainless steel capillary column packed with pellicular anion or cation exchange resins. Also standard: a sensitive, low dead volume ultraviolet absorption detector which measures to picomoles of component.

Utilizing a unique gradient elution capability, the LCS 1000 is particularly useful in the separations of such complex mixtures as bases, nucleosides, nucleotides, and dinucleotides. Only nanomole sample quantities are required and molecules as similar as 2′ and 3′ RNA nucleotides can be separated clearly.

The separation of Mono-, Di- and Tri- phosphates of cytidine, uridine, guanosine and adenosine, which typically requires more than a day with other techniques, can be



performed in a couple of hours or less with the LCS 1000.

Our new ion-exchange liquid chromatograph is also extremely easy to operate. Just plug it in. No water lines, air tubes or nitrogen feeders. It even has provision for sample collection.

For complete details and a copy of our recently published applications booklet, *Nucleic Acid Constituents by Liquid Chromatography,* write Varian Aerograph, Walnut Creek, California 94598; Tokyo, Japan; Malton, Ontario, Canada; Crows Nest, N.S.W., Australia; or Zug, Switzerland.

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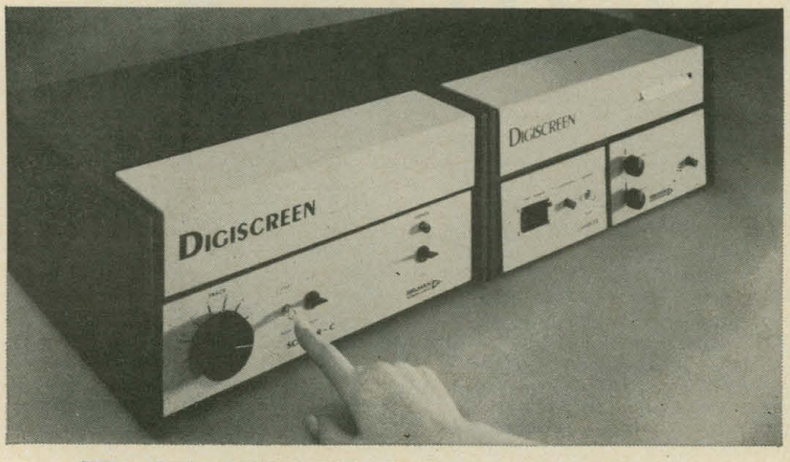
with push-button convenience

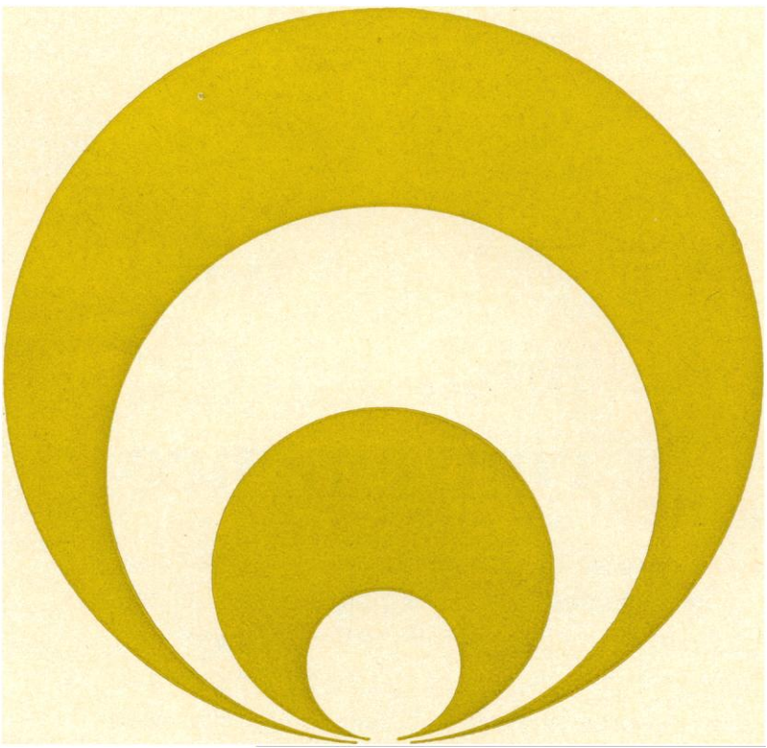
Push a button and Digiscreen™, the Electrophoresis Computer automatically scans eight electrophoresis separations. There is no need to make tedious adjustments since Digiscreen has an automatic zero to compensate for any background. Optical Filters can be changed to scan various stains.

A labeled density curve, relative area percent values, and sample identification data are printed out for each sample. With the push of one button eight separations can be completely quantitated in less than 60 seconds.



DIGISCREEN

GELMAN INSTRUMENT COMPANY
Ann Arbor, Michigan 48106



MICROMEDIC
SYSTEMS, INC

A new company that shares your interest in doing small things better

Under the joint sponsorship of Rohm and Haas Company and a leading international research institute, Micromedic Systems is a firm developing a new generation of components with some impressive specifications. These advanced instruments will do wet chemical microanalysis several times more rapidly and accurately than existing equipment.

A preview of what you can expect from the Micromedic line is our Micromedic Automatic Pipette. Designed with motor and twin interchangeable pumps, this automatic pipette will prepare ten diluted samples per minute. It will make possible for the first time accurate and reproducible sample volumes under 20 microliters. An automated version to come later, the Micromedic Automated Pipette, will handle multiple samples of this size range in sequence—*without manual intervention.*

These are but the forerunners of analytical systems that will make automation of submicro clinical determinations on body fluids a reality within the next few years.

Learn more about a company that shares your interest in doing small things better. For information on the Micromedic Automatic Pipette and Automated Pipette write to:

MICROMEDIC SYSTEMS, INC
Rohm and Haas Building
Independence Mall West
Philadelphia, Pa. 19105.

See us in Booth D 126 at FASEB, Atlantic City

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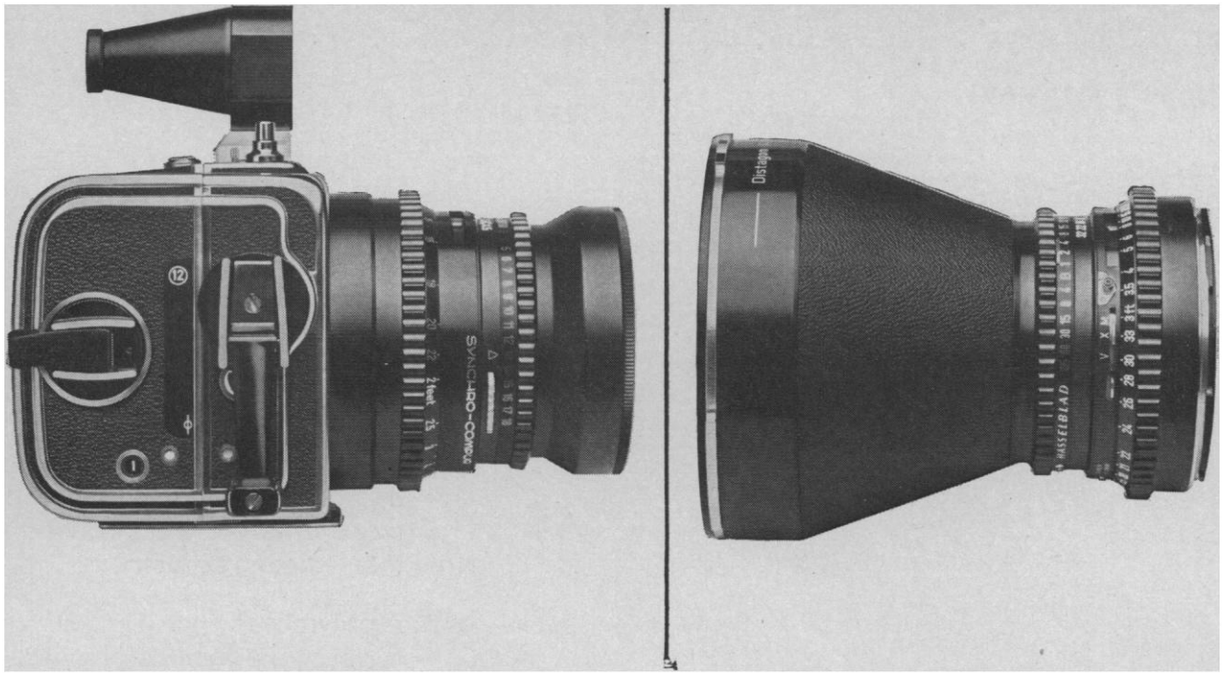

How to get involved in Hasselblad wide angle photography. For under $1,000. Or over $1,000.

For under $1,000 you can buy a Hasselblad Super Wide C. The whole camera. Body. Lens. Magazine and all.

The lens is a 38mm Zeiss Biogon f/4.5, and you couldn't buy it separately for any money. Because it comes permanently attached to the camera body.

The Super Wide C is the only Hasselblad that isn't a reflex camera. It couldn't be. To take advantage of its optical properties, a true wide-angle lens such as the 38mm Biogon had to be placed less than ¾" from the film plane. Which didn't leave much room for a mirror.

So we gave up a mirror to gain some unique advantages.

Like superb corner to corner sharpness and distortion-free images that only a true wide angle lens can give. (Verticals and horizontals emerge as straight lines, not distorted curvatures from edge to edge.)

And a sweeping 90° angle of view (a normal lens covers about 52°) that lets you take in a wide area without having to back away from your subject.

And enormous depth of field (at f/22. everything is sharp from 12" to infinity) which makes the Super-Wide C a great camera for grabbing quick shots when there isn't time to focus.

And a very compact camera for one that provides 2¼" x 2¼" photographs.

The Super Wide C employs an optical viewfinder. But should you ever require reflex viewing and focusing, you can remove the film magazine and attach a ground glass back in its place. Then when you're ready to shoot, just take it off and put the film magazine back.

The magazine might be any one of the five interchangeable film magazines of The Hasselblad System, because the Super Wide C accepts them all. So you can work in a variety of film formats and exposures per roll, all the way up to 70.

The Super Wide C was one of the Hasselblads chosen by NASA for use in space. During Gemini 9, it was taken on a two hour space walk where it recorded fifty remarkable photographs, working in total vacuum.

For over $1,000 you can buy our 40mm Zeiss Distagon f/4. lens, and a camera to go with it.

The lens alone costs about as much as the entire Super Wide C camera, and you still need a body and film magazine.

It costs what it does because the Distagon is a very remarkable lens.

It had long been thought that 50mm was the practical limit in building a fast, wide angle lens for a 2¼" reflex camera. Which limited the angle of view to 75°.

The Distagon broke the rules. It added another 13° to the angle of view, and proved to be as distortion-free as our 38mm Biogon.

But the biggest advantage of the Distagon lens is that it fits the Hasselblad 500 C and 500 EL cameras. So you can look through the large ground glass and see what's in and what's out of focus, how vertical the verticals are and what kind of perspective the finished picture will have.

The Distagon lens also interchanges with nine other Carl Zeiss lenses, up to 500mm telephoto.

And allows you to utilize all the backs and accessories of The Hasselblad System.

Both the 38mm Biogon and 40mm Distagon lenses are very much alike in terms of quality. Both lenses have built-in Compur shutters, so you can shoot at any shutter speed with any type of flash. Which is only possible when the shutter is in the lens—instead of in the camera.

The big difference between these two wide angle lenses is that one permits reflex viewing and one doesn't.

And it's up to you to decide how much that's worth to you.

For information, see your Hasselblad dealer. For his name, and a free 48-page catalog on The Hasselblad System, write to address below.

38mm Biogon	Comparison of lenses	40mm Distagon
f 4.5	Aperture	f 4.
38mm	Focal length	40mm
90°	Angle of view	88°
8	Number of lens elements	10
12" to ∞	Focusing range	19" to ∞
B, 1-1/500 sec	Synchro Compur Shutter	B, 1-1/500 sec
4.5-22	Diaphragm	4-32
63	Filters—Hasselblad Series	104
Optical	Viewing system	Reflex
No	Interchangeable?	Yes
Under $1,000 (including body)	Price	Over $1,000 (including body)

HASSELBLAD

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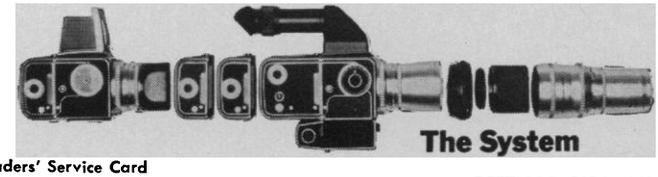

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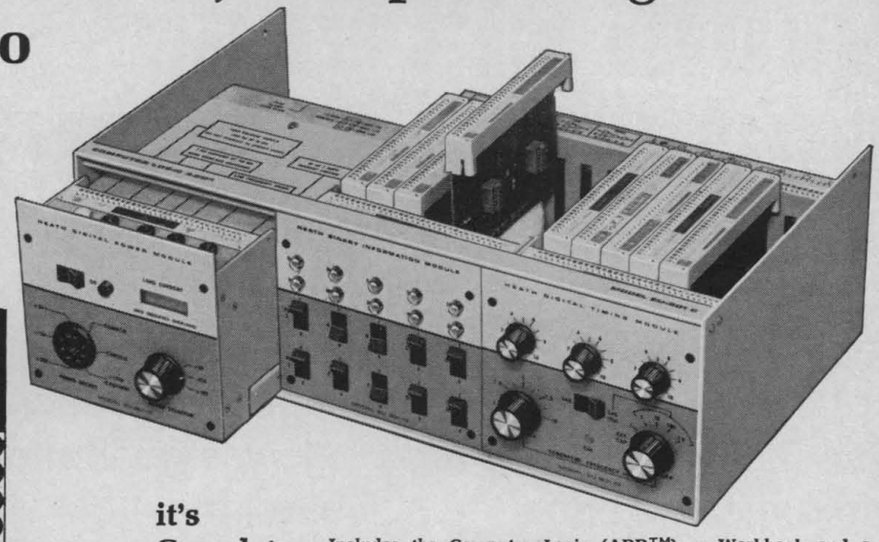

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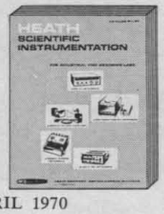

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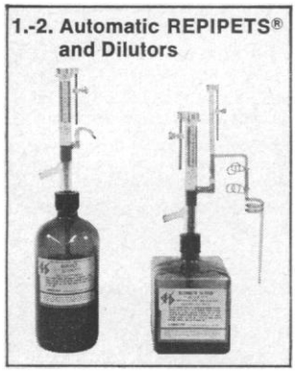

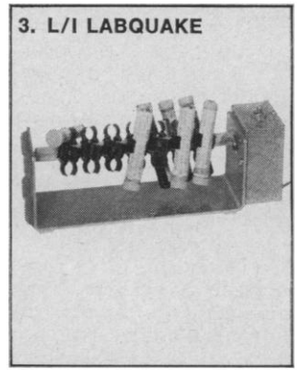

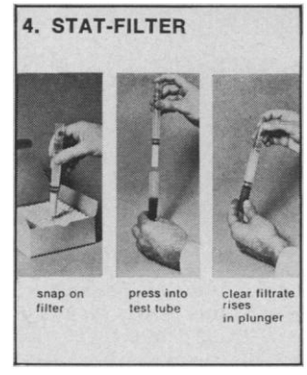

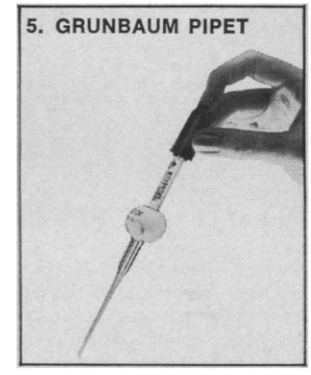

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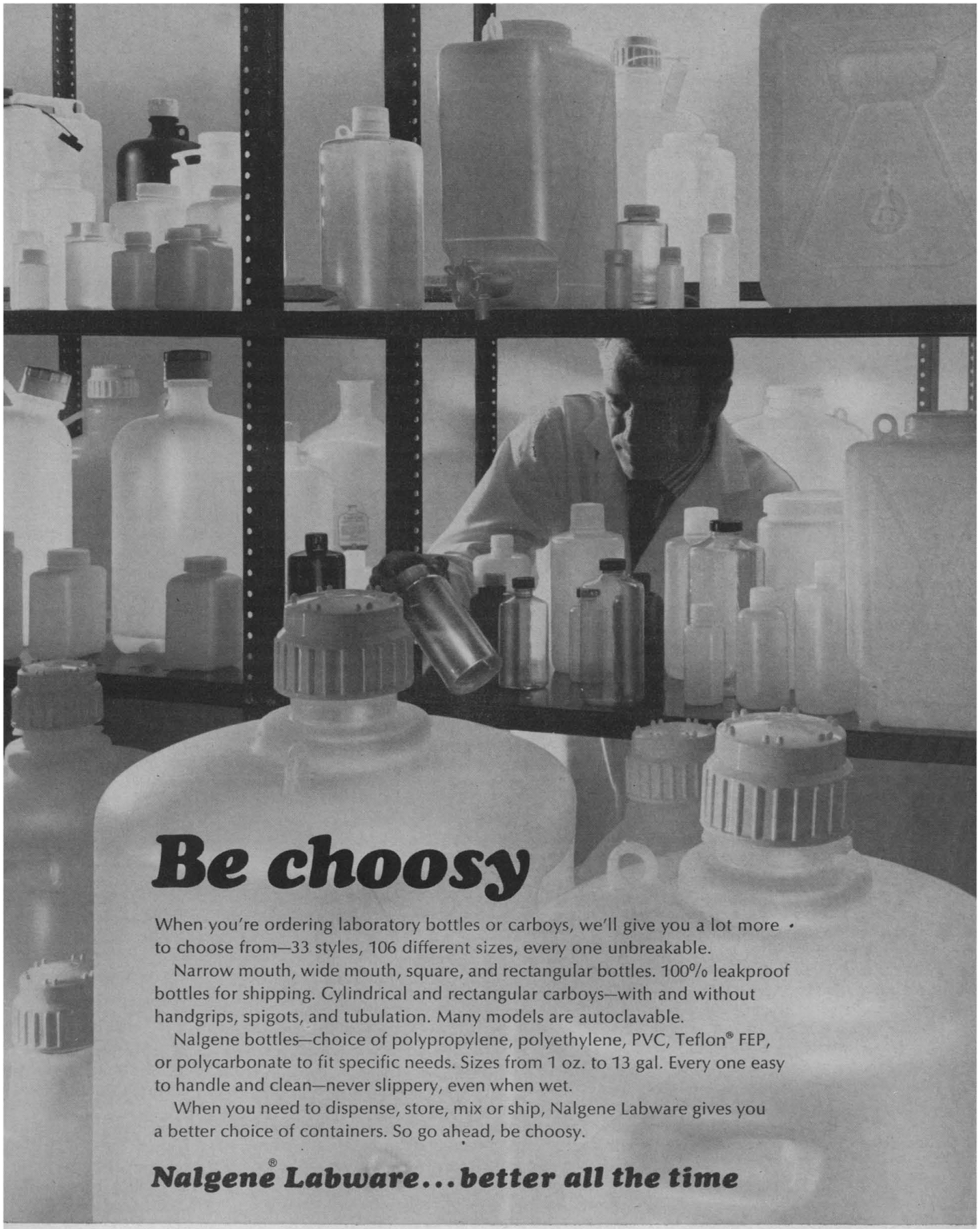

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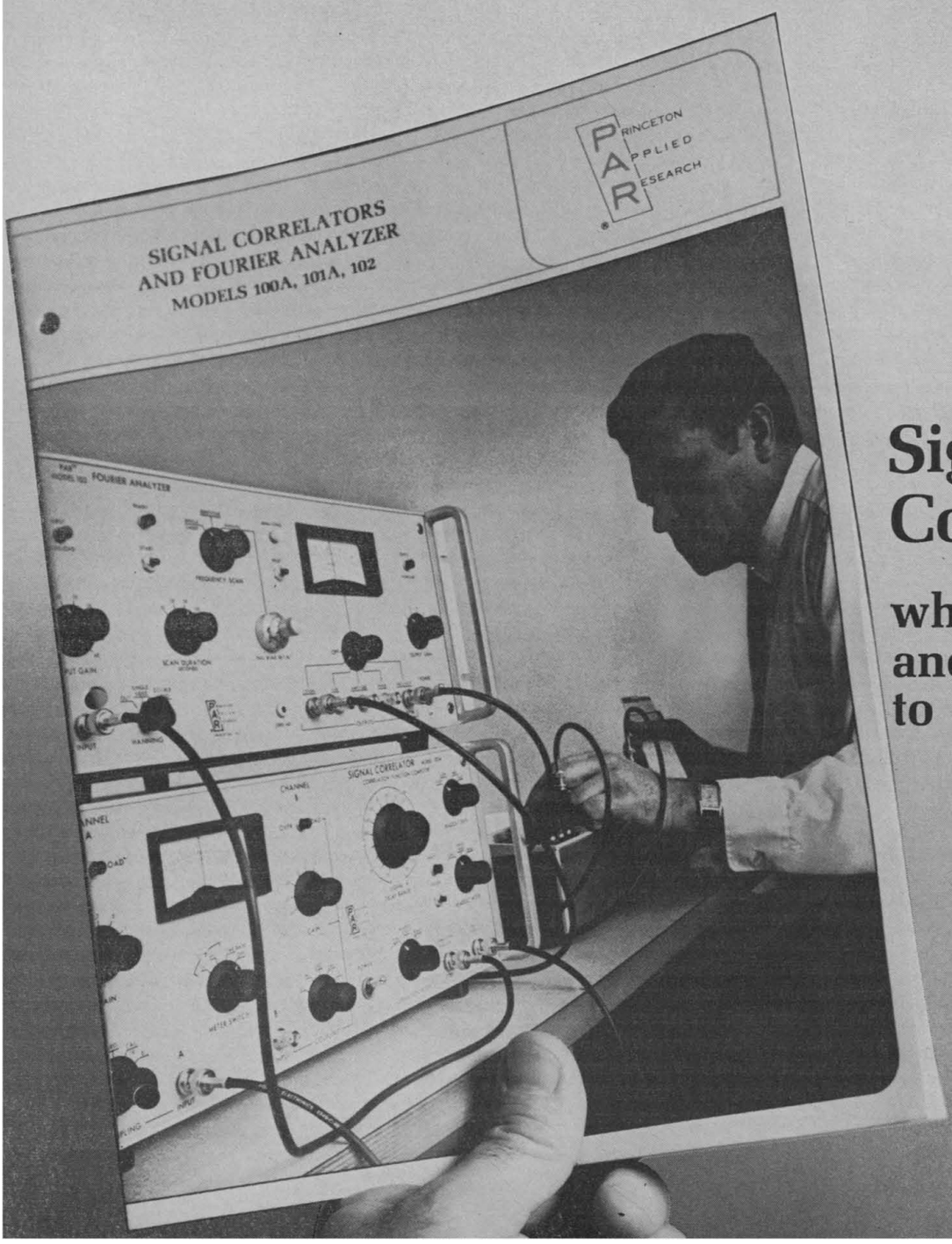

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Scientists are invited to submit to me outlines of projects (including a summary of methods, equipment, personnel, and proposed timing).

ALAN R. EMERY
Ontario Department of Lands and Forests, Maple, Ontario, Canada

Serratia marcescens: A Pathogen

Laboratory manuals are still being published with directions for rubbing suspensions of *Serratia marcescens* directly on the hands of students in experiments which demonstrate, with handshaking, the dispersal of a microorganism. *Serratia marcescens* has been indicted as the infectious agent in urinary tract infections, pneumonia, empyema, lung abscess, meningitis, wound infection, sinusitis, endocarditis, and a frightening variety of other diseases.

Any instructor who plans to use this organism in his laboratory should read the papers by Gaughran (*1*) and Dodson (*2*).

THOMAS A. WHALEN
Division of Science, Siena College, Loudonville, New York 12211

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2. W. H. Dodson, *Arch. Intern. Med.* **121**, 145, (1968).

Alaska: Ground-Level View

The purpose of my letter is not to contest the privilege of a marine geolologist to express his opinions on the recovery of terrestrial ecosystems ("Rape of Alaska can be rational," Wright, Letters, 5 Dec.). However, such opinions must be based upon a more ground-level view of the ecosystem rather than a view from a slow flying airplane.

A more thorough examination must be made of Wright's examples of how the land has been "raped in a rational manner." He maintains that areas dredged 50 years ago are now completely recovered, but it was not until 1928 that gold dredging commenced in the Fairbanks area (*1*). Even if the "raped" areas are 41 years old, it is hard to imagine that a spruce forest that takes 100 to 150 years to mature after a burn (*2*) could possibly achieve a stage of "complete recovery" or successful healing in that period of time. I have personally walked over the barren expanses of coarse gravel of many of the dredged areas of the interior. With the exception of a few willows and an occasional spruce, I would describe the tailings as barren piles of rock. It is not true that these rocks have even begun to recapture the completeness of the food web that was once represented before the dredging. Wright's statement that gold mining is an example of "how an area can be exploited without permanent damage" is unfactual and at least 100 years premature. In short, gold dredging is one of the most blatant examples of irresponsible exploitation in Alaska.

Wright's description of the widespread burning of interior Alaskan forests by the early miners and the assumed beneficial effects for moose overlooks the fact that fire has been a dominant ecological factor long before man's influence (*3*). Even today lightning fires account for the greatest proportion of

acreage burned annually (*4*). While fires may have beneficial effects for moose under some circumstances . . . the intensity and frequency of burns is an important factor influencing the vegetation that follows (*2*). Also fires may be detrimental to many species of wildlife which are dependent upon climax vegetation types. Fire is considered to be responsible for the extinction of caribou on the Kenai Peninsula around the turn of the century and the drastic decrease in their numbers in interior Alaska in the early 1930's (*5*).

In Alaska the muskox has become the subject of a controversy between those promoting its domestication and advocates of the muskox as an element of the native fauna subjected to conventional wildlife management practices. The successful exploitation of the muskox in the Arctic is subject to the same biological, social, and economic problems that have plagued the reindeer herding industry. The muskox appears suitable for a cottage economy such as existed in northern Scotland 100 years ago, but the lack of an animal husbandry tradition in the North American Arctic and the rapid acculturation of the native peoples do not favor acceptance of pastoralism as a way of life in the future (*6*). With these observations in mind, I find it hard to accept Wright's assumption that muskox herding is a "sensible" technique for exploiting the Arctic barrens.

I realize that Wright does not favor blind destruction of Alaska in the process of oil development. However, if the examples he cited are the most rational support available, I can only envision Wright's rational rape as the birth of a monster.

PAUL WHITNEY
Institute of Arctic Biology,
University of Alaska, College 99701

References and Notes

1. J. D. Crawford and J. C. Boswell, *Mining Met.* **29**, 574 (October, 1948).
2. *U.S. Dep. Agri. Tech. Bull. No. 1133* (Government Printing Office, Washington, D.C., 1956), p. 33.
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4. R. J. Barney, *Interior Alaska Wildfires, 1956–1965* (Institute of Northern Forestry, Juneau, Alaska, 1969).
5. A. S. Leopold and F. F. Darling, *Wildlife in Alaska* (Ronald, New York, 1953), p. 58.
6. D. Klein, "Tundra Ranges North of the Boreal Forest," *J. Range Manage.*, in press.

Realities of Physicians' Income

Kramer's report (28 Nov., p. 1126) on the soaring costs of Medicare and Medicaid raises many good points but unfortunately includes a false statement which we have been hearing recently with increasing (and depressing) frequency: "Doctors fees have been increasing more than twice as fast as they were before Medicare and Medicaid were enacted." Kramer states that this is a major factor in the soaring costs.

While it is probably true that there are isolated instances of undesirable or even unscrupulous fee manipulation under these programs by certain individuals, as would be anticipated in any human endeavor related to the profit motive, I am quite certain on the basis of personal experience and many professional contacts that most physicians have raised their fees not at all or considerably less than would be justified by the cost-of-living increases. Kramer refers to overall payments to physicians. What has been occurring with the development of Medicare and Medicaid is that more patients have been seeing doctors more often, which is expensive. For example, as a consultant in neurology, I am now seeing many patients that I would not have seen in the past, because the patient could not afford a consultation. In some of these cases, I do not add substantially to the diagnosis and treatment already undertaken by the referring physician; in others, I make important suggestions for the subsequent management of the case. Most of us think that this constitutes better

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medical care. If comparison with private patients is any yardstick for making such a judgment, consultation has been common practice for many years for patients who could afford it. Somewhat paradoxically, it has also been common practice in the care of charity patients at university teaching hospitals. A very large percentage of physicians are earning less in terms of real income; many of us are on a downward income curve even though working harder and for longer hours.

. . . The fact is that first-rate medical care for the entire population is very expensive. I have not yet heard any national politician tell the public in real terms just how expensive it is. One cannot help but wonder, however, about the complaints of such an expense in a society which spends as much on tobacco and alcohol while dissipating nearly a third of its annual national expenditure in Vietnam.

FORBES H. NORRIS, JR.
Pacific Medical Center,
Clay and Webster Streets,
San Francisco, California 94115

Long Arm of "Security Clearances"

Bryce Nelson (9 Jan., p. 154) reports the changes in procedures that the Department of Health, Education, and Welfare will be using in the selection and appointment of its scientific consultants. These appear to be good changes, but the essential problem as to why part-time consultants for HEW must be considered part-time government employees has not been raised. If a scientist is invited for consultation or a seminar at another university or institution because of his expertise in a certain area, expenses plus an honorarium are given to him. The scientist is not considered an employee, albeit temporary, of that university or institution. Why should HEW consider scientists serving in advisory capacities as government employees? Merely paying expenses plus $50 a day is not sufficient reason.

Nelson predicted that with the new HEW "security" procedures, the existing blacklists will be scrapped. Mere restructuring of "security" procedures at HEW masks the main problem which is whether there should be any "security" procedures for HEW scientific personnel. Unless HEW does away with *all* "security clearances" of scientists, there is a good probability that new blacklists may begin to appear. Professional qualifications should be the *sole* criterion in the selection of scientific consultants.

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Bronx, New York 10461

Conflicting Pronouncements

The letter of Epstein, Hollaender, Lederberg, Legator, Richardson, and Wolf (26 Dec.), which supported the ban on cyclamates, noted the potential hazard of cyclohexylamine, a cyclamate derivative. While reading the 13 December issue of *Lancet* (p. 1301), I chanced upon an editorial comment that seems pertinent:

> Our annotation of Nov. 1 (p. 941) was wrong in stating that a derivative of cyclamates, cyclohexylamine, has been shown to be carcinogenic in animals. The only evidence of carcinogenicity in cyclamate-related compounds concerns dicyclohexylamine given to animals. Pliss (*1*) reported the development of sarcoma at the site of a single injection of dicyclohexylamine; and dicyclohexylamine nitrite given subcutaneously was followed in some animals by multiple cancer foci of different types. Cyclohexylamine was not carcinogenic. Shabad (*2*) described the results of feeding and subcutaneous injection in mice and rats. Again, cyclohexylamine gave rise to no tumours. Dicyclohexylamine and its nitrite were associated with the appearance of sarcomas in 13% of surviving animals. . . . Lomonova (*3*) has also produced some evidence that dicyclohexylamine can cause tumours. Czech workers studied the effects of oral administration of dicyclohexylamine nitrite in rats and dogs and found no evidence of carcinogenicity. . . .

I can readily understand the confusion and anxiety among the general population, caught between conflicting scientific pronouncements. This exists not only over cyclamates, but for the "Pill," DDT, and a host of other environmental-ecological problems.

How about a moratorium on partisan pontification over as yet highly subjective "facts"?

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Pennsylvania 19102

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2. L. M. Shabad, *Khim. Nauka. Prom.* **3**, 828 (1958); *Acta Unio Int. Contra Cancrum* **19**, 458 (1963).
3. G. V. Lomonova, *Fed. Proc.* **24**, 96 (1965).

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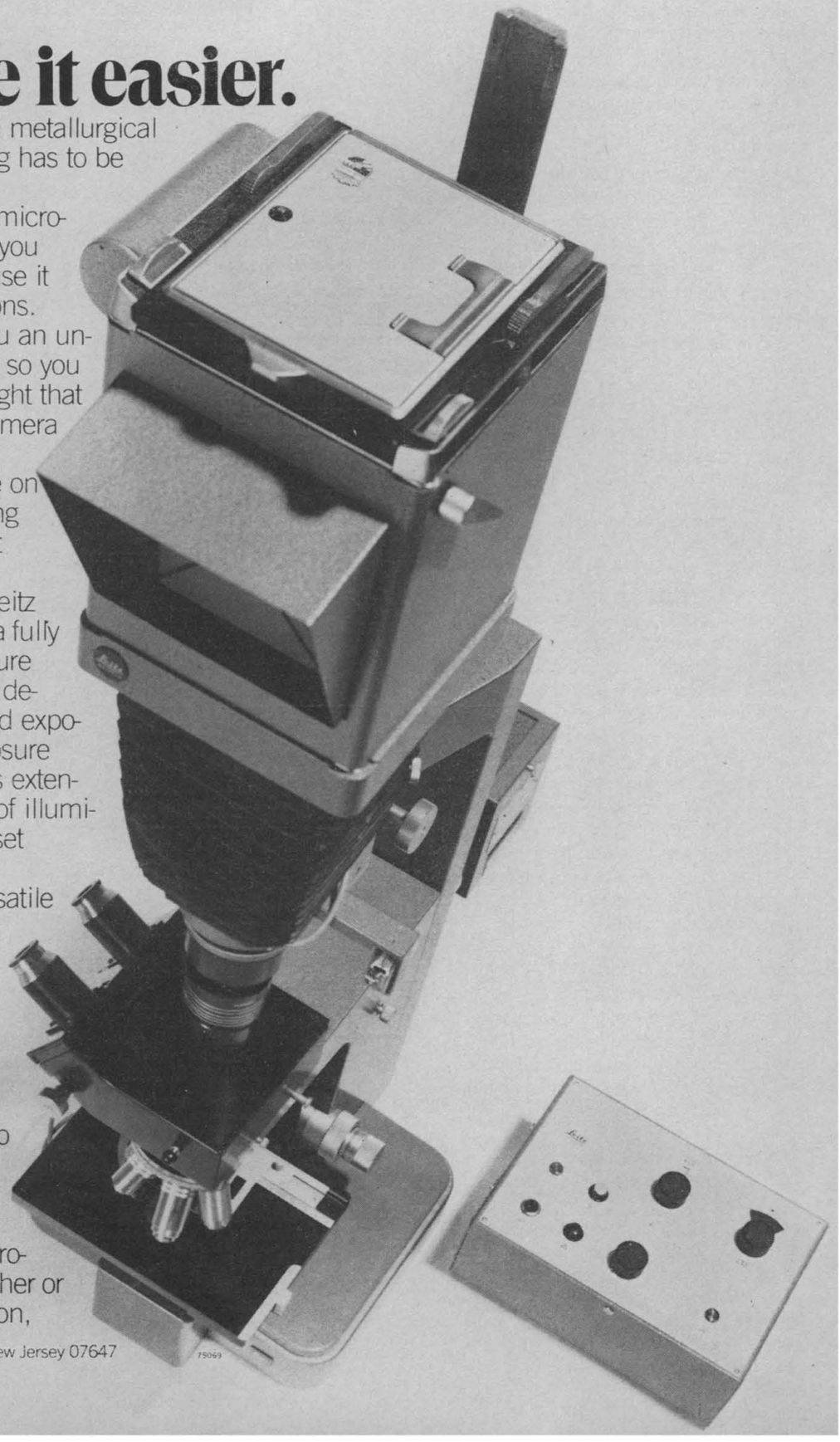


3 April 1970, Volume 168, Number 3927

SCIENCE

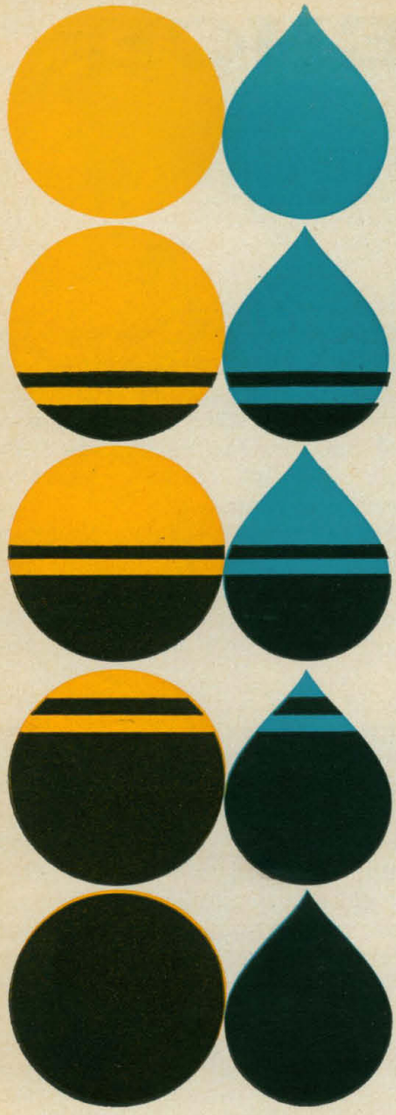
The 1972–75 Budgets

Not until 1975 (according to the report the President's Council of Economic Advisors sent to Congress in February) is the gross national product likely to be substantially above foreseeable claims on the nation's income. Although the GNP is expected to be $268 billion greater in 1975 than in 1969, a larger population, increased medical costs, and other built-in increases will require almost all of the greater total. Specifically, the Council of Economic Advisors expects foreseeable claims to use up all of the GNP in 1970, 1971, and 1972, and to require all but $3, $6, and $12 billion in 1973, 1974, and 1975, respectively. Moreover, the $12 billion surplus in 1975 may get smaller as 1975 comes closer, for between now and then new claims will be staked out. The situation may be as tight in 1975 as it appears now for 1971.

The Council projects an increase in federal expenditures from $189 billion in 1970 to $206 billion in 1975. Economic conditions, tax rates, the nature of military activities, and other variables may, of course, make the actual figures somewhat different from these projections. Nevertheless, it is within this budgetary situation—one so cramped as to allow little room for maneuvering—that future research funds must be considered. The President's budget for 1971 calls for $15.8 billion of R & D funds, an amount which constitutes a smaller percentage of the total federal budget than in any year since 1959. Research and development funds hit a high of 12.6 percent of the federal budget in 1965 and have been decreasing at an average rate of 0.8 percentage point a year, to 8.7 percent in 1970 and a requested 7.8 percent in 1971. Any statistical projection of R & D funds for the next several years looks bleak, and there is little that can be done to improve matters for the coming year.

There is, however, some room for growth and perhaps more for shifts in priorities in the next few years, as demonstrated in the 1971 budget, which asks for $700 million less for development and $260 million more for basic and applied research than was appropriated in 1970. It is time for general consideration of how such funds as may become available in the next few years can be most productively used. Widespread reports of the damage to universities and to the nation's research accomplishments and prospects that has resulted from recent cutbacks and slowdowns have already begun to appear. These reports constitute important signs, but they are not sufficient. What is needed, as a basis for a vigorous effort to secure more adequate funding in the future and for the establishment of priorities, is objective analysis of these reports and the gathering of as much additional factual information and informed judgment as can be collected on how and where recent R & D cutbacks are most seriously damaging the nation's future prospects.

The Council of Economic Advisors has given fair warning that they see no slack in the GNP or in federal funds for the next several years. As always, claims for the nation's scientific welfare will have to compete with other claims. It is therefore urgent to develop as solid an evidential base as possible if the R & D budgets of 1972 through 1975 are to be more satisfactory than those of 1968 through 1971.—DAEL WOLFLE



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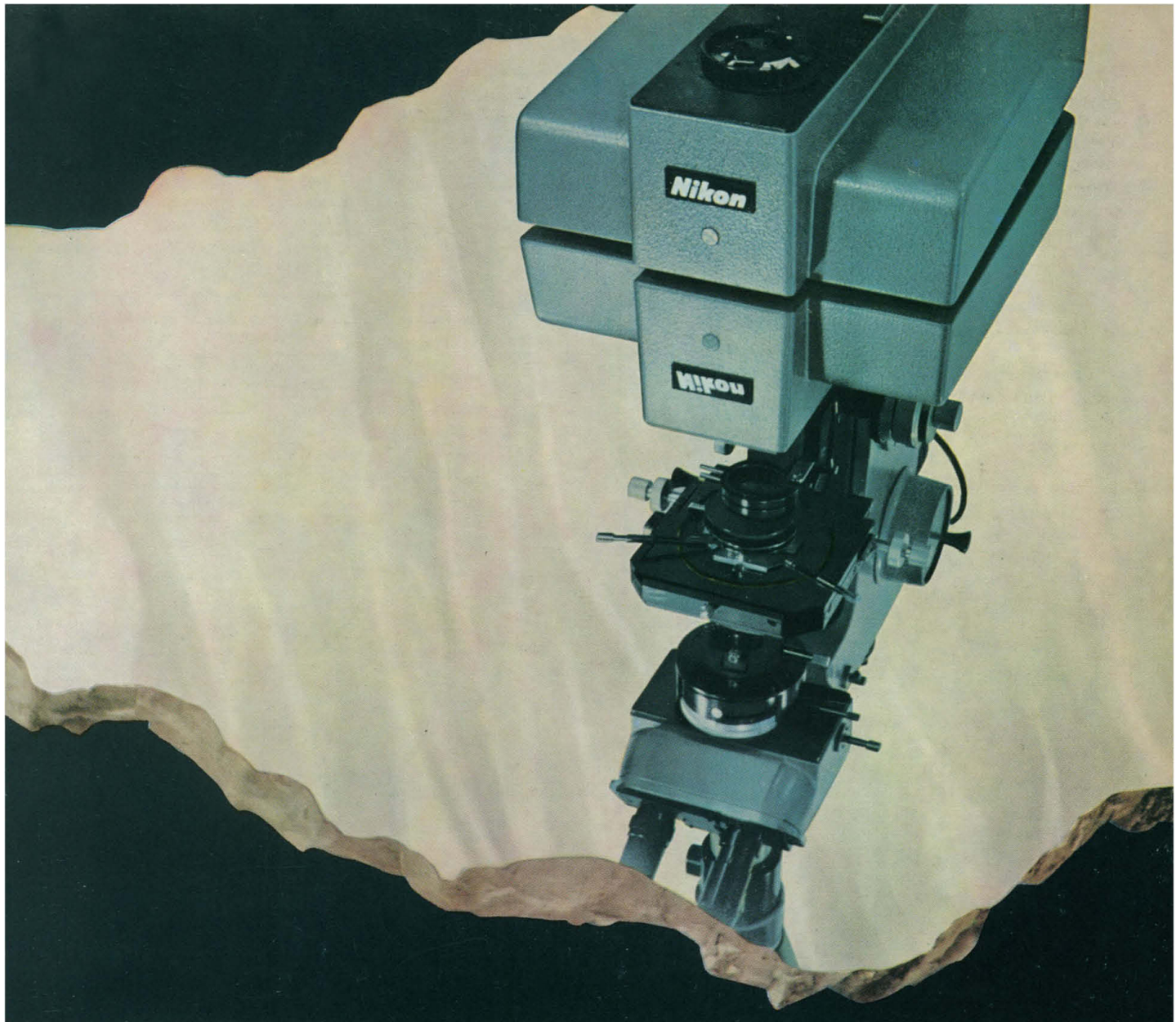

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MEETINGS

Biochemical Toxicology of Insecticide Action

The last year has seen the tide of public interest and legislative action concerning the question of pesticides rise to a new height. A recurrent theme of the discussions is the inadequacy of available information to evaluate the effects of the use of pesticides on health and on the environment. The pesticides of maximum concern are the insecticides. The United States and Japan account for the largest share of the fundamental research that has been done in the area of insecticide metabolism and action. This was the background for the fifth meeting of the U.S.–Japan Cooperative Science Program, which met in Tokyo, 16–20 June 1969, under the joint sponsorship of the Japan Society for the Promotion of Science and the U.S. National Science Foundation.

Fundamental to the background of understanding needed to design new compounds is a way of dealing with the interaction of multiple factors which can affect toxicity. C. Hansch (Pomona College, California) discussed the application of his sigma-rho-pi analysis to the problem of accounting for the variations in anticholinesterase activity of organophosphates and carbamates. He analyzed the contributions of hydrophobic, electronic, and steric factors to the variations which had been described in the publications of Metcalf and Fukuto; in one series of aromatic phosphonates, hydrophobic character had negligible importance and one could account for virtually all the variation in terms of steric factors only. By contrast, in substituted phenyl carbamates, hydrophobic character was the single most important variable, and the electronic contribution was relatively small. Finally, in diethyl phenyl phosphates, one could account for the variation in the potency of the para derivatives using electronic factors alone; for the meta derivatives, extremely good accounting for the effects could be obtained if one included the steric parameter, and once more the hydrophobic character was important. Still better correlation was obtained if one included a "position term" to account for the consistent difference between meta and para compounds. In the discussion of this paper, the importance of the free radical character in some particular enzyme-inhibitor interactions

was stressed by Hansch. It was also pointed out that, in alkyl diethyl phosphates, the hydrophobic character of the alkyl group could be all-important, quite unlike the two aromatic series described previously. T. Fujita (Kyoto University) described collaborative work with I. Yamamoto and M. Nakajima on the analysis of activity in nicotine analogs. The role of electronic, hydrophobic, and hydrogen bonding factors was considered and also the distance between the pyridyl and pyrrolidyl nitrogens. Although nicotine probably acts on the acetylcholine receptor in insect ganglia, there were similarities between the effect of factors upon acetylcholinesterase and insecticide activity. Both were favored by substituents of low electron affinity and marked hydrophobic character. The results lead to a modification of the simple model which stressed the importance of coulomic interaction between cationic nitrogen and the anionic site of the receptor or the enzyme.

The metabolism of insecticides is commonly of major importance in determining toxicity, selectivity, synergism, and biodegradability. The role of microsomal systems, both in insects and vertebrates, in metabolizing virtually all insecticides, has been a subject of intensive interest in recent years. R. Kato (National Institute of Hygienic Sciences, Tokyo) investigated various factors affecting drug metabolism by liver microsomes of the male rat. Drug-oxidizing activities were influenced by hormones and abnormal physiological states. However, the effect appeared in different ways for different substrates (inducers). For example, the magnitude of spectral change induced by hexobarbital was decreased by methylcholanthrene, but increased by administration of androgen, to the castrated rat. However, the change induced by aniline was increased by methylcholanthrene; androgen did not increase the change. The difference in the androgen dependence for the substrate interaction with cytochrome P-450 may be a factor responsible for the difference in the alterations of the spectral change between aniline and hexobarbital under the abnormal physiological states. It was suggested that the magnitude of substrate-binding with P-450 is one of the rate-limiting steps in the drug oxidation. D. J. Hennessy (Fordham University) reviewed the effectiveness and selectivity of several types of carbamate synergists; he argued that the potential of some of these for practical utility

was good, even though not presently realized. He pointed out that the target of the synergists was the insect microsomal oxygenase system, and discussed the mechanism by which the synergist attacked this target. Replacement of hydrogen in the methylene group of methylenedioxybenzenes by deuterium substantially reduced the synergistic ability, suggesting that the methylene group was involved in the attack. He suggested that the current debate as to whether the active attacking species was a benzodioxolium ion or a free radical could be resolved if one argued that the parent compound was converted through a free radical mechanism to the hydroxymethylene-dioxy derivative and the latter was in equilibrium with the diheterolium ion, of which it was a pseudo-base. He pointed out the plausibility of the diheterolium ion, which is an aromatic species, forming π-complexes with iron or copper in the microsomal oxygenase and suggested similarity in mode of action with organic thiocyanates, propynyl ethers, and aryloxyalkylamines. S. Kuwatsuka (Institute of Physical and Chemical Research, Saitama) examined the mode of action of methylenedioxyphenyl synergists. These synergists inhibited the microsomal hydroxylation of various insecticides, and themselves were degraded through hydroxylation by the same microsomal system. There were no essential differences between demethylenation, demethylation, and aniline ring hydroxylation. His study on various cases suggested that though the methylenedioxyphenyl compounds may serve as alternate substrates or competitive inhibitors for the microsomal hydroxylation, other factors may modify this basic mechanism in various degrees. The possibility that formate released from the methylenedioxy moiety reacts with microsomal enzyme was denied; but catechol released may act as an inhibitor. Possibly an allosteric effect on the microsomal components may be produced by the synergist.

P. A. Dahm (Iowa State University) discussed the work performed in his laboratories on the degradation of phosphorothionate insecticides by a microsomal system requiring oxygen and $NADPH_2$. It has been shown that such a system splits aromatic phosphorothionates (P=S compounds) at the aryl phosphate bond; phosphates (P=O compounds) are not usually split in this way, an exception being *n*-propyl paraoxon. The data covered a number of parathion analogs and also the phosphonate EPN. Comparisons were made with parathion labeled with P^{32} and S^{35}. Cleavage at the aryl group was important, as well as the expected activation to paraoxon (with S^{35} going to S^{35}-sulfate) and its subsequent degradation. Parallel studies performed with diazinon suggested that in this case also, two-thirds of the metabolism by isolated microsomes occurs through cleavage of the "leaving group" by an oxidative process. Similarly in the housefly, there was substantial cleavage of the aryl group of parathion, and the evidence was that this was again by a microsomal oxidase rather than by a hydrolase. In two species of *Rhizobium* bacteria, by contrast, most of the metabolism was to aminoparathion, although about 10 percent of the compound was degraded through aryl cleavage. R. M. Hollingworth (Purdue University) reviewed the cleavage of organophosphorus triesters by liver enzymes, paying special attention to the soluble *O*-dealkylation system which has glutathione as a cofactor, and to the oxidative dealkylation pathway catalyzed by microsomes. Studies of the metabolism of C^{14}-methyl-labeled methyl paraoxon in mouse liver homogenates showed that most activity was in the supernatant fraction, and that in this fraction there was a dependence on glutathione concentration. This system showed a pronounced preference for *O*-methyl phosphates. Studies in the whole mouse showed that when the labeled methyl group is removed, it is catabolized to volatile compounds which can be recovered in the respired air. Supplementary evidence on the importance of glutathione in in vivo metabolism was the finding that liver glutathione was substantially decreased when the phosphates Sumithion or Sumioxon were administered; Sumithion administration reduced the liver glutathione level by almost 50 percent. In other experiments, methyl iodide (135 mg/kg) was administered to mice and caused no overt symptoms, yet reduced the liver glutathione level to about one-third in an hour; such treated mice were ten times more susceptible to Sumithion poisoning. It is clear that glutathione-dependent degradation is an extremely important pathway in the metabolism of *O*-methyl organophosphates.

In the glutathione reaction just discussed, organophosphates are acting as alkylating agents rather than phosphorylating agents. M. Eto and H. Ohkawa (Kyushu University) have shown that

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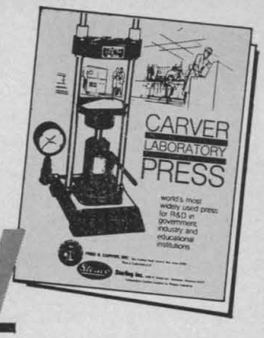

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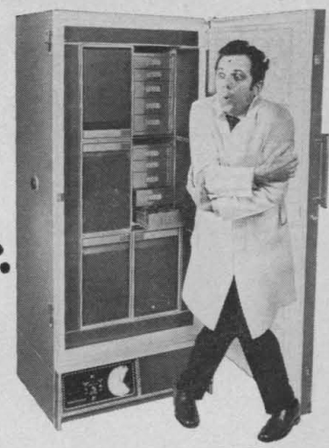

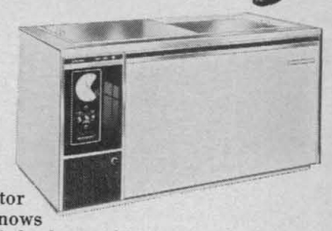

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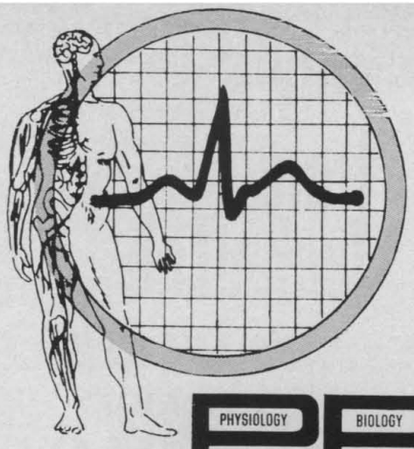
saligenin cyclic phosphates are particularly good alkylating agents. They form S-salicyl glutathione in the above liver system. Furthermore, because they salicylate oximes quite readily, oximes cannot be used to reactivate cholinesterase which has been inhibited by these phosphates. One finds that the oxime, instead of dephosphorylating the inhibited cholinesterase in the usual way, removes the salicyl group and so yields an "aged" enzyme, whose esteratic site now has an ionic phosphate group bonded to it. Saligenin cyclic phosphates are fairly readily hydrolyzed to salicyl phosphates, which then can be converted to an *O*-hydrobenzyl cation, which in turn readily alkylates amines and mercaptans. Consequently, SH-enzymes can be inhibited by this route, and the fungicidal activity of saligenin cyclic phosphates appears to be due to this SH-alkylation.

J. Miyamoto (Sumitomo Chemical Co., Osaka) described studies on the metabolic fate in rats of Meobal, 3,4-dimethylphenyl *N*-methylcarbamate, using a 4-methyl-^{14}C-labeled sample. When orally administered, it was easily absorbed and distributed into several tissues within 15 minutes and then excreted rapidly and almost completely within 4 hours, mostly into urine and to a small extent into feces. At least 28 metabolites were shown in urine, while the unchanged carbamate was less than 0.5 percent after 48 hours. A thorough examination of the chemical structures of the metabolites both in vitro and in vivo revealed that the major metabolic pathway was the hydroxylation of either ring methyl group followed by further oxidation or conjugation as glucuronides. Hydroxylation of the *N*-methyl group and hydrolysis at the carbamoyl moiety were minor routes.

Metabolism is one of the important factors involved in resistance to insecticides, a phenomenon which has in some cases confounded attempts at insect control. F. W. Plapp, Jr. (Texas A & M University) presented a review of the status of our information on resistance mechanisms in houseflies. The numerous kinds of resistance appeared to be the expression of seven major genes, although additional genes might make minor contributions. He stressed the multiplicatory nature of resistance which occurred when two genes were involved with a single compound, for instance, one gene controlling penetration and another controlling metabolism. There appeared to



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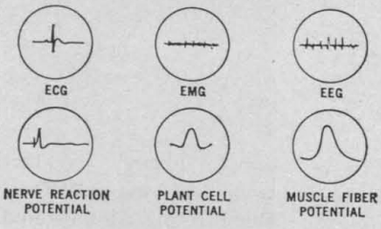

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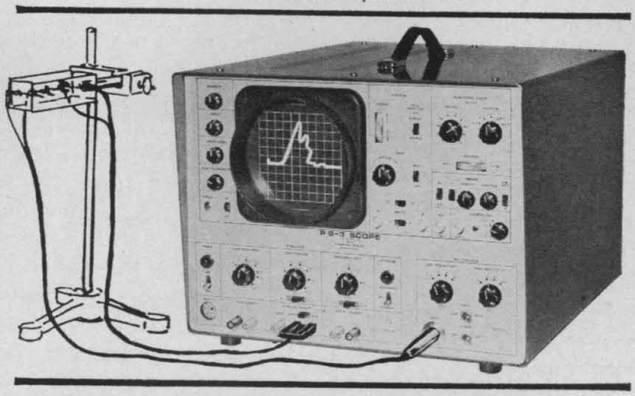

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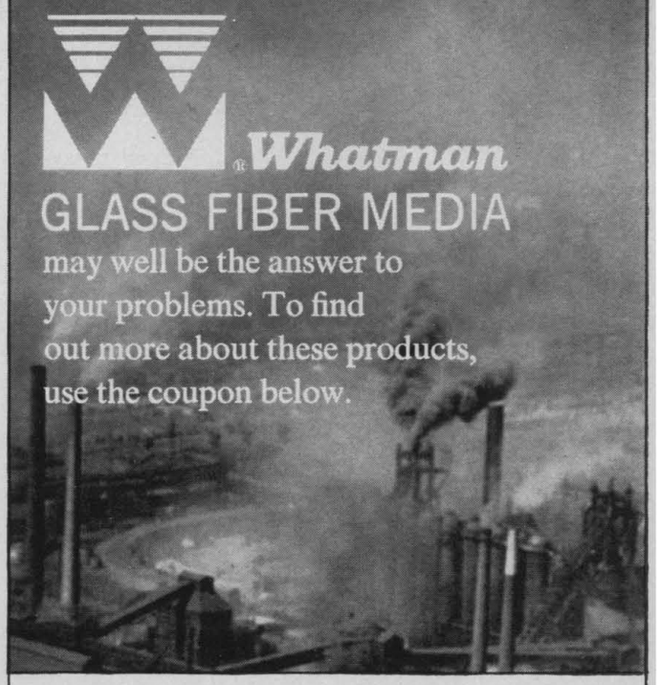

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be only two kinds of resistance. One involved semi-dominant genes acting through a detoxifying mechanism. The other involved recessive genes conferring resistance by various other mechanisms. Only the former type appeared to be capable of being overcome, for instance by the use of synergists; the latter type appeared to be intractable. Plapp pointed to parallels between resistance and the induction of enzymes by their substrates, a phenomenon thoroughly explored in microorganisms. He had been able to induce microsomal oxidizing enzymes in insects by treating with DDT. The possibility therefore exists that the relatively simple view of resistance as involving Mendelian selection among randomly fluctuating levels of detoxifying enzymes (for instance) might need to be replaced by a model in which the selecting agent actively increased the level of detoxifying enzyme. A study of the effects of insecticides at the nuclear level was clearly called for.

Certain aspects of the toxicity of organophosphate insecticides were discussed. T. Saito, T. Miyata, and K. Iyatomi (Nagoya University) described the effects of chronic poisoning by several such compounds. By frequent exposure to subacute doses of dimethoate and Sumithion contained in food (300 and 1000 ppm, respectively), an accumulation of physiological effects were observed in mice, such as the occurrence of typical organophosphorus toxicity symptoms after several days, reduced growth rate, and marked inhibition of cholinesterase and aliesterase activities of brain, blood, and liver. However, such effects were very small or absent with trichlorphon. The metabolic pattern as observed with the use of labeled insecticides was altered by continuous administration. Of interest was that such insecticides did not accumulate in the tissues, although giving marked chronic effects.

There has been a resurgence of interest in botanically derived insecticides, which will undoubtedly increase as the chlorinated hydrocarbons are phased out by legislative action. J. Fukami, T. Mitsui, T. Shishido, and K. Fukunaga (Institute of Physical and Chemical Research, Saitama, and National Institute of Agriculture Science, Tokyo) discussed the causes of the selective toxicity of rotenone insecticide between mammals, fish, and insects from a biochemical point of view. Vitamin K_3 played a part in restoring the mitochondrial respiration inhibited

by rotenone or piericidin A in the case of rat liver, but not in the case of insect tissue. This may be due to the reduced DT-diaphorase activity in insects. For metabolic degradation of rotenone, qualitative and quantitative differences in the soluble fractions derived from various organisms were also an important factor; one derived from mammals and fish enhanced the production of water soluble metabolites, while one from insects did not. Of interest was the probable presence in the soluble fraction derived from insects of a natural inhibitor, which was found to be a protein of molecular weight of 6,000 to 15,000. I. Yamamoto (Tokyo University of Agriculture) reviewed the problems of pyrethroid insecticides, which interact with the nerve axon. Recent electrophysiological studies disclosed the mechanism of action at the cellular level: effects on the negative after-potential are the cause of abnormal excitation and convulsions, and the block of both sodium and potassium conductances is the cause of paralysis. However, many problems, such as the primary site of action, central or peripheral; the mechanistic difference for knockdown and kill; the molecular aspects of the interaction with the nerve components; the cause of the effect on the negative after-potential; and the chemistry of the neurotoxin released by intoxication, remained to be solved. On the other hand, our knowledge of the metabolic pathway of pyrethroids in insects and mammals has greatly progressed. Oxidation is a major mechanism. While the structure-activity relation has remained empirical, the essentiality of *gem*-dimethyl group on the acid moiety was recognized and the introduction of new alcohol moieties provided several potent new pyrethroids.

The relation between insecticides and the nervous system was further explored. M. Sakai (Takeda Chemical Industries, Kyoto) reported the mode of insecticidal action of nereistoxin, a poison from a marine annelid, *Lumbrineris heteropoda*, and having the structure of 4-*N*,*N*-dimethylamino-1, 2-dithiolane. Electrophysiological experiments gave evidence that it competitively blocked the acetylcholine receptor of the cockroach central nervous system by depressing excitatory postsynaptic potentials without potentiating the postsynaptic membrane potentials, in contrast to nicotine and eserine. The ganglionic blocking activity of the derivatives was nearly pro-

portional to their insecticidal activity. Cartap, which is 1,3-bis(carbamoylthio)-2-(*N,N*-dimethylamino) propane hydrochloride, was developed from nereistoxin and used in practical insect control, particularly for lepidopterous insects. It probably acts by being converted metabolically into nereistoxin or its dihydro form. R. D. O'Brien (Cornell University) described the first successful attempts to study the acetylcholine receptor in broken cell preparations. Evidence was provided that preparations from the electroplax of the electric skate *Torpedo*, and from housefly head, contained receptor activity, which could be followed by the binding of tritiated muscarone in concentrations of the order of $10^{-6}M$. The evidence included the suitability of the location, the high affinity and reversibility of the binding, the appropriate amount, and above all the appropriate response to selected blocking agents. Evidence was provided that the plax receptor was a phospholipoprotein. The effect of numerous blocking agents suggested that the plax receptor was of the classic neuromuscular type, as is generally believed, but that the housefly receptor was of a mixed muscarinic and nicotinic type. In addition, the housefly receptor was unexpectedly blocked by compounds such as tyramine and hordenine. The findings gave promise that the receptor in the insect might be quite unlike that in the vertebrate and might offer the possibility of designing new kinds of insecticidal compound.

Finally, some new techniques of interest to students of insecticide action were described. N. Kurihara (Kyoto University) and E. Nakajima and H. Shindo (Sankyo Company) have developed a new frozen technique for whole insect body autoradiography. With the use of labeled compounds on the American cockroach, it was shown that γ-BHC penetrated much faster than the β-isomer and reached almost all parts of the central nervous system, crop, and gizzard within 15 minutes, but very little if any reached the area of the fat body. Of interest was the striking difference in the penetration pattern of γ-BHC and nicotine into the central nervous system: γ-BHC accumulated at the peripheral region of the brain, ganglia, and other parts of the central nervous system, but not inside, while nicotine penetrated into the central nervous

system was very small. These studies were consistent with the known behavior of nicotine and may throw a light on the mode of action of BHC. Y. P. Sun (Shell Chemical Company, Modesto, California) discussed the complicated interplay of events which follows the treatment of an insect with an insecticide. He described a method by which a given dose of insecticide could be injected into a housefly over a time period varying from a few seconds up to many hours. In general, the toxicity of any insecticide was reduced by giving the dose over a long period. It was of special interest that dieldrin, which is not metabolized by houseflies, was of much less toxicity if administered over 30 minutes. The implication is that slow delivery permits the operation of other mechanisms (such as storage) quite apart from the anticipated increased role of metabolism which occurs in compounds such as organophosphates. It was also observed that, in a series of vinyl phosphate analogs of Azodrin®, the toxicities by topical application varied greatly, but by injection of flies pretreated with a synergist the toxicities varied very little. The implication was that the compounds, which differed only in their *N*-alkyl substituents, showed a great variation in topical toxicity only because of variations in their penetration and detoxication rates in the organism.

The above papers are scheduled for publication in the near future by Academic Press. Another outcome of the conference is an attempt to provide information through a "clearing house" mechanism to Japanese and U.S. scientists about the opportunities for research by visitors in the two countries. Scientists working in insecticide action or metabolism who would be interested in such information, should communicate with either one of the undersigned.

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Sterile Males for Control of Insect Populations

The increasing concern over pesticides has stimulated greater attention to alternate methods of insect control. A meeting on The Application of the

Sterile Male Technique for Control of Insects with Special Reference to Fruit Flies was held in Vienna, Austria, 1 to 5 September 1969.

The primary purpose was to review the status of laboratory experimentation and field trials relating to the application of the method of releasing sterile insects for controlling or eradicating a variety of fruit fly species and to plan future programs. Data on the mass rearing, nutrition, radiation sterilization, physiology, genetics, and ecology of the following species were presented: Mediterranean fruit fly *Ceratitis capitata* Wied.; Olive fly *Dacus oleae* (Gmelin); cherry fruit fly *Rhagoletis cerasi* (L.); Caribbean fruit fly *Anastrepha suspensa*; Mexican fruit fly *Anastrepha ludens* (Loew); melon fly *Dacus cucurbitae* (Coq.); and oriental fruit fly *Dacus dorsalis* (Hendel).

Of these species, the most thoroughly studied in relation to the application of the sterile insect release method is the Mediterranean fruit fly. Flies of this species that were laboratory reared and sterilized have been used in a number of successful field demonstrations for the control of the medfly; three recent programs were evaluated. G. Guerrieri, Comitato Nazionale de Energia Nucleare, Italy, summarized the results of a recently completed test on the island of Procida near Capri; R. H. Rhode, project manager, UNDP/SF (*1*) Central American Medfly Project, San José, Costa Rica, presented the results of a test in Nicaragua involving aerial releases of sterilized medflies over an area of 48 km^2; and L. Mellado discussed the tests in the Murcia area of Spain. All of these tests were conducted jointly between the national and international organizations in cooperation with the Joint FAO/IAEA (*1*) Division.

The Procida experiment involved a 3.7-km^2 island containing many species of host fruit trees that are attacked each year by the medfly. Sterilized flies reared in the IAEA laboratory at Seibersdorf, Austria, were transported by air to Italy and released weekly from 17 May to early August 1969, in 426 ground-release points. Approximately 15 million sterile flies were liberated. The effectiveness of the released flies was evaluated by (i) surveys of the ratio of wild to sterile flies in traps, (ii) observations on egg hatch collected on the island compared with a control point on the mainland, and (iii) determination of the fruit infestation in the two areas. A clear indication of suppression of medfly population was obtained.

The Spanish experiment involved the release of over 32 million sterile medflies from March to August 1969 in an area of 24 hectares. Again estimates of fruit infestation were consistently below 10 percent (0.1 to 10) in the release area while the infestations in the control area were often close to 90 to 100 percent.

In the larger test in Nicaragua sterile medflies were released periodically over an area of 48 km^2. The test area, situated in the center of larger infested areas was not completely isolated because it was impractical. However, periodic aerial applications of insecticide to a barrier 2 km wide around the perimeter provided some degree of isolation. Sterile insects were reared in San José, Costa Rica, and released in Nicaragua from September 1968 to May 1969 about four times a week (11 million sterile flies at each release) for a total of over 1 billion sterile flies. Rhode reported that examination of fruit during the period showed 90 to 98 percent fewer larvae in the release area than in the control area. Trapping data indicated that wild flies in the test area increased threefold from the lowest to highest population, whereas population increases of 183-fold and 47-fold were recorded in the untreated areas.

The group concluded that the successful results in several field trials with the medfly were promising enough to warrant a large-scale demonstration experiment for the control or eradication of this species over a large area and that both development and progress of the sterile-male-release method for a number of other species of fruit flies were promising enough to justify small-scale field trials.

D. A. Lindquist, Joint FAO/IAEA Division, presented a proposed plan to eradicate the medfly from Nicaragua. The feasibility of the plan for eliminating the pest from an infested area of 3900 km^2 (approximately 1500 square miles) in a 4-year, $6-million program was studied by the participants at the meeting.

Formal papers which provided the basis for extensive discussion by the group were presented on the following topics: methods and results of laboratory experimentation on medfly rearing for the purpose of studying the sterile male technique (Hooper, FOA/IAEA);

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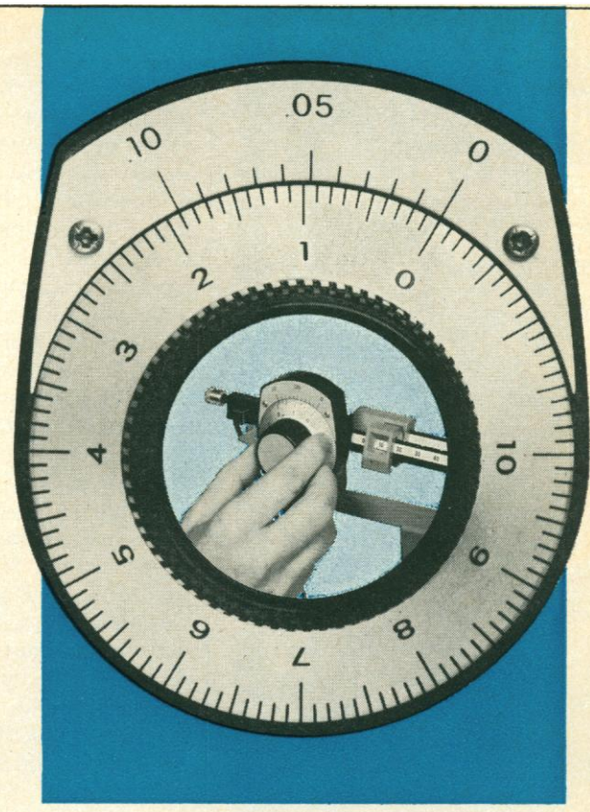

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review of medfly mass rearing (Nadel, FOA/IAEA); medfly physiology as related to the sterile male technique (Langley, FAO/IAEA); recent medfly research in Hawaii (Chambers, USDA); status of the sterile male technique against the olive fly—eradication and rearing (Silva, Portugal); review of the ecology of the olive fly as related to the sterile male technique (Mourikis, Greece); and status of the sterile male technique for eradication or control of the cherry fruit fly (Boller, Switzerland). Research on several other species of fruit flies was introduced by two papers: (i) a review of the sterile male technique for eradication or control of the Caribbean and Mexican fruit flies (Lopez, USDA) and (ii) a review and current status of the sterile male technique for eradication or control of the melon and oriental fruit flies (Chambers, USDA). In addition, numerous shorter summaries of recent research in various laboratories were presented and discussed by the group; D. Enkerlin (FAO/IAEA) was chairman.

Some of the obstacles hampering the application of this method to other species of fruit flies were (i) the development of economical, large-scale mass-rearing techniques, (ii) difficulties in mass release of sterilized insects, and (iii) the dearth of ecological information on the distribution of fruit fly species in various countries. Several solutions to these problems were proposed, and coordinated research programs were discussed.

The meeting was attended by 16 scientists from ten countries, in addition to representatives from FAO, WHO, Euratom (*1*), and the Swiss Federal Research Council and staff members of the Joint FAO/IAEA Division of Atomic Energy in Food and Agriculture. Publication of the proceedings of the meeting, including discussion and formal papers by the IAEA Technical Information Division, is expected in early 1970.

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Note

1. Abbreviations are FAO, Food and Agriculture Organization of the United Nations; IAEA, International Atomic Energy Agency of the United Nations; UNDP/SF, United Nations Development Program/Special Fund; USDA, U.S. Department of Agriculture; WHO, World Health Organization; Euratom, European Atomic Energy Community.

Food-Borne Toxic Microorganisms

The Toxic Microorganisms Panel of the United States–Japan Cooperation on Development and Utilization of Natural Resources met in Tokyo, Japan, 17–20 November 1969, for governmental interagency exchanges of information for insuring the development of the highest hygienic standards for the food supplies of the two nations. Japan as a net food importing nation and the United States as a net food exporting nation have humanitarian and economic incentives for mutual concern with the maintenance of desirable hygienic and nutritive qualities of food commodities moving in international commerce. Attention was focused on botulism, mycotoxins, and *Vibrio parahaemolyticus* contamination. The panel agreed it would be desirable in the future to also consider the question of staphylococcal food poisoning. The Japanese expressed great interest in how the Food and Drug Administration of the U.S. Department of Health, Education, and Welfare exercises its authority in insuring safe food supplies.

The first outbreak of type B botulism in Japan occurred in 1969 and was traced to imported caviar. Thus, type E botulism traceable to marine food products remains as the only indigenous form of clinical botulism in Japan. This fact contrasts with the condition in the United States where human botulism is traceable to types A, B, and E bacilli. A group led by Genji Sakaguchi has been successful in purifying and characterizing the type E toxin. In laboratory culture and in contaminated foods, this toxin occurs as a 350,000 dalton molecular weight ($S_{20,w}11.6$) simple protein. This protein can be separated into a 150,000 molecular weight ($S_{20,w}7.3$) toxic component and similar weight nontoxic component. Only antibody against the toxic component is effective in neutralizing the toxicity. Both the $S_{20,w}11.6$ and 7.3 toxins can have their toxic potency increased by short-term exposure to trypsin. This activation is not accompanied by an identifiable change in sedimentation coefficient. None of the Japanese work with type E toxin supports the claims of Canadian workers that activation by trypsin is accompanied by a loss of amino acid residues from the toxic protein, or that toxicity exists in molecules smaller than $S_{20,w}7.3$. Carl Lamanna of the U.S. panel and Sakaguchi prepared a paper on the nomenclature of toxins. It was

suggested that the naturally occurring toxin be called progenitor toxin and that toxic components that can be prepared in the laboratory from a progenitor toxin be labeled derivative toxins. Adoption of these suggestions would limit the use of the terms protoxin and prototoxin to nontoxic protein that can be activated to a toxic state by any kind of manipulation such as exposure of proteolytic enzyme.

Japanese investigations of antitoxin treatment of type E poisoning under the leadership of Hiroo Iida continue to demonstrate curative value for antitoxin employed in the earliest phases of intoxication. The absence of reports of serum sickness in patients treated with type E antitoxin derived by Japanese methods of manufacture at Chiba Serum Institute has stimulated the panel to sponsor a comparative study of the allergenic properties of horse botulinal antitoxin manufactured in Japan and the United States. Consistent with Japanese clinical experience, L. L. Layton (Western Regional Laboratory, U.S. Department of Agriculture), employing biophysical and serological characterization techniques, has found the Japanese antitoxin to be freer of extraneous protein than the American product.

Very little work is in progress on studies of mechanisms of action of botulinal toxin. In following up a report of W. I. Jensen that malathion offers some protection against poisoning by the type C toxin, E. M. Sporn has had negative results in attempts to demonstrate protective effects in rats against type A poisoning by using the anticholinesterases malathion and parathion.

J. T. Graikoski reviewed U.S. studies in preparation of smoked fishes which show that proper combinations of salting, dehydration, and smoking will prevent the growth of *Clostridium botulinum* type E. Thus, knowledge is now available for the preparation of fish products safe from botulism during packaging.

Japanese investigators have been the world leaders in studies of *Vibrio parahaemolyticus* and the severe acute gastroenteritis caused by growth of this organism in naturally contaminated fish products. J. C. Olson, Jr. (U.S. Food and Drug Administration) reviewed studies of the organism in the United States. He agreed with Riichi Sakazaki, the leading expert on this organism, that formidable problems of specific identification exist, and that the role of this organism in causing food poisoning in the United States is still obscure. The panel agreed it would be of great practical benefit to both countries to exchange laboratory personnel concerned with *V. parahaemolyticus* investigations.

H. W. Schroeder, C. W. Hesseltine, and P. B. Marsh of the U.S. panel and H. Kurata and S. Matsuura of the Japanese panel reviewed recent studies of mycotoxins in the United States and Japan. While in both countries fungi that contaminate agricultural commodities are found which produce mycotoxins, and while progress is evident in elucidating the conditions under which growth of the fungus is accompanied by mycotoxin production, no definitive answer can be given to the question at what level of aflatoxin production can the organisms be considered harmless. It is obvious that analytic techniques can enhance capabilities for precise accurate detection of smaller and smaller quantities of the mycotoxins.

As a net importer of grains and other food products subject to contamination with mycotoxin-producing fungi, Japan is greatly interested in conditions of storage and shipment that eliminate development of mycotoxin-producing fungi. The panel agreed it would be of both scientific and practical value to

initiate a cooperative research program between the two nations for systematic surveillance of food products moving between Japan and the United States at storage, shipment, transit, and receiving points. Only in this way can practical suggestions be evolved for the control of harmful fungal growth by identification of the points of initial contamination and those environmental situations in commerce conducive to fungal growth and mycotoxin production. Such investigations remain to be done.

The Toxic Microorganisms Panel sponsored a conference on toxic microorganisms in Hawaii in October 1968. Over 60 papers presented at this meeting will be published as a book entitled "Proceedings of the First U.S.–Japan Conference on Toxic Microorganisms" (U.S. Department of the Interior and UJNR Panels on Toxic Microorganisms, Washington, D.C.). Publication is scheduled for March of this year.

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Courses

Tropical Botany, Coral Gables, Fla., 15 June–31 July. The University of Miami, Fairchild Tropical Garden, and U.S. Plant Introduction Station will offer an NSF-sponsored advanced seminar for graduate students in plant science. Stipends and travel allowances are available. (Dr. Howard J. Teas, Coordinator, Tropical Botany Seminar, Department of Biology, University of Miami, Coral Gables, Fla. 33124).

Physics of Quantum Electronics, Prescott, Ariz., 22 June–3 July. The course will be similar to the ones held in 1968 and 1969 but with additional emphasis on superconductivity phenomena. Other subjects will include atomic coherence effects (light scattering, self-induced transparency, theory of the laser), nonlinear phenomena (pico-second pulses, parametric optics), and statistical properties of radiation. (Prof. S. F. Jacobs or Prof. M. O. Scully, Optical Science Center, University of Arizona, Tucson 85721).

Marine Sciences, Cape Henlopen, Del. Marine Biology, biological oceanography, algal ecology, and special problems will be presented 15 June–21 July; and benthic invertebrates, engineering in coastal environment, nearshore geotechnique, and special problems will be presented 27 July–28 August. A short course on field methods in marine geophysics will be offered 13–18 July. These courses will be appropriate for graduate students, undergraduates, and teachers. (Dr. Victor A. Lotrich, Marine Laboratories, 114 Wolf Hall, University of Delaware, Newark 19711).

BOOKS RECEIVED

(*Continued from page 110*)

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Hans Berger on the Electroencephalo-

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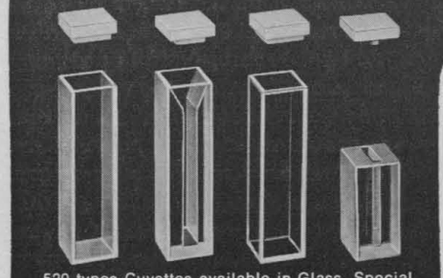

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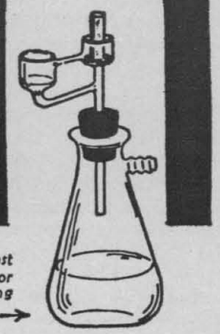

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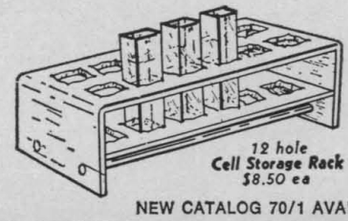

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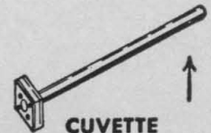

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