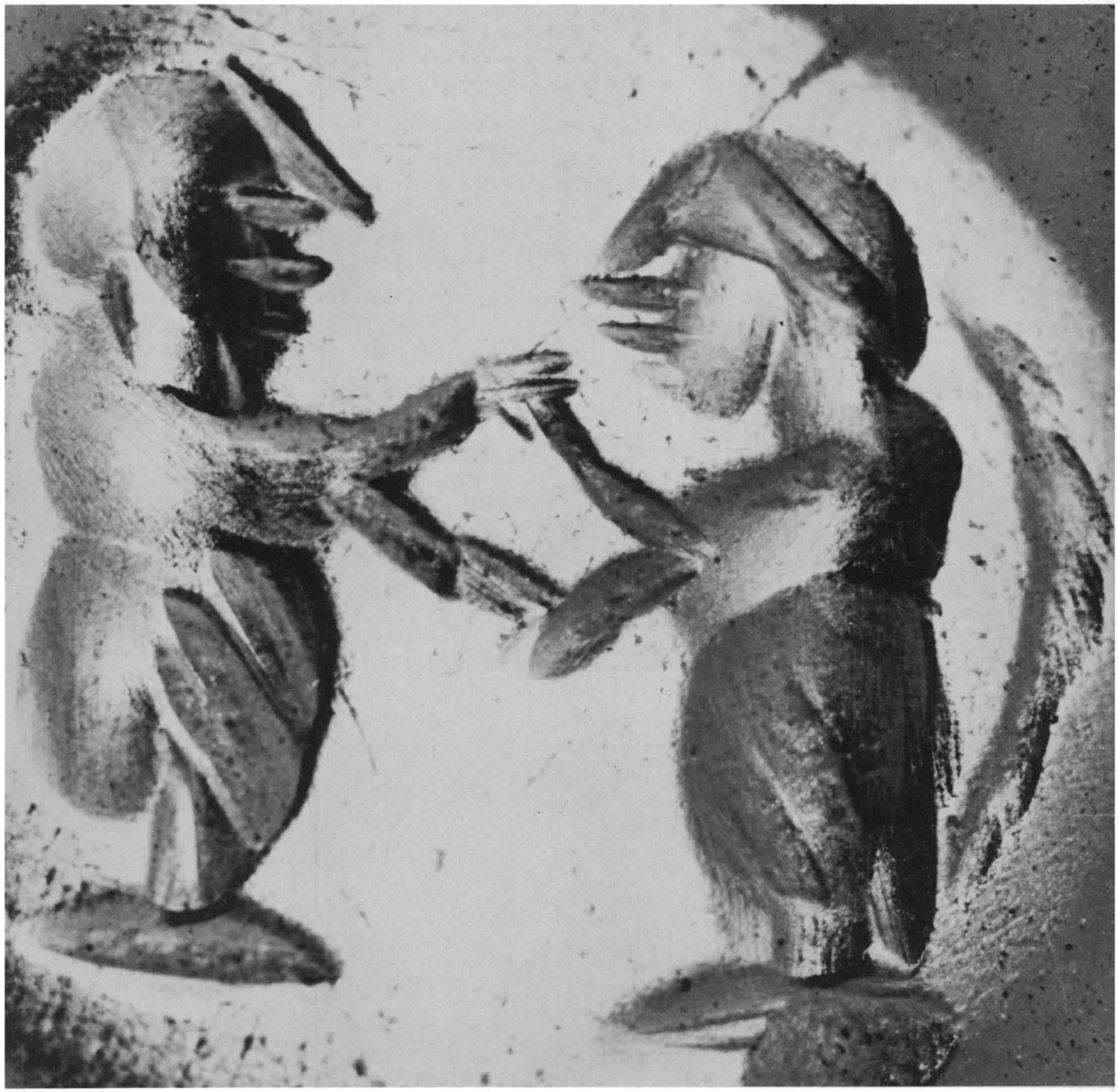
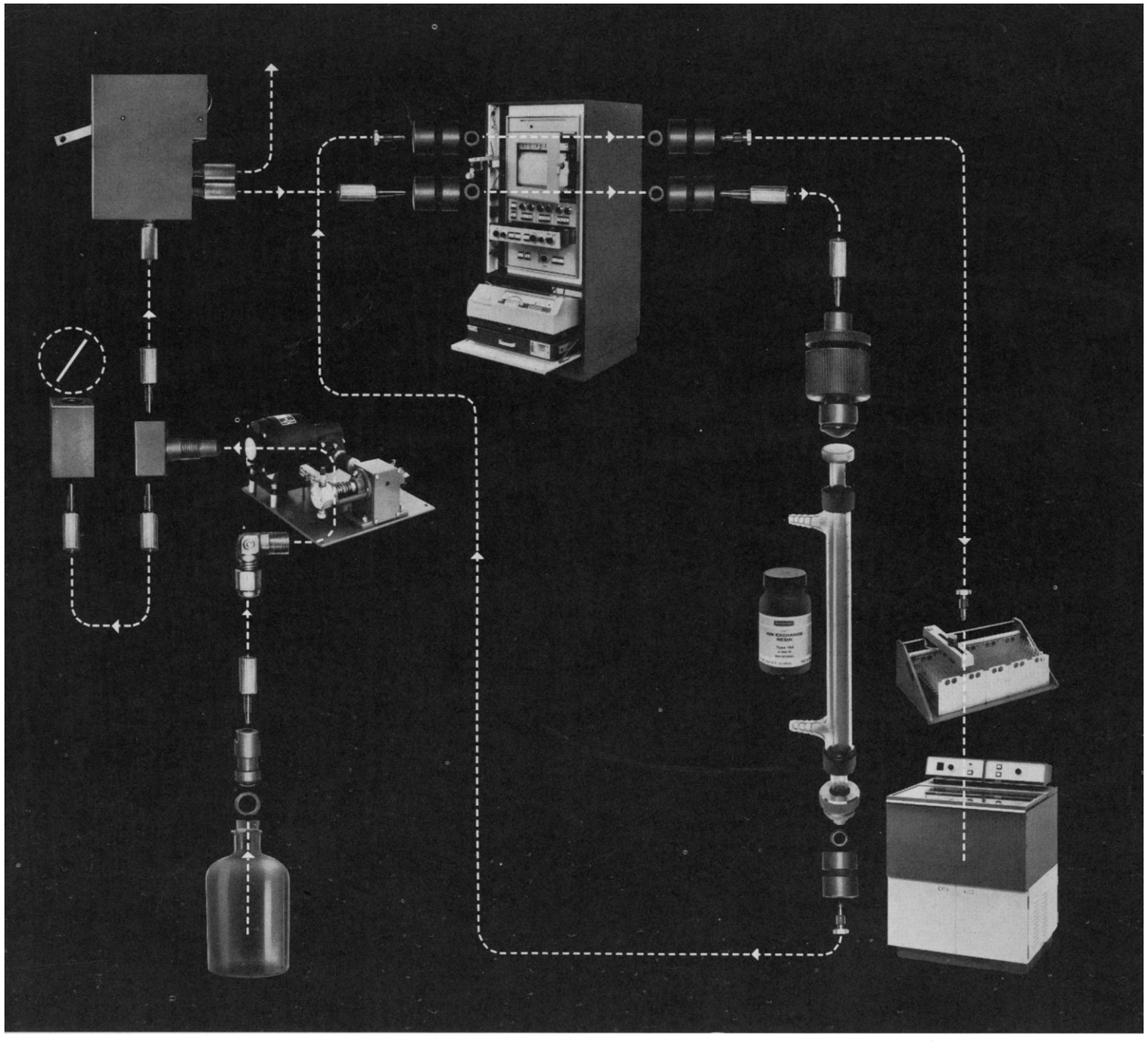
SCIENCE

21 May 1965
Vol. 148, No. 3673

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

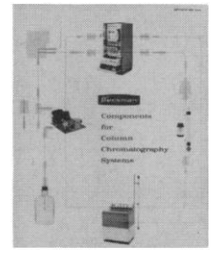


ANCIENT GREETING



It can grow on you . . .

When you build a column chromatography system with Beckman components, you can design it for present applications with the good knowledge that it can be added to or changed later on. That's why Beckman components are a particularly practical purchase for any laboratory. They are all designed to work together, to be interchangeable—and to be easily assembled. And you can depend on them for long life and leak-free operation. It is also a convenience to be able to get so much from a single source. You can start with just a column and Fraction Collector and build to a complex pressure system like the one shown above—complete with Spectromonitor (for wavelength scanning and recording and for pH and conductivity measurements), Accu-Flo® Pump, and Mobile Refrigeration Unit. We can also provide everything you need to connect up the system—fittings, slide valves, tubing, clamps, precision-bore columns, even the resins. Our Data File has pictures, prices, and descriptions of all the components—and diagrams them in representative flow systems. We will gladly send you a copy on request. Ask for SB-244-5.



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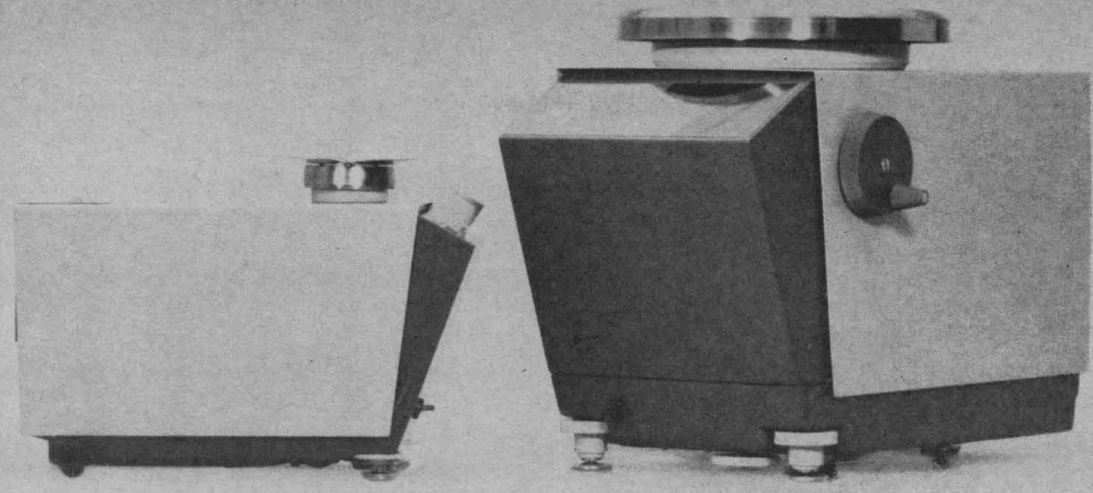

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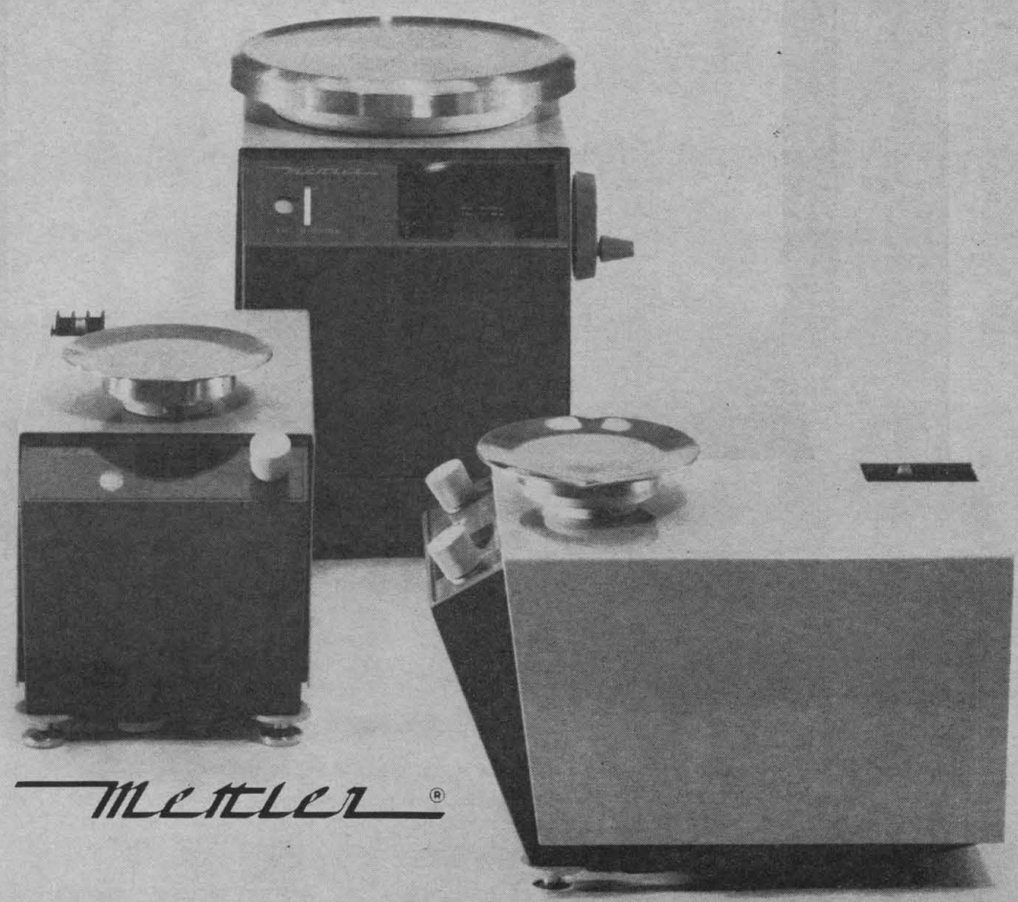

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21 May 1965
Vol. 148, No. 3673

SCIENCE

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AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Relief of an ancient seal from Persia (Sassanian Period A.D. 200 to 600) shows two men greeting one another. The figure on the right carries a bow. Original height of figures, 13 mm. Photographic reversal of intaglio to relief occurs after photographing objects in polarized light and then combining negative and positive transparencies. See page 1089. [C. A. Erskine, University of Dublin]

SARGENT pH meters...

HIGH PRECISION DIGITAL—MODEL DR

- **High Precision—High Sensitivity**
- **Direct Digital Reading**
- **Drift Free**

The Sargent Model DR pH meter combines the explicit accuracy of a digital read-out with the electrical accuracy of a precise potentiometer. It is continuous reading, showing the measurement quickly and directly and following changes in reading through an automatic self-balancing system based on that proven in thousands of Sargent Recorders. Controls are no more complex than those of an ordinary meter. Thus it combines the best features of direct reading and null balance instruments, extending the advantages of both. Whether routine convenience or research accuracy is the requisite, the Model DR pH meter is a complete answer.

SPECIFICATIONS

Ranges: 0 to 14 pH, graduated at each 0.002 pH; 0 to 1400 mv, graduated at each 0.2 mv.

Temperature: manual compensation, 0 to 100°C; automatic compensation, 0 to 100°C.

Relative Accuracy:* ±0.002 pH within 4 pH of buffer set point.

**Relative to buffer accuracy and assuming proper standardization technique.*

Absolute Accuracy: ±1.4 mv (±0.01 pH).

Repeatability: ±0.002 pH; ±0.2 mv.

Input Current: less than 10^{-12} amperes.

External Resistance Tolerance: will accommodate up to 10,000 megohms and maintain specified accuracy.

Price—$630.00 with accessories

For details, write for Bulletin pHDR

LABORATORY STANDARD—

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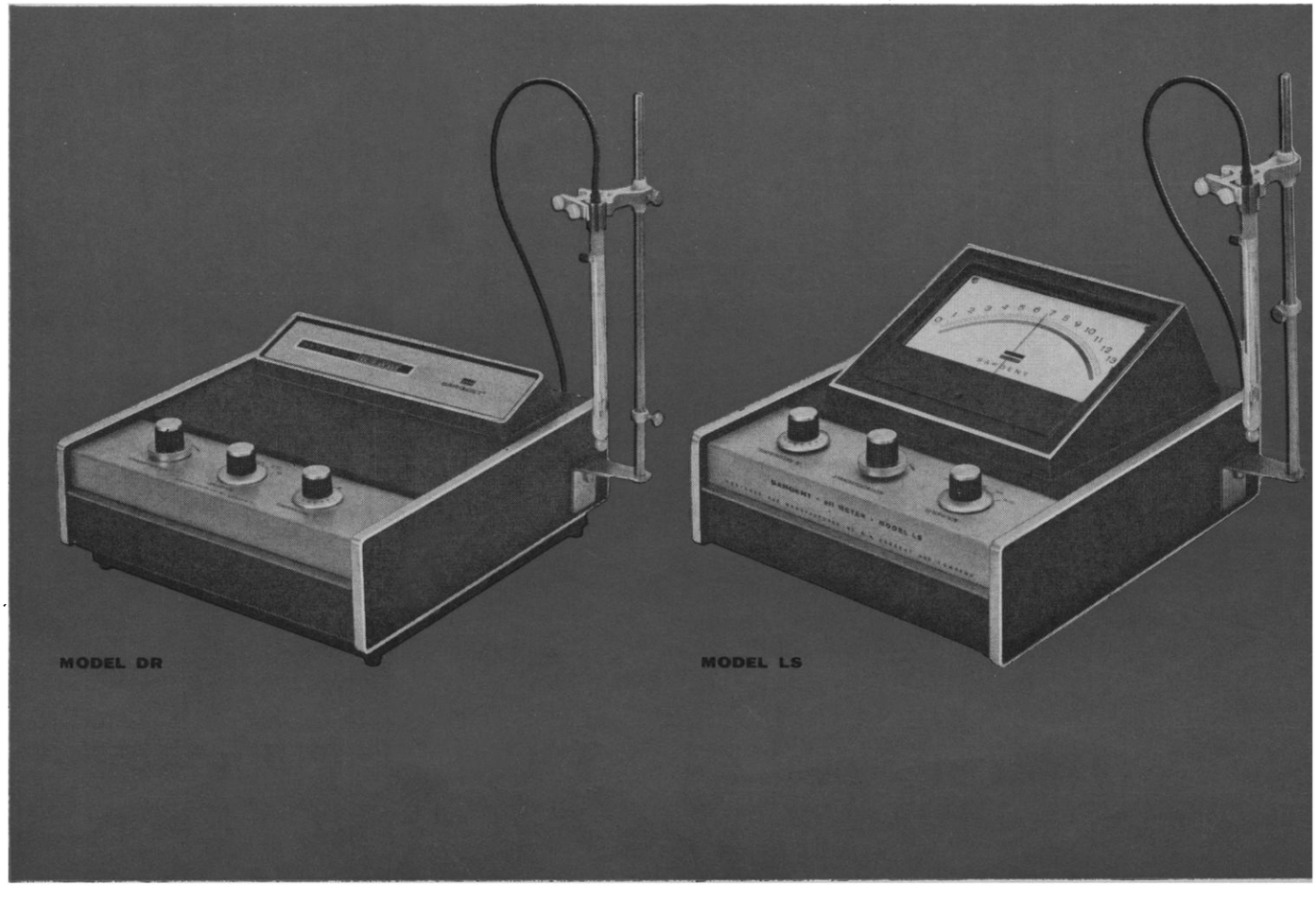
Modern in concept and modern in execution, the Sargent Model LS meter meets the most exacting requirements of the laboratory. It provides accuracy and sensitivity suiting or exceeding the majority of requirements; it provides reliability guaranteeing "on call" service without frequent rechecking or maintenance; it provides versatility for other kinds of measurements and convenience in simplified controls and a large, clear scale. Thus it serves as a Laboratory Standard for pH measurement.



like no other pH meters

MODEL LS

SPECIFICATIONS

Ranges: Meter: 0 to 14 pH, graduated each 0.1 pH; −700 to +700 mv, graduated each 10 mv (0 to ±1400 mv by zero displacement).

Recorder: recommended for use with recorders of 10 mv to 250 mv full scale range.

Temperature: manual compensation, 0 to 100°C; automatic compensation, 0 to 100°C.

Relative Accuracy:* ±0.03 pH within 4 pH of buffer set point.

**Relative to buffer accuracy and assuming proper standardization technique.*

Absolute Accuracy: At meter, ±5 mv (±0.05 pH) over full scale.
At recorder outlet, ±0.6 mv (±0.01 pH).

Repeatability: pH, ±0.01 pH; mv, ±0.6 mv.

Input Current: less than 1×10^{-12} amperes.

External Resistance Tolerance: will accommodate up to 10,000 megohms and maintain specified accuracy.

Price—$330.00 with accessories

For details, write for Bulletin pHLS

LINE OPERATED—MODEL PL
PORTABLE—MODEL PB

- **Accuracy usually found only in highest priced meters**
- **Interchangeable, plug-in power supplies for alternate use**
- **Rugged construction for use in most severe environments**

These Sargent pH meters provide new and unique execution, both electronically and physically, to provide meters tailored to the broad spectrum of today's applications, in the lab, in the field, or both. Accuracy and concomitant stability have been held paramount in view of their increasing importance in present day technology, while complexity has been reduced to a minimum in view of the increasing cost of time used in adjustment of maintenance. These new instruments are completely new tools for the chemist or technician and provide full reliability of pH measurement.

SPECIFICATIONS

Ranges: Meter: 0 to 14 pH, graduated each 0.1 pH; −700 to +700 mv, graduated each 10 mv (0 to ±1400 mv by zero displacement).

Recorder: recommended for use with recorders of 5 mv to 250 mv full scale range.

Temperature: manual compensation, 0 to 100°C; automatic compensation, 0 to 80°C.

Absolute Accuracy: At meter, ±5 mv (±0.05 pH) over full scale. At recorder outlet, ±2.5 mv (±0.025 pH). Manual temperature compensation —±2°C. Automatic temperature compensation— ±2°C (0° to 60°C) ±5°C (60° to 80°C).

Repeatability: pH, ±0.01 pH; mv, ±1 mv.

Input Impedance: greater than 10^{14} ohms.

Input Current: less than 1×10^{-12} amperes.

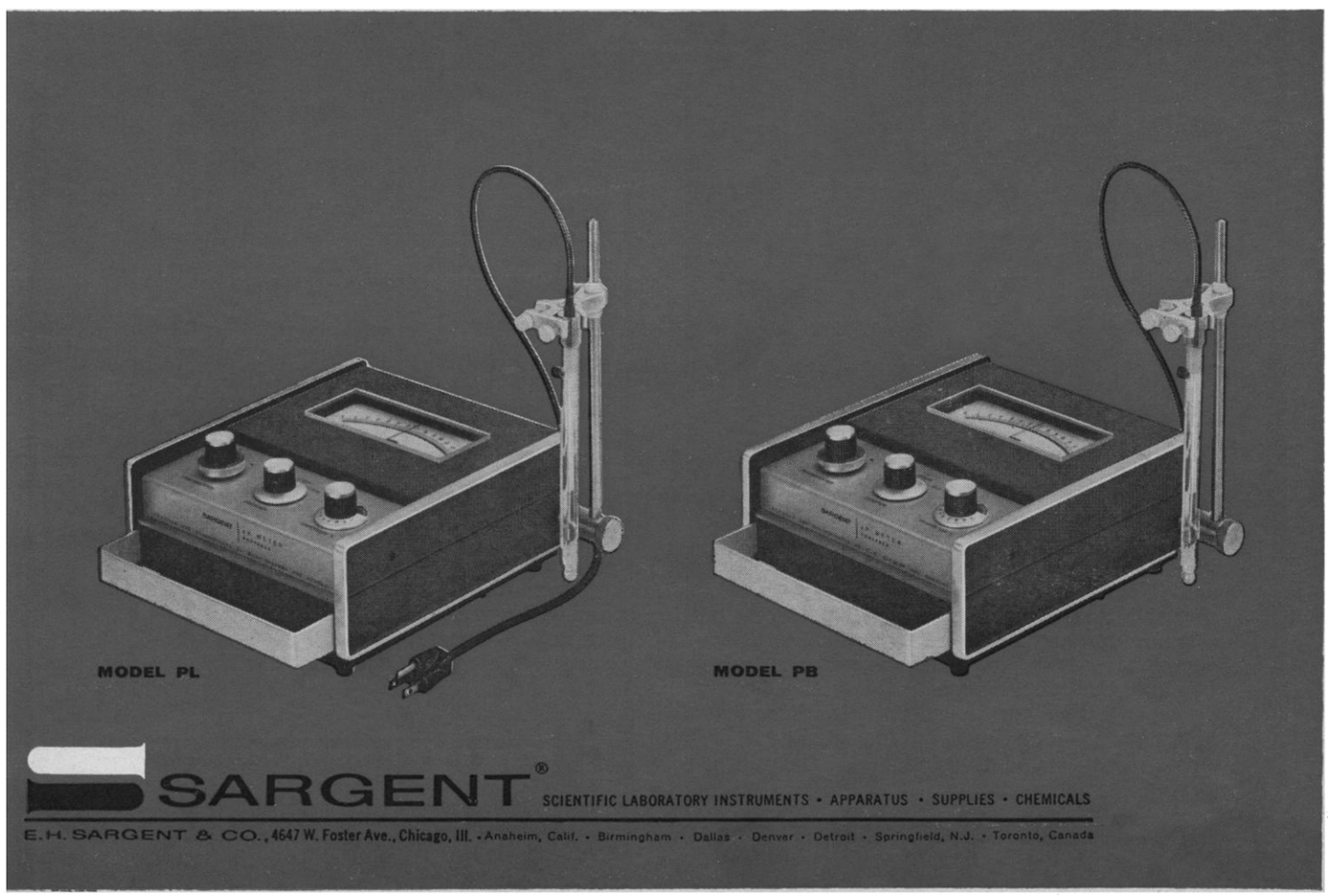
External Resistance Tolerance: will accommodate up to 10,000 megohms and maintain specified accuracy.

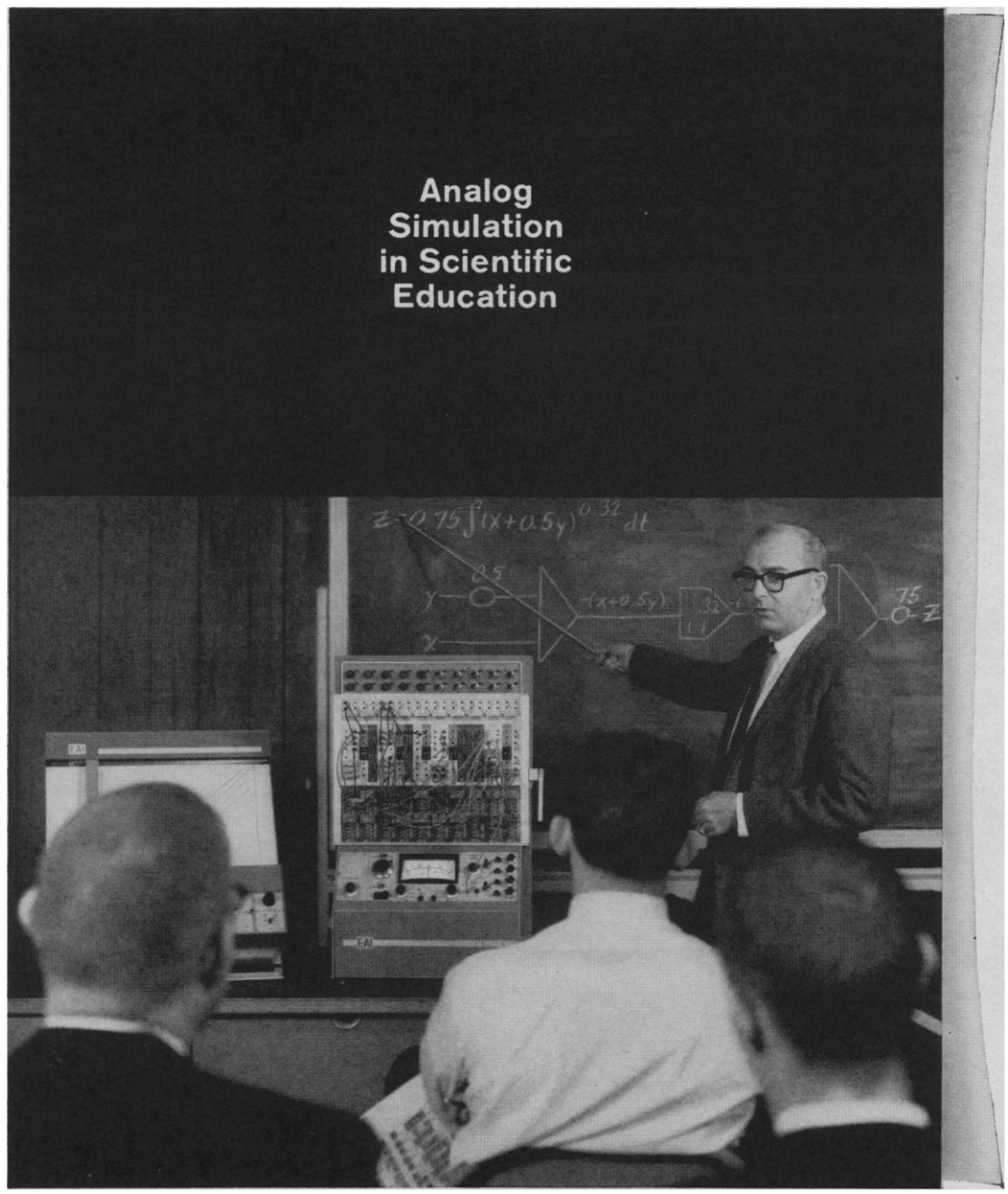
Relative Accuracy:* ±0.03 pH within 4 pH of buffer set point.

**Relative to buffer accuracy and assuming proper standardization technique.*

Price—Model PL—$295.00 with accessories
Model PB—$255.00 with accessories

For details, write for Bulletin pHP





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For additional information on the Northern Scientific Model NS-601 Pulse Height Analyzer, please write or phone, (608) 238-4741.

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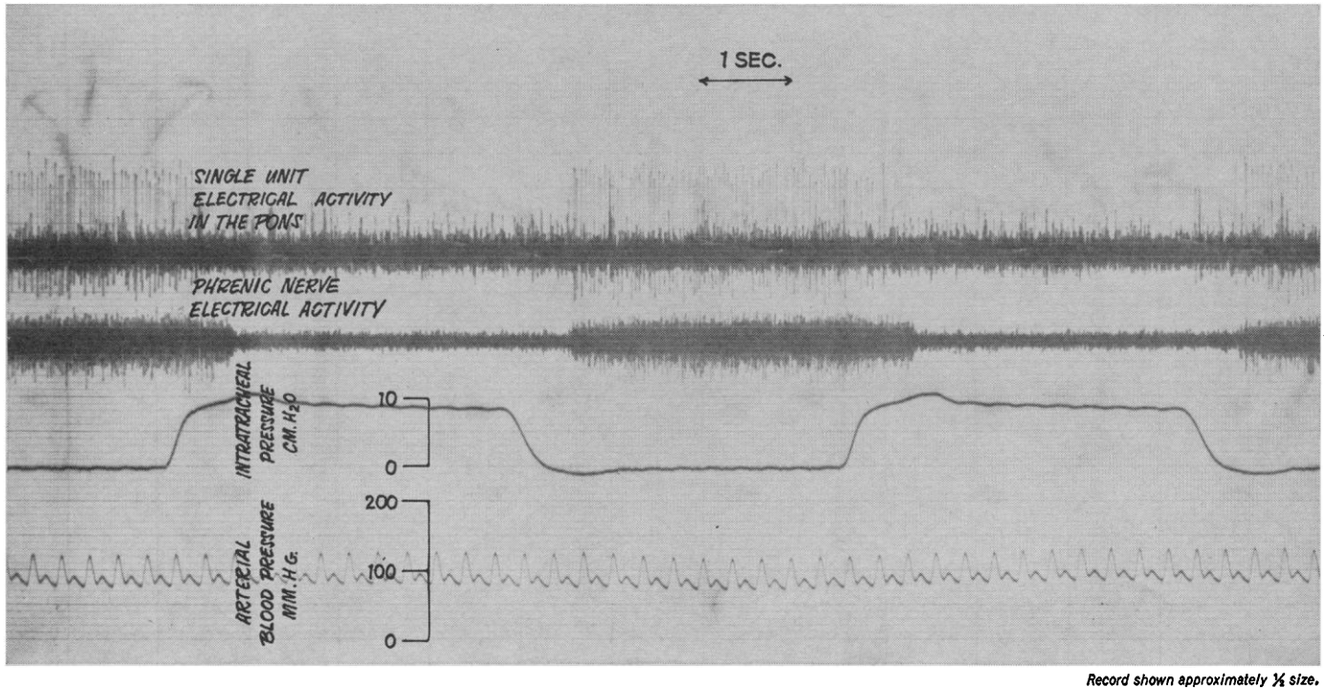
This is a typical record from a Honeywell Neurophysiological Recording System



Record shown approximately ½ size.

See for yourself how it records both high and low frequencies, while maintaining an accurate time correlation between channels.

If you're using an oscilloscope and 35mm camera to handle the information from your research, consider these facts . . .

The Honeywell Visicorder oscillograph that produced this neurophysiological record for a research laboratory provides an immediate, readable recording. There's no film to develop, no enlargement to make.

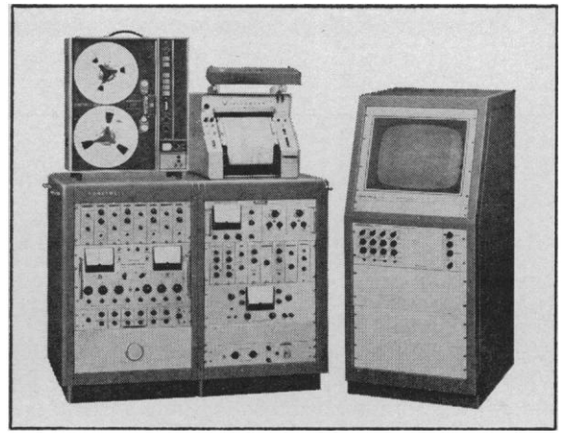
It provides data continuously. You eliminate the lapses you get with ordinary oscilloscopes.

It handles up to 24 channels, with accurate time correlation between all of them . . . far more than you can do with any scope and camera combination.

Honeywell physiology/engineering teams can design a system to meet all your data acquisition, storage, and reduction requirements.

Visicorders are available to instantly and simultaneously record up to 36 channels of physiological data of frequencies from DC to 10,000 cycles per second. They have as many as 15 recording speeds, from 2.5mm to 4000mm per second.

For complete details on using Honeywell data acquisition to handle the information from your research, write direct to Dr. D. C. Sutfin, Mail Station 418, Honeywell, Denver, Colorado 80217. In Canada, Honeywell Controls, Ltd., Toronto 17. Sales and service in all principal cities of the world.



This medical data acquisition system was custom-engineered from standard modules. Shown is a 24-channel Visicorder, a Model 8100 FM portable tape recorder / reproducer (8 channels, DC to 10KC), and a multi-trace oscilloscope which simultaneously monitors up to 8 channels.

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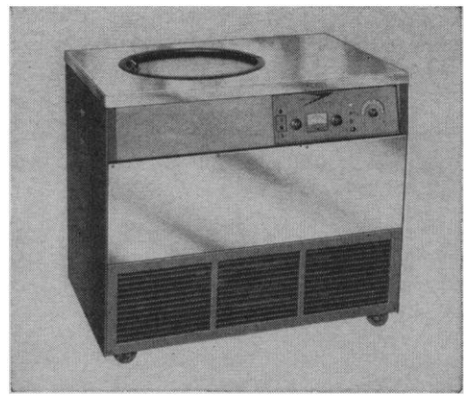

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400 ml to 28,700 x G

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The refrigerated model has temperature range of −20°C to +40°C. Cooling to −20°C from ambient is attainable in only 40 minutes. A single temperature control is employed.

The desired temperature is maintained to within ±1°C in all operational phases.

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Ralph H. Muller, Anal Chem 36, 85A, August 1964

"...atomic absorption...has provided the analytical chemist with an invaluable tool for rapid and accurate measurement of metallic components of solutions.

"Apparatus: Perkin-Elmer Model 303...."
Robert G. Shafto, Products Finishing, August 1964.

"We are the proud possessors of a Perkin-Elmer (Model 303) Atomic Absorption Spectrophotometer.

"By means of this wonderful electronic instrument we are able to accurately determine trace metals and other elements from ppm to ppb...."

Brochure, Clarendon Laboratory, Brooklyn, N.Y (1964)

"Last November, Colorado State University acquired a Model 303 Perkin-Elmer Atomic Absorption....

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W. L. Lindsay, Colo Farm and Home Research, 14, May-June 1964.

"The recent advances in atomic absorption spectroscopy have greatly simplified the analysis of biological fluids for many elements.... A Perkin-Elmer Model 214... was used."

C. F Decker, A. Aras, and Lucile E. Decker, Anal. Biochem, 8, 344 (1964).

"Detailed analysis of each lot (of reagents) was Fisher innovation in 1879, new tool here is (Perkin-Elmer Model 303) atomic absorption Spectrophotometer."

The Laboratory, 32.3, Fisher Scientific, 1964.

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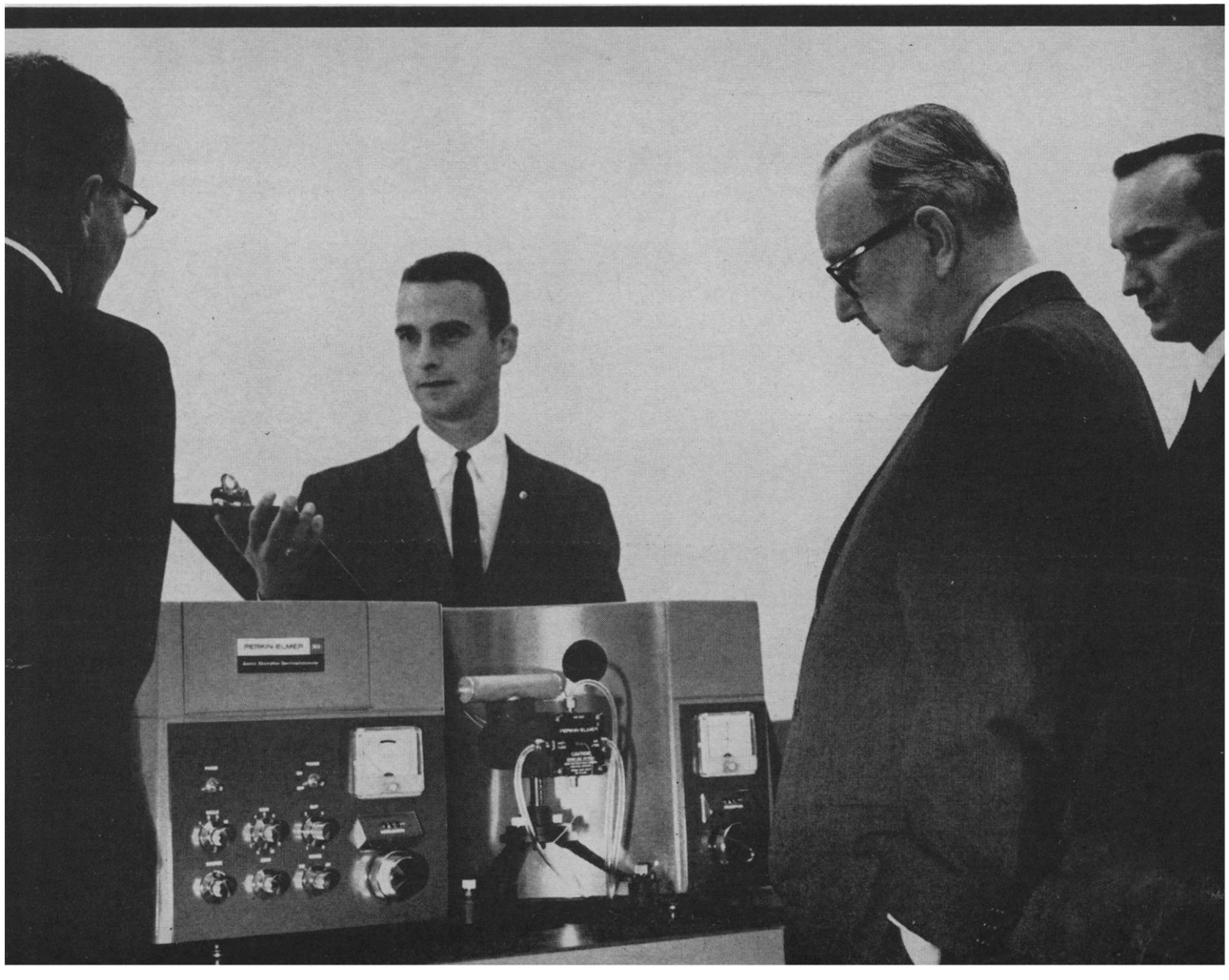
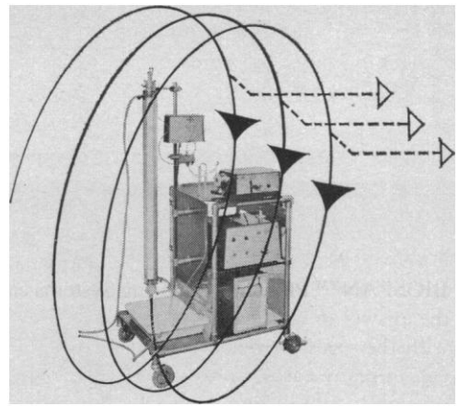


Introducing the LKB ReCyChrom for

RECYCLING CHROMATOGRAPHY

NEW INSTRUMENTATION FOR A NEW TECHNIQUE* IN CHROMATOGRAPHIC SEPARATION



The ReCyChrom is equally applicable for preparative and analytical separation of mixtures of large-sized or of small-sized molecules. These molecules do not have to be electrolytes and restrictions on the type of buffer used are less than with other types of chromatography. Components within a narrow range of molecular sizes, usually not resolved on simple gel filtration columns, are separated in the ReCyChrom by allowing the sample to pass repeatedly through the bed, thereby multiplying its effective height many times. Separated fractions and uninteresting or disturbing parts of the effluent may be bled out of the stream after any cycle without interrupting the separation of the remaining components.

The apparatus is especially suitable for grading homologous series of polymers, e.g., dextrans; for routine control of the purity of biochemical preparations such as serum proteins, enzymes and hormones; and for separation of heat labile substances.

One unique advantage of recycling chromatography is the need for columns of only moderate length. Columns in two standard lengths, 60 cm and 100 cm, both with 32 mm bore are available at present. The range of sample volumes accommodated by these columns depends greatly on the nature of the sample. For simple desalting operations or for separation of peptides and amino acids from proteins, a sample of up to *150 ml* is not unusual, whereas for purity controls of radioactively tagged concentrated preparations, quantities down to 1/100 of this volume are feasible. Sample application by pipette is eliminated. The pump sucks sample through a selector valve with a holdup of 150 µl—a reproducible and non-critical method.

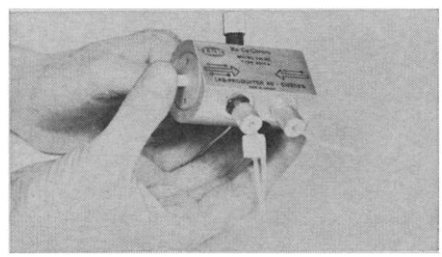
The four main components of the ReCyChrom, namely, a separation column, a peristaltic pump, a selector valve and a flow analyzer are available separately for incorporation into other instrument setups. The specially constructed columns with adjustable plungers at both ends can be sealed completely to eliminate the pressure of water head and permit liquid flow in either direction. Closed system operation and ascending flow maintains even packing and prevents the flow rate from falling off with use, even when beds of material with low mechanical strength (gels) are used.

LKB's specially designed peristaltic pump has a very high flow constancy—0.5% over a period of a week—and a continuously variable pumping rate from 0-390 ml/hr.

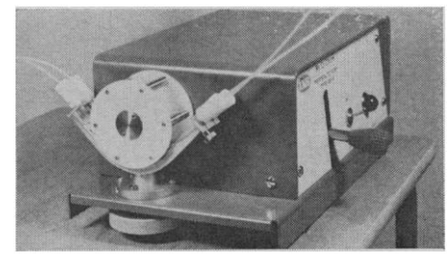
A choice of three flow analyzers, cooling jackets, terminal box, connections and a cart comprise the remainder of the assembly.

Request literature file 4900S-5 for details.

*According to J. Porath and H. Bennich



The simple push of a button on the Selector Valve alters the flow circuit from injection or bleeding to recycling.



The Peristaltic Pump has many other uses when not in service for the ReCyChrom.

LKB INSTRUMENTS, INC., 4840 Rugby Ave., Washington, D.C. 20014

LKB PRODUKTER AB, P.O. Box 12220, Stockholm 12, Sweden

Family traits: reproducibility, sensitivity, reliability.

Family name: Nuclear-Chicago Planchet Counting Systems.

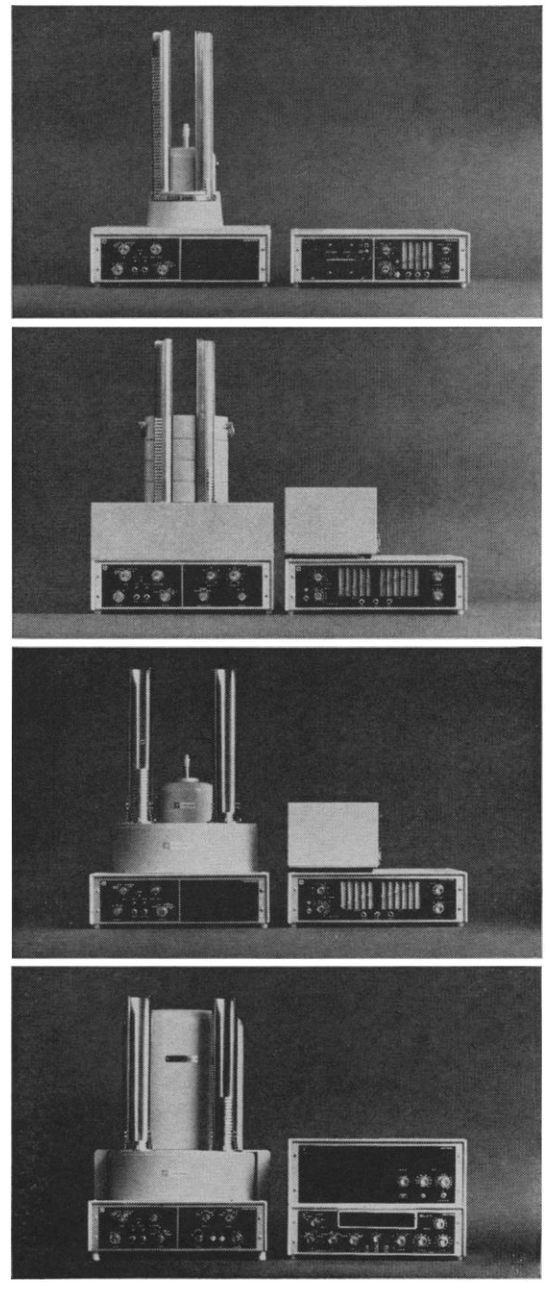
One of Nuclear-Chicago's new family of BIOSPAN™ Planchet Counting Systems can deliver the answer to your counting problems. For example, with the gas flow detector in each system, you can get, in many cases, improved E^2/B for samples that quench highly in liquid scintillation systems.

That these new planchet counting systems do their job so well is the result of a number of operating innovations. For reproducible results, the *new* gas flow detector is uniformly sensitive up to the edge of the window. During windowless operation, the detector is automatically flushed by the gas for a predetermined period before counting starts and is protected by an electrostatic dust shield. The detector has low background (12-15 cpm in the standard systems) and easily replaceable windows.

Then too, the sample changer is all solid-state with no electromechanical relays and offers a wide variety of sample-changing programs. The powerful, reliable changer handles up to 150 samples.

You have a total of nine systems to choose from—for normal or low-background counting, for 1¼ or 2-inch diameter planchets. All with a wide selection of data readout options.

Consult your Nuclear-Chicago sales engineer for full details or write directly to us. NUC:B-5-227



SHOWN AT RIGHT (TOP TO BOTTOM):

Model 4340. 1¼-inch Standard System with print-out of sample number and time.

Model 4342. 1¼-inch Low-Background System with print-out of sample number, time, and count.

Model 4330. 2-inch Standard System with print-out of sample number, time, and count.

Model 4336. 2-inch Low-Background System with print-out of sample number, time, counts, cpm, and scaler ratio.

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No longer need skilled people spend time at the messy work of coating glass plates for thin-layer chromatography. The simplicity of paper chromatography is back with the speedy, detailed separations that first turned you to TLC. EASTMAN CHROMAGRAM Sheet consists of inert poly(ethylene terephthalate) bearing polyvinyl alcohol-bound silica gel which Kodak itself processes and controls. It works with all the solvents for silica-gel TLC. The adsorbent is 100 microns thick. The whole sheet is thick enough not to be limp, thin enough to make storage problems disappear. The 20 cm x 20 cm sheets come 20 to a box. You stock only one size, since the sheet may be readily cut. Results are equal to or better than with glass.

Now there are 2 kinds of EASTMAN CHROMAGRAM Sheet for TLC

1. Type K301R Silica Gel *with* fluorescent indicator

The fluorescent indicator can prove highly useful in any of three ways:

a. by showing a conspicuous dark spot under ultraviolet when the compound has u-v absorption bands that intercept the exciting radiation;

b. by a similar dark spot caused by photochemical quenching behavior of the compound;

c. by a brighter spot where the compound enhances the fluorescence.

2. Type K301R2 Silica Gel *without* fluorescent indicator

Three reasons why you may prefer to work with EASTMAN CHROMAGRAM Sheet that has no lead-manganese-activated calcium silicate in the coating are:

a. A secondary excitation of light from the phosphor could introduce needless complications when you cut out separated compounds that carry a radioactive label for quantitative evaluation in a scintillation liquid.

b. Light emitted by the phosphor might conceal pertinent absorption bands in spectrophotometric examination of migrated spots when an instrument is used that disperses the light into a spectrum after traversing the sheet rather than before.

c. An incorporated fluorescent indicator could mask fluorescence intrinsic to the separated substance or induced by a fluorescing spray reagent.

Or you may have other reasons.

For data and samples, get in touch with one of the dealers listed below or *Distillation Products Industries,* Rochester, N. Y. 14603.

Both types of EASTMAN CHROMAGRAM Sheet are available from these dealers:

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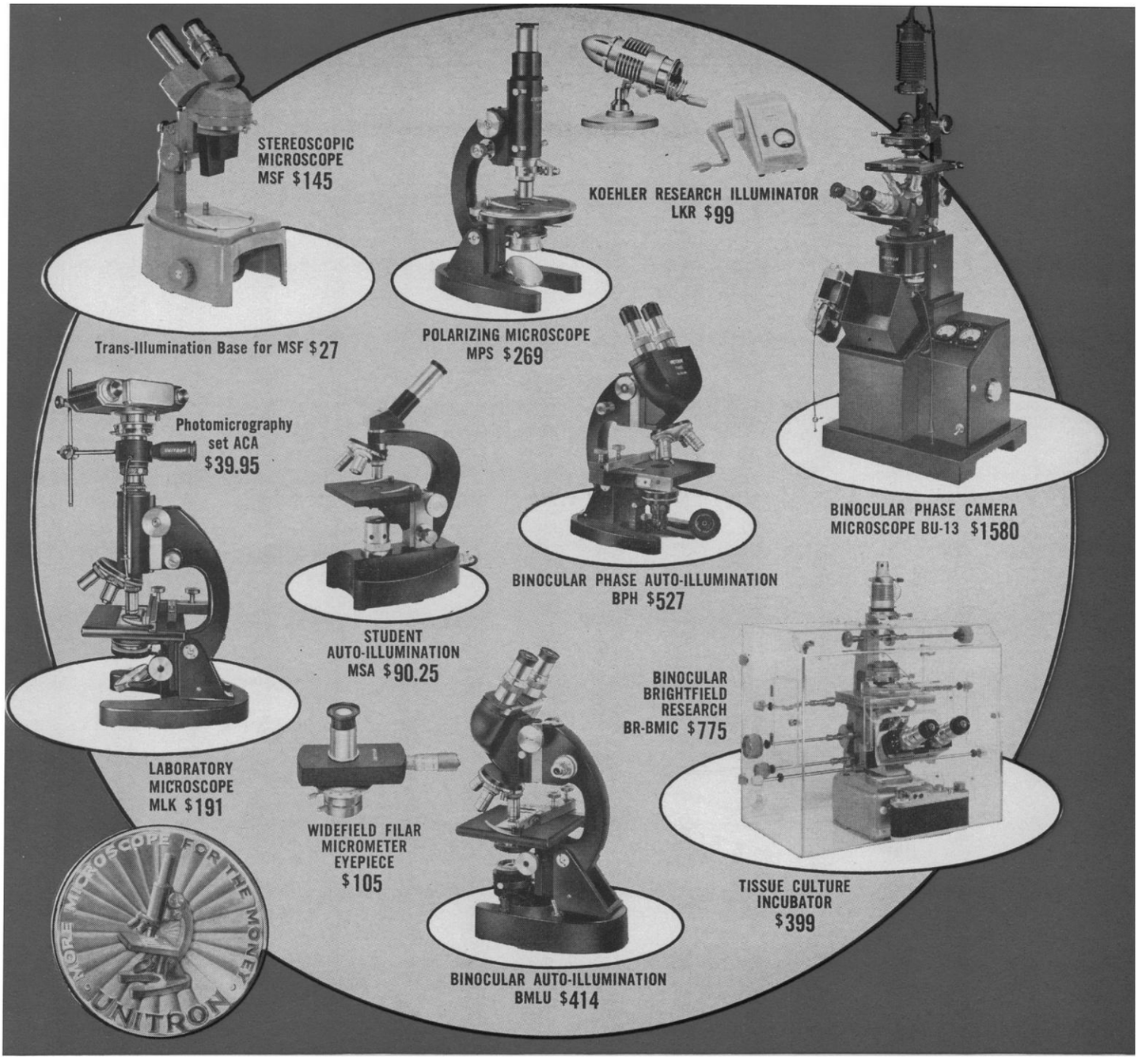

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EPR IN THE WORLD OF BIOCHEMISTRY

MONITORING ASCORBATE LEVELS IN BLOOD SERA

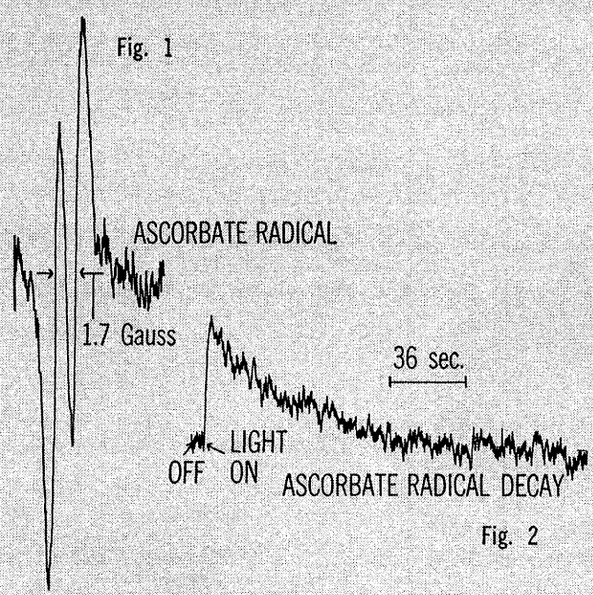

Fig. 1

Fig. 2

The monitoring of drug levels of phenothiazine psychotropic drugs in blood sera was demonstrated in our most recent "EPR in the World of Biochemistry." During the course of these experiments, it was also observed that this EPR-photolysis technique could be used as well to detect changes in ascorbate levels — especially when high dosages were used. The EPR signal observed for the ascorbate radical produced during photolysis of serum is quite different from that obtained from the phenothiazine drugs. The signal is a doublet, with a splitting of 1.7 Gauss and a g level of 2.0043. The spectrum is illustrated in Fig. 1. Another distinguishing characteristic of the ascorbate radical is the fact that the intensity of the signal decreases during irradiation. The half life of the signal during irradiation (illustrated in Fig. 2) is approximately 30 seconds. In cases where both drug and ascorbate radicals are present, prolonged irradiation for about three minutes completely removes the signal associated with the ascorbate, leaving only the drug signal. This method should be very effective for studying the effects of ascorbic acid on drug levels.

Additional information about this and other examples in this series is available upon request, or if you would like to see a demonstration of our EPR systems and their accessories, write the EPR Product Group, Palo Alto, for an appointment at one of our Applications Laboratories. They are located at Pittsburgh, Pennsylvania; Palo Alto, California; and Zurich, Switzerland. In Europe, contact Varian A. G., Zug, Switzerland.

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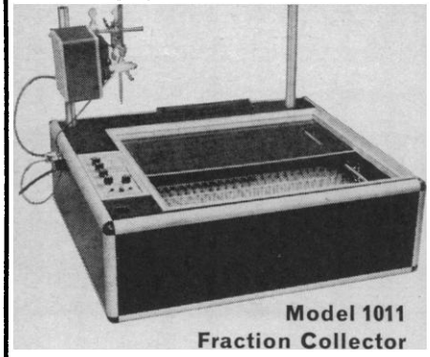

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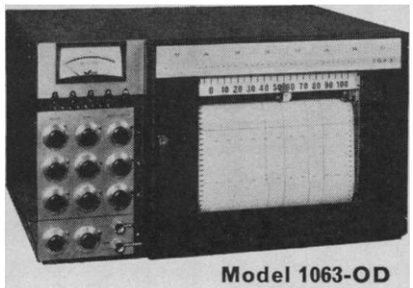

Model 1063-OD
Automatic Multi-Channel Ultra-Violet Analyzer

Presents recording at three different wave lengths. Provides a recording of the ratio of the optical density of the effluent at two of these wave lengths. Space-saving design. Completely transistorized. Detection system completely self-contained and light shielded.

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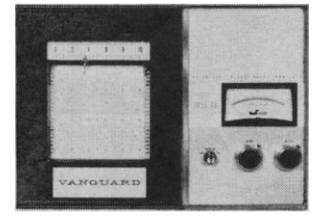

Model 1056-OD Automatic Ultra-Violet Analyzer

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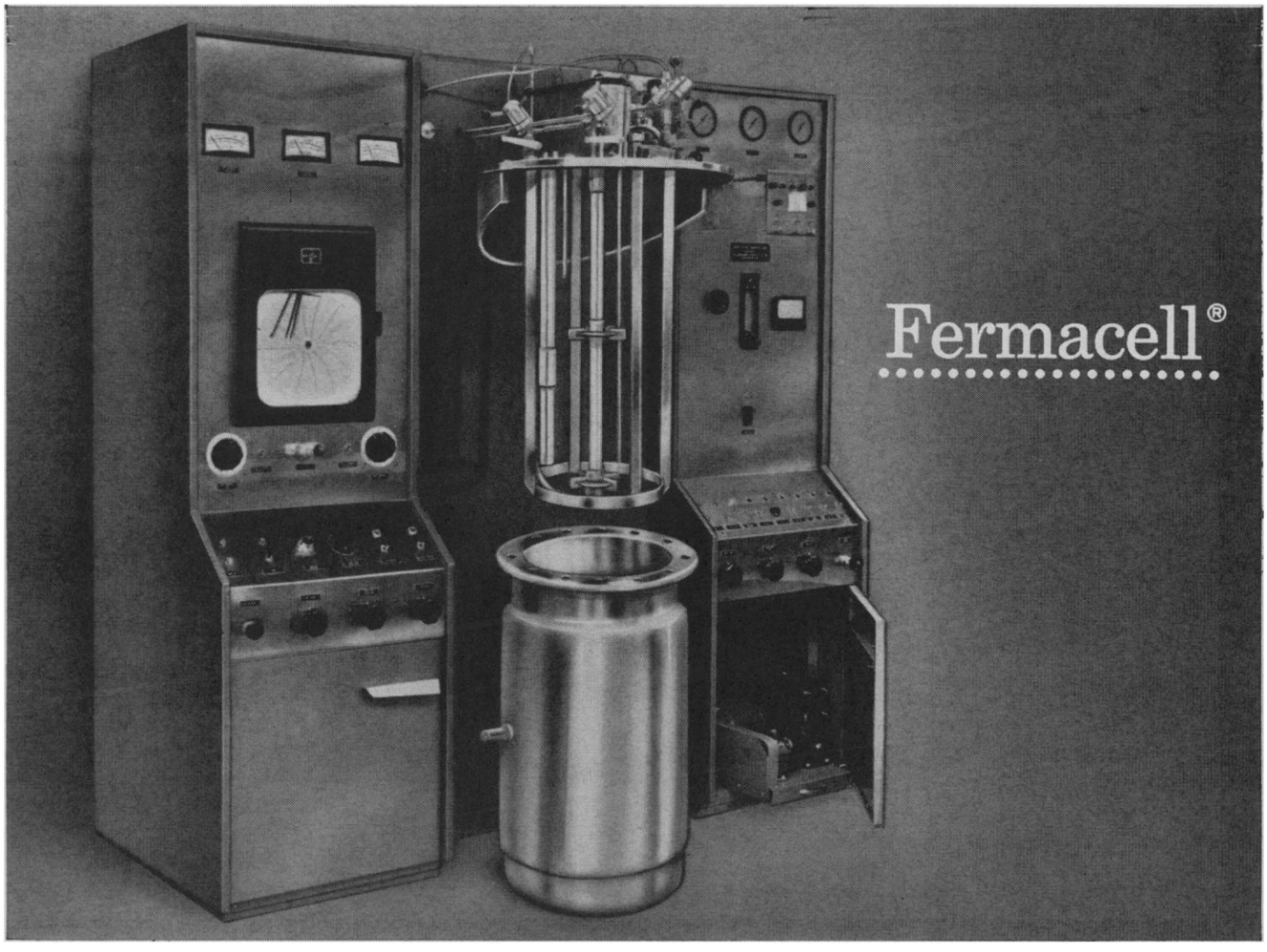

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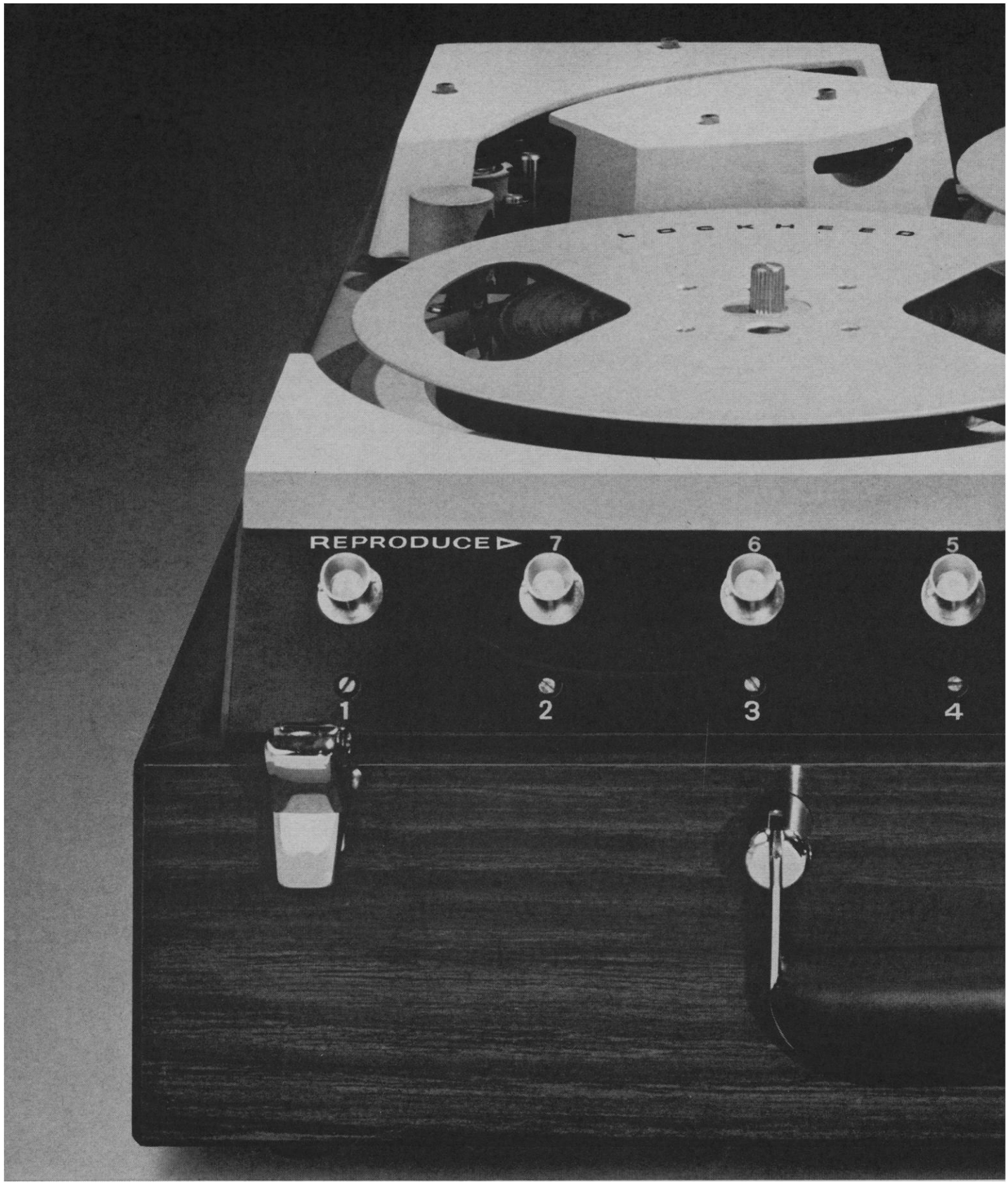

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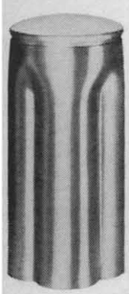

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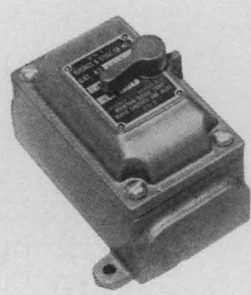

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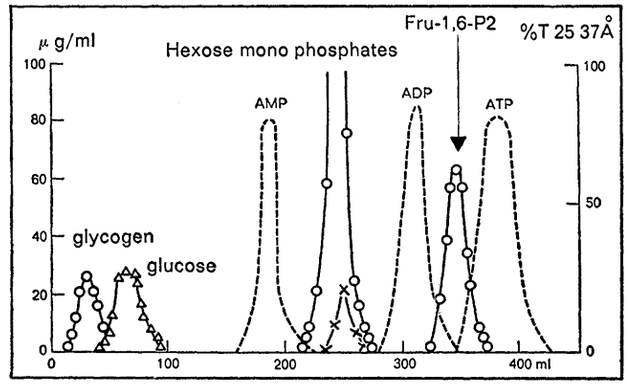

Model experiment with glycogen, glucose, sugar phosphates and adenosine phosphates on a column of DEAE-Sephadex A-25. Reproduced from Biochim. Biophys. Acta 74 (1963) 588, by permission of the author.

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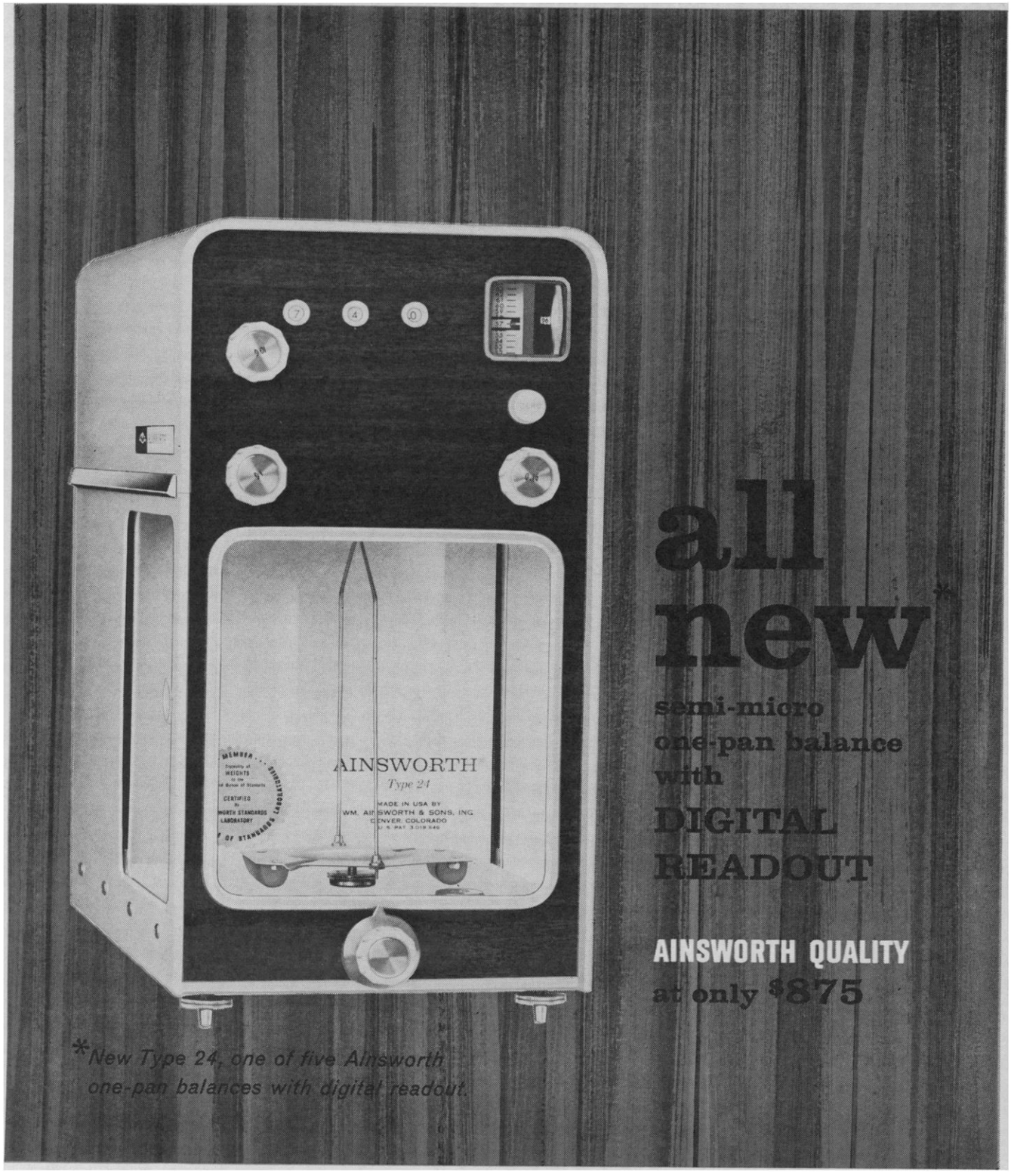

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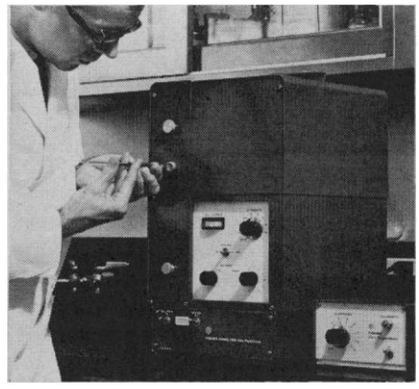

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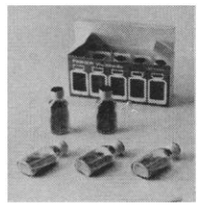

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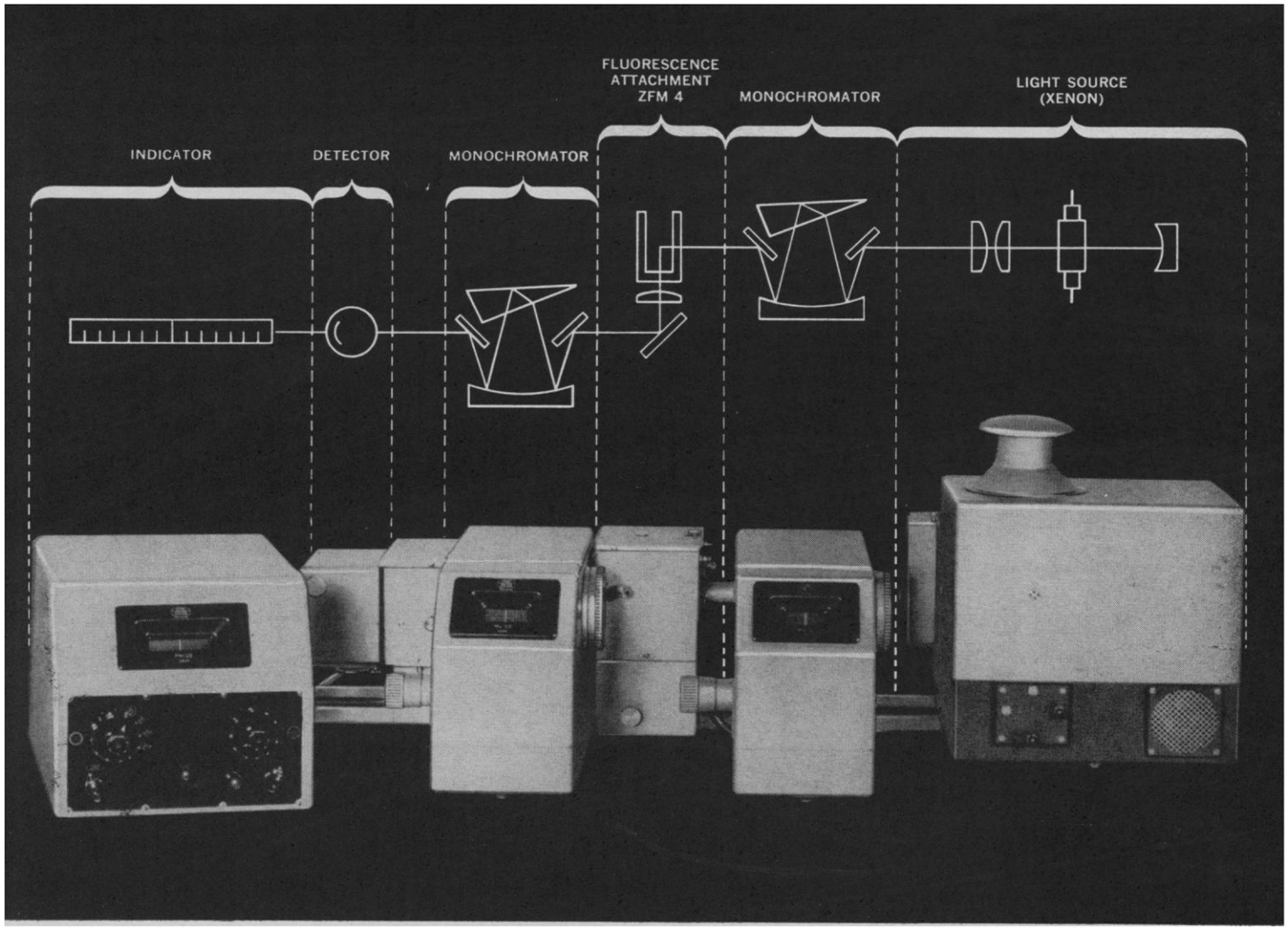

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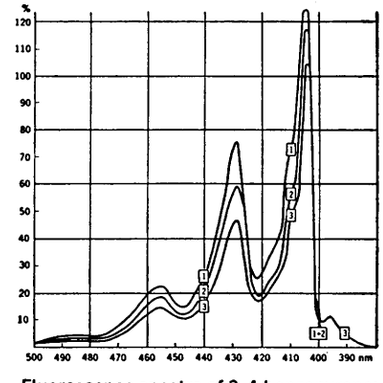

Fluorescence spectra of 3, 4-benzopyrene: 1, dissolved in benzene, 2. from a paper chromatogram, 3. benzopyrene on paper.

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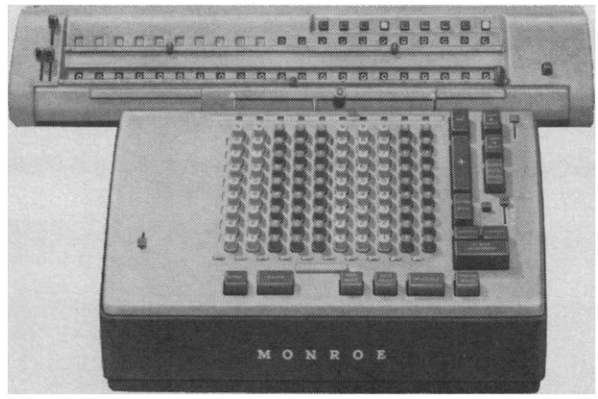

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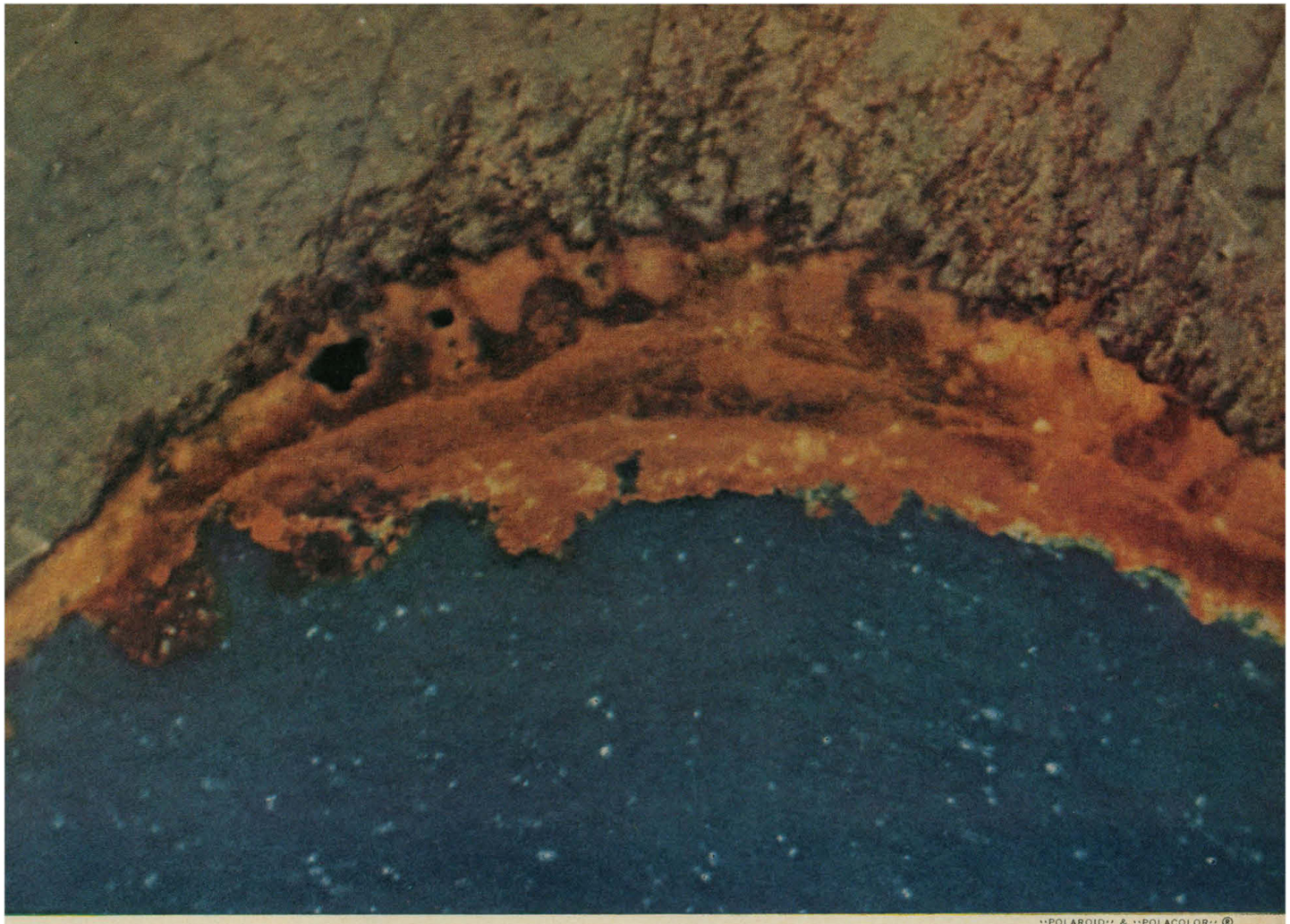

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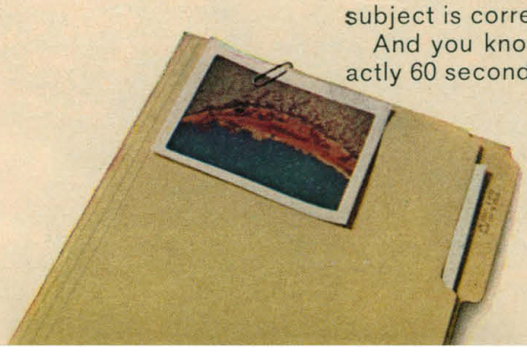

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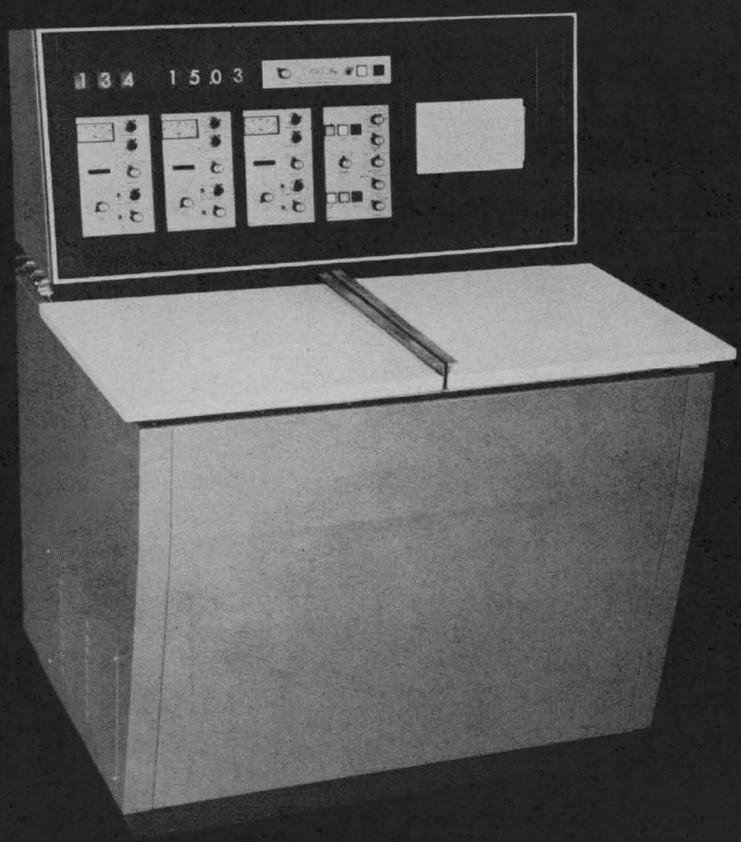

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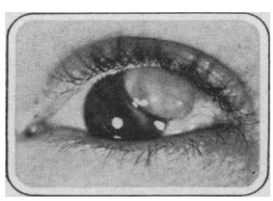
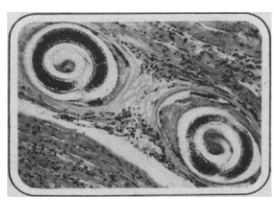
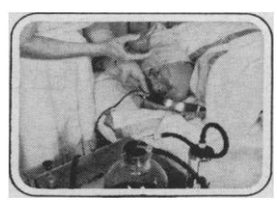
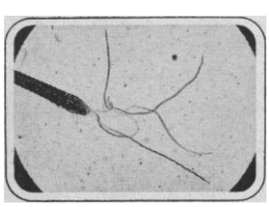


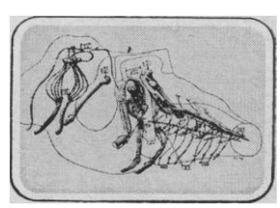

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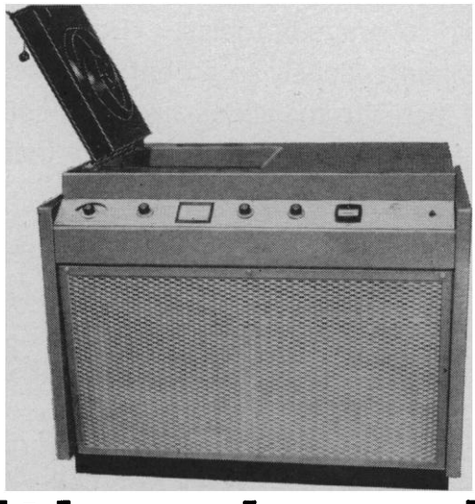

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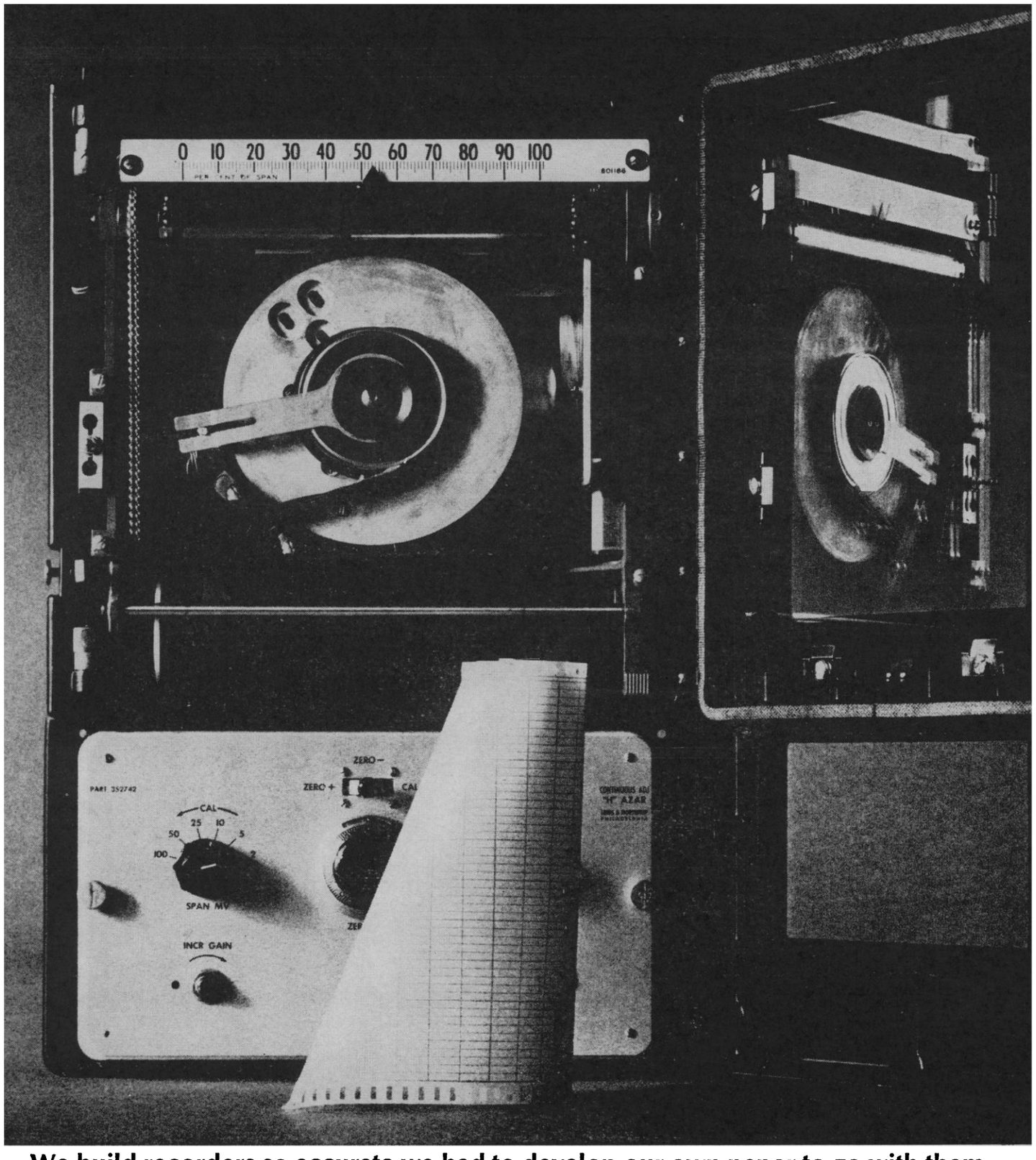

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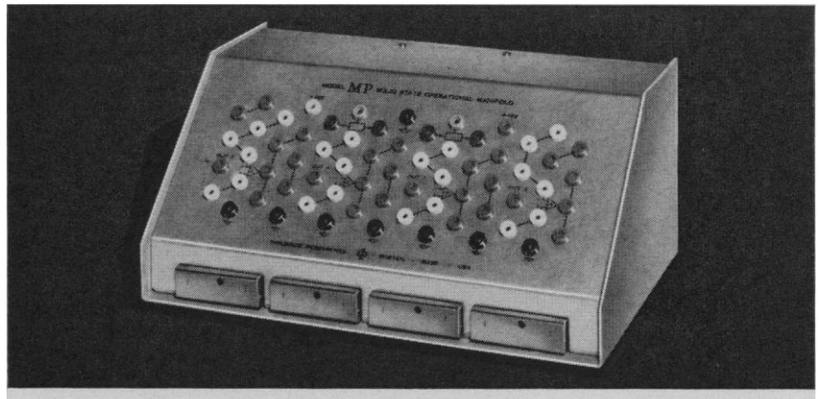

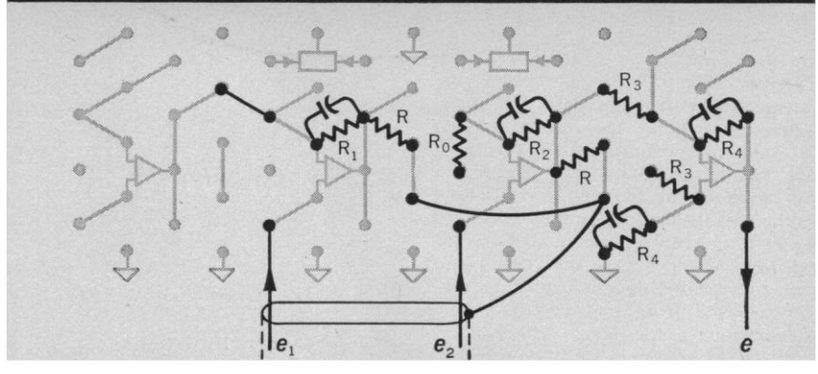

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APPLICATIONS

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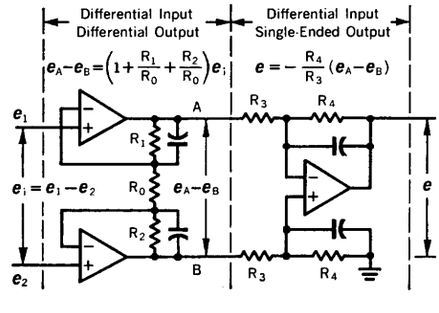

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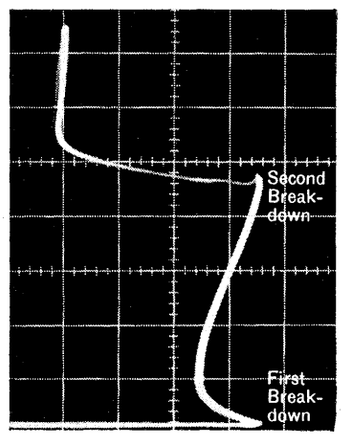
The Problem of Second Breakdown in Transistors

The use of transistors is limited by second breakdown, where there is an abrupt reduction in the collector voltage at levels of current below the rated value. In certain cases this can cause destruction of the transistor. New research indicates there are both thermal and electrical causes and some opportunities to push second breakdown limits considerably higher.

Transistors have a characteristic which is not completely understood and which puts undesirable limits on their use.

In all transistors as the collector-to-emitter voltage (Vce) is increased the transistor will reach a point where the collector current I_c increases rapidly. (See Fig. 1)



Vce with $I_b = 0$
Fig. 1

This occurs at first breakdown and as current increases further, voltage will decrease to a sustaining value. This sustaining value is considered the maximum operating value of the transistor.

As current is further increased, the transistor enters a new mode of operation where voltage decreases rapidly. This is termed the second breakdown region. (See Fig. 1)

Obviously, this phenomenon puts an even lower limit on the device and one that if exceeded is potentially destructive.

Many theories have been proposed to explain this second breakdown but none have been found completely satisfactory.

Honeywell scientists in earlier work on first breakdown developed a technique that is useful in studying second breakdown. They experimentally studied the collector junction, or the interface between the P and N regions, to observe whether breakdown occurs in a uniform manner over the entire collector junction or in localized hot spots at random in the junction.

By introducing a variable transverse base current they literally obtained a "contour map" of the breakdown voltages over the entire collector junction surface. These "maps" show that breakdown voltage is not uniform.

An infrared sensor was used to confirm the non-uniform characteristic. It was observed that the infrared emission was not uniform and in fact at breakdown there was a point of intense local heating.

The results of the mapping technique supported by the infrared observations have led to the development of a model with which to analyze second breakdown.

The model treats a transistor as if it were two discrete devices operated in parallel: one device where second breakdown occurs and one where it has not occurred. It is then possible to compare the devices and come to some conclusions as to what the mechanism is that causes breakdown and triggers the negative resistance phenomena. In general, both electrical and thermal effects are important, with the dominant mechanism determined by the transistor design, mode of operation and imperfections present.

Honeywell scientists have concluded that second breakdown in transistors originates in majority carrier current (electron current in a PNP transistor) from the breakdown spot. These majority carriers are generated by the process of avalanche multiplication. During multiplication at the breakdown spot an equal number of electrons and holes are produced. In a PNP transistor the holes enter the collector and the electrons flow through the base region to recombine with holes lost by the emitter. This electron flow has a transverse component which causes a voltage drop which concentrates the emitter current in the vicinity of the breakdown spot. The higher emitter current to the breakdown spot results in a higher electron current through the base. Thus the cycle is regenerative and if the process continues, it will result in the hot spot mentioned earlier.

Continuing work should lead to a computer program to solve equations to predict where and when breakdown will occur and whether by electrical or thermal mechanisms.

The result, it is hoped, would be the ability to design transistors to minimize thermal effects and to eliminate or minimize the electrical effects.

If you are engaged in research on second breakdown you are invited to correspond with Mr. Harold Josephs, Honeywell Research Center, Hopkins, Minnesota. If you are interested in a career at Honeywell's Research Center and hold an advanced degree, write to Dr. John Dempsey, Director of Research at this same address.

the construction of Pleistocene time scales until firmer data are available upon to which to base such a chronology.

PAUL E. DAMON
Geochronology Laboratories, University of Arizona, Tucson

References

1. D. B. Ericson, M. Ewing, G. Wollin, *Science* **146**, 723 (1964).
2. C. Emiliani, *J. Geol.* **63**, 538, (1955).
3. J. N. Rosholt, C. Emiliani, J. Geiss, F. F. Koczy, P. J. Wangersky, *ibid.* **69**, 162 (1961).
4. F. E. Zeuner, *Dating the Past* (Methuen, London, ed. 3, 1952), p. 140.

Observatories in the Southern Hemisphere

I should like to correct or clarify some statements made by V. K. McElheny in his article on "Large new telescopes for the Southern Hemisphere" (6 Nov. 1964, p. 755).

The Lick Observatory has not had a station in Chile since 1929. Previously it operated a 0.94-meter (37-inch) reflector on Cerro San Cristóbal, Santiago. This was sold more than 30 years ago to a private individual, who donated it to the Catholic University in Santiago, which has since maintained and operated it.

La Silla, the site selected for the European Southern Observatory, was not among those tested during the site-survey expedition that I conducted for AURA (Association of Universities for Research in Astronomy). However, because of its nearness to Cerro Tololo, the site chosen by AURA, and because it has a similar elevation, La Silla is expected to be a good site.

McElheny says that "the project of the European Southern Observatory (ESO) organization is most advanced." ESO only recently purchased a large tract of land around its future observatory site, and has also only recently acquired a tract of land in Santiago for a future headquarters; no construction has started yet on La Silla nor on an access road to the summit. The first ESO telescope for Chile, a 1-meter reflector, has been completed in Holland and is scheduled to be delivered in Chile later in 1965. The AURA construction program, on the other hand, was started more than 20 months ago, after a 3-year program of site surveys. The headquarters in La Serena, including an administration building and three residences, are completed. An access road to Cerro Tololo, 38 kilometers long, was completed more than a year ago. All sites for the entire building program on the mountain have been leveled and prepared for construction. The first two permanent buildings on the summit are under construction now. The water-supply system, which will bring water to the peak from a spring 1000 meters below, is nearly installed, and so is much of the system for the distribution of electrical power. A large generator has been operating on the mountain for a year. Of the four telescopes in the present plans of AURA, one has been operating on Cerro Tololo for 3½ years. An identical telescope, a 40-centimeter reflector, will be delivered to Chile soon. Two other reflectors (1.5 and 0.9 meters) are under construction and will be delivered near the end of 1965. The optical components for these three telescopes are being made at the optical shop of the Kitt Peak National Observatory in Tucson, and will be finished well before the telescopes. The U.S. Air Force is providing funds for the 1.5-meter telescope, the National Science Foundation for the others and for all construction and operations.

The main reason for using fused quartz for large mirrors, instead of pyrex, is not its greater rigidity, as McElheny suggests, but its lower coefficient of thermal expansion, because of which the effect of atmospheric temperature changes on telescopic images will be negligible.

JURGEN STOCK
Cerro Tololo Inter-American Observatory, Casilla 63-D, La Serena, Chile

(An article on Cerro Tololo by Stock appears on p. 1054 of this issue.)

Stock's remarks are a welcome clarification of an article written from a European vantage point. The statement about the Lick Observatory derived from misunderstanding of a public source. The fact that the European organization relied strongly on Stock's investigations of a nearby site led to inexact wording which made it seem as if he had actually surveyed the site chosen by the Europeans after they decided against accepting the American offer of part of their large site. In saying that the European project was most advanced, I was speaking only of plans to build a telescope of nearly the resolution of Palomar. Although AURA hopes for a 3.5-meter telescope at the Chilean site, presumably of design

similar to the one to be completed at Kitt Peak, funding had not been requested at the time of writing. Design of the European telescope, which continues to benefit from generous cooperation from AURA, is well advanced, to the point where a choice can be made of the supplier of the blank, and the money has been pledged for its construction. In describing the advantages of a fused silica block, spokesmen of the European organization spoke often of the lower coefficient of thermal expansion of quartz, and had not used an imprecise word like "rigidity."

V. K. McElheny
18 Kensington Court Place, London, W.8, England

Oral Reports

The effectiveness of the "short" paper (10 to 15 minutes) at major scientific meetings might be considerably enhanced if speakers would abandon the classic format of the printed article and, instead, use the following order: (i) background information (if needed); (ii) conclusions of present report; (iii) methods; (iv) results; (v) discussion (if needed); (vi) conclusions repeated.

Conclusions cannot be evaluated properly without consideration of the methods used to collect the data. The reader of a printed paper has the chance to flip back and forth among the pages; the listener at a meeting must depend on his memory. If the listener were to be told first the use that was made of the data, he then could evaluate the methods in this light. I believe that papers delivered orally according to this format would be more interesting and informative and, further, would provoke more useful questions and discussion.

Bernard K. Forscher
Mayo Clinic, Rochester, Minnesota

NIH Career Awards

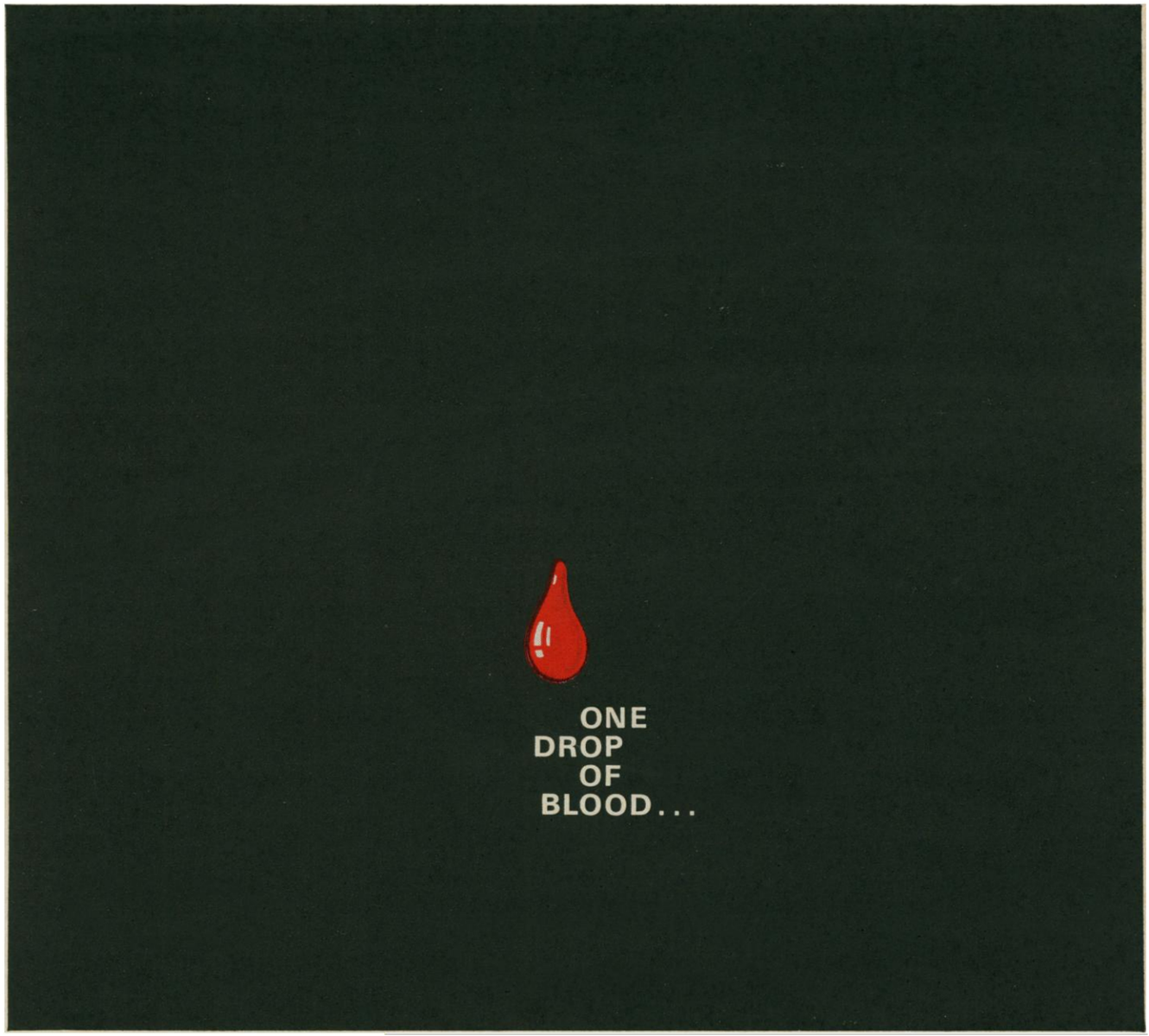
Before I state my profound disapproval of the attitude expressed by I. D. J. Bross in his letter on NIH Career Awards (19 Mar., p. 1395), I want to establish my credentials. First, I am an active researcher. Although I am an administrator (chairman of a large department) and teacher (43 class hours this April), I manage to spend about half my time in my laboratory. I have published three papers in the last 12 months, and I have two in press. On all I am first or sole author, because I did most of the work described. Second, I am grateful for NIH-NSF support of research, not only because it has multiplied resources but because it has given a healthy independence to every scientist competent to command such support. No man or woman in my department need say "Yes, sir" to me in order to be able to work.

The job of a university administrator is to create an atmosphere in which good people can do good teaching and research, and the job of a university faculty member is to teach, to do research, and to carry some of the administrative burden according to his interests and abilities. Teaching at all levels, undergraduate, professional, and graduate, is a job worth doing and doing well.

There has grown up since the war a new generation of faculty members, nursed on NIH-NSF support, which regards its own research productivity as its only valid contribution to society. To members of this group, research alone is a positive good, and administration and teaching, because they interfere with research, are evils. A man who holds such views may have his home most appropriately in a research institute; he does not belong on a university faculty. Since universities, imperfect though they may be, are still our chief means of accumulating, preserving, and transmitting knowledge, scientists and supporting agencies should seek to strengthen universities in all their functions. I believe NIH, NSF, and other granting agencies do understand this obligation, and I am sure that most faculty members cheerfully accept it as well. Any scheme of outside support which allows a faculty member flatly to refuse to accept his just share of teaching and administration is destructive of the best interests of both the university and its faculty, and a scientist who accepts such support without accepting his university obligations is a parasite.

Horace W. Davenport
Department of Physiology, University of Michigan, Ann Arbor

. . . The scientist is right in asking for the privilege of doing as he pleases as soon as he has credentials, but the judgment should come from his super-



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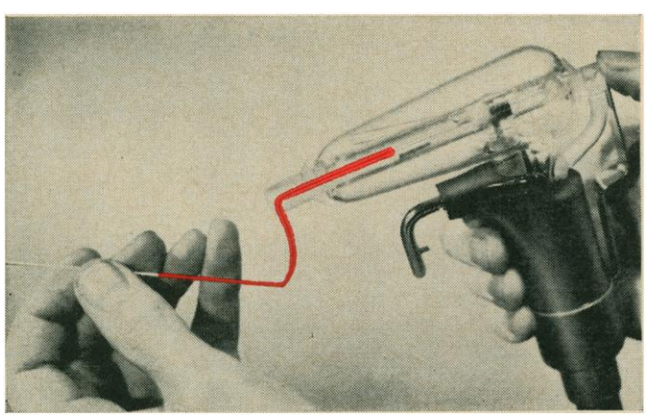

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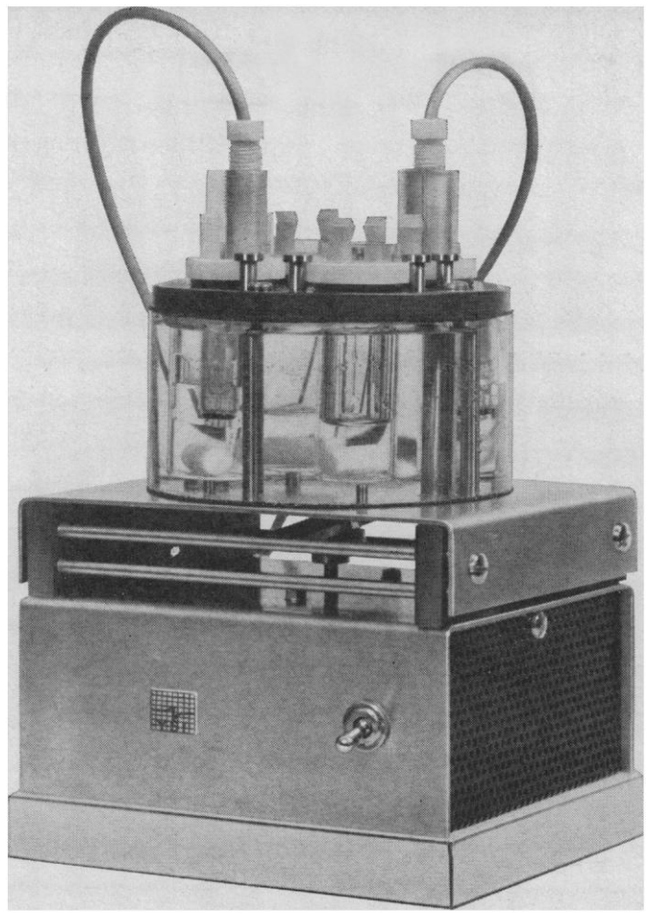

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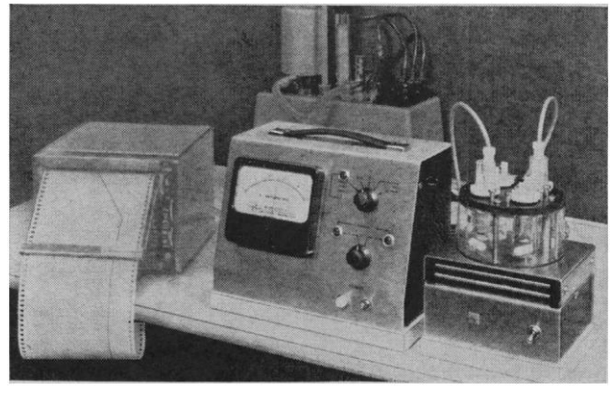

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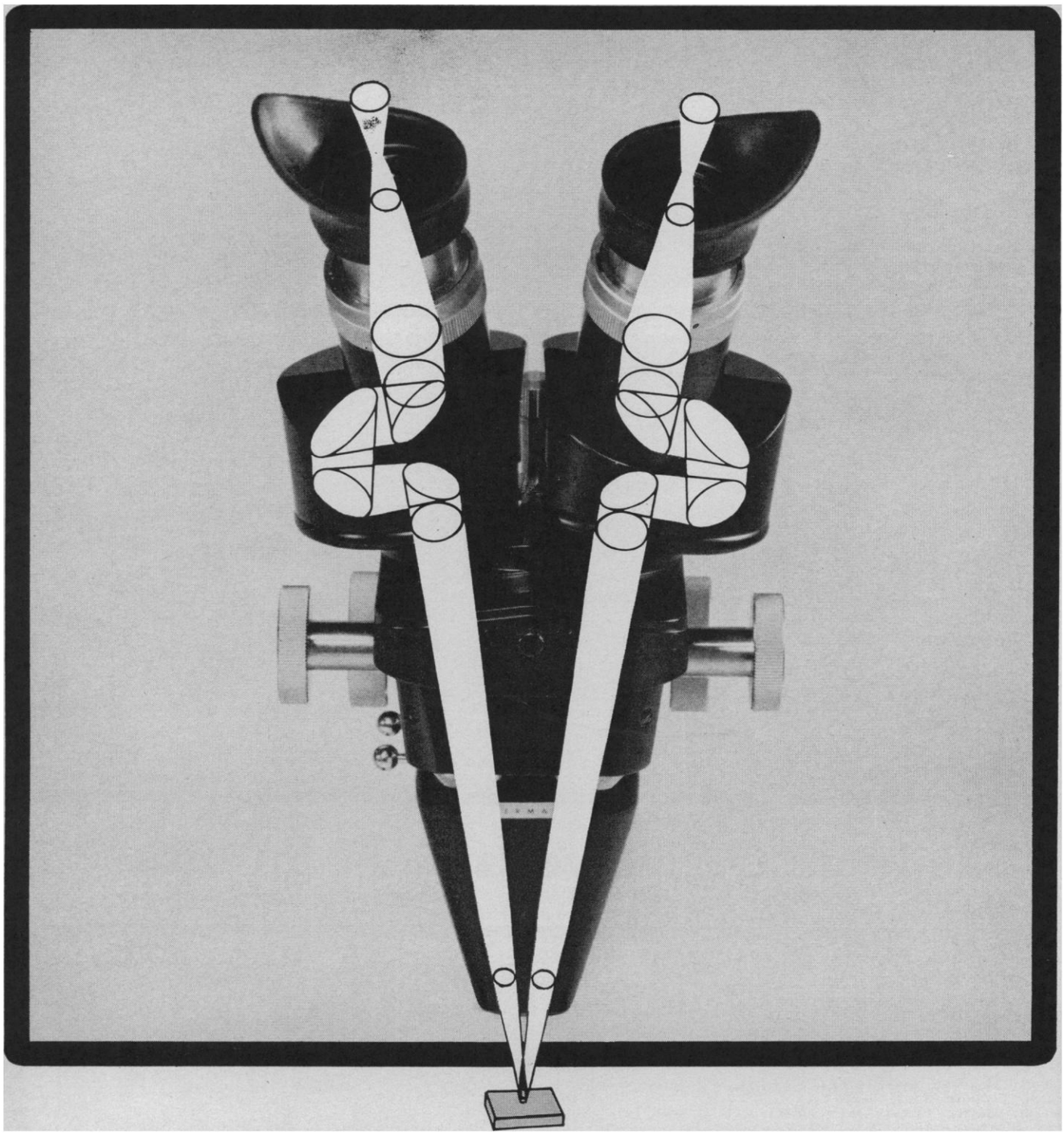

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Of Time and the Doctorate

The idealized picture of a new Ph.D. in science is of a student who had his course well charted in advance and who was aided by assistantships and fellowships to earn the doctorate in approximately 4 years. As a matter of fact, only about one student in ten gets through that quickly. The typical one finished college without expecting to go on for the doctorate and without clear plans for any graduate work. In the B.A.–Ph.D. interval he spent 9 months in military service, worked a couple of years, usually as a college teacher or in other professional work, was enrolled in graduate school for more than 3 years on a full-time basis and for another year and a half part time, and finally got the doctorate nearly 8 years after the B.A.

These data are from a new study* that adds considerable descriptive and interpretive detail to the information on B.A.–Ph.D. time lapse previously published by the National Academy of Sciences–National Research Council and others. The study surveyed recipients of the doctorate between 1950 and 1958 in 16 fields, from 23 southern universities. Some factors may differ by geographic region, but in terms of B.A.–Ph.D. time lapse the sample was generally representative of the country as a whole.

Both the Ph.D. recipients and their mentors were asked whether the usual delay could or should be shortened. About a fourth thought not, but the large majority suggested ways of reducing the time lapse. Much emphasis was given to changes in organization and planning. Students and teachers both recommended that more and earlier counseling be given graduate students, that program planning be more systematic, that students be given a clearer understanding of their own responsibilities and of institutional and departmental expectations, and that faculty advisers provide more continuous monitoring of student progress.

Science departments already appear to do better on these points than do others. The graduate deans and professors explained the shorter average time lapse in the sciences (and particularly in chemistry, the "fastest" field of all) largely in terms of the tighter structuring of graduate work in science. But the respondents thought there was room for considerable improvement in most science departments.

These recommendations merit serious consideration. They would probably work, and shortening the average time for the next few years would be the equivalent of increasing the number of successful candidates. Yet caution is in order. Too much guidance, structuring, detailed program planning, and the like could change the character of the Ph.D. degree even if its level were not intentionally or appreciably changed. While some change in character may be appropriate for the nonresearch degree that is being considered in some quarters, the independent research characteristic of the Ph.D. surely should be preserved.

Graduate faculties seem therefore to be presented with a nice problem of balancing objectives and techniques. The task is one of identifying and encouraging good candidates earlier, and of imparting a clearer understanding of what is expected of them while still leaving them ample opportunity to stumble, to profit from their own errors and successes, and to develop scholarly independence.—DAEL WOLFLE

* *Of Time and the Doctorate*, by Kenneth M. Wilson. Atlanta, Georgia, Southern Regional Education Board, 1965, ix + 212 pp.

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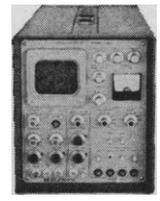

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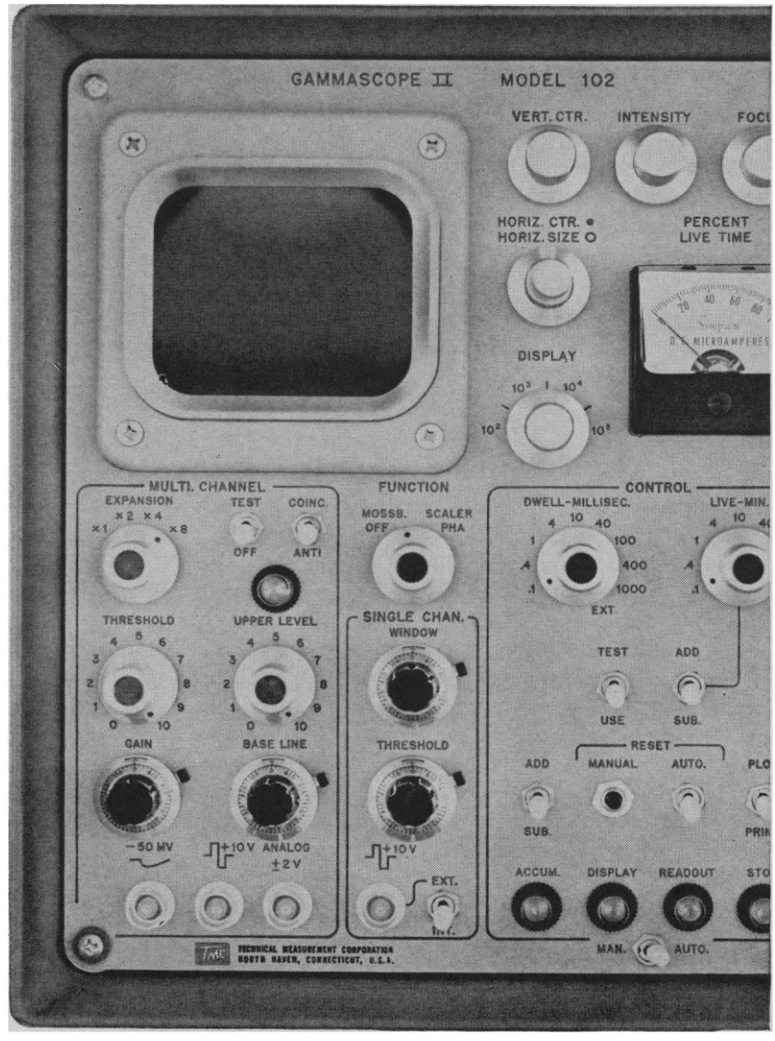

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ode, and with series resistance, was devised. With experimentally determined constants, this circuit can be used to predict current characteristics of the cell voltage as a function of grid spacing at high fluxes. The cells were maintained below 100°C by mounting them on a forced-circulation, water-cooled, pinned heat-transfer surface. Beckman presented data on an operating system which produces 50 watts using 36 cm^2 of close-gridded cell area under various ambient conditions.

T. Noguchi (Government Industrial Research Institute, Nagoya, Japan) discussed the results of fundamental research on refractory systems with a solar furnace. He explained a method of measuring temperature by means of a brightness pyrometer. These measurements established the freezing point of metal oxides by a specular reflection method. The freezing points of zirconia, hafnia, alpha-alumina, and high-purity lanthanide oxides were determined. The data on the 11 lanthanide oxides extended the data which heretofore have been available. Noguchi further investigated the melting behaviors of the ZrO_2-CaO system, and observed an anomaly of the liquidus curve with a composition of 70 percent CaO. Noguchi suggested that the formation of a new cubic-like phase might be expected.

P. J. Sheehan and T. S. Laszlo (Avco Corporation) reported on the results of high-temperature emittance measurements and ablation tests in a solar furnace. Excellent correlations were obtained between the heat flux and the recession rate of the ablating sample. The recession rate was measured by means of a camera viewing the sample surface through a 12-foot light pipe.

H. Masson and J. P. Giradier (Faculty of Science, University of Dakar, Senegal) reported on activation by a solar motor of a pump capable of supplying about 40 m^3 of water per hour for 4 or 5 hours per day. The water, withdrawn from a well at a depth of 10 m, supplies the approximate daily requirement of a community of 500 persons. The area of the solar collector is 300 m^2. E. A. Farber discussed the results obtained with a solar hot-air engine (1/3 horsepower, closed-cycle), which is portable and is cooled by a water-cooled radiator. L. F. Yissar (Tucson, Arizona) reported on the performance of a liquid-piston solar prime mover. The mover uses a self-feeding inverted siphon loop with an

inert liquid piston whose oscillations transmit the power output to a driven device. Solar energy, collected by a flat collector, supplies useful mechanical output.

A. J. Drummond and co-workers (Eppley Laboratory) described the instruments used to measure the components of solar shortwave and terrestrial longwave radiation. Drummond stressed the advantages of coated-receiver (thermopile-type) pyranometers over those employing photoelectric detectors such as selenium and silicon photovoltaic cells. Because the selenium or silicon cells are selective with regard to the wavelength of the incident energy when exposed to sources of varying spectral emission, they require careful calibration to account for the shortwave reflectance of terrestrial surfaces and for radiation from the sun and sky. The pyranometers are particularly useful when accuracy of better than 10 to 15 percent in hourly values and of 5 to 7 percent in daily summations are desired. Drummond considered the major problems associated with the determination of the transfer of longwave (terrestrial) radiation within the earth atmosphere system; he reviewed the principal characteristics of ventilated and unventilated radiometers in common use in recent years. He also described a new instrument, with very short time response, which is used for precise evaluation of shortwave and longwave components and net flux radiation near the ground. The design of the instrument is based on thermopile principles. Drummond pointed out the errors in the measurement of the solar constant outside the earth's atmosphere, and outlined experiments designed to measure the effect of the absorption of the atmosphere on the solar constant over the range of wavelengths of interest.

L. P. Gaucher (Texaco) forecast the pattern of energy consumption up to the year 2200. After accounting for the different sources of energy capable of filling the gap between increasing demands from increases in population and in per capita consumption, he projected that beginning about two generations from now the United States should become more and more dependent upon electrical energy derived from central solar-powered stations. By the year 2200 the stations could account for approximately 30 percent of all of the energy consumed in this country. Gaucher estimated that a satellite solar collector about 35 km in

diameter would be adequate to supply the energy of 48 × 10^{15} Btu (12 × 10^{15} kcal) per year presently required by this country.

The attendees at the meeting were informed of the efforts of Congressman Schmidhauser (D–Iowa) to introduce a bill (H.R. 3434) designed to provide support for research on and development of means for utilizing solar energy.

PETER E. GLASER
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Forthcoming Events

May

27–29. American **Gastroenterological** Assoc., Montreal, Quebec, Canada. (D. Cayer, 2240 Cloverdale Ave., Winston-Salem, N.C.)

27–29. American **Ophthalmological** Soc., Hot Springs, Va. (S. D. McPherson, Jr., 1110 W. Main St., Durham, N.C.)

27–29. American Assoc. of **Physical Anthropologists**, annual, Pennsylvania State Univ., University Park. (F. E. Johnston, Dept. of Anthropology, Univ. of Pennsylvania, Philadelphia 4)

27–30. **Neuro-Ophthalmology and Neurogenetics**, intern. congr., Albi, France. (M. Amalric, Congrès Intern. de Neuro-Ophthalmologie et Neuro-Génétique, B.P. 79, Albi, Tarn, France)

27–30. German Bunsen Soc. for **Physical Chemistry**, 64th general assembly, Innsbruck, Austria. (Deutsche Bunsen-Gesellschaft für Physikalische Chemie, Varrentrappstr. 40–42, 6 Frankfurt am Main, Germany)

27–11. World **Meteorological** Organization, 17th executive committee session, Geneva, Switzerland. (WMO, 41 avenue Giuseppe Motta, Geneva)

28–1. Canadian Assoc. of **Geographers**, annual, Vancouver, B.C. (Local Arrangements Committee, Dept. of Geography, University of British Columbia, Vancouver)

30–2. Recent Advances in **Adrenal Steroid Metabolism**, symp., Montreal, Quebec, Canada. (Chemical Inst. of Canada, 48 Rideau St., Ottawa 2)

30–2. Canadian **Dental** Assoc., conv., Quebec. (L. Bernier, 1024, avenue des Erables, Quebec)

30–2. American **Thoracic** Soc., Chicago, Ill. (F. W. Webster, 1790 Broadway, New York 10019)

30–2. National **Tuberculosis** Assoc., Chicago, Ill. (S. Wicker, 1790 Broadway, New York 10019)

30–3. **Medical Library** Assoc., annual, Philadelphia, Pa. (MLA, 919 N. Michigan Ave., Chicago 11, Ill.)

31–2. Canadian **Museums** Assoc., annual, Ottawa, Ontario. (Mrs. H. Downie, Royal Ontario Museum, Univ. of Toronto, 100 Queen's Park, Toronto 5)

31–2. **Chemical** Inst. of Canada, 48th conf., Montreal, Quebec. (Chemical Inst. of Canada, 48 Rideau St., Ottawa 2)

31–2. **Spectroscopy**, 5th Australian conf., Perth. (A. J. Parker, Dept. of Chemistry, Univ. of Western Australia, Nedlands)

31–2. **Pharmaceutical Industry**, intern. conf., Baden-Baden, Germany. (J. Laar, Karlstr. 21, Frankfurt am Main, Germany)

31–3. Canadian **Public Health** Assoc., annual, Edmonton, Alberta. (E. J. Young, 1255 Yonge St., Toronto 7, Ont.)

31–4. **Exchange Reactions**, symp., Brookhaven Natl. Laboratory, N.Y. (J. H. Kane, Intern. Conferences Branch, Div. of Special Projects, U.S. Atomic Energy Commission, Washington, D.C.)

31–4. Institute of **Hospital Administrators**, annual conf., London, England. (Secretary, 75 Portland Pl., London, W.1)

31–4. Society of **Physical Chemistry**, 15th annual, Paris, France. (G. Emschwiller, Société de Chimie Physique, 10, rue Vauquelin, Paris 5°)

31–4. Group for Advancement of **Spectrographic Methods**, 27th congr., Paris, France. (1, rue Gaston Boissier, Paris 15°)

June

1–3. **Tissue Culture** Assoc., Miami Beach, Fla. (M. M. Sigel, Univ. of Miami, Department of Microbiology, Coral Gables, Fla.)

1–4. Nordic **Medical Rehabilitation** Congr., Oslo, Norway (Chief Physician B. Rogan, Socialmedisinsk Avdeling, Aker Sykehus, Oslo, Norway)

1–4. **Water Studies**, 18th intern. conf., Liege, Belgium. (Belgian Center for the Study and Documentation of Waters, 2, rue A. Stevart, Liege)

1–8. **Fruit Virus Diseases**, 6th European symp., Belgrade, Yugoslavia. (Prof. Sutic, Institutza Zastitu Bilja, T. Drajzera 7, Belgrade)

2–3. Diagnosis and Semeiology of **Cerebral Vascular Diseases**, European symp., Modena, Italy. (Segreteria della Clinica Oculistica, Policlinico Universitario, Modena)

2–3. **Endemical Struma**, symp., Prague, Czechoslovakia. (K. Silink, Národní 8, Prague 1)

2–3. **Quality Control of Engineering Materials**, conf., Kenilworth, England. (Inst. of Production Engineers, 10 Chesterfield St., Mayfield, London, England)

2–4. International Federation of **Consulting Engineers**, annual, Copenhagen, Denmark. (Consulting Engineers Council, 1155 15th St., NW, Washington, D.C. 20005)

2–4. Canadian **Phytopathological** Soc., annual, University of Guelph, Guelph, Ont. (R. Stace-Smith, C.D.C. Research Station, 6660 NW Marine Dr., Vancouver 8, B.C.)

2–4. Nordic Congr. of **Surgeons**, Oslo, Norway. (F. Hauge, Sophies Mindle, Trondheimsveien 132, Oslo)

2–5. **Acoustical** Soc. of America, 69th meeting, Washington, D.C. (ASA, 335 E. 45th St., New York 10017)

3–4. **Endemic Goiter** and allied conditions, symp., Prague, Czechoslovakia. (J. Blahoš, Výzkumný Ústav Endokrinologický, Národní tr. 8, Prague 1)

3–5. Canadian Soc. of **Plant Physiologists**, 6th annual, Univ. of New Bruns-

wick, Fredericton. (R. G. S. Bidwell, Dept. of Botany, Univ. of Toronto, Toronto, Ont.)

3–5. **Manufacturing Chemists'** Assoc., 93rd annual, White Sulphur Springs, W.Va. (MCA, 1825 Connecticut Ave., NW, Washington 20009)

3–5. Advances in **Biomedical Computer Applications**, New York, N.Y. (T. D. Sterling, Dept. of Preventive Medicine and Industrial Health, Univ. of Cincinnati, Cincinnati, Ohio 45219)

4–7. American Soc. of **Lubrication Engineers**, annual, Detroit, Mich. (R. L. Hammill, ASLE, 838 Busse Highway, Park Ridge, Ill. 60068)

5–7. Society for **Experimental Stress Analysis**, Denver, Colo. (D. H. Fietz, 730 Kalamath Sq., Denver)

5–10. American Soc. of **Radiologic Technologists**, intern., Chicago, Ill. (G. J. Eilert, 537 S. Main St., Fond du Lac, Wis.)

5–13. **Medical-Surgical** Meetings, 5th intern., Turin, Italy. (Segretaria Generale Riunioni Medico-Chirurgiche Internazionali, c/o Minerva Medica, Corso Bramante 83-85)

6–10. **Special Libraries** Assoc., 56th annual conv., Philadelphia, Pa. (J. G. Hopper, Free Library of Philadelphia, Logan Square, Philadelphia 19103)

7–8. **Environment-Sensitive Mechanical Behavior of Materials**, Relay, Md. (A. R. C. Westwood, RIAS, Martin Co., 7212 Bellona Ave., Baltimore, Md. 21212)

7–9. **Communications**, annual, Inst. of Electrical and Electronics Engineers, communication technology group, Boulder, Colo. (W. F. Utlaut, Natl. Bureau of Standards, Boulder)

7–9. **Fluids Engineering and Applied Mechanics**, conf., Washington, D.C. (American Soc. of Mechanical Engineers, United Engineering center, 345 E. 47 St., New York 10017)

7–9. Society for **Industrial and Applied Mathematics**, natl., New York, N.Y. (D. L. Thomsen, Jr., SIAM, 33 S. 17 St., Philadelphia, Pa. 19103)

7–9. **Rheology**, symp., Washington, D.C. (A. W. Marris, School of Engineering Mechanics, Georgia Inst. of Technology, Atlanta 30332)

7–9. Genetic Control of **Differentiation**, symp., Brookhaven Natl. Laboratory, Upton, L.I., N.Y. (H. H. Smith, Dept. of Biology, Brookhaven Natl. Laboratory, Upton 11973)

7–11. **Hyperbaric Medicine**, conf., Buffalo, N.Y. (School of Medicine, State Univ. of New York at Buffalo, Buffalo 14214)

7–11. **Silicate** Industry, 8th conf., Budapest, Hungary. (Szilikátipari Tudományos Egysület, Szabadság tér 17, Budapest)

7–11. Statistical **Quality Control** for the Graphic Industries, Rochester, N.Y. (A. DeWinter, Rochester Inst. of Technology, Rochester 14608)

7–11. **Carbon-14 and Tritium Dating**, intern. conf., Washington State Univ., Pullman. (R. M. Chatters, Washington State Univ., Pullman 99168)

7–18. Communication Sciences, **Psycholinguistics**, seminar, Univ. of Florida, Gainesville. (P. J. Jensen, Communication Sciences Laboratory, Bldg. L, Univ. of Florida, Gainesville)

8–9. **System Safety**, symp., Seattle, Wash. (H. E. Wessman, College of Engineering, Univ. of Washington, Seattle)

8–11. European Organization for Research on **Fluorine and Dental Caries Prevention**, 12th annual congr., Utrecht, Netherlands (H. R. Held, 18, passage du Terraillet, Geneva, Switzerland)

8–12. **Electron and Photon Interactions** at High Temperatures, Hamburg, Germany. (E. D. W. Steel, Scientific Conf. Secretariat, European Organization for Nuclear Research, 1211 Geneva 23, Switzerland)

8–12. German Soc. for **Medicinal Plant Research**, 13th conf., Hamburg, Germany. (H. Friedrich, Deutsche Gesellschaft für Arzneipflanzenforschung, Bei den Kirchhöfen 14, 2 Hamburg 36)

8–12. American Assoc. on **Mental Deficiency**, 89th annual, Miami Beach, Fla. (I. Goldberg, Dept. of Special Education, Teachers College, Columbia Univ., New York, N.Y.)

9–10. **Electron Scattering**, Cambridge, England. (Electron Microscopy and Analysis Group, Inst. of Physics and the Physical Soc., 47 Belgrave Sq., London S.W.1, England)

9–10. **Air Force Materials**, 4th symp., Miami Beach, Fla. [The Symposium, AFML, (MAS) Wright-Patterson Air Force Base, Ohio]

9–11. Canadian Federation of **Biological Societies**, annual, Ottawa, Ont. (A. H. Neufeld, Faculty of Medicine, Univ. of Western Ontario, London)

9–11. Principles of **Biomolecular Organization**, symp., London, England. (Ciba Foundation, 41 Portland Pl, London W.1)

9–11. Canadian Inst. of **Food Technology**, annual conf., Winnipeg, Manitoba. (J. M. Sisler, 300 Norquay Bldg., Winnipeg)

9–11. **Genetics in Ophthalmology**, congr., Brno, Czechoslovakia. (Secretariat, c/o Eye Clinic, Pekarska 53, Brno)

9–11. **Heat Flow below 100°K**, and Its Technological Applications, symp., Grenoble, France (Centre de Recherches sur les Tres Basses Temperatures, Boite Postale 319, Grenoble)

9–11. German **Metallurgical** Soc., general assembly, Salzburg, Austria. (Deutsche Gesellschaft für Metallkunde, An der Alteburger Mühle 12, Köln-Marienburg, Germany)

9–11. Association of **Physiologists**, 33rd, Louvain, Belgium. (A. Fessard, Assoc. des Physiologistes, 45 rue des Saints-Peres, Paris 63°)

9–11. Economic Aspects of **Research Management**, conf., Evanston, Ill. (American Soc. for Metals, Metals Park, Ohio 44073)

9–12. Canadian Assoc. of **Physicists**, annual congr., Vancouver, B.C. (R. E. Bell, Dept. of Physics, McGill Univ., Montreal, Quebec)

9–14. **Cardiovascular Radiology**, 4th intern., Marseilles, Naples, Sicily, Corsica, Elba. (G. Lavaurs, Journees Internationales de Radiologie, Cardio-Vasculaire de Marseilles, 77 rue du Dr.-Escot, Marseilles)

11–12. **Nutrition** Soc. of Canada, 8th annual, Ottawa, Ont. (K. K. Carroll, Collip Medical Research Laboratory, Univ. of Western Ontario, London, Ont.)

11–13. Society of **Obstetricians and Gynecologists** of Canada, annual, Halifax, N.S. (J. L. Harkins, 537 Medical Arts Bldg., Toronto, Ont.)

11–20. **Aeronautics**, 7th intern. congr., Paris, France. (A. Collomb, Assoc. Française des Ingenieurs et Techniciens de l'Aeronautique, 4, rue Cimarosa, Paris 16e)

12–20. National **Speleological** Soc., annual conv., Bloomington, Ind. (D. R. Martin, 2711 Oak St., Terre Haute, Ind. 47803)

13. Society for **Surgery of the Alimentary Tract**, New York, N.Y. (R. Turell, 25 E. 83 St., New York)

13–15. **Medicine and Religion**, 1st natl. symp., Estes Park, Colo. (Office of Postgraduate Medical Education, Univ. of Colorado Medical Center, 4200 Ninth Ave., Denver 80220)

13–17. American Inst. of **Chemical Engineers**/Institution of Chemical Engineers, joint meeting, London, England. (F. J. Van Antwerpen, American Inst. of Chemical Engineers, 345 E. 47 St., New York, N.Y. 10017)

13–18. American Soc. for **Testing and Materials**, 68th annual, Purdue Univ., Lafayette, Ind. (ASTM, 1916 Race St., Philadelphia, Pa. 19103)

14–16. Cooper **Ornithological** Soc., Univ. of British Columbia, Vancouver, Canada. (J. Davis, Hastings Reservation, Carmel Valley, Calif.)

14–16. **Cost-Effectiveness Techniques**, 1st natl. symp., Washington, D.C. (D. E. van Tyn, 1700 K St., NW, Washington, D.C.)

14–16. American **Neurological** Assoc., 19th annual, Atlantic City, N.J. (M. D. Yahr, 710 W. 168 St., New York 10032)

14–16. **Oral Biology**, 3rd intern. conf., London, England. (Conference Secretary, Dept. of Dental Science, Royal College of Surgeons of England, Lincoln's Inn Fields, London, W.C.2)

14–17. **Health Physics** Soc., Los Angeles, Calif. (W. S. Snyder, Health Physics Div., Oak Ridge Natl. Laboratories, Oak Ridge, Tenn.)

14–17. **Ocean Science and Ocean Engineering**, natl. conf., Washington, D.C. (Marine Technology Soc., 1030 15th St., NW, Washington, D.C. 20005)

14–17. American **Proctologic** Soc., annual, Minneapolis, Minn. (N. D. Nigro, 320 West Lafayette, Detroit, Mich. 48226)

14–17. **Spectroscopy**, annual Mid-America symp., Chicago, Ill. (L. R. Pearson, American Can Co., Research Center, Barrington, Ill.)

14–18. Basic Environmental Problems of **Man in Space**, symp., Paris, France. (Intern. Acad. of Astronautics, Intern. Astronautical Federation, 250 rue St. Jacques, Paris 5e)

14–18. Canadian **Medical** Assoc., annual, Halifax, N.S. (A. D. Kelly, 150 St. George St., Toronto 5, Ont.)

14–18. **Molecular Structure and Spectroscopy**, annual symp., Columbus, Ohio. (K. N. Rao, Dept. of Physics and Astronomy, 174 W. 18 Ave., Columbus 43210)

14–18. **Vacuum Metallurgy**, intern. conf., Brussels, Belgium. (R. Winand, Service du Prof. Decroly, Metallurgie-Electrochimie, Universite Libre de Bruxel-

Dissymmetries

Among the synthetic polymers, polyamides (nylons) have not been, until recently, investigated by means of the light scattering technique. The first paper on the subject appears to be the one by Fendler and Stuart (1), who observed anomalies due to polyelectrolyte character of perlon when dissolved in formic acid. This point as well as other macromolecular properties of nylons have been elaborated upon recently by several workers, all of whom employed Brice-Phoenix light scattering photometers and differential refractometers in their studies.

POLYELECTROLYTE EFFECTS IN NYLON SOLUTIONS

The first evidence of polyelectrolyte character of polyamides in formic acid came in 1951 from viscosity measurements. The charge on the polyamides results from the protonation of the polymer amide groups. The presence of these charges and the interactions they cause lead to the interference phenomena in the light scattering experiments. This makes determination of molecular weights and molecular parameters unreliable.

In a series of papers (2, 3, 4, 5), Saunders (Chemstrand Research Center, Inc., Durham, N. C.) explored in detail the influence of the solvent composition and ionic strength on polyelectrolyte behavior of nylon 66 (polyhexamethylene adipamide). In one study (4) the solvent system used was formic acid-water-sodium formate. The changes in intrinsic viscosity and second virial coefficient in 90% formic acid were small for the concentrations of sodium formate higher than 0.2 M. Light scattering data led to an estimate of the molecular weight that was independent of the sodium formate concentration. When sodium formate was present in the concentration of 0.5 M, the polyelectrolyte effects were completely repressed and the polymer-solvent interaction could be varied by changing the amount of water in mixture with formic acid. The concentration of formic acid varied from 98% to 75%. The molecular weight, as derived from light scattering measurements, was independent of the amount of water, but the second virial coefficient decreased with the increase in water content. Nylon 66 was not soluble when the water content exceeded 30%.

REFRACTIVE INDEX INCREMENT

The refractive index increment was also much dependent on the change in the degree of ionization of the polymer and ionic strength of the solution. This finding was confirmed in another study by Saunders (3), in which the effects of potassium chloride in the formic acid-water solvent system were investigated. It was established that a whole range of theta solvents are possible by proper manipulation of the relative proportions of the components of the solvent system. Only when formic acid was present in amounts greater than 95%, i.e., when the degree of ionization of the polymer was very high, theta conditions could not be achieved by adding KCl.

CHARACTERIZATION OF MOLECULES

Once the conditions defining ideal solvents for nylon 66 were found, it was possible to study the unperturbed molecular dimensions of the polymer. The exponent a in the Mark-Howink equation relating the intrinsic viscosity and molecular weight of a series of fractions was 0.5, which indicates that nylon 66 obeys random coil statistics in solution. The molecular parameters of nylon 66 were studied in detail also by Elias and Schumacher (6) at Eidgenössisches Technische Hochschule in Zurich, Switzerland, who used several other solvents (sulfuric acid, m-cresol, dichloroacetic acid) in addition to those utilized by Saunders.

Chiang of the Hercules Powder Co., Wilmington, Del., (7) emphasized that very high values of the second virial coefficient observed for nylons in different solvents introduce an uncertainty larger than usual in the estimate of the molecular weight by extrapolating the light scattering data to zero polymer concentration. For practical purposes, therefore, it is desirable to suppress the polyelectrolyte effects in the way indicated by Saunders.

Another suitable solvent for nylons is 2,2,3,3-tetrafluoropropanol. Beachell and Carlson of the University of Delaware, Newark, Del., (8) reported that polyamides when dissolved in this solvent exhibited strong polyelectrolyte effects which could be suppressed by addition of 0.1 mole/liter of sodium trifluoroacetate. This was a rather surprising result since the solvent has little tendency to protonate nylons. Very recently (9) Saunders observed that in completely dry tetrafluoropropanol no polyelectrolyte behavior of nylon 66 was noticeable and, therefore, this solvent is a nonionic one for nylons. Traces of water, however, brought about typical polyelectrolyte effects which could be repressed by adding sodium trifluoroacetate. Molecular weights obtained under these conditions were identical to those measured in the solvent system formic acid-water-sodium formate.

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(1) H. G. Fendler and H. A. Stuart, Makromolek. Chem., *25*, 159 (1958).
(2) P. R. Saunders, J. Polymer Sci., *43*, 273 (1960).
(3) P. R. Saunders, J. Polymer Sci., *57*, 131 (1962).
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(7) R. Chiang, J. Polymer Sci., *45*, 524 (1960).
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Inquiries concerning the Brice-Phoenix Light-Scattering Photometer should be sent to the **PHOENIX PRECISION INSTRUMENT COMPANY, 3803 North 5th Street, Philadelphia, Pa. 19140.**

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14–18. **Propulsion** Conf., Colorado Springs, Colo. (C. Builder, Aerospace Corp., 2400 E. El Segundo Blvd., El Segundo, Calif.)

14–18. Association of **Official Seed Analysts**, annual, Lexington, Ky. (M. V. Maddows, Florida State Seed Laboratory, 406 Nathan Mayo Bldg., Tallahassee)

14–19. **Multivariate Analysis**, intern. symp., Univ. of Dayton, Ohio. (P. R. Krishnaiah, Aerospace Research Laboratories, Wright-Patterson Air Force Base, Ohio)

14–23. Statistical Techniques in **Quality Control**, 22nd annual, Rochester Inst. of Technology, Rochester, N.Y. (J. H. Swanton, Extended Services Div., Rochester Inst. of Technology, Rochester, 14608)

15–18. **Biophysics and Physiology of Biological Transport**, symp., Rome, Italy. (L. Bolis, Via Alamanni 19, Milan, Italy)

15–18. American Soc. of **Pharmacognosy,** 6th annual, Kingston, R.I. (L. R. Worthen, College of Pharmacy, Univ. of Rhode Island, Kingston)

15–19. European **Orthodontic** Soc., 41st congr., Stockholm, Sweden. (D. P. Walther, Royal Dental Hospital, 32 Leicester Sq., London, W.C.2, England)

15–22. Design of **Hydrometeorological Works**, intern. symp., Quebec, Canada. (World Meteorological Organization, 41, avenue Giuseppe Motta, Geneva, Switzerland)

16. American **Cancer** Soc., scientific session, Philadelphia, Pa. (Director, Professional Education, ACS, 219 E. 42 St., New York 10017)

16–18. **Water Chemistry**, applications and principles, 4th research conf., Rutgers Univ., New Brunswick, N.J. (Office of Resident Instruction, College of Agriculture, Rutgers Univ., New Brunswick 08903)

16–19. Society of **Nuclear Medicine**, 12th annual, Bal Harbour, Fla. (S. N. Turiel, 333 North Michigan Ave., Chicago, Ill.)

16–19. International College of **Surgeons**, European Federation, congr., Helsinki, Finland. (P. Vara, Haartmaninkatu 2 A, Helsinki)

16–20. American Soc. of **Ichthyologists and Herpetologists**, annual, Lawrence, Kan. (W. Duellman, Museum of Natural History, Univ. of Kansas, Lawrence)

16–24. International Council of **Nurses**, 13th congr., Frankfurt am Main, Germany. (German Nurses' Federation, Cronstettenstr. 25, Frankfurt am Main)

17–18. **Biomedical Lasers**, 1st annual conf., Boston, Mass. (P. E. McGuff, Director, Laser Medical Research Foundation, 91 Brighton Ave., Boston 02134)

17–18. **Computer Personnel Research Group**, 3rd annual conf., Washington Univ., St. Louis, Mo. (M. H. Gotterer, 120 Boucke Bldg., Pennsylvania State Univ., University Park 16802)

17–18. American **Rheumatism** Assoc., annual, Philadelphia, Pa. (ARA, 10 Columbus Circle, New York, N.Y. 10019)

17–19. International Assoc. for the Study of the **Bronchi**, 15th congr., Oporto, Portugal. (E. Pinto, Estrada da Circumvalaçao 10039, Oporto)

17–19. **Endocrine** Soc., New York, N.Y. (H. H. Tucker, 1200 North Walker, Oklahoma City, Okla.)

17–19. **Pediatrics**, 13th congr., Prague, Czechoslovakia. (J. Houstek, Sokolska 2, Prague 2)

17–19. American Assoc. of **Physics Teachers**, summer meeting, Knoxville, Tenn. (M. Phillips, Physics Dept., Univ. of Chicago, Chicago, Ill.)

17–19. **Steroid Hormones**, 2nd symp., Ghent, Belgium. (A. Vermeulen, Dept. of Endocrinology and Metabolism, Medical Clinic, Akademisch Ziekenhuis, Ghent)

17–20. American College of **Angiology**, New York, N.Y. (A. Halpern, 50 Broadway, New York)

17–20. Wilson **Ornithological** Soc., Black Hills, S.D. (P. B. Hofslund, Biology Dept., Univ. of Minnesota, Duluth 55812)

17–21. American College of **Cardiology**, Boston, Mass. (P. Reighert, Empire State Bldg., 350 Fifth Ave., New York 10001)

17–21. American College of **Chest Physicians**, New York, N.Y. (M. Kornfeld, 112 E. Chestnut, Chicago 11, Ill.)

18–19. American Soc. of Certified **Engineering Technicians**, 1st annual, Milwaukee, Wis. (ASCET, 2029 K St., NW, Washington, D.C. 20006)

19. Academy of **Tuberculosis Physicians**, New York, N.Y. (G. P. Bailey, 1295 Clermont, Denver 20, Colo.)

20. Society of **Vascular Surgery**, annual, New York, N.Y. (W. S. Edwards, Dept. of Surgery, Medical College of Alabama, Birmingham)

20–22. Society for **Investigative Dermatology**, 26th annual, New York, N.Y. (H. Beerman, 255 S. 17 St., Philadelphia, Pa. 19103)

20–23. American Soc. of **Agricultural Engineers**, 58th annual, Univ. of Georgia, Athens. (J. L. Butt, P.O. Box 229, St. Joseph, Mich.)

20–24. American Soc. of **Mammalogists**, Winnipeg, Manitoba, Canada. (B. P. Glass, Dept. of Zoology, Oklahoma State Univ., Stillwater 74075)

20–24. American Soc. of **Medical Technologists**, Cincinnati, Ohio. (R. Matthaei, Suite 25, Hermann Professional Bldg., Houston, Tex. 77025)

20–24. American **Nuclear** Soc., 11th natl., Gatlinburg, Tenn. (ANS, 244 East Ogden Ave., Hinsdale, Ill.)

20–24. Air **Pollution Control** Assoc., 58th annual, Toronto, Ont., Canada. (M. Katz, Dept. of Natl. Health and Welfare, 45 Spencer St., Ottawa, Ont.)

20–24. **Aerospace**, conf., Houston, Tex. (T. B. Owen, Douglas Aircraft Co., 300 Ocean Park Blvd., Dept. A2-260, Santa Monica, Calif.)

20–25. American **Physical Therapy** Assoc., Cleveland, Ohio. (L. Blair, 1790 Broadway, New York 10019)

20–25. **Weights and Measures**, natl. conf., Washington, D.C. (M. W. Jensen, Office of Weights and Measures, 203–213, Natl. Bureau of Standards, Washington, D.C. 20234)

21–22. **Genetic Selection and Infectious Diseases**, London, England. (Ciba Foundation, 41 Portland Pl., London, W.1)

21–22. **Vacuum Metallurgy** Div., American Vacuum Soc., 8th annual conf., New York, N.Y. (L. M. Bianchi, Refractomet Div., Universal-Cyclops Steel Corp., Bridgeville, Pa.)

21–23. Society for the Study of **Development and Growth**, annual, Carleton Col-

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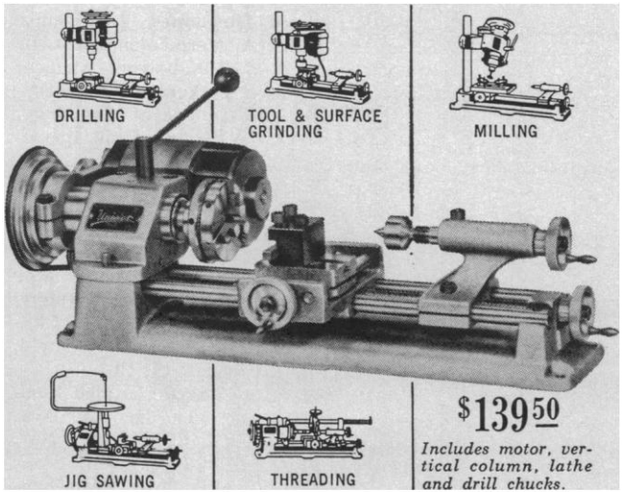

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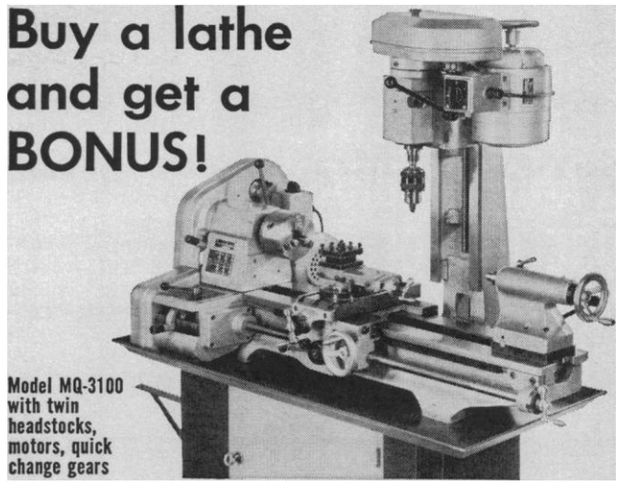

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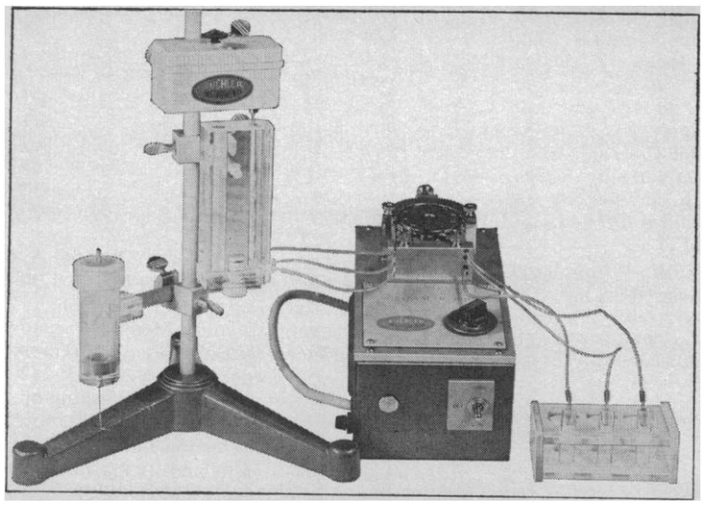

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lege, Northfield, Minn. (J. A. Schiff, Dept. of Biology, Brandeis Univ., Waltham, Mass.)

21–23. **Luminescence Dosimetry**, intern. conf., Stanford, Calif. (F. H. Attix, Code 7280, U.S. Naval Research Laboratory, Washington, D.C. 20390)

21–23. **Heat Tansfer and Fluid Mechanics**, inst., Univ. of California, Los Angeles. (A. F. Charwat, Dept. of Engineering, Univ. of California, Los Angeles 90024)

21–24. **Agricultural** Inst. of Canada, Vancouver, B.C. (AIC, Central Office, 176 Gloucester St., Ottawa 4, Ont.)

21–24. Canadian Soc. of **Animal Production**, annual, Vancouver, B.C. (J. A. Newman, CSAP, Experimental Farm, Lacombe, Alta.)

21–24. **Automatic Control in Peaceful Uses of Space**, intern. symp., Stavanger, Norway. (J. A. Aseltine, Aerospace Corp., P.O. Box 95085, Los Angeles, Calif.)

21–24. **Fuel Cells**, intern. symp., Brussels, Belgium. (Mr. Vanleugenhaghe, S.E.R.A.I., 1091, chaussee d'Alsemberg, Brussels 18)

21–25. Canadian **Anaesthetists'** Soc., annual, Charlottetown, Prince Edward Island. (S. M. Campbell, 178 St. George St., Toronto 5, Ont.)

21–25. **Carbon**, 7th biennial conf., Case Inst. of Technology, Cleveland, Ohio. (W. W. Lozier, Union Carbide Corp., Carbon Products Div., P.O. Box 6116, Cleveland, Ohio 44101)

21–25. **Engineering Education**, world congr., Chicago, Ill. (American Soc. for Engineering Education, Univ. of Illinois, Urbana)

21–26. **AAAS Pacific Div.**, Riverside, Calif. (R. C. Miller, California Acad. of Sciences, Golden Gate Park, San Francisco 18)

The following societies plan to meet in conjunction with the AAAS Pacific Div.:

American **Meteorological** Soc. (J. E. Miller, New York Univ., New York)

American **Nature Study** Soc. (B. O. Bergh, Univ. of California, Riverside)

American **Phytopathological** Soc., Pacific Div. (C. E. Horner, Oregon State Univ., Corvallis)

American Soc. for **Horticultural Science**, western regional (C. K. Labanauskas, Univ. of California, Riverside)

American Soc. of **Ichthyologists and Herpetologists**, western div. (R. Rosenblatt, Scripps Institution of Oceanography, La Jolla, Calif.)

American Soc. of **Limnology and Oceanography**, Pacific Div. (J. G. Pattullo, Oregon State Univ., Corvallis)

American Soc. of **Plant Physiologists**, western section (M. Mazelis, Univ. of California, Davis)

American **Statistical** Assoc. (E. King, Pacific Telephone Co., Los Angeles, Calif.)

Biometric Soc. western North America Div. (F. S. McFeely, Montana State College, Bozeman)

Botanical Soc. of America, Pacific section (J. R. Stein, Univ. of California, Berkeley)

Ecological Soc. of America, western section (H. G. Baker, Univ. of California, Berkeley)

Institute of **Food Technologists** (H. Lineweaver, Western Regional Research Laboratory, Albany, Calif.)

Western Soc. of **Soil Science** (R. Miller, Utah State Univ., Logan)

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22. National Assoc. of **Science Writers**, New York, N.Y. (H. Nelson, Los Angeles *Times*, Los Angeles, Calif.)

22–24. **Research Problems in the Physics of X-ray Spectra**, Ithaca, N.Y. (H. W. Schnopper, Dept. of Physics, Cornell Univ., Ithaca)

22–25. Joint **Automatic Control**, 6th conf., Rensselaer Polytechnic Inst., Troy, N.Y. (J. L. Shearer, Mechanical Engineering Dept., Pennsylvania State Univ., University Park)

22–25. American **Home Economics** Assoc., 56th annual, Atlantic City, N.J. (Mrs. J. Gaines, AHEA, 1600 20th St., NW, Washington, D.C. 20009)

23–25. Association of French Speaking **Dermatologists and Venereologists**, 12th congr., Paris, France. (G. Garnier, Assoc. des Dermatologistes et Syphiligraphes de Langue Française, 14, rue Cimarosa, Paris)

24–26. British Soc. of **Urological Surgeons**, London, England. (J. P. Mitchell, 21 St. John St., Manchester 3, England)

24–26. **Small-Angle X-Ray Scattering**, conf., Syracuse, N.Y. (H. Brumberger, Chemistry Dept., Syracuse Univ., Syracuse, N.Y. 13210)

24–27. **Biochemistry and Physiology of Alkaloids**, 3rd intern. symp., Halle/Saale, Germany. (Deutsche Akademie der Wissenschaften zu Berlin, Weinbergweg Hall an der Salle, East Germany)

25. American **Laryngological, Rhinological and Otological** Soc., New York, N.Y. (V. R. Alfarno, 917 20th St., NW, Washington, D.C.)

25–26. **Veterinary Education**, natl. symp., Univ. of Georgia, Athens. (J. T. Mercer, School of Veterinary Medicine, Univ. of Georgia, Athens)

25–10. Pan American Committee of **Geophysical Sciences**, 1st meeting, Guatemala City, Guatemala. (General Secretariat, Pan American Inst. of Geography and History, Ex-Arzobispado 29, Mexico, D.F.)

26–3. International **Dental** Federation, 53rd, Vienna, Austria. (G. H. Leatherman, 35 Devonshire Pl., London, W.1, England)

27–29. **Smoking and Health**, 1st intern. congr., New York, N.Y. (W. A. Scharffenberg, 6830 Laurel St., NW, Washington, D.C. 20012)

27–30. **Botanical** Soc. of America, Northeastern Section, summer field meeting, Univ. of Maine, Orono. (R. K. Zuck, Dept. of Botany, Drew Univ., Madison, N.J.)

27–30. Canadian **Pediatric** Soc., annual, Ottawa, Ont. (CPS, 14 Green Ave., St. Lambert, Quebec)

27–2. American **Crystallographic** Assoc., Gatlinburg, Tenn. (W. L. Kehl, Gulf Research and Development Co., P.O. Box 2038, Pittsburgh, Pa.)

27–2. **Mineralogical** Soc. of America, Gatlinburg, Tenn. (G. Switzer, U.S. Natl. Museum, Washington, D.C.)

27–2. **New Industrial Technologies**, engineering seminar, Pennsylvania State University, University Park. (Continuing Education Conference Center, Pennsylvania State Univ., University Park 16802)

NEW BOOKS

(*Continued from page 1084*)

of gram-positive bacteria" by Maclyn McCarty and Stephen I. Morse; "Structure and biological activity of immunoglobulins" by Sydney Cohen and Rodney R. Porter; "Autoantibodies and disease" by H. G. Kunkel and E. M. Tan; and "Effect of bacteria and bacterial products on antibody response" by J. Munoz.

Advances in Pharmacology. vol. 3. Silvio Garattini and Parkhurst A. Shore, Eds. Academic Press, New York, 1964. 349 pp. Illus. $12. Six papers: "Experimental approaches to the development of antianginal drugs" by Martin Winbury; "Pharmacological aspects of Parkinsonism" by Alexander H. Friedman and Guy M. Everett; "The pharmacology and biochemistry of parasitic helminths" by Tag E. Mansour; "The adrenergic system and sympathomimetic amines" by E. Marley; "Pharmacological aspects of drug dependence" by G. A. Deneau and M. H. Seevers; and "Drugs used in control of reproduction" by G. Pincus and G. Bialy.

Advances in Veterinary Science. vol. 9. C. A. Brandly and E. L. Jungherr, Ed. Academic Press, New York, 1964. 397 pp. Illus. $14. Seven papers: "The development of veterinary medical science: Some historical aspects and prospects" by J. F. Smithcors; "Uitpeuloog (bulging eye disease): A recently described oculovascular myiasis of domestic animals in southern Africa" by R. A. Alexander; "SPF swine" by George A. Young; "Rinderpest" by Gordon R. Scott; "Porcine enteroviruses" by A. O. Betts; "The profession and the science: International trends in veterinary medicine" by W. Ross Cockrill; and "Anthrax" by Ralph E. Lincoln, Jerry S. Walker, Frederick Klein, and Bertram W. Haines.

Drugs and Respiration. Papers presented during the Second International Pharmacological Meeting (Prague), August 1963. Domingo M. Aviado and František Palecek, Eds. Pergamon, London; Macmillan, New York, 1964. 253 pp. Illus. $10. Twenty-three papers; the topics are Central Control of Respiration (5 papers); Respiratory Failure (6 papers); Respiratory Stimulants (4 papers); Reflexes from Pulmonary Circulation (4 papers); Reflexes from Other Areas (4 papers).

Ecology of Soils. V. R. Volobuev. Translated from the Russian edition (Baku, 1963) by A. Gourevich. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1964. 264 pp. Illus. $10.25.

Embryology of the Ovary and Testis: Homo sapiens and Macaca mulatta. Gertrude van Wagenen and Miriam E. Simpson. Yale Univ. Press, New Haven, Conn., 1965. 274 pp. Plates. $7.50.

Grosses Zoologisches Praktikum. pt. 1, Arbeitsmethoden der makroskopischen und mikroskopischen Anatomie. Ein Laboratoriumshandbuch für Biologen, Mediziner, und technische Hilfskräfte. Hans Adam and Gerhard Czihak. Fischer, Stuttgart, Germany, 1964. 599 pp. Illus. Paper, DM. 58.50.

The Hormones: Physiology, Chemistry, and Applications. vol. 5. Gregory Pincus,

Kenneth V. Thimann, and E. B. Astwood, Eds. Academic Press, New York, 1964. 976 pp. Illus. $28. Seven papers: "Chemistry of pituitary hormones" by H. B. F. Dixon; "Metabolic actions of pituitary hormones" by Frank L. Engel and Jack L. Kostyo; "The thyroid" by J. E. Rall, J. Robbins, and C. G. Lewallen; "In vivo studies of steroid dynamics in man" by J. F. Tait and Shlomo Burstein; "Tumors and hormones" by R. L. Noble; "On the action of mammalian hormones" by O. Hechter and I. D. K. Halkerston; and "Selected problems in endocrine medicine" by Rachmiel Levine.

International Review of Experimental Pathology. vol. 3. G. W. Richter and M. A. Epstein, Eds. Academic Press, New York, 1964. 442 pp. Illus. $16. Eight papers: "The use of labeled antibodies in ultrastructural studies" by G. B. Pierce, Jr., J. Sri Ram, and A. R. Midgley, Jr.; "The mode of reproduction of the psittacosis-lymphogranuloma-trachoma (PLT) group viruses" by Noboru Higashi; "Ultrastructural and subcellular pathology of the liver" by Jan W. Steiner, Melville J. Phillips, and Katsumi Miyai; "Ultrastructure of the enamel organ" by Ennio Pannese; "The significance of the 'dying back' process in experimental and human neurological disease" by J. B. Cavanagh; "Intravascular clotting: Focal and systemic" by George D. Penick and Harold R. Roberts; "Experimental production of malformations of the limbs by means of chemical substances" by Berthe Salzgeber and Etienne Wolff; and "Teratogenic effects of ionizing radiations on the embryonic development of the higher vertebrates" by Jean-Michel Kirrmann and Etienne Wolff.

International Review of General and Experimental Zoology. vol. 1. William J. L. Felts and Richard J. Harrison, Eds. Academic Press, New York, 1964. 459 pp. Illus. $14.50. Nine papers: "The biology of foraminifera" by R. H. Hedley; "The study of longevity in biting insects" by M. T. Gillies; "Equilibrium orientation in fish" by Wolfgang Pfeiffer; "Environment and reproduction in domesticated species" by E. S. E. Hafez; "The evolution of the long flexor muscles of the leg and foot" by O. J. Lewis; "Experimental, histochemical, and ultrastructural contributions to our understanding of mammalian pituitary function" by R. L. Holmes; "The reproductive biology of a Strepsirhine (*Galago senegalensis senegalensis*)" by H. Butler; "The phylogeny of mineralized tissues" by Melvin L. Moss; and "Influence of chronic exposure to increased gravity upon growth and form of animals" by Charles C. Wunder and Lorenz O. Lutherer.

International Review of Neurobiology. vol. 7. Carl C. Pfeiffer and John R. Smythies, Eds. Academic Press, New York, 1964. 380 pp. Illus. $13. Eight papers: "Alteration and pathology of cerebral protein metabolism" by Abel Lajtha; "Micro-iontophoretic studies on cortical neurons" by K. Krnjević; "Responses from the visual cortex of unanesthetized monkeys" by John R. Hughes; "Recent developments of the blood-brain barrier concept" by Ricardo Edström; "Monoamine oxidase inhibitors" by Gordon R.

Pscheidt; "The phenothiazine tranquilizers: Biochemical and biophysical actions" by Paul S. Guth and Morris A. Spirtes; "Comments on the selection and use of symptom rating scales for research in pharmacotherapy" by J. R. Wittenborn; and "Multiple molecular forms of brain hydrolases" by Joseph Bernsohn and Kevin D. Barron.

Methods in Carbohydrate Chemistry. vol. 5, *General Polysaccharides*. Roy L. Whistler, Ed. Academic Press, New York, 1965. 485 pp. Illus. $16.50. Eighty-nine papers; the sections are General Isolation Procedures (18 papers); Polysaccharides Preparations (38 papers); Chemical Analyses (4 papers); Physical Analyses (5 papers); Molecular Weight Determinations (4 papers); Structural Methods (13 papers); Derivatives (7 papers); and Selected Methods Found in Other Collections.

Methods in Hormone Research. vol. 3, pt. A, *Steroidal Activity in Experimental Animals and Man*. Ralph I. Dorfman. Academic Press, New York, 1964. 544 pp. Illus. $19. Nine papers: "Estrogens" by C. W. Emmens and L. Martin; "Antiestrogens" by C. W. Emmens and L. Martin; "Irradiation protection" by Wendell H. Rooks, II; "Anti-mammary tumor activities in rats and mice" by Wendell H. Rooks, II; "Steroids and lipid metabolism" by Donald L. Cook; "Activities of adrenocorticosteroids in experimental animals and man" by Ira Ringler; "Antialdosterones" by C. M. Kagawa; "Steroid central depressants" by S. Y. P'an and G. D. Lubach; and "Copulatory reflex response to steroids" by Fred A. Kincl.

The Physiology of Insecta. vol. 2, pts. B and C. Morris Rockstein, Ed. Academic Press, New York, 1965. 921 pp. Illus. $33. Fourteen papers: "Physiology of insect behavior" by H. Markl and Martin Lindauer; "Social behavior and mutual communication" by Martin Lindauer; "Migration" by C. G. Johnson; "Locomotion: Terrestrial" by George M. Hughes; "Locomotion: Swimming (hydrodynamics) of aquatic insects" by Werner Nachtigall; "Locomotion: Flight" by J. W. S. Pringle; "Neural integration (central nervous system)" by F. Huber; "Neural control of skeletal muscle" by Graham Hoyle; "The biochemistry of the contractile elements of insect muscle" by Koscak Maruyama; "Energetics and respiratory metabolism of muscular contraction" by Bertram Sacktor; "Intermediary metabolism of carbohydrates in insects" by W. Chefurka; "Intermediary metabolism of nitrogenous and lipid compounds in insects" by W. Chefurka; "Insect nutrition" by H. L. House; and "Digestion" by H. L. House.

Physical Processes in Radiation Biology. Proceedings of an international symposium (East Lansing, Mich.), May 1963. Leroy Augenstein, Ronald Mason, and Barnett Rosenberg, Eds. Academic Press, New York, 1964. 393 pp. Illus. $14. Twenty papers contributed by D. P. Craig; M. Kasha; E. G. McRae and M. Kasha; Eugene J. Rosa and William T. Simpson; Robert H. Haynes; Leroy Augenstein, James Carter, Jayanti Nag-Chaudhuri, DeVaughn Nelson, and Edward Yeargers; Sean P. McGlynn, Leo

Azarraga, Tohru Azumi, Freddie Watson, and Andrew Armstrong; Barnett Rosenberg; O. Klemperer; R. D. Birkhoff; Aron Kuppermann and L. M. Raff; J. E. Lovelock; John S. Avery and Ronald Mason; Sanford Lipsky; Joseph J. Weiss; J. W. Boag, G. E. Adams, and E. J. Hart; Klaus Dose; R. B. Webb; Leonard I. Grossweiner; and John D. Spikes and Camillo A. Ghiron.

The Physiology of Insecta. vol. 3, pt. C, *The Insect and the Environment-Homeostasis-2*. Morris Rockstein, Ed. Academic Press, New York, 1964. 706 pp. Illus. $25. Eleven papers: "The circulatory system of insects" by Jack Colvard Jones; "Hemolymph: Composition" by Marcel Florkin and Ch. Jeuniaux; "Hemolymph coagulation" by Ch. Grégoire; "Salt and water balance: Excretion" by R. H. Stobbart and J. Shaw; "Immunological responses" by John D. Briggs; "The physiology of insecticide resistance by insects" by Albert S. Perry; "The structure and formation of the integument in insects" by Michael Locke; "Chemistry of the insect cuticle" by R. H. Hackman; "The permeability of insect cuticle" by Walter Ebeling; "Respiration—aerial gas transport" by P. L. Miller; and "Respiration: Some exogenous and endogenous effects of rate of respiration" by Margaret Keister and John Buck.

Progress in Nucleic Acid Research and Molecular Biology. vol. 3. J. N. Davidson and Waldo E. Cohn, Eds. Academic Press, New York, 1964. 377 pp. Illus. $11.50. Eight papers: "Isolation and fractionation of nucleic acids" by K. S. Kirby; "Cellular sites of RNA synthesis" by David M. Prescott; "Ribonucleases in takadiastase: Properties, chemical nature, and applications" by Fujio Egami, Kenji Takahashi, and Tsuneko Uchida; "Chemical effects of ionizing radiations on nucleic acids and related compounds" by Joseph J. Weiss; "The regulation of RNA synthesis in bacteria" by Frederick C. Neidhardt; "Actinomycin and nucleic acid function" by E. Reich and I. H. Goldberg; "*De Novo* protein synthesis *in vitro*" by B. Nisman and J. Pelmont; and "Free nucleotides in animal tissues" by P. Mandel.

The Proteins: Composition, Structure, and Function. vol. 3. Hans Neurath, Ed. Academic Press, New York, ed. 2, 1965. 599 pp. Illus. $21. Six papers: "Fractionation of proteins" by Herbert A. Sober, Robert W. Hartley, Jr., William R. Carroll, and Elbert A. Peterson; "Structure and function of virus proteins and of viral nucleic acid" by H. Fraenkel-Conrat; "Structure and function of the plasma proteins" by Frank W. Putnam; "Structure and function of antigen and antibody proteins" by S. J. Singer; "The proteins of blood coagulation" by Earl W. Davie and Oscar D. Ratnoff; and "Interaction of proteins with radiation" by G. Weber and F. W. J. Teale.

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