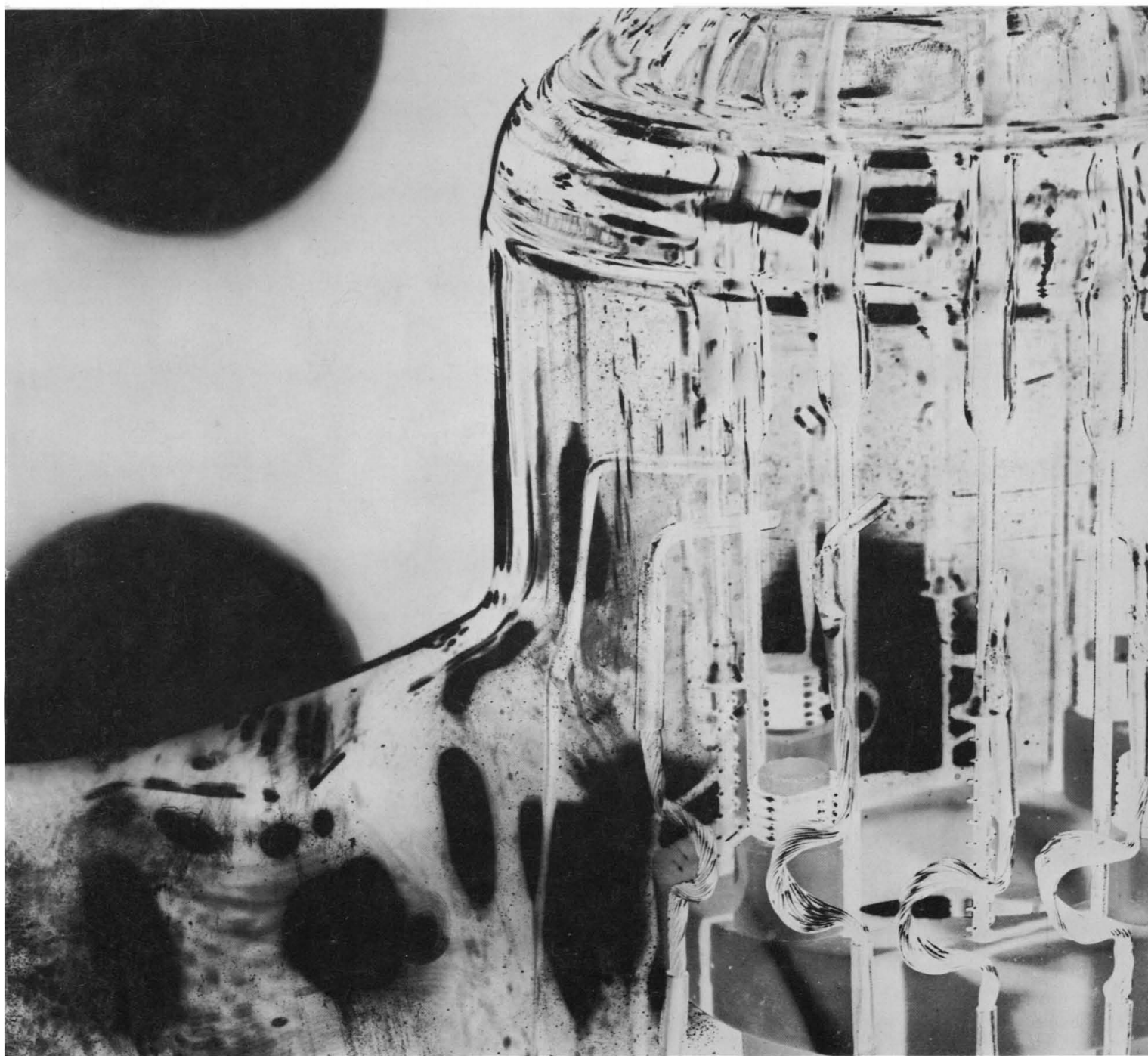


# SCIENCE

11 October 1963

Vol. 142, No. 3589

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



S SPECTROMETER TUBE

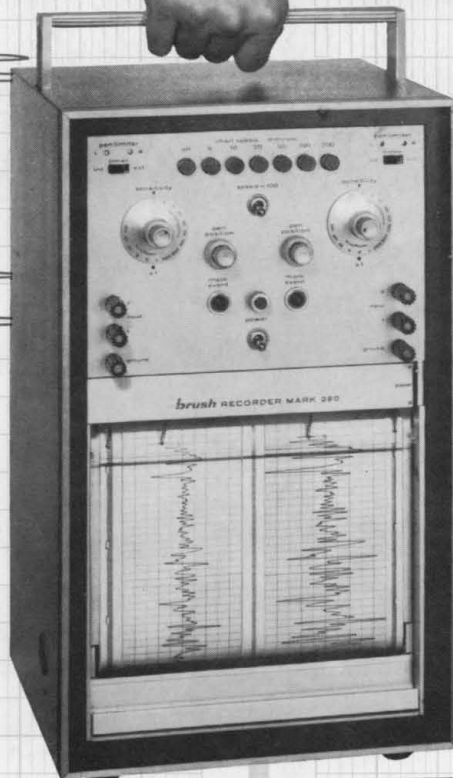
Instrument Issue

Signal on  
conventional channel  
width

40mm

Identical signal  
on Mark 280 channel width

80mm



# New! Brush records 35 cps full scale on 80mm

The new portable Mark 280 doubles resolution of traces without sacrificing frequency response! And . . . you get instantaneous rectilinear ink records of unparalleled accuracy and clarity. Forced fluid writing presents traces, at frequencies to 35 cps full scale, on low cost chart paper. Dual channels each have 50 divisions in an 80 mm width, with trace width constant at one-tenth of a chart division. So now, you can easily detect minute signal variations and take *full* advantage of a  $\frac{1}{2}\%$  system accuracy. Matched solid-state amplifiers provide a sensitivity of 0.5 millivolts/div. Operating controls include attenuator, pen-position, variable gain and 12 push-button chart speeds. No other recorder can match the total capability of the Mark 280. Write for details.

**brush** INSTRUMENTS

DIVISION OF CLEVITE 37TH AND PERKINS, CLEVELAND 14, OHIO



# LAB-LINE TEMP-BLOK Module HEATER

*no water required*



**6 INTERCHANGEABLE HEATING BLOKS\***

**• MODULES HOLD UP TO 30 TEST TUBES**

**Here's how to improve test tube heating  
for a variety of laboratory procedures  
...get uniform temperatures  
adjustable from ambient to 130°C  
...controllable to  $\pm 0.5^\circ\text{C}$**

Only the Temp-Blok dry heat design provides the economy, convenience and versatility of *modular* construction. One heater handles all Module Bloks. So compact, so efficient you wonder why it wasn't developed before. Interchangeable aluminum bloks nest snugly into the heater base; accommodate test or culture tubes 6 mm. to 25 mm. in diameter. Close contact of blok and heater assures exceptionally uniform heating of tube contents; provides

rapid temperature rise (from ambient to 37°C in less than 20 minutes). Module blok has opening for thermometer to check temperature.

Designed to facilitate tests for Rh, prothrombin, blood urea nitrogen (BUN), blood matching, incubation and inactivation of cultures, enzyme reactions, melting and boiling points, and a wide variety of clinical and industrial procedures.

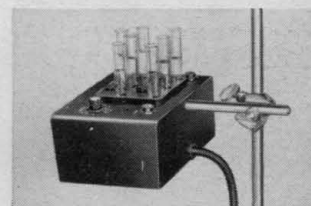
\*Special Module bloks made to order. Prices on request.

**CAT. NO. 2090 TEMP-BLOK Module HEATER (base only).** 4 lbs. net, 100 Watts, 115 Volts, 50/60 Cycles. 8" W x 5" D x 3" H. **\$34.50**  
230 Volts available on request. Stainless steel cover available, also, for shielding of test tubes.

**Module HEATING BLOKS**, black anodized aluminum. 4" W x 3" D x 2" H.

Write today for Bulletin 325

Cat. Nos.	No. of openings	Tube diam.	Price
2070	30	6 mm.	<b>\$15.00</b> each
2072	20	12 & 13 mm.	
2073	12	15 & 16 mm.	
2074	8	20 mm.	
2075	6	25 mm.	
2076 (combination)	5	12 & 13 mm. 6 6 mm.	



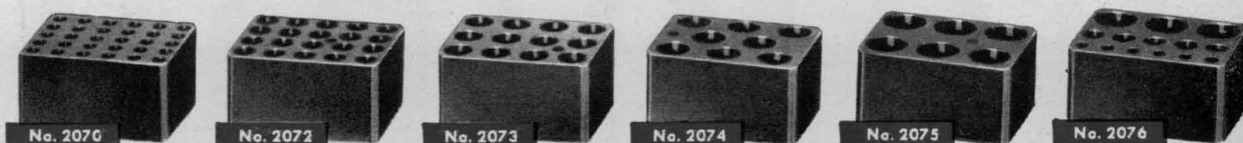
Threaded hole at rear permits suspending Temp-Blok.



**LAB-LINE INSTRUMENTS, Inc.**

Manufacturers and Designers

**LAB-LINE PLAZA • MELROSE PARK, ILL. 60160**



11 October 1963

Vol. 142, No. 3589

# SCIENCE

<b>LETTERS</b>	Connecticut Votes Dogs for Medical Research; Revision of the Copyright Law; Overhead and Research Grants; Equal Opportunity; Critical Evaluation of Reviews; Identity of Organized Elements in Carbonaceous Chondrites; Science in the Humanities .....	147
<b>EDITORIAL</b>	Instrumentation Creates New Opportunities .....	161
<b>ARTICLES</b>	Biological Implications of Gas Chromatography: <i>A. Karmen</i> .....	163
	Improved instrumentation and methods increase the utility of gas chromatography to the biologist.	
	Electric Propulsion: <i>W. E. Moeckel</i> .....	172
	For space exploration we need rockets that are better, not necessarily bigger, than those being developed.	
	Ultrahigh Vacuum Instrumentation: <i>T. A. Vanderslice</i> .....	178
	The general subject of the measurement techniques associated with ultrahigh vacuum are reviewed.	
	Origin of the Electron Microscope: <i>M. M. Freundlich</i> .....	185
	The history of a great invention, and of a misconception concerning the inventors, is reviewed.	
	Scientific Instruments in Space Exploration: <i>R. L. Heacock</i> .....	188
	As our mission capability increases, the problems become more complex and difficult.	
	Institute for Experimental Surgical Instruments in Moscow: <i>T. Takaro</i> .....	195
	Doctors and engineers in a unique cooperative effort have developed a group of surgical stapling devices.	
	Measurement of Optical Activity: New Approaches: <i>B. Carroll</i> and <i>I. Blei</i> .....	200
	Spectropolarimeters of new types, which give promise of wider application, are being developed.	
<b>NEWS AND COMMENT</b>	High-Energy Physics—Midwesterners Want Their Share; Federal Science—New Overseers; Indirect Costs—Ceilings on Overhead .....	208
<b>BOOK REVIEWS</b>	<i>The Sea</i> , reviewed by <i>E. L. Hamilton</i> ; other reviews .....	215

## EDITORIAL BOARD

DAVID M. BONNER  
MELVIN CALVIN  
ERNEST COURANT

FARRINGTON DANIELS  
JOHN T. EDSALL  
DAVID R. GODDARD

ALEXANDER HOLLAENDER  
ROBERT JASTROW  
KONRAD B. KRAUSKOPF

EDWIN M. LERNER II  
WILLARD F. LIBBY  
NEAL E. MILLER

## EDITORIAL STAFF

Editor  
PHILIP H. ABELSON

Publisher  
DAEL WÖLFLE

Business Manager  
HANS NUSSBAUM

Managing Editor: ROBERT V. ORMES. Assistant Editor: ELLEN E. MURPHY. Assistant to the Editor: NANCY TEIMOURIAN.  
News and Comment: DANIEL S. GREENBERG, JOHN R. WALSH, ELINOR LANGER, MARION Y. KLINE. Book Reviews: SARAH S. DEES.

## ADVERTISING STAFF

Director: EARL J. SCHERAGO  
Sales: New York, N.Y., 11 W. 42 St.: RICHARD L. CHARLES, ROBERT S. BUGBEE (212-PE-6-1858)  
Old Bridge, N. J., 3 Woodcrest Dr.: C. RICHARD CALLIS (201-257-3448)  
Production Manager: RAYMONDE SALAMA

SCIENCE is published weekly by the American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington 5, D.C. Now combined with *The Scientific Monthly*. Second-class postage paid at Washington, D.C. Copyright © 1963 by the American Association for the Advancement of Science. Annual subscriptions \$8.50; foreign postage, \$1.50; Canadian postage, 75¢; single copies, 35¢. School year subscriptions: 9 months, \$7; 10 months, \$7.50. Provide 4 weeks' notice for change of address, giving new and old address and zone numbers. Send a recent address label. Opinions expressed by authors are their own and do not necessarily reflect the opinions of the AAAS or the institutions with which the authors are affiliated. Indexed in the *Reader's Guide to Periodical Literature*.



# AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

<b>REPORTS</b>	Hydrogen: Electrolytic Technique for Purifying It and Removing It from a Gas Stream: <i>S. H. Langer and R. G. Haldeman</i> .....	225
	Xanthine Dehydrogenase in <i>Drosophila</i> : Detection of Isozymes: <i>K. D. Smith, H. Ursprung, T. R. F. Wright</i> .....	226
	Inverted Indexing on Edge-Notched Cards: <i>J. G. Roney, Jr.</i> .....	227
	Venom Collection from Honey Bees: <i>A. W. Benton, R. A. Morse, J. D. Stewart</i> ....	228
	Measurement of Bone Mineral in vivo: An Improved Method: <i>J. R. Cameron and J. Sorenson</i> .....	230
	Aragonite and Calcite as Constituents of Adult Oyster Shells: <i>H. B. Stenzel</i> .....	232
	Ammonia: Possible Use for Preserving Fish: <i>V. Subrahmanyam et al.</i> .....	233
	Cytochromes of a Blue-Green Alga: Extinction of a c-Type with a Strongly Negative Redox Potential: <i>R. W. Holton and J. Myers</i> .....	234
	Spectroscopic Ultramicroanalysis with a Laser: <i>R. C. Rosan, M. K. Healy, W. F. McNary, Jr.</i> .....	236
	Freezing-Point Depression: New Method for Measuring Ultramicro Quantities of Fluids: <i>D. J. Prager and R. L. Bowman</i> .....	237
	Alcohol Consumption in Rats: Effects of Intracranial Injections of Ethanol: <i>R. D. Myers</i> .....	240
	Ultramicrotome: A Simple, Easily Constructed Instrument: <i>M. R. Clevenger</i> .....	241
	Estrogen-Induced 16-Hydroxysteroid Dehydrogenase Activity in Rat Kidney: <i>K. J. Ryan et al.</i> .....	243
	Biodegradation of Alkylbenzene Sulfonate in a Simulated Septic Tank and Drain Field: <i>A. E. Straus</i> .....	244
	Ornithocholanic Acids and Cholelithiasis in Man: <i>L. Peric-Golia and R. S. Jones</i> ....	245
	Muscle: Volume Changes in Isolated Single Fibers: <i>J. P. Reuben et al.</i> .....	246
<b>MEETINGS</b>	Instrumentation for Biomedical Sciences; Cell Division and Cancer; Free Radicals; Spectrophotofluorometry; Biological Techniques; High Magnetic Fields: Production and Application; Forthcoming Events .....	249
<b>DEPARTMENTS</b>	New Products .....	279

PHILIP M. MORSE  
COLIN S. PITTENDRIGH  
KENNETH S. PITZER

DeWITT STETTEN, JR.  
WILLIAM L. STRAUS, JR.  
EDWARD L. TATUM

JOHN R. WINCKLER  
CLARENCE M. ZENER

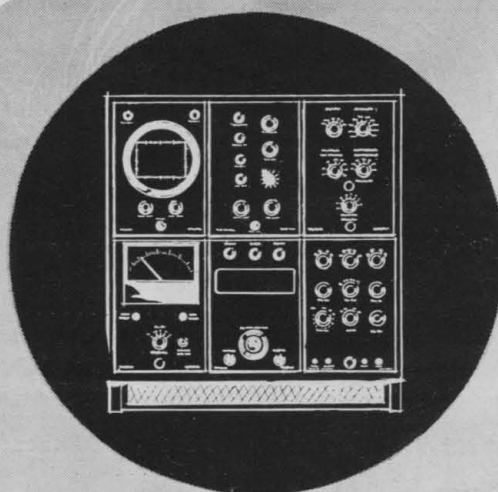
Editorial Assistants: ELEANORE J. BUTZ, GRAYCE A. FINGER, NANCY S. HAMILTON, VIRGINIA HAMILTON, OLIVER W. HEATWOLE, ANNE D. HOLDSWORTH, SHELLEY MANN, EDGAR C. RICH, JOHN E. RINGLE, HARRIET WILLIAMS, EVA WOO.  
Staff Assistants: VIRLINDA M. GIBSON, LILLIAN HSU, BARBARA J. SHEFFER.

Chicago, Ill., 6 W. Ontario St.: HERBERT BURKLUND (312-DE7-4973)  
Los Angeles 45, Calif., 8255 Beverly Blvd.: WINN NANCE (213-653-9817)

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., N.W., Washington 5, D.C. Phone: 202-DU 7-7171. Cable: Advancesci, Washington. Manuscripts should be submitted in triplicate, double-spaced throughout. The AAAS assumes no responsibility for the safety of manuscripts. Copies of "Instructions for Contributors" can be obtained from the editorial office.  
ADVERTISING CORRESPONDENCE: Room 1740, 11 West 42 St., New York 36, N.Y. Phone 212-PE 6-1858.

## COVER

Close-up view of mass spectrometer tube which was used to measure partial pressures of  $10^{-10}$  torr. This instrument is capable of being out-gassed at temperatures of  $450^{\circ}\text{C}$  and has operated at total pressures of  $10^{-9}$  torr. See page 178. [General Electric Company]



## THINKING OF BUYING AN ANALYZER?

### THEN GET ALL THE FACTS FIRST

Price is an important consideration in the purchase of an analyzer. But it's just one factor. Quality is even more important. So, too, are greater flexibility and utility, that provide long-life usefulness which means true economy in the long-run. To a great extent these features are functions of cost. There are several low-priced "stripped down" analyzers available. But do they provide all the features you'll need for tomorrow's experiments? In fact, do they give you all the features you need today?

Before you purchase an analyzer you owe it to yourself to get all the facts. (Remember, the experiments you conduct tomorrow will be governed by the equipment you purchase today.) So write or call for a free demonstration. No obligation, of course.

#### THESE "EXTRAS" ARE STANDARD ON THE RCL MULTICHANNEL ANALYZER.

All channels usable. . . . Accepts widest range of input shapes and levels. . . . Log energy conversion with selectable energy scales. . . . Direct compatibility with existing single and double delay line clipping amplifiers. . . . Built-in single channel analyzer for coincidence operation. . . . Fine gain control directly calibrated in KEV per channel. . . . Two lower level discriminators

for noise suppression and energy restrictions. . . . Variable rise time control for accepting signals from Alpha and Beta chambers. . . . High resolution solid state detectors. . . . Slow rise time signals from delay circuits and detectors.

OTHER STANDARD BUILT-IN FEATURES. . . .  $10^6$  count. . . . H.V. Power supply. . . . Multi-scaler time and count mode. . . . Scope. . . . Timer. . . . Log display. . . . Complete realistic specifications.



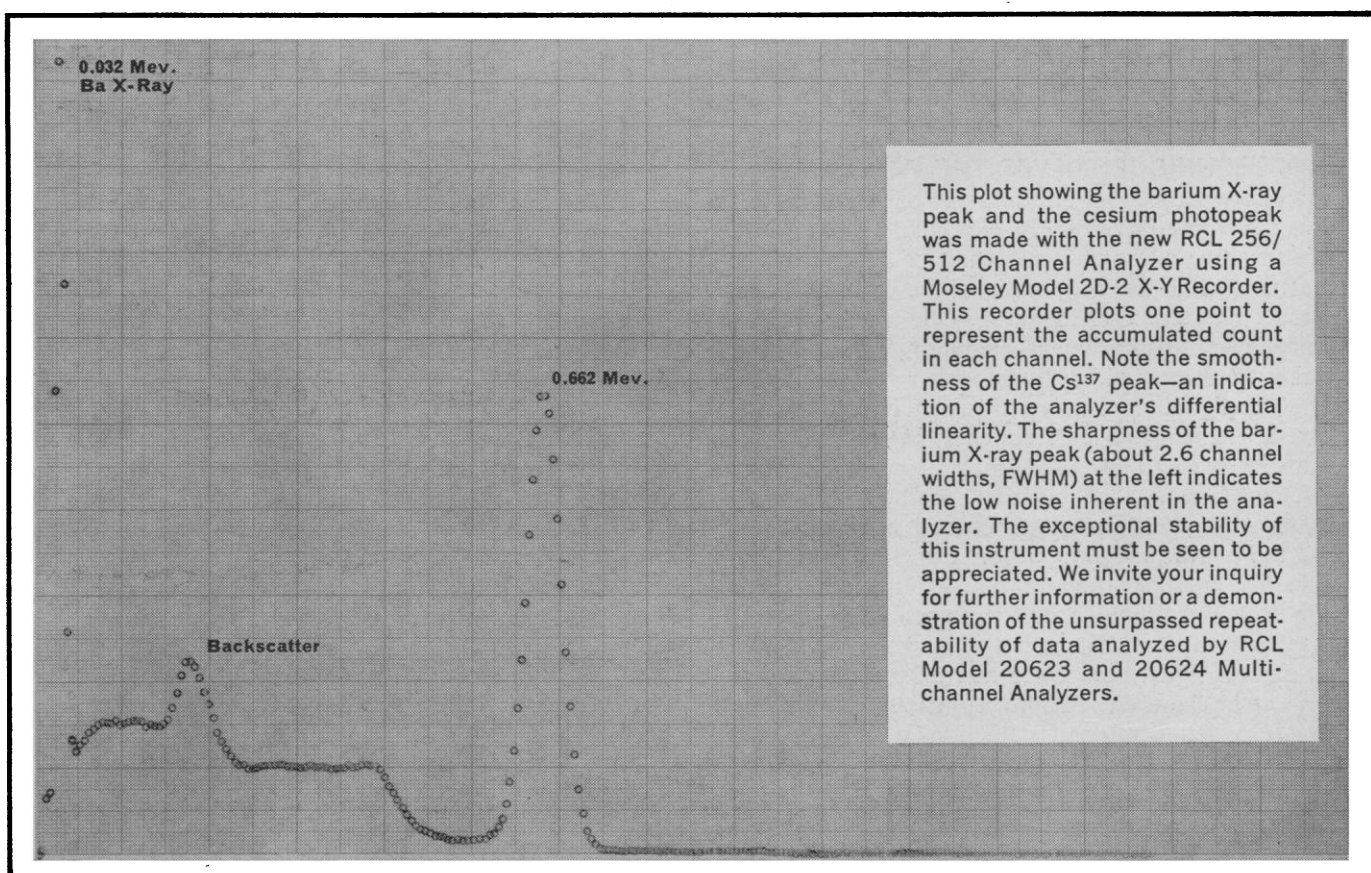
*For Free Demonstration & Complete Specifications, Write:*

**RADIATION COUNTER LABORATORIES, INC.** A SUBSIDIARY OF ALLIED RESEARCH ASSOCIATES, INC

5121 West Grove Street, Skokie, Illinois, U.S.A., TWX: 9675150, Cable Address: RACOLAB / Phone YOrktown 6-8700

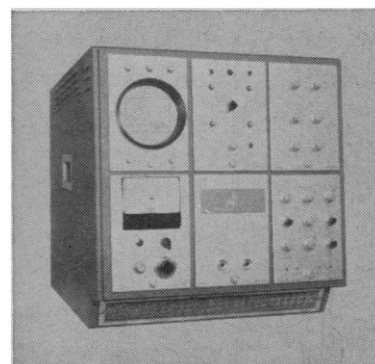
# HERE'S PROOF!

## NEW ADC SETS STANDARD FOR MULTI-CHANNEL ANALYZERS



Superior linearity and stability are designed into the new RCL Model 20623 (256 channel) and Model 20624 (512 channel) analyzers. The new analyzers will accept an unprecedented range of input pulse waveshapes and signal levels. One channel is used to store clock pulses and all other channels in the group are useable. These analyzers have two unique features. An expansion control allows detailed examination of the top quarter or half of the energy range. A logarithmic expansion of the energy scale can be made, permitting a full spectrum survey with excellent resolution and linearity over the full energy range. Memory modules are interchangeable (256 or 512 channels) and provide sub-groups in multiples of 64 channels.

In addition to direct display on the self-contained five inch oscilloscope, data may be read out on most conventional devices, including strip chart recorders, X-Y recorders, the IBM typewriter, the RCL Model 21016 Digital Printer, and magnetic or paper tape systems. For complete specifications write: Analyzer Sales Section, Radiation Counter Laboratories, Inc.



**RADIATION COUNTER LABORATORIES, INC.**

5121 West Grove Street, Skokie, Illinois, U.S.A., TWX: 9675150, Cable Address: RACOLAB / Phone YOrktown 6-8700

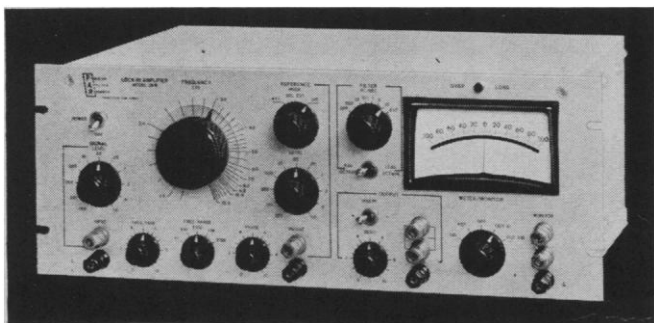


## a note to the experimentalist who has signal/noise problems:

It is safe to say that the majority of current research in the physical sciences involves the measurement of small-effect phenomena where noise sets the limit to attainable precision or detectability. When discussing noise, we include most of the extraneous effects that arise during the course of an experiment that mask the effect under investigation. We also include noise having as its origin either the fundamental thermal fluctuation of all matter not at absolute zero or the quantized nature of radiation. One does not have to be engaged in highly sophisticated research problems such as detecting the Doppler shift of 21 centimeter galactic radiation to have need for modern signal processing techniques. In fact, many less exacting experiments, be they in physics, chemistry, astronomy or even biology, would be rendered more tractable by the application of relatively simple concepts that allow the realization of signal-to-noise ratios near the theoretical optimum.

### LOCK-IN TECHNIQUE SOLVES THE PROBLEM

A particularly simple, yet elegant, way of achieving this goal has been pointed out by R. H. Dicke\* who applied it to his sensitive microwave radiometer. This technique involves modulation *at the source* of the quantity being measured. The unknown signal may be a voltage, current, mechanical displacement, radiation, or any physical quantity that can be transformed into electrical energy. The signal to be detected is switched on and off at a fixed frequency,  $f_0$ , a frequency not too high for the transducer to follow, and not so low as to invite flicker-effect noise. The resulting small AC electrical signal, together with the multi-sourced noise that has entered the picture are now brought up to a high level in a selective amplifier tuned to  $f_0$ . A tuned amplifier is used to avoid dynamic range problems (overloading on noise) and to reject harmonics of  $f_0$ , when important. The amplified signal plus noise and a large "reference voltage" at  $f_0$  are then fed into a mixer. This mixing process is called "coherent detection" and shifts the information in a given bandwidth at  $f_0$  to an equal bandwidth about DC. The signal at DC is filtered by a simple resistor-capacitor low-pass network and displayed on a D'Arsonval meter or strip-chart recorder. It is easily shown that the equivalent bandwidth of the overall system is the cut-off frequency of this RC low-pass filter, which can be made as narrow as desired.



Transistorized Lock-In Amplifier — Model JB-5

\*R. H. Dicke, *Rev. Sci. Inst.* 17, p 268, 1947

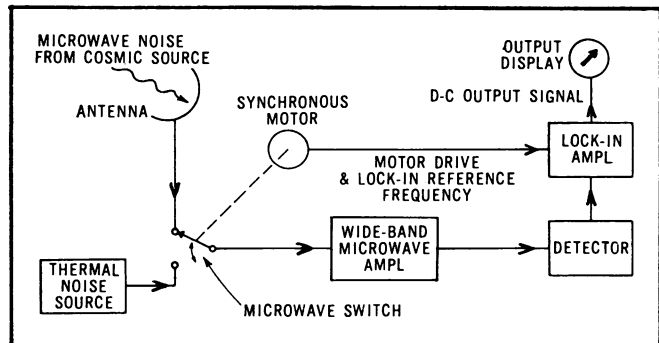


Write for Bulletin 109 to:

**PRINCETON APPLIED RESEARCH CORP.**, Box 565 / Princeton, N. J. / Tel. 799-1222, Code 609

### NO FREQUENCY DRIFT PROBLEMS

Inasmuch as the signal frequency is always "locked-in" to the detector, there are no frequency drift problems, regardless of the bandwidth used. The signal/noise ratio can thus be made arbitrarily large at the expense only of observation time. A sample experimental set-up is shown in block-diagram form below.



*Lock-in amplifier used in radio telescope. Receiver noise, although much larger than noise signal from antenna, is not modulated and hence contributes little to DC output of lock-in amplifier. With this arrangement, it is possible to detect cosmic noise signals 40 db below the input noise level of the wideband microwave receiver.*

Princeton Applied Research can provide the experimenter with a lock-in detection system for implementing this technique, the use of which will allow signals deeply buried in noise to be retrieved and measured with good accuracy. This equipment is contained in a single 7" relay rack chassis and has the following specifications:

### TECHNICAL FEATURES

Transistorized Lock-In Amplifier — Model JB-5

**Frequency Range:** 1.5 cps to 150 kc continuously tunable in five ranges.

**Time Constants:** 0, 0.001, 0.01, 0.1, 1, 3, 10, EXT. Single or double section RC filtering.

**Gain:** (rms AC in to push-pull DC out) — Greater than 9,000.

**Linearity:** Better than  $\pm 1\%$  of full scale.

**Zero Drift:**  $\pm \frac{1}{2}\%$  of full scale per hour, maximum.

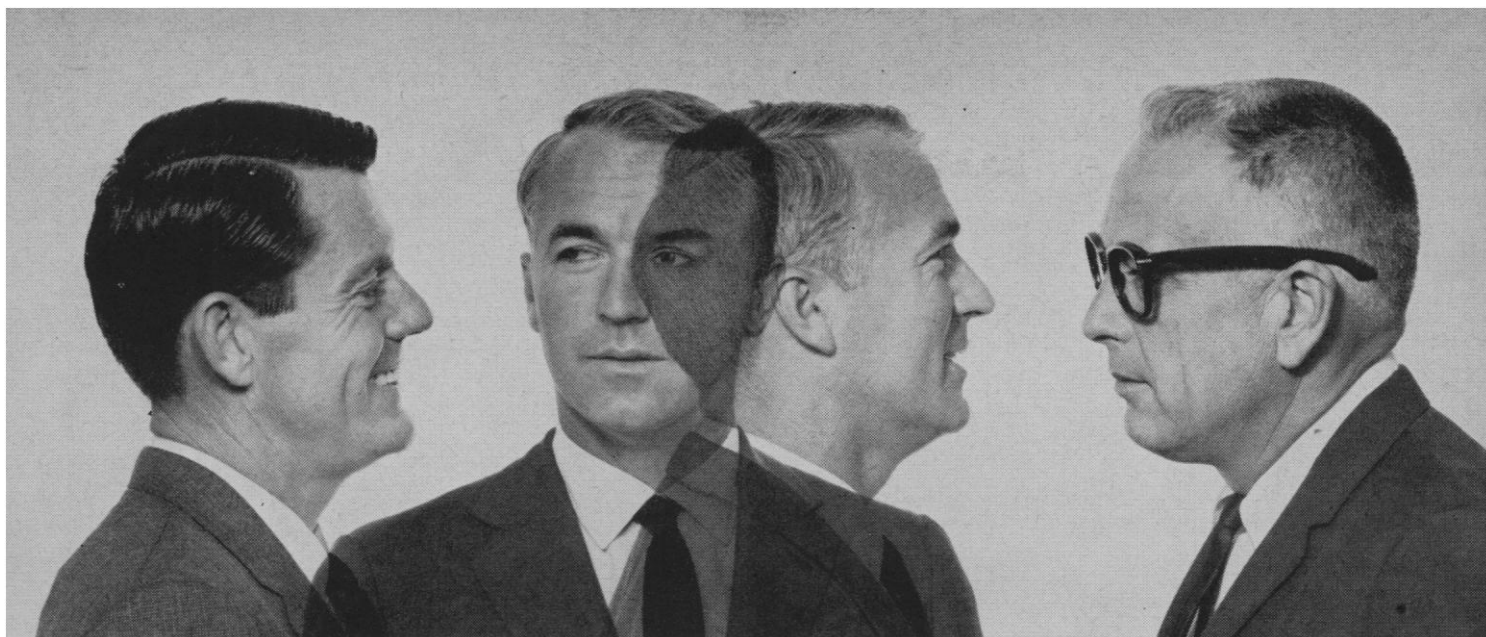
**Outputs:** (a)  $\pm 5$  volts DC maximum, balanced to ground into high impedance load. (b)  $\pm 1$  ma or  $\pm \frac{1}{2}$  ma switch selectable into pen recorder of less than 2K internal resistance.

**Frequency Selective Amplifiers:** Selectivity characteristic of tuned amplifiers in signal and reference channels is that of parallel resonant circuit with a Q of approximately 25 (*NOT TWIN-T TYPE*).

**Operating Modes:** External, Selective External or Internal. Lock-in accepts sinusoidal or non-sinusoidal reference signal or provides sinusoidal 5V p to p reference from internal oscillator.

**Price:** \$1350.00

To acquaint those interested we are offering our Bulletin 109 which describes how the PAR lock-in system may be used to advantage in experiments in many fields.



**one step removed**



**removed!**

Now there are only two. You and your Beckman Sales Engineer. He's one of 83 who now serve your analytical instrument needs directly. What does this mean to you? It means that when you talk to him, you're talking to a Beckman man—employed by Beckman, trained by Beckman, a Beckman Instrument Engineer. He doesn't just sell instruments, he works with the men who design and develop them. He's a jack-of-one-trade. An instrument man. Now meet him face to face.

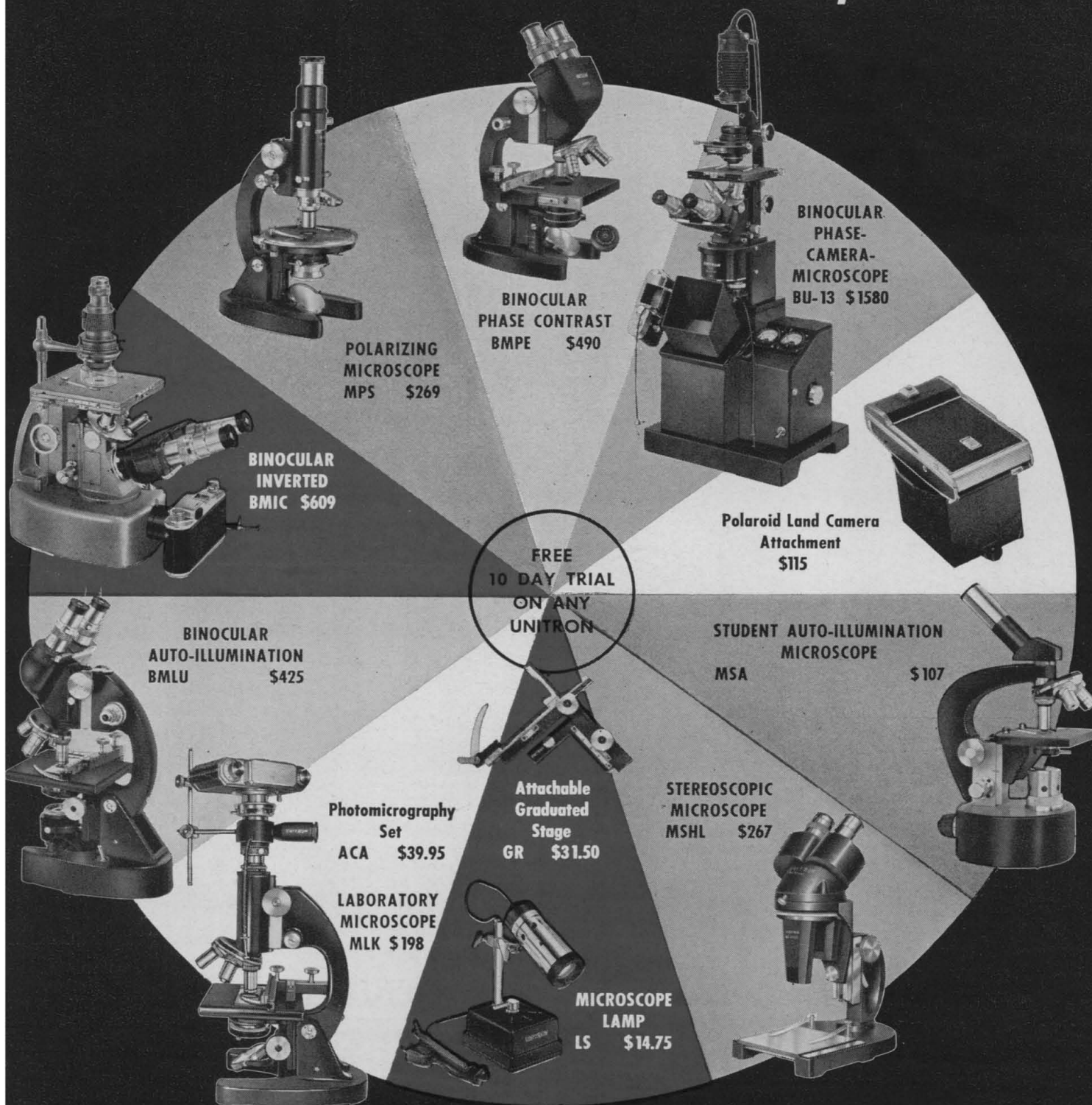
**Beckman**

INSTRUMENTS, INC.

**SCIENTIFIC AND PROCESS INSTRUMENTS DIVISION**  
Fullerton, California

INTERNATIONAL SUBSIDIARIES: GENEVA, SWITZERLAND; MUNICH, GERMANY; GLENROTHES, SCOTLAND; PARIS, FRANCE; TOKYO, JAPAN; CAPETOWN, SOUTH AFRICA

*In the Laboratory . . . where optical quality counts  
 . . . the trend is to **UNITRON** Microscopes*



UNITRON offers an extensive line of Laboratory Microscopes & Accessories for Research, Industry and Education. Illustrated is a partial selection for biology, medicine, chemistry and related fields. UNITRON also has companion instruments for the metalworking industries.

Noted for optical quality . . . advanced optical and mechanical design . . . unique and convenient operational features . . . long wearing construction . . . attractive budget prices which include basic optics . . . these, together with years of proven instrument performance, are the reasons why . . .

**THE TREND IS TO UNITRON!**

**UNITRON**

INSTRUMENT COMPANY • MICROSCOPE SALES DIV.  
 66 NEEDHAM ST., NEWTON HIGHLANDS 61, MASS.

Please rush UNITRON's Microscope Catalog 4-q

Name

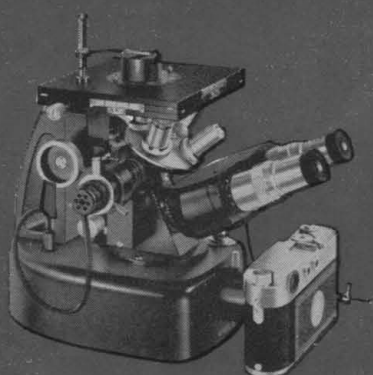
Company

Address

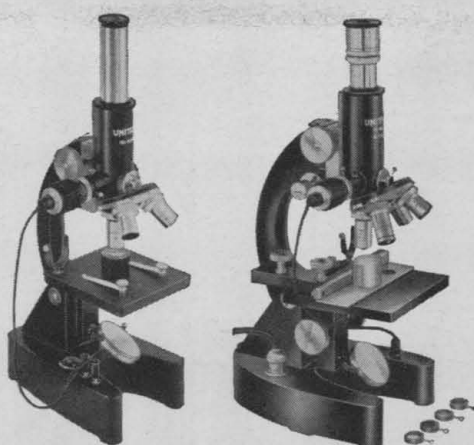
City  State



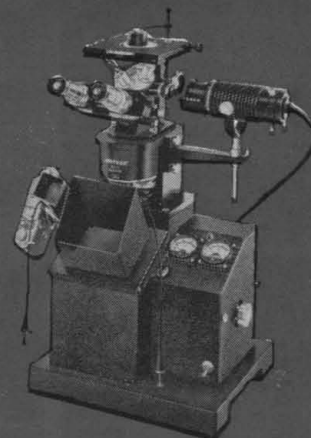
# If METALLURGY is your field, UNITRON is your microscope



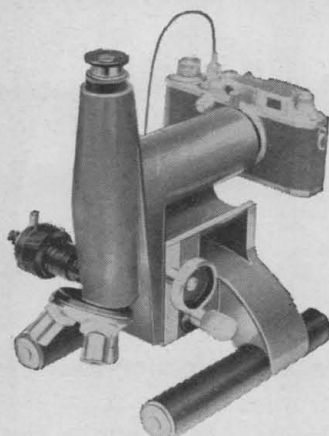
Binocular Inverted Model BMEC with camera mechanism.....\$615.  
Monocular Inverted Model MEC.....\$399.  
(Polaroid Land Camera attachment available)



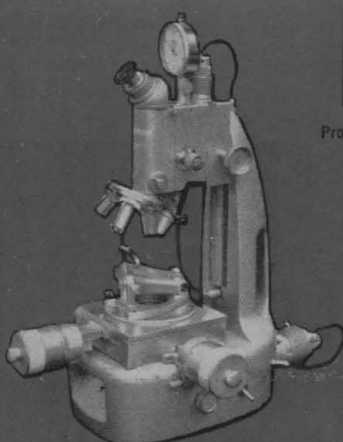
Model MMA.....\$149. Model MMU.....\$287.



Binocular Metallograph BU-11.....\$1379  
Monocular Metallograph U-11.....\$1195  
Polaroid Land Camera attachment.....\$115



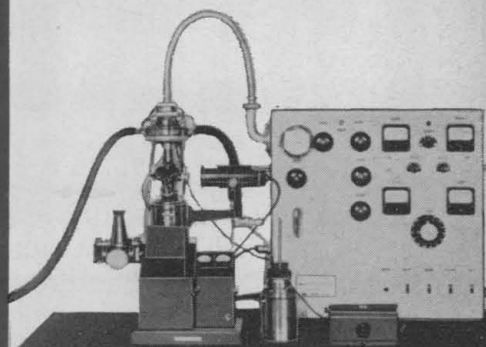
Model DMR Depth-Measuring Rollescope for examination of large or cylindrical surfaces.....\$445.



Toolmakers and Metallurgical Microscope Model TM for 3-dimensional measuring.....\$1050.  
(other models available)

Projection Screen ..\$95.

UNITRON'S Complete Laboratory Installation for High Temperature Metallography with Metallograph and HVC-Control and Power Station.

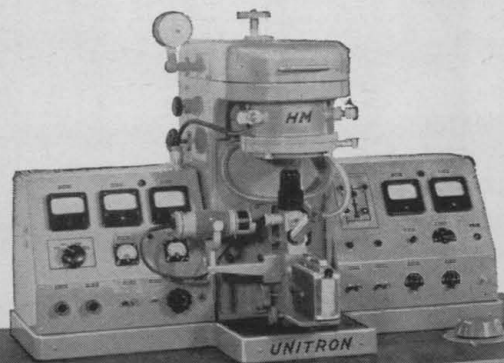


Stereoscopic Model MSL.....\$110.

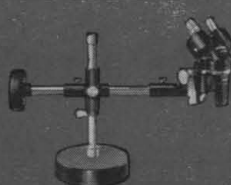


Stereoscopic Model MSM with turret changer.....\$320.

UNITRON'S Research Installation for High-Temperature Microscopy, Desk Model HM  
(Write for price and complete specifications)



Stereoscopic Model MSHL with revolving nosepiece.....\$267.



Pillar Stand for Stereoscopic Models.....\$75.



HHS-3 Vacuum Heating Stage for 1500° C.....\$625.



Long Working Distance Objective FF40X .....\$149.



Goniometer Eyepiece from \$55



Austenite Grain Size Eyepieces:  
Turret-Type..\$76.  
Ke 10X.....\$25.



Filar Micrometer Eyepiece ..\$69.50



Stage Micrometer \$11

## UNITRON IS YOUR COMPLETE SOURCE FOR MICROSCOPES

to meet every metallurgical application . . . from low-power macro to high-power micro examinations, right on through to advanced research in high temperature studies of the new metals in the space age. And when it's time to balance your equipment budget against your needs, UNITRON prices will be among the best news of all.

## TRY A UNITRON IN YOUR LAB . . . FREE, FOR 10 DAYS

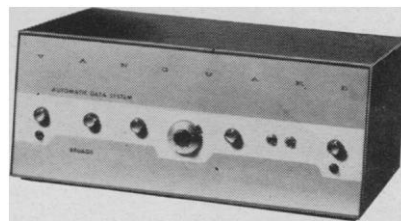
A salesman's demonstration gives you only about 30 minutes to examine a microscope . . . hardly the best conditions for a critical appraisal. But, UNITRON'S Free 10-Day Trial allows you to use the microscope in your own lab and put it through its paces on your own particular problem. Use the coupon to ask for a no-obligation, prepaid trial. And if you want more details on these and other UNITRON Microscopes, use the coupon to request a complete catalog.

## UNITRON

INSTRUMENT COMPANY • MICROSCOPE SALES DIV.  
66 NEEDHAM ST. • NEWTON HIGHLANDS 61, MASS.

- ☐ I want a FREE 10-day trial of Model.....  
☐ Send me your catalog No. 4-Q

NAME \_\_\_\_\_ DEPT. \_\_\_\_\_  
COMPANY \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_ STATE \_\_\_\_\_

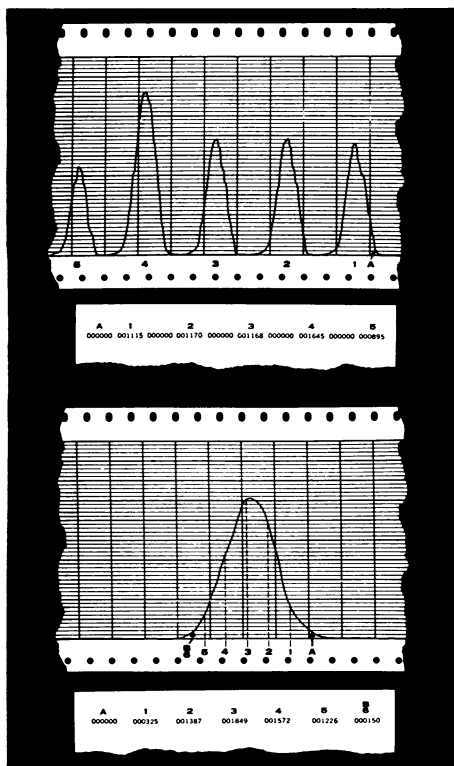


# OUTSTANDING PERFORMANCE

## IN AUTOMATIC CHROMATOGRAM SCANNING

Outstanding is indeed the word for the performance of Vanguard Model 880ADS Low Background Autoscanter with Automatic Data System. Now you can automatically perform both qualitative and quantitative assays of chromatograms on the intact strip . . . with an accuracy and efficiency never before possible. This exclusive system scans, detects and presents radioactivity in direct digital form. It completely eliminates mechanical integration, planimetry and triangulation. No painstaking cutting, eluting and counting of radioactive zones on strips.

Vanguard's Model 880 Autoscanter is the most sensitive instrument ever designed for scanning tritium, carbon-14, sulphur-



35 and other low-energy, beta-emitting radioisotopes. It features windowless, 4 pi detection with a total background of less than 10 cpm. Completely transistorized for long performance, dependable performance. 10 scanning speeds, 5 rate meter time constants, 7 count rate ranges, 5 individual slit width collimations

Two modes of Data Presentation are available with the Model 880ADS. Digital information obtained in the Peak Print mode (above) and the Interval Print mode (below) is utilized through all phases of the quantitating procedure.



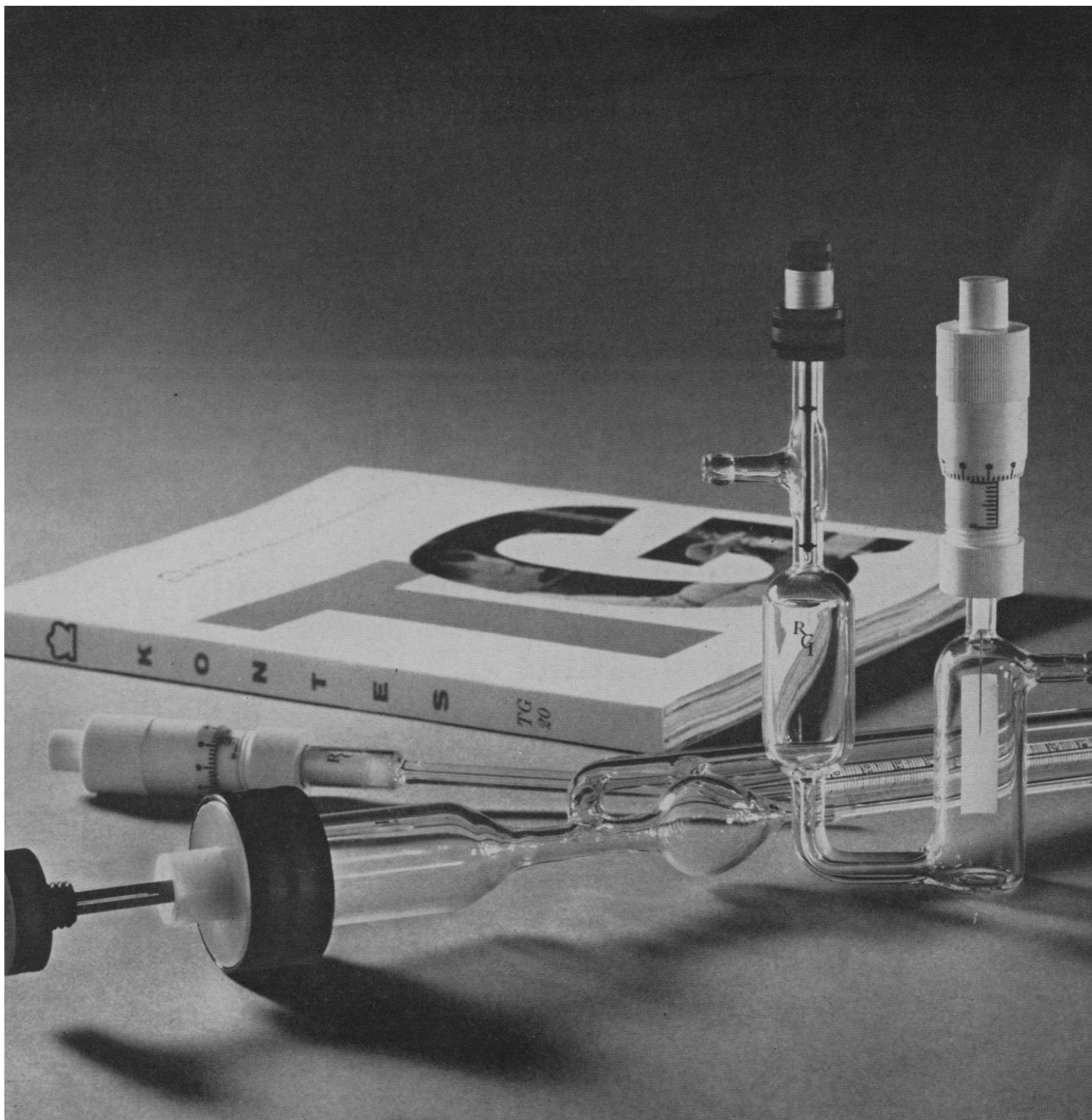
For complete information on the most sensitive scanning system you can buy, write today for this informative brochure.



**VANGUARD INSTRUMENT COMPANY**

Designers and Manufacturers of Precision Instrumentation for Research

P. O. Box 244, LaGrange, Illinois 60525, Fleetwood 2-1600 • Regional Offices: New York, N. Y., 520 Fifth Avenue, TN 7-1998  
San Francisco, Calif., 115 New Montgomery Street, EXbrook 2-0511 • Baltimore 2, Maryland, 217 North Calvert Street, 301-727-3666



## Birds of a feather

The old adage proves true here.

We're proud to announce our newly formed association with RGI Incorporated. Our sales force is now sporting two feathers in their hats and equipped to handle RGI instrumentation products as well as Kontes quality technical glassware.

The RGI line of precision laboratory instruments is second to none for

trouble-free simplicity of design and ease of operation. Designed by Dr. Roger Gilmont, each instrument was stripped of unnecessary complexity and functionally improved to eliminate points of possible failure and, logically enough, *reduce costs*.

If you work with pressure or vacuum controls, flowmeters, viscosimeters, McLeod gages, manometric gages,

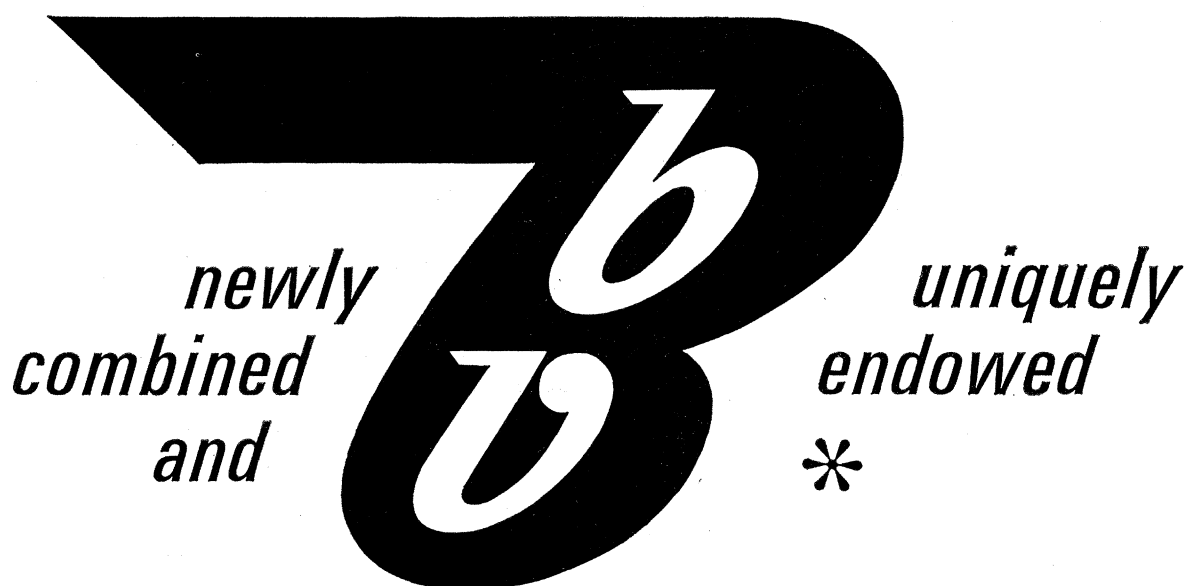
and micrometric syringes or burets, we think you will be interested in talking to your Kontes representative—or, write to our general offices for the new comprehensive Kontes Catalog TG-20 which includes a 24-page section on RGI Incorporated products.

**KONTES**  
GLASS COMPANY  
Vineland, New Jersey



*KONTES of Illinois. Franklin Park, Illinois*





in high vacuum and thin film technology...  
for today...and tomorrow

---



Newly combined...yes...and uniquely endowed by the integration of the applied research and engineering depth of the Bendix Corporation with the well-established technological and manufacturing skills of Balzers AG in the formation of Bendix-Balzers Vacuum, Inc.

As an industrial team, both firms are contributing their diverse experience toward the research, design, and construction of both standard and custom high vacuum systems for the electronics, optical, metallurgical and aerospace industries.

Our goal is to provide advanced and reliable equipment to you who are engaged in the use of high vacuum.

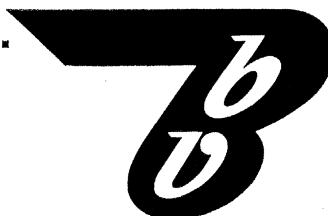
*May we serve you?*

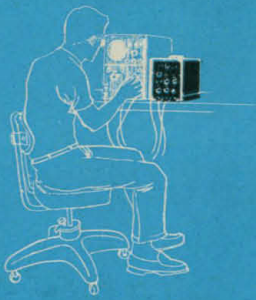
## **BENDIX-BALZERS VACUUM, INC.**

1645 ST. PAUL STREET • ROCHESTER, NEW YORK 14621

AN AFFILIATE OF THE *Bendix* CORPORATION

VISIT US AT BOOTH 51-52, AMERICAN VACUUM SOCIETY SHOW





from Nuclear Data:

## ANNOUNCING: THE ENHANCETRON 1024

DIGITAL STORAGE OSCILLOSCOPE

*a fascinating & important new measurement tool for the enhancement of the signal-to-noise ratio of repeatable or naturally recurrent noisy signals, useful in many fields:*

**GEOPHYSICS, NUCLEAR MAGNETIC RESONANCE, RADAR ASTRONOMY, ELECTROPHYSIOLOGY, VIBRATION ANALYSIS, BIOCHEMISTRY, SONAR, & OTHERS**

*Why not use ordinary filtering to eliminate noise? Because noise sometimes has frequency components in the same range as the signal. For example, noise due to unrelated nerve activity in electrophysiological measurements has exactly the same general appearance as the signal of interest. In isolating the vibrations of a complex system, due to one cause such as a motor or engine, in the presence of numerous unrelated vibrations, filtering is usually impossible. In nuclear magnetic resonance measurements, high frequency noise may be filtered by decreasing the sweep rate of the magnetic field and using low amplifier upper passband frequency, but very low frequency noises, such as amplifier gain drifts, become increasingly important as sweep speeds decrease. Filtering therefore has definite limitations.*

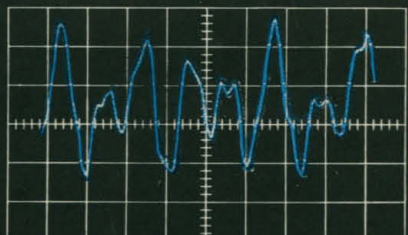
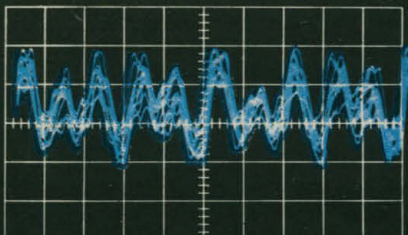
*Here is how the Enhancetron 1024 works:* Signals obscured by noise are digitized at 1024 time intervals, and the results recorded

as 1024 numbers in a magnetic core memory. Positive numbers indicate positive input voltages, negative numbers negative input voltages. This is repeated for each signal recurrence, with the numbers for corresponding time intervals numerically added. Noise in general tends to average toward zero, since it is as likely to be positive as negative. **THE SIGNAL OF INTEREST ADDS LINEARLY.** The signal-to-noise ratio improves in proportion to the square root of the num-

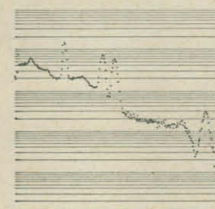
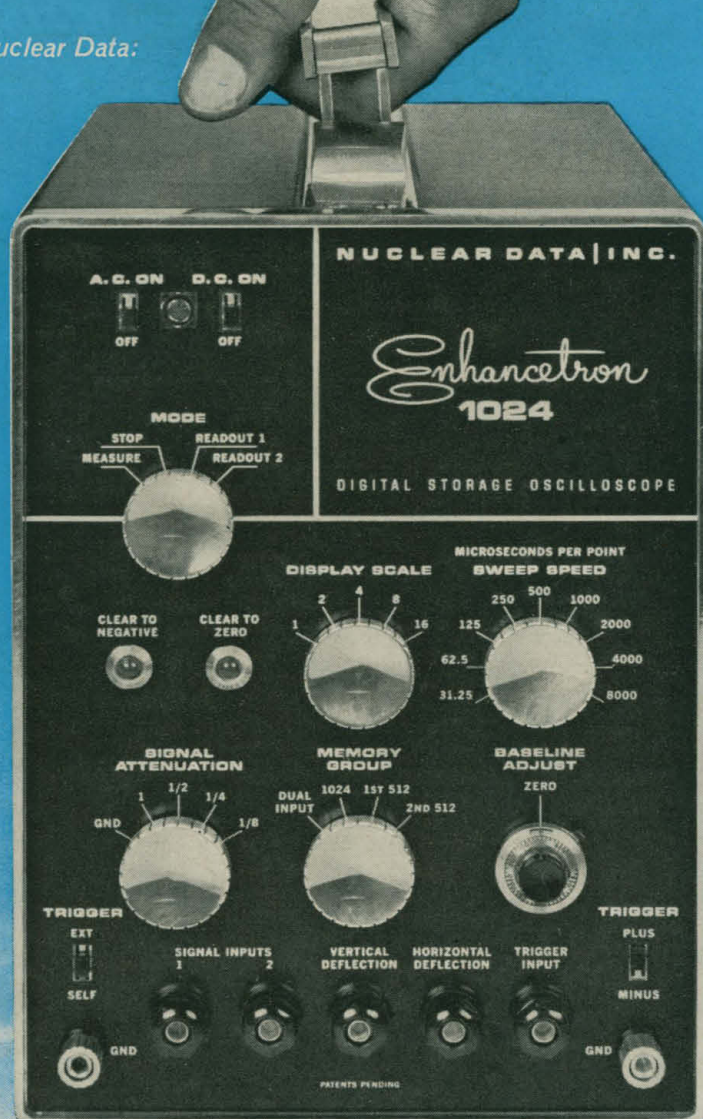
ber of signal recurrences. This number is limited only by the length of each signal and the measurement time available.

Digitizing and storage occurs at a rate of 31.25 microseconds per point. The sweep speed range is operator-selected from 31.25 microseconds to 8 milliseconds per point. Bandwidth is about 10 kc/sec. Results are displayed on a standard oscilloscope, which is also used to view the input signal. If desired, data may be read out by typewriter, or on computer compatible punched paper tape.

Write or phone Nuclear Data for further information and literature.



**LEFT:** Input signal indicating vibrations of a complex machine, due to several unrelated forces. **RIGHT:** Enhancetron 1024 output signal indicating motion due to a single vibration producing member.



**NUCLEAR  
DATA  
INC.**

3833 WEST BELTLINE HY.  
MADISON, WISCONSIN 53701



# A modern research instrument with built-in Koehler illumination for critical microscopic investigation

In less than one year since its introduction, the Nikon Series S has become one of the most talked about microscopes in the field. It has attracted wide and favorable attention for its mechanical ruggedness, its smoothly responsive controls, its seemingly unlimited versatility, and its almost incredible quality of optics.

The new Series S-Ke offers even more of special interest to the critical microscopist. Except for the base, the S-Ke employs the same construction as the Series S and accepts the same interchangeable eyepiece tubes and stages. The base is larger, and contains the light source and optics of the Koehler illuminator.

Koehler illumination is undoubtedly the most efficient known to optical microscopy, and is virtually prerequisite in photomicrography. Its principle advantage is that it makes the light source and microscope a compatible optical system. All available light is concentrated in the area under investigation. There is no

glare or halo. Details, usually obscured by these conditions emerge with new clarity and definition.

To attempt Koehler illumination with conventional mirror and external lamps is a difficult, time-consuming procedure. With the model S-Ke it is utterly simple and virtually automatic. A sliding, centerable optical system permits the user to enjoy its benefits over the entire magnification range of the microscope.

The S-Ke is supplied with a step-down transformer which provides the correct lamp voltage. This transformer has a built-in voltmeter and a variable intensity control with adjustable high- and low-position 'stops' so that any selected degree of brightness can be repeated.

Optional accessories: Interference-Phase, Phase-Contrast, and Polarizing attachments, Projection Head, Macro-Photo and Photomicrographic equipment.

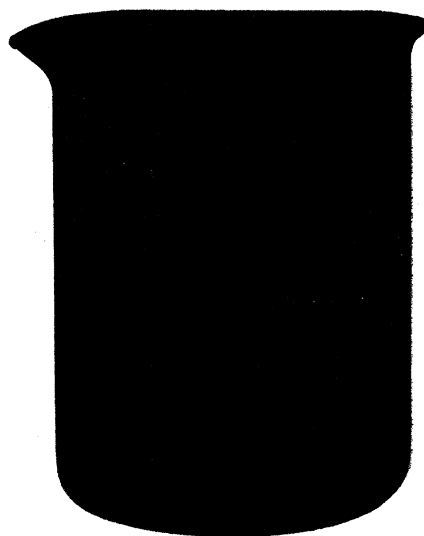
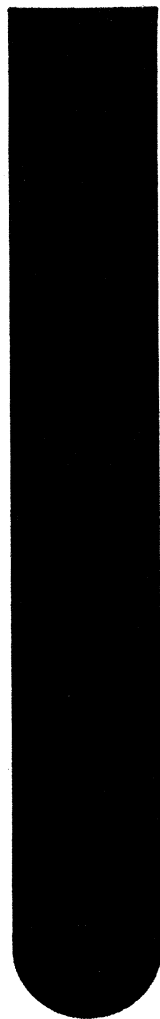
For complete details, write to Dept. S-10.

## Nikon Series S-Ke



NIKON INCORPORATED Instrument Division • 111 Fifth Avenue, New York 3, N. Y. • Subsidiary of Ehrenreich Photo-Optical Industries, Inc.





*Three reasons you're better off  
buying through a PYREX® brand*

Number one is his knowledge. He knows your lab and he knows the new, blue PYREX brand labware Catalog LG-3.

That's why he can help you choose the specific labware item that will handle your tasks best. He's got "best buy" recommendations in more than 20 labware categories—from beakers to tubes—and he can offer special-application sugges-

tions, too.

And there's greater convenience. A telephone call across town starts things moving fast for you.

There's a full inventory for you to order against, too. You can expect off-the-shelf delivery from your dealer, because that's his business.

You can count on the companies that distribute our labware to give you helpful, personal, convenient

*labware dealer*

service, coupled with fast deliveries.

Your Corning dealer is a good man to do business with. We know. Laboratory Glassware Dept., Corning Glass Works, 7210 Crystal St., Corning, New York.

**CORNING**  
CORNING GLASS WORKS

*One of a series briefly describing GM's research in depth*

## ELECTROCHEMICAL ADDITION: $1+1=3$

Electroplating is a well-known process . . . on the surface, anyway.

But the plating of just one metal on another may involve a dozen or more physical or chemical events. At the GM Research Laboratories, we are examining some of these to better understand particular idiosyncrasies.

Like the action of organic addition agents. For instance, an organic leveling agent in a plating bath causes more metal to be deposited on low places and less on the high spots—giving a smoother, more level surface. Two together do stranger things. How? Radioactive tracers are telling us.

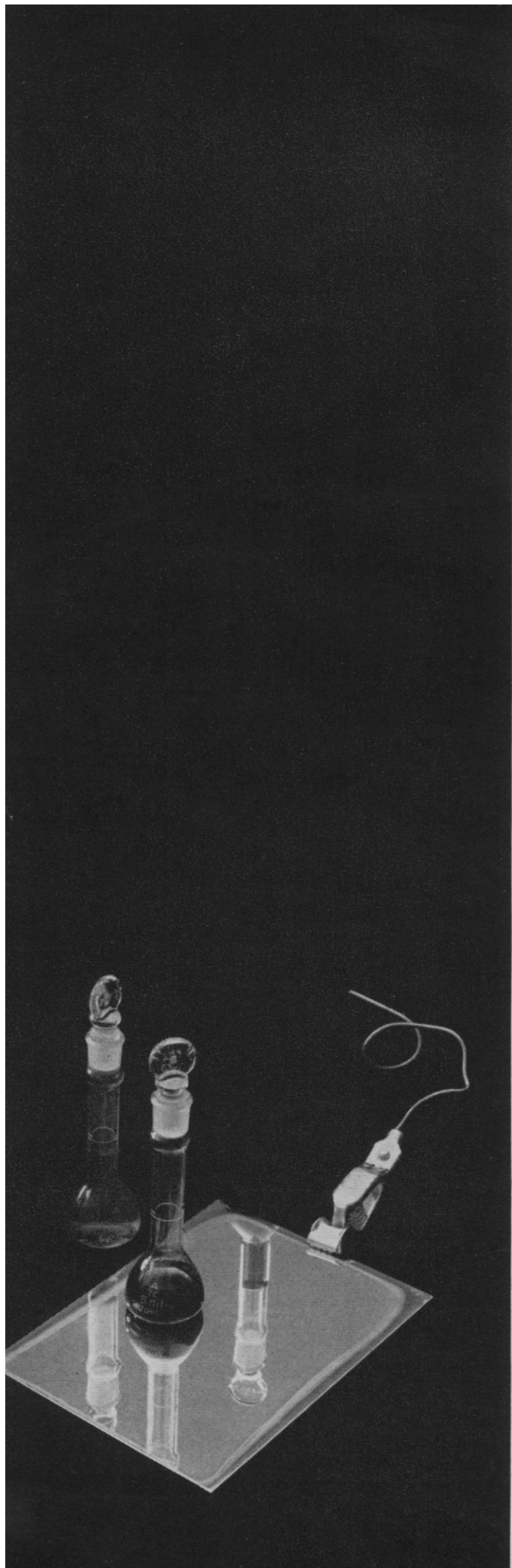
Example: Take a radioactively tagged leveler. More is adsorbed on the peaks of the surface being plated than in the valleys. Its adsorbed ions tend to block current flow, reducing metal deposition most where the ion concentration is greatest. Then add another leveler. It levels, too, but also causes even more adsorption of the *first* one on the high points. More leveling yet.

This one-plus-one-equals-three synergistic effect has been widely used in decorative plating. Now, supported by unique autoradiographic evidence, we have postulated a theoretical explanation. Details are available on request. Briefly, it involves ion interactions and adsorptions and gets deeper into matters of ion and atom bonding and bond breaking—subjects typical of persistent basic research in General Motors.

### General Motors Research Laboratories Warren, Michigan

	Before plating	With A alone	With B alone	With A & B
Amount of A adsorbed	0	113	0	189
Amount of B adsorbed	0	0	3	49
Surface roughness	304	279	254	140

Relative adsorptions and roughnesses. Plating with two organic levelers, A and B, added to solution singly and together.





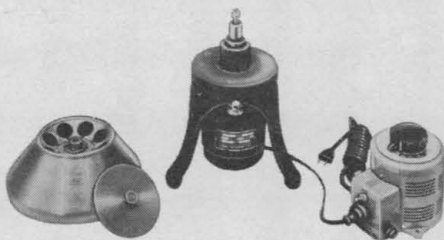
in keeping  
with the times

## MODEL "A" *Beta-Fuge* AUTOMATIC SUPER-SPEED REFRIGERATED CENTRIFUGE

- Speeds to 17,700 RPM
- Forces to 40,000 x G
- Capacity to 3,300 ml (6 x 550 ml)
- New dual temperature control range from  $-20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$
- Solid state electronic system
- New brush life indicator
- Eleven interchangeable rotors
- New sliding door cover



### And Ever Keeping Pace . . .



#### Model AX Centrifuge

- Speeds to 16,500 RPM
- Forces to 34,800 x G
- Capacity to 400 ml (8 x 50 ml)
- Rpm calibrated transformer dial

#### All-Purpose Multi-Mix Homogenizer

- Centrifuge tube attachments
- Mason jar attachments
- And many, many more



BE SURE—  
... CHOOSE  
LOURDES  
SUPER-SPEED  
CENTRIFUGES



## LOURDES INSTRUMENT CORP.

656-78 Montauk Avenue • Brooklyn 8, New York



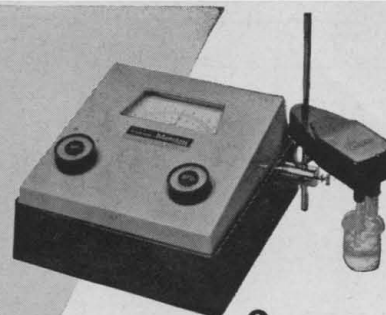
8

# Versatile pH METERS available from "SGA"

*... plus a large selection of electrodes  
and accessories*

Here are eight excellent pH Meters from three outstanding producers of laboratory instruments—Coleman, Leeds & Northrup, and Photovolt. All are drift-free. All are simple to operate and maintain. All may be used for pH, oxidation reduction, and titration measurements. And all are line-operated except Photovolt Models 125 and 180 which use ordinary radio batteries. Descriptive literature with detailed prices will be sent on request.

- 1 Direct reading to 0.02 pH from 0-14. Accuracy  $\pm 0.05$  pH. Calibration and temperature compensation adjustment.
- 2 Similar to Metrion but with control knob for temperature compensation (0-100°C); also provision for use with Coleman Titron.
- 3 Range: pH 0-14, millivolts -1400 to +1400. Direct reading to 0.02 pH. Accuracy  $\pm 0.05$  pH. Re-zeroes automatically.
- 4 Five ranges: 0-14 pH; 0- $\pm 700$  and 0- $\pm 1400$  millivolts. Readable to 0.02 pH. Accuracy  $\pm 0.07$  pH. Temperature compensator (0-100°C).
- 5 For pH (0-14) and millivolt (+400 to -400 and +800 to -800). Readable to 0.02 pH. 0-100°C temperature control. Built-in voltage selector.
- 6 Same pH and millivolt ranges as Model 110. Readable to 0.03 pH unit. Temperature control adjustable from 20° to 100°C.
- 7 Battery operated, 2000 hours service. pH range 0-14, readable to 0.03. Millivolt scale. Temperature control adjustable from 0-100°C.
- 8 Seven expanded ranges each covering 2 pH units. Also single 0-14 range and millivolt scale for titrations. Readable to 0.01 pH. Battery operated.



1  
Coleman Metrion  
H-5305X—\$139.00



2  
Coleman Metrion II  
H-5306X—\$160.00



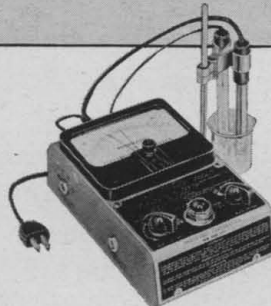
3  
Coleman  
Companion  
H-5330X—\$300.00



4  
Leeds & Northrup 7401  
H-4901X—\$330.00



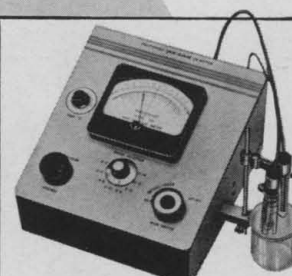
5 Photovolt Model 110  
H-3625X—\$265.00



6 Photovolt Model 115  
H-3620X—\$175.00



7 Photovolt Model 125  
H-3610X—\$225.00



8 Photovolt Model 180  
H-3615X—\$375.00

SCIENTIFIC  
GLASS  
APPARATUS  
CO. INC.  
BLOOMFIELD, NEW JERSEY



LABORATORY...  
♦ APPARATUS  
♦ INSTRUMENTS  
♦ CHEMICALS  
♦ GLASSWARE

Branches: Boston 16 Mass. Danbury Conn. Elk Grove Village Ill. Fullerton Calif. Philadelphia 2 Penna. Silver Spring Md. Syracuse 2 N. Y.



**6733**

**6722,3**

**6746**

**6754**

**H<sup>3</sup> 31% at 40 cpm**  
**C<sup>14</sup> 78% at 30 cpm**

These are room-temperature differential counting efficiencies and backgrounds. This excellent performance is a routine accomplishment for all of these Nuclear-Chicago liquid scintillation spectrometers. Each system includes a 3-channel analyzer.

**A complete line of room-temperature liquid scintillation systems—write for details.**

MODEL 6733—a semi-automatic system for use with your present scaler. \$4,375.

MODEL 6723—a 50-sample automatic system with two scalers and lister/calculator. \$10,800.

MODEL 6722—as 6723, but with lister only. \$9,900.

MODEL 6746—a 50-sample automatic system with single scaler and lister. \$7,750.

MODEL 6754—a semi-automatic system with single scaler. \$6,350.

NUC:B-3-254

EXPORT PRICES SLIGHTLY HIGHER.

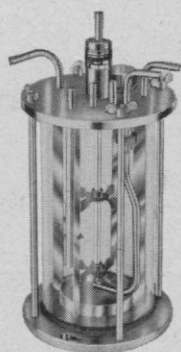
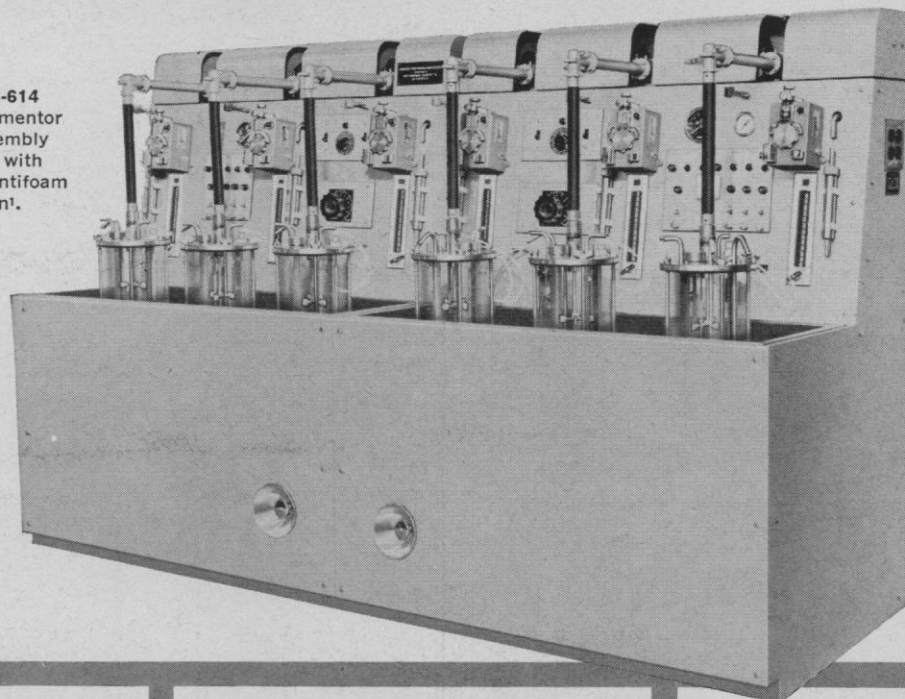


**DEPENDABLE  
SERVICE  
EVERYWHERE**

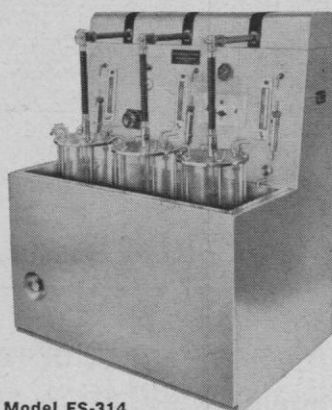


349 East Howard Avenue, Des Plaines, Illinois • Telephone 312 827-4456

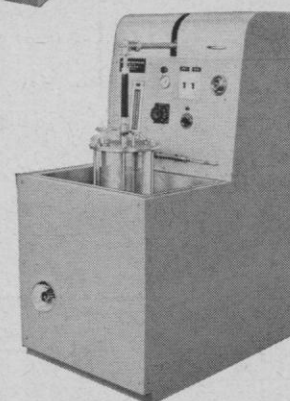
**Model FS-614**  
Six-unit Fermentor  
Drive Assembly  
Equipped with  
Automatic Antifoam  
Addition<sup>1</sup>.



**Model F-05**  
Stainless Steel Fermentor



**Model FS-314**  
Three-unit Fermentor Drive Assembly



**Model FS-1114**  
Single-unit Fermentor Drive Assembly

## **NBS FERMENTATION APPARATUS for the growth of Bacteria, Fungi, Yeasts, Tissue Cultures and Viruses**

**For Aerobic  
and  
Anaerobic Studies of  
Microbial and Chemical  
Processes at Laboratory  
and  
Pilot Plant Levels**

The NBS Fermentor Drive Assemblies offer a convenient and efficient means for culturing microorganisms under well-defined conditions. Temperature, agitation, pH<sup>1</sup>, air volume and pressure can be selected and rigidly controlled while sterility is maintained.

Stainless steel fermentors with Pyrex glass jars are available in 5, 7½ and 14 liter sizes. Impellers are driven through a non-freezing, stainless steel agitator housing which incorporates stainless steel ball bearings and leak-

proof Teflon seals. The fermentors are easily and quickly disconnected from the drive and will sustain *repeated* autoclaving.

Water bath temperature is adjustable up to 60°C ± 0.5°C. A continuous-duty, variable speed motor enables impeller speed to be regulated between 150 and 750 rpm. Performance is quiet and dependable under continuous operation. All NBS apparatus is unconditionally warranted for one full year.

**WRITE FOR CATALOG F55/10113**

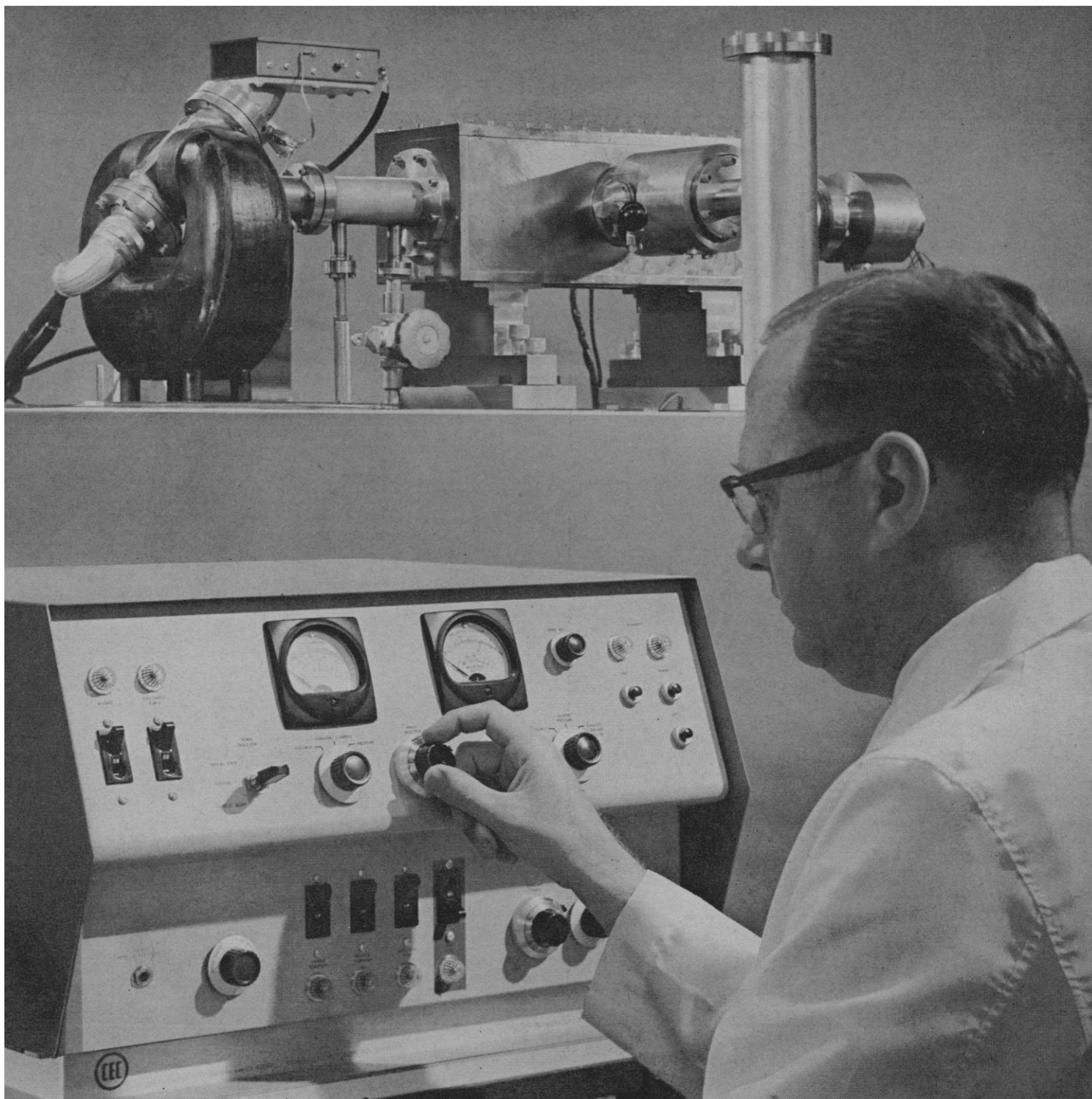
*(1) Automatic pH Control and Antifoam Addition optional*



**New Brunswick Scientific Co., Inc.** 1130 Somerset St., New Brunswick, N.J.

*Manufacturers and Distributors of Precision Laboratory Apparatus*





## Pinpointing nothingness?

21-613 RGA MEASURING OUT-GASSING  
FOR SPACE MATERIALS RESEARCH

### Cover the spectrum better with CEC's Residual Gas Analyzers

If the realm of high vacuum is your domain, CEC's Residual Gas Analyzers cover the spectrum better than any others, and help you in five areas:

1. Gas identification
2. Partial pressure measurement
3. Leak detection
4. Out-gassing analysis
5. Permeability studies

Because they are mass spectrometers, CEC's Residual Gas Analyzers serve as specific vacuum gages, pinpoint and measure leaks, help you study out-gassing and select proper pumping techniques. And,

they're the most accurate pressure gages you can get.

Very effective for many applications are CEC's 21-612, 21-613-1, and 21-613-2. The 21-613-1 has high resolution: measures partial pressure  $5 \times 10^{-11}$  Torr, m/e 2-150, complete resolution at 150. The 21-613-2 is more sensitive: a partial pressure  $5 \times 10^{-12}$  Torr, m/e 2-150, resolves at 44. Both have cycloidal tubes for "perfect" focusing, with recorded peaks having "flat tops" and no "tails" thereby allowing better quantitative measurement.

CEC's 21-612 (right) is less expensive,

bakeable to  $450^{\circ}\text{C}$  for high vacuum and has a rapid response and linear scan. Further data? Call your CEC office, or write for Bulletins CEC 21612-X7 and 21613-X11.



**CEC**

Analytical & Control Division

**CONSOLIDATED ELECTRODYNAMICS**

A Subsidiary of Bell & Howell • Pasadena, California

# NOT JUST BLOOD GAS TENSIONS...



a complete system  
for blood acid-base  
measurements

- FAST
- RELIABLE
- FIELD PROVEN
- ULTRA-MICRO

In the increasingly important field of acid-base balance in the blood system, *no reliable diagnosis can be made from pH alone, — or from  $p\text{CO}_2$  alone.*

Respiratory and Metabolic disturbances are difficult to identify and segregate for therapy, unless *all* the parameters of the acid-base status are known.

The Astrup Technique includes not only an Ultra-Micro arterial blood sampling method, but — with the Radiometer AME1 — a complete system for exposing and evaluating all the separate factors related to both the volatile and fixed acids in the system.

Quick, reliable, and *field proven*, the AME1 requires only a few moments, and a few drops of blood, to accurately define all the values of: pH,  $\text{CO}_2$  tension, Bicarbonates (both Actual and Standard), Buffer Base, total  $\text{CO}_2$ , and a figure of excess acid or base in the system for chemical therapy.

The unit is completely self-contained for both sampling and measurement, and is mounted in a wheeled cabinet for rapid movement from clinical to research laboratory, to surgery, or to intensive care wards.

Write for complete literature and reprints of pertinent scientific papers — and should you wish it, a list of the many distinguished and satisfied users in your area.

(Radiometer also supplies a Modular system of similar instrumentation for fixed installation on a bench top.)

## THE ASTRUP ULTRA-MICRO APPARATUS *by Radiometer*

SOLD AND SERVICED IN U.S.A. BY  
**THE LONDON COMPANY**

3355 Edgecliff Terrace

CLEVELAND 11, OHIO



# RADIOMETER

72 Emdrupvej

COPENHAGEN, DENMARK

In Canada: Factory representatives Bach-Simpson Limited; sold and serviced by Canadian Laboratory Supplies Limited

## More preservation progress using liquid nitrogen

### Notes on preserving parasitic protozoa, tissue cultures...successful applications of new cryogenic cooling systems...latest cryobiology equipment.

Significant achievements were recently reported on the use of liquid nitrogen for freezing and storage of biological specimens. Diamond, et al.<sup>1</sup> successfully applied cryogenic techniques to preserve a selected group of parasitic protozoa for extended periods. Using two- or three-step freezing cycles and storing at liquid nitrogen temperature (-196°C.), this research team was able to preserve *Entamoeba histolytica*, *Trichomonas gallinae*, *T. vaginalis*, *T. foetus*, *T. hominis*, *Trypanosoma cruzi*, and *T. rana-rum*, for unprecedented times. In evaluating the efficiency of this liquid nitrogen preservation technique, they reported:

"No difference in yields were found between samples of a given species thawed 24 hours after freezing and those thawed after the longest period of storage. This indicated absence of decay during storage..."

At dry ice temperature, degradative activity commonly occurs.

Greaves, et al.<sup>2</sup> designate the two major biological products requiring low temperature storage as: (1) the preservation of cells for tissue culture and (2) the preservation of erythrocytes of rare blood groups. These authors note that the key to very low temperature storage is reliability, and: "The LINDE containers require recharging only once a week as routine and in an emergency (they) will last from 28 to 90 days."

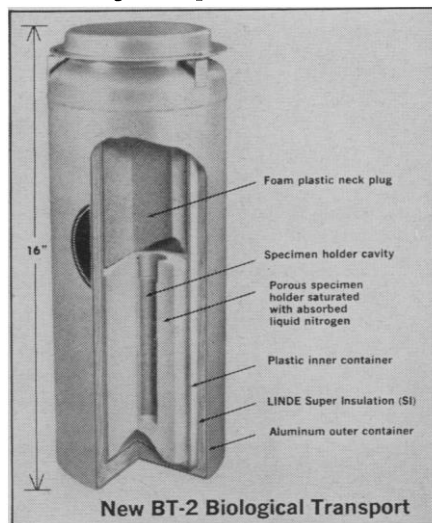
In this paper the authors also describe a modification to the plug of the LINDE LR-25B Refrigerator, which serves as a controlled-rate cooling device.

#### LATEST EQUIPMENT FROM LINDE

The BF-5 Biological Freezer provides a simple, economical means of freezing small quantities of biological materials with reasonable accuracy. Designed for use with the LINDE LR-35 Refrigerator, this low-cost, plug-type freezer holds nine 1.2 cc. am-

pules. The refrigerant is cold nitrogen gas, evolving from liquid nitrogen in the refrigerator. Cooling rate, from ½°C. to 7°C. per minute, depends upon the number and position of ampules.

The BT-2 Biological Transport (see illustration) is a practical, lightweight container that is designed to permit, for the first time,



shipment of biological materials at cryogenic temperatures via postal service or common carrier.

This new container completely eliminates loss of refrigerant by spillage during shipment. The new BT-2 features a porous specimen holder-block, which absorbs liquid nitrogen and retains it as a liquid until heat from the refrigeration load gradually evaporates this liquid as cold gas. Liquid nitrogen lasts up to five days.

The LR-120 Refrigerator combines convenience and space economy. As the first liquid nitrogen refrigerator to offer square exterior and interior geometry, it permits more convenient use of laboratory floor space and more efficient utilization of internal storage space. Completely non-mechanical, the LR-120 features LINDE's exclusive Super Insulation (SI). Storage space, providing a total bulk capacity of four cubic feet, is divided into four compartments. Storage temperature is -196°C. below and -130°C. above liquid level. Access is via a large opening covered by a two-section plastic lid. The LR-120 holds up to 9600 ampules; liquid nitrogen capacity is 120 liters. It is especially recommended for applications requiring frequent handling of stored materials.

LINDE offers a complete line of quality cryogenic equipment—biological refrigerators, freezers, and other cryogenic containers—as well as fast, nation-wide delivery of liquid nitrogen and top-flight technical service. To secure reprints and full information on latest developments in cryobiology, complete and mail the coupon below.

(1) Diamond, L. S., Meryman, H. T., and Kafig, E., *CULTURE COLLECTIONS: PERSPECTIVES AND PROBLEMS* (Ed. Martin, S. M.): University of Toronto Press (1963). (2) Greaves, R. I. N., Nagington, J., and Kellaway, T. D., *Fed. Proc.*, 22:90 (Jan.-Feb.) 1963.

CHECK—CLIP COUPON—ATTACH TO BUSINESS LETTERHEAD

Dept. SC-102, Linde Division  
Union Carbide Corporation  
270 Park Avenue, New York, N.Y. 10017

Please send the following:

☐ Reprint: Preservation of Living Cells by Freezing and by Drying by R. I. N. Greaves et al.

☐ Cryobiology Report No. 3

Information on:

☐ LINDE Liquid Nitrogen Refrigerators  
☐ BT-2 Transport ☐ BF-5 Freezer

☐ PLEASE ADD MY NAME TO MAILING LIST

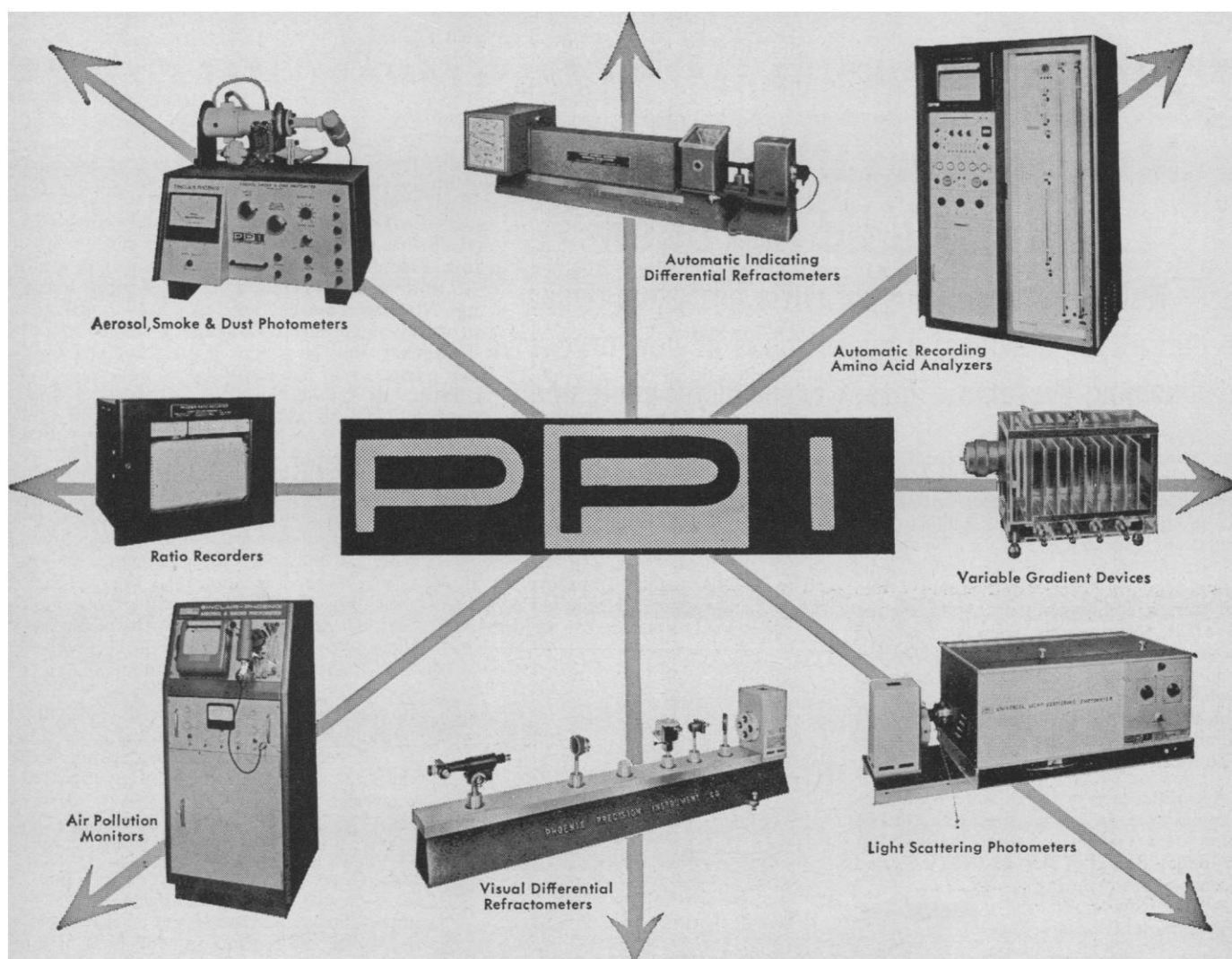


**LINDE  
DIVISION**

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.



# Phoenix Scientific Instruments — Automatic Control Systems - *for Industry and Research*



## OTHER PHOENIX PRODUCTS

Dual Photomultiplier Type Photometers • Electron Multiplier Photometers • Turbidimeters • Colorimeters • D. C. Amplifiers  
 Automatic Recording Mass Collecting Differential Refractometers • Regulated High Voltage Power Supplies • Optical Benches  
 Maple Syrup and Honey Comparators • Monochromatic Light Sources • Color Standards • Lenses, prisms, mirrors, and reticles  
 Colorimetric Absorption Cells • Precision Electro-phoresis Cells • Flanged glass pipe ( $\frac{1}{4}$ " I.D. to 6" I.D.) • Flow meters and tubes  
 Precision Bore Glass Tubing — round, square, rectangular, and conical (from .002" I.D. to 6" I.D.) tolerance plus or minus .0002"  
 Manometers • Glass Venturi tubes and nozzles • Glass pumps and valves • Glass sheets, plate, rod, and balls  
 Recording Flow Photometers • Continuous Flow Colorimeters • Nephelometers  
 Recording Differential Refractometers for Process Streams  
 Continuous Recording Nephelometers

PHOENIX FACILITIES AND PERSONNEL ARE AVAILABLE FOR • CONSULTATION • RESEARCH • DEVELOPMENT • SERVICE



**PHOENIX PRECISION INSTRUMENT COMPANY**  
 3803-05 North Fifth Street, Philadelphia 40, Pennsylvania, U.S.A.  
 BALDWIN 8-7417 • Cable PPI CO.

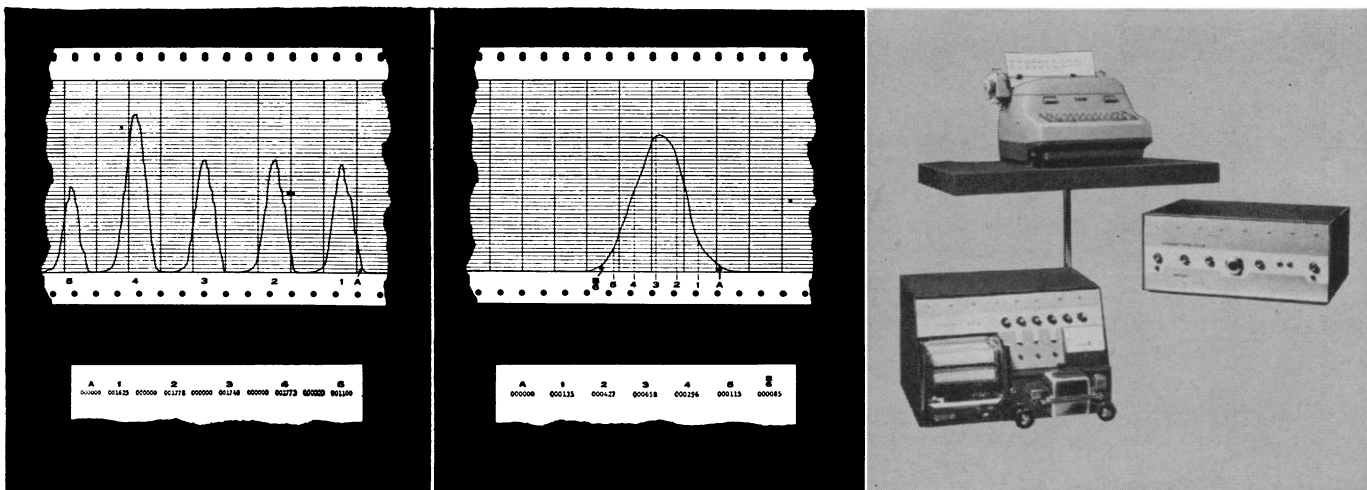
NOW . . .

# SCAN CHROMATOGRAMS AUTOMATICALLY

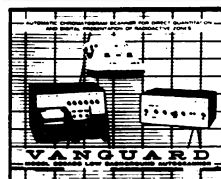
## New Ultra-Sensitive Vanguard AUTOSCANNER Detects and Presents Radioactivity In Direct Digital Form

Now both qualitative and quantitative assays of chromatograms can be performed automatically *on the intact strip* with greater accuracy and efficiency than ever thought possible. The exclusive, ultra-sensitive Vanguard Model 880ADS Low Background AUTOSCANNER with Automatic Data System scans, detects and presents radioactivity in direct digital form, eliminating the need for mechanical integration, planimetry and triangulation. Designed for scanning of tritium, carbon-14, sulphur-35 and other low-energy, beta-emitting radioisotopes, the AUTOSCANNER features windowless, 4 pi detection with a total background of less than 10 cpm. Two mode Logic Function Control permits programming to present various parameters of entire scan while eliminating unwanted data. Digital information, therefore, may be utilized through all phases of the quantitating procedure.

Investigate today! See how the designed-in versatility of the Model 880ADS can meet your scanning applications with clear, precise data presentations in a minimum of time with little or no operator supervision.



Shown above are the two modes of Data Presentation available with the model 880ADS. Digital information obtained in the Peak Print mode (left) and the Interval Print mode (right) is utilized through all phases of the quantitating procedure.



885 Glass Plate Scanner available with above model 880. Complete specifications available on request.

**WRITE FOR THIS BOOK-LET . . .** Outlines distinctive features and operational characteristics of the Vanguard Model 880ADS Low Background AUTOSCANNER.

VANGUARD



## VANGUARD INSTRUMENT COMPANY

Designers and Manufacturers of Precision Instrumentation for Research

P. O. Box 244, LaGrange, Illinois 60525, Fleetwood 2-1600 • Regional Offices: New York, N. Y., 520 Fifth Avenue, TN 7-1998  
San Francisco, Calif., 115 New Montgomery Street, EXbrook 2-0511 • Baltimore 2, Maryland, 217 North Calvert Street, 301-727-3666

# IN THE FOREFRONT OF RESEARCH



# RC-2

## Automatic Superspeed Refrigerated Centrifuge

**SORVALL**

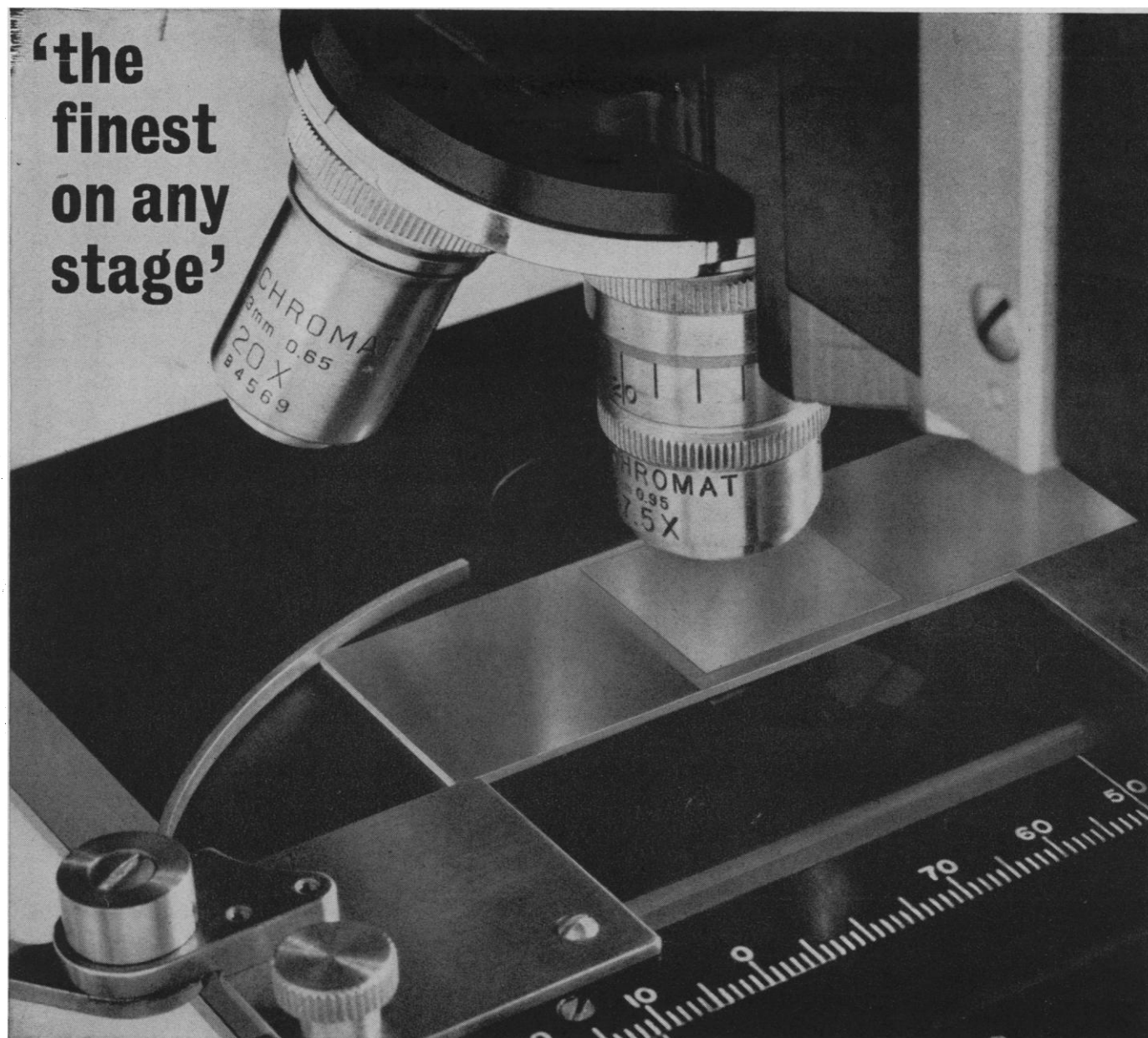
From its convenient, elevated control panel, to the completely smooth-walled stainless steel combination rotor-chamber/evaporator, the RC-2 stands out as the foremost Refrigerated Centrifuge in the Superspeed range. Acceleration, Timing, Braking, Temperature Control, etc. are all automatic. High gravities reduce running time; acceptance of six different rotors directly onto the unequalled SORVALL-Blum Gyro-Action self-balancing drive provides functional versatility in routine and research applications. SS-34 Rotor adapts to SORVALL Continuous Flow System which collects sediment in 8, 4, or 2 standard 50 ml stainless steel tubes. We invite you to "lift the lid" on the RC-2 and see for yourself why it is *the* Refrigerated Centrifuge designed to researchers' requirements. 17,500 rpm —37,000 x G (with SS-34 Rotor). Write for Bulletin SC-10RC-2

***Ivan Sorvall, Inc.***

**Norwalk, Connecticut**

SORVALL CENTRIFUGES SERVE YOU BEST





**'the  
finest  
on any  
stage'**

# **GOLD SEAL<sup>®</sup> SLIDES and COVER GLASSES**

Microslides and cover glasses bearing the familiar "Gold Seal" label have set standards of quality for many years. They are as perfect as painstaking manufacturing processes can make them. And as a final safeguard, they are individually inspected before being packaged.

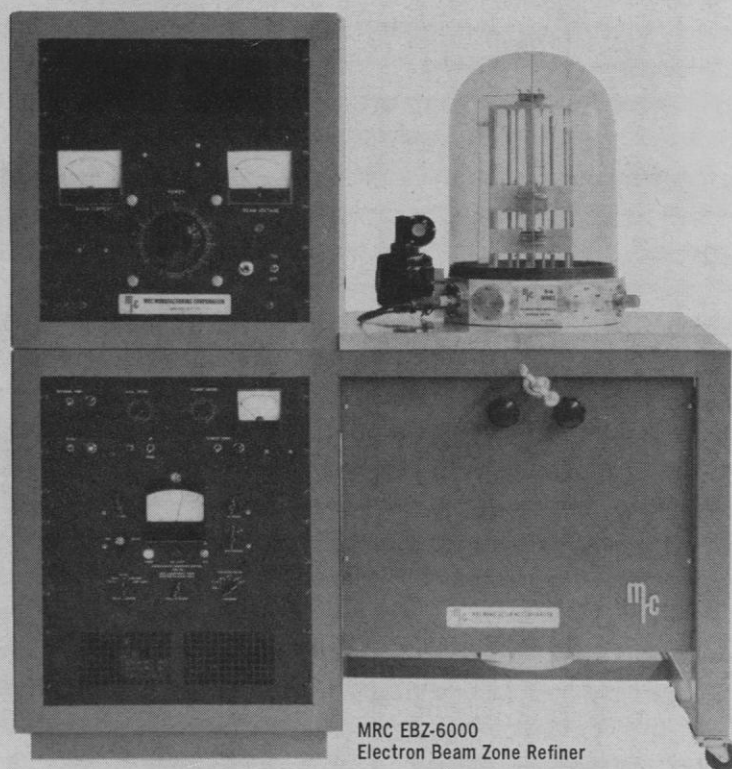
"Gold Seal" microslides are made of flawless, colorless, non-corrosive glass. Each slide is of uniform thickness, length, and width and has ground, polished edges. Each is precleaned and ready for use. A special-edged Stand-Rite dispenser box, used to pack all "Gold Seal" microslides, keeps slides upright, permits finger-tip removal without smearing or fingerprinting.

"Gold Seal" cover glasses are of equal excellence. Carefully selected and guaranteed perfect, they are made of rigidly specified, non-corrosive, nonfogging glass of uniform thinness. Available in every convenient size and thinness, "Gold Seal" cover glasses are dispensed clean from lint-free plastic boxes holding one ounce of glass.

Your dealer carries "Gold Seal" microslides and cover glasses and a large selection of microslide boxes, cabinets, and other accessories. Illustrations and full details of all items may be found in the Clay-Adams catalog No. 107. If you do not have a copy, write today on your institutional letterhead to:

*Clay-Adams*  
New York 10, N. Y.

**Look how our Collar has grown**



...into the MRC Modular Systems of Vacuum Equipment for a broad spectrum of vacuum research and applications. Latest developments are the Electron Beam Floating Zone Refining Module, and the Electron Beam Thin-Film Vapor Deposition Module. Both of these Electron Beam Modules utilize the MRC V-4 Feed-Thru Collar. Its uniformly flanged ports act as the versatile single link between Electron Beam Refiner or Deposition unit and power supply, controls, instrumentation and pumping station. All MRC modules, components, assemblies and 33 Feed-Thru vacuum tools can be used interchangeably in the Collar, which seals to any base plate without drilling.

Modular design means you can buy and use the Electron Beam Zone Refiner and Vapor Deposition Modules separately, or included in an MRC Modular System of Vacuum Equipment complete from pumping station to bell jar. All MRC components are available separately for building or adding to your own equipment.

As your guarantee of performance, every MRC System is use-tested in MRC's plant before sale. Write for specification sheets, mentioning your special interests.



**MRC MANUFACTURING CORPORATION**

406 Glenshaw Road, Orangeburg, New York

a subsidiary of MATERIALS RESEARCH CORPORATION

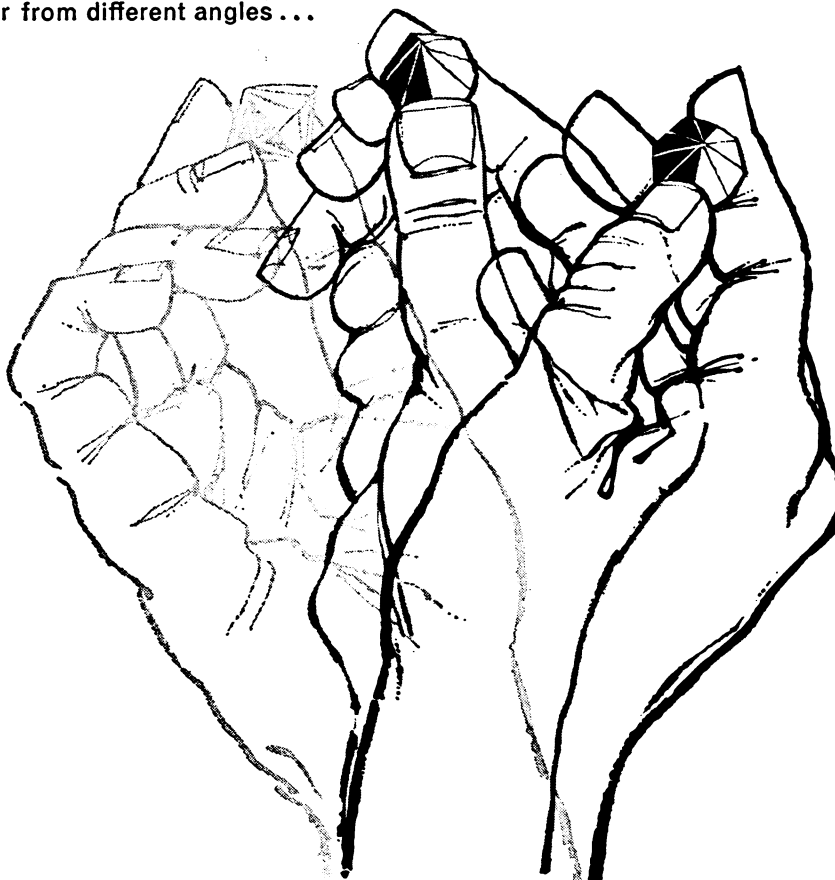
Distributed in Western U.S.: Van Waters and Rogers, Inc.

Orangeburg, N. Y.; Medina, Ohio; Santa Ana, Cal.; and Wakefield, Mass.

Visit us at Booth 7, American Vacuum Society Show, Boston, Mass., October 16-18.

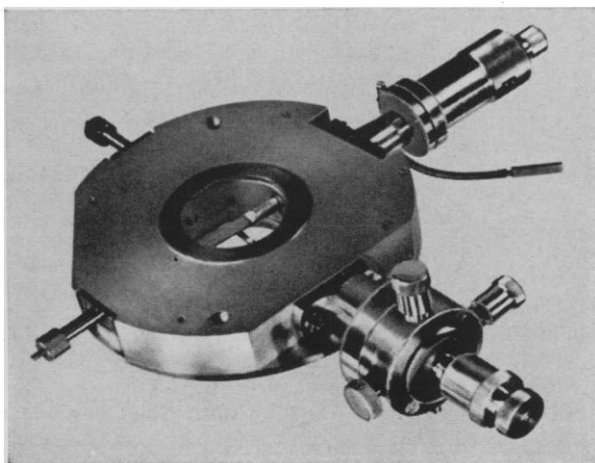
Visit us at Booth 1160, Metals/Materials Show, Cleveland, Ohio, October 21-25.

looking at the matter from different angles...



## ...is equally easy with Norelco Electron Microscope EM 200

Two-dimensional lateral displacement and two independent angular movements of the specimen under investigation are obtained by replacing the standard specimen stage with the **new rotating/tilting specimen stage.**



This new accessory, the first of a series, is specially designed to meet the requirements of **metallurgists** interested in crystalline structures. The specimen holder of the new stage has a rotatable ( $\pm 160^\circ$ ) specimen carrier, and may be tilted  $\pm 30^\circ$  about its axis.

The specimen can also be moved a maximum of 2.4 mm in two directions at right angles, in a plane perpendicular to the beam axis. The new specimen stage is equipped with the same type of airlock as used in the standard stage; the specimen can be kept in vacuum during the exchange of film, plates, or of the filament. An extra opening is provided to insert auxiliaries for stressing, heating or cooling of the specimen. A point resolution of 10 Å is obtainable.

### **PHILIPS ELECTRONIC INSTRUMENTS**

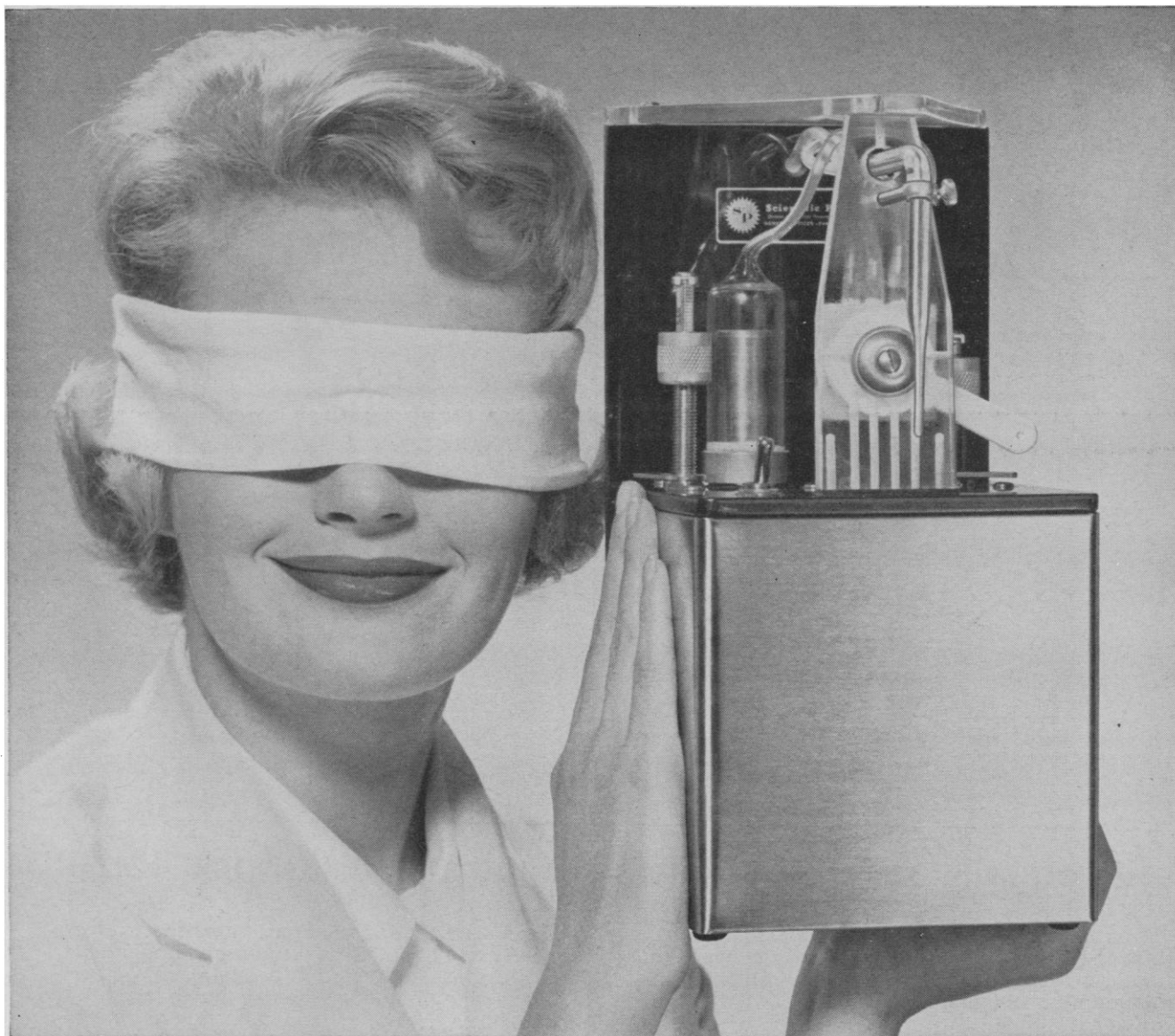
*A Division of Philips Electronics  
and Pharmaceutical Industries Corp.*

750 South Fulton Avenue, Mount Vernon, N. Y.  
Phone: 914-664-4500

# *Norelco*<sup>®</sup> electron optics

ELECTRON PROBE MICROANALYZERS • INDUSTRIAL RADIOGRAPHIC EQUIPMENT • PROCESS CONTROL INSTRUMENTATION  
X-RAY SPECTROGRAPHS • ELECTRON MICROSCOPES • X-RAY DIFFRACTOMETERS • NUCLEAR INSTRUMENTATION





With the S/P Auto Dilutor, you could prepare  
**repeat-dilutions blindfolded**

The S/P Auto Dilutor lets you do a series of identical dilutions faster, easier than ever before. It saves hours of pipetting time and pipette cleaning; eliminates costly glassware breakage. Accuracy better than 1%. Operation is simple: Preset sample and diluent volumes with direct-reading controls . . . *the rest is automatic.* Moving lever upward, draw sample into glass tip. Depress lever, sample is dispensed together with diluent. It's that simple . . . takes just seconds. There's no

cleaning required. The sample contacts only the glass tip which is thoroughly diluent-rinsed during each cycle. Put the Auto Dilutor to work in your lab—it's available from S/P exclusively.

**No. P5080-1**—S/P AUTO DILUTOR, 2 ml. to 20 ml. capacity diluent syringe, .01 ml. to 0.1 ml. sample syringe . . . . . **\$275.00**

**No. P5081-1**—S/P AUTO DILUTOR, 2 ml. to 20 ml. capacity diluent syringe, .03 ml. to 0.3 ml. sample syringe . . . . . **\$275.00**



For demonstration or information, contact your S/P Representative . . . or write

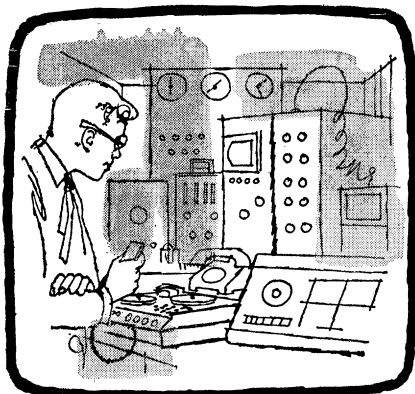
**scientific products**

DIVISION OF AMERICAN HOSPITAL SUPPLY CORPORATION

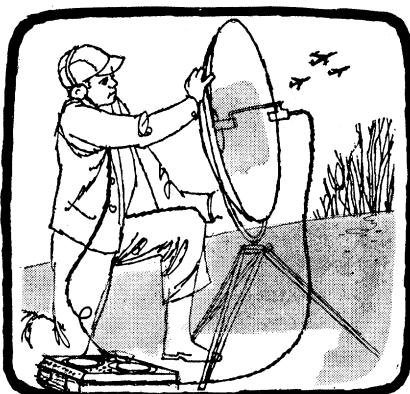
GENERAL OFFICES: 1210 LEON PLACE, EVANSTON, ILLINOIS

Regional Offices: Atlanta • Boston • Charlotte • Chicago • Columbus • Dallas • Detroit • Kansas City  
 Los Angeles • Miami • Minneapolis • New York • San Francisco • Seattle • Washington

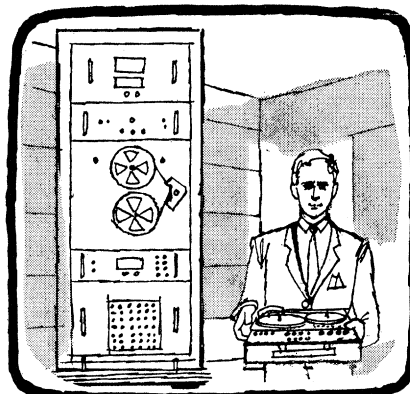
Export Department—Flushing 58, L. I., New York. In Canada: Canadian Laboratory Supplies Limited.  
 In Mexico: Hoffmann-Pinther & Bosworth, S. A.



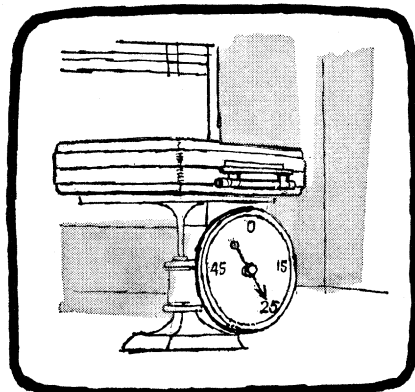
IF YOU ARE RECORDING IN THE LAB...



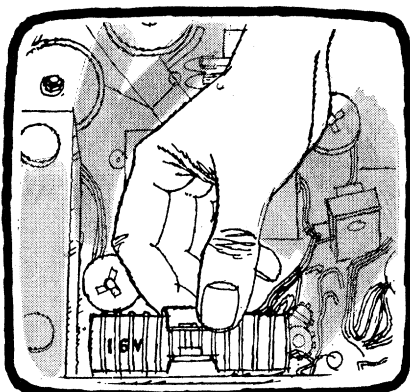
OR IN THE FIELD, YOU CAN NOW...



GET PRECISION PERFORMANCE...



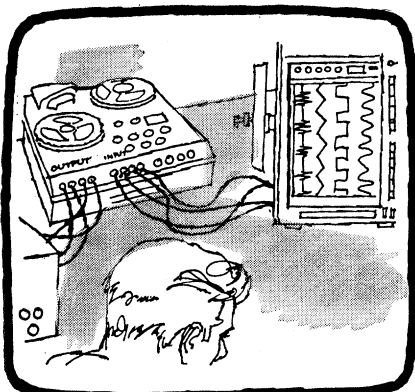
IN A 25-POUND RECORDER/REPRODUCER



THAT IS COMPLETELY SELF-POWERED,



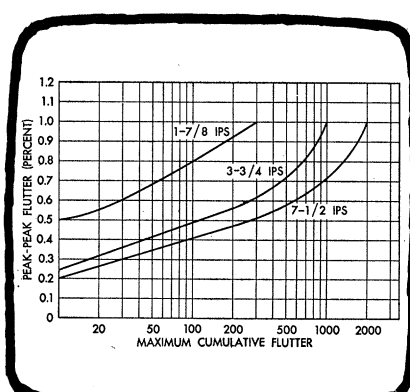
CAN BE HAND-CARRIED ANYWHERE,



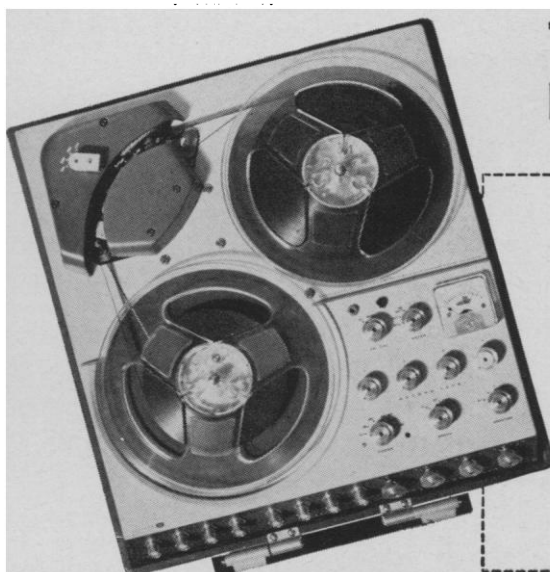
CAN SIMULTANEOUSLY RECORD/REPRODUCE  
4 TRACKS.

DIRECT SYSTEM	
*Tape Speed	Frequency Response $\pm 3$ db
1 7/8	50—5,000
3 3/4	50—10,000
7 1/2	50—20,000
FM SYSTEM	
Tape Speed	Frequency Response $\pm 1/2$ db
3 3/4	0—1,000
7 1/2	0—2,000
*optional speeds available	

FM OR DIRECT,



WITH EXTREMELY LOW FLUTTER,



## THE NEW LOCKHEED 411 INSTRUMENTATION RECORDER

MAIL COUPON TODAY FOR FULL INFORMATION

LOCKHEED ELECTRONICS COMPANY/TAPE PRODUCTS DEPT.,  
INDUSTRIAL TECHNOLOGY GROUP, Metuchen, New Jersey

Mr. Bernard Mayer: Send me free product specification folders  
on the Lockheed 411 instrumentation recorder/reproducer.

NAME .....

TITLE .....

COMPANY .....

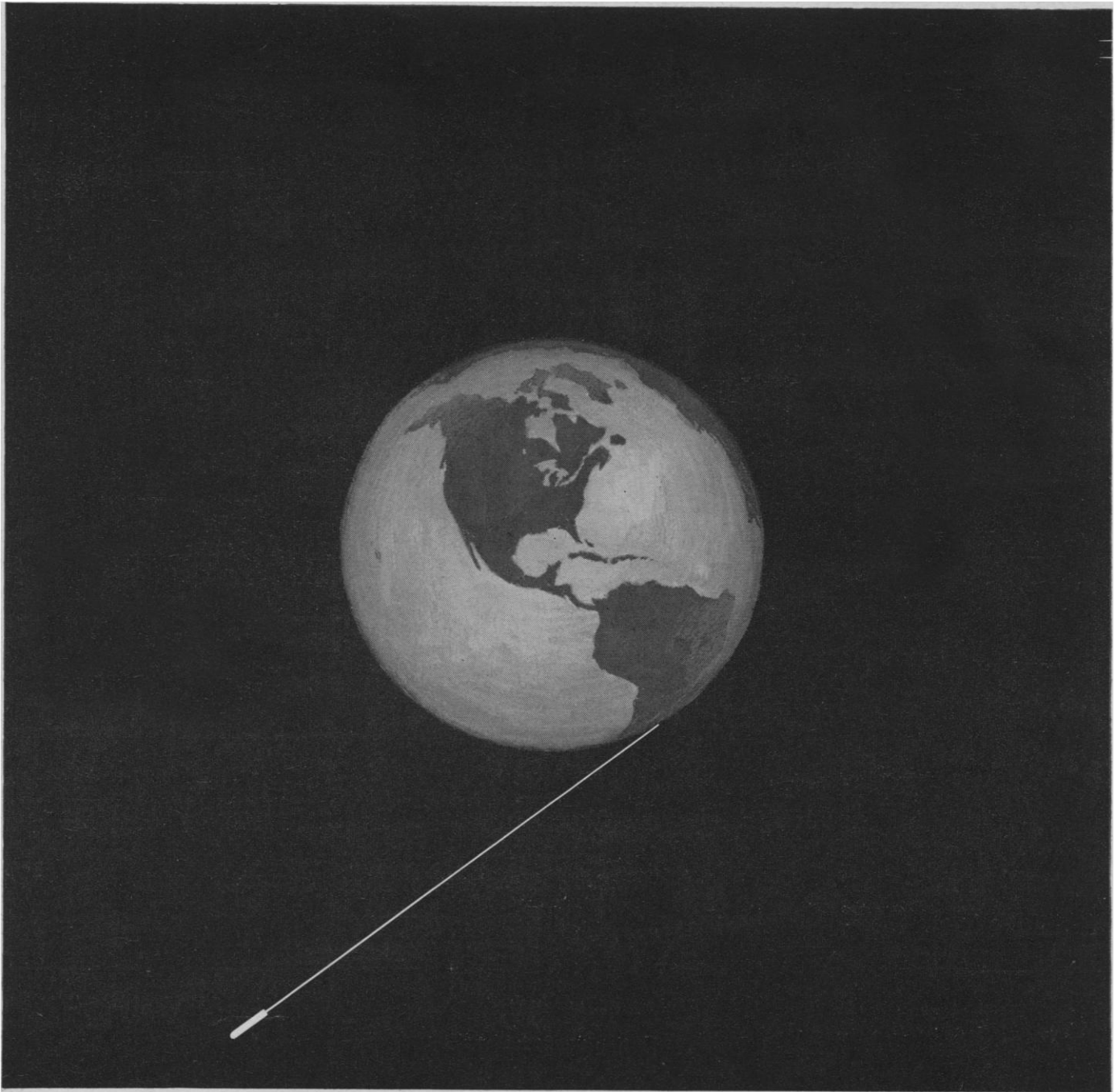
ADDRESS .....

CITY..... STATE .....

**LOCKHEED ELECTRONICS COMPANY**

A Division of Lockheed Aircraft Corporation/Metuchen, N. J.

S-10



***Some of our work is "out of this world!"***

More and more of our sterilization work for NASA will be "out of this world." Space probes, equipment, satellites, interplanetary vehicles . . . all will be sterilized to prevent earth-type contamination from being transferred into space or to other planets. Castle also does an excellent job setting up sterilization programs for various industries right here on earth. Our know-how and equipment have provided positive sterilization for

thousands of items, from adhesive bandages to photographic film. Remember, sterilization ideas *start* with Castle. For more information on our Contract Sterilization, and Process Development plans, write to the Wilmot Castle Company, 1734 E. Henrietta Road, Rochester 18, New York.

***Castle*** Subsidiary of Ritter Company Inc.





## \*Autoclear...THE NEW LOOK IN PLASTIC TUBES

The Autoclear tube — a new development by IEC — can substantially cut your laboratory tube costs. It's absolutely clear. Clear as glass. But it won't break. It's made of a special high impact polycarbonate plastic. You can drop it. Step on it. Hit it with a hammer — it just won't shatter. You can centrifuge it to 100,000 XG. Autoclave it at 285° F. Re-use it over and over again. Autoclear tubes are resistant to most laboratory chemicals.

And they're cheap — not just economical — cheap. When you consider their low initial cost and long life, you can easily see the favorable impact they'll make on your lab budget.

CAT. NO.	DESCRIPTION	LIST PRICE/100 TUBE CASE		
		1-4	5-19	20+
1648	15 ml, 16 mm x 114 mm	25.20	23.80	22.40
2810*	15 ml, 15 mm x 119 mm	29.70	28.05	26.40
1650	50 ml, 29 mm x 104 mm	31.50	29.75	28.00
2809*	50 ml, 29 mm x 133 mm	36.00	34.00	32.00

\*Conical Style

Thirteen other sizes are available ranging from 3 to 125 ml. Have your IEC dealer deliver a trial case. You will see what we mean — clearly!

Write for 12-page brochure on IEC plastic ware.

**INTERNATIONAL  EQUIPMENT CO.**

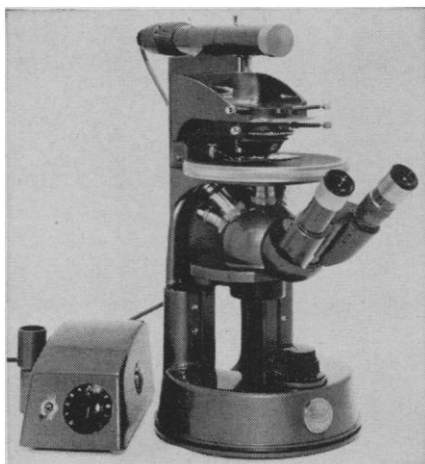
300 SECOND AVENUE • NEEDHAM HEIGHTS 94, MASS.



## VICKERS BRIEFS

### *Instruments and Applications*

#### The Vickers Inverted Biological Microscopes



Inverted Microscope with Baker Trilux Condenser allowing instant interchange between regular, dark ground and phase contrast examination.

This new series of microscope stands has been produced to suit the needs both of those who are concerned with the examination of material in large flasks and those who wish to employ all techniques of high-powered microscopy and photomicrography on preparations which may or must be viewed with slide or chamber in inverted position.

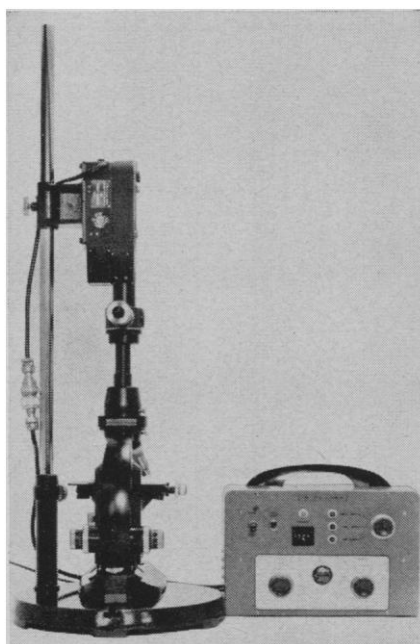
A feature of the design is that the stage is fixed and does not move upon manipulation of the focusing controls. Stability is further increased by the employment of ball bearing focusing slideways, set unusually far apart and of extra length, which move objectives and body tube. An omni-directional gliding stage provides for fast scanning and precise positioning of the object.

The focusing substage can be swung off the optical axis so as to accommodate even very large bottles and flasks. With the substage in use accessories are provided for normal transmitted light, dark ground or phase contrast examinations at all magnifications. A special long working distance objective is offered, initial magnification 20X, N.A. 0.25, working

distance 14mm, which can be used either dry or immersed, with or without a cover-slip.

Accessory equipment for simultaneous viewing and 35mm photography can be employed. The new Vickers Automatic Exposure equipment (which provides for automatic integrating calculation of exposure time and actuation of electromagnetic camera shutter) ensures the obtaining of rapid, correct and uniform exposures.

#### Vickers-Vinten Equipment for Time-Lapse Cine-photomicrography



Vickers-Vinten Time Lapse Equipment.

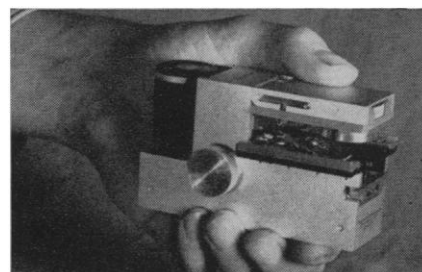
Featured in this new equipment is an Electronic Time Lapse unit of extraordinary versatility which has been developed in collaboration with Dr. R.

Barer and Mr. J. Underwood, Oxford University. With this unit the 16mm Vinten Camera can be operated on Single Shot, Time Lapse or Continuous (8, 16 or 24 frames per second) settings, with changeover between these instantaneous. On the Time Lapse setting any of 15 time intervals from  $\frac{1}{4}$  second to one hour can be dialled in. Nine different exposure times from  $\frac{1}{4}$  sec. to 1 minute can be selected. A zeroing frame counter is fitted as well as provision for switching off an external light source between exposures (when interval times longer than one minute are selected).

The Vinten 16mm Scientific Camera Mk 1. has been especially designed for time-lapse applications. It is remarkably free of vibration. Construction is at once rugged and precise — its operation is absolutely dependable at any speed and over long periods of time. A 200 ft. film magazine is supplied.

The viewing system shown in the photograph allows the operator the choice of (1) viewing object or (2) monitoring light level, either simultaneously with exposure.

#### The McArthur Microscope



The McArthur Microscope shown was originally designed for malaria diagnosis and control work in the field in Southeast Asia. It can be quite easily carried in a coat pocket, but retains all the performance advantages of a full size instrument. A full range of achromatic and fluorite objectives is available as well as dark ground accessories. Illumination can be by mirror or by a battery or transformer operated built-in light source.

Biological • Metallurgical • Polarizing — MICROSCOPES — Student • Routine • Research • Special Research



COOKE, TROUGHTON & SIMMS, INCORPORATED  
91 WAITE STREET, MALDEN 48, MASSACHUSETTS  
IN CANADA: DON MILLS, ONTARIO

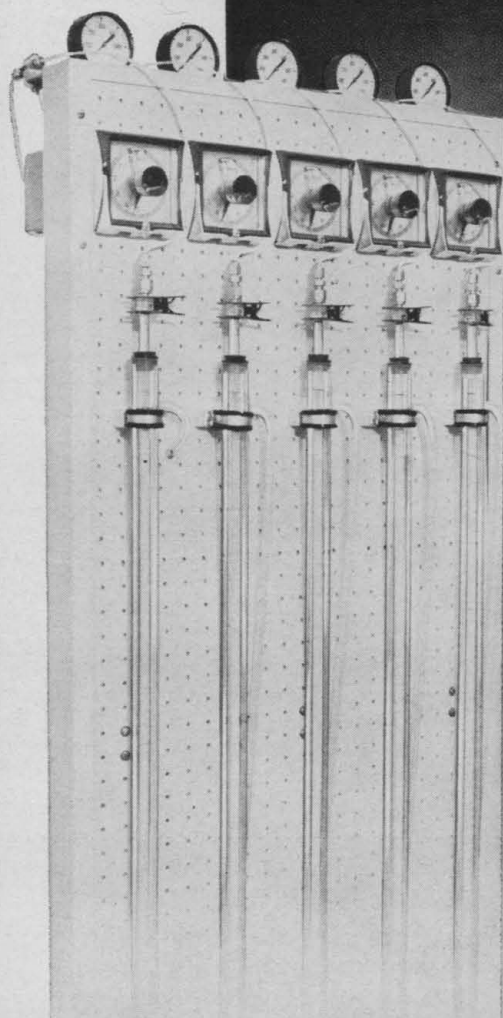
Metallographs • Dilatometers • Thermobalances • Particle Counting and Sizing Equipment

now automatically

...up to **FIVE**

amino acid chromatograms  
in 24 hours

(without human intervention)



**Load 1, 2, 3, 4 or 5...**

columns depending on your daily workload. What's more, you can adapt your present AutoAnalyzer system to this new technique.

Load it, set it and forget it...samples are automatically programmed one after the other...next day you'll have up to five complete chromatograms from a like number of samples. Technicon's accelerated Amino Acids AutoAnalyzer separates and analyzes the amino acids normally found in protein hydrolysates in less than five hours

...one machine completes the separation and analysis of up to *five different* samples in just one day.

One Chromatogram automatically follows another from start to finish with no human intervention. Here's how...merely arrange the required chromatographic columns (up to five) in series and autoanalyze the column effluents in pre-timed sequence. This advance in ion exchange chromatography is made possible by the superior resolving power of Technicon's unique Chromobead\* resin...plus new chromatographic columns which are eluted by a very steep pH and ionic strength gradient.

TECHNICON®  
*AutoAnalyzer*®

\*Trade Mark

**TECHNICON**

CHROMATOGRAPHY CORP.  
Research Park • Chauncey, New York



Including INTERSCIENCE

### BIOLOGY TEACHERS' HANDBOOK

*Edited by* JOSEPH J. SCHWAB, *Department of Education, University of Chicago*. This volume serves the teacher of biology in two ways. First, it provides the knowledge of developments in biology stemming from the use of modern advances and techniques from statistics, physics, and chemistry. Second, it provides actual material for use in the classroom art of teaching science as *enquiry*. The *Handbook* is divided into four sections: Part I explores the content, emphases, themes, and objectives of BSCS (Biological Sciences Curriculum Study) biology. Part II develops the teaching of science as enquiry. Part III offers a rigorous, minimal selection of material in physics and chemistry for the biology teacher. Part IV offers materials designed to facilitate the day-to-day teaching of biology. 1963. 585 pages. \$7.00.

### PROGRESS IN PHYSICAL ORGANIC CHEMISTRY Volume I

*Edited by* SAUL G. COHEN, *Brandeis University*; ANDREW STREITWIESER, JR., *University of California, Berkeley*; and ROBERT W. TAFT, *Pennsylvania State University*. Physical organic chemistry is a relatively modern field concerned with investigations of organic chemistry by quantitative and mathematical methods. This is the first volume in a new series—*Progress in Physical Organic Chemistry*—that provides a forum for exchange of views and for critical and authoritative reviews of topics in the field. Subjects are discussed in detail, with the emphasis in each chapter deriving from the personal ideas of the author. An Interscience Book. 1963. Approx. 412 pages. \$15.00.

### HISTORY, PSYCHOLOGY, AND SCIENCE: Selected Papers

*By* EDWIN G. BORING, *Harvard University*. *Edited by* ROBERT I. WATSON and DONALD T. CAMPBELL, *Northwestern University*. A unique collection of papers by a renowned psychologist. The main theme is the "science of science," including the history and psychology of science and the sociology of the knowledge processes. The author stresses the various ways in which the *Zeitgeist* unconsciously influences scientific theory, method and data. 1963. 372 pages. \$8.95.

### THE DESIGN OF ELECTRIC CIRCUITS IN THE BEHAVIORAL SCIENCES

*By* TOM N. CORNSWEET, *University of California, Berkeley*. The first book to combine basic electrical theory with explanations and descriptions of electrical apparatus used in behavioral research. An introductory treatment, the work takes the reader with no previous knowledge of electricity to a stage at which he can design, construct, and understand complex switching and timing circuits. 1963. Approx. 320 pages. Prob. \$8.95.

### CHEMISTRY: A Survey of Principles

*By* GALEN W. EWING, *New Mexico Highlands University*; and E. GERALD MEYER, *University of Wyoming*. Presenting an over-all view of present-day chemistry, this text balances basic theory with descriptive material on such important topics as biochemistry—organic reaction mechanisms—thermodynamics—chemical equilibrium and reaction rates—metal-organic and metal-inorganic complexes. The book not only develops fundamental principles but also emphasizes the essential link between theory and experiment. Laboratory experiments are an integral part of the treatment. A selection of portraits is included, giving thumbnail biographical sketches of scientists outstanding in the development of chemistry. 1963. 239 pages. \$4.95.

### QUANTUM THEORY OF SOLIDS

*By* C. KITTEL, *University of California, Berkeley*. This book presents the central principles of the quantum theory of solids. The first part of the book treats phonon, magnon, and electron fields and their interactions. It culminates in the theory of superconductivity, which is not treated in any comparable work. The second part deals with Fermi surfaces and electron wave functions in metals, alloys, semiconductors, and insulators, with considerable attention given to the *theory* of important types of experiments. The third part treats correlation functions and their application to time-dependent effects in solids. It includes a brief introduction to Green's functions. 1963. Approx. 640 pages. *In press*.

### AUTOMATIC DATA PROCESSING

*By* FREDERICK P. BROOKS, JR., *International Business Machines*; and KENNETH E. IVERSON, *Harvard University*. Treats those fundamental aspects of data processing common to all fields of application. The book covers fundamental theory—manual, semi-automatic, and automatic equipment—computer design—programming—search and sorting procedures—automatic programming—and system design. The book *organizes* and *structures* a great mass of information, impressing upon it order and unity of viewpoint and terminology. 1963. Approx. 560 pages. \$10.75.

### GUIDES TO INFORMATION SOURCES IN SCIENCE AND TECHNOLOGY

#### Volume I: Space Science and Technology

*Edited by* BERNARD M. FRY, *National Science Foundation*; and FOSTER E. MOHRHARDT, *Director, National Agricultural Library*. This book initiates a new series—*Guides to Information Sources in Science and Technology*—each volume of which will offer up-to-date coverage of all significant sources of information and data in a major field of science or technology. Volume I is a compilation of over 3,500 published and 400 nonpublication sources and references pertaining to the missile and space fields. An Interscience Book. 1963. Approx. 544 pages. \$9.50.

*Send for examination copies.*

**JOHN WILEY & SONS, Inc.**

**605 Third Avenue, New York, N. Y., 10016**

Including INTERSCIENCE

**ADVANCES IN PHOTOCHEMISTRY—Volume I**

*Editors:* W. ALBERT NOYES, JR., *University of Rochester*; GEORGE S. HAMMOND, *California Institute of Technology*; and J. N. PITTS, JR., *University of California, Riverside*. This new series brings together expert discussions of topics of current interest in photochemistry. It will include reports and reviews on such areas as: the elucidation of spectra of polyatomic molecules—the behavior of molecules—the study of atomic and radical reactions—reactions involving internal rearrangements—excited state reactions—photochemical syntheses—and the photochemistry of biological systems in plants and in animals. Volume II of the series will be published shortly after Volume I. Interscience Books. Volume I: 1963. Approx. 454 pages. Prob. \$16.00. Volume II: 1963. In preparation.

**ELECTRON PROBE MICROANALYSIS**

By L. S. BIRKS, *U. S. Naval Research Laboratory, Washington, D.C.* The first work on the subject of electron probe microanalysis, this book incorporates principles, instrumentation and practices in a form that can be readily understood by beginners in the field. Volume 17 in the Chemical Analysis series. An Interscience Book. 1963. 253 pages. \$9.25.

**VITAMINS AND COENZYMES**

By ARTHUR F. WAGNER and KARL FOLKERS, *both of Merck, Sharp & Dohme Research Laboratories Division*. This book provides summaries of salient aspects of the field, including isolation—structure determination—organic synthesis—biosynthesis—metabolic role—mechanism of action—and others. An Interscience Book. 1963. Approx. 512 pages. In press.

**BIOCHEMICAL PREPARATIONS—Volume 10**

*Editor-in-Chief:* GEORGE B. BROWN, *Sloan-Kettering Division, Cornell University Graduate School of Medical Sciences*. As in previous volumes in the Biochemical Preparations series, Volume 10 contains carefully tested directions for the preparation of compounds (and enzymes). 1963. In press.

**GENETICS AND METABOLISM—Second Edition**

By ROBERT P. WAGNER, *University of Texas*; and HERSCHEL K. MITCHELL, *California Institute of Technology*. The second edition of this well-known book incorporates the revolutionary concepts in genetics that have come into being in the last eight years. It includes the results of intensive studies in the structure and biosynthesis of proteins and nucleic acids. 1963. Approx. 672 pages. Prob. \$14.00.

**VACUUM TECHNOLOGY**

By ANDREW GUTHRIE, *Alameda State College*. A ready reference that treats the vacuum field in a non-mathematical way, with emphasis on conventional vacuum systems. 1963. Approx. 528 pages. Prob. \$12.50.

**ORGANIC SYNTHESES—Volume 43**

*Editor-in-Chief:* B. C. MCKUSICK, *E. I. du Pont de Nemours & Co.* This well-known series provides tested procedures for preparing useful organic compounds in reasonable quantities. The preparations serve as a reliable source of detailed, practical directions for valuable intermediates, and as models for related reactions. Each preparation has been checked independently in the laboratory of one of the editors. Volume 43 retains the same format as its predecessors, providing convenient access to exceptionally useful compounds. 1963. Approx. 144 pages. Prob. \$5.50.

**MATERNAL BEHAVIOR IN MAMMALS**

*Edited by* HARRIET L. RHEINGOLD, *National Institute of Mental Health*. Brings together reports of outstanding current research on maternal behavior in mammals—written by the investigators themselves. 1963. Approx. 336 pages. Prob. \$7.50.

**MICROWAVE RESEARCH INSTITUTE SYMPOSIA**

**Volume 13: Symposium on Optical Masers**

*Edited by* JEROME FOX. The latest volume in an annual series of symposia on microwaves and related electronic subjects. Sponsored by the Microwave Research Institute, Polytechnic Institute of Brooklyn. An Interscience Book. 1963. In press.

**LIFE SCIENCES AND SPACE RESEARCH**

**A Session of the Third International Space Science Symposium, Washington, D.C., April 30-May 9, 1962.**

*Editors:* R. B. LIVINGSTON, *National Institutes of Health, Washington, D.C.*; A. A. IMSHENETSKY, *Institute of Microbiology, Academy of Sciences, Moscow*; and G. A. DERBYSHIRE, *Space Science Board Secretariat, National Academy of Sciences, Washington, D.C.* A North-Holland (Interscience) Book. 1963. 184 pages. \$7.75.

**BIOLOGY OF THE SEAS OF THE U.S.S.R.**

By L. ZENKEVITCH. This book presents the collected results of research carried out in the seas adjacent to the frontiers of the U.S.S.R. The author has given a short physico-geographical introduction to the description of each sea, and has also included biological data. An Interscience Book. 1963. In press.

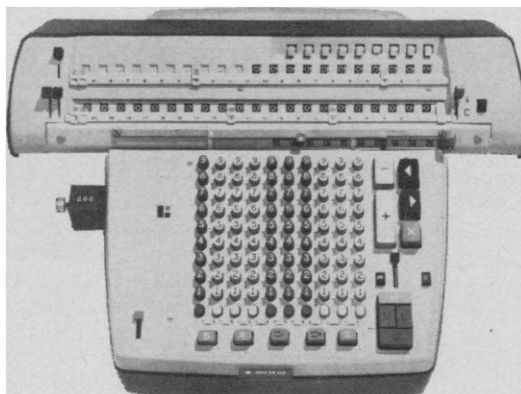
**AN INTRODUCTION TO VACUUM TECHNIQUE**

By A. H. TURNBULL, *B.Sc.*; R. S. BARTON; and J. C. RIVIERE, *M.Sc., Ph.D.* With a foreword by F. A. VICK, *Ph.D.* An expansion in book form of an Atomic Energy Research Establishment report entitled "Vacuum Technique for Beginners." The equipment and techniques described have been thoroughly tried and tested by the authors. An Interscience Book. 1963. 190 pages. \$7.75.

*Send for examination copies.*

**JOHN WILEY & SONS, Inc.**

**605 Third Avenue, New York, N.Y., 10016**



## Know-it-all!

The Monroe-Matic® 8F-1 statistical calculator trusts you not a whit. Insists, instead, on double checking you throughout every statistics problem. It uses its own Veeder Counter, for instance, to keep track of precisely how many multiplications you've made. Automatically retains the multiplicand you've entered to be used as the multiplier in squaring. (All you do is press the multiplication key.) Won't even trust you to work with a dollar and cents keyboard — provides you, instead, with a statistical color-coded keyboard. It even demands that you use its exclusive proof dials to double check accuracy. (In squaring, this second set of dials records the last number squared. In division, it provides you with individual answers while the larger dials are simultaneously accumulating.) The fastest, simplest, most accurate standard calculator ever devised for statistics, the 8F-1 is priced more competitively than less disciplined machines. Ask your local Monroe representative to demonstrate how it can give you five simultaneous answers to a correlation problem. Or, if you prefer, write directly to us. Monroe Calculating Machine Company, Inc., Orange, New Jersey.

**MONROE** 

A DIVISION OF THE BUSINESS MACHINES GROUP OF LITTON INDUSTRIES



Aluminum • Antimony • Barium • Beryllium • Bismuth • Cadmium • Calcium • Cesium • Chromium  
Cobalt • Copper • Gallium • Gold • Indium • Iron • Lead • Lithium • Magnesium • Manganese  
Mercury • Molybdenum • Nickel • Palladium • Platinum • Potassium • Rhodium • Rubidium • Selenium  
Silver • Sodium • Strontium • Tellurium • Titanium • Thallium • Tin • Vanadium • Zinc

performance-proved instruments for SPECTROSCOPY

## A NEW ATOMIC ABSORPTION SPECTROPHOTOMETER FOR EASY ANALYSIS OF METALLIC TRACE ELEMENTS

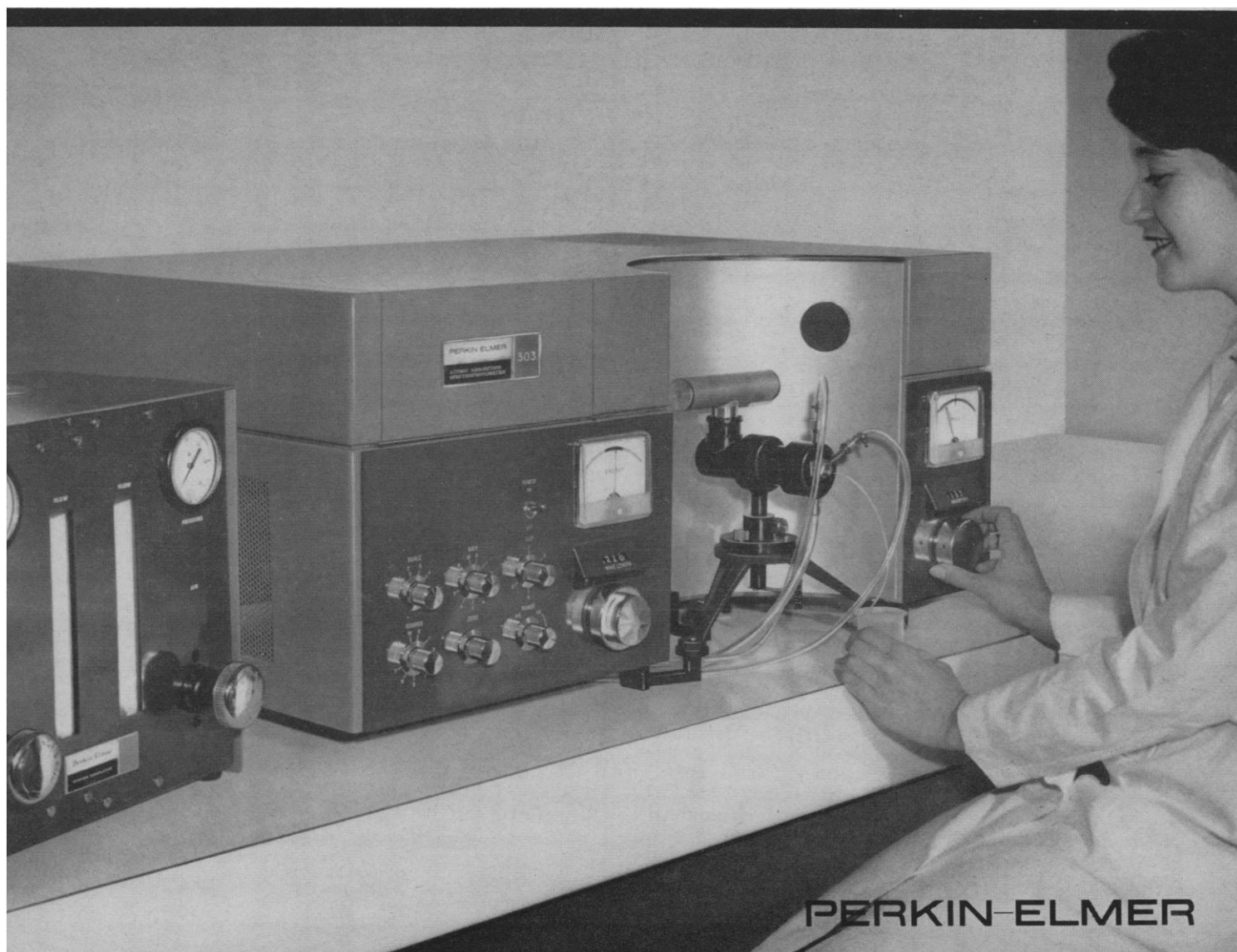
To meet the need for an easy-to-operate atomic absorption spectrophotometer

suited to general laboratory use in analyses of metallic trace elements, Perkin-Elmer presents the new Model 303. Designed around the principle of absorption by ground-state atoms of the resonance line of a lamp having a cathode of the metal being sought, the instrument is highly sensitive—detects concentrations ranging below one ppm for most metals. It is capable of producing, in less than 4 minutes, including set-up time, many analyses that take 2 to 3 days by wet chemistry.

Applications include determination of

magnesium, calcium, potassium, sodium and trace metals in blood, urine and tissue samples; magnesium, zinc and lead content in ferrous, aluminum and copper alloys; trace metals in plants and animals; metal components in process streams; and changes in metals content of lubricating oils, as a check on engine performance.

For complete Model 303 specifications write to Instrument Division, Perkin-Elmer Corporation, 910 Main Avenue, Norwalk, Connecticut.



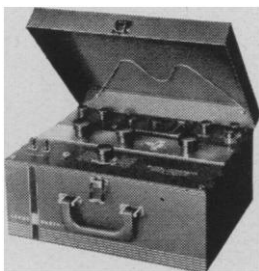
PERKIN-ELMER

# Make Important Measurements Faster...More Precisely

## With L&N Convenience-Styled Instruments

### TO OBTAIN MEASUREMENTS OF TEMPERATURES & MILLIVOLTS

The use of this three-dial 8686 Portable Potentiometer is rapidly spreading in research laboratories. It features a central reading window . . . where measured values appear as a row of digits plus a scale value . . . for rapid reading of test results. This instrument has a wide operating range of  $-10.1$  to  $+100.1$  mv and an accuracy of  $\pm(0.05\%$  of reading  $+3\mu\text{v}$ ) without reference junction compensation;  $\pm(0.05\%$  of reading  $+6\mu\text{v}$ ) with ref. jct. comp. Write for Data Sheet E-33(1a).



### TO MAKE OXYGEN MEASUREMENTS RAPIDLY, ACCURATELY



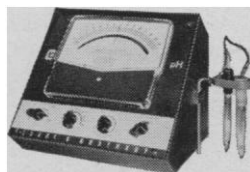
For measurements of  $\text{O}_2$  in medical and environmental research, in combustion processes and in testing applications, the new L&N 7308-G Thermo-Magnetic Oxygen Analyzer features maintenance-free operation, quick calibration against air and

compact size (9-1/2" x 11-1/2" x 16-3/8").

Available in three standard ranges, 0-5%, 0-10% or 0-25%  $\text{O}_2$ , this Analyzer has a sensitivity of 0.05%  $\text{O}_2$  and an initial response of 2 seconds. A meter providing continuous  $\text{O}_2$  indication and/or a Speedomax G or H millivolt recorder may be used. Write for Data Sheet ND46-91 (3).

### TO OBTAIN DRIFT-FREE MEASUREMENTS OF pH AND REDOX

Only one initial calibration setting is required on the L&N Stabilized pH Indicator. Synchronous conversion of d-c input with amplification eliminates zero-drift. An electronic converter provides d-c feedback to stabilize gain. Ranges are 0 to 14 pH, in 0.1 pH divisions, and for measuring redox potentials, 0 to  $\pm 700$  mv and  $\pm 1400$  mv—both in 10 mv divisions. Write for Folder E-96(4).



### TO MAKE CONTINUOUS CONDUCTIVITY MEASUREMENTS "ON-LOCATION"

This continuous indicating Conductivity Monitor is completely transistorized. It is provided with a linear scale calibrated 0 to 100 micromhos/cm (scale reading is multiplied by cell constant). Lightweight, the Monitor is extremely convenient for check-



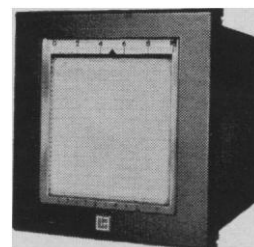
ing in the laboratory or on the process line. Exceptional design permits automatic or manual compensation . . . provides d-c output signal for recorder or other data-logging equipment. Write for Data Sheet E-95(3).

## With L&N Automated Equipment

### TO RECORD TEMPERATURE & MILLIVOLTS MEASUREMENTS

These compact, low-cost Speedomax® H Recorders are widely used in laboratories for measuring temperatures, millivolts, pH, gas chromatography, etc. With interchangeable ranges—50 for temperature and six for millivolt (0 to 1, 0 to 5, 0 to 10 mv, etc.)—

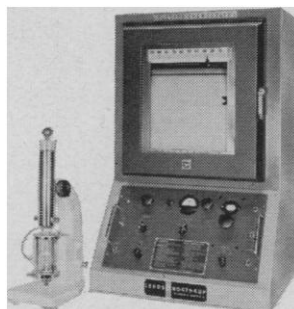
these instruments will record practically any variables encountered in research work with a limit of error of  $\pm 0.3\%$  of span. Write for Data Sheet ND46-51(100).



### TO MAKE FAST, ACCURATE POLAROGRAPHIC ANALYSES

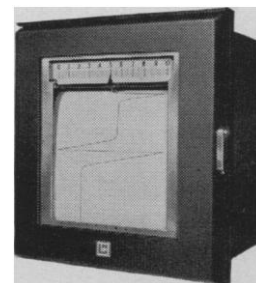
For analyzing metals, organics or biochemicals in solution, the combination of the L&N Electro-Chemograph® and Polarotron® is unmatched in accuracy and speed. The Electro-Chemograph provides: fast determination — one-second recorder balancing time

for full scale travel; minimum error—polarizing accuracy to 4 mv. The Polarotron facilitates time-saving operation; stable (reference) half-cell comes prepared for immediate use. Write for Data Sheet E-97(1).



### TO RECORD TEMPERATURES WITH AN ACCURACY OF $\pm 0.01^\circ\text{C}$

Invaluable in advanced research laboratories, this High Precision Speedomax G Recorder is used with L&N Resistance Thermometers for a variety of temperature measurements over a range of  $-190$  to  $+500^\circ\text{C}$  with an accuracy of  $\pm 0.01^\circ\text{C}$ . An "automatic Mueller Bridge," this recorder is used in cryoscopic determinations of purity, in measuring boiling ranges of liquids and in general calorimetry, etc. Write for Data Sheet E-ND46(7).

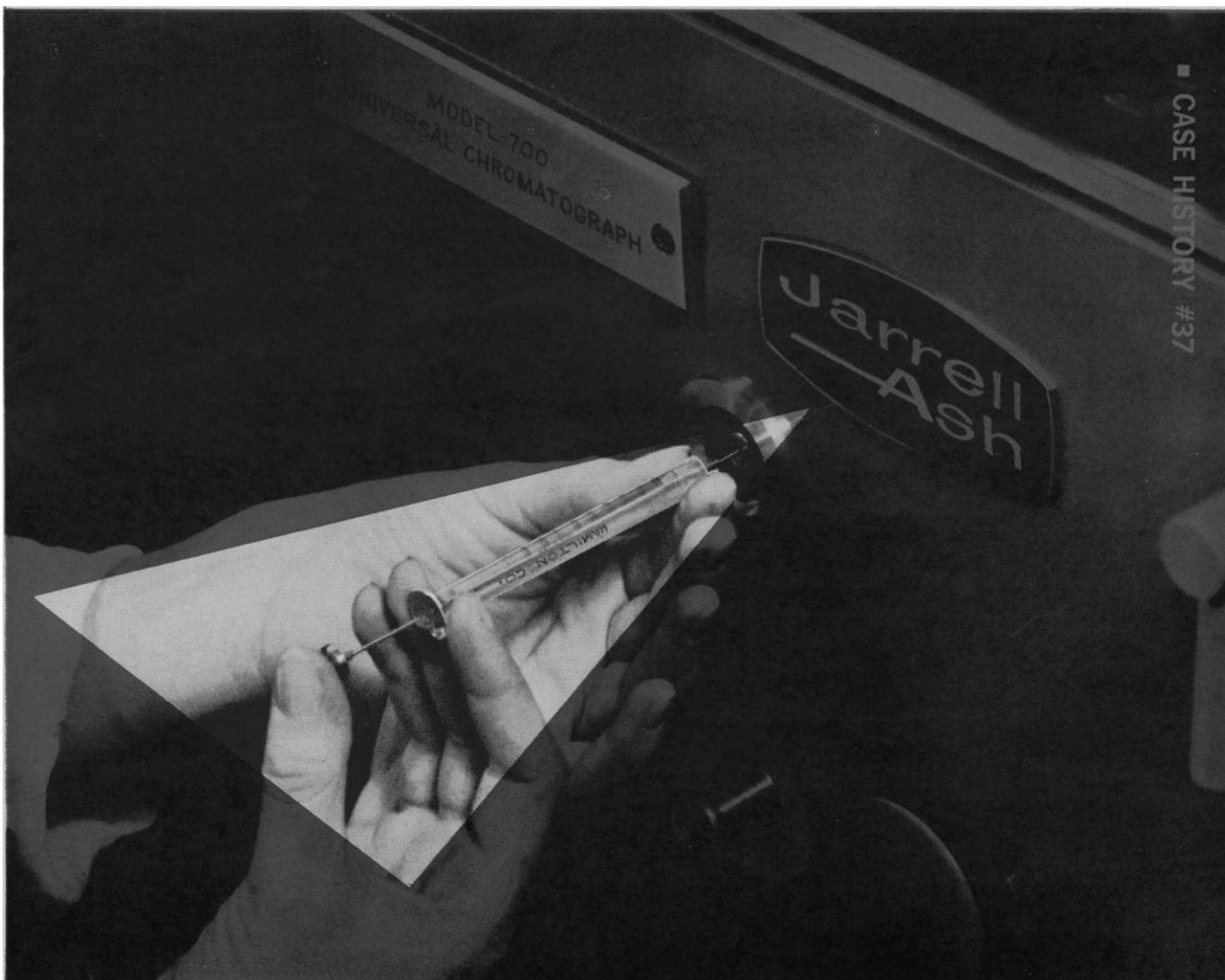


*These are only a few of the modern, precise instruments that L&N provides for today's exacting research requirements. For further details, write to Leeds & Northrup Co., 4926 Stenton Ave., Philadelphia 44, Pa.*



**LEEDS & NORTHRUP**


*Pioneers in Precision*



## Electron Capture Detection used in G. C.

Gas chromatography utilizing electron capture detection is employed by the Agricultural Analytical Development Department of **Eli Lilly and Company** for the quality control of herbicide and pesticide formulations. John R. Koons, Eli Lilly Analytical Chemist, relates that a Hamilton 701 syringe is filled with sample and the plunger is advanced to the 1.0 microliter mark. The plunger is then withdrawn so that the total volume in the stem and the needle can be measured. The injection is made in the normal manner and then the plunger is again withdrawn to measure the remaining sample which has not been flashed off in the needle. For quantitative work a standard pre-determined volume must be delivered by the syringe for each injection. The standard volume delivered will depend upon the syringe and solvent. Using this technique, Heptachlor, at levels of 0.1, 0.2, and 0.3 nanograms per microliter, can be measured with a precision of  $\pm 4.56\%$ ,  $\pm 3.75\%$ , and  $\pm 2.65\%$ , respectively at the 95% confidence level calculated for a single injection. By shooting duplicate samples a precision of approximately  $\pm 2.5\%$  from the true mean is obtained 95% of the time. **Hamilton manufactures a complete line of precision syringes from a capacity of 0.5  $\mu$ l to 500  $\mu$ l and other related chromatograph equipment.**

# HAMILTON

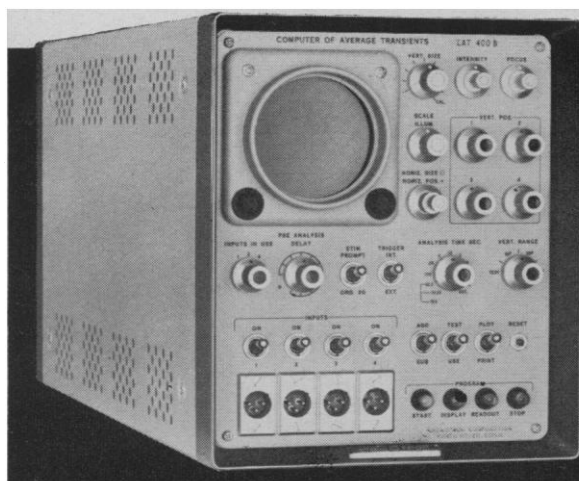



*Clip, attach to  
letterhead and mail*

**To: HAMILTON COMPANY, inc. • P.O. Box 307K • Whittier, Calif.**  
Send me a catalog on your complete line of syringes and related equipment

Name \_\_\_\_\_ Title \_\_\_\_\_





## ON-LINE SIGNAL AVERAGING WITH CAT 400B ELIMINATES BACKGROUND NOISE

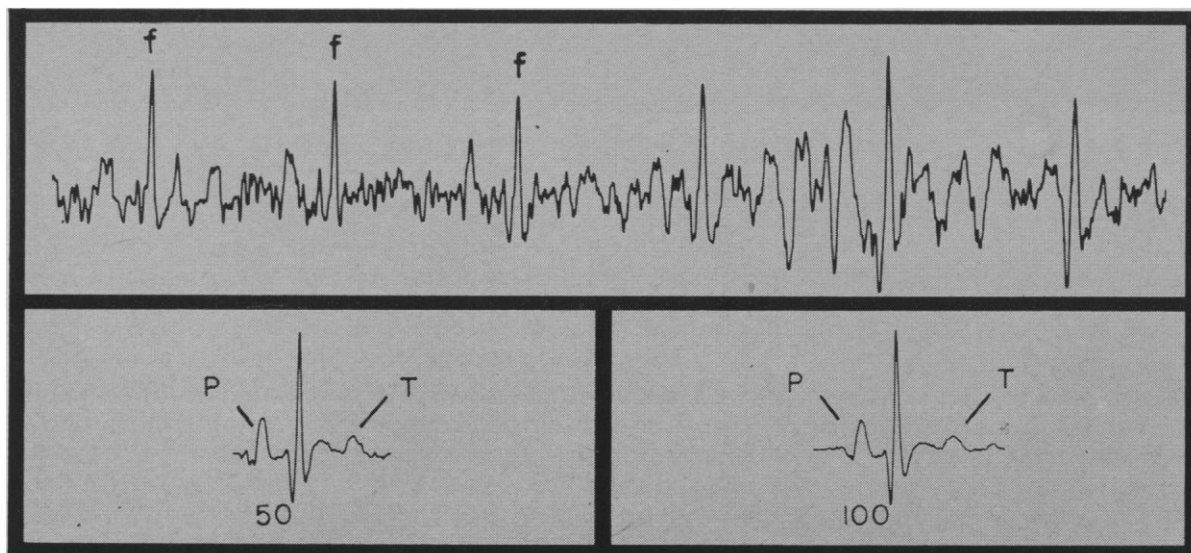
MNEMOTRON's Computer of Average Transients, the CAT 400B, is unique in its ability to isolate transient signals masked by high background noise.

Biological waveshapes are generally difficult to extract because the signals are normally quite small when compared with the prevailing electrical noise. The CAT is a special-purpose digital computer which

provides an improvement of the signal-to-noise ratio by an averaging technique. The transient signals are averaged on-line, to provide the investigator with a sharply defined waveshape for subsequent interpretation.

The figures illustrate CAT application in Fetal ECG analysis.<sup>1,2</sup> The upper portion, taken directly from a plotting device, is a waveshape recorded from the fetal scalp with concurrent noise components, before being applied to the CAT 400B. The lower portions indicate the same ECG signals summed 50 and 100 times. Note the clear definition of the signal under investigation and the gradual dissipation of the background noise.

***For the first time, clear definition of a Fetal ECG has been obtained.***



The CAT combines portability (38 lbs.), economy of space (1 cubic foot), with completely reliable operation under the most rugged environmental conditions. It is today's most invaluable instrument for processing biological data derived from investigations in Neurophysiology, Pharmacology, Ophthalmology, Psychology, and Cardiology, among others.

- 1 E. H. HON, S. T. LEE, Paper presented at the Fifth International Conference on Medical Electronics, July 1963, Liège, Belgium.
- 2 E. H. HON, S. T. LEE, "Noise Reduction in Electrocardiography," American Journal of Obstetrics and Gynecology (In press).

See us at The National Institutes of Health  
Symposium-Exhibit



Division Sales Office: 202 Mamaroneck Ave., White Plains, N. Y.  
Phones: (212) 876-1444 (914) 761-5000 Cable: MNEMOTRON

IN EUROPE: Technical Measurement Corp., GmbH,  
Mainzer Landstrasse 51, Frankfurt/Main, Germany  
Other offices in principal cities throughout the world

## Four reasons why the new H6 saves time and money



- A new 100 scale division micrometer permits direct reading to .1 mg without estimation.
- The 1200 mg optical range is the largest available in any analytical balance.
- Only 2 knobs control all weight combinations up to the full 160 g capacity.
- A patented damping system rapidly brings the balance into equilibrium.

This new Macro-Analytical Balance features a 1200 mg optical range,  $\pm 0.05$  mg precision and direct reading to .1 mg. It can be operated by unskilled laboratory personnel, liberating skilled specialists for other work; it reduces the sources of error

in analytical work; and it makes weighings fast! If you would like to try this new balance, or want more detailed information, contact your Mettler dealer now, he will be glad to arrange a demonstration or trial.

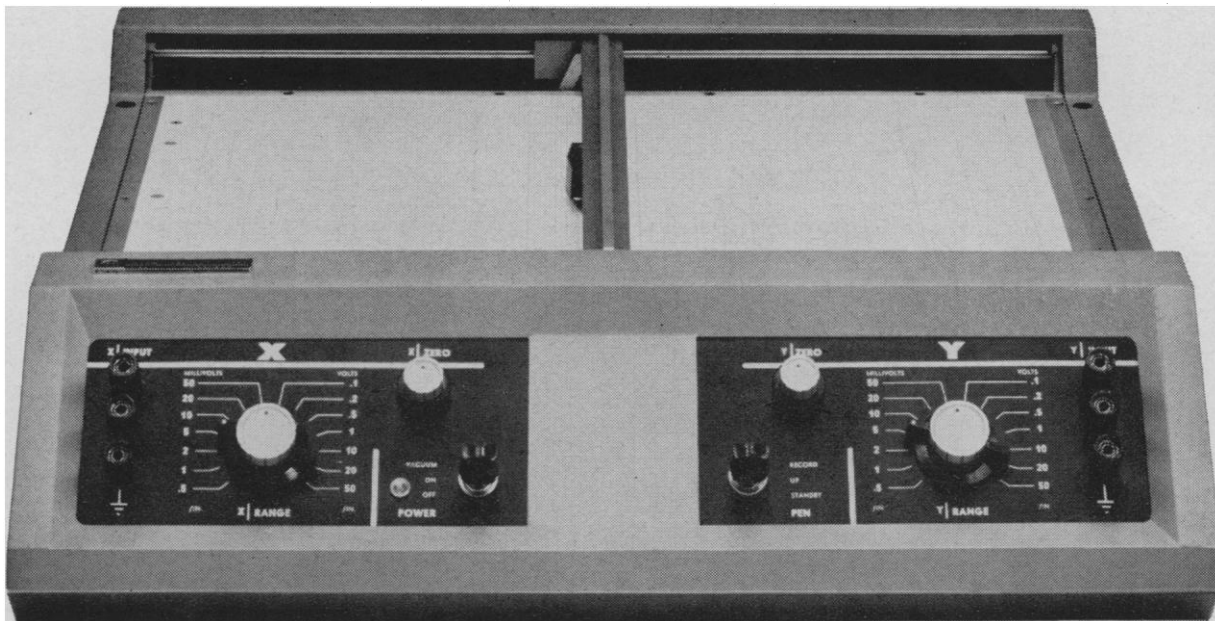
---

**Mettler**®

---

Mettler  
Instrument Corporation

20 Nassau Street  
Princeton, New Jersey



# ANOTHER NEW X-Y RECORDER FROM VARIAN?

Yes and no. The new F-81 is the same high quality recorder as our recently introduced F-80. It is also the most accurate, fully-equipped X-Y you can buy for under \$1900. Here's a basic instrument that comes with all the features you need to do the job. It has a unique vacuum hold down for the chart, electric pen lift, and solid-state ruggedness throughout. You can use any size or shape of paper from 2" x 2" to 11" x 17", without masking. And you can position the chart with the vacuum on. □ Human engineering on the F-81 gives you new operating convenience. Simple control panel, easy-to-service magnetic pen holders and field-convertible bench top or rack mounting make it easy for you to build this X-Y recorder into test consoles, control panels, and analytical instruments.

## IMPORTANT FEATURES OF THE NEW F-81:

- accuracy 0.2%
- 17"/sec pen speed
- 14 DC voltage ranges, 0.5 mv/in to 50 v/in
- vernier adjustment between ranges
- full scale zero plus 100% suppression
- exceptionally high input impedance
- zener diode reference
- independent servo-operated X and Y axes
- weight, 29 pounds
- F-81 price \$1875

What's the difference between the F-80 and the F-81? The F-80 has an automatic-cycling time base and sells for \$2025. □ For further information or a demonstration write Recorder Products. In Europe contact Varian A.G., Zug, Switzerland.

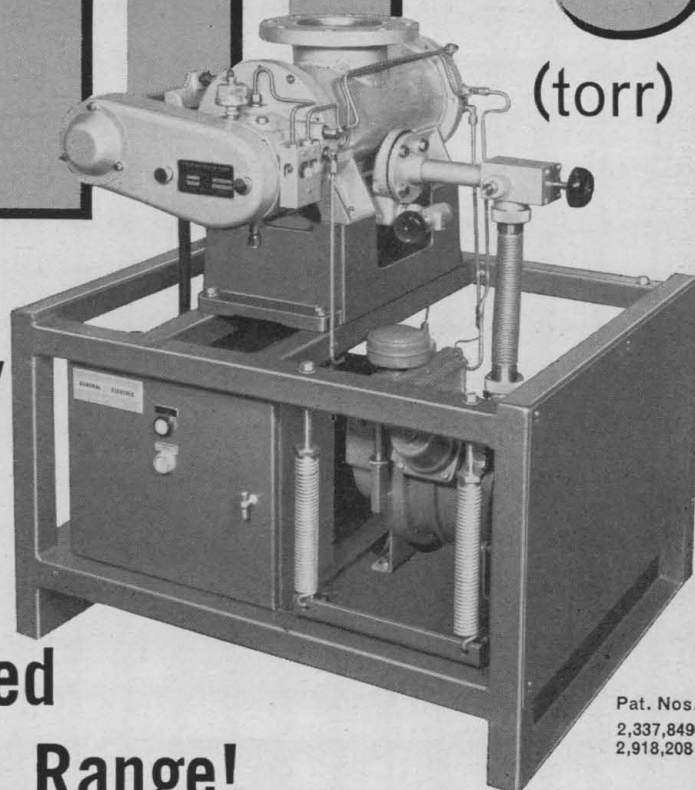
 **VARIAN ASSOCIATES**  
PALO ALTO 18, CALIF.



# 1X10<sup>-9</sup>

(torr)

## New, Compact **ULTRA-HIGH VACUUM** Pumping System With Constant Speed Over Wide Pressure Range!



Pat. Nos.  
2,337,849  
2,918,208

BLANK-OFF PRESSURE — LOWER THAN  $1 \times 10^{-9}$  torr

SPEED (AIR) — 140 LITERS/SECOND

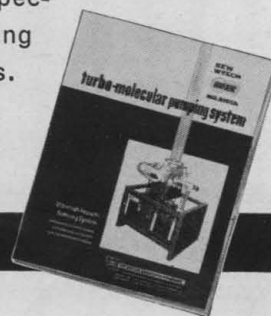
The new, Welch 3101A Turbo-Molecular Pumping System has a blank-off pressure lower than  $1 \times 10^{-9}$  torr and a constant speed (air) of 140 liters per second over a range of  $10^{-2}$  to  $10^{-9}$  torr. It combines a Welch No. 3101 Turbo-Molecular Pump (manufactured under a license of the Becker patent for the U.S.A. and Canada) with the well-known Welch "Duo-Seal" No. 1397, two-stage mechanical pump in a completely assembled and tested package, ready for use.

The clean, *vapor-free* No. 3101 Turbo-Molecular Pump embodies a major advance in the design of molecular pumps, permitting the use of running clearance as much as ten times that of previous designs. Risk of damage by sudden air inrush, thermal expansion and dirt particles has been eliminated and higher pumping speeds and pressure ratios have been achieved.

### APPLICATIONS:

Wherever a **vapor-free** high or ultra-high vacuum is required. Typical Uses:

- Evacuation of power tubes and X-ray tubes
- Solid state research
- Semiconductor production
- Thin film metallizing
- Purification of metals such as silicon and germanium
- Optics coating
- Separation of materials or isotopes with different molecular weights, as in particle accelerator work
- Space simulation chambers
- Mass spectrometers
- Roughing ion pump systems.



**Send for Bulletin 3101A TODAY!**



**THE WELCH SCIENTIFIC COMPANY**

FOREMOST MANUFACTURERS OF SCIENTIFIC EQUIPMENT

1515 Sedgwick Street, Dept. 920A, Chicago, Illinois 60610

# SCHIZOPHRENIA and the AIRPLANE WING

A discussion of a unique instrument we have developed which seems to be useful to the aircraft designer, the medical researcher, the oceanographer, the meteorologist, and in a number of other scientific disciplines . . .

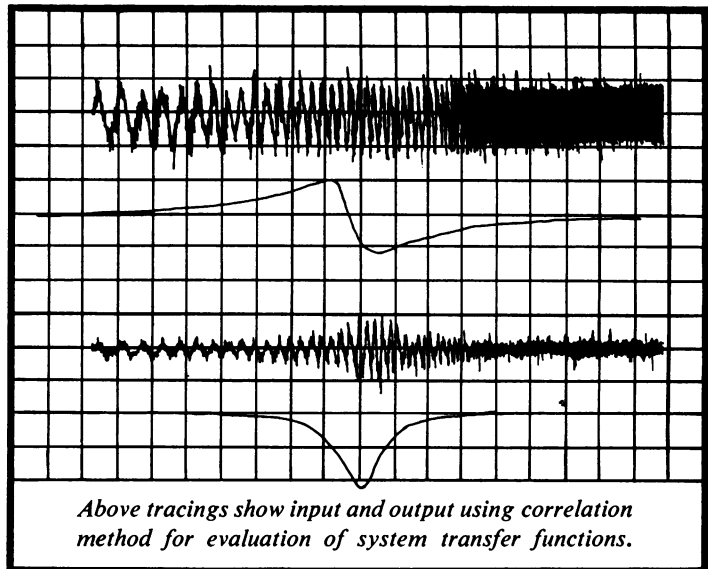
The relationship between the human brain and an aircraft wing seems remote, yet engineers at McDonnell who are working on America's fighter aircraft, and medical researchers in St. Louis, have discovered that study of events in these two unlikely areas involves a common technique called "pattern recognition".

The measurable dynamics of the brain are recorded as variations in voltages, in the same way engineers measure stresses on an aircraft wing during critical flight maneuvers at supersonic speeds.

Recording these dynamic parameters has been possible for several years. Isolating them for immediate interpretation was not. Data engineers at McDonnell have now developed a device called an Analog Signal Correlator, which not only solves the problem for military aircraft designers, but for the medical researcher as well. With this device, medical researchers have been able to establish definite relationships between psychological functioning and the recorded waveform patterns of the brain as they exist in normal and schizophrenic humans.



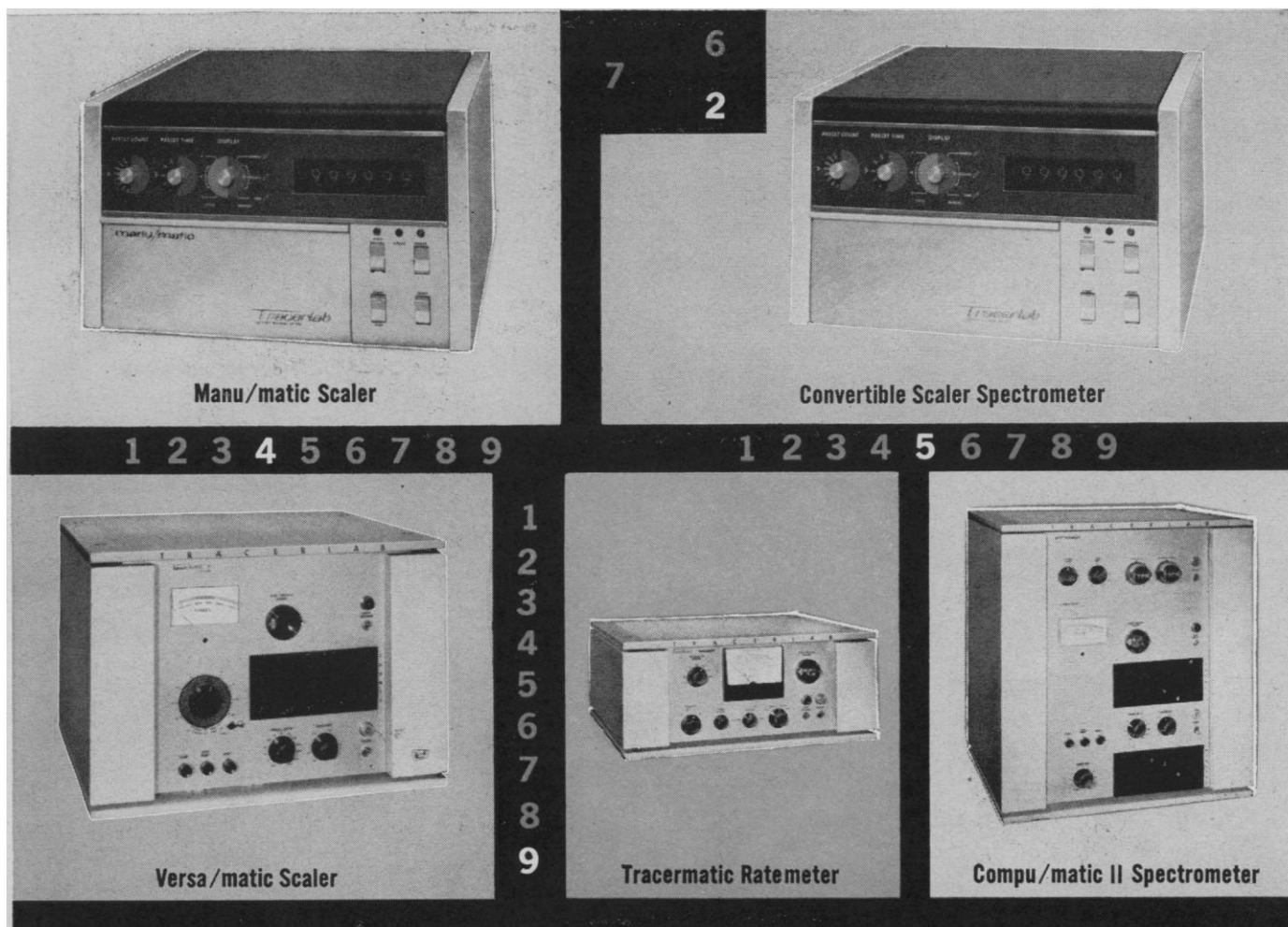
The McDonnell Analog Signal Correlator\* provides, in real time, a dynamic measurement of coherence between any two random signals. The output is visually displayed for immediate interpretation and is simultaneously provided as a voltage output for recording.



Data stored on magnetic tape is converted to "hard numbers" at real time rates. Voluminous archives and painstaking visual evaluation with its potential for bias are avoided. Operation of the Analog Signal Correlator "on line" reduces research time by making data results immediately available. Sampling, digitizing-rate and time restrictions are eliminated thus providing thorough and complete data for analysis.

The application of this device is just beginning. Current contract programs include such diverse studies as noise, vibration and flutter onset as they apply to supersonic development-flights and wind-tunnel research. In biomedicine, the Analog Signal Correlator makes possible the study of EEG bilateral phase relationships in humans. It is a significantly useful device for determining human habituation to external stimuli. Other areas which may be studied with this new research tool include pharmacology and fetal electrocardiography as well as aircraft-related research involving pilot proficiency and detection of pilot stress during hyperventilation.

We have already learned that Analog Signal Correlation can be utilized to improve data analysis in Biomedicine, Seismology, Radar, Sonar, Structural Dynamics, Oceanography, Bionics, Automatic Control, Radio Astronomy, Meteorology. Our engineers would be pleased to discuss this device with you and are especially interested in applications you might suggest. Additional information about the design, operational parameters, price and delivery schedule is available. Write W. W. Toole, McDonnell Electronic Equipment Division, Department 946, Box 516, St. Louis 66, Missouri.



from *Tracerlab*: a complete line of the most flexible  
analytical nuclear instruments

*Tracerlab* offers the most versatile, comprehensive counting instruments for radioisotope analysis. Broad in performance, modular in design, *Tracerlab* instruments meet your every application. There's no need for custom engineering, we've designed them with all possible applications in mind.

Need tubes or transistors, versatile scalers or ratemeters, precise spectrometers or flexible power supplies for any present or future application? Look no

more — *Tracerlab* has them all — attractively priced too.

In single units, in multiple units, from timers to scaler/spectrometers, in performance and application, your single nuclear instrument source is *Tracerlab*.

Chances are the instrument you need is available, right now, from *Tracerlab* — backed up by a national network of sales and service offices.

Locate your Tracerlab/Keleket representative in the yellow pages or write for our complete instrument catalog from *Tracerlab/Keleket* — Your partners for progress in the Life Sciences.



**K E L E K E T**

A DIVISION OF LABORATORY FOR ELECTRONICS, INC.  
WALTHAM 54, MASSACHUSETTS

• Nuclear Instruments • Medical X-Ray Equipment • Film Badge Service  
Accessories & Supplies





**HITACHI  
PERKIN-ELMER  
ULTRAVIOLET  
VISIBLE GRATING  
SPECTRO-  
PHOTOMETER**

The Model 139 Grating Spectrophotometer, a compact, precise modern instrument, out performs similar spectrophotometers costing significantly more.

Check these features: High resolution grating Monochromator — gives exceptional radiation purity in transmittance / absorbance measurement from 205 to 800 millimicrons; Direct reading meter — presents measurements in both transmittance and absorbance quickly and accurately; Single wide-range phototube — covers the entire range from 205 to 800 millimicrons, eliminates need to change even at wavelength extremes; Dual Hydrogen/Tungsten lamp source assembly — has high energy output, gives

instant switching from one source to the other; Direct line-operated power supply — is stable, fully transistorized, eliminating batteries and drift problems; Low cost — brings the advantages of modern instrumentation to any laboratory with unmatched economy and superior performance.

The five basic functional units, in combination, provide the analyst with a fully integrated instrument for the rapid and precise analysis of any sample by absorption measurement.

For details see your Aloe Scientific representative or write Aloe Scientific, ☐ Division of Brunswick, 1831 Olive Street, St. Louis 3, Mo.

*Serving the Sciences that Serve Mankind*



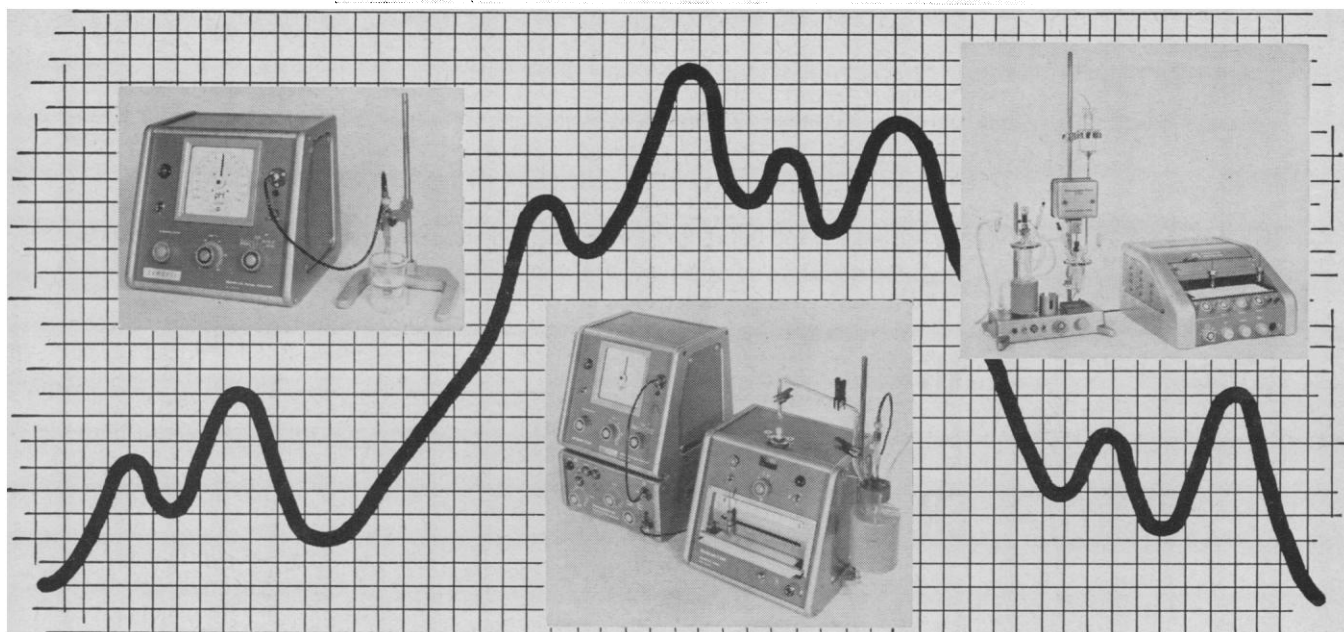
# RECORDING

## TITRATORS

## pH STATS

## POLAROGRAPHIC ANALYZERS

## RESEARCH pH METERS



For complete descriptive literature, please contact:



# METROHM

(NEW ADDRESS)

BRINKMANN INSTRUMENTS INC.,  
CANTIAGUE ROAD, WESTBURY, L. I., NEW YORK

ST. LOUIS • CHICAGO • HOUSTON • CLEVELAND  
PHILADELPHIA • SAN FRANCISCO

# MEASURING

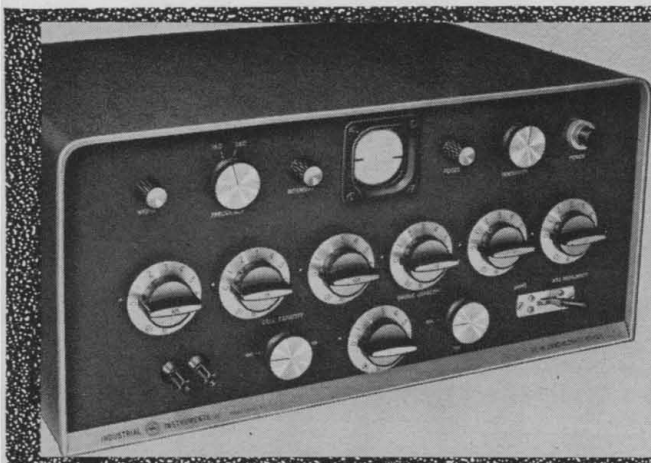
# SPECIFIC CONDUCTANCE?

*may we recommend ...*

**Model RC-16B2**... a general purpose conductivity bridge featuring extremely wide range, high sensitivity, and moderate accuracy. The Model RC-16B2 has a dual calibration, in resistance and conductance units. Bridge current at 50-60 and 1000 cycles are provided, selected by a panel mounted switch.

A sensitivity control is provided to permit increase of sensitivity without reducing the speed with which the instrument may be balanced. When used with conductivity cells of appropriate cell constants, the entire range of electrolytic conductance from that of ultra-pure demineralized water to concentrated acids is easily covered.

Price \$237.00



**Model RC-18 Conductivity Bridge**... a precision laboratory instrument measuring electrolytic conductivity and resistivity in micromhos and ohms to  $\pm 0.1\%$  accuracy. Internal generator frequencies of 1000 and 3000 cps are provided, and balance indication is by means of a self-contained, two-inch oscilloscope.

Bridge balance is obtained through operation of 6 decades of card-wound resistors of 0.1 to 10,000 ohms each. The overall instrument range is 0-100,000 ohms. Sensitivity is better than  $\pm 0.01\%$ . A decade of 100 pf mica capacitors and two 10-100 pf adjustable air capacitors permit balancing the reactive component of the conductivity cell impedance.

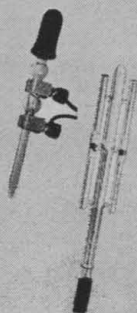
Price \$850.00



**Recording Requirements?**... The Model RA-4 Solu Meter® is a direct-reading instrument providing a continuous indication of solution conductivity. In addition, a 0-10 mv DC signal proportional to conductivity is provided to operate a remote potentiometer recorder. A non-bridge type of measuring circuit is utilized, and meter scales are linear in conductivity.

Accuracy is within 2% of scale span with supply voltages between 105 and 125. Adjustment of full scale meter deflection against a built-in standard resistor permits closer readings. Solu Meters can be supplied in a great many different ranges and calibrations. The Model RA-4 is provided with a temperature compensator to correct for the change of conductivity with temperature. A manual compensator is standard in the Solu Meters; automatic compensators are available as optional equipment for every service.

Price \$186.00



**Electrolytic Conductivity Cells.** A most comprehensive line of cells and cell constants is available for every application from measurement of ultra-pure water to concentrated solutions of acids, alkalis and salts. Dip type glass and platinum conductivity cells are available in any cell constant from 1/100 to 100 with certified accuracy within  $\pm 1\%$  of nominal value. Pipette cells, for making conductivity measurements with small volumes of solution, are furnished for samples as small as 1/100 ml. Cell constants range from 5 to 500/cm. Jones type cells in many cell constants can also be provided. Prices on request.

**Industrial Instruments Inc.** has pioneered in the field of electrolytic conductivity and offers a complete line of instrumentation and cells. In addition, we can supply a variety of gas analysis equipment for laboratory and plant use. We invite your inquiries on the application of our equipment to your particular requirements.

All prices FOB Factory

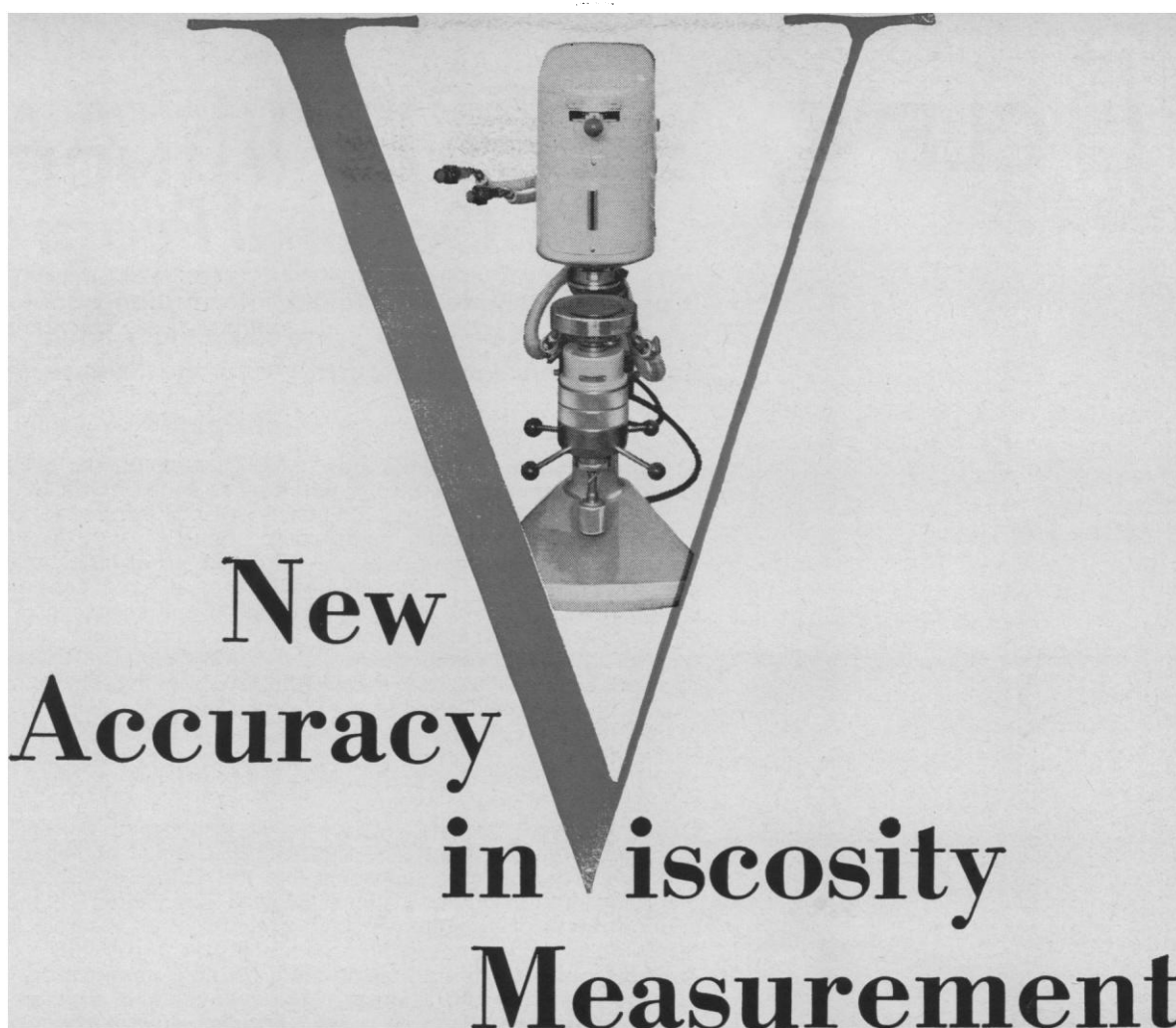
**ELECTROLYTIC CONDUCTIVITY  
IS OUR BUSINESS!**

**Industrial Instruments Inc.**

89 Commerce Road, Cedar Grove, Essex County, N. J.  
201 Center 9-6200 TWX: 201 239-4704







## THE FERRANTI-SHIRLEY CONE-PLATE VISCOMETER

With today's new formulations of liquid products, and the need for new and speedy handling, processing and packaging methods, a more precise knowledge of fluid behavior is essential. The advanced Ferranti-Shirley Electronic Viscometer fills this exacting need. It is especially valuable in handling complex non-Newtonian materials. Methods formerly used were often subject to error, which would be costly under today's streamlined production techniques. The viscometer shown here operates on the principle of a cone rotating against a stationary plate, with the material (less than 0.5 ml. in volume) in between.

Shear rate can be controlled, variable from 0.2 to 20,000 sec.<sup>-1</sup> and accurate to 0.2% under potentiometer control. The characteristics of the fluid can be read on a meter, or recorded as chart flow curves. The viscometer permits rapid examinations, and importantly, it is very easy to clean. It is of great value both in the laboratory and in production.

### VISCOSITY MEASUREMENT

A new attachment is now available which simplifies the use of the Ferranti-Shirley and makes it particularly suitable for use under production conditions where very highly skilled operators may not be available.

This latest improvement is the automatic gap stabilizer, a simple addition which insures that the gap is maintained to within 0.0001 inch at all times irrespective of temperature variations. Variations in results due to the techniques employed by different operators are thus eliminated and the full benefits of the instrument with regard to the speed and accuracy of making determinations and the very small sample size can be realized under production conditions. Other accessory items already available include:

### AUTOMATIC PROGRAM UNIT—

for controlled condition rheograms

### X-Y RECORDER—

plots shear rate/shear stress curves automatically when used with the automatic program unit.

### TEMPERATURE CONTROL BATHS—

suitable for use up to 200°C.

### SPECIAL CONES—

for increased range and to deal with larger particles.

### SPECIAL TORQUE SPRINGS—

500 and 2000 gm. cm. springs for increased range (1000 gm. cm. is standard).

Write for detailed literature.

# **Ferranti**

**FERRANTI ELECTRIC, INC.**

INDUSTRIAL PARK NO. 1 • PLAINVIEW, LONG ISLAND, N. Y.

Tel. 516 WElls 8-7500 • TWX 516-433-9160



Terminal Tower

# CLEVELAND • 130th AAAS

## Order Your General Program

It provides complete, detailed information about all the sessions and symposia scheduled, the Annual Exposition of Science and Industry, and the Science Theatre.

### Program Highlights

**Moving Frontiers of Science** A. M. Gleason on the evolution of an active mathematical theory; Gordon J. F. MacDonald on deep structure of continents; A. L. Schawlow on infrared and optical masers; V. G. Dethier on microscopic brains.

**Interdisciplinary Symposia** AAAS day: Uses of lasers and masers; philosophical aspects of present-day cosmogony and cosmology; developmental aspects of immunity; biological and sociological research on the effects of human reproduction control; the federal government, science, and the universities.

**Special Sessions** AAAS Presidential Address by Paul Gross; the AAAS Distinguished Lecture on ideology and income by J. K. Galbraith; the Joint Address of Sigma Xi and Phi Beta Kappa by Paul Sears; the George Sarton Memorial Lecture by Hudson Hoagland; and the National Geographic Society Illustrated Lecture on Mozambique by Volkmar Wentzel.

**Other General Events** Three-session symposium on the sciences in Japan sponsored jointly by the Science Council of Japan and the AAAS. Two symposia sponsored by the Office of Economic and Statistical Studies of the National Science Foundation: Planning and administration of scientific research programs, and the role of instruments and equipment use in research program planning.

**AAAS Committees** Joint symposium of the Committee on Meetings and the Committee on Science in the Promotion of Human Welfare on chemical control of heredity, arranged by Barry Commoner and David R. Goddard.

**Sections and Societies** The 20 AAAS Sections and some 70 participating societies are scheduling specialized symposia, and many have sessions for contributed papers.

**Science Theatre** The latest foreign and domestic films.

**Exposition** The Annual Exposition of Science and Industry is conveniently located adjacent to the Ballroom on the mezzanine of the Sheraton-Cleveland.

**Advance Registration** By registering in advance, you avoid delay at the Registration Center on arrival, you receive the *General Program* in time to plan your days at the meeting, and your name is posted in the Visible Directory of Registrants when the meeting opens.

Use the coupon below for advance registration or to order your advance copy of the *General Program*.

AAAS  
1515 Massachusetts Ave., NW  
Washington, D.C., 20005

(Check 1a or 1b)

1a. ☐ Enclosed is \$5.00 for Advance Registration, including the General Program and Convention Badge.

1b. ☐ Enclosed is \$3.00 for the General Program only. (If I attend the meeting, the badge, which I need to obtain the privileges of the meeting, will cost me \$2.00 more.)

2. FULL NAME (Dr., Miss, etc.) ..... (Last) ..... (First) ..... (Initial) .....  
(Please print or typewrite)

3. OFFICE ☐ OR HOME ☐ ADDRESS .....  
(For receipt of General Program)

4. ACADEMIC, PROFESSIONAL, OR BUSINESS CONNECTION .....

CITY ..... STATE ..... ZIP CODE .....

5. FIELD OF INTEREST .....

6. CONVENTION ADDRESS .....  
(May be added later, after arrival)

Please mail this coupon and your check or money order for the total amount to the AAAS.

# MEETING • 26-30 DECEMBER

## Reserve Your Hotel Room

Make sure you have the accommodations you prefer. A list of headquarters hotels of participating societies appears on page 280, 19 July, *SCIENCE*. The AAAS headquarters is the Sheraton-Cleveland.

The hotels for the AAAS Cleveland meeting have established special, low flat rates and have reserved large blocks of rooms for the meeting.

Use the coupon below to make your hotel reservation in Cleveland. Send your application to the AAAS Housing Bureau in Cleveland, not to any hotel. Give a definite date and estimated hour of arrival, and also probable date of departure. The Housing Bureau will make the assignment and send you a confirmation in two weeks or less.

A rollaway bed can be added to any room at \$3.00 per night. Mail your application now to secure your first choice of accommodations.

**HOTEL RATES\***  
**AMERICAN ASSOCIATION**  
**FOR THE ADVANCEMENT OF SCIENCE**

For a list of the headquarters of each participating society and section, see page 280, *Science*, 19 July.

Hotel	Single Bed	Double Bed	Twin Beds	Suites
Sheraton-Cleveland	\$8.50	\$14.00	\$15.50	\$33.00—\$60.00
Statler-Hilton	8.50	14.00	15.50	28.00— 59.00
Manger	7.50	13.00	14.50	25.00— 35.00
Pick-Carter	7.50	13.00	14.50	32.50— 60.00
Auditorium	5.50—10.50	8.50—12.50	12.50—13.50	

\* All rooms are subject to a 3% Ohio state sales tax.



Cleveland Art Museum

AAAS Housing Bureau  
511 Terminal Tower  
Cleveland, Ohio, 44113

Date of Application .....

Please reserve the following accommodations for the 130th Meeting of the AAAS in Cleveland, 26–30 December 1963

First Choice Hotel ..... Second Choice Hotel ..... Third Choice Hotel .....

Type of room: Single ☐ Double ☐ Double, twin beds ☐ Suite ☐ Rates: Desired ..... Maximum .....

Number in party.....Sharing this room will be: .....  
(List name and address of each person, including yourself. Attach list if space is insufficient.)

.....  
.....

DATES: ARRIVAL ..... A.M. .... P.M. .... DEPARTURE .....  
(These must be indicated—add approximate hour, A.M. or P.M.)

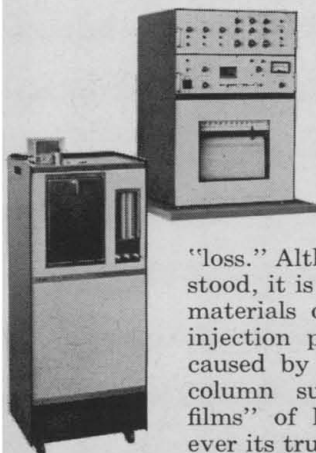
NAME .....  
(Individual requesting reservation) (Please print or type)

ADDRESS .....  
(Street) (City) (State) (ZIP Code)

Mail this coupon now to the Housing Bureau. Rooms will be assigned and confirmed in order of receipt of reservation.



# eliminate component "loss" in steroid analysis... even at nanogram levels



The quantitative analysis by gas chromatography of many biological compounds such as steroids and other substances with polar functional groups has not been entirely satisfactory. Of the several factors which may be involved, one of the most critical is the phenomenon of component "loss." Although this is not completely understood, it is due in part to adsorption of polar materials on metal or glass surfaces in the injection port or detector. It may also be caused by adsorption on active sites of the column support, particularly when "thin films" of liquid phase are employed. Whatever its true cause and its correct name, component "loss" is a very real problem that has made the quantitative analysis of very small amounts of such compounds difficult, thus limiting the usefulness of gas chromatography in certain biochemical and medical investigations . . . until now.

The F & M Model 400 Biomedical Gas Chromatograph eliminates the component "loss" phenom-

enon, even when sample size is reduced to the nanogram level. Dramatic proof of the accuracy with which steroids may be quantitatively analyzed is illustrated in the series of chromatograms below, covering a range of sample quantities from 0.1 microgram down to 5 nanograms.

There are excellent reasons for the almost perfect results obtained with the Model 400 in the analysis of biological compounds such as steroids, vitamins, alkaloids, bile acids, fatty acids and amino acids. Foremost among these reasons are exclusive design features that permit sample injection directly onto the column, the use of glass U-tube columns, the complete absence of "plumbing" at the detector, and the extremely sensitive but stable and linear flame detector.

For complete information about the Model 400 Gas Chromatograph or for a demonstration of the separation and quantitative analysis of other types of biological compounds, contact the Applications Laboratory, F & M Scientific Corporation, Route 41 and Starr Road, Avondale, Pennsylvania, 215 COLONY 8-2281. *European subsidiary: F & M Scientific Europa N.V., Leidsestraat 67, Amsterdam, The Netherlands.*

**INSTRUMENT:** F & M Model 400

**DETECTOR:** Flame Ionization

**SAMPLE:** 1.0 microliter of successive dilutions of a mixture of testosterone (A) and cholestane (B) in chloroform:

#1: A=0.1 microgram/ul  
B=0.05 microgram/ul

#2: A=0.05 microgram/ul  
B=0.025 microgram/ul

#3: A=0.01 microgram/ul  
B=0.005 microgram/ul

**COLUMN:** 4' x 1/4" OD, glass U-tube, 2% SE-30 silicone gum rubber on 80-100 mesh Diatoport S

**TEMPERATURES:**

Column—230°C

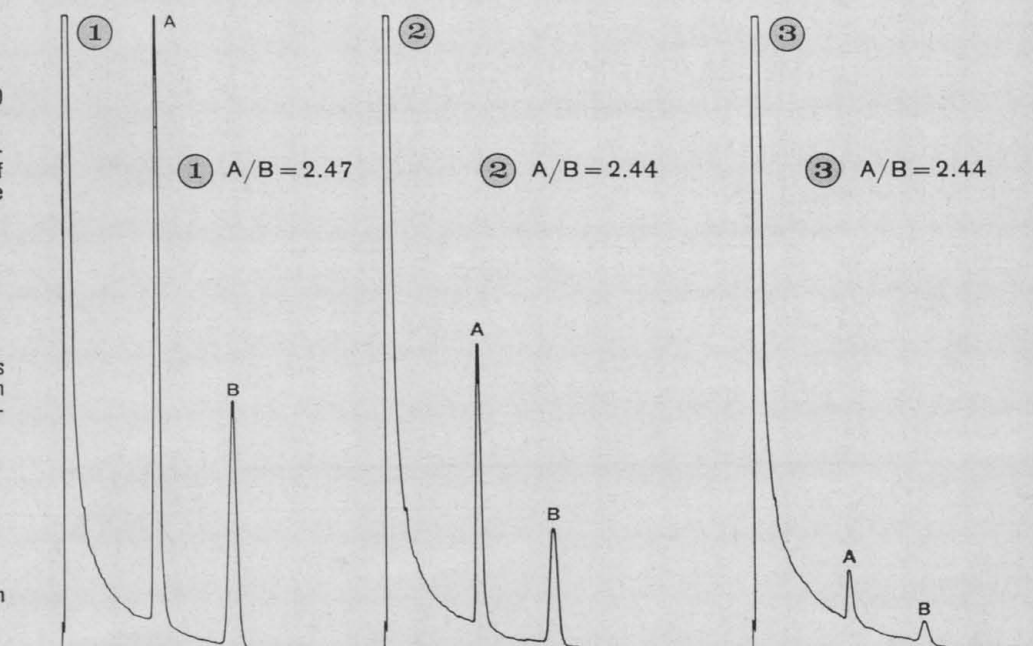
Injection port—300°C

Detector—250°C

**CARRIER GAS:**

Helium at 60 ml/min

**SENSITIVITY:** 1/32 of maximum



In this series of chromatograms, successive dilutions of a mixture of testosterone (a highly polar, easily "lost" steroid) and cholestane (a saturated, non-polar hydrocarbon that is readily chromatographed without "loss") were injected into the Model 400. If testosterone "loss" were occurring, the peak height ratio of testosterone to cholestane would decrease as the amount of sample injected decreased (because

the amount "lost" would be a larger percentage of the smaller sample.) But this ratio (A/B) remains constant through all three injections, even the most dilute run #3 where only 0.01 microgram of testosterone was injected. Note also the almost perfect symmetry of all the peaks, including the cholestane peak in run #3, which represents only 5 nanograms of sample. In all cases, the detector was operated at 1/32 of full sensitivity.



**F & M SCIENTIFIC CORPORATION**  
AVONDALE / PENNSYLVANIA

SALES OFFICES:

Atlanta • Boston • Chicago • Dallas • Cleveland • Houston • Los Angeles • New York • Pittsburgh • St. Louis • Toronto • Washington

Convince yourself —  
ask for a demonstration

# New Torsion 1,000 gram balance speeds laboratory work

Only Torbal  $\frac{1}{10}$  gram PL-1 offers all these features

- *Fast, accurate readings optically projected to  $\frac{1}{10}$  gram*
- *No-knife edge construction eliminates friction and wear*
- *Greater taring range*
- *Remains unaffected by out-of-level conditions*
- *Oil dampened to speed weighings*

Price  
only \$525.



To give you more convenient, accurate readings, Torsion has designed the PL-1 with a fine-reading vernier to  $\frac{1}{10}$  gram and a capacity of 1 kilogram. The balance has an optical range of  $-10$  grams to  $+110$  grams.

The heart of the mechanism in the new PL-1 is the Torsion no-knife edge construction. This eliminates friction and wear, insures lifetime accuracy

and speeds weighing. The balance will operate accurately even in severely corrosive or dust-laden atmospheres. Taring through a 125 gram range is accomplished with a built-in knob on the side of the balance. By using the

second pan the balance can be made to tare up to 325 grams. Torsion's optical projection Model PL-1 offers a sharp image with a high degree of illumination for easy reading and an oil damper to speed up weighing.

ASK YOUR LABORATORY SUPPLY SALESMAN FOR A DEMONSTRATION OR WRITE FOR BULLETIN TB-100.

THE  
**TORSION BALANCE**  
COMPANY

Main Office and Factory: Clifton, New Jersey • Sales Offices: Chicago, Ill., San Mateo, Cal.



**NEW**  
**Sanborn instrument**  
**ACCURATELY COMPUTES**  
**CARDIAC OUTPUT IN SECONDS**



**WITH LARGE**  
**NUMERICAL DISPLAY**

*Set controls and push button — new Sanborn Computer automatically calculates data, eliminates replotting dye curve.*

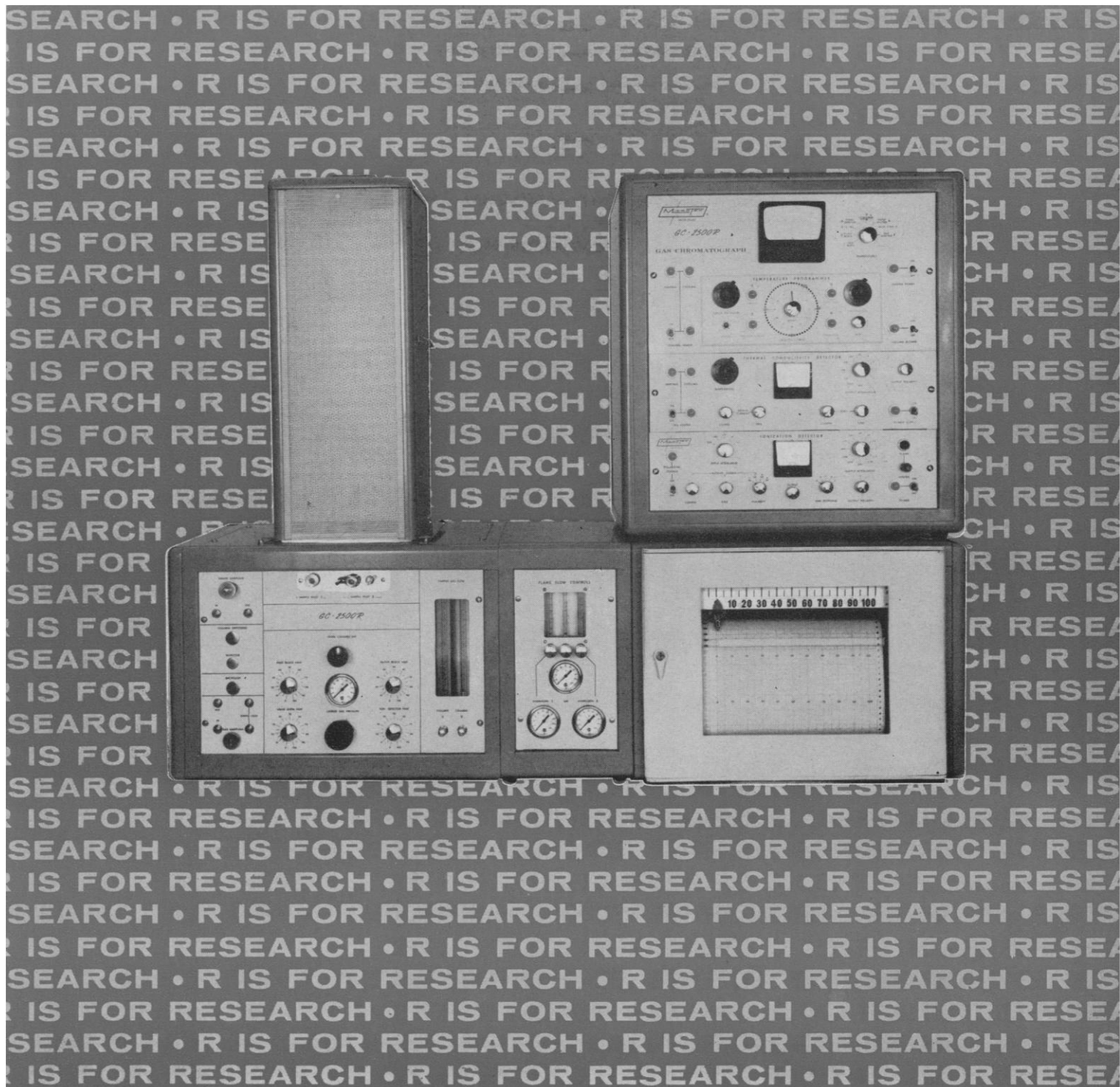
Immediately available cardiac output data allows the researcher, diagnostician or surgeon to make decisions regarding the need for further measurements, while the procedure is in progress. Valuable technician's time in routine determinations is also saved by the rapid "on line" results of this new Computer.

**Compatible with most densitometers** regularly used in dye dilution techniques. Remarkably simple to operate: once computer is zeroed and delay time chosen, operator simply pushes start and reset buttons, reads data on large illuminated numerals. Calibration factor is automatically provided. Built-in baseline sensing circuit assures accurate integration of dye curve, eliminates need for zeroing densitometer at beginning of each dye curve. Computer also provides electrical output suitable for printers, analog or digital computers.

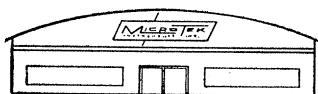
**Operating principle:** area under the dye concentration curve is computed without being affected by recirculation. Integration is performed using digital electronic techniques and two points on the downward exponential are used to complete calculation of the remaining area related to the primary circulation. The computer is also designed to electronically calculate the calibration factor related to normal sampling of blood and dye.

**Economical:** Model 130 Cardiac Output Computer (Patent Pending) \$1500, F.O.B. Waltham, Mass., continental U.S.A. (subject to change without notice). Specifications and application data on request: write Manager, Research Instrument Sales, Medical Division. Sanborn Company • Waltham 54, Mass. A Subsidiary of Hewlett-Packard Co.





## R IS FOR RESEARCH



An additional 75,000 sq. ft. of manufacturing area insures you of a continuing policy of unexcelled service.

Gas chromatographs fill many needs—in quality control, in educating future chemists and in specialized areas such as pesticide analysis and forensic chemistry. But no single application can impose the many stringent requirements of the serious research worker. So, if your assignment is RESEARCH, look to today's most advanced RESEARCH Gas Chromatograph. Look to the GC-2500R. Join other research scientists who applaud this superb instrument.



DYNAMIC LEADERSHIP IN  
ANALYTICAL INSTRUMENTATION

HOME OFFICE AND PLANT: 7330 FLORIDA STREET, BATON ROUGE, LOUISIANA • REGIONAL OFFICES: ATLANTA, CHICAGO, HOUSTON, NEW YORK, WASHINGTON.

choose the  
**SARGENT**  
 MODEL XV  
**RECORDING**  
**POLAROGRAPH®**  
 4 important advantages!

1. Full 10" Chart
2. 1/10% Accuracy of Measurement
3. 10 Standardized Polarizing Ranges
4. Low Cost

This Sargent POLAROGRAPH gives you a large 250 mm (10 inches) chart and the highest accuracy and current sensitivity at the lowest price of any pen writing polarographic instrument meeting these specifications.

It offers you optimum specifications based on over twenty years of leadership in design, manufacture and service in this specialized field of analysis.

The polarographic method is capable of reproducibility to 1/10% and analytical accuracy to 1/2%. To make use of this facility, the instrument must be accurate to 1/10% and chart space must be provided for recording large steps to achieve measuring precision. We strongly advise against the purchase of any polarographic instrument using miniature (5 inch) charts and low gain balancing systems in the 1% order of precision.

This Model XV is adaptable to  $10^{-6}$ M determinations with the S-29315 Micro Range Extender.

#### SPECIFICATIONS

**Current Ranges:** 19, from .003 to 1.0  $\mu$ A/mm.

**Polarizing Ranges, volts:** 0 to -1; -1 to -2; -2 to -3; -3 to -4; +.5 to -.5; 0 to -2; -2 to -4; +1 to -1; 0 to -3; +1.5 to -1.5.

**Balancing Speed:** standard, 10 seconds; 1 second or 4 seconds optional.

**Bridge Drive:** synchronous, continuous repeating, reversible; rotation time, 10 minutes.

**Chart Scale:** current axis, 250 mm; voltage axis, 10 inches equals one bridge revolution.

**Current Accuracy:** 1/10%

**Voltage Accuracy:** 1/2%

**Chart Drive:** synchronous, 1 inch per minute standard; other speeds optional.

**Writing Plate:** 10 1/2 x 12 1/2 inches; angle of slope, 30°.

**Standardization:** manual against internal cadmium sulfate standard cell for both current and voltage.

**Damping:** RC, four stage.

**Pen:** ball point; Leroy type optional.

**Suppression:** zero displacement control, mercury cell powered, 6 times chart width, upscale or downscale.

**Potentiometric Range:** 2.5 millivolts, usable as general potentiometric recorder.

**Finish:** case, enameled steel; panels, anodized aluminum; writing plate, polished stainless steel; knobs and dials, chromium plated and buffed.

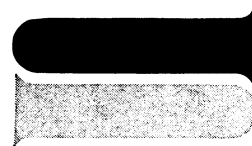
**Dimensions:** 23 x 17 x 10 inches.

**Net Weight:** 65 pounds.

S-29310 Sargent Model XV Recording Polarograph with accessories and supplies.....\$1650.00

For complete information write for Sargent Bulletin P-3.

E. W. SARGENT & CO., 4647 W. FOSTER AVE., CHICAGO 30, ILLINOIS  
 Detroit 4, Mich. • Dallas 35, Texas • Birmingham 4, Ala.  
 Springfield, New Jersey • Anaheim, California

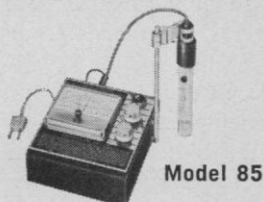


**SARGENT®**

Scientific Laboratory Instruments  
 Apparatus • Supplies • Chemicals

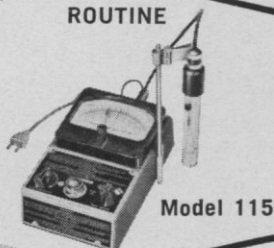
# pH METERS for every purpose

## INDUSTRIAL



Model 85

## ROUTINE



Model 115

## HIGH PRECISION



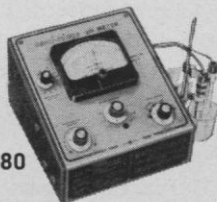
Model 110

## PORTABLE



Model 125

## EXPANDED SCALE



Model 180

Stocked by  
laboratory supply houses

# PHOTOVOLT

CORPORATION  
1115 Broadway • New York, N.Y. 10010  
write for bulletin

Those who introduced the medical research bill had to make a hard decision not to accept a compromise of the original specifications, including an amendment which would have put its administration into the Department of Agriculture. The original bill finally passed both chambers, with overwhelming support. The Governor signed it into law on 4 April.

The outstanding lesson of the effort to enact this bill was that, when there is adequate public discussion of the issues, an informed electorate can convince legislators that the use of animals in medical research is essential and should be supported. Similar legislation in other states would make completely unnecessary any additional federal legislation restricting the use of animals in research.

MICHAEL HUME

*Yale University School of Medicine,  
333 Cedar Street,  
New Haven, Connecticut*

## Revision of the Copyright Law

Under the caption of "Copyrights, royalties, reprints, and scholarly interests" [*Science* **141**, 483 (9 August 1963)] appeared a letter by Franklin Folsom, and a reply by Hayward Cirker to which I would like to add some details.

Folsom advocates support for a revision of the copyright law that would increase the maximum duration of a copyright from 56 years to 76 years. Concerning the present maximum of 56 years he says: "Laws about such publicly useful property as real estate, oil wells, factories, and others do not normally place such severe limits on private ownership." This comparison would be more appropriate if it referred to the common law copyright which lasts as long as the author keeps his writing privately in his possession, but is lost as soon as he gives it to the public through publication. The comparison is not appropriate when made with reference to the federal copyright law which does not limit an existing right but creates a new one—the right to prohibit others from doing something they would otherwise be free to do, the right to prohibit them from copying and distributing material which has been published.

A patent constitutes a truer analogy. In common law, if an invention can be used and still kept secret by the

inventor, it is protected against theft, but after it has been disclosed to the public, others can copy it. The federal patent law, like the federal copyright law, creates a new right, the right to prohibit others from making, using, or selling counterparts of the patented invention. (Under the patent law the prohibition will apply even to others who may make the same invention independently, while under the copyright law the prohibition does not apply to others who may write the same thing independently.)

The requirements for issue of a patent by the Patent Office are, however, far more exacting than those of the Copyright Office for issue of a "Certificate of Registration of a Claim to Copyright" (notice the word "Claim"). The invention must, with some exceptions, be new and useful, whereas literary matter need only be "original" (meaning only that the writer did not copy it from someone else, although the same thing may have previously been written by others and may be in the public domain). The scope of the claims for an invention—its novelty and usefulness—must be clearly specified and delineated. The original material on which a copyright is claimed does not have to be specified: original and non-original material; and material on which a copyright has expired, can be combined to give the misleading appearance that a copyright is claimed on the aggregate and to complicate litigation. A patent application is scientifically examined by experts in the Patent Office for novelty and usefulness, but no examination is made or could be made for originality of literary material in the Copyright Office; in fact the Copyright Office does not necessarily retain a copy of all material filed with it, but may discard such material even before expiration of the copyright period. In other words, a patent represents a finding that the invention is a substantial advance over the prior art, but a certificate of registration of a claim to copyright does not represent a finding that a writing is creative or even that it is "original." Yet the potential life of a copyright is already more than three times as long as the life of a patent: an initial term of 28 years plus a renewal term of 28 years, or a total of 56 years, as against 17 years for a patent.

Cirker remarks that extension of the life of copyrights to 76 years is being promoted by a small, special-interest





# THIS BOTTLE CONTAINS ARGON?

YES. MC&B packs atmosphere-sensitive chemicals under argon or other inert gases, to maintain purity. Inert gas packaging extends shelf life and permits us to maintain 100% stocks of reliably pure chemicals. This is one of the procedures that is making MC&B the first choice at an increasing number of the nation's laboratories.

Write for Catalog of over  
5000 MC&B chemicals

# MC&B

Matheson, Coleman & Bell  
Division of the Matheson Company, Inc.  
Norwood (Cincinnati) Ohio, E. Rutherford, N. J.

## From Matheson

## NEW LITERATURE ON COMPRESSED GASES & ACCESSORIES

**Wall Chart—"Safe Handling of Compressed Gases"** This 14" x 21" Chart illustrates proper techniques for safe handling of various Compressed Gases. A copy of this safety chart should be displayed wherever compressed gases are used or stored. Supplied without charge.  
Matheson

Circle 9

### New Compressed Gas Catalog



Latest edition of the Matheson Catalog lists 95 compressed gases and mixtures available from Matheson plants in East Rutherford, N.J., Joliet, Ill., Houston, Texas, and Newark, Calif. The 64 page catalog is published in 4 regional editions. Includes a section on Matheson Gas Regulating Equipment, Flowmeters, Purifiers, Valves, Controls, etc.  
Matheson

Circle 10

**Gas Data Book.** Comprehensive fact book and manual containing essential data on almost every gas available for laboratory use. Includes physical constants and specifications, recommended controls and regulators for all gases, safety and first aid procedures, handling and storage recommendations. 444 pages, 68 tables, 68 charts. Order from Matheson at \$8.00 postpaid in U.S. and Canada, or mail coupon for further information.  
Matheson

Circle 11

**Cylinder Valve Outlet Chart.** Convenient 8½" x 11" chart shows dimensional drawings of CGA Valve Outlets and Connections. Lists 95 gases with recommended outlet and connection.  
Matheson

Circle 12

**Vinyl Fluoride.** Available from Matheson plants shipped as a liquefied gas under its own vapor pressure. Minimum purity 99.9%. Vinyl Fluoride is of interest as a chemical intermediate. Can be polymerized to form a homopolymer, and can also be copolymerized with other monomers. Mail coupon for Data Sheet.  
Matheson

Circle 13

**1,1-Dichloro-1,1-Difluoroethylene.** A liquefied gas; minimum purity of 98.0%. Used in polymerization and copolymerization, and as a chemical intermediate. Data Sheet.  
Matheson

Circle 14

**Deuterium.** A heavier, stable isotope of ordinary hydrogen supplied as a non-liquefied gas at a minimum of 99.5 atom percent. For tracer applications, exchange reaction studies. Data Sheet.  
Matheson

Circle 15

**Ethyl Acetylene.** Supplied as liquefied gas; minimum purity 95.0%. Used in organic synthesis. Data Sheet.  
Matheson

Circle 16

**Phosphorus Pentafluoride.** Useful as catalyst for polymerization, isomerization, alkylation, dealkylation, cracking of hydrocarbons. Data Sheet.  
Matheson

Circle 17

**Sulfuryl Fluoride.** Liquefied gas; minimum purity 99.5%. Used as insecticidal fumigant, as a catalyst, and in preparation of fluorocarbon compounds. Data Sheet.  
Matheson

Circle 18

**Sulfur Tetrafluoride.** A reactive gas, capable of replacing oxygen in many organic, inorganic and organo-metallic compounds with fluorine. Data Sheet.  
Matheson

Circle 19

### CIRCLE ITEMS DESIRED AND MAIL COUPON

The Matheson Company, Inc.  
P. O. Box 85, East Rutherford, N. J.

☐ Please send the following free literature:

9 10 11 12 13 14 15 16 17 18 19

Name \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

Plants in E. Rutherford, N. J., Joliet, Ill., LaPorte, Tex., Newark, Calif., Whitby, Ont.

WACO POWER STIRRER

# HIGH TORQUE

FOR CONTINUOUS  
24 HOUR SERVICE



ONLY... \$29<sup>50</sup>

No other stirrer made will give as much service per dollar. Use the WACO Power Stirrer 24 hours a day, 7 days a week for months at a time... not a stock motor converted to a stirrer, but a sparkless induction type motor specifically designed for laboratories... where long, continuous use is required. Two shaft speeds, 300 and 600 R.P.M., cover the majority of applications. A built-in cooling fan allows continuous operation without overheating or burning out.

86100—WACO Power Stirrer, with tubular brass mounting rod and 6 foot cord... only \$29.50. Stirrer chucks, \$1.85 ea., set of three stirring rods (small, medium, large), \$8.00.

Order direct or write for descriptive folder.

LABORATORY SUPPLIES AND EQUIPMENT

**WILKENS-ANDERSON CO.**

4525 W. DIVISION ST. CHICAGO 51, ILL.

group and that such extension is not in public interest or in the interest of scientists. In support of this contention the following observations may be made. Anyone can claim a copyright on almost any arrangement of words and bring a charge of infringement against anyone who uses a similar arrangement, even though it is original with the latter person or was taken from the public domain. Since the first test of the validity of a copyright must be made in court, the threat of litigation, especially by one with greater financial resources, and the difficulties of proving originality by the accused as compared with the ease of showing similarity by the accuser put a powerful weapon in the hands of the accuser. With the accelerating rate of publications, more similarities among original writings are bound to result, and thus more charges of infringement where none has occurred. Also, a copyright may be misused to try to prevent the free flow of ideas, although an idea cannot be copyrighted. Hence there seem good reasons for not enlarging the privilege of copyright. With respect to scientists in particular, the extension of the life of a copyright would bring no benefit, for the accelerating rate of scientific developments makes it most unlikely that a scientific writing will command royalties or be in demand after 56 years. Scientists and the general public would be better served by a revision of the copyright law requiring a specification of the portions on which copyright is claimed, where it is not all original or where a copyright has expired on part of it—under penalty of voiding the copyright on the whole thing if a false claim is made.

PAUL L. LATHAM

371 Blythe Road, Riverside, Illinois

## Overhead and Research Grants

The recent AIBS predicament [*Science* 139, 317, 392 (1963)] put the spotlight on the rapidly growing, cancerous, "overhead" situation in U.S. science. It seems timely for someone who is not dependent on this source of income to point out what is happening.

"Overhead" of some sort is a justifiable feature of applied science contracts, where the government, or an industrial concern, requires that certain

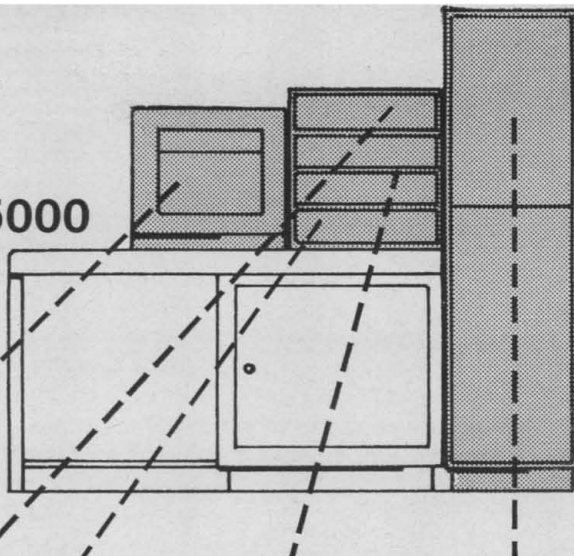
work be done and must bid in the open market for the services of an institution with the necessary facilities and capacity to do the work, or build its own facilities with this capacity. This kind of science, if it can really be called science, does not differ from any other sort of commercial or economic activity. Whether the compensation is called "overhead" or "commission," it is essentially a cost-plus arrangement, and the amount of compensation is determined by the state of the market.

Fundamental science, formerly called "pure science," has come to be subject to the same profit motives. Research was once considered to be one of the normal functions of universities, museums, institutes, academies, and other intellectually oriented organizations. The authorities of such institutions were more than happy when their scientists were able to get grants-in-aid to enable them to carry on this function and considered it a normal part of their own duties to take care of the bookkeeping. We were outraged when we heard of a tight-fisted university administration demanding a 7½ or 10 percent "overhead" to cover the cost of these services.

However, the pattern was set by the contracts for "testing," "research and development," and other applied activities that required the services of scientists or technicians, and the demand for a cut of the pie spread to contracts and grants for strictly fundamental research—research which the scientists wanted to do because of their own intellectual interests. As granting agencies grew to handle the awarding of the increasing government support to pure science, they tended to be staffed by professional scientific administrators, often coming from the agencies that had handled defense and other applied contracts. The idea of overhead was not new to them, and they had also brought with them the businessman's distrust of the people with whom he deals. They were not any more willing to trust the scientist grantee to handle his own grant than they had been to trust the commercial chemist who had been employed to develop a new pesticide or the engineering company that had built a missile. They demanded the assurance provided by an institution that the scientist would not abscond with the money, spend it on wild parties, or take his family on a vacation. The

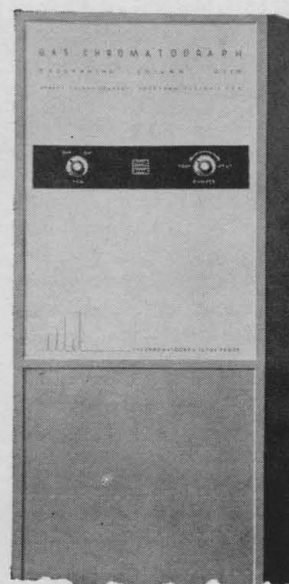
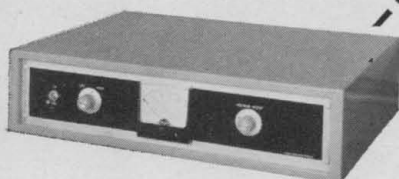
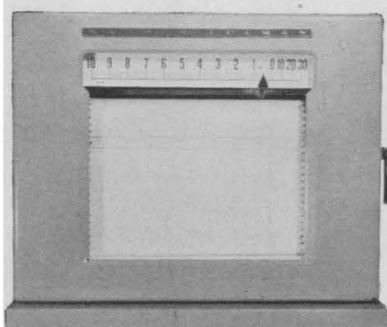


## Selecta-System Series 5000 Gas Chromatographs fit your budget and your laboratory NOW...and...LATER



### SELECTA-SYSTEM MEANS:

- gas chromatograph system tailored to your specific needs — no unwanted or seldom-used parts
- flexibility to start with an inexpensive system and modify to an advanced model at minimum cost
- adaptability to changing needs in gas chromatography — no danger of complete model obsolescence
- freedom of movement of the system components. The cabinets may be arranged to fit the lab



Improved systems mean improved performance — Wide choice of detectors: Argon, High Temperature Flame, Thermal Conductivity, Electron Attachment. Accurate automatic temperature programming and programmable column baths speed analyses. Solid state components, high sensitivity electrometer, wide column se-

lection, triple range power supply, and dual range recorder units add to the superior performance of the NEW Series 5000 Gas Chromatographs. Over 50 different systems can be selected. Bulletin F-11545-1 is yours for the asking. Call our nation-wide network of sales and service factory branches or write to us at Rockford, Illinois.



## BARBER-COLMAN COMPANY

Dept. V, 15131 Rock Street, Rockford, Illinois, U.S.A.

BARBER-COLMAN of CANADA, Ltd., Dept V, Toronto & Montreal — Export Agent: Ad. Auriema, Inc., N. Y





## The Design of Gas-cooled Graphite-moderated Reactors

*Edited by D. R. Poulter.* Staff specialists from the UKAEA Reactor Group describe the sciences, properties, and operations of the reactors on which Britain's nuclear power program is based. Specific parts are covered in detail. For engineers—not a design manual. \$13.45

## Cosmical Electrodynamics, Fundamental Principles *Second Edition*

*By Hannes Alfvén and Carl-Gunne Fälthammar.* A modernized, expanded version of the first five chapters of the first edition. Covers important developments in plasma physics and magnetohydrodynamics of the last fifteen years. Considerable knowledge of physics and mathematics is assumed. Other volumes to follow. 60 line figures, 3 half-tone plates, numerous tables and equations. \$9.60

## Cosmic Rays

*By T. E. Cranshaw.* Makes recent research discoveries intelligible to advanced physics students who are not specialists in the field. Covers research history, the primary beam, theories of origin, energy interactions above 1,000 GeV, air showers, geomagnetic effects, time variations. Annotated author index is a useful bibliography.

*Paper; 36 illustrations. \$2.90*

## Radioactivation Analysis

*By H. J. M. Bowen and D. Gibbons.* Theoretical and practical details of this sensitive and selective method of elementary analysis. Recent applications are reviewed in chemistry, biochemistry, geochemistry, metallurgy, and the semiconductor field.

\$8.00

**Oxford University Press**  
**New York**

fact that the value of the work they were supporting depended entirely on the same man's honesty was apparently never given a thought. For the assurance of financial responsibility they were willing to pay an appreciable percentage of the total funds available for their grants.

The fiscal authorities of the universities were not slow in seeing the possibilities in this situation. They began to scrutinize their own operations for "indirect costs." These commenced to mount with no relation at all to any change in the work performed by their bookkeepers. The contrast between the 10 to 15 percent overhead allowed by the pure science granting agencies and the 50 to 120 percent allowed on applied science contracts became evident, resulting in pressure, on the one hand, on their scientists to work on "useful" projects, and on the other, on the agencies financing fundamental research for higher overhead. It was inevitable that the possibilities in the use of "overhead" for purposes for which it was never intended would be discovered. An early one, and certainly not an undesirable one, was the attempt by certain universities to build up a fund to provide continued employment between contracts for the professional staff hired for contract work. Such foresight was never widespread and was soon discouraged by higher authorities controlling these institutions themselves, who could not tolerate the idea of this money lying unused. The practice of using the overhead money to finance scientific or other activities which were outside any approved program of the granting agencies was not long in following. The AIBS, admittedly one of the guilty ones, happened to be the one that got caught and made an example of.

I think that it is time to look into the whole overhead situation in pure science grants. NSF officials readily admit that the number of meritorious proposals submitted exceeds their capacity to finance them. They have to reject, because of lack of funds, projects they would otherwise be glad to support. If overhead did not eat up 20 percent of the available funds, 20 percent more work could be supported. The man-hours that go into the preparation of these lost proposals are both a source of frustration and a dead economic loss. In addition to this, another sinister factor has crept into the situation. Panels of scientists, who are

supposedly evaluating proposals on their scientific merits, are allowing the size of the overhead demanded by an institution, what is known of its use of the overhead money, and whether or not the institution normally supports a particular kind of work, all to influence their decisions about the relative merits of the proposals they are judging. This can be described in no other terms than as a perversion of the function of these panels.

The practice of allowing overhead on scientific grants and contracts, except those of a strictly commercial nature, should be abandoned. Abandonment would make at least 20 percent more money available to support meritorious projects. It would, at one stroke, eliminate proposals that are developed because of pressure from administrative authorities rather than because of interest by the scientists themselves. And it would bring out into the open the financial problems of worth-while scientific institutions. The legitimate administrative expenses of these institutions would have to be obtained by the same kind of procedures as the funds for scientific work, would be subjected to the same sort of scrutiny as that given to the scientific budgets, and would have to be justified in the same ways. Such administrative expenses would doubtless decrease materially. We might even be treated to the phenomenon of an administrator not having as many secretaries and clerks as he needed, because he could not afford them. This has long been a common situation with scientists. If the so-called indirect costs were real and legitimate, they could and would be met by appropriate grants. Equally, the costs of maintenance and care of collections, libraries, natural areas, and other facilities for scientific work could be honestly appraised and provided for. If the government is in the business of supporting scientific research, as it obviously is, this should be admitted. The support should be adequate; opportunity for control over the directions pure science may take should be minimized; and the processes of empire-building should at least be brought out into the open, so the empires would stand or fall on their merits, rather than be allowed to take place back in the shadows where funds can be manipulated and things may not be what they seem.

F. R. FOSBERG

*Falls Church, Virginia*

# new PICKER **2/1** SPECTRO/DIFFRACTOMETER

*x-ray emission / x-ray diffraction*

**always ready for either technique**

**two permanently mounted x-ray tubes preclude changeover downtime**

**use this tube for fluorescence analysis**

**it offers these advantages**

- end window type with W, Mo, Cr, or Pt target
- 60 KV CP high intensity radiation
- water-cooled specimen chamber
- rapid, easy crystal changing
- remote crystal tuning (with Omega motor)
- integrating specimen spinner
- air/helium operation (10 second flush)

**this for x-ray diffraction**

**it offers these advantages**

- constant potential operation
- variety of focal spots (.4, .75 and 1.5 mm available)
- both Omega and 2-Theta scanning
- electrically operated shutters
- take-off angle easily adjustable (without disturbing beam alignment)
- track-mounted specimen and detector supports
- complete set of slits or pinhole collimators

slew motor for single-angle programmer

encoder for single-angle programmer

The Picker Two-in-One SPECTRODIFFRACTOMETER provides uniquely versatile technical resources for a minimal outlay. It will find particular welcome in the laboratory where both diffraction and emission analyses may be required on the same specimen: one can follow the other by simple switchover (no need to interchange and/or align components). The instrument's instant readiness to tackle either job commends it to the small laboratory where scant space or stringent budget permits investment in only one goniometer.

To get the detailed story of these remarkable instrumental advances, call any local Picker representative or write PICKER X-RAY CORPORATION, WHITE PLAINS, N.Y.

**another advance...**

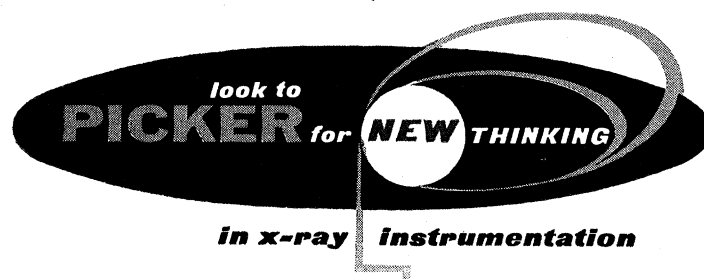
**automatic single-angle programming**

The attachments seen jutting from the diffractometer base in the picture above are the slew motor and encoder for the Picker Single-Angle Programmer.

The programmer will automatically analyze

- up to 10 elements by x-ray emission techniques
- or up to 5 pairs of Bragg angles by diffraction

Operating unattended, it can save countless manhours in situations where much sequential work is to be done.





## A New Concept in Ion Exchangers

### SE-Sephadex®

Introduction of ionic groups into SEPHADEX, a hydrophilic insoluble product derived from cross-linking the polysaccharide, dextran, makes possible an entirely new series of ion exchangers. The SEPHADEX ion exchangers have

- High capacity
- Low nonspecific adsorption

SEPHADEX ion exchangers make possible the purification, separation and fractionation of a wide range of low molecular weight, complex organic compounds, proteins, and related nitrogenous substances with high yields.

A diversity of types, both anionic and cationic, are available to meet specific requirements. Have you investigated—


### SE-Sephadex

Active group	sulfoethyl
character	cationic, strongly acidic
capacity	2.0-2.5 meq/g

SE-SEPHADEX is prepared in two forms:

C-25, which is highly effective for separating low molecular weight, complex organic substances, and C-50, which has a far greater binding capacity than C-25 for large size molecules—particularly useful for purification of proteins, enzymes, and related nitrogenous compounds.

SE-SEPHADEX has total exchange capacity of 2-2.5 meq/g. This product is available in the following sieve fractions: Coarse, Medium, and Fine.

 PHARMACIA FINE CHEMICALS, INC.  
501 FIFTH AVENUE  
NEW YORK 17, NEW YORK

☐ Send me information on  
SEPHADEX Ion Exchangers.

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

### Equal Opportunity

A tremendous amount of money has been and is currently being expended in an attempt to improve the scientific capabilities of American youth. Yet, do all youth receive an equal opportunity to benefit from this expenditure? Are these funds, many of which are derived from current taxes, actually being used to increase the subject-matter competency of future college science students within particular disciplines rather than to increase the scientific literacy of all youth as citizen-consumers? It would seem that a far greater number will become consumers rather than scientists.

During the past 10 years much has been said about the failure of elementary and secondary schools to provide adequate instruction in the sciences. Much has also been said to encourage these same schools to give students a better understanding of the relationships which exist between 20th century technology and modern social institutions. An ever-increasing emphasis seems to be placed upon the need for public and private elementary and secondary school teachers to acquire new factual information for dissemination to their students. However, it is extremely difficult to find publications concerning the degree to which the newly acquired information is communicated to and learned by high school students.

School administrators have been asked to indicate the necessary qualifications for secondary school science teachers. Is the science teacher unable to indicate the deficiencies which exist in his own subject-matter preparation? Further, to what degree does competent supervision exist in the public schools in general and, more specifically, within the sciences, when the administrator is likely to be less adequately prepared in them than the science teacher he supervises? This may be particularly true of smaller schools, but the debility appears to be general.

Is the college science teacher also shirking responsibility? Do those of us who work with science teachers in training attempt to determine the problems encountered by those working in the smaller schools? Do the present course-improvement programs involve a thorough analysis of the ways in which the discipline can be learned by high school students? Little evidence would indicate an affirmative answer.

While substantiating evidence is lacking, are institute participants se-

lected on the basis of their previous college marks? Are some participants being selected because they teach in a particular community? It would seem that many people who are less well prepared academically, both in terms of marks and the number of science courses completed, should be the first to be invited to participate in an institute. Such teachers still remain in the classroom, while others have attended as many as 8 or more institutes.

In essence, while a large number of us welcome the opportunity to obtain grants, is there an abrogation of responsibility on our part? We apparently fail to investigate any values which may accrue from such expenditure in terms of an increase in the scientific literacy of high school students. If we are evaluating outcomes of institutes course-improvement programs, and the many other existing attempts to improve scientific literacy, then our failure to communicate and publicize our findings is also an abrogation of responsibility.

DAVID W. PIERSON

*Division of Biological Sciences,  
Fort Hays Kansas State College, Hays*

### Critical Evaluation of Reviews

Margaret Mead has raised an important issue in her letter concerning "literary" versus "scientific" book reviews [*Science* **141**, 312 (26 July 1963)]. There is a vast difference between a literary work—which is evaluated by the reviewer on the basis of emotional impact, craftsmanship, persuasiveness, or even the reviewer's personal opinion of the author and what he may be trying to say—and a serious book on some scientific specialty that has become of interest to a literary review journal.

The critical evaluation of the work of one professional scientist by another is based on the assumption that both author and reviewer are engaged in a common enterprise: the search for scientific truth. This is not the situation between the author of a novel and its reviewer. Thus when the scientific work seems to contain erroneous logic, insufficient supporting evidence, or unjustified conclusions, the reviewer should point this out—and the author's reply should also be printed. Many times the critic aids the author by pinpointing weaknesses in logic (or even arithmetic) and science benefits.



## VICTOREEN R-METER

## YOUR COMPLETE CALIBRATION FACILITY

It is obviously not feasible to attempt to duplicate the scope of Victoreen's complete Roentgen calibration facility — the most extensive non-governmental installation in the world. Yet the Victoreen Condenser R-Meter gives you a secondary radiation standard that, in a very real sense, is the equivalent of such a facility.

Carefully calibrated against Victoreen's elaborate array of special equipment, including X-ray and gamma radiation sources with an energy range from 6 kev to 1.3 Mev, the Condenser R-Meter allows you to duplicate precisely measurement of the Roentgen in your own laboratory. Intercomparison with Victoreen's free air ionization chamber, which is checked

against the U. S. Standard for agreement, is your absolute assurance of precise Roentgen measurement.

Wide selection of interchangeable chambers offered with the Condenser R-Meter covers a broad spectrum of energies and a variety of total doses and intensities. Don't settle for less than the best — Victoreen Condenser R-Meter. A-8904-A

WORLD'S FIRST NUCLEAR COMPANY

**VICTOREEN**

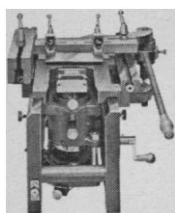
THE VICTOREEN INSTRUMENT COMPANY  
5806 HOUGH AVE. • CLEVELAND 3, OHIO

Victoreen European Office: P. O. Box 654, The Hague

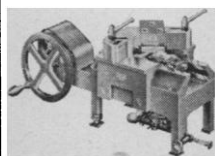




# FLAWLESS SPECIMEN SECTIONS WITH JUNG MICROTOMES



**Tetraender Microtome** for sectioning of very large specimens including whole human brains, entire lungs, laboratory animals, etc. Fully automatic feed to 30 microns in steps of one micron.



**Heavy Duty K Microtome** for the hardest specimens, including undecalcified bone, plastics, rubber, metals, etc. Fully automatic feed, 1-30 microns in steps of 1 micron... optional motor drive.



**1120 Rotary Microtome** for positively uniform serial sections of even very hard and non-homogeneous specimens. Fully automatic feed to 40 microns in steps of 1, 2 or 5 microns.



**1200 Clinical Freezing Microtome** for pathological laboratories, and histochemical, biochemical, isotopic and industrial research. Fully automatic feed, 2-40 microns in steps of 2 microns.

Jung has a Microtome for every sectioning need. With nearly a century of experience, Jung is the only manufacturer specializing exclusively in Microtomes and Microtome Knives. Inquiries on special sectioning problems are invited.

*Hacker*

For further particulars, write to:  
JUNG DIVISION

**WILLIAM J. HACKER & CO., INC.**  
Box 646, W. Caldwell, N. J., CA 6-8450, Code 201

It does not matter where the review appears. When a scientific work is appraised for its content by another scientist, the "scientific reviewing ethic" must govern. For when one scientist criticizes the work of another, the fact that he stakes his reputation in public, keeping in mind the possibility of a sharp rejoinder, serves to maintain responsible discussion. As Arthur Freeman pointed out in the letter printed below Mead's, a reviewer can do himself discredit, as well as the author, if he is inaccurate or hypercritical. The possibility of an immediate rejoinder thus serves the community well.

RAPHAEL G. KAZMANN  
Stuttgart, Arkansas

Is not Margaret Mead's "mare" actually a swarm of hornets [*Science* 141, 312 (26 July 1963)]?

T. H. JUKES  
Bonner Laboratory, University of California, Berkeley

## Identity of Organized Elements in Carbonaceous Chondrites

A recent report in *Science* (1) highlighted the present controversy about the identity of organized elements found in carbonaceous chondrites. In this regard, it may be observed that none of the reported organized elements appear to be from "out of this world" in terms of morphology, structures, and reaction to stains (2). This can be seen by the presence of pores, spines, processes, ornamentation, protist size, canals, plates, necks, collars, tissues, walls, acid-resistant pellicles, apparent pectic substances in some walls, ribs or thickenings, reactions to a broad band of biological stains (2, Table 1). At the New York Academy of Sciences Conference on Fossil and Recent Protobionta last spring, I recall a conversation with Bourrelly in which he expressed surprise that many of the organized elements were reminiscent of terrestrial chrysophytes (which are his specialty) (3).

It follows that for such organized objects, an equivalent biochemistry to that known on earth is indicated. Thus, we may assume that all such objects are carbon-based, that nucleic material compares with that of similar terrestrial objects, that reproduction (fission and copulation) may closely resemble that of terrestrial equivalents (2, Fig. 6a).

This complete terrestriality of the organized elements places a sharp focus on a possible explanation. Either we are dealing with an example of extraterrestrial homeomorphy with terrestrial protists or the terrestrial aspect of the organized elements arises because they are, in fact, terrestrial contaminants (1). The latter explanation, being simplest, has first claim on our attention.

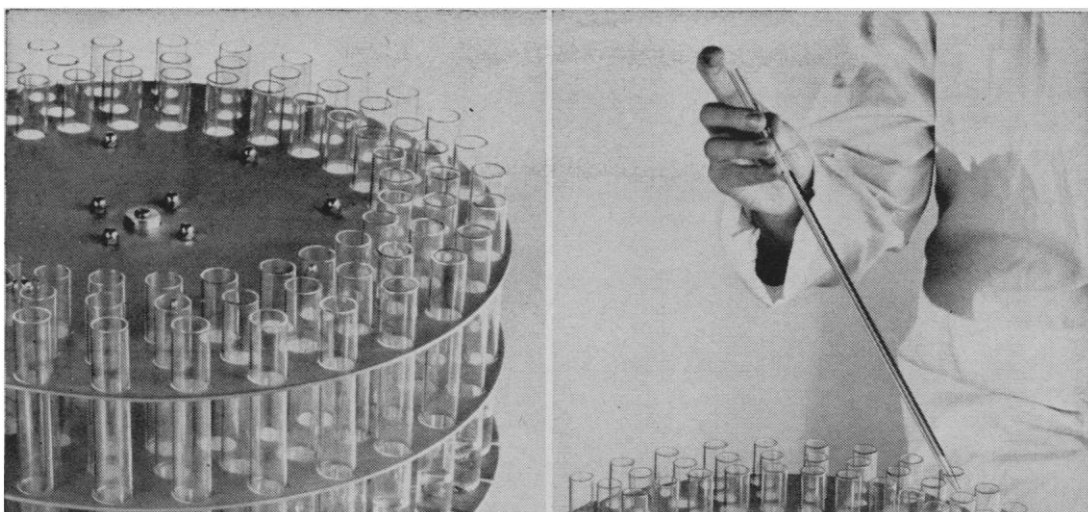
1) *Possibility of terrestrial contamination.* Claus *et al.* (2, Table 2) recently provided a valuable reference to the biological material found in soil and rock samples in the Orgueil impact area. These objects included various chrysophytes and in one rock fragment from a quarry (location not indicated on map), a fragment of an armored dinoflagellate, *Peridinium*. In addition, there was a varied suite of other protists, pollens, and other organic items.

The new data on the microbiology of the impact area becomes important when viewed in the light of observations of the organized elements made by several specialists. Claus, Bourrelly, and others have noted that several of the organized elements resemble chrysophytes. Staplin, Ross, and others have noted that some of the organized elements suggest hystrichosphaeres, dinoflagellate cysts, or dinoflagellate structures. Clearly, some chrysophytes and dinoflagellates are available in the impact area today (2, Fig. 9a-b). If a chondrite impacted in the Orgueil area today, one might reasonably expect incorporation of some of these forms and others listed in Claus's Table 2.

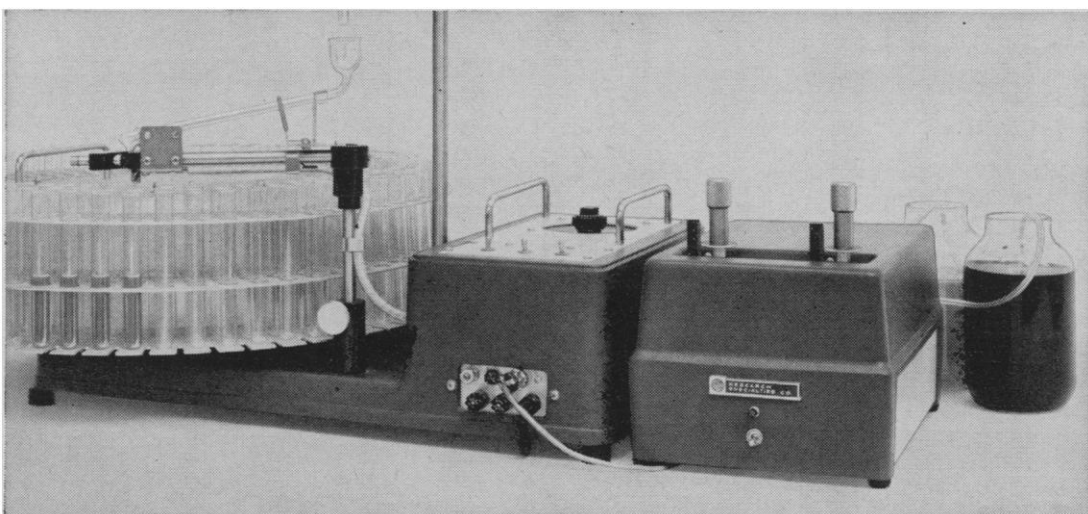
Claus *et al.* (2) cited Bourrelly and noted that the present soil microbiota in the impact area should be similar to that of 1864. Hence, we may conclude that such protists were available in the Orgueil area in 1864 at the time of impact. However, none of the organized elements were found to be "identical" with elements of the existing microbiota of the area. Does that close the case for contamination at the time of impact? I do not think so.

Almost a century has elapsed since the original fall in the Orgueil area and some changes in the biota might have occurred. As the next point to be discussed will show, based on the data of Claus, *et al.*, some changes apparently did occur.

2) *Aquatic contaminants in Anders's sample of the Orgueil chondrite.* Having recently processed a sample of the Orgueil meteorite provided by Anders (4), I was surprised



**Are you collecting fractions...then adding reagents?**



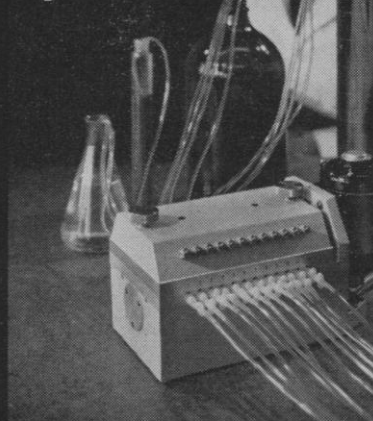
**Now do both at once—automatically.**

**RSCo's NEW REAGENT DISPENSING FRACTION COLLECTOR** completely automates these two operations. Without supervision (at night when the lab is closed), it makes up to 500 cuts, adds two reagents simultaneously. Saves time, improves accuracy and reproducibility. Use it with drop counting, timed flow, or volumetric siphoning. □ Buy the complete system or either component. You can add the new RSCo Reagent Dispenser to your present RSCo fraction collector or to many other fraction collectors. □ Our Model 1205 Fraction Collector is available for volumetric siphoning, or with time base and drop counting accessories. Rugged. Compact. Dependable in both laboratory and cold room. □ Available from your RSCo Dealer. Or write us for more information.



200 SOUTH GARRARD BLVD. • RICHMOND, CALIFORNIA

Single compact  
unit for most  
metering  
and feeding  
requirements...



## check these features of the new DURRUM 12-CHANNEL LIQUID PUMP

- Compact — the Durrum Dial-A-Pump, Model 12AP, provides the versatility and capacity of 12 separate pumping channels in just 12" of bench space.
- Each channel is individually and continuously adjustable over a range of 0-4,000 ml/hour.
- Wide range of applications — ideal for feeding of multiple chromatography columns, mixing of liquids and slurries, perfusion studies, and proportioning chemical streams.
- Handles virtually all your liquid pumping requirements with one unit costing only \$750.

For more information, contact your nearest representative of Van Waters & Rogers, Inc. or Fisher Scientific Company. Or write for Bulletin 12AP.

**Durrum  
Instrument  
Corporation**

925 E. Meadow Drive  
Palo Alto • California

to learn that Claus *et al.* (2, p. 602) found, in another of Anders's samples, the following items: fragments of *Compsopogan* filament (Rhodophyta), individuals of *Chlorella*, a rare species of *Nägeliella*, cladoceran antennae, and so forth. These authors observed that "although the organized elements were clearly visible, the presence of aquatic contaminants suggested a more recent sediment than that of a carbonaceous meteorite."

The contaminants, with special reference to the cladocerans, clearly occupied a small aquatic situation, perhaps on an alluvial floodplain in the area of impact. This is suggested by the map of the area (2, Fig. 14). If not, then they probably represent post-impact contaminants acquired during handling or museum storage. Since *Chlorella* species were also reported in the list of biological specimens found in the surface soil of the impact area at the present time, it is reasonable to conclude that the other aquatic objects found in Anders's specimen also were present in the impact area in 1864. However, according to Claus's Table 2, these other forms are not present in the Orgueil area today.

We may thus infer that some degree of change in the microbiota has occurred in the impact area since 1864. If cladocerans, *Compsopogan*, and others were once in the impact area, why could not other forms belonging to aquatic biotas also have been in the area and since have disappeared?

3) *Organized elements in mineral grains in chondrites.* Some organized elements have been found in mineral grains which suggests that they are indigenous and were not added at impact or subsequently. Brian Mason (5) has pointed out that the "environment can affect the 'organized elements'" in various ways, among others, in the amount of bound water in magnesium sulphate in the chondrites. Now, it seems desirable to reconcile these two observations.

If one grants that a given organized element incorporated in a chondrite mineral grain represents a once-living individual, then it becomes important to know about all possible environmental and diagenetic effects on mineral grains in carbonaceous chondrites. Specifically, to advance the argument, if one assumes that a given organized element embedded in a mineral is a terrestrial contaminant, then a plausible explanation is needed for the steps leading to its incorporation. One might even

ask whether it is possible to *deliberately* incorporate one or more such contaminants in mineral grains of such chondrites under the prevailing temperature conditions in soil or museum air, or during the preparation of thin sections?

The terrestriality of the organized elements is their most distinctive general characteristic. Either homeomorphy (the least likely possibility) or terrestrial contamination (the most likely possibility) can account for it. Only a vigorous and healthy scepticism about *every detail* of published reports (pro and con) can help to resolve the matter.

PAUL TASCH

Department of Geology,  
University of Wichita,  
Wichita, Kansas

### References

1. F. W. Fitch and E. Anders, *Science* **140**, 1097 (1963).
2. G. Claus *et al.*, *Ann. N.Y. Acad. Sci.*, **108**, 580 (1963).
3. P. Bourrelly, *Revue Algologique, Mémoire Hors-Série No. 1* (Muséum National d'Histoire Naturelle, Paris, 1957).
4. P. Tasch, *Ann. N.Y. Acad. Sci.*, in press.
5. B. Mason, *ibid.*, **108**, 615 (1963).

### Science in the Humanities

Comments such as those made by Marcel Roche in "The humanities in the scientific curriculum" (*Science* **141**, 698 (23 July 1963)), distract interested observers from the true problem. Scientists *do* know about the humanities, and they understand them, appreciate them, and participate in them. The degree may be less than perfect but it certainly is not zero, as is the case with regard to the comprehension and understanding of science by the nonscientific community—the major portion of our population.

These people are proud of their ignorance! How often one hears a comment such as, "Oh, that's mathematical; I never was any good at figures."

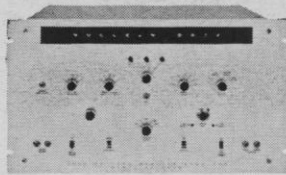
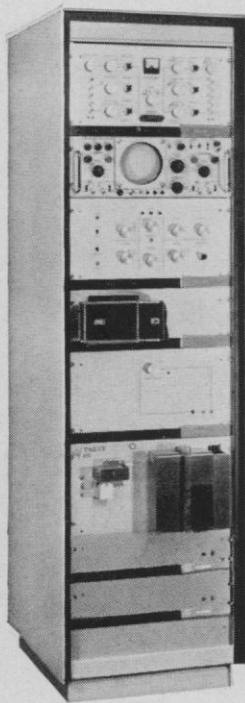
Ask any nonscientific man-in-the-street to explain, even in a rudimentary sense, why an iron gets hot but a refrigerator gets cold when both are plugged into the same outlet; or how a TV set functions or why a satellite stays in orbit. Their ignorance is abysmal.

What is needed, desperately, is science in the humanities curriculum—not further additions to the converse.

RICHARD G. DEVANEY  
238 Hammond Avenue,  
Kingsport, Tennessee

#### OUTSTANDING FEATURES OF THE ND-160 4096 CHANNEL ANALYZER:

1. random access to address & memory register through front panel patchcord programming
2. 262,144 count capacity per channel
3. live display; linear display with factor of 2 control; isometric display; and contour level display with calibrated, continuous control
4. multi-channel scaling
5. subtotalling in readout
6. built-in livetimer (clock)
7. compatability with practically all commercially available amplifiers
8. built-in slow coincidence
9. singles spectra easily obtained
10. all important command signals available at rear deck connectors
11. easily modified for specific purposes
12. binary and BCD outputs available



#### ND-150M 1024 CHANNEL MEMORY UNIT

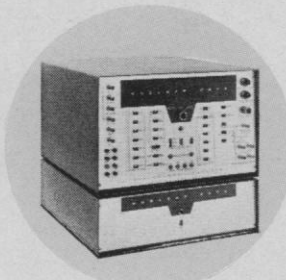
This unit is used with the ND-160F Dual Analog to Digital Converter to provide a reasonably priced, high performance 1024 channel analyzer system, capable of two parameter analysis,

from  
**Nuclear Data**



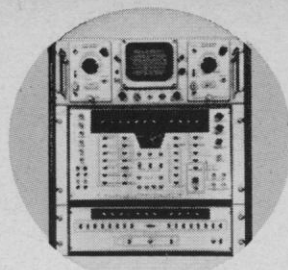
#### ND-307 OPTIKON\* PRINTER

The Optikon is Nuclear Data's solution for a fast, convenient readout: a 512 channel readout is made in 15 seconds, 1024 channels takes 30 seconds, and a 4096 channel readout takes 3 minutes. Printout is on a 3" x 4" Polaroid photograph in column by column format.



#### ND-120 512 CHANNEL ANALYZER

The ND-120 is identical in performance and specifications to the ND-130AT but without the Area Integration and Spectrum Resolving capabilities, and Punch & Reader Control of the ND-130AT.



#### ND-130AT 512 CHANNEL ANALYZER/COMPUTER

This is the most dependable analyzer of its kind. These important features are *built-in*: Spectrum Resolver, Area Integration, Punch & Reader, and Typewriter Control. In most analyzers, these are added as design afterthoughts, at extra cost.



#### ND-160BT BUFFER TAPE CONTROL SYSTEM

This system uses the series ND-160 4096 channel memory unit for high speed storage of digitized data and the transference of this data onto magnetic tape of IBM 7090 computer format. Data resolutions of 18, 36 or 72 bits (effective up to 10<sup>20</sup> channels) are possible. Each parameter offers up to 512 channel resolution. Other features include: on-line monitoring of any two parameters, and high speed dump of the memory units (less than 1 second). Delivery: 90 days.



#### ND-800 ENHANCETRON\* 1024 DIGITAL STORAGE OSCILLOSCOPE

This instrument is a fascinating & important new measurement tool for the enhancement of the signal-to-noise ratio of repeatable or naturally recurrent noisy signals, useful in many fields: Geophysics, Nuclear Magnetic Resonance, Radar Astronomy, Electrophysiology, Vibration Analysis, Biochemistry, Sonar and others. Write for further information.

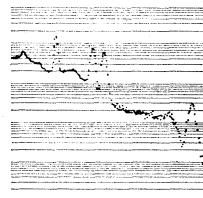
## In Multi-Parameter Analyzer Systems, **NUCLEAR DATA HAS THE EXPERIENCE**

Nuclear Data is the most experienced designer and manufacturer of this type of instrumentation today. This achievement is coupled with the fact that with the growing sophistication of Nuclear Data instruments, there has been no decrease in Nuclear Data's quality and reliability.

For example, the ND-160 analyzer system is Nuclear Data's most advanced instrumentation and the most advanced of its kind. Having many features and proven qualities, substance is given to Nuclear Data's claim of experience, reliability, and continuing progress: 1. The series ND-160

analyzer is the *easiest to use* multi-parameter analyzer on the market today...it is human-engineered, it is reliable, it works. 2. It is the only analyzer available today with a *proven Buffer/Tape system* available as an accessory to provide N parameter analysis with capabilities of billions of channels & resolutions of 18, 36, or 72 bits. 3. Its *portability* enhances the value of the initial investment since many different users can be accommodated. 4. It is the only analyzer available with a *useful, fast and convenient readout*, the ND-307 Optikon printer. 5. It has *unequalled*

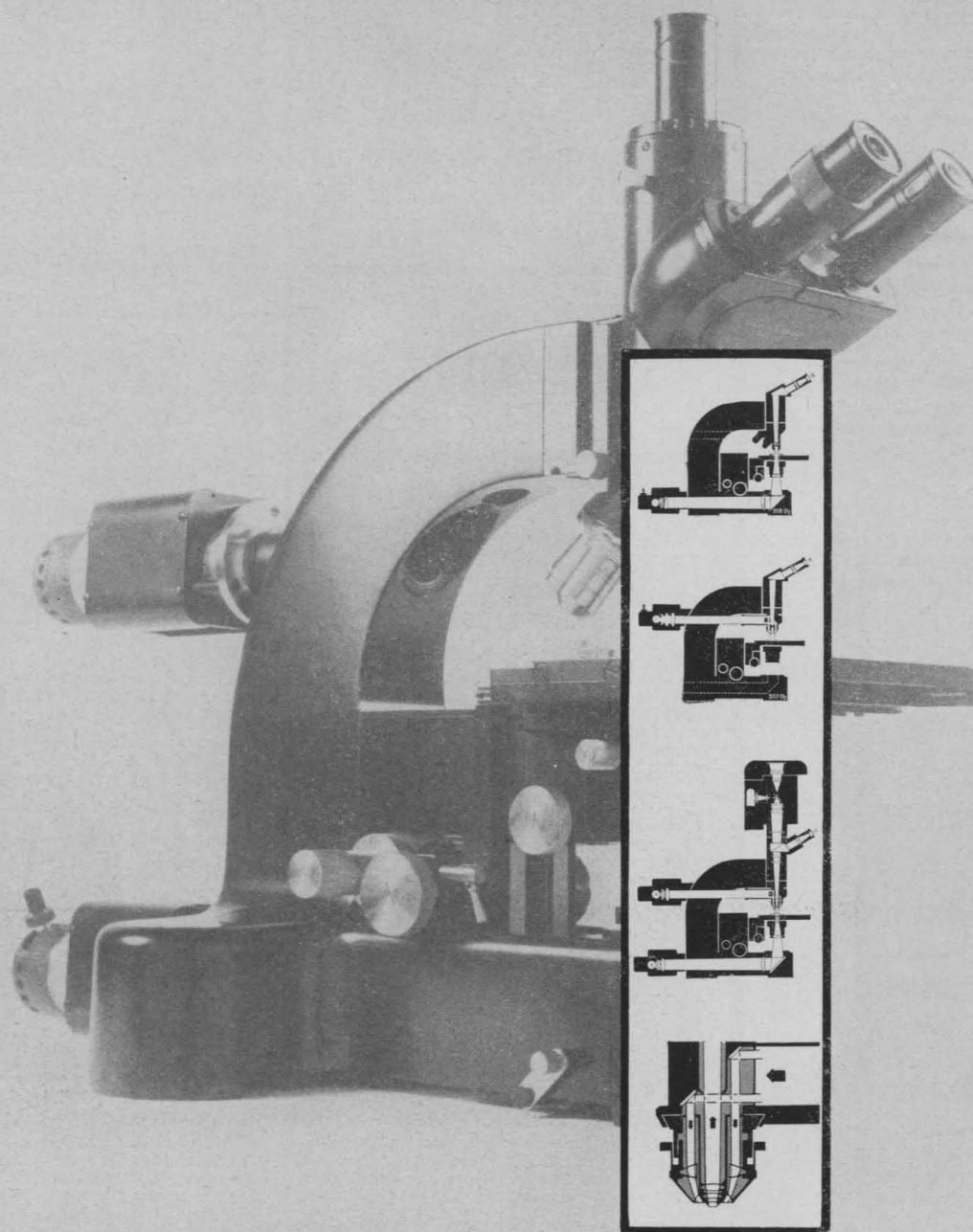
*linearity and stability*. 6. It has a fine *manual* which is clearly presented & graphically lucid. 7. Deliveries are firm and "on-time."



**NUCLEAR  
DATA  
INC.**

3833 West Beltline Hy.  
MADISON 13, WISCONSIN





### THE MANY-FACETED LEITZ ORTHOLUX ...widest-range Universal Research Microscope

The many-faceted Ortholux meets the requirements of creative research for infinitely varied and subtle scientific observations. It truly represents Leitz' more than 110 years of optical experience and uncompromising exactitude. With intricately inter-designed systems of optics, illumination and mechanics, the Ortholux puts at your disposal a multiplicity of techniques including separate or

combined incident and transmitted illumination, bright field, dark field, phase contrast, polarized and fluorescent methods. The new "Orthomat" combined with the Ortholux effortlessly permits optimum results in 35mm photomicrography. With the "Aristophot" it becomes a photomicroscope for sizes up to 4" x 5".

Write for Complete Details and Specifications of This Incredibly Versatile Instrument.

**Leitz**

E. LEITZ, INC., 468 PARK AVENUE SOUTH, NEW YORK 16, N. Y.  
Distributors of the world-famous products of  
Ernst Leitz G. m. b. H., Wetzlar, Germany—Ernst Leitz Canada Ltd.  
LEICA AND LEICINA CAMERAS · LENSES · PROJECTORS · MICROSCOPES

E. LEITZ, INC., 468 Park Avenue South, New York 16, N. Y.  
Gentlemen:

- ☐ Please send me complete information on the ORTHOLUX.  
☐ Kindly have Leitz representative phone for appointment to demonstrate the ORTHOLUX system at no obligation to me.

Name \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_  
Telephone \_\_\_\_\_

41161

## American Association for the Advancement of Science

### BOARD OF DIRECTORS

Paul M. Gross, <i>Retiring President, Chairman</i>	
Alan T. Waterman, <i>President</i>	
Laurence M. Gould, <i>President Elect</i>	
Henry Eyring	Mina Rees
John W. Gardner	Walter Orr Roberts
H. Bentley Glass	Alfred S. Romer
Don K. Price	H. Burr Steinbach
Paul E. Klopsteg	Dael Wolfe
<i>Treasurer</i>	<i>Executive Officer</i>

### VICE PRESIDENTS AND SECRETARIES OF SECTIONS

MATHEMATICS (A)	
Magnus R. Hestenes	Wallace Givens
PHYSICS (B)	
Elmer Hutchisson	Stanley S. Ballard
CHEMISTRY (C)	
Milton Orchin	S. L. Meisel
ASTRONOMY (D)	
Paul Herget	Frank Bradshaw Wood
GEOLOGY AND GEOGRAPHY (E)	
John C. Reed	Richard H. Mahard
ZOOLOGICAL SCIENCES (F)	
Dietrich Bodenstein	David W. Bishop
BOTANICAL SCIENCES (G)	
Aaron J. Sharp	Harriet B. Creighton
ANTHROPOLOGY (H)	
David A. Baerreis	Eleanor Leacock
PSYCHOLOGY (I)	
Lloyd G. Humphreys	Frank W. Finger
SOCIAL AND ECONOMIC SCIENCES (K)	
Kingsley Davis	Ithiel de Sola Pool
HISTORY AND PHILOSOPHY OF SCIENCE (L)	
Adolph Grünbaum	N. Russell Hanson
ENGINEERING (M)	
Clarence E. Davies	Leroy K. Wheelock
MEDICAL SCIENCES (N)	
Francis D. Moore	Oscar Touster
DENTISTRY (Nd)	
Paul E. Boyle	S. J. Kreshover
PHARMACEUTICAL SCIENCES (Np)	
Don E. Francke	Joseph P. Buckley
AGRICULTURE (O)	
A. H. Moseman	Howard B. Sprague
INDUSTRIAL SCIENCE (P)	
Alfred T. Waidelich	Allen T. Bonnell
EDUCATION (Q)	
H. E. Wise	Herbert A. Smith
INFORMATION AND COMMUNICATION (T)	
Foster E. Mohrhardt	Phyllis V. Parkins
STATISTICS (U)	
Harold Hotelling	Morris B. Ullman

### PACIFIC DIVISION

Phil E. Church	Robert C. Miller
<i>President</i>	<i>Secretary</i>

### SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Edwin R. Helwig	Marlowe G. Anderson
<i>President</i>	<i>Executive Secretary</i>

### ALASKA DIVISION

Allan H. Mick	George Dahlgren
<i>President</i>	<i>Executive Secretary</i>

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

## Instrumentation Creates New Opportunities

One of the principal avenues to scientific progress is the development of new means of probing nature. In an earlier day it was possible to make experiments with simple tools in many areas of inquiry. Gradually, however, most of the great questions that could be answered by simple procedures in virtually every area of science were examined. During the last decade the increased funds available through government support of research would not have been so useful had it not been for what has amounted to a revolution in instrumentation. This was financed to a considerable extent from funds in the hands of investigators who were searching for new approaches. Developments in instrumentation have affected the conduct of research in almost all areas of science.

In astronomy many of the recent advances are connected with new instruments and techniques—radio and radar astronomy—or with improvement in the measuring capacity of existing observatories through the development of more sophisticated devices—infrared detection, for instance. In space research all the new findings have involved the use of recently invented equipment, whether it be the launch vehicles, the satellites themselves, or the instrument packages. In nuclear physics most of the new discoveries are dependent on instrumentation—either the accelerators or the detectors, such as bubble chambers or spark chambers. Chemistry has become increasingly dependent on instrumentation for further progress. Recording infrared spectrometers are routinely used tools. In some laboratories whole programs are built around the use of gas-liquid chromatography. In others, mass spectrometry plays an important role. Studies of natural products are being greatly aided by new equipment for measuring optical rotary dispersion. Most organic chemical research laboratories employ nuclear magnetic resonance, which permits unique assignments of structure of complicated compounds. Perhaps nowhere has the impact of instrumentation been greater than in biochemistry and molecular biology. Many of the important advances of the past few years have stemmed from the use of column chromatography, the analytical ultracentrifuge, radioactive tracers, or the amino acid analyzer. The impact of new equipment has extended to the behavioral sciences. Today some psychology departments use more electronic equipment than most physics departments used a decade or two ago.

Instrumentation has an impact that shapes the course of research. The drudgery of many routine measurements has been eliminated by means of automatic equipment. Still more important, some of the new apparatus opens up new experimental capabilities. For instance, gas-liquid chromatography permits effortless identification and measurement of 20 or more substances present in a microgram or less of sample. In an earlier day, to get comparable information might have required kilograms of material and days of work. Similarly, in countless ways the computer saves human effort and permits detailed calculation and correlation which previously were impractical.

As with any useful development there is a danger of misuse. With powerful new gadgets available, some individuals are tempted to ask for each new item as it is developed and to treat it as a new toy. To others, the appeal is the possibility of amassing vast amounts of data. But the greatest importance of the new equipment lies in its usefulness in opening research frontiers which could not be explored in any other way. The potential of the new instrumentation will be developed only insofar as the instruments are used thoughtfully in efforts to answer meaningful questions.—P.H.A.



The incomparable new 3000 and 4000 Series Tri-Carb Liquid Scintillation Spectrometers embody more than a score of major design and operating improvements. The result: sensitivity, accuracy, and reliability of a degree never before achieved in liquid scintillation counting equipment. These ultra-modern instruments are available in configurations and with capabilities to match any research budget or counting requirement. Your Packard Sales Engineer can provide complete details and performance data. Write for illustrated Bulletin.

**Packard**

**PACKARD INSTRUMENT COMPANY, INC.**

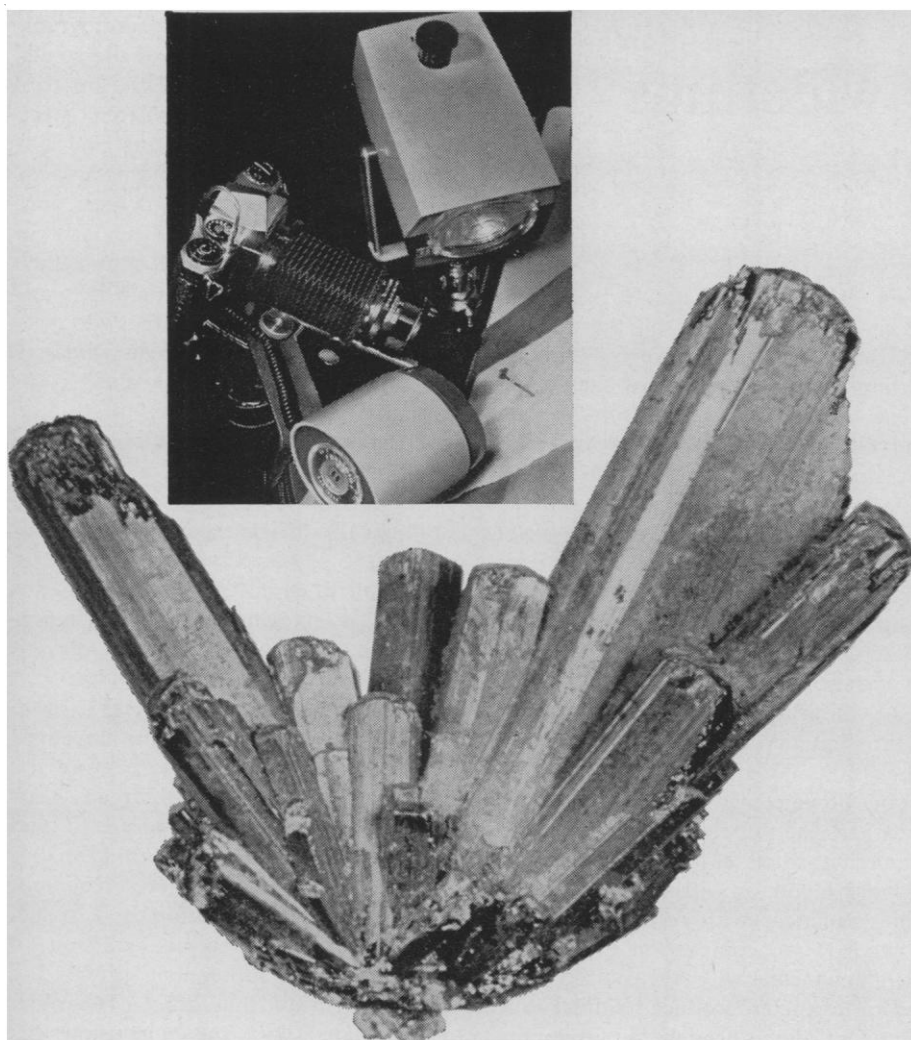
BOX 428 • LA GRANGE, ILLINOIS • AREA CODE 312 • 485-6330

# WHAT'S NEW IN THE NEWEST TRI-CARB® SPECTROMETERS?

## everything!

- 13-dynode photomultiplier tubes with signal pulse summation for highest efficiency and best isotope separation.
- Rugged, "light-lock" detector assembly with new graded shielding and high-speed sample loading.
- Fast coincidence circuitry with wide dynamic range for best performance.
- *Completely separate channels (two or three)* of pulse height analysis for optimum channel selection.
- Precision gain control and fast-recovery linear amplifiers for greatest accuracy.
- Highly stable and linear pulse-height analyzers for best operation with fast liquid and slow crystal pulses (switch selection).
- High-speed (20 megacycle) scalars with in-line, numerical display for greatest counting accuracy and best legibility.
- Built-in automatic background subtraction for convenience and for accuracy of ratios calculated automatically.
- Low activity sample reject to save valuable counting time where many samples contain no material of interest.
- Highest quality digital printers or calculators for fastest and most reliable data presentation.
- Compact console designs to take minimum floor space and no bench space.

## MACRO-CRYSTALLOGRAPHY WITH HONEYWELL



### **Expect outstanding macrophotography with your Honeywell equipment!**

This specimen of an unusual Stibnite crystal has been lighted with Honeywell Strobolar electronic flash units and photographed with the Honeywell Pentax H3v 35mm single-lens reflex camera, appropriately outfitted with Bellows Unit.

The electronic flash unit shown in the foreground is the 65C Strobolar. It is fitted with a Neutral Density Lens from the accessory kit of four interchangeable lenses. The 65C is triggered by the camera shutter, and its light synchronously triggers the other light source, which is a model 52A Modeling Slave Strobolar.

The crystal photograph was made with the 55mm f/1.8 Super-Takumar lens, standard on the H3v. The bellows unit was set at 105mm, and the taking aperture was f/16. An important feature of the H3v which proves very useful in macrophotography is the integral self-timer. Its use precludes camera movement often caused by a cable release or manual operation of the shutter.

Here is a versatile laboratory photography setup consisting of highest quality components, yet the total price for the complete outfit is under \$400, plus light stands.

Write today for literature on this equipment to: David Moore, Mail Station 209, Honeywell, Denver, Colorado 80210.

**Honeywell**  
PHOTOGRAPHIC PRODUCTS

lation. In another example, computer simulation has been applied to human handwriting. Reading and understanding speech were found closely related to the physiology of handwriting. Equivalent current generators have been found to simulate successfully the heart as current source.

Of particular—and from a humane standpoint urgent—interest is a development ultimately meant to make the blind man's fingers "see." An electronic environment sensor transduces optical information into types of sensory information accessible to a blind person, such as pressure outputs which can be fed to the pressure receptors of the human hand as the person moves around.

No biomedical instrumentation symposium in our time could possibly ignore outer space. Applications to space travel and outer space research were presented in many of the sessions, culminating in a program solely devoted to bioinstrumentation in the aerospace age. The status of the art of monitoring chimpanzee and man during space travel was surveyed and included a system for measuring effects of environmental variables on physiological stress. Even though man has made successful space flights, it is still important to conduct further research on both man and animal in their orbital flights.

An instrumentation system using implanted arterial and venous catheters obtains cardiac output, arterial and venous blood pressure, blood protein, and electrocardiograms. Other projects are devoted to the environment of outer space and the environment of the space capsule. A photometric scanning and telemetering device, though still in the developmental stage, has shown wide application in the realms of exobiology and telemetered biomedical responses. Potentially, it could become a valuable tool for man on interplanetary missions and similar explorations of long duration. The paucity of knowledge of major and trace gases inside the manned space vehicle points to an area urgently awaiting further concentrated efforts by the biomedical engineer. This important life support aspect might well determine the duration of the space mission and also, if not adequately monitored, cause the mission to be aborted. Conventional laboratory instrumentation employing gas chromatography, optical absorption, or mass spectrometry offers some potential.



Numerous modifications, however, must be made in the transition from laboratory to space qualified hardware.

Still on telemetering of physiological data of humans in flight—though much closer to earth than outer space—one paper dealt with parachute jumping. Interesting results were obtained from a telemetry system using RF transmission techniques. Head accelerations, for instance, were +6 to +8 G vertically, +9.6 to -9.6 G laterally, and +3.8 to -12 G horizontally; heart rate, 180 prior to jump, decreased to 156 during free fall, returned to 180 at ground impact. Similar variation in breathing rate was 40 to 55 to 48 breaths per minute.

A session on spectroscopy showed the variety of research programs for which one single method can be successfully used. Of immediate medical interest is the infrared determination of protein structure and its application to the clinical analysis of calculi and gallstones.

Advantages, problems, and different methods of automation in hospitals and medical laboratories were noted. The presentations surveyed excellently current developments throughout the country and showed examples of effective uses of automation.

Other new developments covered at the meeting included new methods of monitoring air pollution, and its effect on human health and plant life; the great strides in automation and data processing in clinical pathology, pathologic anatomy, and clinical chemistry (a punch card system in operation was described and illustrated for the latter application); and finally, the impressive developments and the impatiently hoped for progress in the field of artificial organs. Scientists are still working on artificial intracorporeal hearts (32 hours in a live dog are now reported) and on improving the artificial kidney (by bacteria removal through filtering), and have developed an artificial "gastrointestinal pacemaker" whose use in the treatment of paralytic ileus was reported successful in over 60 patients.

After a review of some of the recent advances of the biomedical instrumentation engineer, this man himself and his problems were considered. Three sessions were devoted to questions of how to educate him and how to put him to work. It was also noted that two more schools, Wake Forest College and the University of Florida, have joined the number of those which are offering now, or planning for future

## Scientific Apparatus & Instruments

### BECKMAN INSTRUMENTS, INC.



### 33 NEW SALES AND SERVICE OFFICES

NOW SERVING THE  
UNITED STATES AND CANADA

pH Meters • pH Electrodes  
UV Spectrophotometers  
IR Spectrophotometers  
Oxygen Analyzers and Electrodes  
Laboratory Gas Chromatographs  
Blood Gas Analyzers • Solution Metering  
Pumps • Pycnometers • Fluorometers  
Recorders

#### ALBUQUERQUE

4200D Silver Avenue, S.E.  
Albuquerque, New Mexico....505-265-8511

#### ATLANTA

5765 Peachtree Industrial Boulevard  
Chamblee, Georgia .....404-451-3574

#### BOSTON

Lakeside Office Building  
591 North Avenue  
Wakefield, Massachusetts ....617-245-6800

#### BUFFALO

2451 Wehrle Drive  
Buffalo 21, New York.....716-634-3777

#### CHARLESTON

Suite 301, Nelson Building  
1018 Kanawha, Charleston 1  
West Virginia .....304-344-3591

#### CHICAGO

7360 North Lincoln Avenue  
Lincolnwood 46, Illinois.....312-583-1020

#### CINCINNATI

10 Knollcrest Drive, (Reading)  
Cincinnati 37, Ohio .....513-761-9560

#### CLEVELAND

Suburban-West Building  
20800 Center Ridge Road, (Rocky River)  
Cleveland 16, Ohio .....216-333-3587

#### DALLAS

2600 Stemmons Freeway  
Dallas, Texas .....214-637-1640

#### DENVER

3835 Elm Street  
Denver 7, Colorado .....303-399-2616

#### DETROIT

24755 Five Mile Road  
Detroit 39, Michigan .....313-538-5990

#### DURHAM

Office 911, Central Carolina  
Bank Building, 111 Corcoran Street  
Durham, North Carolina .....919-682-5747

#### FULLERTON (HEADQUARTERS)

2500 Harbor Boulevard  
Fullerton, California .....714-871-4848

#### HOUSTON

5810 Hillcroft Avenue  
Houston 36, Texas .....713-781-0810

#### JACKSONVILLE

Spaces 2-E and 2-F, 1914 Beachway Road  
Jacksonville, Florida .....305-359-2358

#### KANSAS CITY

Room 202  
6016 Troost Avenue  
Kansas City, Missouri .....816-444-0559

#### LOS ANGELES

2400 Harbor Boulevard  
Fullerton, California .....714-871-4757

#### MINNEAPOLIS

5005 Cedar Lake Road  
Minneapolis 16, Minnesota ...612-377-8771

#### NEW ORLEANS

Rooms 215 and 217  
4435 Veterans Highway  
Metairie, Louisiana .....504-831-2631

#### NEW YORK

U.S. Highway 22 @ Summit Road  
Mountainside, New Jersey ...201-232-7600

#### PHILADELPHIA

1 Bala Avenue  
Bala Cynwyd, Pennsylvania ...215-839-3844

#### PHOENIX

5110B North Seventh Street  
Phoenix 14, Arizona .....602-277-4755

#### PITTSBURGH

950 Greentree Road  
Pittsburgh 20, Pennsylvania ..412-921-1530

#### PORTLAND

Room 119, Morrow Building  
811 East Burnside  
Portland, Oregon .....503-234-0646

#### ST. LOUIS

5461 Highland Park Drive  
St. Louis, Missouri .....314-371-5900

#### SALT LAKE CITY

Rooms 164 and 165  
Valley Professional Building  
2520 South State Street  
Salt Lake City 15, Utah .....801-467-5471

#### SAN FRANCISCO

2400 Wright Avenue  
Richmond, California .....415-526-7730

#### SEATTLE

11658 Northeast Eighth Street  
Bellevue, Washington .....206-454-9528

#### TULSA

Suite #3  
4021 South Harvard Building  
Tulsa, Oklahoma .....918-742-0692

#### WASHINGTON, D.C.

12224 Rockville Pike  
Rockville, Maryland .....301-656-1644

### CANADIAN SALES OFFICES

#### CALGARY

1431 Kensington Road  
Calgary, Alberta, Canada ....403-283-5591

#### MONTREAL

2626 Bates Road  
Montreal 26, P.Q., Canada...514-735-1376

#### TORONTO

901 Oxford Street  
Toronto 18, Ontario, Canada ..416-251-5251

#### VANCOUVER

1900 Lonsdale Avenue  
North Vancouver, B.C., Canada 604-985-5347

**Beckman** INSTRUMENTS, INC.

**SCIENTIFIC AND PROCESS  
INSTRUMENTS DIVISION**  
Fullerton, California

International Subsidiaries: Geneva, Switzerland;  
Munich, Germany; Glenrothes, Scotland.

# AUTOMATE WITH C.R.C. LABWASHER

**WASH AND DRY  
GLASSWARE  
AUTOMATICALLY**



- Fully automatic... set it and forget it.
- Accommodates over 90% of all labware.
- Choice of distilled or tap water rinse.
- Saves 50% of glassware breakage.
- Removes oil-soluble material.
- Pays for itself in weeks.
- Low operating costs.

**REQUEST USAGE REPORTS**  
Read how both large and small laboratories are employing C.R.C. Labwashers as a solution to glassware cleaning problems. Step by step procedures and cost analysis are detailed by well-known laboratory directors. Write for this field report and Bulletin 109 today!

**THE CHEMICAL RUBBER CO.**  
2310 Superior Ave. 4907 Cordell Ave. 9074 Springfield Pike  
Cleveland 14, Ohio Washington 14, D.C. Cincinnati 14, Ohio A-4049

## Dajac LABORATORIES

**Need reagents for medical research and biochemical testing?**

Why not check with Borden's Dajac Laboratories?

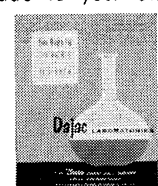
Over 300 reagents are available for research and testing—including enzyme substrates, fluorescent reagents, tetrazolium salts, and a wide variety of biological stains, amino acids, analytical reagents, sample and reagent kits.

New reagents are constantly being added as a result of Dajac's own independent research and the advances of biochemical knowledge.

Your inquiry is invited about special preparations made to your own specifications.

**Do you have Dajac's new catalog of over 300 medical reagents?**

Write for your **FREE COPY** today to Department S-103



**THE Borden CHEMICAL COMPANY**  
5000 LANGDON STREET • P. O. BOX 9522  
PHILADELPHIA 24, PA.

## PARR Apparatus For Catalytic Hydrogenation Reactions



Numerous reactions with hydrogen at pressures up to 5 atm. (60 psig.) can be performed in this convenient shaker apparatus using either 250 or 500 ml. pressure-tested glass bottles.

New needle valves with replaceable plastic seats, separate gages to show tank and bottle pressures, and improved bearings in the shaker mechanism are provided in the latest model. A larger unit with interchangeable 1 and 2 liter bottles is also available.

Ask for New Specification 3900



**INSTRUMENT COMPANY**  
MOLINE, ILLINOIS

addition, curricula in interdisciplinary biomedical engineering education.

On the question of organizing effective engineering support to life science research and hospitals, it became apparent that the concept of centralized engineering facilities, rather than the reliance on individual engineers assigned to individual research projects, is slowly proving its value and gaining ever increasing recognition. Pioneered years ago for the intramural research program of the National Institutes of Health, the centralization system has been adopted recently by several other research organizations. Central support facilities represented at the symposium—among speakers and audience—included such newcomers as the Eastern and Western Research Support Centers of the Veterans Administration, the engineering center at the Bowman Gray School of Medicine, and the new Center for Computer Technology under the auspices of the Massachusetts Institute of Technology. The operation of two other biomedical engineering support centers at the University of Oregon and the University of California was described.

The meeting was sponsored by the Instrument Society of America with three cooperating societies—American Society of Clinical Pathology, National Society for Medical Research, and Society for Applied Spectroscopy. The full text of the papers will be published in book form by Plenum Press, New York City.

Appreciation of the help of the following in summarizing the contents of the 20 sessions and over 80 papers is noted: H. S. Dordick, C. D. Ferris, R. Jonnard, R. I. Larsen, L. L. May, H. V. Pipberger, J. C. Roberts, G. H. Sullivan, T. B. Weber, and G. Z. Williams.

FRED ALT

*National Institutes of Health,  
Bethesda, Maryland.*

### Cell Division and Cancer

The hypothesis that cancer involves an abnormality in the control of cell division was the major theme at an international symposium on the control of cell division and the induction of cancer held 1-7 July at Lima, Peru, and Cali, Colombia.

The organizers brought two groups of individuals together, those interested in the control of cell division, and those interested in the induction of

*measures  
.002 microvolts!*

## KEITHLEY MILLI-MICROVOLT METER

The Keithley Model 149 is the most sensitive electronic voltmeter available today, having a signal-to-noise ratio that approaches the theoretical limit. Recommended for use with thermocouples or thermopiles, the Model 149 is also ideal in cryogenics investigations and Hall Effect studies.

Zero suppression up to 100 times full scale adds versatility for the user. Line-operated, the Model 149 can accommodate either a floating or ground-referenced input. Output is 5 v or 5 ma on all ranges. Brief specifications:

- **range:** 0.1 microvolt to 100 millivolts in 13 overlapping 1x and 3x steps
- **noise:** less than  $6 \times 10^{-10}$  v rms with shorted input
- **input impedance:** 10K ohms on 0.1  $\mu$ v range rising to 10 megohms on 100  $\mu$ v scale
- **stability:** within 0.01  $\mu$ v per hour
- **speed of response:** to 90% fs in .5 seconds on most ranges
- **accuracy:** 2% fs on all ranges
- **price:** \$895.00

### Other MICROVOLT METERS:

Model 150A 1  $\mu$ v sensitivity \$750.00  
Model 151 100  $\mu$ v sensitivity \$420.00

full details in latest catalog...



**KEITHLEY  
INSTRUMENTS**

12415 Euclid Avenue • Cleveland 6, Ohio

cancer. The assumption was made that viruses, radiations, chemicals, and all other carcinogenic situations cause cancer by altering the mechanisms that control somatic cell mitosis.

Both Arthur Pardee (Princeton) and Herman Kalckar (Boston) discussed the idea that the point of action or final expression of the carcinogenic agents might be on the surface properties of the cell. Pardee reviewed known surface changes in malignant cells and suggested that control by growth-inhibiting factors from adjacent cells was lacking. Kalckar extended this concept with the terms "ectobiology" and "ectobiochemistry," defining the latter as involving the receptor sites for surfaces of antigens and the existence of histocompatibility factors. The biochemical entities that Kalckar described were the polysaccharides, which he thought subserved the "social functions" of the cell. He pointed out further that the lack of particular antigens on cell surfaces may be related to an epimerase defect. The Leloir equilibrium is disturbed in tumors and epimerase is the rate-limiting enzyme in them. Measurements on HeLa and L cells, Erlich ascites tumor, and mammary carcinoma support this point of view.

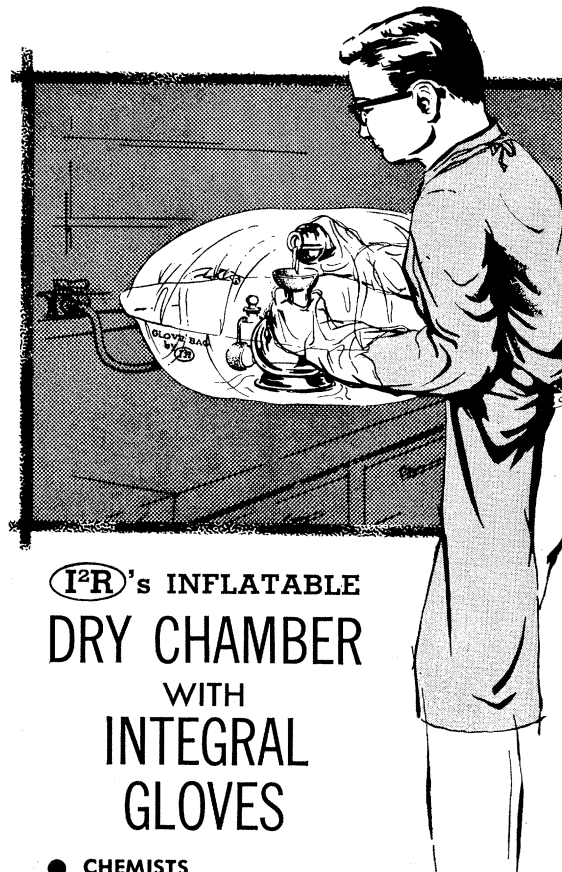
The more frequently considered approach to control of cell division through understanding DNA and RNA synthesis was presented by Eduardo de Robertis (Buenos Aires), D. M. Prescott (Oak Ridge), and Robert P. Perry (Philadelphia). De Robertis reviewed the electron microscopy of the nucleus and emphasized that the basic unit of the chromosome is a filamentous, macromolecular component or microfibril which may be a single nucleoprotein molecule. Prescott continued the theme, stating that the cell life cycle is a DNA cycle with all events subserving DNA. He felt the question should be asked, "What controls initiation of DNA synthesis?" This presumably is the point at which carcinogens act or alter DNA in a way that results in cancer. The interrelations of DNA, RNA, and protein synthesis describe the major events of the cell cycle, but Prescott thinks control for DNA synthesis might reside within each gene itself. Chromosomes do not all begin DNA synthesis at once, and the X-chromosome is especially known as a late replicator.

Perry developed the idea that the nucleolus is a prominent RNA-containing organelle intimately associated

# DRY BOXES ARE EXPENSIVE

**I<sup>2</sup>R's**

## GLOVE BAG IS NOT!



### **I<sup>2</sup>R's INFLATABLE DRY CHAMBER WITH INTEGRAL GLOVES**

- **CHEMISTS**  
use it for pouring, grinding, and transferring hygroscopic or pyrophoric materials—
- **SPECTROSCOPISTS**  
use it for sampling liquids susceptible to moisture or oxygen—
- **BIOLOGISTS**  
use it to obtain germ-free atmospheres by gas sterilizing it—
- **OTHER SCIENTISTS**  
use it too, where their work requires a dust-free, oxygen-free, or moisture-free atmosphere.
- **ORDER**  
Model 3X available in multiples of half dozen. They are packaged in individual envelopes. Price: \$13.95 per box of 6.



**INSTRUMENTS  
FOR RESEARCH  
AND INDUSTRY**

215-Pi 5-4408  
CHELTENHAM, PENNA.

## LABORATORY RECORDER

HIGH SENSITIVITY  
LOW COST

**\$325<sup>00</sup>**

### FEATURES:

- Pen travel 1 Second full scale.
- Accuracy 99% or better.
- Photoelectric Chopper for long life.
- Zener diode stabilized reference voltage.
- Adjustable paper speeds.
- Input suitable for high impedance sources.
- Adjustable range control.

### MODEL #22700 SERVO-GRAPHIC RECORDER

RANGE: 0-10 MILLIVOLTS D.C.  
0-100 MILLIVOLTS D.C.

The Servo-Graphic Recorder is an ideal laboratory instrument. Put it to work and save a valuable technician's time. O.E.M. users invited.

Write for literature

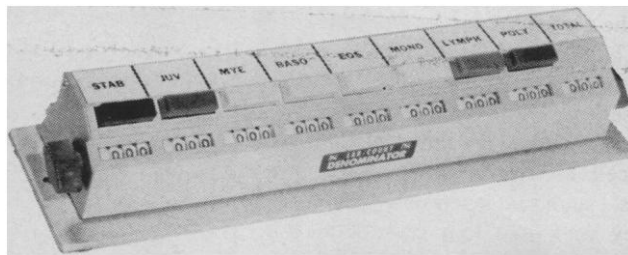
**C. H. STOELTING CO.**

12" CHART SERVO RECORDERS  
MULTI-CHANNEL HIGH FREQUENCY OSCILLOGRAPHS  
POLYGRAPHS • KYMOGRAPHS • MANIPULATORS

424 NORTH HOMAN AVE., CHICAGO 24, ILL.

# NEW!

**DENOMINATOR  
MULTIPLE-TALLY  
WITH TOTALIZER**



**Locking Totalizers** . . . lock all counters at every 100 counts. Release lever quickly unlocks machine for next 100 counts. Percentages readily determined. A real time-saver for lab reports.

**No Over-counts** . . . positive locking feature prevents inadvertent counting beyond 100 counts. Over-counting can lead to serious inaccuracies and makes percentage calculations difficult.

**Lightest touch, shortest stroke, least effort.**

**Foolproof Counting** . . . "no skips," "half-counts," or "split figures."

**Color Coded Push Buttons** . . . speed accurate counting in many applications. Choice of seven colors.

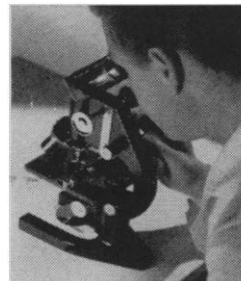
**Quick-change Titles** . . . durable, pressure-sensitive tape easily erased, quickly applied or removed.

**Non-locking totalizers** are also available . . . they continuously accumulate the counts on the individual counters. Totalizers on Denominators available from 2 to 12 counters in a row. Three-digit counters are standard, but they also can be furnished with four digits. Write for further information, brochure and price list.

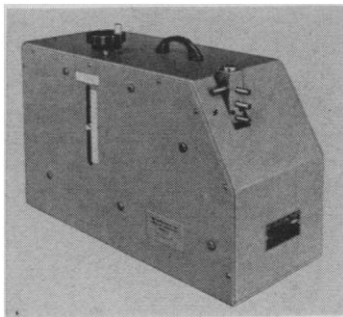
Serving those who count since 1914.

**THE DENOMINATOR COMPANY, INC.**

Woodbury, Connecticut



Make Blood, Pollen and Point Counts with the Denominator Lab-Counter



## SMALL ANIMAL RESPIRATOR

Model 670 is a positive-pressure, positive displacement respiration pump designed for use with small laboratory animals, such as rabbits, cats, etc. Stroke volume can be continuously varied while in operation. As the piston travels all the way to the end of the cylinder on each stroke, all cylinder dead space is eliminated. Interchangeable cylinders of 25, 50 and 100 cc. size are available. Motor control from 10 to 200 r.p.m. with full torque.

### SPECIFICATIONS

Rate: 20 to 200 strokes/min., independent of load

Motor Control: Silicon control rectifier with feedback circuit. All solid state.

Motor: 1/20th shunt wound d.c. for electronic control

Cylinder Volume: Adjustable while in operation from 10% to 100% of total cylinder volume

Valves: Solid brass with stainless steel plunger

Model 670, complete with one cylinder . . . \$550.00

Replacement cylinders, each . . . \$ 30.00

All prices f.o.b. Dover, Mass.

Bulletin 670 and Catalog Available on request

**HARVARD APPARATUS CO., INC.**

DOVER • MASSACHUSETTS • U. S. A.

(a non-profit organization)

## NEW! LOW COST LABORATORY OVEN

**\$55<sup>00</sup>**

For drying, baking, annealing, conditioning, sterilizing, evaporating and heat treating.



ADJUSTABLE SHELVES  
12"W. X 10"D. X 10"H.  
ONE YEAR GUARANTEE

### MODEL LO-200C

- Welded steel construction.
- Thermostat control — U. L. APPROVED.
- Damper controlled induced air circulation.
- Cool handle — explosion-proof door latch.
- Nickel plated shelves and interior hardware.
- Gray-green Hammerloid baked enamel exterior.

Operating range to 200° C. Thermostat response sensitivity  $\pm 1^\circ$  C. An efficient system of air intake and exhaust vents provide exceptionally fast drying. Ready for plug in. Thermometer and two removable shelves included. 110 and 220 volt units available.

88 Standard models — larger bench, cabinet and walk-in ovens.

Write for bulletins with prices.



**GRIEVE-HENDRY CO.**

1345 N. ELSTON AVE.,

CHICAGO 22, ILLINOIS



with specific chromosomal loci, and whose function is a prerequisite for cell division. From Perry's ideas one could make the thesis that carcinogens upset the usual control of cell division by interfering with the normal function of the nucleolus.

The evolutionary point of view about control of cell division was discussed by both Prescott and Pardee. They pointed to the lack of control of cell division in single-celled organisms, such as bacteria and protozoa. They suggested that control of cell division was acquired late in evolution and was inevitably associated with the presence of differentiation in multicellular organisms. In their view, one could ask what mechanisms that stop cell division appeared during evolution.

A different line of discussion during the conference was the consideration of specific examples of metabolic control mechanisms in cells. Daniel Mazia (Berkeley) mentioned two classes—those that operate by modulating existing cell machinery and those that create new cell machinery. The first class was essentially equivalent to examples of feedback inhibition of enzyme synthesis illustrated by Pardee. He included in his discussion the two-site model for control of the enzyme, and emphasized that a special site designed for control of the enzyme was present which had nothing to do with the site concerned with the function of the enzyme. Mazia's other class in illustrating enzyme induction had been considered by Pardee who pointed out in addition the basic concepts of gene function learned from the study of bacteria. The discovery that repressor genes control operator gene function (being able to turn a gene on or off for an extended period) could simulate a mutation in some circumstances.

Major interest at nearly all cancer meetings centers around the role viruses play in inducing or perpetuating malignant disease. S. E. Luria (Cambridge, Massachusetts), and Stanfield Rogers (Knoxville) dealt exclusively with the actions of viruses on different kinds of systems; the subject was also considered at length by other participants directly concerned with radiation-induced cancer. Luria reviewed functional alterations in cells caused by viruses, showing how they may produce permanent changes by initiating new synthetic processes directed by viral genes or by establishing new regulatory controls on the function of cellular genes. Modifications induced

by the host cell on the virus can also be demonstrated in bacteria. Findings of special interest mentioned by Luria were that a virus can bring a large amount of information to a cell and viruses are capable of mass repression of gene action. They can turn off entire blocks of host genes. Viruses can also specify bacterial cell antigens. The concept of helper viruses that complete the action of a defective virus, such as that seen with the Rous sarcoma, was described by Luria as a potentially significant aspect of tumor viruses.

Rogers presented in detail his work on the Shope papilloma virus. Here the virus brings new antigens to the papilloma, and, in addition, new metabolic information in the form of a unique papilloma arginase. He speculated that one approach to the therapy of a genetically determined human disease with loss of an enzyme would be to find a human virus that might transfer the information for producing the enzyme back into the genome.

Since the control of cell division and the induction of cancer must ultimately

## UNUSUAL AND HARD TO GET SCIENTIFIC ITEMS

**NOW . . . ACCURATE Weather Forecasting for Schools, Homes, Hobbyists**  
Consistently accurate thermometer, barometer and humidity meter. Foretells weather changes to 12 to 24 hrs. in advance. Humidity meter calibrated in "percent relative humidity." Thermometer accurate to 1°F. Excellent for teaching weather phenomena. Instruments on handsome wood-grained panel 15½" x 5¼". Meter cases heavily metalized. Dials in etched aluminum, made with micro-meter precision. Full instructions.  
Stock No. 70,607-W .....\$9.95 Postpaid

**Bargain 3" Astronomical Telescope**  
See the stars, moon, phases of Venus, planets close up! 60 to 180 power—famous Mt. Palomar Reflecting type. Unusual Buy! Equipped with Equatorial mount; finder telescope; hard-wood tripod. Included FREE: "STAR CHART"—22-page "HANDBOOK OF HEAVENS"—"HOW TO USE YOUR TELESCOPE" book.  
Stock No. 85,050-W.....\$29.95 Postpaid

4¼" Astronomical Reflector Telescope  
Stock No. 85,105-W .....\$79.50 F.O.B.

**WORLD'S LARGEST OPTICS VARIETY**  
Not only largest selection of telescopes, microscopes and magnifiers, but greatest variety of stock optical parts . . . war surplus, commercial, seconds, imported, etc. Typical bargains from our giant catalog:  
Stock No. 3003-W .....\$2.00 Ppd.  
Right angle prism 5¼" x 2¼"  
Stock No. 60,083-W .....2.00 Ppd.  
Infra Red Filter  
Stock No. 50,204-W .....3.00 Ppd.  
Experimental optics kit.  
Stock No. 50,202-W .....2.00 Ppd.  
Reflecting & Transmission Diffraction Grating (8" x 5¼" pieces)  
Stock No. 40,043-W .....3.15 Ppd.  
5" x 7" Front surface mirror.

**NEW BINOCULAR-TO-CAMERA HOLDER**  
Will Fit Any Camera  
For Exciting Telephoto Pictures. Bring distant objects 7 times nearer with a 35mm camera. 7x50 binocular and our NEW BINOCULAR-TO-CAMERA HOLDER. Camera and binocular attach easily. Use any binocular or monocular—still or movie. Take color or black and white. Attractive gray and chrome finish. 10" long. Directions included.  
Stock No. 70,223-W .....\$11.50 Postpaid

**BARGAIN! LONG & SHORT WAVE ULTRA-VIOLET LIGHT SOURCE**  
Small! Lightweight! Portable! Most Powerful at the Price!  
Newly developed for prospecting, mineral collecting, fluorescence demonstrations, etc. Most powerful source of long and short wave ultra-violet light in one compact home-or-field unit! One source produces short wave UV radiation with peak intensity of 2537 angstroms. Other source produces long wave UV with peak intensity of 3660 angstroms. Unit has rugged all-metal housing, special circuitry for battery conservation, easy access for replacing tubes, extra large filters. Operates on house current or batteries. Lightweight, only 1 lb. 5 oz. Compact 5¼" x 2" x 8½". Fully guaranteed. 6 identified mineral specimens included.  
Stock No. 70,258-W .....\$24.95 postpaid  
BATTERY ADAPTER CASE With Adjustable Shoulder Strap.  
Stock No. 70,260-W .....\$5.75 postpaid  
Order by Stock No. • Send Check or M.O. • Satisfaction Guaranteed

**EDMUND SCIENTIFIC CO.**  
BARRINGTON, NEW JERSEY

**Make Your Own Astronomical Telescope**  
**GRIND YOUR OWN ASTRONOMICAL MIRROR**  
Kits contain mirror blank, tool, abrasives, diagonal mirror and eyepiece lenses. You build instruments ranging in value from \$75.00 to hundreds of dollars.  
Mirror  
Stock # Diam. Thickness Price  
70,003-W 4¼" ¾" \$7.50 ppd.  
70,004-W 6" 1" 11.95 ppd.  
70,005-W 8" 1¼" 19.50 ppd.  
70,006-W 10" 1¾" 30.75 f.o.b.  
70,007-W 12½" 2½" 59.95 f.o.b. Barrington

**SOLAR MOTOR RUNS AT ASTONISHING 3000 R.P.M.**  
Powered by light only. Radiometer (solar motor) rotates at up to 3000 R.P.M. in bright sunlight. Also operates with invisible blacklight, even moves from glow of cigarette. 5" high, 3" dia. vacuum glass globe with 4 rotating vanes.  
Stock No. 60,082-W.....\$1.25 Ppd.

**WHIRLING WONDER WHEELS**  
Here's a new adventure in optical impressions—created by the magical effect of these fascinating rotating discs. In addition to weird shapes and fantastic "after images" the kit demonstrates "stop motion" stroboscopic principles—"off center" focus and hypnotism. Kit includes 13 discs, approx. 5" in dia. battery holder, theostat, small motor mounted on bracket, bulb, socket, plug and instruction.  
Stock No. 70,414-W .....\$9.95 Postpaid

**LOW-COST SOL-A-METER**  
Measures Solar Radiation Intensity  
Now Edmund offers a low-cost SOL-A-METER pyrheliometer to schools, research labs engaged in aerospace, solar energy, meteorology, or agriculture. Also useful testing products affected by solar radiation such as paints and dyes, seed production and pesticides. Using a silicon solar cell, it generates a signal directly proportional to intensity of solar radiation falling on cell. Maximum output of 5 and 10 millivolts produced by solar radiation of 440 BTU/hr.ft.² or 2.0 Langley. Built-in circular level vial; temperature compensated; insensitive to position or orientation. Instantaneous response (20 microseconds) to change in intensity of incoming solar radiation. Each instrument numbered and registered, individually calibrated under Arizona sun, calibration certificate included. Lifetime guarantee. Wiring and mounting diagram included.  
Stock No. 60,381-W .....\$75.00 Ppd.

**STEREO MICROSCOPE**  
Precision American-made. For classroom, home or laboratory use. Up to 3" working distance. Helical rack and pinion focusing. 2 sets of objectives on rotating turret. Clear, erect image. Wide 3-dimensional field. 23" and 40". 10 DAY FREE TRIAL  
Stock No. 85,056-W.....\$99.50 f.o.b.

**MAIL COUPON for FREE CATALOG "W"**

**NEW! 1,000'S OF BARGAINS 164 PAGES**  
**EDMUND SCIENTIFIC CO.,**  
Barrington, New Jersey  
Please rush Free Giant Catalog-W  
Name .....  
Address .....  
City .....Zone.....State.....

**IT'S WHAT'S  
UP FRONT  
THAT COUNTS!**

## SAVANT'S Model 620 GAS CHROMATOGRAPH

HYDROCARBONS  
FATTY ACIDS  
STERIODS  
LIPIDS

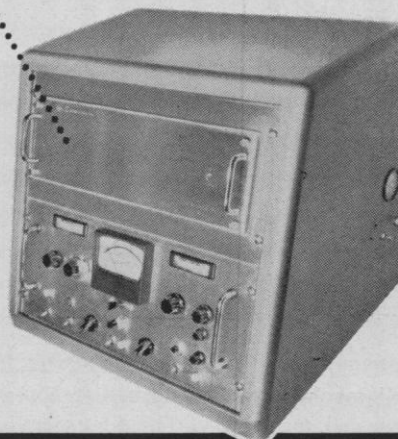
### SAVANT SERVES SCIENCE

Investigate today. Write for  
Bulletin #1011/63, for com-  
plete specifications.

Compact, bench top system with built-in versatility complete with interchangeable columns and detectors. Makes it readily adaptable to changing research requirements. **Up front** are controls, indicators, oven openings and sample injection port for reproducible performance. The sensitivity and stability of Savant's Gas Chromatograph system, makes it suitable for the most demanding high-precision analytical determinations.

DETECTOR OVEN  
TOP VIEW OF OVEN ASSEMBLIES

COLUMN OVEN  
PRE-HEATER



**SAVANT**  
INSTRUMENTS, INC.

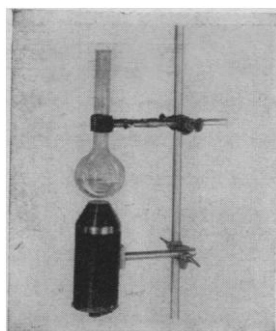
221 PARK AVENUE • HICKSVILLE, NEW YORK

## TRI-R VERSATILE LABORATORY INSTRUMENTS



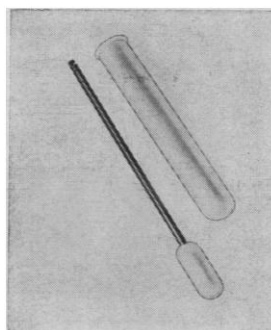
### ELECTRONIC THERMOMETER

- Rapid, Accurate, Direct Reading
- Low Cost, Portable, Thermistor Type
- Many Ranges from  $-35$  to  $+100^{\circ}\text{C}$ .
- Interchangeable & Special Probes
- Controllers & Recorders Available



### COMPACT MAGNETIC STIRRER

- Stir at Any Angle
- In Open or Closed Vessels
- Under Vacuum or Pressure
- With or without Hot-plate



### TEFLON TISSUE HOMOGENIZERS

- Interchangeable Teflon Pestles
- Precision Bore Pyrex Glass Tubes
- Notched for Quick Change Chuck
- Complete Apparatus Available



### AUTOMATIC EGG-PUNCH

- For Opening Embryonated Eggs
- Open 60 Eggs Per Minute
- Clean 1" Circular Fracture
- One Hand Efficient Operation

Write for individual bulletins  
or complete catalog to Dept. S103

## TRI-R INSTRUMENTS

Developers of Electronic and Mechanical Instruments for Scientific Research

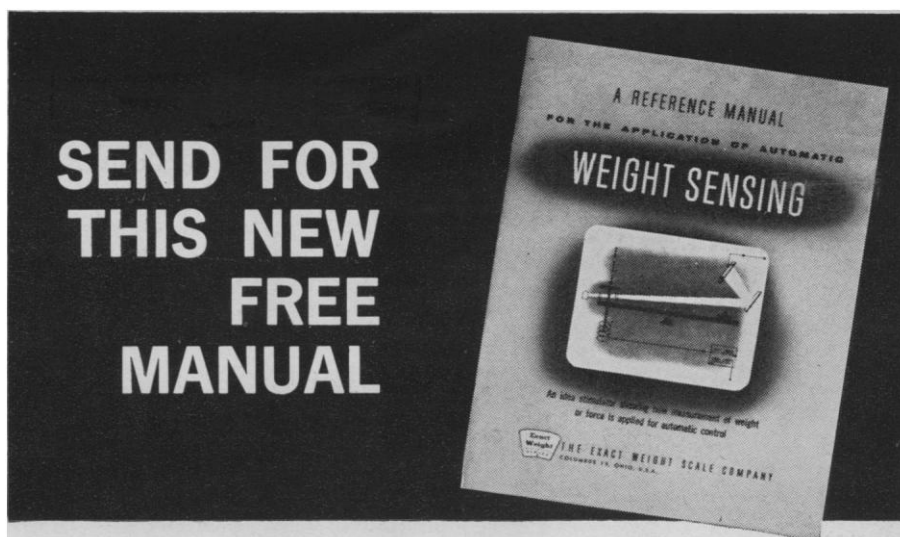
144-13 JAMAICA AVENUE, JAMAICA 35, N. Y.

involve the cells from which the cancer arises, several significant studies on stem cells were presented by C. P. Leblond (Montreal), Joan Wright Goodman (Oak Ridge), G. S. Hodgson (Santiago), and L. F. Lamerton (London). Leblond reviewed the general theory of stem cells and developed the concept of static, expanding, and renewal cell populations encompassing all cells in an individual. Tumors, to a significant extent, resemble expanding and renewal cell populations without the appropriate mechanisms for eliminating the new cells produced. Goodman reported her work on stem cells of the hemopoietic and lymphatic tissues, which, she pointed out, could easily be removed from the animal for study or manipulation in vitro, a feature not readily visualized for stem cells of most organ systems. Transplantation studies revealed the presence of hemopoietic and lymphatic tissue stem cells in bone marrow, blood, and peritoneal fluid, whereas lymphatic tissues contained only stem cells for lymphatic tissue replacement, not those of the hemopoietic system.

Hodgson considered the erythropoietic stem cells a specially advantageous model to study control of cell division since proliferation of these elements can be controlled more or less at will by manipulating endogenous or exogenous erythropoietin. Not only can cell division be initiated by the action of this substance, but it can be stopped by its withdrawal.

Lamerton's work on the ability of stem cells from various cell renewal systems to proliferate under continuous irradiation demonstrates the great variability in resistance to injury of mechanisms that control cell division. Presumably, this includes the initiation of DNA synthesis. C. Pavan (São Paulo), however, presented evidence that in some Diptera, where DNA synthesis occurs without cell division, irradiation may actually stimulate DNA synthesis. Others felt Pavan's data reflected a reduction in the pool of endogenous thymidine. Of the systems he studied, Lamerton found the stem cells of the lining of the small intestine most resistant and the testis most sensitive to continuous irradiation. Other cell renewal systems, such as bone marrow, lie between these two extremes.

Radiation-induced cancer was more thoroughly covered at the conference than any other type of induced cancer. H. S. Kaplan (Palo Alto), A. C. Upton (Oak Ridge), Miriam P. Finkel



**It shows you how measurement of weight or force is applied for AUTOMATIC CONTROL**



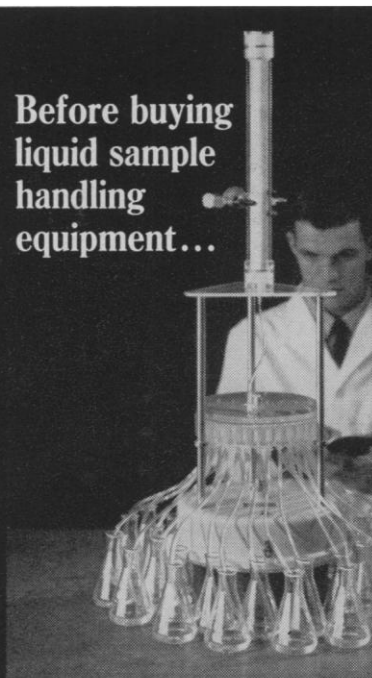
**It's FREE! No obligation**

This valuable new reference manual, packed with explanatory diagrams, presents many control possibilities offered by a proven weight-sensing principle. It shows how the principle is applied for control of basic operative functions in automated machines; for control of processing equipment; and for quality control operations. Here is a source of ideas that can lead to the solution of problems concerned with weighing or control by weights. Write for your free copy of "Weight Sensing."



**THE EXACT WEIGHT SCALE CO.**  
901 W. FIFTH AVE., COLUMBUS 8, OHIO  
In Canada: P.O. Box 179, Station S, Toronto 18, Ont.

Before buying  
liquid sample  
handling  
equipment...



## check these features of the new DURRUM FRACTION COLLECTOR

- New concept in liquid sample handling, the versatile new Durrum Model BF will distribute any stream or column effluent into precise fractions. Ideal for preparative column chromatography.
- Unique design features let you collect fractions without interference from relays, sticky siphons, tricky photocells, shorted wiring, or unreliable timers.
- Compact size—so small you can even operate it in your laboratory refrigerator.
- Low price—unit sells for just \$375, yet is reliable, accurate, accommodates up to 4 columns or liquid inputs simultaneously.

For more information, contact your nearest representative of Van Waters & Rogers, Inc. or Fisher Scientific Company. Or write for Bulletin BF463.

**Durrum  
Instrument  
Corporation**

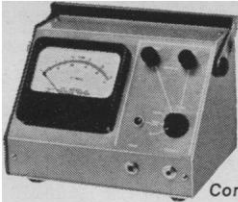
925 E. Meadow Drive  
Palo Alto • California

(Argonne), and R. H. Mole (Harwell), respectively, took up the problems of radiation-induced thymic lymphosarcoma, myeloid leukemia, osteogenic sarcoma, and tumors in general, in the mouse. Michael Court Brown (Edinburgh) discussed radiation-induced leukemia in man.

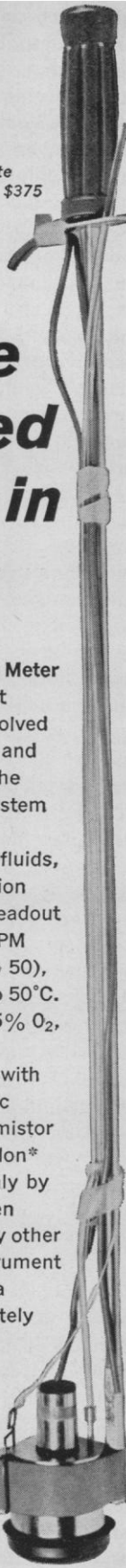
Kaplan pointed out there were two paths the investigator could follow. He could describe the intracellular events essential to the malignant transformation or he could follow the approach Kaplan himself took of defining the pathogenesis by giving the conditions for induction of the neoplasm under study. All five investigators followed the latter course for the most part. Both Upton and Kaplan, however, gave progress reports on their studies with filterable agents probably released by radiation, thus causing leukemia through intracellular events in which a virus might conceivably be incorporated into the genome of the target stem cell. Upton described very rapid myeloid leukemia induction with cell-free preparations obtained with the Anderson zonal ultracentrifuge. Kaplan, trying to cope with the variability in assay results that plague work with new leukemia viruses, pointed out the desirability of using a 1-week interval between x-ray exposure and administering the filtrate preparation to the test host.

Finkel suggested in her introductory remarks, before defining the conditions under which radionuclides induce osteogenic sarcoma in mice, that this lesion might turn out to be virus mediated. Mole was chiefly concerned with complexities in dose-response relations as influenced by the dose rate.

The problem of leukemia in man was described by Court Brown. A total of 13,000 persons with spondylitis who were irradiated in 32 British radiation centers have been studied for induction of leukemia, and many for radiation-induced chromosome abnormalities. In the chronic myeloid leukemia cases Court Brown investigated, 95 percent showed the Philadelphia chromosome, and a few cases did not. This nearly pathognomonic myeloid leukemia chromosome is not present in other tissues such as fibroblasts. Sixty-five percent of the myeloid leukemia cases show no other chromosome abnormality, but 35 percent have other lesions of the karyotype. Erythrocyte, megakaryocyte, and granulocyte precursors all show the Philadelphia chromosome. There is no difference between the



Complete system, \$375

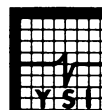


## Now measure dissolved oxygen in minutes

**New YSI Model 51 Oxygen Meter** gives a quick, convenient method for obtaining dissolved oxygen, oxygen tension, and temperature. Used with the YSI 5023 Sampler, the system is ideal for field sampling of lakes, rivers, biological fluids, sewage plants, fermentation tanks, etc. It gives direct readout of oxygen measured in PPM (0 to 25) or percent (0 to 50), and temperature from 0 to 50°C. Accuracy is 0.3 PPM or 0.5% O<sub>2</sub>, and better than ±1°C. The Sampler is equipped with a Clark type polarographic oxygen probe and a thermistor temperature probe. A Teflon\* membrane, permeable only by gases, protects the oxygen probe from interference by other materials in solution. Instrument calibration requires only a minute, is done immediately preceding measurement and under the same conditions.

\*DuPont registered trademark

For complete specifications and details write:



YELLOW SPRINGS INSTRUMENT CO., INC.

Yellow Springs, Ohio



radiation- and nonradiation-induced chromosome lesion. Normal cells are present in a dormant state when they return during remission. During the transition of chronic myeloid into acute leukemia, the positive cells of the Philadelphia chromosome increase in numbers. The same chromosomal lesion can presumably be produced by two or more agents. Viruses, such as measles and yellow fever, can cause extensive chromosome breaks in vivo and in white blood cell tissue cultures, respectively. Direct preparations of the African Burkitt's lymphoma show chromosome changes. Study of the spondylitis cases revealed stable and unstable abnormalities in the chromosome karyotype. The stable abnormalities persisted for as long as 20 years. What was the significance of the chromosome lesions for the leukemia problem? No clone formation was detected and unstable lines did not persist. Upton pointed out that studies he and Niel Wald were doing on transmitted myeloid leukemia in mice revealed a typical extra chromosome in all the instances so far examined. This included cases transmitted with cell-free supernatant fluid. Luria remarked in the discussion that there may be a gene function that keeps chromosomes intact and which may be unrelated to proliferation.

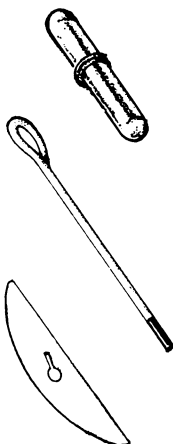
Other speakers at this conference included H. L. Stewart (Bethesda), Pablo Mori-Chavez (Lima), Albert Tannenbaum (Chicago), C. C. Congdon (Oak Ridge), and Alexander Hollaender (Oak Ridge). Stewart quoted the definition of geographic pathology—"Who has what, when, where, and why." He pointed out that less than 1 percent of cancer in man has a known etiology and gave examples of how geographic pathology dealt with the extrinsic factors in the etiology of scurvy, pellagra, beri beri, and yellow fever. He suggested that geographic differences in cancer incidence might similarly provide clues as to the pathogenesis of the tumors in question.

Other researchers found that cancer induction and metastasis of cancer at high altitude differed from those at sea level and that cancer occurred in man at high altitudes in Peru (Mori-Chavez and Arias Stella, Lima).

Tannenbaum demonstrated the multiple carcinogenicity of urethane and noted how it produces many different kinds of tumors besides the well-studied pulmonary adenoma. He then asked if all carcinogens were not mul-

## STIR CRAZY?

### Better start using BEL-ART Stirring Aids



Is stirring a problem with you? It need not be if you use Bel-Art stirring aids. Using a magnetic stirrer? Bel-Art has 21 different sizes of Teflon<sup>®</sup> magnetic spin-bars in four diameters and three sizes of magnetic balls to fit any type flask or beaker.

Any of these bars can be easily removed from the container with the Bel-Art Polyethylene magnetic stirring bar retriever.

Need stirrer blades? Bel-Art has a Teflon<sup>®</sup> stirrer blade to fit almost any size flask.

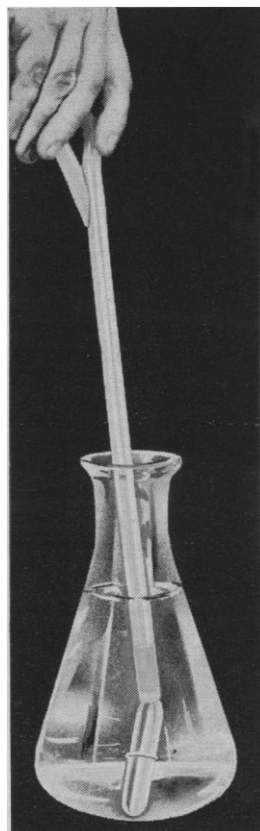
Remember Teflon<sup>®</sup> has the greatest resistance to chemical attack. The above items will last indefinitely. Available from your local laboratory supply dealer.

\*DuPont's TFE Fluorocarbon Resin

Listed in our NEW 1963 56-page catalog.  
Write Dept. E for your FREE copy.

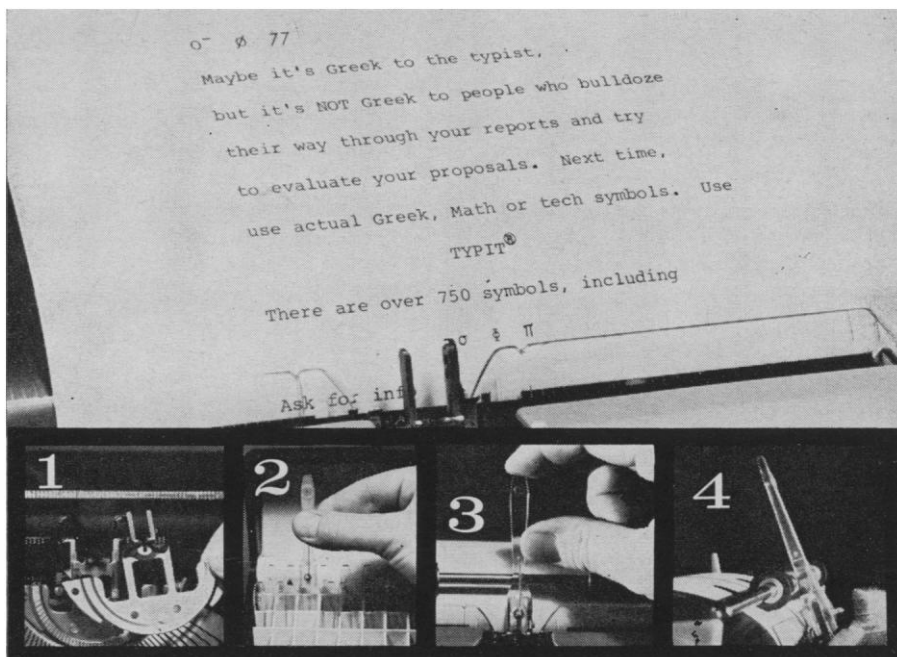
**BEL-ART PRODUCTS,**

PEQUANNOCK, N. J. OXbow 4-0500



**PLASTICS**

*for Science and Industry*



- 1 Have TYPIT<sup>®</sup> installed
- 2 Select the symbol
- 3 Insert the symbol
- 4 Strike any key:

type the symbol

**NOW LEARN ABOUT**

**TYPIT<sup>®</sup>** manufactured by  
mechanical enterprises, inc.  
3127-B Colvin Street, Alexandria, Va.

Gentlemen:

Send: ☐ Catalog ☐ Representative  
Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

# TRY THIS EXPERIMENT IN ECONOMY... TRY NEW, LOW-COST UNBREAKABLE PLASTIC LAB WARE

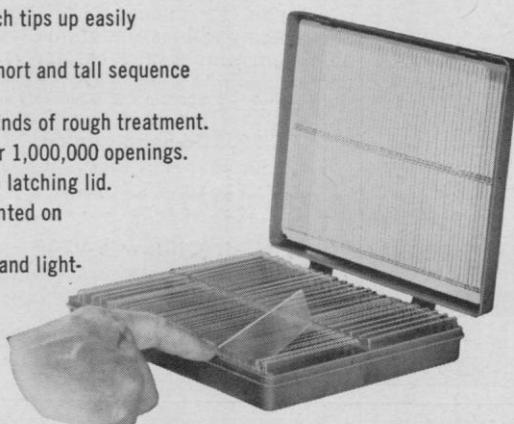
BY **econo-lab**

## Exclusive Slide Box . . . Another Econo-Lab First!

Slide selection at your fingertips at a price well within your reach! New, one-piece design in polypropylene outdates any other slide box ever made.

- Slides rest on raised ridges—each tips up easily for split-second removal.
- Slide dividers are staggered in short and tall sequence to give fast, easy alignment.
- Unbreakable—stands up to all kinds of rough treatment.
- Spring-back hinge guaranteed for 1,000,000 openings.
- Tight, dust-proof lip and positive latching lid.
- Numbering system and index printed on pressure-sensitive tape.
- Comes in 25 and 100 capacities and light-defying, solid color.
- For standard slides, 75mm x 25mm.

Available from your  
Local Laboratory Supply Dealer



## Now! Completely Disposable Beakers...

- Excellent for experiments involving viscous or radio-active materials.
- Special "dripless" lip.
- Exclusive ribs prevent binding—they stack but don't stick.
- Safe—made of unbreakable, translucent polypropylene.
- Sizes: 15ml, 30ml, 50ml, 100ml.

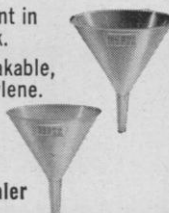
Available from your  
Local Laboratory Supply Dealer



## Now! Completely Disposable Funnels...

- Exclusive—special vent in stem prevents air lock.
- Safe—made of unbreakable, translucent polypropylene.
- Sizes: 9cm and 11cm.

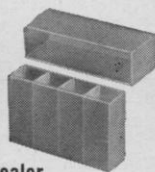
Available from  
your Local  
Laboratory Supply Dealer



## NEW! Polyethylene Vial Holder...

- Accommodates vials, bottles, etc.
- Four compartments—each 17½mm square, 49mm deep.
- Overall size—3" x ¾" x 2" high.

Available from  
your Local  
Laboratory Supply Dealer



Econo-Lab products are brought to you by the manufacturer of famous Econo-Cages—the leader in plastic laboratory animal housing.

**TAKE THE CARE OUT OF LAB WARE WITH  
ECONO-LAB UNBREAKABLE PRODUCTS!**

**econo-lab**

ECONO-LAB division of  
**MARYLAND PLASTICS, INC.**

9 E. 37th Street, New York 16, N. Y.  
Factory: Federalsburg, Maryland

tipotential. The data presented showed this to be true. In addition, the same tumor (for example, mammary tumors in rats) could be produced by several different chemical carcinogens. In Tanenbaum's view, carcinogenesis is an augmentation of spontaneous neoplasia.

Not taken up specifically at this conference, although mentioned in the discussion, was the possibility that chemical carcinogens release tumor viruses. William Hueper (Bethesda) also mentioned some aspects of chemical carcinogenesis in his report on tumor induction by polymers.

In summation, Congdon suggested that gene control of somatic cell division needs to be considered from the point of view of cancer induction. Little is known about specific loci that produce some abnormality in the cell division process. One could think of the problem in terms of many specific genes operating to initiate cell division and to determine its features, or, in the sense mentioned by Prescott, that each gene has at least one pleiotropic effect in determining its own replication.

Congdon also discussed what he called the three basic long-established principles in the theory of cancer in relation to the idea that all cancer is caused by viruses. The first principle, that the carcinogenic agents are adventitious stimuli which do not specify the kind of cancer produced, is no longer valid if viruses bring new specific information to the host cell genome. The second, that the host cell determines the nature of the tumor, is also probably invalidated if a virus brings new information to the host cell genome. The extreme position that all cancer is caused by viruses is a difficult one in view of the third basic principle, which relates the biological phenomenon of cancer to normal growth and development through a series of imperceptible gradations including the congenital and acquired tissue malformations. This position would also suggest that viruses, or some other similar phenomena, are the cause of normal growth and development and tissue malformations.

Hollaender, in an unusual impromptu session in Lima, described some of the schemes now being considered for stimulating international cooperation in science and mentioned the establishment of international research institutes to help solve urgent major biological and medical problems, such as

those taken up at this conference. He also encouraged Latin-American scientists to participate in these efforts.

The major sponsor of the symposium in Lima was Universidad Peruana de Ciencias Médicas y Biológicas, and in Cali, Universidad del Valle. Pablo Mori-Chavez was general secretary for the organizing committee.

Substantial financial assistance was also provided by the following organizations: Pan American Union, Damon Runyon Memorial Fund, Rockefeller Foundation, Anna Fuller Fund, The Jane Coffin Childs Memorial Fund for Medical Research, the United States Atomic Energy Commission, National Cancer Institute, National Science Foundation, International Atomic Energy Agency, the British Council, and numerous commercial firms in Lima and Cali.

The U.S. National Academy of Sciences-National Research Council also sponsored the meeting and encouraged the development of this series of symposia in Latin America. The first one was held in Santiago, Chile, in 1961 on "Tissue transplantation"; the second, in 1962, took place in São Paulo and Rio de Janeiro with two programs, "Mammalian tissue culture and cytology" and "Specific topics in radiobiology"; and a fourth symposium is being organized in Buenos Aires in 1964 on "Genes and chromosomes—structure and function." Publication of the proceedings of this year's conference, as a monograph from the National Cancer Institute, is anticipated.

CHARLES C GONGDON  
*Biology Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee*

### Free Radicals

Free radicals, particularly when trapped in solid materials at low temperatures, were the topics of discussion at the sixth international symposium on free radicals which took place 2-5 July 1963 at Cambridge, England. The total attendance was about 260, with the host (United Kingdom) delegation numbering almost as many as the representatives from all other countries combined.

R. G. W. Norrish (University of Cambridge), organizer of the symposium, gave an introductory lecture which dealt with studies of free radicals in the gaseous state and showed the transient nature of such radicals as



**STILL ON THE JOB** even after the chemist has gone home. The new Fisher Titralyzer\* will run up to 16 titrations and print out the results for him to pick up in the morning. The tape shows titrant volumes to the nearest 0.01 ml — higher precision than he can get manually with any but micro equipment. Any kind of repetitive potentiometric titration is handled with ease. Price: \$2,750. Available under Fisher Financing Plan. **More details on Titralyzer** in Bulletin FS-245. Write Fisher Scientific Company, 139 Fisher Building, Pittsburgh 19, Pennsylvania.

\* Fisher Scientific Company Trademark

J-330

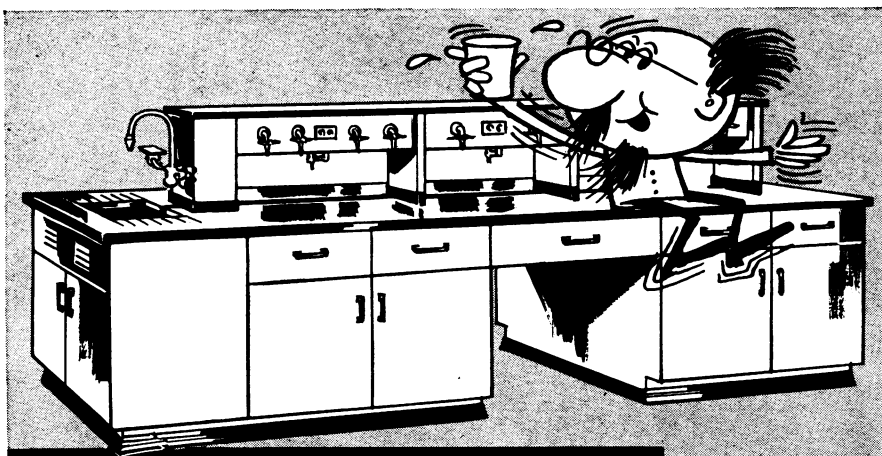


## FISHER SCIENTIFIC

*World's Largest Manufacturer-Distributor of Laboratory Appliances & Reagent Chemicals*

Atlanta • Boston • Chicago • Fort Worth • Houston • New York • Philadelphia  
Pittsburgh • St. Louis • Union, N. J. • Washington • Edmonton • Montreal • Toronto





## QUALITY IS A MUST IN KEMETAL LABORATORY

**EQUIPMENT...** Any resemblance between the handsome young scientist, shown above, and our prospective customers is purely coincidental. He is trying to tell you that he's sold on Kewaunee's METAL LABORATORY FURNITURE because it is quality built to last and last and last.

For complete information  
call or write



5013 S. Center St., Adrian, Michigan

**NEW! MALMSTADT-ENKE INSTRUMENTATION LAB...IDEAL FOR RESEARCH & EDUCATIONAL APPLICATIONS IN EVERY SCIENCE!**

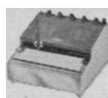
Complete Lab Station  
**\$1100**  
(Less optional cabinet)

Specially developed to perform numerous tasks and experiments in both the physical and life sciences, this new highly accurate system was designed by the Heath Company in conjunction with Dr. H. V. Malmstadt of the University of Illinois and Dr. C. G. Enke of Princeton University. You'll find it the "long awaited" answer to securing a firm foundation in the principles, design and use of electronic instrumentation as well as a versatile lab station for daily use.

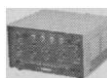
Included in this multi-purpose system are factory assembled and calibrated test equipment, special-design instruments, special experimental chassis and parts which feature "solderless" spring clip connectors, and the acclaimed Malmstadt-Enke text, "Electronics for Scientists".

All components may be purchased either as a complete lab station (at a special savings) or individually. Educational institutions qualify for an additional discount on the entire group as well as individual units. For a free 8-page brochure describing this system in detail, simply mail the coupon below.

**Servo-Pen Recorder**  
True potentiometric input; 5 adjustable ranges; plug-in connectors for special servo applications; pen lift; 10" chart; 1 second response.....**\$195.00**



**Operational Amplifier System**  
Performs many functions in measurement, computation and control work as described in brochure.....**\$135.00**



**Universal Regulated Lab Power Supply**  
Ideal for circuit design or teaching power supply design; provides many different types of power circuits...**\$75.00**



**Voltage Reference Source**  
Use for calibration, potentiometric measurements, or calibrated bucking voltages **\$65.00**



### FREE 8-PAGE BROCHURE!

Includes complete specifications, descriptions and prices of separate system components. Mail the coupon today!

### HEATH COMPANY,

Benton Harbor 37, Michigan 49023

☐ Please send free brochure on the Malmstadt-Enke Instrumentation lab.

☐ Please send free copy of the new 100-page 1964 Heathkit Catalog.

Name \_\_\_\_\_

Address \_\_\_\_\_

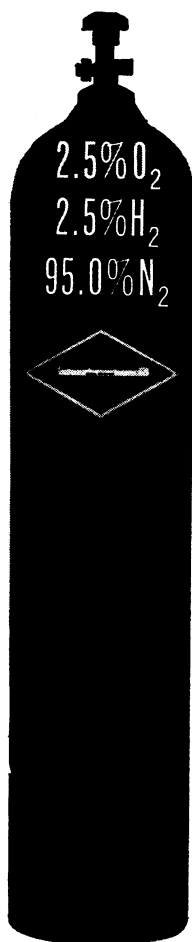
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

intermediate species and the ubiquitous role of chain reactions. Under these conditions, free radicals bore the status of some postulated entities necessary for the logic of reaction kinetics but were hardly "real" enough for direct and on-the-spot inspection. It was G. N. Lewis who in 1942 first achieved stabilization of the radicals by trapping them in the frozen state, thus obviating difficulties due to very short life times. But the principal job of direct and specific inspection of trapped species had to wait for the introduction, after the end of the Second World War, of a technique known as electron spin resonance (ESR). Since then, the rapid adoption of the ESR technique for the study of free radicals has been most phenomenal. Whereas there was only one paper on ESR in the first international symposium on free radicals (Quebec, Canada, 1956) 27 of the 39 papers presented at this symposium dealt with this method.

Free radicals can be produced and trapped in solids in a variety of ways. In some experiments radicals were generated in an electric discharge and were condensed, along with other discharge products, on a cold target. In a majority of cases, however, they were generated by irradiating the solid sample at a low temperature with ultraviolet light or  $\gamma$ -rays (occasionally x-rays). Results obtained by using electron beam bombardment were not materially different from those using x- or  $\gamma$ -rays because radical production was most probably accomplished by secondary electrons in either case.

The stabilization of free radicals in solid media or on solid surfaces is not very well understood. It is hard to understand, for instance, that hydrogen atoms are not stable in irradiated ice at liquid nitrogen temperature whereas they are quite stable in certain irradiated frozen acids at the same temperature. J. Weiss (New Castle) raised questions of this kind and speculated about the nature of the trapping sites. If, according to one suggestion, the hydrogen atoms could only be stabilized at certain trapping sites, then with a limited site density the radical concentration ought to reach a saturation value after prolonged irradiation. There is as yet no experimental verification of this suggestion. In another direction, V. B. Kasanskii and G. B. Pariiskii (Moscow) studied the problem of stabilization of free radicals on solid surfaces. They found, for instance, that





## precise blending of gas mixtures

Exact mixtures of compatible 2- and 3-gas mixtures — contents accurate to  $\pm 0.5\%$ .

Available in various cylinder sizes for commercial, educational and research applications.

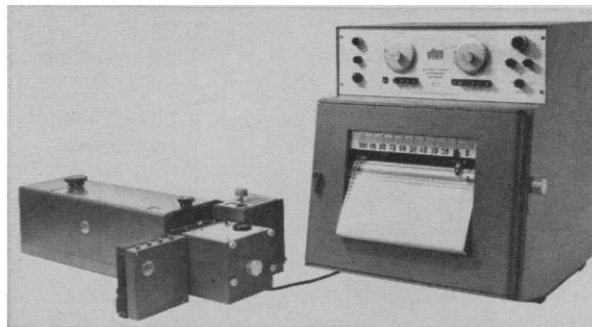
Regulators, valves and flow-meters designed for exact control and delivery.

Ask for Catalog No. 2453.

**Ohio Chemical**

OHIO CHEMICAL & SURGICAL EQUIPMENT CO.,  
Madison 10, Wisconsin; OHIO CHEMICAL PACIFIC  
CO., Berkeley 10, California; OHIO CHEMICAL  
CANADA LIMITED, Toronto 2, Ontario.

## Enzyme Assays Simplified ...with Linear Recording of Absorbance on Multiple Samples



Versatility is an outstanding characteristic of the Gilford Model 2000 Multiple Sample Absorbance Indicator-Recorder. Linear, stable absorbance measurements at any full-scale sensitivity—0.1 to 3.0 units, or at any 0.1 increment therein—provide the needed flexibility to handle diversified research problems. The Model 2000 significantly reduces data-gathering time and effort by making

enzyme-catalyzed reaction rate measurements virtually automatic. Available equipped for liquid column chromatography or thermal denaturation of DNA or RNA. Request brochure and quotation.

**gilford**

INSTRUMENT LABORATORIES INCORPORATED • OBERLIN 1, OHIO



## MICROSCOPE SCREEN

**\$33**

ONLY

A professional microscope screen—4" x 5" that can be mounted on any standard microscope

For General Medical Use • Research • Laboratory Education • Industrial Analysis

Brilliant, clear images of specimen material can be viewed in normal room light on the SS Microscope Screen, when illuminated with a high-intensity, transformer-powered illuminator. Fits standard 1" eyepiece tubes.

The SS Microscope Screen will fit practically all microscopes having a standard diameter eyepiece tube, vertical, inclined, monocular, binocular or trinocular. Huygenian and wide field optics can be utilized for a larger image. High impact plastic, anodized aluminum construction. 4" x 5" unique, "black" viewing screen, grainless, with no hot spots. Adapter ring included for wide field optic.

Cat. No. S-72590—

Microscope Screen w/case..... \$33.00

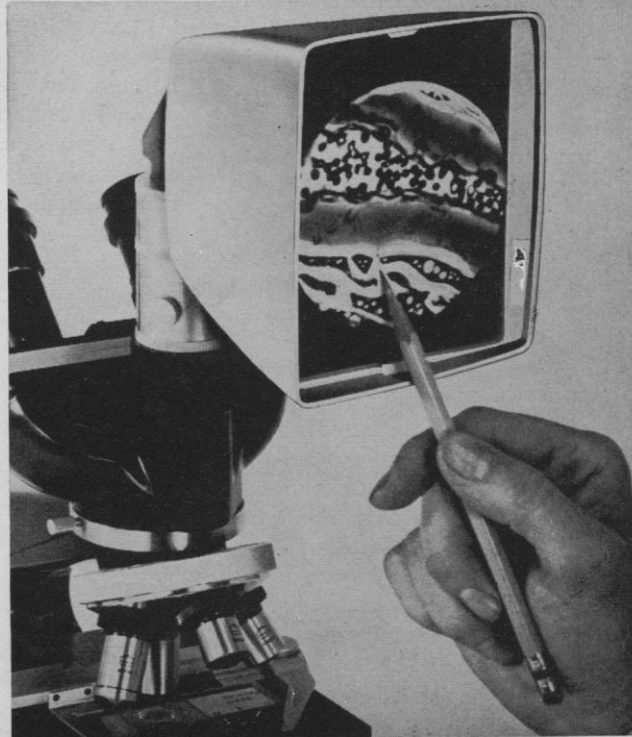
Cat. No. S72591—

Adapter for 29 mm diameter

lens tubes..... \$ 4.50

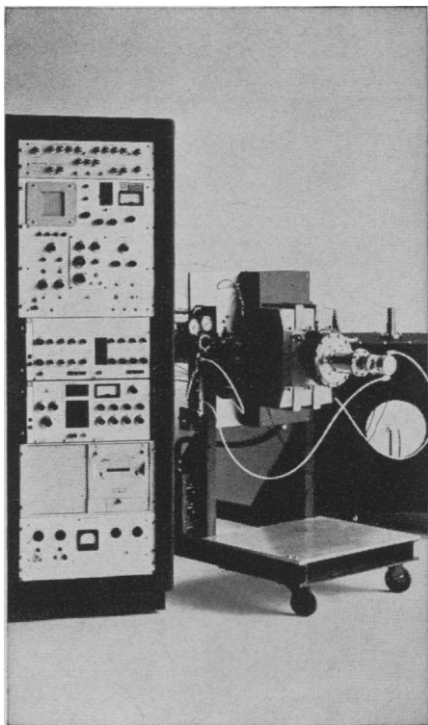
Huygenian Eyepiece 10x..... \$11.00

**75th  
Anniversary  
Year**



**STANDARD SCIENTIFIC**  
*Supply Corp.* 808 BROADWAY  
NEW YORK 3, N.Y.

LABORATORY APPARATUS • REAGENTS AND CHEMICALS



## ACTIVATION ANALYSIS

Texas Nuclear's activation analysis laboratory is built around a new, more powerful neutron source—the Series 9900 Neutron Generator. The 9900 with its yield of  $2.5 \times 10^{11}$  n/sec is available at the same price as other neutron sources of lower yield.

By means of the prolific T(d,n) reaction and a positive ion beam current of 2.5 ma, the 9900 produces a fast neutron flux of  $5 \times 10^9$  n cm<sup>-2</sup> sec<sup>-1</sup>.

By combining its efforts and technical resources with those of its parent company, Nuclear-Chicago, and its affiliate, RIDL, Texas Nuclear is the only manufacturer offering a fully integrated activation analysis laboratory. This includes a rapid sample transfer and programmer system, a dual-crystal (3" x 3") scintillation detector and shield, a flux monitoring system, and a newly developed analyzer system designed for the reduction of as many as four gamma-ray lines in a complex spectrum. This system includes a 400 channel pulse-height analyzer, a multi-scaler programmer, and associated power supplies and readout. Write for details.

NUC-N-3-244



349 Howard Avenue, Des Plaines, Illinois, U.S.A.

hydrogen atoms could be stabilized on the surface of a silica gel (an insulator) up to about 170°K. On the other hand, hydrogen atoms or any other free radicals could not be stabilized at all on the surface of a semiconductor or conductor. Theories postulating a one-electron bond between a radical and an insulator or a two-electron bond between a radical and a semiconductor (or conductor) may well explain the above-mentioned phenomena but they are so far only qualitative.

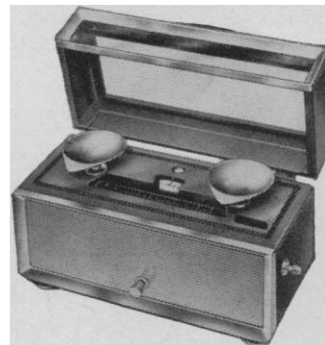
In the field of radical identification by ESR technique, many successful examples exist. However, there is also a case of considerable confusion that is concerned with the problem of identifying free radical species in a solid hydrogen-oxygen system (H<sub>2</sub>O, H<sub>2</sub>O<sub>2</sub>, or mixture) when one of several radical production methods (frozen discharge product, uv, x-ray,  $\gamma$ -ray, or electron bombardment) is used. For a number of years various groups of workers all over the world (American, Russian, English, and French) have put forth their claims of identification (such as OH, HO<sub>2</sub>, and so forth) with rather different kinds of ESR data and quite dissimilar interpretations. More recently, Siegel, Baum, Sholnik, and Flournoy (Aerojet Corp., California) observed a doublet ESR spectrum in  $\gamma$ -irradiated ice and interpreted this as due to the OH radical. The results of Kroh, Green, and Spinks (University of Saskatchewan) with partially tritiated ice strongly supported this identification.

However, one would hardly get this feeling of surety if he had listened to some of the researchers who dealt with this same general subject. After studying radicals produced in frozen H<sub>2</sub>O<sub>2</sub>-H<sub>2</sub>O solutions by ultraviolet and ionizing radiations, S. J. Wyard and R. C. Smith (Guy's Hospital, London) concluded that one of five observed spectra could most probably be assigned to HO<sub>2</sub> but none could reasonably be assigned to OH. Other experiments with ultraviolet-irradiated, frozen H<sub>2</sub>O<sub>2</sub>-H<sub>2</sub>O solution led to the belief that the observed spectra were due to a mixture of OH and HO<sub>2</sub> radicals, according to B. C. Green and J. W. T. Spinks (University of Saskatchewan).

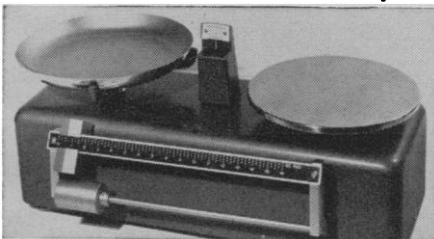
R. Marx, S. Leach, and M. Horani (University of Paris) studied the condensed product (at 77°K) of water vapor bombarded by low energy electrons and interpreted their observed spectra as due to HO<sub>2</sub> and one other complicated radical. Experiments by R. Livingston (Oak Ridge National

# 3

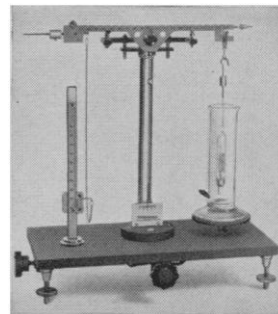
## TIME-SAVERS BY TROEMNER



**1. Precision laboratory balance—Model 410**—Sensitivity 2 mg. Capacity 120 g. No bands or wires to bend or lose "life." Handsome blue-gray heavy metal case. Weighs to full capacity with lid closed. **\$165.**



**2. Heavy-duty precision balances—Models 195-B and 2-89B**—Capacities 3 or 6 kg. Sensitivity as fine as 100 mg. Locking tare weight. Beams graduated in mg., g., or oz. **From \$95.**



**3. Specific-gravity chain balance—Model S100**—Ideally suited for S.G. determinations of liquids and solids to within 0.0001. Also operates as a sensitive chain analytical balance. **From \$168.**

Write for complete information on these and the complete line of quality Troemner balances and weights.



**Henry Troemner, Inc.**  
22nd & Master Sts., Philadelphia 21, Pa.  
Phone Area Code 215/POplar 9-6386

Laboratory) with frozen discharge products of water vapor and  $\gamma$ -irradiated ice and solid hydrogen peroxide (both single- and polycrystalline) revealed five different types of ESR spectra, two of which could be assigned as triplet state systems. Of the three remaining spectra, two were regarded as unknown and the last one may possibly be assigned to OH. Livingston further conjectured that the triplet state species may be thought of as two OH molecules coupled in a hydrogen-oxygen complex. In summary, the problem of identifying free radicals in a hydrogen-oxygen system is still unresolved.

The electronic structure of free radicals by ESR analysis was investigated by F. J. Adrian, E. L. Cochran, and V. A. Bowers (Applied Physics Laboratory, Johns Hopkins University) in their studies of the  $HC=R$  type of free radicals. Here the unpaired electron occupies a  $\sigma$ -orbital which, unlike a  $\pi$ -orbital, has very rarely been treated experimentally or theoretically. They observed the hyperfine splittings for formyl ( $HC=O$ ) and vinyl ( $HC=CH_2$ ) radicals and were able to assign the observed splittings for the vinyl radical to its  $\alpha$  and two  $\beta$  protons. Their theoretical investigations on the basis of a valence bond model gave results which were in good agreement with the experimental values and, in addition, spelled out the specific splittings for the two non-equivalent  $\beta$  protons. In another work, R. J. Cook, J. R. Rowlands, and D. H. Whiffen (National Physical Laboratory, Teddington) observed the ESR spectrum of frozen furoic acid ( $C_5H_4O_3COOH$ ) after x-ray irradiation. Free radicals were known to be formed by the addition of a hydrogen atom to the aromatic molecule. The problem for these investigations was to determine at which position around the aromatic ring the hydrogen atom was added. With a molecular orbital approach they concluded, from calculations, that the hydrogen atom was added at position 5, with oxygen at position 1, and  $COOH$  at position 2.

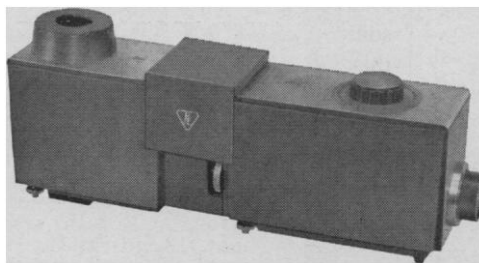
A different type of electronic structure problem is that of a triplet state molecule. This area of research, which was initiated several years ago by C. A. Hutchison, Jr. (University of Chicago), was discussed by W. A. Yager, R. W. Murray, G. Smolinsky, A. M. Trozzolo, and E. Wasserman (Bell Telephone Laboratories, Murray Hill). They observed a number of stable triplet state molecules in rigid glasses when certain organic compounds were decomposed



# NEW HIGH INTENSITY

## PURE MONOCHROMATIC LIGHT

### NEW BAUSCH & LOMB GRATING MONOCHROMATOR



Compare it! See the dazzling difference! This new B&L Monochromator produces strikingly brighter light than any other instrument anywhere near its low price and small size. And wider dispersion, which is linear throughout all wavelengths. Just dial

the IR, UV or visible wavelength you need. Five interchangeable gratings let you pinpoint any wavelength in the entire range from 2000A to 32000A. And the price is just as newsworthy. Only \$880\* to \$1390\*, depending on your choice of light sources and slit sets. Try it out and see for yourself.

\*Suggested Retail Price

**BAUSCH & LOMB**



**BAUSCH & LOMB  
INCORPORATED**  
85646 Bausch Street  
Rochester 2, N. Y.

☐ Please demonstrate the new B&L High-Intensity Monochromator.

☐ Please send me Catalog D-2025.

Name .....

Professional Address ..... (PLEASE PRINT)

.....

In Canada, write Bausch & Lomb Optical Co., Ltd., Dept. 856, Scientific Instrument Division, 16 Grosvenor St., Toronto 5, Canada

## TIME YOUR TESTS IN SPLIT-SECONDS!



### **GRA LAB** ALL PURPOSE LABORATORY TIMERS

MODELS AT  
\$25.00 to \$31.00

You can set the large 8" dial for any desired time period within an unusually wide range of 3600 possible settings, (ie., 1 sec. to 60 min., 1 min. to 60 hrs., etc.). At end of preset interval, alarm sounds and external load is automatically switched on or off.

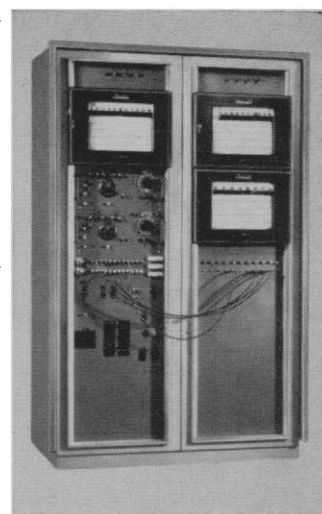
GRA-LAB MICRO TIMERS, Electric Stop Clocks, are available in 1/10 sec. or 1/1000 min. graduations for split-second measurements of elapsed time in laboratory or production operations. Price \$39.50

WRITE FOR COMPLETE CATALOG!



**DIMCO-GRAY COMPANY**

203 E. Sixth St.  
DAYTON 2, OHIO



## Simple...or Complex

Protect your valuable precision instruments  
with Honeywell MODU-MOUNT\* CABINETS

Versatile all-steel units provide the ultimate in space efficiency and mounting convenience—plus economy. They assemble quickly without special tools. Hundreds of combinations let you customize enclosures to fit your needs. Modular construction lets you add components and accessories easily. For free catalog, write: Honeywell, Apparatus Controls Division, Dept. SE-10-61, Minneapolis 8, Minn.



\*TRADEMARK

## Honeywell

HONEYWELL INTERNATIONAL: Sales and service offices in principal cities of the world.



## To men who grow plants for research . . . “PERCIVAL” means “PLANT GROWTH”

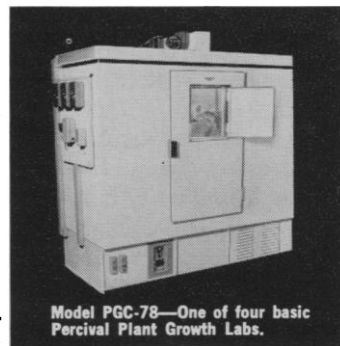
With many long years experience in building Plant Growth Labs, and with scores of units in successful operation, many scientists consider Percival the “standard of quality performance.”

Like the very first Percival unit which was built, every unit provides a wide range of controlled temperatures, light intensities and photo periods, and will continue to do so for years and years. Almost any set of conditions can be met by modification of the standard units.

Custom-engineering is part of our service. Why not put Percival engineers to work on your specific requirements.

Ask for complete details.

**PERCIVAL Refrigeration & Mfg. Co.**  
Box 589-S Boone, Iowa



Model PGC-78—One of four basic  
Percival Plant Growth Labs.



by ultraviolet light. They found that a divalent carbon species (methylenes) and a monovalent nitrogen species (nitrenes) represented two classes of triplet state molecules which had the stable characteristics of being in the ground state.

Some ingenious experimental methods were presented for the study of radical reactions and intermediate radical species. A new technique was introduced by J. E. Bennett and A. Thomas ("Shell" Research, England) who used a rotating cryostat for direct measurement of rates of radical-molecule reactions. The rotating cryostat served as a "conveyor belt" on which radicals were first frozen and then bombarded by molecules for specific reactions. The reaction products were then examined by an ESR spectrometer. Another new technique was initiated by P. L. Kolker, T. J. Stone, and W. A. Waters (Oxford University) for the study of transient free radicals involved in oxidation and reduction processes. By appropriately injecting the reactants, they were able to observe intermediate radical species when the reaction products passed through the ESR spectrometer at a very high flow rate. It was possible to establish whether the observed species were the primary or secondary products of a reaction sequence. The information on the identity of transient radicals should throw light on the mechanism of chemical reactions and the nature of electron transfer for oxidation and reduction processes.

C. K. JEN

*Applied Physics Laboratory,  
Johns Hopkins University,  
Silver Spring, Maryland*

#### Spectrophotofluorometry: Biological Techniques

The initial extramural activity of the new Instituto Di Ricerche Farmacologiche "Mario Negri" in Milan, Italy, was the organization of lectures and demonstrations on spectrophotofluorometric techniques in biology, given by an invited international staff and 110 participants from 19 countries. A NATO grant aided in the financing, and the institute provided the fine facilities of its laboratories and lecture hall now being completed in Milan. The institute, directed by Silvio Garrattini, was founded by a bequest of Mario Negri, a Milanese philanthropist.

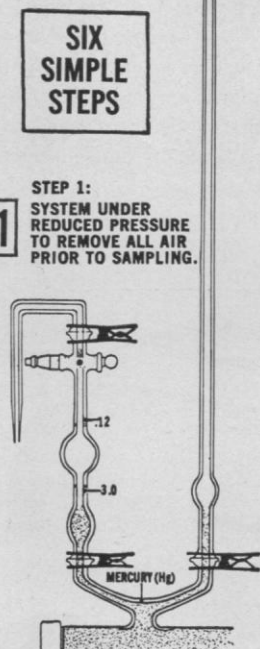
The program was organized as a survey course. Practical experience and

## MASTERED WITHIN 1/2 HOUR!

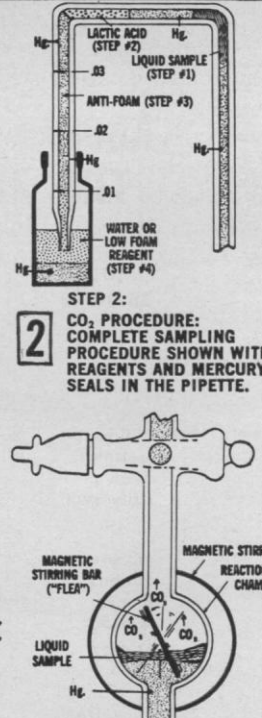
# NATELSON MICROGASOMETERS

for Gas Determinations of Ultra-Micro Samples

**SIX  
SIMPLE  
STEPS**

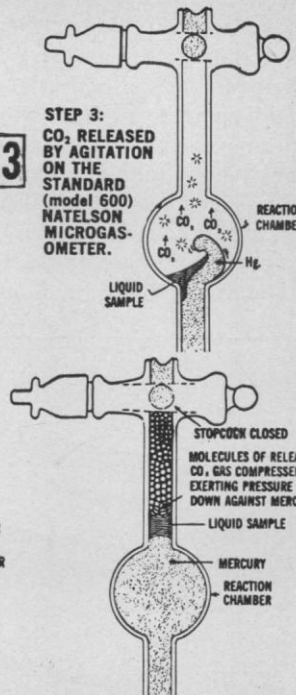


**STEP 1:**  
SYSTEM UNDER  
REDUCED PRESSURE  
TO REMOVE ALL AIR  
PRIOR TO SAMPLING.

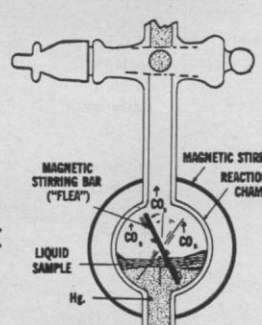


**STEP 2:**  
CO<sub>2</sub> PROCEDURE:  
COMPLETE SAMPLING  
PROCEDURE SHOWN  
WITH REAGENTS AND MERCURY  
SEALS IN THE PIPETTE.

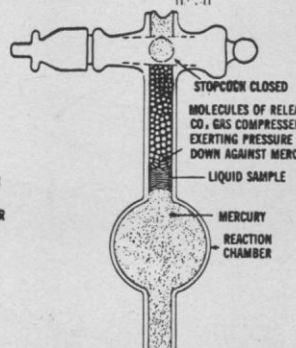
**STEP 3:**  
CO<sub>2</sub> RELEASED  
BY AGITATION  
ON THE  
STANDARD  
(model 600)  
NATELSON  
MICROGAS-  
OMETER.



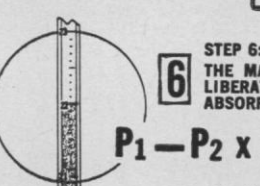
**STEP 4:**  
CO<sub>2</sub> RELEASED BY AGITATION  
ON THE MOTORIZED (model  
650) NATELSON MICROGAS-  
OMETER.



**STEP 5:**  
THE MOLECULES OF RE-  
LEASED CO<sub>2</sub> GAS COM-  
PRESSED SHOWN EXERTING  
PRESSURE DOWNWARD ON  
THE MERCURY.

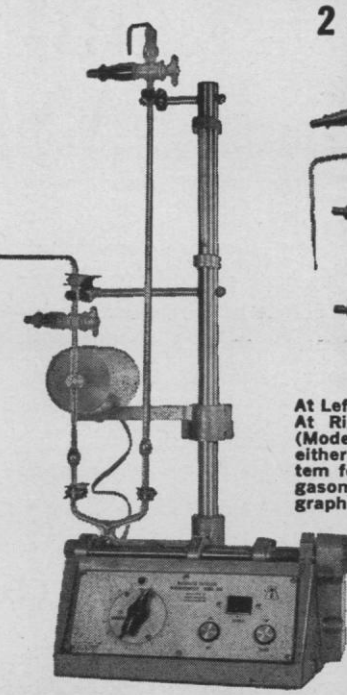


**STEP 6:**  
THE MANOMETRIC PRESSURE (P<sub>1</sub>) AS A RESULT OF COMPRESSING THE  
LIBERATED CO<sub>2</sub> IN THE REACTION CHAMBER. THROUGH SELECTIVE  
ABSORPTION WITH 3N NaOH, P<sub>2</sub> IS OBTAINED.




**P<sub>1</sub> - P<sub>2</sub> x Temperature Factor vol. % = CO<sub>2</sub> vol. %**

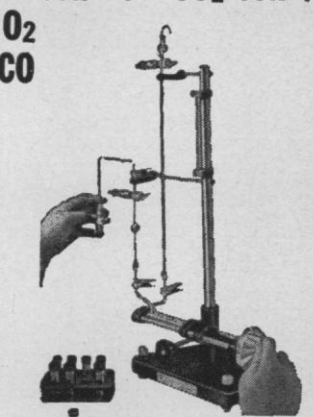
... and you're **1 step from O<sub>2</sub>**  
**2 steps from CO**



At Left: The New Natelson Microgasometer (Model #650).



At Right: Standard Manual Natelson Microgasometer (Model #600).



Above: The Gas Injector Attachment for either model Natelson Microgasometer. This is the system for direct injection of gases liberated in the Microgasometer. These gases are fed into a Gas Chromatograph. (Model #M-373-25).

AT YOUR LABORATORY SUPPLY DEALER  
QUALITY PRODUCTS FROM

## Scientific Industries INC.

DEPT. NM, 220-05 97TH AVENUE • QUEENS VILLAGE 29, N. Y.

demonstrations were offered on American and European instruments loaned for the occasion. Theoretical and practical considerations determining the design and use of currently available instruments were reviewed and demonstrated by Bowman (National Institutes of Health, Bethesda, Md.) and Hower-ton (American Instrument Company, Silver Spring, Md.). They pointed out the possibilities of increasing sensitivity by utilizing the options offered by the instruments available. The use of mercury xenon sources, specially blazed gratings, and photomultipliers with optimal spectral characteristics, as well as micro cells or phosphorescence attachments, was discussed and demonstrated.

The high sensitivity, rivaling that of bio-assay, the specificity afforded by the activation and excitation spectra, and the fact that radioactive labels and counting are not necessary make the method attractive.

Details of the various commercial instruments illustrate the compromises in spectral resolution and photometric accuracy which are made in the interest of obtaining high sensitivity. The advantages of the use of spectra in identifying sources of blank emission, second-order scatter peaks and Raman lines that overlap the region of emission, and the ability to select working wavelengths that eliminate these were demonstrated in the laboratory sessions. Once these

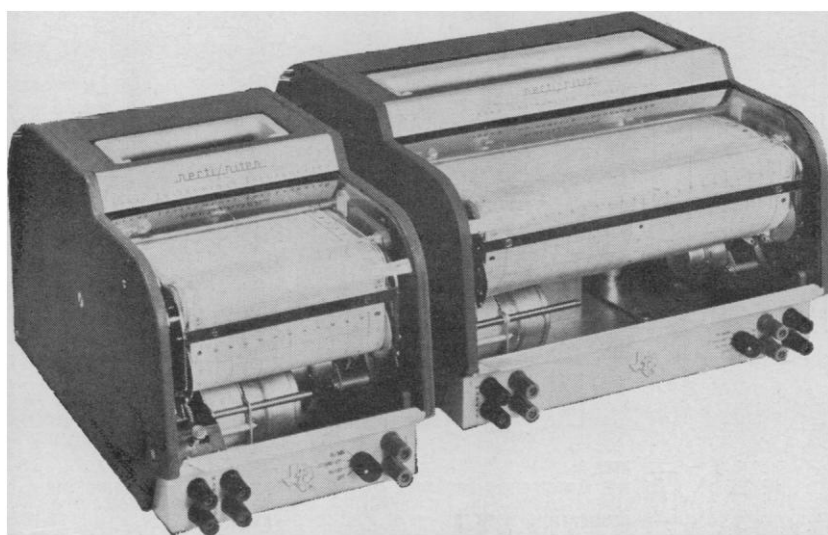
working areas are selected a simple filter instrument probably can be more sensitive if similar conditions are preserved.

The fluorescence of several homologous series of derivatives of indoles, sulfonamides, pyridoxines, and related compounds was analyzed over a range of hydrogen ion concentration by Williams (St. Mary's Hospital Medical School, London). He showed how electronegativity or positivity of substituent groups at various positions on the aromatic ring can be used to predict whether a new member of the series will be fluorescent or not. James (St. Mary's) described several methods for measuring plasma and urinary steroids in man which provide the basis for clinical research, diagnostic tests, and control of therapy. The methods for plasma generally involved simple extraction and assay on a filter fluorometer, but urinary tests had to be run on a spectrophotofluorometer to obtain the necessary specificity.

Corticosteroid and estrogen methods are applicable to normal levels in plasma and urine by nature of the sub-microgram sensitivity of the fluorescence assay. Separation on paper or columns is necessary to identify specific estrogens. It was pointed out that there is a method for converting non-fluorescent androgens to fluorescent estradiol by the use of a placental enzyme to introduce the hydroxy and aromatize the "A" ring. The resultant product in ethanol and concentrated sulfuric acid is fluorescent enough to measure 0.1 microgram per 100 milliliters.

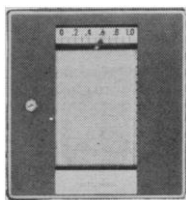
With simple solvent extraction and measurement in ethanol- $H_2SO_4$ , cortisol output in urine can be measured when Dexamethasone, a synthetic nonfluorescent steroid, is given to suppress cortisol secretion. Tests of pituitary response, adrenal response, and hepatic function in clearing the plasma were described, and their potentialities in diagnosis and therapy were pointed out.

Several methods for enzyme assay based on the release of a fluorescent product from a suitable synthetic substrate were reviewed by Roth (Hôpital Cantonal, Geneva). The method for determining trypsin with an arginine  $\beta$ -naphthylamide substrate was described as a clinical procedure applicable to the assay of trypsin in pancreatic juices. Another procedure also releasing the highly fluorescent  $\beta$ -naphthylamine utilizes leucine naphthylamide for plasma leucine amines and may



## Performance, Reliability and Quality—your best buy

Quality and simplicity of design make the *recti/rite*® recorder an outstanding, reliable performer. Utilizing a large, powerful magnet, the *recti/rite* recorder offers maximum sensitivity, fast response time, and low input impedance



—requires less damping circuitry. True rectilinear recording using the proven

error-free *recti/rite*® system developed by Texas Instruments in 1956—the widest selection of ranges and chart speeds—plus exclusive operator convenience features have made the *recti/rite* a first choice of the most demanding user. There is a *recti/rite* to fit your particular requirement: single and dual channel in both portable and flush-mounting models. Write for complete information.

INDUSTRIAL  
PRODUCTS  
GROUP



**TEXAS INSTRUMENTS**  
INCORPORATED  
P. O. BOX 66027 HOUSTON 6, TEXAS

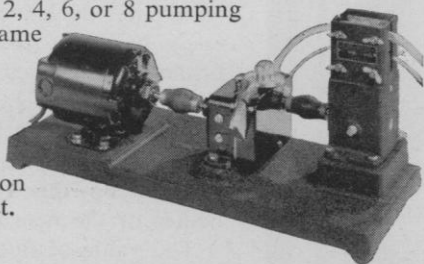
SENSING • RECORDING • TESTING • DIGITIZING INSTRUMENTS  
THE INSTRUMENTS OF TEXAS INSTRUMENTS

## AUTOMATION IN COLUMN CHROMATOGRAPHY with the SIGMAMOTOR PUMP

### Vernier Adjustment Insures Accuracy at Low Flows

Various column chromatography metering operations are simplified by the use of a peristaltic type constant volume pump, such as the Sigmamotor Model T-8. A typical installation combines the Sigmamotor pump with solenoid actuated valves and timing equipment to deliver elutant buffers into ion exchange columns on a reproducible schedule. The T-8 pump is equipped with vernier for accurate flow adjustment.

Single Sigmamotor units can be provided to handle 1, 2, 3, or 4 simultaneous pumping operations. Double units are available to handle 2, 4, 6, or 8 pumping operations at the same time. Capacities from 1 cc to 250 cc/minute are obtained by the vernier adjustment. Complete information available on request.

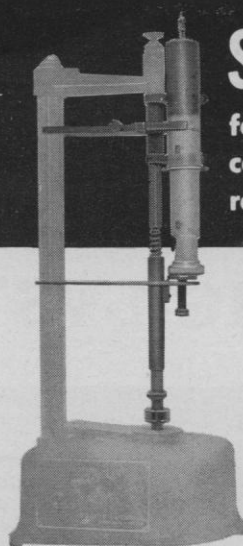


## SIGMAMOTOR Inc.

68 NORTH MAIN STREET • MIDDLEPORT, NEW YORK

## Syringe Driver

for economical, convenient  
controlled infusion and  
retraction of liquids



The Bird Syringe Driver delivers small quantities of liquids at a wide range of accurately controlled delivery rates, particularly applicable for anaesthesia, surgery, gynecology, radiology and neuropsychiatry.

A threaded shaft, carrying a syringe holder and a pusher, is mounted in place of the regular drum spindle of the Bird Kymograph #70-060. The Bird Kymograph rotates the shaft and operates the pusher, providing a choice of 5 speeds.

Any Luer syringe, from 5 ml to 50 ml capacity may be used.

Catalog No. 71-0499 Syringe Driver only.

Request Syringe Driver and Retractor Bulletin for table of delivery rates and catalog numbers.

## PHIPPS & BIRD, INC.



Manufacturers & Distributors of Scientific Equipment

6th & Byrd Streets — Richmond, Virginia

beside the **STILL** waters...  
there's always the **LOUGHBOROUGH**  
ALL GLASS WATER STILL

Two highly productive  
models available:

4 LITERS PER HOUR  
and 8 LITERS PER HOUR

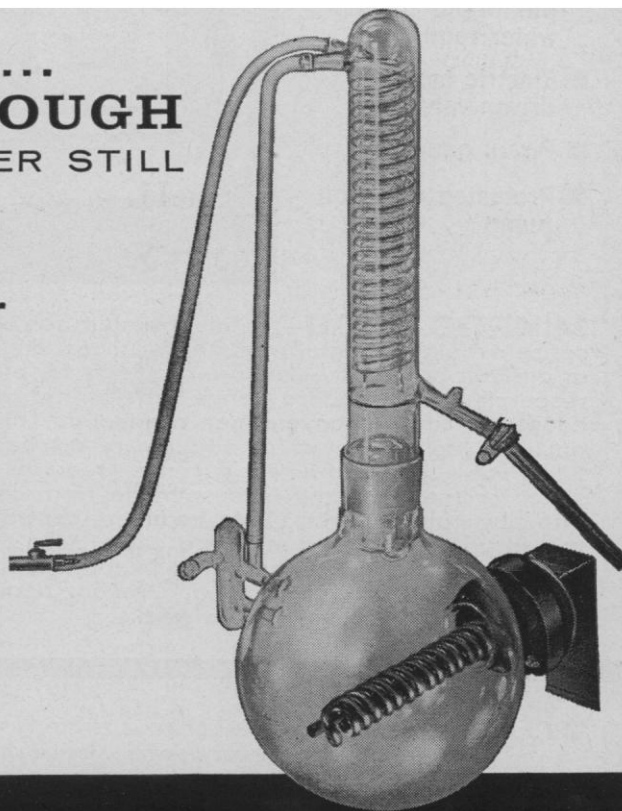
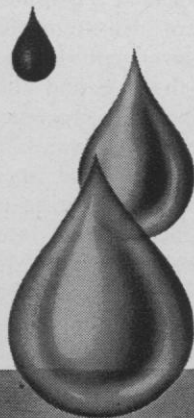
**COMPACT • INGENIOUS • EFFICIENT**

**COMPACT:** Only 3 components: condenser, boiling reservoir, immersion heater (automatic overload protected).

**INGENIOUS:** Reservoir fills from tap and automatically maintains constant water level. Cooling water in condenser recycles to boiling reservoir . . . *preheated*. Steam trap allows only vapor to enter condenser — no solids.

**EFFICIENT:** Distillate produced is pyrogen free and analyses have shown it to contain less than one part in 10 millions of iron, copper, chromium or nickel.

Write for brochure LSI-JCE-9

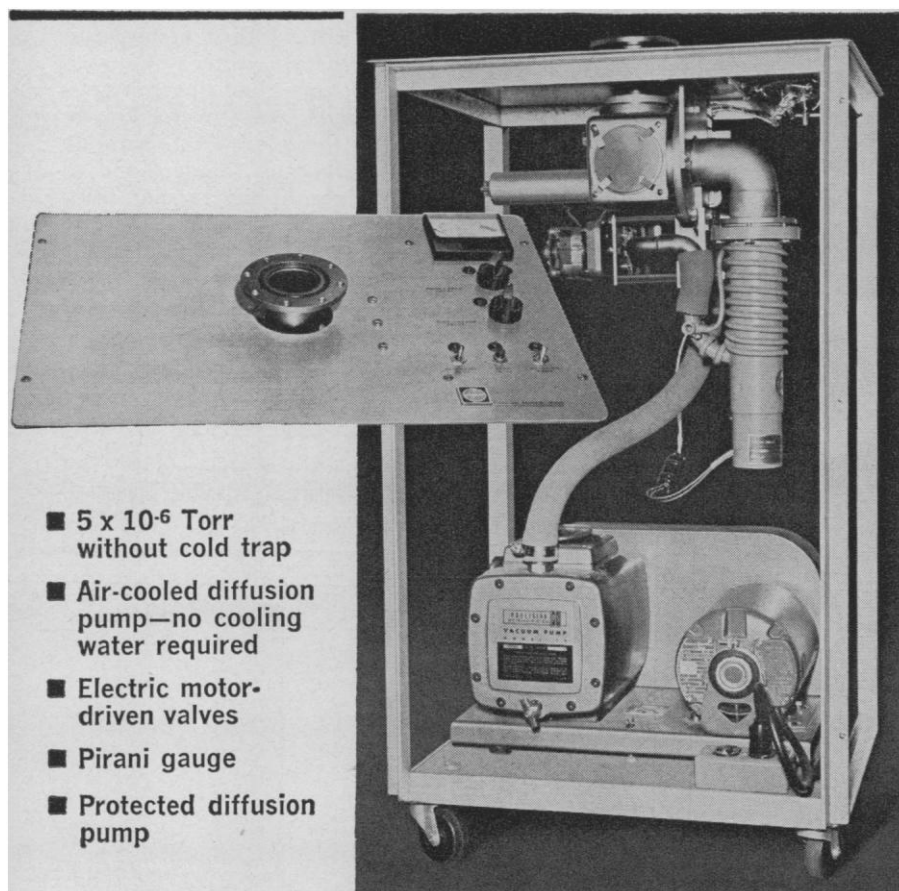


## Bellco GLASS INC. VINELAND, N.J.



# NEW from MIKROS

## VERSATILE LOW-COST Switch-operated PUMPING SYSTEM



- 5 x 10<sup>-6</sup> Torr without cold trap
- Air-cooled diffusion pump—no cooling water required
- Electric motor-driven valves
- Pirani gauge
- Protected diffusion pump

**MIKROS PS-10**—the ideal system for electronics research, space simulation, small vacuum furnaces, degassing, the solution of difficult or variable vacuum problems for electronics or physics research labs. Standard flange with O-ring groove quickly, easily adaptable to any conventional connector. Threaded 1/2 x 20 port on high vacuum valve for addition of discharge gauge or back-filling valve. Self-contained, portable—requires only 15" x 20" floor space or may be hung or suspended from ceiling or wall. Plugs into any conventional 117-volt outlet—control panel may be remotod up to 200' with standard cable. Also available with water-cooled diffusion pump, cold trap or multi-coolant baffle. Approximately \$1500, f.o.b. Portland, Oregon, depending upon equipment supplied. Delivery three weeks.

**MIKROS INC.** SUBSIDIARY of ESI-ELECTRO SCIENTIFIC INDUSTRIES

7634 S. W. CAPITOL HIGHWAY • PORTLAND 19, OREGON • 503, 246-5494

ELECTRON MICROSCOPES/HIGH VOLTAGE GENERATORS/VACUUM EVAPORATORS/VACUUM EQUIPMENT

SALES OFFICES—MIKROS, INC., 2414 Leimert Blvd., Oakland 2, Cal. (261-6884). HARRY D. EDMISTON CO., P. O. Box 5832, Dallas, Texas (747-8277). TECH SALES & MARKETING, 3107 Radford Dr., Indianapolis, Ind. (547-9208). DILCHER ENGINEERING CO., 3376 Peachtree Rd., Atlanta 5, Ga. (231-1678). ELECTRON MICRO SALES, 2002 Arnold Lane, Falls Church, Va. (534-5872). ENGINEERING ASSOCIATES OF N. E., INC., 319 Lincoln St., Manchester, N. H. (623-7294). CANADA-INSTRONICS LTD., P. O. Box 100, Stittsville (Ottawa) Ont. (828-5115).

be of value in the diagnosis of liver or pancreatic disease. Other synthetic substrate systems with fluorescent products and a method of coupling a dye to the product for histochemical localization of enzymes were reviewed.

Falck (University of Lund, Sweden) showed some of his remarkable fluorescence photomicrographs of the monoamines in adrenergic tissue. With this method it is possible to produce clear pictures of the amines stored in the adrenergic nerve endings. When the tissue is prepared by freeze-drying and then is exposed to dry formaldehyde gas, a highly fluorescent product is formed with green fluorescence from noradrenaline and dopamine and yellow-green fluorescence from serotonin. Reserpine depletion experiments and assay by other techniques have confirmed the specificity and resolution of the method. In ganglia, the terminations of adrenergic fibers on cell bodies showed up as sharply defined regions surrounding the relatively clear cell bodies of the neurons.

The value of fluorescence and phosphorescence methods in determining molecular structure was illustrated by Parker (Admiralty Materials Laboratory, Poole, England). He pointed out the possibility of converting fluorescence to phosphorescence and utilizing energy transfer systems for selective quenching of interfering substances. Emphasis was placed on the quenching effect of oxygen and the greater effect for longer duration of the excited state, Schwartz (Hoffman-LaRoche, Basle) reviewed methods involving dehydrogenation of tetrahydroisoquinolines to form fluorescent products by treatment with mercuric acetate-acetic acid reagent for the determination of several important alkaloids in tissues. Van-Duuren (New York University Medical Center) analyzed curves showing how the ratio of dye to nucleic acid can affect the wavelength of the fluorescent peaks of the dye and thus indicate the form of the aggregation of the dye on the nucleic acids. He also showed how fluorescence spectra of polycyclic aromatics could be obtained from material incorporated into potassium bromide pellets. Spectra of charge transfer complexes that may be useful in the study of the carcinogenic activity of these substances were obtained by this method.

The details and practical suggestions for the assay of tissues for catecholamines and related compounds were presented by Magnusson (Göteborg, Swe-



den), and the chemistry of the compounds was discussed by Werdinius (Göteborg). The method requires great care, and various laboratories find different modifications necessary for optimal results. R. L. Smith (St. Mary's) presented the modifications necessary for application to adipose tissue.

In a review of the pharmacology of the catecholamines, Costa (National Institutes of Health) presented a working theory of the interaction of the mediators, monoamine oxidase, the inhibitors, reserpine, and other drugs. The theory provides a good picture of the current state of the art. Spectrofluorometric techniques are used in much of this work.


Bowman concluded the lecture sessions with some discussion of new techniques utilizing low-energy electrons to excite fluorescence and suggested that new advances in fluorescence techniques are just as likely to develop from experimentation as from analysis of the complex theoretical possibilities.

The institute is now examining the possibilities of holding another session within the year for the more than 100 qualified applicants who could not be accommodated in this session.

ROBERT L. BOWMAN  
*National Institutes of Health,  
Bethesda 14, Maryland*

### High Magnetic Fields: Production and Application

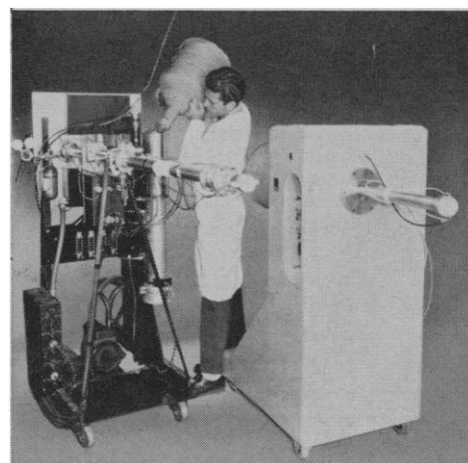
In the evolution of research, cross divisions of science sometimes arise which are based on specialized objectives or experimental techniques. Such research areas cut across the time-honored, historic, or pedagogic divisions of science and are often reabsorbed into these after a more or less brief period of vigorous progress and cross-fertilization. The field of low-temperature physics has enjoyed such a transient existence during the past decade or two, and high magnetic-field research, a closely related area, appears to be following. The environment of low temperature and high magnetic field actually have a great deal in common. Both are of value largely because they are conducive to minimum entropy, and each environment is helpful, if not necessary, in generating the other. The community of high magnetic-field research had its formal birth at the first international conference, held at Mas-



## Should your laboratory have an activation analysis facility?

General Atomic, which operates one of the world's leading activation analysis laboratories and services, now offers a Facility Design Service to help you answer this question. The Service, based upon General Atomic's knowledge and experience, assures an objective, comprehensive study of your analytical problems, and offers savings in both time and money.

Instrumental neutron activation analysis employing a small accelerator provides a very rapid, accurate, versatile, non-destructive and sensitive means of analyzing many kinds of samples for many elements—at a moderate investment in equipment.



*Typical neutron generators used in the Activation Analysis Service at General Atomic.*

The Service is presented in three stages—which can be undertaken one at a time if desired. It will (Stage 1) help you decide whether a low-cost accelerator facility would be useful in your analytical work. Based on these results, it can then (Stage 2) design and specify a fully integrated, minimum cost, maximum performance facility for your needs; and (Stage 3) provide and install such an optimum facility in your laboratory, put it into full operation, and train your personnel in its operation and applications.

The entire cost of the installed facility, including all equipment and all three stages, can be as low as \$30,000. Much more versatile facilities may cost only \$40,000-\$70,000. For a detailed brochure on General Atomic's Facility Design Service, please fill out the coupon below, or contact General Atomic, Activation Analysis Service, area code 714, 459-2310.

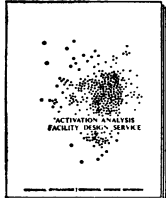
**GENERAL ATOMIC, DEPT. AA-31**  
**P. O. BOX 608, SAN DIEGO 12, CALIFORNIA**  
 Please send me a Facility Design Brochure.

Name \_\_\_\_\_ Title \_\_\_\_\_

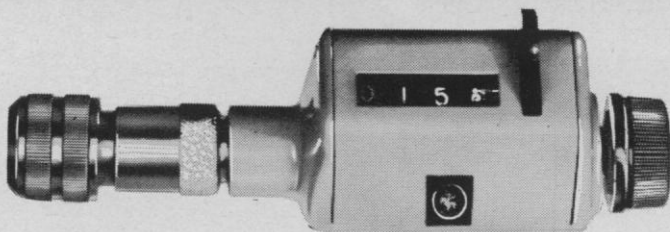
Firm \_\_\_\_\_ Phone \_\_\_\_\_

Address \_\_\_\_\_ Ext. \_\_\_\_\_

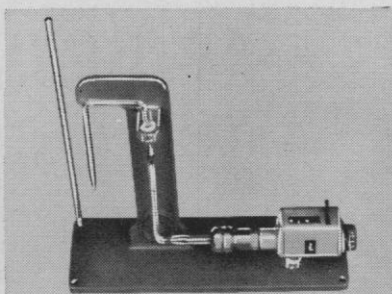
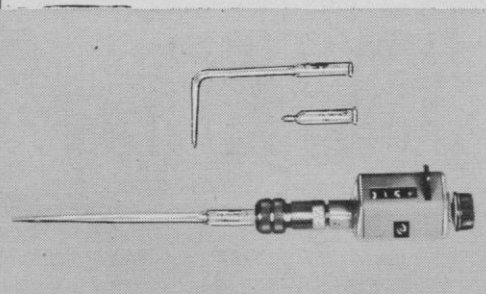
City \_\_\_\_\_ State \_\_\_\_\_



**GENERAL DYNAMICS  
GENERAL ATOMIC DIVISION**



**NEW from MANOSTAT** Newly designed push-button reset counter with four-digit direct readout gives accuracy and sensitivity never before possible!



No calculations—new digital counter provides quick, accurate direct reading of volume dispensed. Sensitivity: .01%! Accuracy: up to 0.1% of dispensed volume! Push-button action permits dispensing and resetting with one hand. Comfortable grip for hand operation. Comes with adapters for clamp mounting. Pipet models have interchangeable tips: straight, luer or right angle bend. Buret models for ultramicro work come with mercury and metal stand. In 0.01 ml, 0.1 ml, 1.0 ml, 10 ml sizes—from only \$139.50! Write for descriptive bulletin.



**MANOSTAT Corporation**  
A SUBSIDIARY OF GREINER SCIENTIFIC CORPORATION  
26 N. MOORE ST., DEPT. 524, NEW YORK 13, N. Y.

See your local laboratory supply dealer.

ALL  
POLYOLEFIN

## REAGENT DISPENSER

Permits Safe  
Handling of  
Reagents . . .  
Even Acids



Screws on any standard 5 pint acid bottle and regular half-gallon and gallon jugs. One hand operation delivers reagent at about 1000 ml per minute. Slight pressure on relief valve stops flow instantly. Price — 3 for \$11.25

Pioneer Plastics, Inc., is the manufacturing leader in plastic laboratory apparatus, with proven product economy and practicability in the world's chemical laboratories for over 7 years.

Write for Free Catalog Today

ENGINEERED PLASTIC LABWARE PRODUCTS



**PIONEER  
PLASTICS**

Dept. 1, Box 8066  
JACKSONVILLE 11, FLORIDA

## APPLICATION MANUALS WORTH WRITING FOR

Copies are available at no charge.

**ADM-30** *Detection and Analysis of Contamination.* Outlines the measurement of particulate contamination in fluids with Millipore filters as applied to fine chemicals, aerospace hydraulic fluids, air, nuclear energy, fuels, lubricants, electroplating, crystal growth. 36 pages

**ADM-60** *Ultracleaning of Fluids and Systems.* Illustrates the design of both open-end and recirculating systems for cleaning hydraulic fluids with Millipore filters in test stands, fill-flush and bleed stands and in airborne vehicles. Also covers ultrasonic and solvent-type cleaning systems. 36 pages

**ADM-70** *Microchemical and Instrumental Analysis.* Describes techniques for using Millipore filters in optical microscopy, morphology, electron microscopy, microchemistry, ring oven analysis, infrared and ultra-violet absorption spectroscopy, flame photometry, radioactivity analysis and other analytical methods. 48 pages.

### OTHER TECHNICAL LITERATURE AVAILABLE

**TB-961** *Millipore General Brochure.* Describes all Millipore filters, apparatus and accessories together with an outline of principal applications. Complete specifications and prices are included. 40 pages.

**BIBLIOGRAPHY** A reference listing of published information concerning applications of Millipore Filters. 24 pages.

**Millipore** FILTER CORPORATION

145 ASHBY ROAD, BEDFORD, MASS.

Millipore filters are cellulose plastic porous membranes made in twelve different pore-size grades from 8 microns down to 10 millimicrons. All particles larger than pore size are retained on the filter surface.

sachusetts Institute of Technology in November 1961. The second such conference was held at Oxford University 10–12 July 1963, and it appears quite likely that these events will become biennial and follow the pattern of the one in low-temperature physics.

The conference was opened by Bitter and Montgomery who described the recently dedicated M.I.T. National Magnet Laboratory, sponsored by the U.S. Air Force. The laboratory represents the first cooperative effort in this area of research and is expected to do for various branches of atomic physics what Brookhaven and similar institutions have done for nuclear physics. It will not only provide very high fields as a research environment but will also serve as a center for advancing the art of generating high magnetic fields. This facility is based on a family of high-performance, reinforced copper solenoids, water-cooled, and supplied by an 8-megawatt power plant capable of 32-megawatt overload operation. It is flexibly arranged to accommodate many simultaneous experiments and will supply continuous fields up to 250 kilogauss and 2-second fields up to 400 kilogauss. These reports as well as others from Leiden University, Oxford University, the Royal Radar Establishment, and the Lewis Research Center of NASA in Cleveland indicate that conventional (normal conductor) magnets are still the object of a great deal of sophisticated work and are likely to continue as the principal tool for generating high fields for many years to come.

The science and technology of superconductivity formed at least half of the subject matter of the conference. Compared to other conferences devoted specifically to this topic, emphasis at Oxford was phenomenological. The topic was ably introduced by Berlincourt of Atomics International, who summarized what little progress appears to have been made during the past two years. Composite materials containing niobium-tin as a core or diffusion layer still appear to have the most promising properties, just as they did 3 years ago. However, the technical difficulties involved in reacting these materials at 1000°C *in situ* and subsequently immobilizing them have caused almost universal abandonment of composite materials in favor of the less promising, though less problematic, alloy materials, notably niobium-zirconium. About half a dozen commercial organizations now sell niobium-zirconium alloy, and a comparable number of organizations

# NEW LEITZ MODEL M PHOTROMETER

...for colorimetric chemical analysis  
**fast • simple • accurate**

40 precalibrated determinations\*

Exclusive single-knob operation...no further adjustments

Extra-large, easier-to-read meter

Covers entire range of the visible spectrum

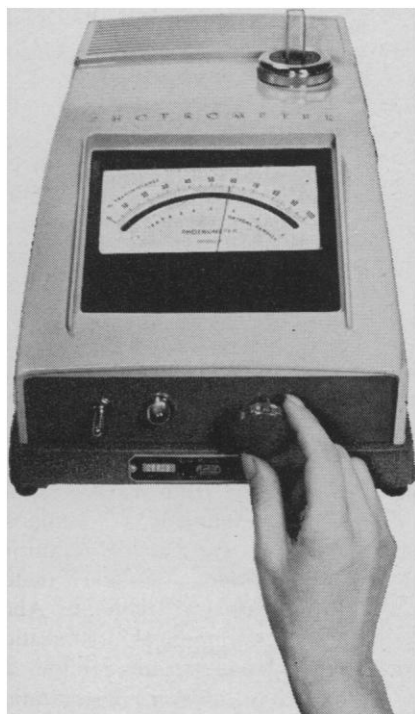
Sturdy, stable construction for years of accurate performance

\*Available uncalibrated for special purposes

**Write for illustrated brochure.**

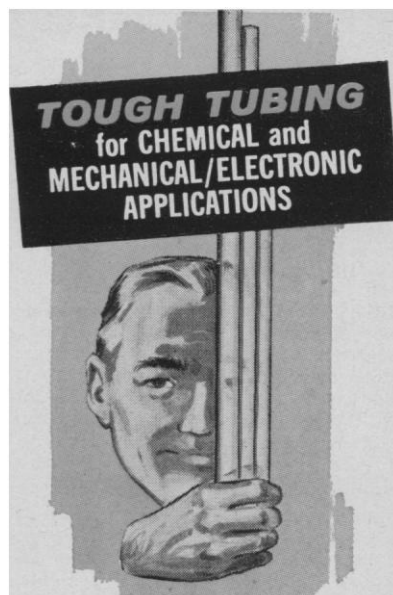
**E. LEITZ, INC.**

468 PARK AVENUE SOUTH, NEW YORK 16, N. Y.



are marketing niobium-zirconium solenoids supplying fields of up to 60 or 70 kilogauss. Much has been learned about the motion of magnetic flux through hard or magnetically permeable superconductors to explain many of the originally baffling phenomena. In particular, magnetization measurements have indicated that the instability of the current-carrying state in hard superconductors (the mysterious "coil degradation") is predominantly a thermal effect related to the release of magnetic energy when transport currents destroy magnetization currents.

In the light of some very recent success with composite materials, it appears regrettable that this facet of superconductivity has been virtually abandoned for at least 2 years. It is perhaps one of the adverse effects of modern communication among investigators. The outstanding bit of news at the conference was undoubtedly from the General Electric group which described a niobium-tin solenoid capable of generating 101 kilogauss. This is the first report on such a magnet since the early attempts at Bell Telephone Laboratories and M.I.T. more than 2 years ago. Although little detail concerning the material was given, the work is bound to stimulate workers to give more attention to composite superconductors. Two groups are, in fact, working along similar lines: Saur (University of Giessen, Germany) and collaborators reported systematic studies of vanadium-gallium and silicon systems, and Stauffer (National Research Corporation) reported on a metallurgical process leading to a new composite niobium-tin material. From the viewpoint of high magnetic-field research, superconducting magnets at present appear most promising as supplementary solenoids surrounding conventional magnets. Problems of force containment and heat removal remain to be solved. The former are receiving attention by Wakefield and collaborators at Princeton University and Boom at Atomics International, where a study of force-free structures is being continued. The problem of cooling large structures has thus far received essentially no attention. A feasibility study by Stekly (Avco) indicates that when suitable materials become available, the generation of 500 kilogauss is structurally possible in simple solenoid design. Two methods were described for solving the difficult current supply problems in large superconducting solenoids. Volger and Van Suchtelen (Phillips Research Labora-



## PENNTUBE® VI (KYNAR®)

Use PENNTUBE VI for your real tough electronic or corrosive chemical assignments. It is a strong tubing of vinylidene fluoride, precisely engineered and extruded by Pennsylvania Fluorocarbon to meet the most critical requirements. Tubing sizes available are from AWG #20 to 1/2".

**CHEMICAL**  
PENNTUBE VI withstands HF, HNO<sub>3</sub>, and other acids; hot caustic soda and other alkalis; chromic acid, liquid oxygen and other strong oxidizing agents; wet and dry halogens; solvents and hydrocarbons.

**MECHANICAL/ELECTRONIC**  
Coupled with high dielectric strength and resistivity, PENNTUBE VI offers extreme mechanical strength, stability to temperatures from -80 to 300°F and resistance to severe environmental stresses.

Give us your tough assignments for PENNTUBE VI. Contact us, too, about other PENNTUBE products and to make sure you're not paying too much for one plastic when another, less expensive plastic will do the job. Write, wire or call.

**PENNSYLVANIA  
FLUOROCARBON  
CO., INC.**

Holley Street & Madison Ave., Clifton Heights, Pa.  
(215) MADison 2-2300 TWX: 215-623-1577

PENNTUBE I Teflon† TFE; PENNTUBE II Teflon FEP; PENNTUBE III Trifluoroethylene (Halon\*\*); PENNTUBE IV Polycarbonate (Lexan\*); PENNTUBE VI Vinylidene Fluoride (Kynar®).

®P.F. Reg. T.M. \*General Electric Reg. T.M.  
†DuPont Reg. T.M. ‡Pennsalt Reg. T.M.  
\*\*Allied Chemical Reg. T.M.

PF ENGINEERED PLASTICS PF ENGINEERED PLASTICS PF ENGINEERED PLASTICS PF ENGINEERED PLASTICS PF ENGINEERED PLASTICS

## LEA & FEBIGER BOOKS

### Laboratory Exercises for Biological Sciences

By OLWEN WILLIAMS, Ph.D., Associate Professor of Biology and ERIK K. BONDE, Ph.D., Associate Professor of Biology, University of Colorado; and NEWELL A. YOUNGGREN, Ph.D., Associate Professor of Biology, University of Arizona. 190 wire-bound pages. *New 2nd edition.* \$350

#### New 2nd Edition

Filled with classroom tested laboratory exercises, this manual gives non-science majors in beginning biology splendid experience in scientific methodology. The textmatter is a series of carefully developed exercises designed especially for the use of living or freshly killed material. Technical terms are kept to a minimum.

### Medical Mycology

By CHESTER W. EMMONS, Ph.D., Chief, Medical Mycology Section, National Institute of Allergy and Infectious Diseases, Bethesda, Maryland; CHAPMAN H. BINFORD, A.B., M.D., Chief, Geographic Pathology Division and Chief Leprosy Branch; Armed Forces Institute of Pathology, Washington, D. C.; and JOHN P. UTZ, M.D., Chief, Infectious Disease Service, National Institute of Allergy and Infectious Diseases, Bethesda, Maryland. 380 pages, 7" x 10". 388 illustrations on 112 figures and 12 in color on 2 plates. \$14.00.

#### New!

This thorough review of general mycology explains the relationship of mycology to fungi which cause diseases in man and animals, gives directions for handling, maintaining and identifying fungi, and discusses clinical characteristics, sources of infection and diagnosis.

### Clinical Chemistry

By JOSEPH H. BOUTWELL, Jr., Ph.D., M.D., Associate Professor of Physiological Chemistry, Temple University School of Medicine and Director, Clinical Chemistry Laboratory, Temple University Hospital. 359 pages, plus end papers. Illustrated. 29 Tables. \$8.50.

Clear and explicit, this manual is filled with sound guidance on what to do and why. It is an excellent guide for medical technicians. Many helpful features are in the appendix.

**LEA & FEBIGER** Washington Square Philadelphia, Pa. 19106

Please send me books circled above or listed in margin below.

I will return books or pay for those I keep within 60 days of their receipt.

NAME .....

ADDRESS .....

CITY..... STATE..... ZIP NO.....  
Sc. 10-11-63

tory, Netherlands) described an ingenious superconducting generator without moving parts, and Laquer (Los Alamos) described an electrical-flux pumping method. General progress, trends, and future prospects were discussed in an unusually lively ad hoc session.

Regardless of whether or not superconducting solenoids will ultimately replace normal ones, solid-state research in high magnetic fields continues at an increasing rate.

For the purpose of this conference, solid-state research was divided into two parts: (i) metals and magnetic materials in high magnetic fields and (ii) semiconductors in high magnetic fields. The keynote speech on the first of these subjects was delivered by A. B. Pippard (Cambridge). He discussed in physical and pictorial terms the measurement of conduction electron motion in a magnetic field. Particular emphasis was given to the high field phenomenon of magnetic breakdown, which becomes important when the magnetic energy  $h\omega_c$  becomes comparable to the energy band gap  $E_g$ . In this limit, the two adjacent energy bands become strongly coupled by the magnetic field. Those electron trajectories corresponding to open orbits can then carry current by transmission through the zone boundaries and, in fact, dominate the conductivity in the high field limit. An experimental illustration of the magnetic breakdown phenomena was presented by J. M. Reynolds (Louisiana State University) in galvanomagnetic measurements on Zn and Sn, materials which have small band gaps.

Considerable progress has been made recently in the application of magneto-resistance experiments and of the De Haas van Alphen effect measurements to study the topology of the Fermi surface of metals. Interesting magnetoresistance results in fields up to 100 kilogauss were reported on the transition metals by Fawcett (Bell Telephone Laboratory). De Hass van Alphen results in the alkali metals were presented by Shoenberg and Stiles (Cambridge University), who used a novel modulation technique, and by Okumura and Templeton (National Research Council, Ottawa). Small departures from a spherical Fermi surface were found for the alkali metals. The possibility of observing the De Haas van Alphen oscillations in alloy systems (Au-Zn) is also quite exciting.

The use of high magnetic fields to study magnetism attracted attention. Wohlfarth (Imperial College, London)

**ANOTHER  
PFEIFFER  
1<sup>ST</sup>\***

**BLUE  
RIBBON  
AWARD**

*tested for  
one year*

Under  
actual  
shipping  
conditions



**OUR UNIQUE PACKAGING**

ELIMINATES SHIPPING  
BREAKAGE—INDIVIDUALLY  
SEATED IN POLYURETHANE  
FOAM

*Customers* **REPORT:**

- 1 Breakage in shipment almost non-existent
- 2 Scratching of pipettes in shipment eliminated
- 3 Package of 12 more convenient for laboratory storage
- 4 Packages used as pipette trays cut down "in use" breakage

**\*OTHER PFEIFFER "FIRSTS"**

- ... large, permanent, bold numerals
- ... 3-line WBC pipette
- ... Class "A" accuracies on general purpose pipette
- ... Accuracy tolerances marked on every pipette

For catalog, write

**PFEIFFER  
GLASS  
INC.**



Manufacturers of  
Pipettes for 44 Years

140 BENNINGTON DR.  
ROCHESTER 16, N. Y.  
Phone: UNiversity 5-1290



challenged the experimentalists to produce density of state curves for magnetic materials, while Jacobs (General Electric Laboratory, Schenectady) confronted the theoreticians with the intricacies of magnetization studies of several antiferromagnetic systems.

The introductory talk by R. J. Elliott (Oxford) not only summarized high field research in semiconductors but also covered the use of high magnetic fields to study crystals and cooperative magnetism. The contributed papers on semiconductors were largely concerned with magneto-optical measurements and calculations. Optical studies on the metal silver were reported.

The realm of high magnetic-field research, in fact, is by no means limited to solid-state physics. One of the more exotic applications of magnetic fields concerns the search for ferromagnetically trapped Dirac monopoles. None have yet been found by this or other means. Perhaps the next international conference on high fields will feature the finding of both monopoles and megagauss.

The conference was sponsored by the Institute of Physics and the Physical Society (of Great Britain), and organized by a committee comprising Kurti and Bagguley (Oxford University), Chester (Central Electric Research Laboratories, Leatherhead), and Parkison (Royal Radar Establishment, Malvern). Complete proceedings will not be published, but the four invited introductory papers and a summarized report of the conference by M. Lock (Royal Radar Establishment) will appear in the *British Journal of Applied Physics*.

HENRY H. KOLM

Massachusetts Institute of Technology, National Magnet Laboratory, Cambridge 39

MILDRED S. DRESSELHAUS

Massachusetts Institute of Technology, Lincoln Laboratory, Lexington 73

## Forthcoming Events

### October

17-18. American Soc. of Tool and Manufacturing Engineers, Pittsburgh, Pa. (H. E. Conrad, 10700 Puritan Ave., Detroit, Mich.)

17-19. Society of Photographic Scientists and Engineers, Washington, D.C. (E. Ostroff, SPSE, Box 1609, Main Post Office, Washington, D.C.)

17-20. British Medical Assoc., annual clinical meeting, Stoke on Trent, Eng-

# WHICH OSCILLOSCOPE?

Choosing the *right* oscilloscope to help solve a measurement problem is sometimes confusing. The choice seems so large. For example, Tektronix offers over fifty different types.

The choice of an oscilloscope narrows considerably, however, once the application is known. Determining the *type* which best suits the application then becomes a matter of understanding the various features of the oscilloscope.

To help you better understand oscilloscope features, Tektronix offers you a free booklet. The booklet, FUNDAMENTALS OF SELECTING AND USING OSCILLOSCOPES, can be an invaluable aid in furthering your knowledge of oscilloscopes and in learning more about how these precision tools might help you in your studies of changing phenomena. Also, in addition to explaining oscilloscope features, this informative 16-page booklet designates differences in oscilloscope types and describes factors affecting validity of waveform displays.

For your copy of the booklet, please write to Tektronix or use the coupon below.

## SOME OSCILLOSCOPE TERMS AND TECHNIQUES EXPLAINED IN THIS FREE BOOKLET

**Tektronix, Inc.** P. O. Box 500, Station 96750P, Beaverton, Oregon

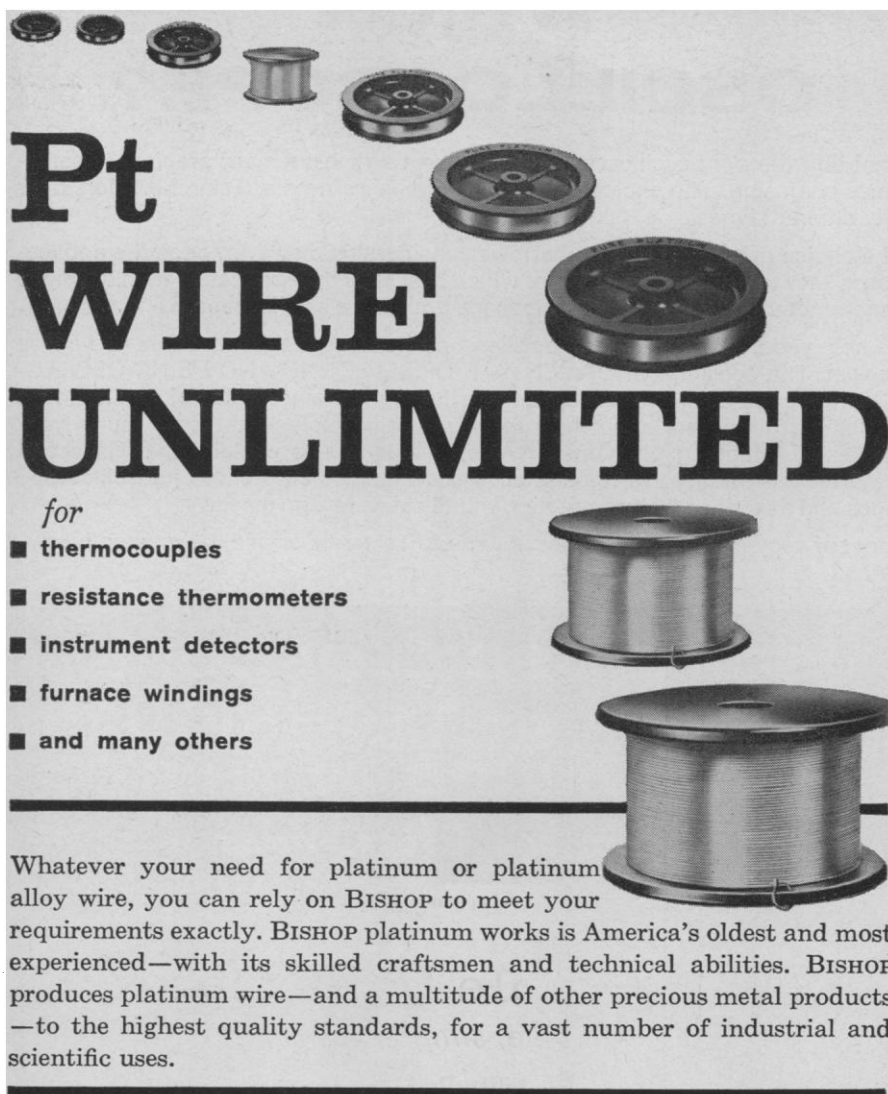
Please send me the free booklet "Fundamentals of Selecting and Using Oscilloscopes."

Name \_\_\_\_\_ Title \_\_\_\_\_

Company or Organization \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



# Pt WIRE UNLIMITED

for

- thermocouples
- resistance thermometers
- instrument detectors
- furnace windings
- and many others

Whatever your need for platinum or platinum alloy wire, you can rely on BISHOP to meet your requirements exactly. BISHOP platinum works is America's oldest and most experienced—with its skilled craftsmen and technical abilities. BISHOP produces platinum wire—and a multitude of other precious metal products—to the highest quality standards, for a vast number of industrial and scientific uses.

## A PORTION OF BISHOP'S CAPABILITIES IN PLATINUM ALLOY WIRE ARE:

### Metal

- Platinum: pure; Pt/5%Rh; Pt/6%Rh; Pt/10%Rh; Pt/13%Rh; Pt/20%Rh; Pt/30%Rh; Pt/40%Rh
- Rhodium: pure and alloys
- Molybdenum/platinum alloys
- Clad and composite wires of precious and base metals

### Purity

- up to 99.999%, as specified
- (BISHOP thermocouple wire ex-

ceeds ISA standards—matches NBS standards to  $\pm 0.10\%$  or  $0.25\%$ , as specified)

### Diameters

- Standard of 0.003 to 0.187 inches
- Uniformity—as close as  $+0.0000''$  and  $-0.0002''$
- Special—as low as 0.00004 inches

### Package

- color-coded, labeled, dust-proof plastic spools in sturdy, fitted boxes or transparent containers.

Write for Bulletin P-6 "Platinum Metals Products" or Bulletin TC-2 "Thermocouple Wire." Engineering Data Sheets are available on standard wires.

# BISHOP



**J. BISHOP & CO. platinum works**

MALVERN, PENNSYLVANIA — A JOHNSON MATTHEY ASSOCIATE

OFFICES: NEW YORK • PITTSBURGH • CHICAGO • ATLANTA • HOUSTON • LOS ANGELES

land. (D. Gullick, BMA, Tavistock Sq., London W.C.2, England)

17-22. Anglo-American Aeronautical Conf., Cambridge, Mass., and Montreal, Canada. (American Inst. of Aeronautics and Astronautics, 500 Fifth Ave., New York, N.Y.)

18-19. American Physical Soc., Chicago, Ill. (K. K. Darrow, American Physical Soc., Columbia Univ., New York 27)

18-19. American Soc. of Ophthalmologic and Otolaryngologic Allergy, New York, N.Y. (J. Hampsey, Grant Bldg., Pittsburgh 19, Pa.)

19. Research in Blindness and Severe Visual Impairment, symp., New York, N.Y. (Natl. Committee for Research in Ophthalmology and Blindness, 406-C S. Blvd., Evanston, Ill.)

19-23. Chemical Engineering conf., Montreal, P.Q., Canada. (N. E. Cooke, P.O. Box 10, Montreal)

20-23. Society of American Foresters, Boston, Mass. (H. Clepper, 704 17th St. NW, Washington, D.C. 20006)

20-25. Exploration Geophysicists, 33rd intern., New Orleans, La. (J. S. Johnson, California Company Bldg., New Orleans 12)

20-25. Pan American Congress of Neurology, Lima, Peru. (J. O. Trelles, Organizing Committee, Apartado 5117, Lima)

21-23. Direct Aeronomie Measurements in the Lower Ionosphere, Urbana, Ill. (S. A. Bowhill, Dept. of Electrical Engineering, Univ. of Illinois, Urbana)

21-23. Aerospace and Navigational Electronics, 10th East Coast conf., Baltimore, Md. (R. J. Allen, Research and Advanced Technology Dept., Martin Co., Baltimore 3)

21-23. Pathology of Laboratory Animals, New York, N.Y. (Office of Medical Education, New York Acad. of Medicine, 2 E. 103 St., New York 29)

21-25. Beryllius Oxide, intern. conf., Lucas Heights, New South Wales, Australia. (Secretary, AAEC, Research Establishment, Private Mail Bag, Sutherland, N.S.W., Australia)

21-25. American Soc. for Metals, metals and materials show, Cleveland, Ohio. (ASM, Metals Park, Ohio)

21-25. Protein Rich Foods in Developing Areas, intern. conf., Food and Agriculture Organization, United Nations, Rome, Italy. (FAO, Rome)

21-25. Society for Nondestructive Testing, 23rd natl., Cleveland, Ohio. (P. D. Johnson, 914 Chicago Ave., Evanston, Ill.)

22-25. Society for Clinical and Experimental Hypnosis, New York, N.Y. (SCEH, 200 W. 57 St., New York, N.Y. 10019)

22-28. Medical Radiation, seminar, Geneva, Switzerland. (WHO, Palais des Nations, Geneva)

23-24. Industrial Hygiene Foundation, 28th annual, Pittsburgh, Pa. (R. T. P. deTreville, 4400 Fifth Ave., Pittsburgh 13)

23-25. Design of Experiments (invitation only), Huntsville, Ala. (F. G. Dressel, Army Research Office, Durham, Box CM, Duke Station, Durham, N.C.)

23-25. Human Factors Soc., Palo Alto, Calif. (J. A. Kraft, Bioastronautics Organization, 50-03, Lockheed Missiles and Space Co., Sunnyvale, Calif.)