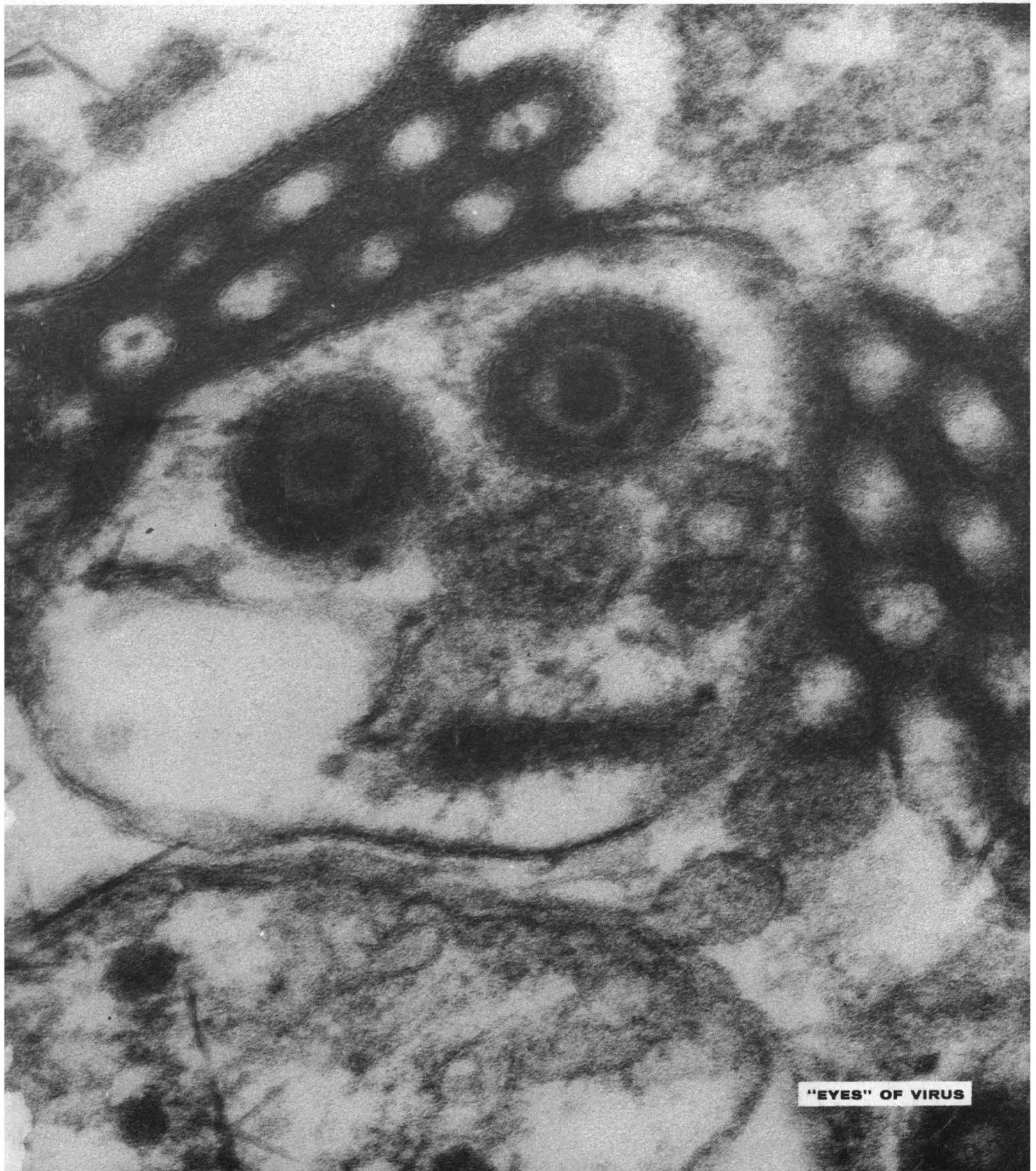


SCIENCE

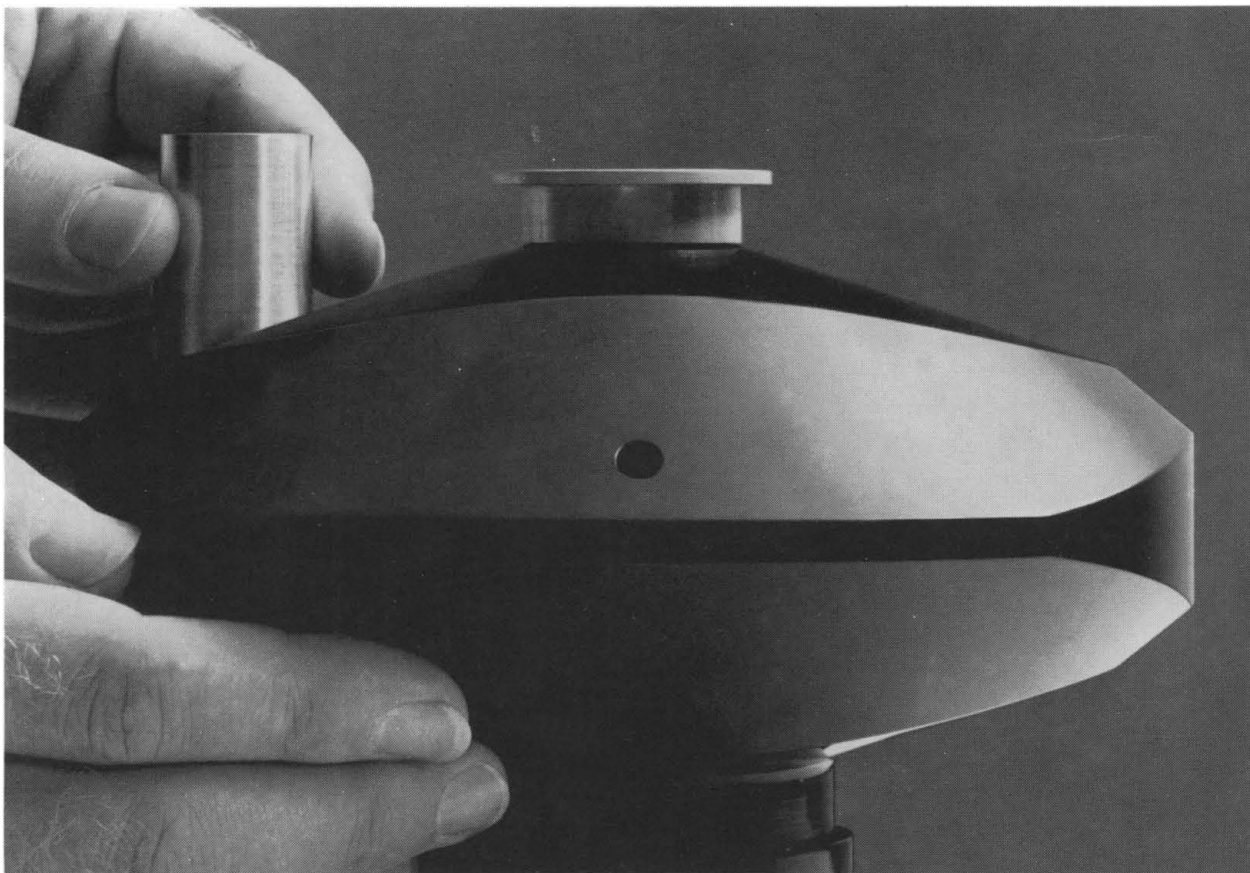
3 February 1967

Vol. 155, No. 3762

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



"EYES" OF VIRUS



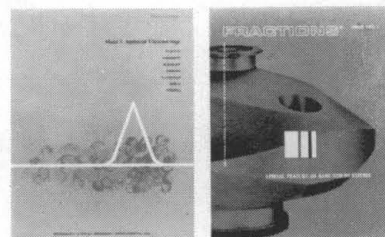
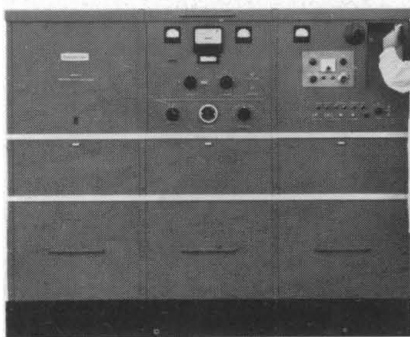
Large molecules and the Analytical Ultracentrifuge

How in touch are you with recent advances in that basic tool for making molecular measurements, the Model E Analytical Ultracentrifuge? Band sedimentation, the short column equilibrium technique, high temperature work with synthetic polymers, the use of computers, direct scanning and recording, higher forces at speeds to 68,000 rpm, lower forces at steady speeds down to 800

rpm for studies of extremely large molecules, new areas of investigation such as the correlation of molecular structure with function—all are steps forward that could very well enable the analytical ultracentrifuge to make a valuable contribution to your research.

Literature Available

If you've not been following the fast-developing field of analytical ultracentrifugation, we'd like to keep you up to date on advances in theory, technique, and instrumentation. One way is to send you the new brochure on the Model E. It reviews applications, measurements, and methodology, and describes the analytical ultracentrifuge of today. Ask for SB-189A.



Another way is to see that you receive *Fractions*®, our quarterly publication sent to users of Beckman instruments for biochemical research; a note on your letterhead to the Editor of *Fractions* will add your name to the distribution list. Extra copies of the two most recent issues are also available: they feature a review of band sedimentation in velocity studies, and a discussion of computers and the ultracentrifuge. Our address: 1117 California Ave., Palo Alto, California.

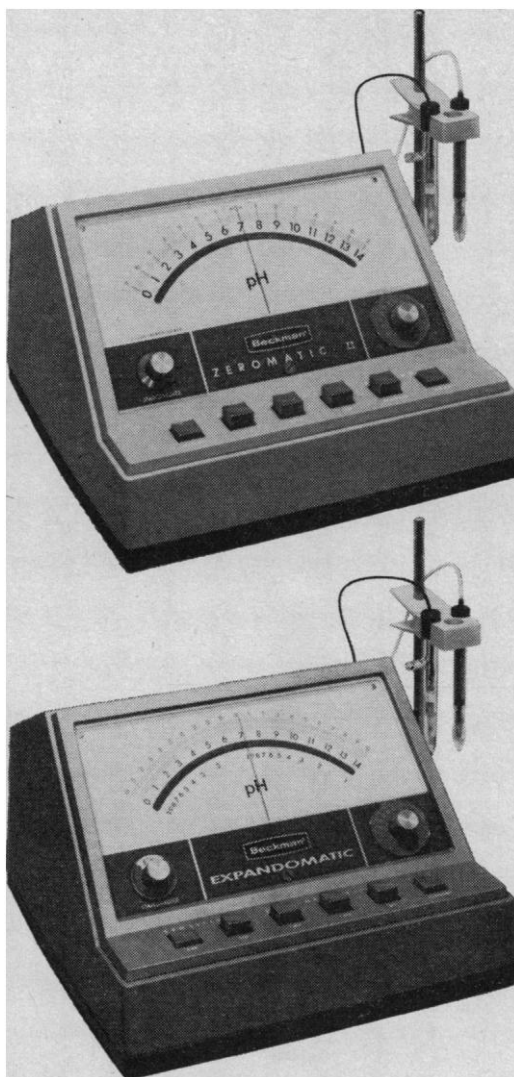
Beckman®

INSTRUMENTS, INC.

SPINCO DIVISION

PALO ALTO, CALIFORNIA • 94304

INTERNATIONAL SUBSIDIARIES: GENEVA; MUNICH; GLENROTHES, SCOTLAND; TOKYO; PARIS; CAPE TOWN; LONDON; MEXICO CITY



After a double-take...read the fine print

Here are two Beckman pH meters made to look alike...but which are significantly different internally. Both instruments provide broad flexibility, precision, and a high degree of accuracy in electrochemical measurement.

ZEROMATIC® II pH METER...When you need an instrument for general lab pH measurements, look to the Zeromatic II. This is an instrument ideally suited and designed for general-purpose use in the laboratory. The taut-band meter, with an 8.2-inch scale, offers the ultimate in readability and permits readout over the 0 to 14 pH or 0 to ± 700 mv range, which may be extended up to ± 1400 mv. It is a line-operated instrument with the capabilities required for most applications.

EXPANDOMATIC® pH METER... When you need an instrument for more precise pH measurements on an expanded scale to spot minute differences in pH or millivolts, the Expandomatic should be used. A standard scale covering the full 0 to 14 pH (0 to ± 1400 mv) range

is available for ordinary pH and millivolt measurements. An *expanded* scale displays any 2 pH units or 200 millivolts over full scale with ± 0.01 accuracy. A *logarithmic* scale, corresponding to the expanded scale, permits the correlation of any two pH units with their hydrogen-ion activity.

Otherwise, these two pH meters have the same outstanding features: ± 0.05 relative accuracy and ± 0.015 repeatability over the full standard scale; an extra large, taut-band meter that is precise and highly readable; easy-to-use push button controls for convenient operation; a die-cast aluminum case resistant to chemicals; a continuously adjustable temperature network which covers the full 0 to 100°C temperature range; and a drift-free performance am-

plifier. Added to this is the unequalled background and back-up of Beckman sales and service, based on 31 years of experience in perfecting the technique of pH measurement.

Take a second look — choose between the ZEROMATIC II or EXPANDOMATIC. Or you may want both for your laboratory. Contact your local Beckman Sales Office for a demonstration. Or write for Data File No. 2.

Beckman

INSTRUMENTS, INC.
SCIENTIFIC AND PROCESS
INSTRUMENTS DIVISION
FULLERTON, CALIFORNIA • 92634

INTERNATIONAL SUBSIDIARIES: GENEVA; MUNICH; GLENROTHES, SCOTLAND;
TOKYO; PARIS; CAPE TOWN; LONDON; MEXICO CITY

SCIENCE

LETTERS	Brain Drain Dilemma: <i>C. M. Poser; A. Labbauf; S. A. Rudin; H. Aschmann; G. R. Saini; J. Sacks</i> ; Radio Astronomy: Conflict of Frequencies: <i>G. W. Swenson, Jr., and R. N. Bracewell</i>	513
EDITORIAL	John Edward Fogarty	523
ARTICLES	Lunar Receiving Laboratory: <i>J. C. McLane, Jr., et al.</i>	525
	Radiation Chimeras and Genetics of Somatic Cells: <i>A. Lengerová</i>	529
	Privacy and Behavioral Research: <i>Panel on Privacy and Behavioral Research, Appointed by the President's Office of Science and Technology</i>	535
	Keto-Aldehydes and Cell Division: <i>A. Szent-Györgyi, L. G. Együd, J. A. McLaughlin</i>	539
NEWS AND COMMENT	Pittsburgh Selects Posvar Chancellor; CERN—Focus on 300 Bev; Science Policy—The Super Bowl; Project Themis—Research Dollars for the Have-Nots	541
BOOK REVIEWS	<i>Niels Bohr</i> , reviewed by <i>A. Petersen</i> ; other reviews by <i>J. T. Edsall, K. E. Boulding, D. Pramer, M. L. Kohn, B. Fontana, E. Farber</i> ; New Books	549
REPORTS	Transitional Pre-Desert Phase in San Diego County, California: <i>J. R. Moriarty</i>	553
	Venus: Atmospheric Evolution: <i>M. O. Dayhoff et al.</i>	556
	Weight Loss in Men in Space: <i>P. Webb</i>	558
	Rates of Surficial Rock Creep on Hillslopes in Western Colorado: <i>S. A. Schumm</i>	560
	Mouse Immunoglobulin Allotypes: Detection with Rabbit Antiserums: <i>J. E. Coe</i>	562
	Serum Osmolality in the Coelacanth, <i>Latimeria chalumnae</i> : Urea Retention and Ion Regulation: <i>G. E. Pickford and F. B. Grant</i>	568
	Urea, and Its Formation in Coelacanth Liver: <i>G. W. Brown, Jr., and S. G. Brown</i>	570
	Nitrate Ions: Potentiation of Increased Permeability to Sugar Associated with Muscle Contraction: <i>J. O. Holloszy and H. T. Narahara</i>	573

BOARD OF DIRECTORS

ALFRED S. ROMER
Retiring President, Chairman

DON K. PRICE
President

WALTER ORR ROBERTS
President-Elect

BARRY COMMONER
DAVID R. GODDARD

HUDSON HOAGLAND
GERALD HOLTON

VICE PRESIDENTS AND SECTION SECRETARIES

MATHEMATICS (A)
A. M. Gleason
Wallace Givens

PHYSICS (B)
Allen V. Astin
Stanley S. Ballard

CHEMISTRY (C)
Herman F. Mark
Milton Orchin

ASTRONOMY (D)
John S. Hall
Frank Bradshaw Wood

ANTHROPOLOGY (H)
Cora Du Bois
Anthony Leeds

PSYCHOLOGY (I)
Leo J. Postman
Frank W. Finger

SOCIAL AND ECONOMIC SCIENCES (K)
David Truman
Eugene B. Skolnikoff

HISTORY AND PHILOSOPHY OF SCIENCE
Peter J. Caws
Norwood Russell Hanson

PHARMACEUTICAL SCIENCES (Np)
André Archambault
Joseph P. Buckley

AGRICULTURE (O)
Richard Geyer
Ned D. Bayley

INDUSTRIAL SCIENCE (P)
Ellis A. Johnson
Burton V. Dean

EDUCATION (Q)
Herbert A. Smith
Frederic B. Dutt

DIVISIONS

ALASKA DIVISION
A. B. Colyer
President

Eleanor Viereck
Executive Secretary

PACIFIC DIVISION
Daniel G. Aldrich, Jr.
President

Robert C. Miller
Secretary

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION
Earl D. Camp
President

Marlowe G. Anderson
Executive Secretary

SCIENCE is published weekly on Friday and on the fourth Tuesday in November by the American Association for the Advancement of Science, 1515 Massachusetts Ave., N. Washington, D.C. 20005. Now combined with *The Scientific Monthly*. Second-class postage paid at Washington, D.C. Copyright © 1967 by the American Association for the Advancement of Science. Annual subscriptions \$8.50; foreign postage, \$1.50; Canadian postage, 75¢; single copies, 35¢, except *Guide to Scientific Instruments*, which is \$1.00. School year subscriptions: 9 months, \$7; 10 months, \$7.50. Provide 4 weeks' notice for change of address, giving new and old address and zip numbers. Send a return address label. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Genomic Exclusion: A Rapid Means for Inducing Homozygous Diploid Lines in <i>Tetrahymena pyriformis</i> , Syngen 1: <i>S. L. Allen</i>	575
Mongoose Throwing and Smashing Millipedes: <i>T. Eisner</i> and <i>J. A. Davis</i>	577
Primary Oxidation Variation and Distribution of Uranium and Thorium in a Lava Flow: <i>N. D. Watkins, C. W. Holmes, S. E. Haggerty</i>	579
Contact Inhibition in Colony Formation: <i>H. W. Fisher</i> and <i>J. Yeh</i>	581
Plasma Membrane: Substructural Changes Correlated with Electrical Resistance and Pinocytosis: <i>P. W. Brandt</i> and <i>A. R. Freeman</i>	582
Neoplastic Transformation of Rat Thymic Cells Induced in vitro by Gross Leukemia Virus: <i>H. L. Iouchim</i>	585
Activation Analysis of Soluble and Fixed Sodium in Mammalian Hair: <i>G. S. Kennington</i>	588
Volatile Principle from Oak Leaves: Role in Sex Life of the Polyphemus Moth: <i>L. M. Riddiford</i> and <i>C. M. Williams</i>	589
Phase Polymorphism in the Grasshopper <i>Melanoplus differentialis</i> : <i>H. Dingle</i> and <i>J. B. Haskell</i>	590
Poisoning with DDT: Effect on Reproductive Performance of <i>Artemia</i> : <i>D. S. Grosch</i>	592
Antiandrogen Implanted in Brain Stimulates Male Reproductive System: <i>G. J. Bloch</i> and <i>J. M. Davidson</i>	593
Neuromuscular Transmitter Substance in Insect Visceral Muscle: <i>B. E. Brown</i>	595
Neural Basis of the Sense of Flutter-Vibration: <i>V. B. Mountcastle</i> et al.	597
Frog Cerebellum: Absence of Long-Term Inhibition upon Purkinje Cells: <i>R. Llinás</i> and <i>J. R. Bloedel</i>	601
Magnesium Pemoline: Lack of Facilitation in Human Learning, Memory, and Performance Tests: <i>R. G. Smith</i>	603
Technical Comments: Polonium-210 in Bronchial Epithelium of Cigarette Smokers: <i>J. B. Little</i> and <i>E. P. Radford, Jr.</i> ; <i>R. B. Holtzman</i> ; Infrared Absorption of Carbonate Apatite: <i>D. McConneli</i> ; <i>J. D. Termine</i> and <i>A. S. Posner</i>	606
MEETINGS Oxygenases: <i>P. Feigelson</i> ; Forthcoming Events	609

MINA S. REES ATHELSTAN F. SPILHAUS	H. BURR STEINBACH JOHN A. WHEELER	PAUL E. KLOPSTEG Treasurer	DAEL WOLFLE Executive Officer
GEOLOGY AND GEOGRAPHY (E) Louis Quam Richard H. Mahard	ZOOLOGICAL SCIENCES (F) Richard B. Roberts David E. Davis	BOTANICAL SCIENCES (G) William C. Steere Warren H. Wagner	
ENGINEERING (M) Paul Rosenberg Newman A. Hall	MEDICAL SCIENCES (N) Britton Chance Robert E. Olson	DENTISTRY (Nd) Lester R. Cahn Richard S. Manly	
INFORMATION AND COMMUNICATION (T) Phyllis V. Parkins	STATISTICS (U) William G. Cochran Rosedith Sitgreaves		

COVER

Infectious laryngotracheitis virus in tissue culture cell. This anthropomorphic configuration resulted from the presence of virus particles among elements of cytoplasmic structures. The "wide open eyes" were formed by mature virus particles. The head was formed by electron dense tubular formations (about $\times 190,000$). [A. M. Watrach, College of Veterinary Medicine, University of Illinois]

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.

gilford[®]

the versatile Model 2000 an all-purpose spectrophotometer

The Gilford Automatic Spectrophotometer — Model 2000 — offers research laboratory precision with the dependability and ease of handling needed in a high yield production instrument. The extended absorbance range, long-term stability and programmed sample positioning have earned it a reputation for unusual versatility among quality UV-VIS spectrophotometers.

Enzyme kinetics. Reaction rates for up to four enzymes may be determined at one time. The great sensitivity and low noise level enable accurate initial rates to be obtained from one or two minute runs, even in the presence of high background absorbance.

Column chromatography. Flow-through microcells permit use as a multiple station monitoring unit for as many as three columns with a common reference blank. Unattended, hour after hour, the Model 2000 produces high-resolution quantitative charts. An outlet is also available for digital data processing.

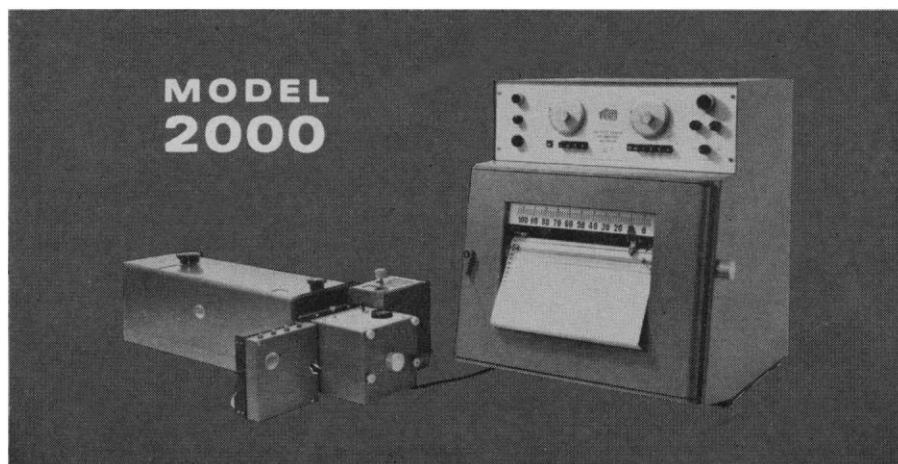
Nucleic acid melting points. With temperature sensing, regulating and recording accessories, absorbance-time-temperature data may be recorded for thermal stability and denaturation profiles, guanine-cytosine ratios, etc.

Density gradients. Equipped with flow cells the Model 2000 is widely used in continuous scanning of protein and ribosomal preparations, whether gravity fed or pumped, sucrose or cesium gradients.

Semi-automatic scanning. The simple operating procedure makes the Model 2000 particularly suited for barbiturate identification and similar short-span scans. Semi-automatic, wide-spectrum scanning with excellent resolution of absorbance peaks is far easier than with conventional instruments.

And while readily converted from one automatic application to another, the Model 2000 is still the most convenient manual spectrophotometer for measurements on a single sample. Write for brochure, specifications and quotation.

GILFORD INSTRUMENT LABORATORIES INCORPORATED • OBERLIN, OHIO



where do you find Clay-Adams quality?

■ in teaching aids to put together and take apart; to teach, to study, and to use

■ in instruments to scrape and slice, to clip and cut and clamp

■ in machines to mix and separate; to shake, rotate and incubate

■ in equipment to collect, dilute; to time and measure and weigh; to view, to type, to count

Wherever biomedical people are learning, practicing, teaching—
Clay-Adams quality is there—as it has been for more than half a century.



Workhorse



Meet the toughest of high-speed refrigerated centrifuges. Our B-20. Durable. Dependable. The strong, silent type. With its flexible belt-drive it will deliver 46,300 g with hardly a murmur. Or swing 4x250 ml in a bucket head. You won't find a comparable centrifuge that'll do all that for you. What's more the B-20 has a unique Turbo-Cover (patent pending) that stabilizes the load and provides remarkable temperature control. And it offers programmed, one-knob automation. In short, the B-20 is in a class by itself. So if you're in the market for a workhorse that can shoulder more than its share of the workload, drop us a line. We'd like to tell you more about ours. Your IEC dealer has the B-20 in stock. Send for Bulletin B-20.

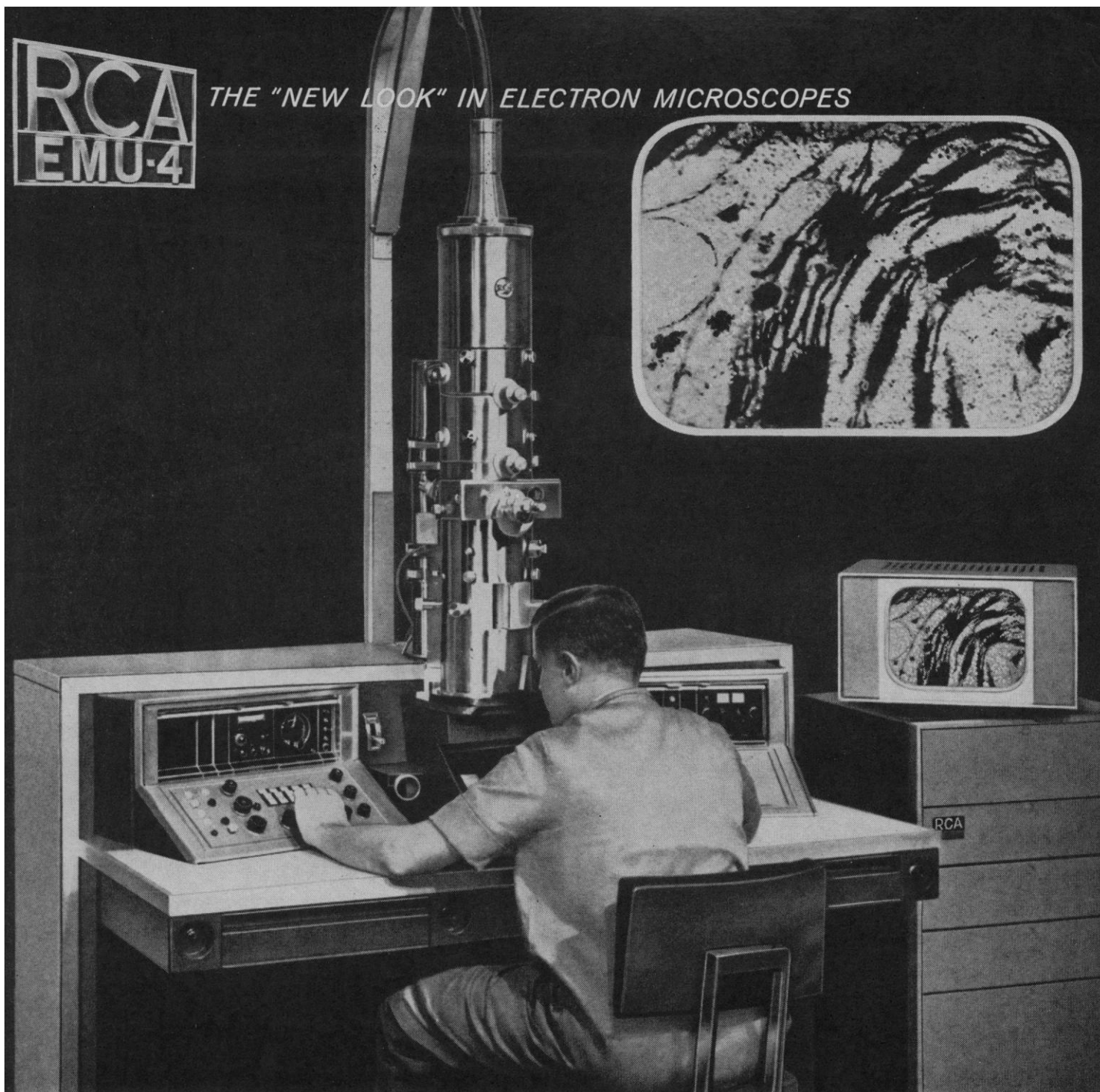


**INTERNATIONAL
EQUIPMENT CO.**

300 SECOND AVENUE • NEEDHAM HEIGHTS, MASSACHUSETTS 02194.

RCA
EMU-4

THE "NEW LOOK" IN ELECTRON MICROSCOPES



Electron microscope with true image intensification makes it possible to see images once too faint to view

The all-new EMU-4 provides a remarkable tool for extending the range of electron microscopy. By means of optional true TV image intensification, transient phenomena can be observed and recorded. Images, too faint to view on the microscope screen, are clearly visible. Specimens such as polymers, which are normally altered or destroyed by the electron beam, can now be studied. Use of multiple and remotely located monitors permit many persons to study the images in a lighted room. Television intensification can open up a whole new range of research possibilities.

The EMU-4 is the first and only electron microscope to offer the

With its many innovations this entirely new instrument adds a new dimension to the field of electron microscopy and scientific research. A full line of accessories is available. Nation-wide service can be provided. For further information, write RCA Scientific Instruments, Building 15-5, Camden, N. J. In Canada: RCA Victor Company Ltd., Montreal.

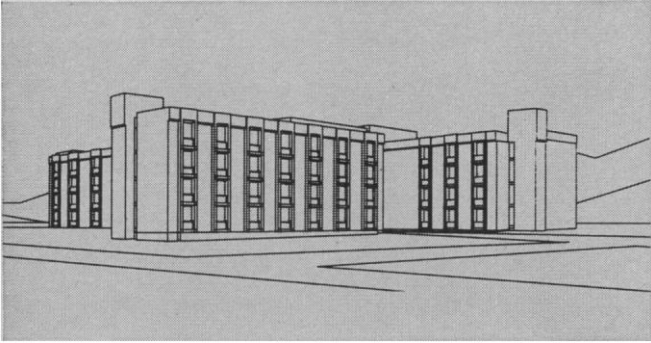
high-reliability advantages that characterize today's space-age technology. Self-adjusting circuits and modular ("building block") design simplify operation, reduce maintenance. And with building block modules, new functions later deemed necessary can easily be added. Routine procedures are automated. New high-capacity photographic facilities and ten-fold larger specimen chamber increase versatility.

Start-up and shut-down time is a matter of seconds, the result of the new push-button vacuum system. Permanent objective aperture is standard equipment.

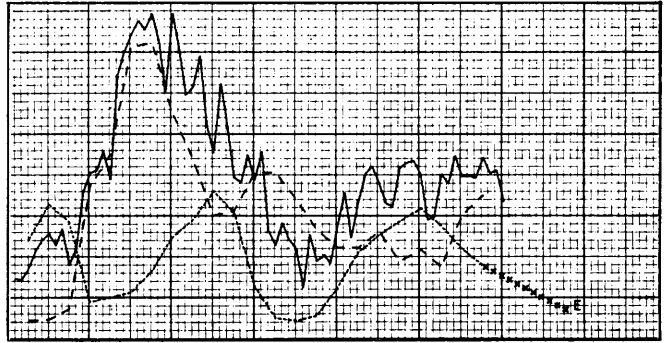


The Most Trusted Name in Electronics

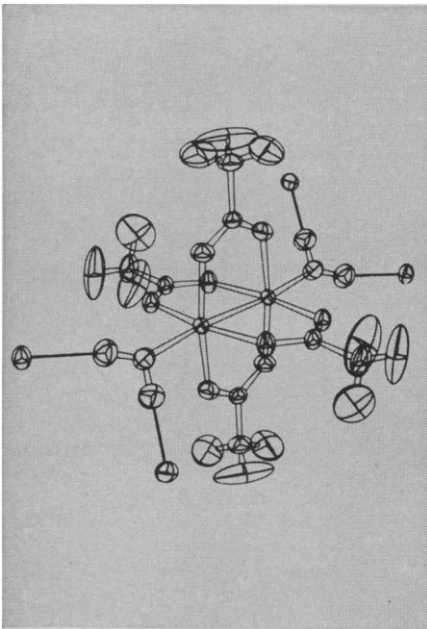
**Would you believe a
CalComp plotter and any
computer can draw pictures
like these in seconds?**



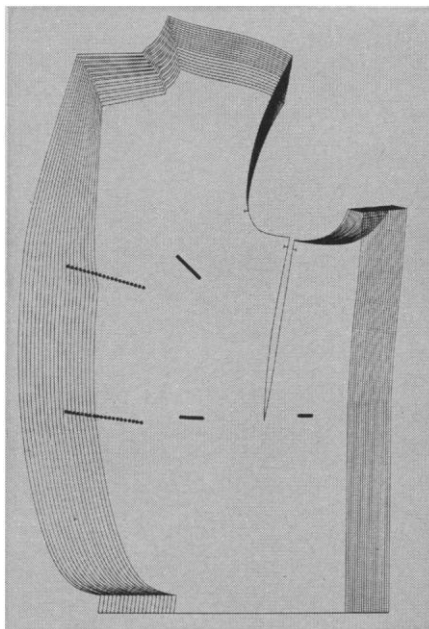
a perspective sketch of your new plant



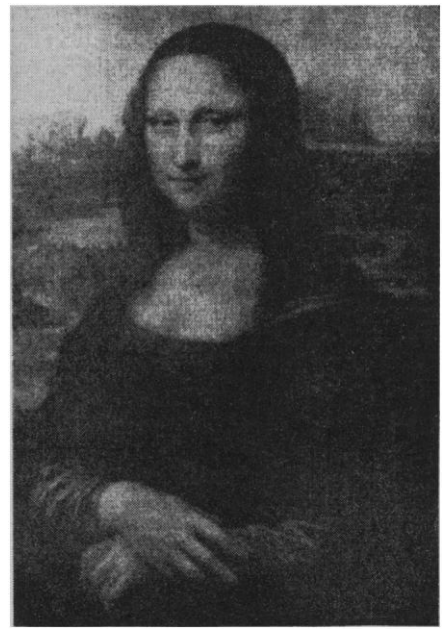
statistical trend charts



molecular structure diagrams



apparel patterns, graded for sizes



and even the Mona Lisa

it can

Call or write Dept. T-2, California Computer Products, Inc., 305 Muller, Anaheim, California 92803. Phone (714) 774-9141.

CALCOMP

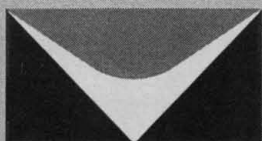
Standard of the Plotting Industry

(Talented Engineers and Programmers required—right now.)

GAS OR STEAM

STERILIZERS

FOR SCIENCE AND INDUSTRY

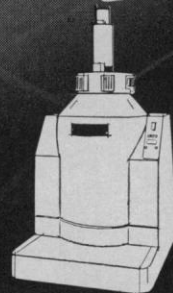


V A C U D Y N E®

VACUDYNE CORPORATION / 375 E. JOE ORR RD. / CHICAGO HEIGHTS, ILL. / PHONE: 312-374-2200



research - for all peoples



The unique properties of Cobalt 60 Irradiation are now available to research laboratories and to industry anywhere in the world.

AECL Cobalt 60 Irradiators are available in various forms and sizes to suit every purpose from research to full scale production.

The well known Gammacells are self-contained units that simply "plug in" to your regular electrical circuit. They may be placed in any convenient location. A number of full scale production units are operating with remarkable success. In fact, there are more than 150 AECL Cobalt 60 Irradiators in operation in 27 countries backed by Sales and Service Representation in over 100 countries.

If you desire information on the application of gamma radiation to research, manufacture, sterilization or preservation, please get in touch with Sales Promotion Department at the address below.

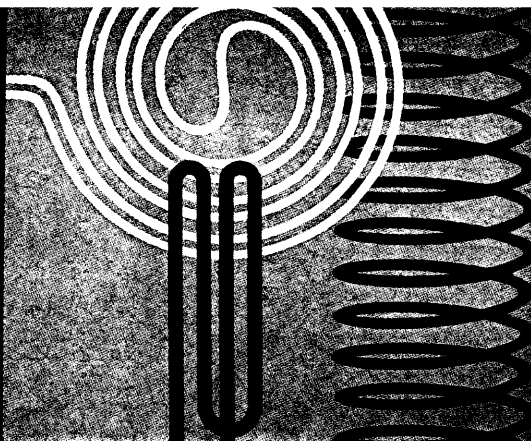


ATOMIC ENERGY OF CANADA LIMITED
Commercial Products • P.O. Box 93 • Ottawa • Canada

Telephone 613-728-1841 Cable "NEMOTA"

6605

**THE PERKIN-ELMER
CORPORATION
NORWALK,
CONNECTICUT
VOL. 2
NO. 4
1966**



**GC
NEWSLETTER**

The Model F-11 Now Available with Hot Wire Detector

The modern, low cost Model F-11 Gas Chromatograph, which until now has been available in the United States only with a Flame Ionization Detector, can now be obtained with a Hot Wire Thermal Conductivity Detector, as well.

The unique design of the F-11 places all of the components which are in contact with the sample — injectors, columns, and detector — in an interchangeable analyzer unit which forms the lid of the precision oven. To change from one detector to the other is as simple as changing lids.

A primary objective of the F-11 design is to provide the maximum in performance and economy by providing all of the required features in the basic instrument. To this end, the new Hot Wire Detector Analyzer comes complete with fully proportional temperature control for the detector as well as a solid state power supply for filament current. There are, of course, separate temperature controls for the injectors, columns, and detector.

Compare these features of the new F-11 with Hot Wire Detector with those of competitive instruments . . . even the high priced gas chromatographs:

- Dual column with dual injectors.
- Fully Proportional Temperature Control.
- Solid State Power Supply featuring constant current with ten discrete current settings.
- "Check Filaments Control" which gives a direct readout of filament temperature.
- A filament protection circuit.
- Discrete, reproducible temperature settings for the Hot Wire Oven.
- Heated lines for sample collection.

A completely assembled, ready-to-operate hot wire F-11, including analyzer column, oven, and all the necessary gas lines to install the chromatograph, should be ordered as follows:

455-0010	Hot wire detector assembly
455-0011	Electronic unit for hot wire analyzer unit
455-0001	Precision oven
228-0901	Installation kit



It should be emphasized that, although the F-11 is ordered under four part numbers, the instrument is shipped completely assembled and ready to operate.

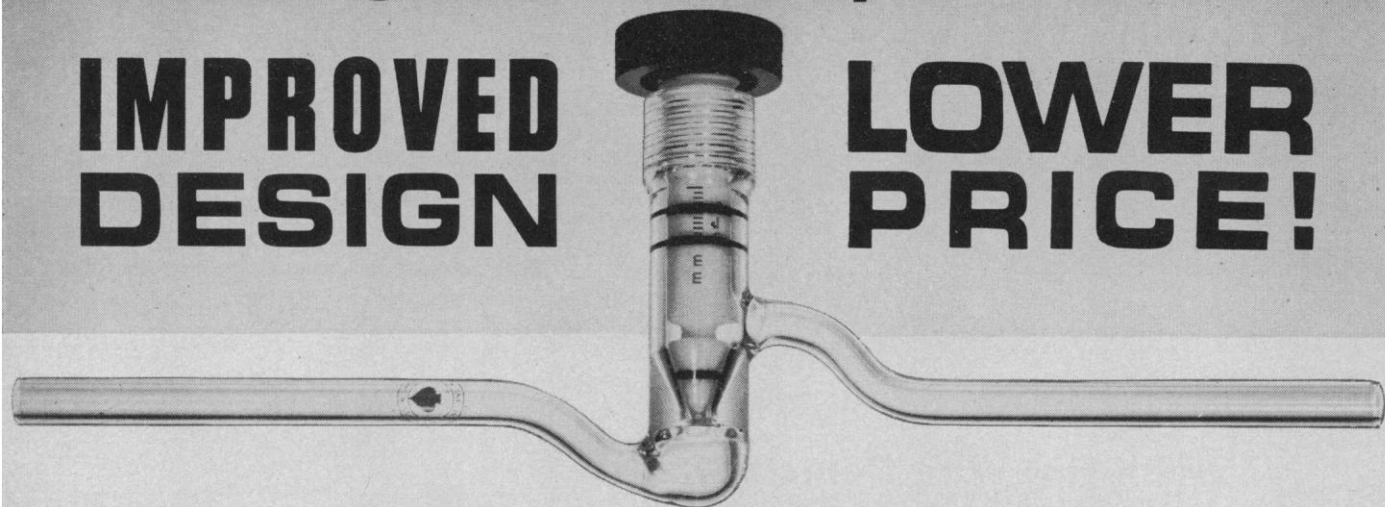
For further information on the Model F-11, including an illustrated brochure and complete price list, please write Perkin-Elmer Corporation, Instrument Division, 723 Main Avenue, Norwalk, Connecticut 06852. And if you'd like a free subscription to the Perkin-Elmer GC Newsletter, add that to your request.

PERKIN-ELMER

A Better High Vacuum Stopcock from ACE

IMPROVED DESIGN

LOWER PRICE!



- All glass and Teflon - very easy to operate, can be annealed.
- Suitable for use with oxygen and other corrosive gases.
- Rugged design: may be used to at least 30 lbs. internal pressure.

8115 HIGH VACUUM STOPCOCK. Variable opening **A:** 0-5 mm. **B:** 0-10 mm. Smooth acting semi-needle valve permits fine adjustment of opening. "O" ring makes positive closure against a precision formed heavy glass seat. Reference marks on body and handle aid repetitive setting. The stem is made of long life Teflon and is triple sealed within heavy walled glass housing, accurately threaded. All glass construction permits annealing. Side arms are also of heavy walled glass. Supplied with plain side arms 120 mm. long. **8115-A** (variable opening 0-5 mm.) **\$22.50**, **8115-B** (variable opening 0-10 mm.) **\$24.50**.

Threaded Glass/Nylon Thermometer Adapters from Ace

Convenient • Suitable for vacuum application • Wide range of sizes.

5028 ADAPTER, Thermometer Vacuum. Inner joint at bottom and threaded plastic bushing at top which tightens into glass piece to form an "O" ring compression seal with thermometer. Plastic bushing comes complete with Viton A "O" ring. $\frac{1}{8}$ 10/30 size will accommodate thermometers up to 6.5 mm. diameter, and all others will accommodate 7 mm. diameter thermometers. Suitable for vacuum applications.

Joint	$\frac{1}{8}$ 10/30	$\frac{1}{8}$ 14/20	$\frac{1}{8}$ 19/22	$\frac{1}{8}$ 24/40	$\frac{1}{4}$ 18/9	$\frac{1}{4}$ 35/20	$\frac{1}{4}$ 35/25
Glass Bottom	2.85	2.90	2.95	3.15	3.25	3.40	3.40
Plastic Bushing	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Complete	4.35	4.40	4.45	4.65	4.75	4.90	4.90

Threaded section with tubing 4" long x $\frac{1}{2}$ " O.D. \$1.50.

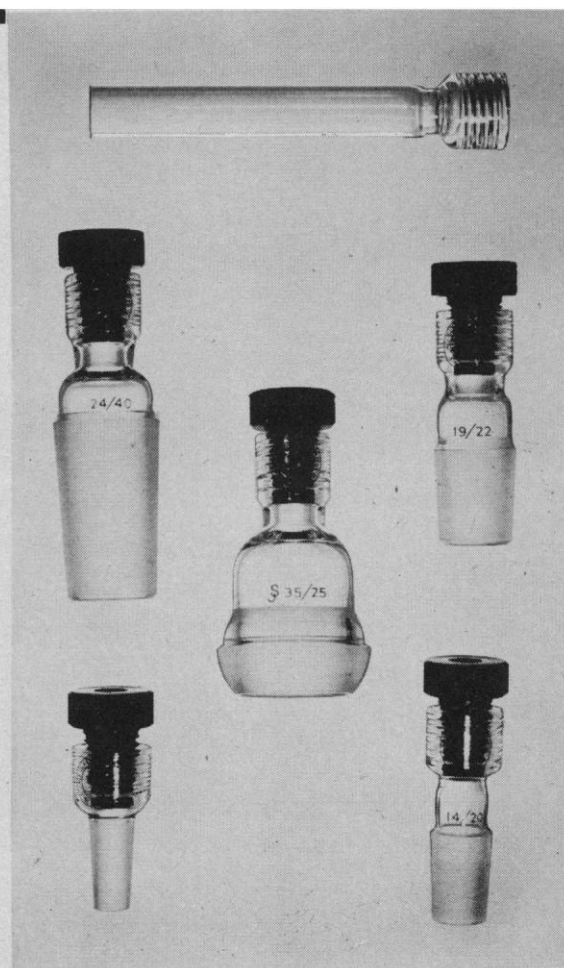


ACE GLASS INCORPORATED

Vineland, New Jersey

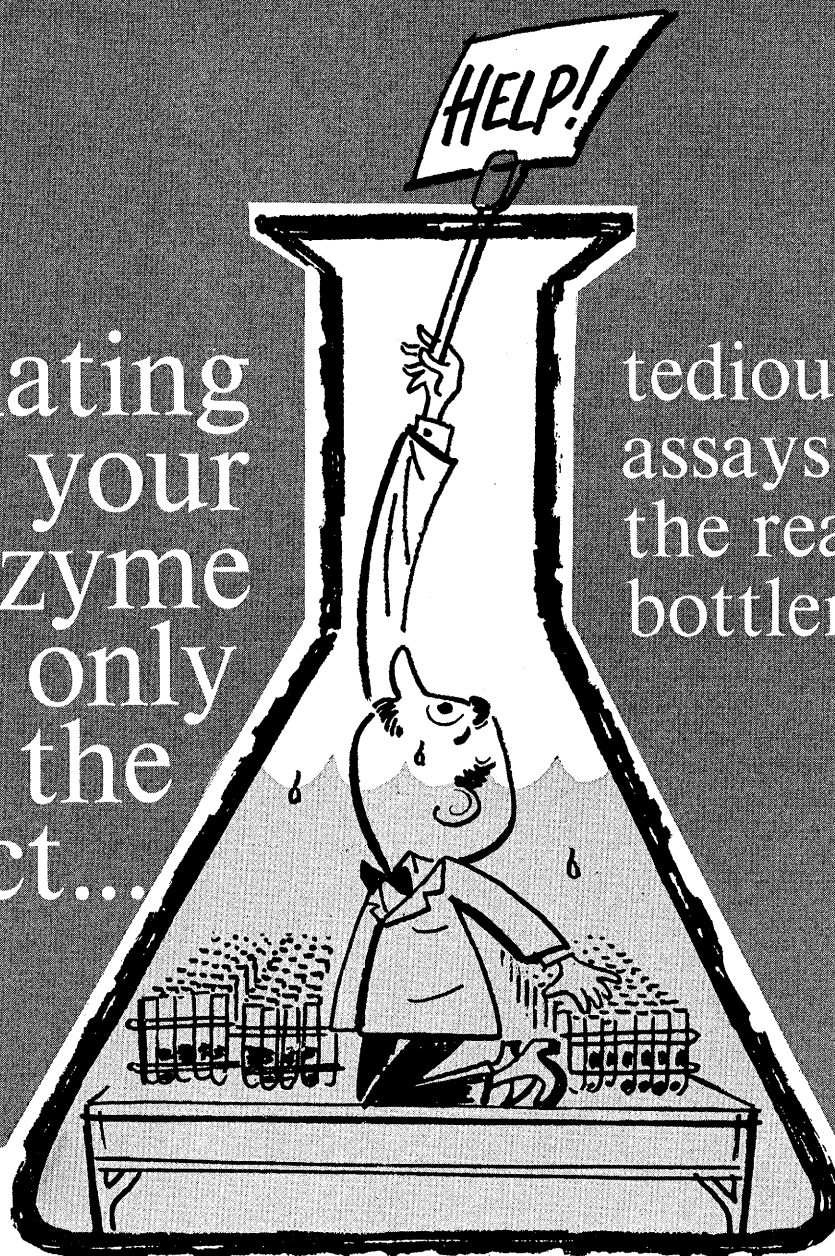
Louisville, Ky.

Springfield, Mass.



Isolating
your
enzyme
is only
half the
project...

tedious
assays cause
the real
bottleneck



But they needn't. The frustrations of manually assaying enzymes can be broken with the Technicon® AutoAnalyzer®. The following procedures have been automated at rates up to 60 samples per hour or by continuous monitoring of column effluents:

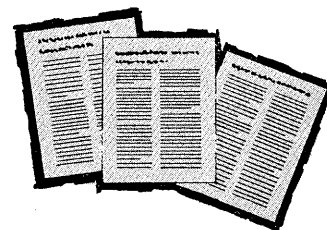
amylase	6-phosphogluconate-1, dehydrogenase
cholinesterase	hydrolytic enzymes
cytochrome oxidase	lysolytic enzymes
amino acid decarboxylases	NAD-NADH systems
dehydrase	peptidase
alcohol dehydrogenase	phosphohexose isomerase
lactic dehydrogenase	phosphorylase
glucokinase	acid phosphatase
glucose oxidase	alkaline phosphatase
glucuronidase	proteolytic enzymes
hexokinase	sulfatase
histidase	glutamic oxalacetic transaminase
urease	glutamic pyruvic transaminase
glutamine synthetase	ornithine carbamoyl transferase
ornithine transaminase	and others

Reaction rates...quantitation...
assay...chromatography

It is quite likely that we can automate the assay for the enzyme system you have under investigation.

Contact us...we may already have done so.

In any case, we will be happy to furnish a selection of reprints which report the methods and equipment employed to effect significant savings in time, labor and material.



TECHNICON

INSTRUMENTS CORPORATION

Ardsley (Chauncey), New York 10502

What type of data are you generating, and how fast? Bits? Bytes? Nuclear events? Analog signals? . . . 50,000 words per second? Up to 250,000? One million? (PDP-9 can handle your problem easily and economically. Low speed devices interface to the I/O bus inexpensively; higher speeds can be handled by the standard, built-in data channels. Truly high speeds, up to one megacycle or 18,000,000 bits per second, can be achieved by the Direct Memory Access Channel unavailable on less serious computers.)

Do you have lots of input devices? Ten measuring tables digitizing data from photos of nuclear events? Scalers attached to x-ray diffractometers? Nuclear event detectors? A room full of gas chromatographs? Analog-to-digital converters? (PDP-9 can take them all. A unique, 32-channel automatic priority interrupt option assures that no data will be lost. Devices interface directly to the I/O bus with low cost R series FLIP CHIP modules and without expensive options. Up to eight data channels can be used at no additional cost.)

Do you have many tasks for the same computer? Data col-

lection? On-line analysis? Mathematical analysis and problem-solving? . . . Do you want to do serious programming? Develop your own software library? (PDP-9 has the right instruction set, the right standard features — like built-in high speed paper tape reader and punch and 8K of memory — the right word length and memory size, the right software — the all-new PDP-9 ADVANCED software system with FORTRAN IV, macro assembler, and two monitor systems — and the right bulk storage systems and options.)

THE SERIOUS PDP-9 HAS: 18-bit word length for easier addressing, larger instruction set, more data per word; standard 8K core memory, expandable to 32K; 1.0 μ sec cycle, 2.0 μ sec add time; 18,000,000 bits per second maximum I/O transfer rate; standard real-time clock; 300 cps paper tape reader and 50 cps paper tape punch; console teleprinter; wide range of peripheral options including card readers, line printers, CRT displays, plotters, A/D and D/A converters and multiplexers, magnetic tape, DECtape, and drums. Write for full story.

**Even \$35,000 for
a computer is serious.**

**Answer some serious
questions.**



digital
COMPUTERS • MODULES

DIGITAL EQUIPMENT CORPORATION, Maynard, Massachusetts 01754. Telephone: (617) 897-8821 • Cambridge, Mass. • New Haven • Washington, D.C. • Parsippany N.J. • Rochester, N.Y. • Philadelphia • Huntsville • Pittsburgh • Chicago • Denver • Ann Arbor • Houston • Los Angeles • Palo Alto • Seattle • Carleton Place and Toronto, Ont. • Reading, England • Paris, France • Munich and Cologne, Germany • Sydney and West Perth, Australia • Modules distributed also through Allied Radio

Now in bead form for chromatography of biologic substances...

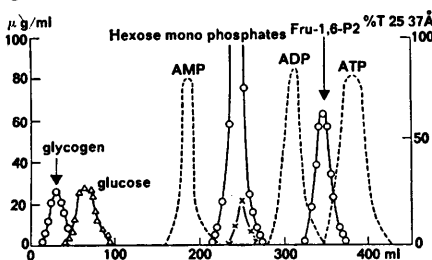
Sephadex

Ion Exchangers

Because of its advantages—stability and inertness—Sephadex has been used to produce a new class of ion exchangers: DEAE-, CM- and SE-Sephadex. Since their introduction they have been used extensively, particularly in the biochemical and clinical field.

In the new bead form they will be more useful both for laboratory and manufacturing scale processes. Their spherical shape gives increased mechanical strength and leads to easier column packing. More uniform particles result in improved hydrodynamic properties.

All Sephadex Ion Exchangers have a high capacity and low nonspecific adsorption. They are available in two types that differ in porosity, thus offering flexibility for your specific requirements. Sephadex Ion Exchangers are of analytic grade purity and are produced under rigorous quality control, thus ensuring uniform products to give accurate and reproducible results.



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

Anion Exchangers (Bead Form)

Type	Grade	Ionic Form	Capacity (meq/g)	Bed Volume ¹ (ml/g)
DEAE-Sephadex A-25	40-120μ	Cl ⁻	3.5 ± 0.5	5-9
DEAE-Sephadex A-50	40-120μ	Cl ⁻	3.5 ± 0.5	25-33

Cation Exchangers (Bead Form)

Type	Grade	Ionic Form	Capacity (meq/g)	Bed Volume ² (ml/g)
CM-Sephadex C-25	40-120μ	Na ⁺	4.5 ± 0.5	6-10
CM-Sephadex C-50	40-120μ	Na ⁺	4.5 ± 0.5	32-40
SE-Sephadex C-25	40-120μ	Na ⁺	2.3 ± 0.3	5-9
SE-Sephadex C-50	40-120μ	Na ⁺	2.3 ± 0.3	30-38

1. In Tris-HCl buffer, pH = 8.3, ionic strength = 0.05.
2. In sodium phosphate buffer, pH = 6, ionic strength = 0.06.

For additional technical information, including booklet on Sephadex Ion Exchangers, write to:



PHARMACIA FINE CHEMICALS INC.
800 Centennial Avenue, Piscataway, N. J. 08854
Pharmacia (Canada) Ltd., 110 Place Crémazie,
Suite 412, Montreal 11, P. Q.

(Inquiries outside U.S.A. and Canada should be directed to PHARMACIA FINE CHEMICALS, Uppsala, Sweden.)

of dependents it supports, either by importing adults whose rearing has been paid for elsewhere or by exporting the dependent elderly, thereby enjoys an advantage. If the adults imported are an especially able group, the advantage is enlarged.

A second statement which suggests an enormous ignorance of the educational structure of the underdeveloped countries is this: "At the same time, a student's studies abroad and his failure to return home do not mean that his native country's stock of *educated* people is reduced by one; rather that the stock of *uneducated* people is reduced, since the emigrant's vacant place in his country's educational system is taken by a person who otherwise would not have received the schooling." This might be true if students were brought to this country at the age of six, though the native economy would still have borne the expense of rearing them to that age without any return. Actually, most foreign students enter at the university or the graduate level, having occupied some of the limited places in the schools through their secondary and often their college level training.

I do not have a solution for the "brain drain" problem. It has both a moral and an economic aspect. The freedom of the advantaged individual to migrate may well ill serve the community or nation that nurtured him. The world is not a single economic community. The loss of a skilled engineer, manager, or physician does hurt India's economy and welfare.

HOMER ASCHMANN

Department of Geography,
University of California, Riverside

Grubel's recommendation that teachers of foreign students should encourage them to return home by awakening and nurturing patriotic sentiments is not workable. I cannot speak with authority about other countries, but I know many Indians who, as students in India during the days when Gandhi and his party were struggling for independence, contributed their share in winning freedom. Full of patriotism and respect for Nehru, they returned to India after getting their U.S. degrees but stayed only a year or two because they found that Indian administrators, in their struggle to remain in power, would resort to favoritism, nepotism, and corruption, and many well-qualified scientists were ignored when appointments were made. Under such high-handed administra-

tors, there were instances where foreign-trained scientists committed suicide.

Countries like India will not suffer if their young scientists stay abroad. The scientific methods require management to produce results. The partnership between management, on one hand, and science, on the other, is an absolute necessity if improvement is to be expected in developing countries. Homi Bhabha, the late great Indian scientist, was obliquely referring to this problem, I believe, when he said in his last speech, "It is my personal view . . . that the general absence of the proper administration for science is a bigger obstacle to the rapid growth of science and technology than the paucity of scientists and technologists because we are less effective through the lack of [the] right type of administrative support."

The problem of migration of scientists is not new. Tycho Brahe while migrating from Denmark to Czechoslovakia in 1597 wrote, "And when statesmen or others worry him too much then he should leave with his possessions—with a firm and steadfast mind one should hold under all conditions, that everywhere the earth is below and the sky above, and to the energetic man, every region is his fatherland." Even now the earth is everywhere below and the sky above, and thousands of scientists are making decisions to move from one country to the other because world conditions everywhere are more favorable than ever before for their migration.

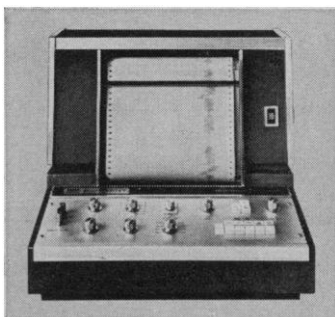
G. R. SAINI

Research Station,
Canada Department of Agriculture,
Fredericton, New Brunswick

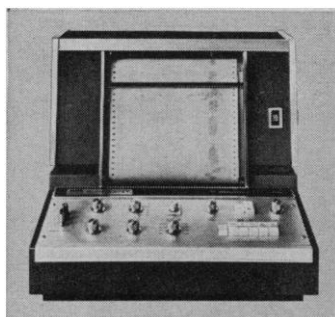
The casuistry of Grubel's statement that "economic theory establishes a very strong presumption that emigrants, brainy or not, do not affect the well-being of the remaining population" calls for vigorous refutation. I base my objection in part on the number of physicians in relation to population in an underdeveloped country with which I am familiar. The same situation undoubtedly applies to many other underdeveloped countries. This small country in Latin America has a good medical school and graduates about 50 physicians per year. The capital city has one physician per 2500 of population, and the rest of the country fewer than one to 5000. The number of physicians graduated per year needs to be doubled

Yes, our MR Recorder often seems like many instruments at work

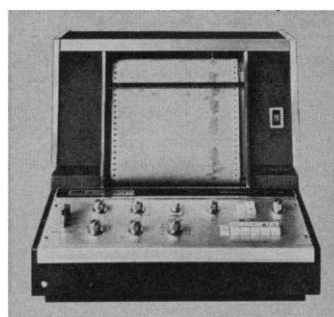
(and the specs tell you why)



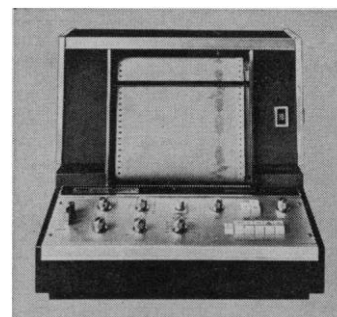
DESCRIPTION: SARGENT MODEL MR RECORDER—automatic, self-balancing, 10-inch potentiometer recorder. Includes special high gain amplifier, and high stability solid state reference power supply requiring no standardization. Line operated.



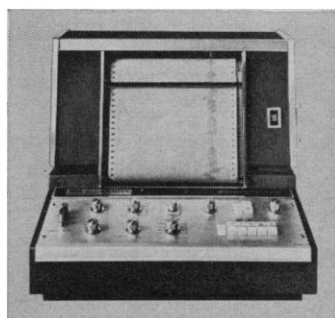
QUANTITY RECORDED: mV, V, μ a and ma—selected by panel switch.



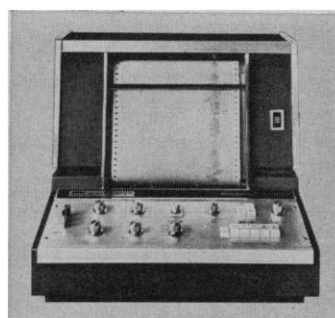
ELECTRICAL RANGE: twelve pre-calibrated ranges by switch selection — 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000. Variable range expansion from 100% (off) to 40% of selected range with continuously adjustable dial.



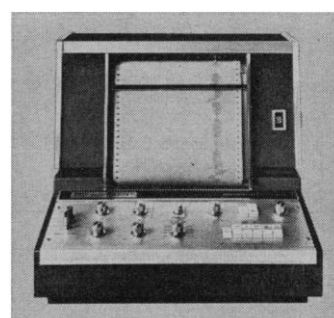
LIMIT OF ERROR: 0.1% or 5 μ v, whichever is greater.



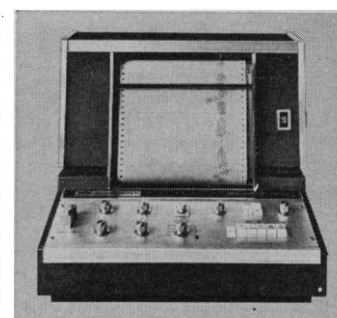
ZERO DISPLACEMENT: calibrated ranges of 10, 100, 1000 and 5000 of the selected units, upscale or downscale. Continuously adjustable reading dial for 0 to 100% of selected range.



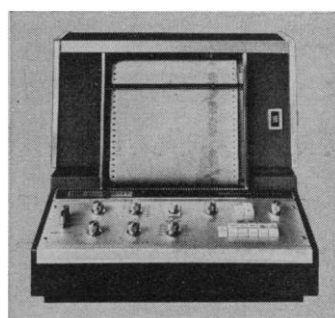
SOURCE RESISTANCE TOLERANCE: 50,000 ohms in most sensitive range, increasing with increasing range.



ELECTRICAL FILTERING: four position switch to reject transverse and common mode A.C. superimposed on the D.C. signal, without loss of sharp balancing characteristics.



PEN SPEED: 1 second for full scale transverse.



DAMPING GAIN ADJUSTMENT: automatic with range change; panel dial for fine adjustment—particularly for low resistance systems like thermocouples.

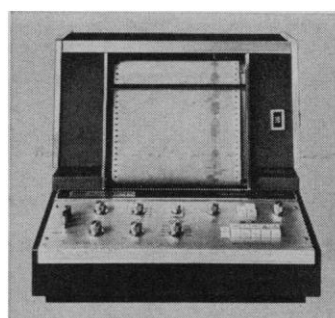


CHART DRIVE: twelve synchronous speeds—0.5, 1, 2, 4, 10, 20—by dial selection, inches per hour or per minute by panel switch. Magnetically braked in "off" position. Free clutch system scans chart with rapid drive; averages 50 feet per minute in forward or reverse directions.

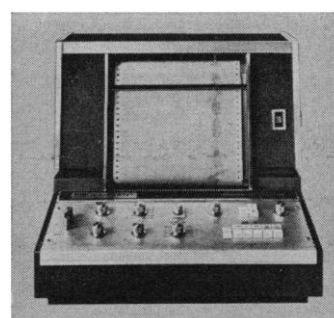
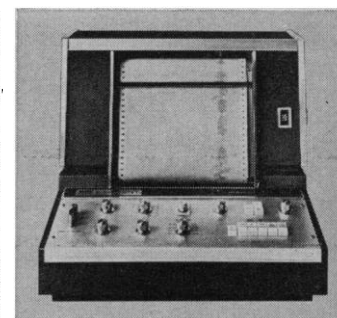


CHART TAKE-UP: automatic, by motor with preset torque—or by-pass for free end chart tear off.



SYNCHRONIZATION: chart drive may be synchronized with external systems connected to rear panel, and operated by the chart drive switch. Or chart drive may be operated from an external switch.

This gives you some idea why the SARGENT MODEL MR RECORDER can do the work of *several* less versatile recorders, manual potentiometers or precision meters. To get the complete picture, write for Bulletin MR.



SARGENT® SCIENTIFIC LABORATORY INSTRUMENTS • APPARATUS • CHEMICALS

E. H. SARGENT & CO.
4647 West Foster Avenue
Chicago, Illinois 60630

Chicago • Anaheim, Calif. • Birmingham • Cincinnati • Cleveland
Dallas • Denver • Detroit • Springfield, N.J. • Toronto, Canada



SPEED UP YOUR RESEARCH

Just drop L/I Automatic RE-PIPETS* and Automatic Dilutors into your reagent bottles. They'll dispense, transfer, mix, aspirate and dilute with a guaranteed accuracy of 1% and 0.1% reproducibility. Because these two automatic L/I instruments complete any operation in only a few seconds, you cut your analysis time 50-95%. And you eliminate the hazards of mouth pipetting and transfer of reagent from bottle to bottle.

L/I's versatile instruments handle any liquid—acids, alkalies, solvents and volatiles included—with viscosities as high as 45 centipoises. Because there's no drainage error, you'll get 1% accuracy and 0.1% reproducibility even with viscous liquids.

L/I instruments give you complete freedom from contamination, require no change in your methods, and never need cleaning. Integral air filters keep reagents pure. Volume? From microliters to deciliters.

Dilutors \$89.50, including complete set of tips for highest precision in all ranges. REPIPETES \$47.50. Immediate delivery in 1, 10, 20, and 50 ml sizes. Please write for details.

* Trademark—(REpetitive PIPETS)

LABINDUSTRIES

1802-H Second Street
Berkeley, California 94710
TH 3-0220, Cable LABIND

in order to bring the ratio to population 1 to 2500 in 15 years. This ratio is far below that in any Western European country.

The per capita income of the country is less than \$300 per year, and the cost to the government for the training of one physician is at least \$10,000 U.S. equivalent, taking into consideration both the premedical and medical school years. If two of the 50 graduates per year—a percentage drain less than half that which Grubel views with equanimity—leave to practice in the United States, the country has not only had \$20,000 go down the drain, but is deprived of an essential public service. In terms of per capita income relative to that of the United States, this loss is equivalent to more than \$200,000.

Were these two physicians to remain in their country, their effect on the well-being of the population would far exceed anything they might absorb in social services. In the course of a year each one could convert a hundred persons made invalid by parasitic diseases into productive workers, whose contribution to the national income would be many times the "more than an average value of government services" that Grubel has the skilled professional absorb in an underdeveloped country. The drain of these two brains impoverishes their land by a far greater proportionate amount than the contribution they can make to the United States.

JACOB SACKS

Department of Chemistry, University of Arkansas, Fayetteville 72701

Radio Astronomy:

Conflict of Frequencies

On 6 December 1966 a scientific satellite was launched from Florida with one of its carefully designed and important experiments purposely rendered inoperative. This expensive decision, and the events that led to it, simultaneously represent a failure of scientific liaison, furnish an example of generous international cooperation, and illustrate the importance of achieving international agreement on the protection of radio frequencies for space research and for radio astronomy.

On 9 November we learned quite accidentally that NASA scientific satellite, ATS-E, proposed for launching in a year or so, was to carry a radio-beacon transmitter for ionospheric research into a synchronous orbit. The

proposed frequency band was centered on 406.8 megahertz. A synchronous satellite is almost stationary with respect to the earth, at an altitude of approximately 22,000 miles. The radio signals can be received over nearly a full hemisphere of the earth's surface.

It happens that a number of the world's most important radio telescopes operate exclusively in the same frequency band. These instruments have extremely great sensitivity, to the degree that they would be interfered with in a very harmful way by radiated power sufficient to accomplish the ionospheric research mission of the satellite. As the satellite is nearly fixed with respect to the telescope, the interference would be continuous for several years.

During discussion of this situation with our colleagues in ionosphere research, we learned that a similar satellite was, in fact, already on the launching pad at Cape Kennedy, to be positioned over the Pacific Ocean in direct view of the new Mills Cross telescope near Canberra, Australia.

An immediate decision was necessary. One can imagine the dilemma in which NASA officials found themselves. On the one hand, the ionospheric experiment was ready to launch. It was part of an expensive complex of experiments. Ground stations were ready. To cut it off at the last minute might cause some unexpected interaction which could jeopardize other experiments on board. Many scientists and engineers had planned and hoped and worked for years to bring the experiment into being. On the other hand, the Mills Cross, a major instrument of the Cornell-Sydney Astronomy Center supported jointly by U.S. government and Australian funds, would probably be put out of action for as long as 5 years. Radio telescopes in other parts of the world could be adversely affected, as well.

The NASA people made a courageous and farsighted decision: expensive and risky and disappointing though the action was, they disconnected the beacon transmitter.

How did this unfortunate situation arise? Radio astronomy, as a late-comer among the users of the radio-frequency spectrum, has never been able to secure adequate frequency protection on either national or international scales. International frequency-allocation practices have been regional rather than worldwide in scope and have led to intercontinental inconsisten-

RECENT findings

RESEARCH LABORATORIES



Kinetic study of reactions of peroxy and phenoxy radicals in hydrocarbon systems yields previously unattainable information.

Much of the present knowledge of the ease of formation and chemical reactivity of free radicals and atoms has been obtained from kinetic studies of chain reactions in which these species occur as reactive intermediates. A free radical species of considerable interest in many areas of chemistry is the phenoxy radical. One system in which phenoxy radicals are generated as intermediates is the free radical initiated liquid phase oxidation of hydrocarbons containing trace amounts of phenolic compounds.

Work at Ford Motor Company Scientific Laboratory has revealed that the kinetic equations which describe the rates of oxygen absorption of liquid hydrocarbons containing phenols are of two types. The rate of oxygen absorption observed when hindered phenols and hydroquinones are the additives is directly proportional to the ratio of hydrocarbon to phenol concentration and is also first order in initiator concentration. This expression is consistent with a competition between the hydrocarbon and the phenolic compound for the chain carrying peroxy radical. The phenoxy radical formed then rapidly terminates or, equivalently, is incapable of any other kinetically significant reaction.

In contrast, an entirely different kinetic behavior is observed with all other phenolic compounds investigated. At a constant concentration of hydrocarbon and phenolic compound the rate of oxygen absorption is proportional to the one-half power in the initiator concentration. As shown in figure 1 the dependence of the rate on the phenol concentration cannot be described by integral orders throughout a wide range of concentrations. The data may be fitted (solid curve Fig. 1) to a general rate equation derived from a kinetic scheme which includes the chain restarting reactions of the phenoxy radical. Under these conditions there are two chain carrying radicals. At low concentrations the predominant chain carrying radical is the peroxy radical while at high concentrations of the phenol the phenoxy radical is the main species. The parameters obtained from this analysis have yielded previously unavailable information regarding the rates of formation, hydrogen abstraction reactions and modes of destruction of phenoxy radicals.

These parameters have then been analyzed in terms of the energies of the highest occupied molecular orbitals (HOMO) of the phenoxy radicals as calculated by the

Hückel technique. One such correlation is presented in figure 2. It is seen that the log of the rates of hydrogen abstraction by the peroxy radical from the monohydroxyphenols is linearly related to energy of the HOMO of phenol. A similar correlation is obtained for the dihydroxyphenols. The relative rates of peroxy-phenoxy radical and phenoxy-phenoxy radical termination are also found to be extremely sensitive to structure; a variation of 10^3 is observed in the relative rates of these processes. Again, this effect may be correlated with the energy difference in the HOMO of the phenoxy and peroxy radicals.

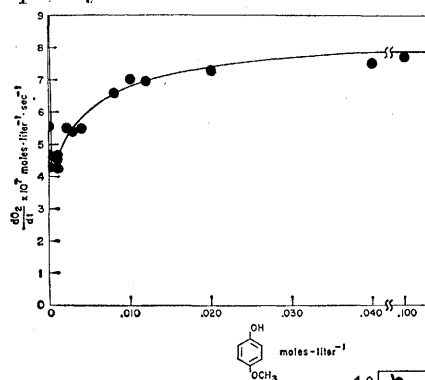


Figure 1. Rate of oxygen absorption versus concentration of 4-methoxyphenol for a chlorobenzene solution containing 0.099 M 9,10-dihydroanthracene and 0.0031 M 2,2', 3,3'-tetraphenylbutane at 60.0 C.

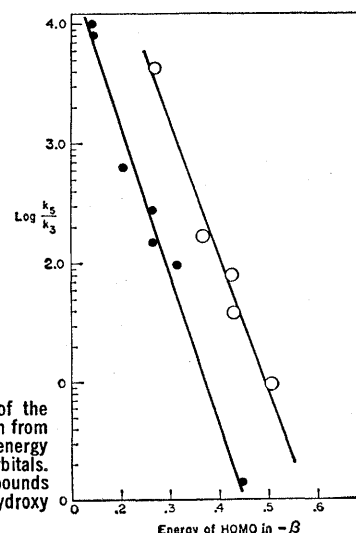


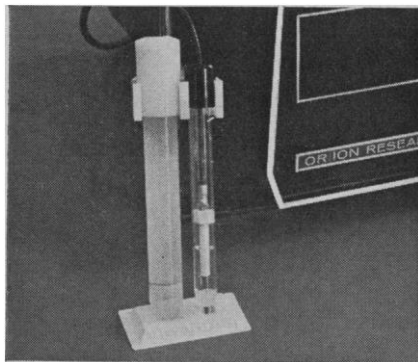
Figure 2. Correlation of the log of the relative rates of hydrogen abstraction from phenols by peroxy radical versus the energy of their highest occupied molecular orbitals. The dark points are dihydroxy compounds and the unshaded points monohydroxy compounds.

PROBING DEEPER FOR BETTER IDEAS



Now— measure calcium ion *directly*

WITH NEW ORION
ELECTRODE



First in a new series of specific ion electrodes, the Calcium Activity electrode of Orion Research Incorporated provides rapid continuous measurement of calcium ion activity in aqueous solutions. It permits direct measurement in solutions with concentrations ranging from saturated to 10^{-5} moles/liter. The electrode is an ideal endpoint detector for EDTA titrations.

ION EXCHANGE PRINCIPLE

The Orion unit detects calcium ion by developing a potential across a thin layer of ion exchanger that is highly selective for calcium. Measurements can be made in a millimolar calcium solution with negligible error despite the presence of a 100-fold excess of sodium or potassium. The electrode is at least 50 times more sensitive to calcium than to magnesium.

INSTRUMENTATION

The electrode can be used with any expanded scale pH meter and a conventional pH reference electrode. Technique is similar to simple pH measurement.

Response and reproducibility are comparable to that of good pH electrodes. Sample requirement, using a special micro sample dish, is only 300 microliters.

The electrode, available through major laboratory supply dealers, is priced at \$145.00.

Use this coupon to request Ca^{++} product literature.

Name

Organization

Street

City

State Zip

Laboratory Supply Dealer

ORION RESEARCH INCORPORATED
11 Blackstone Street, Dept. D
Cambridge, Massachusetts 02139
(617) UN 4-5400

cies in the frequency bands allocated to radio astronomy. With the advent of man-made radio transmitters in space, the situation has become very serious.

The band 401 to 406 megahertz is allocated by international agreement to "meteorological aids," including radiosondes and weather satellites. The band 406 to 420 megahertz is allocated to the "fixed service," which includes mainly point-to-point communication systems. Historically, radio astronomers have long desired some space in this region of the spectrum, but the most that has been achieved to date is the rather weak footnote in the Final Acts of the Extraordinary Administrative Radio Conference, Geneva, 1963:

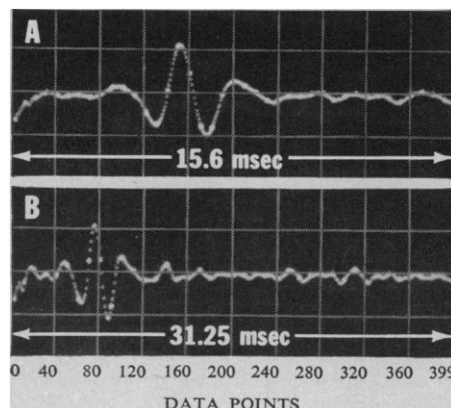
The band 404-410 in Region 2 and the 406-410 in Regions 1 and 3 are also allocated to the Radio Astronomy Service. An appropriate continuous band within these limits shall be designated on a national or area basis. In making assignments to stations of other services to which these bands are allocated, administrations are urged to take all practicable steps to protect Radio Astronomy observations from harmful interference.

In the United States, only the band 404 to 406 megahertz has been so protected.

Thus, radio telescopes operating in this part of the spectrum run the risk of interference from transmitters outside their respective national jurisdictions. Nonetheless, because other suitable frequencies have not been available, and because they have been able to obtain protection on a purely local basis, several radio observatories in Europe and Australia have constructed elaborate radio telescopes operating at or near 406 megahertz.

Technically, the choice of 406.8 megahertz by NASA was perfectly logical. The ionospheric experiment needs two widely separated frequencies with a constant electrical phase relationship. Both ground and satellite instrumentation are greatly simplified if one is a harmonic of the other. In this case, 406.8 megahertz is the third harmonic of the frequency of the existing data-transmission and tracking-beacon transmitter, the latter being chosen in accordance with the international allocations for space research. It is a time-honored practice to transmit on any frequency, regardless of allocation, so long as the transmitted power is so low that it will not interfere with any of the primary uses of the frequency. In this case the latter criterion was certainly satisfied with

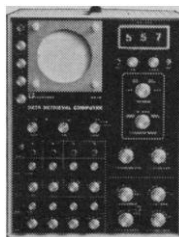
Our signal averager uses all its data points for better resolution.



More usable data points. In a signal averager, resolution is a function of the number of data points that can be placed within a region of interest. Resolution can, therefore, be a problem in any signal averager with a minimum dwell-time per data point of longer than the 39 μsec . of our Model 7100 Data Retrieval Computer (15.6 msec. for 400 data points, display A, above). Many other signal averagers have a minimum dwell-time per data point as long as 78 μsec . (31.25 msec. for 400 data points, display B, above). Our signal averager, the DRC, uses *all* of its data points for signals that occur within as little as 15.6 msec. Result: the DRC gives you *better* resolution.

Pre- and post-analysis interval control. Another way to improve resolution is to average only *meaningful* signals. The DRC provides wide-range control of both pre- and post-analysis delay intervals. No data points are wasted on signals occurring between stimulus and response or during recovery after response.

Performance plus versatility. The DRC also has an input sensitivity of 20 millivolts—requiring no pre-amplification for many applications. Besides transient-averaging, the DRC will perform time- and interval-histogram analysis, *without* add-on modules. Now, all of the DRC's performance and versatility is available at a new, lower price:



**The Model 7100
Data Retrieval Computer.**

*For more information
on the DRC and its
exciting new price,
consult your local
Nuclear-Chicago sales
engineer. Or write to us.*

NUC-12-B-1947



**NUCLEAR-CHICAGO
CORPORATION**

349 E. Howard Ave., Des Plaines, Ill. 60018 U.S.A.
Donker Curtiusstraat 7, Amsterdam W.

respect to the meteorological aids and the fixed services. Nonetheless, the extreme sensitivity of the radio telescope, which radio engineers of other services often appreciate only with difficulty, makes it extremely vulnerable to such transmissions from satellites.

NASA has demonstrated in the most dramatic way possible its desire to cooperate in international protection of radio astronomy observations. Clearly, then, a failure of liaison within both scientific and frequency-management communities was responsible for the last minute cancellation of the experiment. We understand that NASA on 15 September sent a routine announcement of proposed frequency usage, including the experiment in question, to the appropriate governmental agencies in Australia and other countries. The proposed usage was discussed and approved by the cognizant U.S. government committee, but apparently the staff of the National Academy of Sciences Committee on Radio Frequency Requirements for Scientific Research did not become aware of the conflict until too late. Similarly, the Inter-Union Committee on the Allocation of Frequencies for Scientific Research, an international committee of scientists, apparently did not learn of the matter until the last minute (1).

Any one of these agencies could have given *timely* warning of the conflict, had they recognized the danger. The lessons are clear: liaison among scientific users of frequencies must be more systematic and intensive; renewed efforts must be made to provide worldwide, exclusive allocations for radio astronomy and space research; radio astronomers must become more alert to frequency protection problems and must cooperate more in resolving them. In particular, agencies proposing transmissions which are potentially harmful to radio astronomy should request information from the International Frequency Registration Board, Palais Wilson, Geneva, Switzerland. Radio astronomers should make certain that their frequencies are on record with the IFRB.

G. W. SWENSON JR.*

*National Radio Astronomy Observatory,
Charlottesville, Virginia*

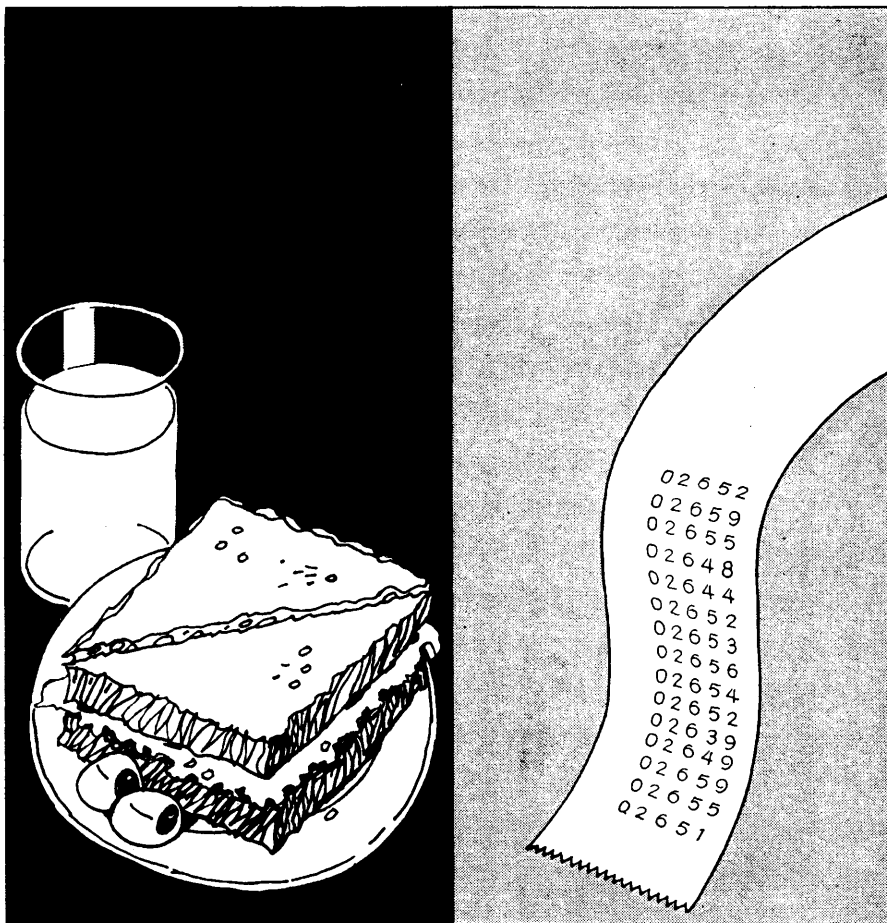
R. N. BRACEWELL

*Radio Astronomy Institute,
Stanford University, California*

Reference and Note

1. R. L. Smith-Rose, *Nature* 203, 7 (1964).

* On leave of absence from the University of Illinois, Urbana.



While Charlie Higgins is having lunch his new Fisher Photometric Titralyzer is performing 15 colorimetric titrations— automatically.

When he gets back to the lab, the printed results will be waiting for him. The new Fisher Photometric Titralyzer increases the efficiency of your lab by doing as much work as any technician. Just fill the buret and reservoir with titrant, set the controls, and place up to 15 repetitive samples in the turntable. You are free to do other work.

The Titralyzer is sensitive to color variations imperceptible to the eye. It also eliminates human errors caused by differences in color vision or fatigue. The print-out tape does away with misreading of burets and transferring figures incorrectly.

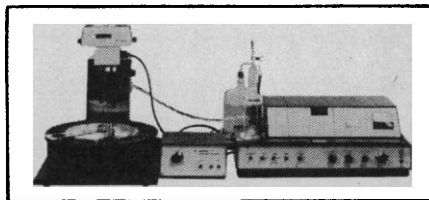
With the Photometric Titralyzer there is no "new chemistry" to learn. We'll send you copies of procedures for Water Hardness (Total) by EDTA Titration (APHA proce-

dures); Water Hardness (Calcium) by EDTA (APHA); P & M Alkalinity/Acidity (also APHA); and Neutralization Numbers of Petroleum Products (ASTM procedures). There are more to come.

The Fisher Photometric Titralyzer costs \$3300. **Write today** for more information. Fisher Scientific Company, 1393 Fisher Building, Pittsburgh, Pa. 15219.

(A photometric titration accessory is available for the Fisher Potentiometric Titralyzer.)

J-597



FISHER SCIENTIFIC CO.

Instruments, Apparatus, Furniture and Chemicals for Laboratories

Complete stocks in all these locations: Atlanta • Boston • Chicago • Cleveland • Houston • New York
Philadelphia • Pittsburgh • St. Louis • Union, N. J. • Washington • Edmonton • Montreal • Toronto • Vancouver

see the gilson

turn with ease
from a research instrument
with a large complement
of channels and transducers
to a sturdy teaching tool
with as few as 2 channels
or vice versa

see its aptitude for new tasks,
its facility in various areas—

from ECG's on small animals to
sweeping servo curves.

Get the essence ⊕

a good polygraph
yet only what you need.

Write for mail!

GILSON MEDICAL ELECTRONICS

Middleton, Wisconsin 53562

or telephone! 608/836-1551



GILSON products are also manufactured in Europe: **GME • 69, Rue Gambetta—95, VILLIERS-LE-BEL, FRANCE**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Editorial Board

ROBERT L. BOWMAN	EVERETT I. MENDELSON
JOSEPH W. CHAMBERLAIN	NEAL E. MILLER
JOHN T. EDSALL	JOHN R. PIERCE
EMIL HAURY	KENNETH S. PITZER
ALEXANDER HOLLAENDER	ALEXANDER RICH
WILLARD F. LIBBY	DEWITT STETTEN, JR.
GORDON J. F. MACDONALD	CLARENCE M. ZENER

Editorial Staff

Editor

PHILIP H. ABELSON

<i>Publisher</i>	<i>Business Manager</i>
DAEL WOLFE	HANS NUSSBAUM

Managing Editor: ROBERT V. ORMES

Assistant Editors: ELLEN E. MURPHY, JOHN E. RINGLE

Assistant to the Editor: NANCY TEIMOURIAN

News Editor: DANIEL S. GREENBERG

News and Comment: JOHN WALSH,* ELINOR LANGER, LUTHER J. CARTER, BRYCE NELSON, NAOMI PANUSH, JANE AYRES, GILLIAN PARRILLO

Book Reviews: SYLVIA EBERHART

Editorial Assistants: JOANNE BELK, ISABELLA BOULDIN, ELEANORE BUTZ, BEN CARLIN, CAROLYN CLARK, JANE COLE, GRAYCE FINGER, NANCY HAMILTON, OLIVER HEATWOLE, ANNE HOLDSWORTH, KONSLYNNIETTA HUTCHINSON, ELEANOR JOHNSON, KATHERINE LIVINGSTON, BARBARA SHEFFER

**European Office:* Lime Tree Farm, East Hagbourne, Berkshire, England. Telephone Didcot 3317

Advertising Staff

<i>Director</i>	<i>Production Manager</i>
EARL J. SCHERAGO	ROSE MARIE ROMAGNOLO
<i>Advertising Sales Manager:</i> RICHARD L. CHARLES	
Sales: New York, N.Y., 11 W. 42 St. (212-PE-6-1858): ROBERT S. BUGBEE	
Scotch Plains, N.J., 12 Unami Lane (201-889-4873): C. RICHARD CALLIS	
Medfield, Mass. 02052, 4 Rolling Lane (617-359-2370): RICHARD M. EZEQUELLE	
Chicago, Ill. 60611, 919 N. Michigan Ave., Room 426 (312-DE-7-4973): HERBERT L. BURKLUND	
Los Angeles 45, Calif., 8255 Beverly Blvd. (213-653-9817): WINN NANCE	

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci. Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. ADVERTISING CORRESPONDENCE: Rm. 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE 6-1858.

John Edward Fogarty

When John Fogarty entered Congress in 1941, at the age of 27, his background included a high school education and 10 years as a brick-layer and union official. At his death, on 10 January, he was highly respected for his knowledge of many aspects of public health and his effectiveness in fostering medical research. He had received more than 100 awards, including many honorary degrees.

Representative Fogarty began service on the Labor and Federal Security Agency Subcommittee of the House Appropriations Committee in 1947 and became subcommittee chairman in 1949. In the first year of his service on the subcommittee, the total budget of the National Institutes of Health was about \$3 million. In the current year the NIH budget approximates \$1.4 billion. Accomplishing this great expansion was not easy. Traditionally the Appropriations Committee seeks to hold down expenditures. Often Fogarty placed his career in jeopardy by clashing with the committee chairman, then Clarence Cannon.

Fogarty never wavered in his belief in the value of medical research, and he fostered its expansion with single-minded zeal. His resources included great energy and unusual political sagacity. Reports of the hearings of his subcommittee reveal a master craftsman at work patiently building an extraordinarily good case for expanded support of medical research. In his efforts Fogarty had an effective partner in Senator Lister Hill. On occasions when House leadership succeeded in thwarting Fogarty, Senator Hill obtained support for increased appropriations in the Senate. Other important allies were James Shannon (director of NIH), Mary Lasker, and the medical research community. Possessing a combination of charm, brains, energy, and money, Mrs. Lasker has had access to all recent Presidents and can mobilize important support for medical research. From the medical community Fogarty could depend on such well-known expert witnesses as Paul Dudley White, Karl Menninger, Sidney Farber, and Michael De Bakey.

Fogarty built skillfully and well. He understood the vital relationship between the support of fundamental science and practical objectives. He built for permanence. His methodical care year after year won for him and the programs he fostered broad support in Congress. The *Congressional Record* for 19 January 1967 provides an indication of the respect he enjoyed. Tributes to him by more than 100 of his colleagues are recorded there. Many of the words of praise are devoted to the enduring value of his efforts in expanding medical research.

There is considerable sentiment in Congress to implement an idea that Fogarty advanced in September 1963:

... I should like to see a plan to bring into being at Bethesda a great international center for research in biology and medicine dedicated to international cooperation and collaboration in the interests of the health of mankind as so boldly envisaged by the President. This center would encompass conference facilities, laboratory and study space, and living quarters to permit the assembly for discussion, study, and research of the outstanding health scientists of the world. I visualize this center associated with the great facilities of the National Institutes of Health and the National Library of Medicine as representing the visible and tangible embodiment of this Nation's devotion to the use of science for peaceful purposes and the good of mankind.

Congressman Laird (R-Wis.), on 18 January 1967, spoke for many Congressmen (and scientists) when he stated, "I can think of no more fitting and lasting tribute to this great humanitarian than the establishment by this Congress of such a center—the John E. Fogarty International Center for Advanced Study in the Health Sciences. Not only will such an institution be a living embodiment of the spirit and aspirations of John Fogarty, but it will serve a needed and valuable role in securing the progress of science in the cause of the well being of all mankind."

—PHILIP H. ABELSON

NEW MODEL 3375 TRI-CARB® LIQUID SCINTILLATION SPECTROMETER...



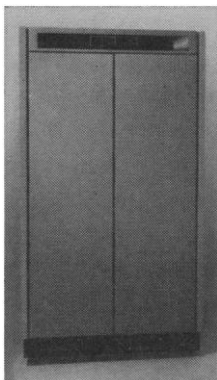
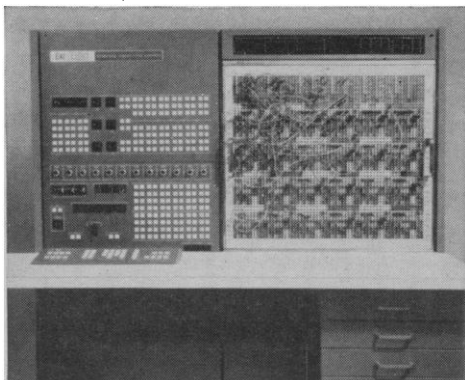
with these exclusive features:

- Push-button channel selection for single, double or triple label experiments; front panel adjustment permits normalization as required to retain factory-optimized counting conditions
- Patented, volume-independent Automatic External Standardization using a *compound source* of Americium-241 and Radium-226; choice of Ratio or Count methods of standardization
- Patented, "3+2" counting channel configuration; three completely independent channels of pulse-height analysis, each with precision gain control and continuously adjustable discriminators... *two additional* channels exclusively for Automatic External Standardization
- "On-line" electronic computation with continuous display of count rate and percent standard deviation; push-button selection of desired display, and full print control; complete selection of all possible Channel Ratios
- IBM Selectric Typewriter data presentation on continuous pre-printed forms... easy to read, organize and file

Model 3375 gives you these exclusive features and the latest, reliable integrated circuitry, plus the outstanding performance that is typical of all new Tri-Carb Spectrometer Systems. For complete information see your Packard Sales Engineer or write for Bulletin 1057U to Packard Instrument Company, Inc., 2200 Warrenville Road, Downers Grove, Illinois 60515.

Packard

HOW TO USE SIMPLE ADDITION TO SOLVE COMPLEX PROBLEMS:



680+693+640+SOFTWARE=690

THE 690 is the new EAI hybrid computing system. Now you can get a working hybrid computing system by adding two EAI computers and an interface together and loading the software into memory.

The new EAI hybrid has an analog computer ready and waiting for a digital that was designed for the hybrid hookup . . . where the interface was designed to take maximum advantage of both computers' features . . . where the software is standard, already written and tested and ready to load. In short, a working hybrid computing system that's still more than the sum of its parts, but is created by straightforward interconnection.

This simple addition means a single responsibility for the system. It also means reliable software maintenance and updating, as well as the advantages of other laboratories using the standard 690 systems.

It means you can start toward a hybrid system from either an analog or digital computer and expand

in orderly fashion without running the risk of "experimentation" in your system.

The four parts of the EAI 690 that you add together were designed together to deliver more computational return on your invested dollar.

First in the addition is the EAI 680 analog computer, embodying over a decade of EAI experience. It's a sophisticated 156-amplifier machine, which even in its basic form includes a healthy complement of digital logic and control.

Then there's the EAI 640 digital computer. It was designed from the start with an extremely flexible input-output structure so that it is integrated easily into a hybrid configuration.

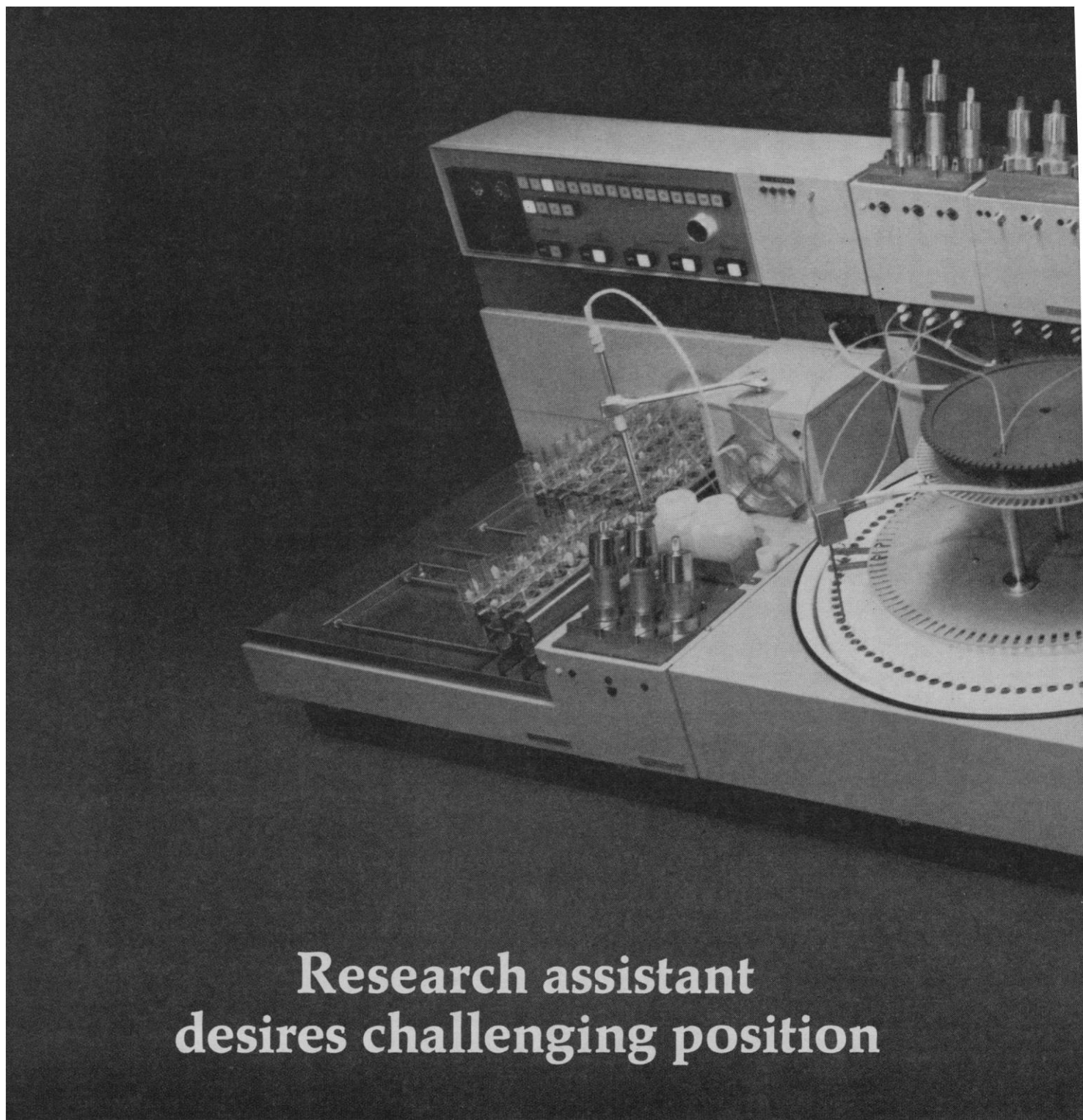
Between them is the EAI 693 which functions as both a data converter and comprehensive monitor and control interface unit for the system.

Finally, there's the 690 software which solves problems rather than

creates them. It includes hybrid FORTRAN, HYTRANSM, Operations Interpreter, Hybrid Debug, Hardware Diagnostics and a Hybrid Subroutine Library.

All this adds up to a superior capability for scientific problem-solving. You get high-speed analog capability for the simulation of system dynamics combined with the memory, logic and high-precision numerical capability of the digital computer. The engineer, the scientist, the designer is still "part of the loop", still capable of direct interaction with the program to add his own creative input.

We'll be happy to send a complete technical description of the EAI 680 analog computer or the EAI 640 digital computer, as well as the EAI 690 hybrid computing system. That way we can also get across what we mean by the EAI backup services, such as training, maintenance and five computation centers with standard systems, as well as total system responsibility, software maintenance and the users library. Write today.



Research assistant desires challenging position

WARNER-CHILCOTT'S ROBOT CHEMIST—The Automated Test Tube — wants a job performing wet chemical analyses in your laboratory.

Make the ROBOT CHEMIST your assistant, and it will give you:

1) MORE ACCURATE ANALYSES. The ROBOT CHEMIST minimizes human error. It accurately pipettes and delivers samples as small as 20 μ l. Its precision micrometer-controlled pumps for reagent dispensing and an incubation turntable with high thermal

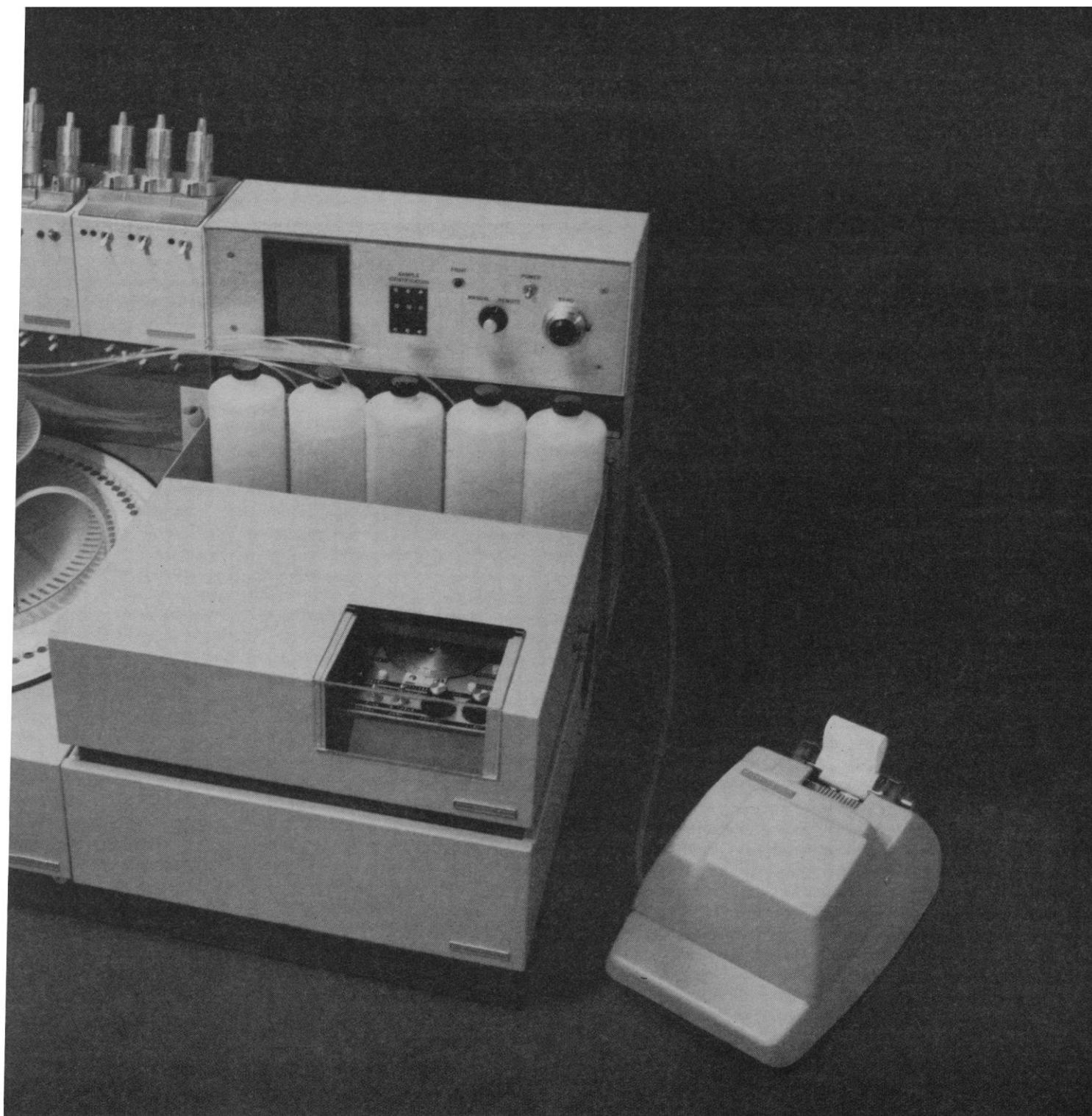
stability—combined with a dual beam spectrophotometer—give you high accuracy and reproducibility.

2) MORE DEPENDABLE RESULTS. The ROBOT CHEMIST can perform 120 wet chemical determinations per hour if you desire. That means you can increase the number of tests performed and thus achieve a higher certainty of accumulated data.

MEET THE AUTOMATED TEST TUBE

The ROBOT CHEMIST is an instrument that performs as your assistant (except that it never gets tired or leaves you for another position). It samples, dilutes,

See you at the Pittsbu



adds and mixes reagents, incubates, reads and prints out a test result. Then, it rinses, washes, dries itself, and gets ready for the next sample. All at your command.

HOW VERSATILE IS THE ROBOT CHEMIST?

It can perform virtually any colorimetric determination, including glucose, urea, calcium, total protein, and enzymes... using your **own** analytical procedures.

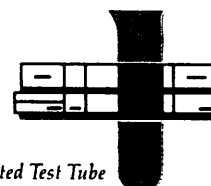
BUY OR LEASE

Purchase your hard-working ROBOT CHEMIST outright or lease it for as little as \$325 per month (with the first month's rent sufficient for delivery).

Conference. Booth #123

For more information and specifications, please write Warner-Chilcott Instruments Division, 200 South Gar-rard Blvd., Richmond, California 94804.

**WARNER-CHILCOTT
INSTRUMENTS DIVISION**

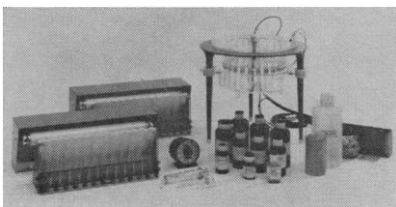


The Automated Test Tube

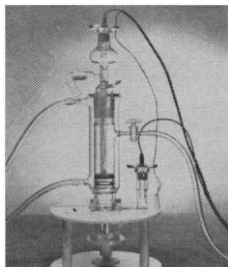
If you're separating, analyzing, collecting and recording, chances are you can do it better with Canalco instruments.

for electrophoresis . . .

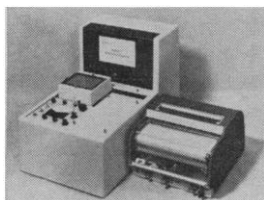
Analytical Disc Electrophoresis offers fast, extremely sensitive separations of 20-30 human serum fractions, equally remarkable resolution of enzymes, polynucleotides, hormones and other protein mixtures. Requires only micrograms of sample. Various models accommodate up to 24 simultaneous separations in one bath assembly, come complete with all chemicals and accessories. Trial Kit—for introduction and classroom training. Models 6 and 66—compact bath assemblies for economical processing of 6 or 12 samples. Models 12 and 24—larger baths, for 12 or 24 samples, to aid the high-workload user. (Model 24 shown.) Regulated current supplies, safety-interlocked, also available. Write for Bulletin DE-S11.



Prep-Disc Electrophoresis applies the high-resolution capabilities of Disc Electrophoresis to the large-scale separation of up to 500 milligrams of material. Unique adjustable elution space, full gel visibility and prepurified and tested chemicals combine to provide dependable, artifact-free runs. Complete selection of components includes basic apparatus, coolant supplies, flow monitors, fraction collectors and power supplies. Write for Bulletin PD-S11.

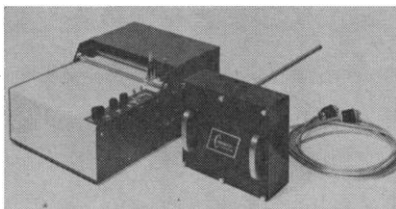


Microdensitometers for all modern electrophoresis techniques. Particularly accurate for resolving and recording fine bands in Disc Electrophoresis. Three Models: D, for scanning with common lab recorders; E, contains its own high-speed recorder for fastest scanning; and F (shown), with 10" wide chart for accurate presentation of even weakest bands. Write for Bulletin MC-S11.

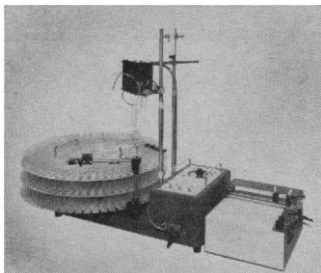


for flow analysis and fraction collection . . .

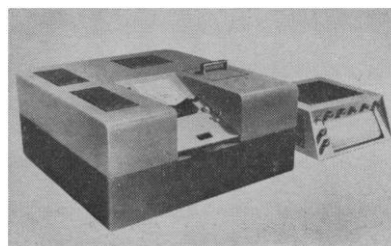
New ultraviolet flow monitors with wide-chart recorders and optional automatic scale expansion give unsurpassed sensitivity for both proteins and nucleotides in column chromatography. The Wide-Track 85 Series includes four models, for single-cuvette (non-absorbing solvents) or dual-cuvette (baseline-compensating for gradient elutions) analysis, with either manual or automatic expansion. All four models incorporate reference phototube and ratio circuitry for stability against source fluctuations. Models S and D are single- and dual-cuvette, with manual scale expansion; Models SA and DA add automatic scale expansion. Model DA shown. Write for Bulletin WT-S11.



Versatile, reliable Automatic Fraction Collector collects up to 240 measured amounts of sample, in any one of three ways; volumetric siphoning, timed flow, or drop counting. Unique distributor head permits simultaneous collection of fractions from two, three or four columns or other sources. Write for Bulletin FC-S11.

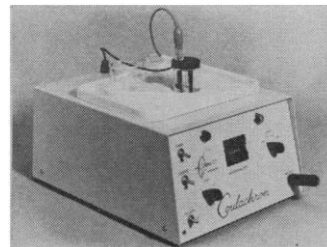


Canalco's Model M2 UV-Visible Spectrophotometer is especially designed for automated analysis of column effluents or other flowing samples, as well as for general-purpose spectroscopy. Double-beam chopped-light system



using high-efficiency grating monochromator can monitor selected wavelengths or scan selected spectral ranges on command, recording all absorption peaks that exceed selected levels. Optional features include selectable scanning speed, automated scan, linear absorbance presentation, wide-range lamps and photomultipliers. Write for Bulletin M-S11.

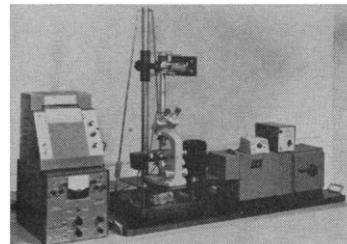
for titration . . .



The Coulachron Automatic Titrator and optional Research Panel generates its own titrants, providing fast analysis of many materials of clinical and industrial interest, without standard solutions. Only microliter samples are required for analysis, usually better than 0.5% accurate. Gives digital readout directly in microequivalents. Write for Bulletin CR-S11.

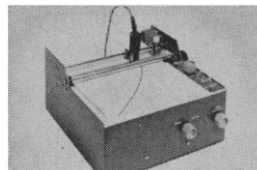
for micro spectrophotometry and microdensitometry . . .

Canalco's Dual Beam Ultra-Microspectrophotometer can be used for either single or dual beam measurement. Advanced engineering design eliminates



error due to light or line fluctuation; does away with repetitive readings; automates 1./1. computation. System accuracy better than 0.2%. Exclusive reference monitor automatically compensates for light source fluctuations. Optional modules available for scanning densitometry, quantitative microfluorescence and interference microscopy. Write for Bulletin UM-S11.

and for related areas . . .



Back-Track is a versatile recorder/curve-follower which records continuously-changing variables for replay. Accepts any 8½" width blank paper either in sheet or roll. Write for Bulletin BT-S11.

Photometric Leak Detector and Vacuum Gauge monitors any change in pressure or characteristics of gas present through ionization process. Small, lightweight, inexpensive . . . Nitro Freeze, a compact, liquid nitrogen freezer for freeze-preserving living biological materials. Electron optical components and high voltage power supplies.



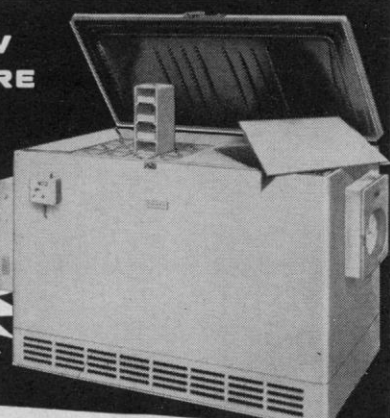
CANAL INDUSTRIAL CORPORATION
5635 Fisher Lane
Rockville, Maryland 20852/(301) 427-1515

Sales and Service Offices in • Boston • Chicago • Cincinnati • Denver • Houston • Los Angeles
• Minneapolis • New York • Philadelphia • San Francisco • St. Louis • Washington, D.C.

REVCO

ULTRA-LOW TEMPERATURE CABINETS

Temperatures to **-140°F.**
(-96°C)



for

- RESEARCH
- STORAGE
- SEASONING
- TESTING

- 1½ to 22 cu. ft. capacity
- Pulldowns from ambient to -140°F.
- Precision accuracy to ±1°F. cycle control
- Full year warranty on parts, workmanship, and preauthorized service
- Indicator-Controllers, Alarm Systems, 7 day recorders, casters, etc., available
- Storage magazines and canisters
- Prompt delivery
- Envious performance record—ask for list of customers served

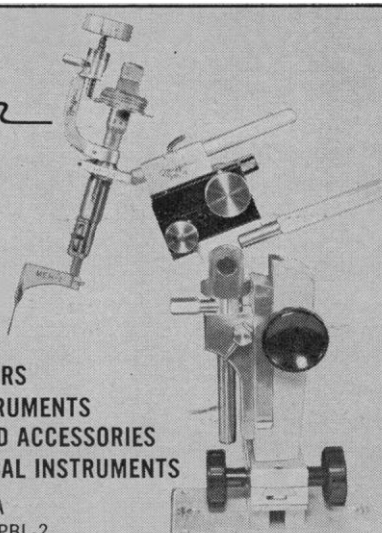
For your free Revco File Folder showing all Revco low temperature cabinets, write Revco, Dept. S-27

6305

INDUSTRIAL PRODUCTS DIVISION
REVCO INC.
Deerfield, Michigan

The Ultimate in Low Temperature Cabinets

Pfeiffer
RESEARCH INSTRUMENTS



- MICROMANIPULATORS
- STEREOTAXIC INSTRUMENTS
- ANIMAL TABLES AND ACCESSORIES
- NEUROPHYSIOLOGICAL INSTRUMENTS

*Photograph shows HP-2A held in utility chuck of PBL-2.

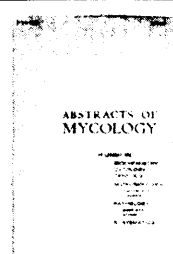
HP-2A Pfeiffer ultra-micromanipulator; metric micrometer driven, 25 mm travel, incorporating a unique patented continuously variable reduction drive which makes possible ultra fine advance of the microelectrode. Variable from: 40 microns per revolution of drum, to 0 microns per revolution. This micromanipulator has been successfully employed in intracellular studies of small neurons in thalamus and cortex.

*This micromanipulator is covered by patent Nos. 2,891,416 & 3,199,362

For complete details, write for catalog 1-S

BERYLLIUM MANUFACTURING CORP.
253 W. Merrick Rd. • Valley Stream, N.Y. 11580 • Tel: 516 LO 1-9330

RESEARCH INSTRUMENTS TO INDIVIDUAL SPECIFICATIONS
FOR CONSULTATION: **ANDREW PFEIFFER**
Whippoorwill Road, Box 385, R.F.D. 4, OLD LYME, CONN. 06371
Phone 203 GE 4-7788



BIOSCIENCES INFORMATION SERVICE
OF BIOLOGICAL ABSTRACTS

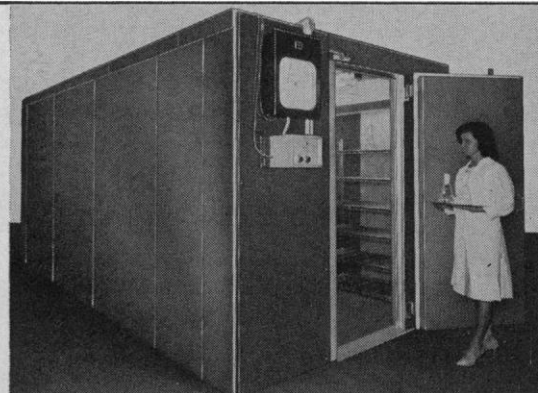
PRESENTS
a customized information service

ABSTRACTS OF MYCOLOGY

Published with the advice and cooperation of prominent mycologists around the world.

- Abstracts of the current literature in mycology:
Over 6000 journals reviewed to obtain the material.
Reports from 91 countries screened.
Estimated 5000 abstracts per year.
- Abstracts indexed for your easy reference:
Subject Finder Index to locate types of studies.
Author Index to locate colleagues' work.
Systematic Index to locate studies by taxonomic categories.
- Abstracts in convenient format for supplementing personal files:
Printed on only one side of the page.
Page ruled for cutting to 3" x 5" card size.

You can subscribe to 12 issues of *Abstracts of Mycology* for a limited time in this first year for only \$22.50. Check or money order should be sent to *Abstracts of Mycology*, 2100 Arch Street, Philadelphia, Pa. 19103.



New Environmental Rooms & Incubators

For cultures, biologicals, animal rearing, food sampling, etc., Tenney space age technology now produces a new line of environmental rooms and incubators. These new rooms and incubators give precise temperature control from -40° C to +60° C in one of four ranges. They range in size from 2' x 3' x 5' to 12' x 18' x 7'. Write today for complete information.

 **Relialab**
by **Tenney**
ENGINEERING, INC.
1090 Springfield Road • Union, New Jersey 07083

225

scribed a steroid-hydroxylating system in adrenal mitochondria which contain, in addition to the components in the liver microsome system, a ferredoxin-like protein with a molecular weight of 22,000 and two inorganic iron and two acid-labile sulfur atoms per mole of protein. Careful electron spin resonance studies conducted by H. S. Mason excluded the presence of non-heme iron in preparations of microsomal liver hydroxylase. Thus, characteristic patterns of electron flow in the different subcellular organelles participate in hydroxylation in these tissues.

The biological role and the chemical nature of the copper-containing phenylalanine hydroxylase were reviewed by S. Kaufman. This enzyme uses molecular oxygen to convert phenylalanine to tyrosine, but, unlike other mono-oxygenases, it utilizes tetrahydrobiopterin rather than reduced pyridine nucleotide as a reductant. Purified phenylalanine hydroxylase contains no inorganic or heme iron; instead it contains catalytically essential copper atoms, which undergo oscillation in charge during the catalytic process. A. Kertesz demonstrated that polyphenoloxidase exists as a tetramer containing four copper atoms per molecular weight of 128,000; the tetramer can be converted to a catalytically active dimer by dodecyl sulfate.

Crystalline salicylate hydroxylase, lysine oxygenase, and imidazole acetate oxygenase are monooxygenases which contain no metals but do contain FAD. Although the nature of the interaction of these enzymes with oxygen is unknown, participation of the flavin moiety in the catalytic reaction is demonstrable by spectrophotometry. S. Yamamoto has shown that, under anaerobic conditions, the substrate reduces the FAD which then undergoes reoxidation by molecular oxygen. Insight into the mechanism of the conversion of salicylate to catechol by salicylate hydroxylase was provided by M. Katagiri, who demonstrated the formation of E-FAD-S and E-FADH-S (E, protein moiety of enzyme; S, salicylate) complexes during the catalytic reaction. Thus, the activation of oxygen, before its incorporation into organic molecules, may occur without the participation of metals.

Some studies were concerned with the reaction mechanism of the dioxygenases. Metapyrocatechase, pyrocatechase, protococatechuate-4,5-oxygenase, and protococatechuate-3,4-oxygenase were all purified to the crystalline state by M. Nozaki from species of *Pseudomonas*

cultured with the appropriate carbon source to induce the enzyme of interest. Metapyrocatechase has a single ferrous iron atom per mole enzyme; it seems to be bound to the enzyme with a mercaptide linkage. Pyrocatechase has two iron atoms per molecule of enzyme; addition of substrate to the enzyme under anaerobic conditions leads to modifications in absorption spectra and ESR signals suggestive of combination of the substrate with the ferric iron, which is subsequently reduced to the ferrous state. Admission of oxygen reversed these changes in spectra and ESR signals, an indication that the iron of native pyrocatechase might be in the trivalent state, but that it undergoes reduction and reoxidation during the enzyme-catalyzed oxidation of catechol.

The isolation and crystallization of 3,4-dihydroxyphenylacetate-2,3-oxygenase from induced *Pseudomonas* was described separately by both Y. Takeda and S. Senoh. The sulfhydryl reagents, *p*-chloromercuribenzoate and *o*-phenanthroline, competitively inhibit enzyme activity by displacing ferrous iron. Senoh demonstrated that the loss in catalytic activity following the addition of six equivalents of *p*-chloromercuribenzoate to the enzyme was accompanied by the release of six ferrous atoms and concomitant dissociation of the enzyme into three monomers. Thus, thio-iron linkages are concerned with both maintenance of structural integrity and catalytic function. From their ESR studies S. Senoh and T. Yamano contributed further insight into the catalytic mechanism of action of this enzyme. Addition of substrate and oxygen to the ferrous-enzyme results in the transient formation of an enzyme-Fe³⁺-substrate-O₂ complex.

P. Feigelson reported on the catalytic mechanism and activation of purified *Pseudomonas* tryptophan oxygenase (tryptophan pyrrolase). Preparations of this dioxygenase, purified to specific activities above 10, contain both copper and tightly bound ferriprotoporphyrin. The heme participates actively in the catalysis; the heme iron undergoes oscillation in charge, being successively reduced by tryptophan and reoxidized by oxygen. Both trivalent and divalent forms of the enzyme were catalytically active, and latent enzyme preparations could be activated without net reduction of the ferriprotoporphyrin component. The heme component of the purified *Pseudomonas* tryptophan pyrrolase was converted to the pyridine

can't find
it?



ask MC&B

Looking for a laboratory chemical that's not commercially available? A new item, or a familiar one made to a higher standard of purity? We're interested—maybe we can produce it for you, or suggest a source. We'd like to hear from you. Write us at 2909 Highland Ave, Norwood, Ohio 45212 or phone (513) 621-3220.

MC/B
Division of The Matheson Company Inc.

Norwood, Ohio; East Rutherford, N.J.; Los Angeles.

GREATER ACCURACY • VERSATILITY



Electrothermal® MARK II MELTING POINT APPARATUS

TEMPERATURE
RANGE:
20° to 360° C

MARK II
Advanced Model
as described
\$295

MARK I
Standard Model
without fine
temperature
control and
instant heat
booster
\$240

OPERATION: Uses established technique of melting samples at the bottom of vertical capillary tubes. Up to three samples are placed in the shielded low heat capacity metal block, illuminated and viewed through a deep fixed focus lens.

MELTING POINT BLOCK: Central vertical hole receives the thermometer, and three holes equidistant from thermometer bulb receive the capillary tubes. A borosilicate glass surrounding sleeve eliminates air currents.

HEATING: The heating element yields infinitely variable rates of heating through coarse and fine control. A press button booster can over-ride the controls for maximum heat input when required.

ILLUMINATION AND VIEWING: Light from two lamps is directed into block for maximum clarity with minimum glare.

THERMOMETER: Specially designed to achieve the accuracy required over the entire range of 20° to 360° C. Specially-treated glass virtually eliminates risk of zero migration. Immersion of thermometer in block has been standardized at 34 mm. and allowance made for emergent stem during calibration.

Write for full information
and name of your local dealer

ELECTRO-THERMAL SALES CORP.

Dept. S-300 Northern Boulevard
Great Neck, N.Y. 11021
Phone 516-466-8218

hemochrome and spectrophotometrically identified as ferriprotoporphyrin IX by Y. Ishimura. If the specific activity is 5.8 and the molecular weight is 150,000, then each mole of enzyme contains one mole of heme and 0.09 to 0.60 mole of copper. Ishimura concludes that the amounts of copper found were too small for copper to be considered a constituent of the enzyme. Resolution of the controversy concerning the presence of copper in tryptophan oxygenase awaits isolation of the enzyme in a homogeneous state.

Possible theoretical mechanisms for the oxygen-activating functions of horseradish peroxidase were considered by I. Yamazaki. He postulated that combination with peroxidase and subsequent reduction bestows upon oxygen the potential for multitudinous hydroxylation and oxidative reactions. He further purposed that, for catalysis to proceed, horseradish peroxidase and oxygenases, such as tryptophan oxygenase, must first catalyze the one-electron reduction of oxygen. These theoretical considerations may be compared with the reaction mechanism, empirically derived from tryptophan oxygenase, which involves electron transfer from tryptophan through heme to oxygen, resulting in activation of these substrates and their subsequent interaction.

The nature of the activated form of oxygen which serves as the hydroxylating agent was discussed by H. Staudinger and L. E. Orgel from experimental and theoretical viewpoints, respectively. Staudinger compared the stereochemical nature of the products of various nonenzymic model systems which generated hydroxyl radicals or oxygen atoms with those resulting from the enzymatic hydroxylation of the same substrates. In each of several instances, model systems generating oxygen atoms, but not those generating hydroxyl radicals, yielded hydroxylated products qualitatively similar to those formed by the microsomal hydroxylase system. Thus, it would seem that hydroxylations may be mediated by the generation of oxygen atoms, not by free hydroxyl radicals. Orgel reviewed the electronic nature of the high and low spin states of iron and factors influencing their ESR spectra. He also discussed theoretical and practical limitations and even the wisdom of attempting to distinguish between the various interconvertible complexes of iron and oxygen, such as $\text{Fe}^{+2} \rightleftharpoons \text{O}_2 \rightleftharpoons \text{Fe}^{+3} \rightleftharpoons \text{O}_2^{-1} \rightleftharpoons \text{Fe}^{+4} \rightleftharpoons \text{O}_2^{-2}$. He emphasized

PHE- NOM- ENA

NATURAL AND DRUG INDUCED

TWINS AND TWIN RELATIONS

by Helen L. Koch

A new look at one of nature's most revealing experiments, based on scientific data gathered from intensive study of ninety dyads — both identical and fraternal, same sex and opposite sex — in comparison with a control group of singletons. Dr. Koch's evidence challenges some allegations about twin behavior and raises many questions for further research. \$6.95

MESCAL AND MECHANISMS OF HALLUCINATIONS

by Heinrich Klüver

This book brings back into print the complete text of *Mescal*, published in 1928, with an additional paper on the "Mechanisms of Hallucinations" and a new author's preface. "Heinrich Klüver has pioneered so many trails that it will be no surprise to discover that (many years ago) he was emphasizing the importance of mescaline to psychology in an admirable book."—*Annals of the New York Academy of Sciences* \$3.95



75th Year

UNIVERSITY OF CHICAGO PRESS

Chicago and London

In Canada:

University of Toronto Press

that in metallo-oxygen complexes, the total number of electrons within the complex may be determinable but, since the charge distribution may vary continuously, it is frequently pointless to assign a discrete structure in which a particular electron distribution between the metal and the oxygen is designated.

Profound insight into the regulation and catalytic mechanisms of the oxygenases awaits future empirical and conceptual advances. It is evident, however, that this colloquium has richly contributed to these ultimate goals. The proceedings of this conference have been published in English as "Biological and Chemical Aspects of Oxygenases," edited by K. Bloch and O. Hayaishi, and may be purchased for \$6.95 from Maruzen Company, 6 Tore Nichome Nihongashi, Chuoku, Tokyo, Japan.

PHILIP FEIGELSON
College of Physicians and Surgeons,
Columbia University, New York

Forthcoming Events

February

17-18. American Psychopathological Assoc., New York, N.Y. (F. A. Freyhan, Room 1006, Cronin Research Bldg., St. Vincent's Hospital, 153 W. 11 St., New York 10011)

17-18. Thyroid, 3rd Midwest conf., Columbia, Mo. (Executive Director, Continuing Medical Education, M-176 Medical Center, Univ. of Missouri, Columbia)

18-22. American Acad. of Allergy, 23rd annual mtg., Palm Springs, Calif. (Executive Secretary, 756 N. Milwaukee St., Milwaukee, Wis. 53202)

19-23. American Inst. of Mining, Metallurgical and Petroleum Engineers, annual mtg., Los Angeles, Calif. (Executive Secretary, 345 E. 47 St., New York 10017)

19-25. Biochemistry, Chemical Inst. of Canada, conf., Ste. Marguerite, P.Q. (General Manager, 48 Rideau St., Ottawa 2, Ont.)

20-25. American Acad. of Forensic Sciences, mtg., Honolulu, Hawaii. (S. R. Gerber, 2153 Adelbert Rd., Cleveland, Ohio 44106)

21-24. Offshore Exploration, conf., Long Beach, Calif. (M. Richardson, Box 88, 2516 Via Tejon, Palos Verdes Estates, Calif. 90274)

22-24. Biophysical Soc., 11th annual mtg., Houston, Tex. (A. Cole, M. D. Anderson Hospital, Univ. of Texas, Houston 77025)

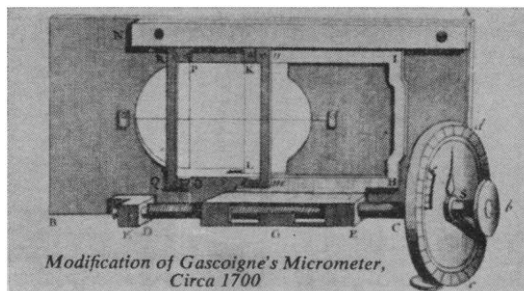
23-25. American Physical Soc., mtg., Austin, Tex. (K. K. Darrow, American Physical Soc., Columbia Univ., New York 10027)

26. Psychoanalysis, 5th annual conf., New York, N.Y. (D. M. Kaplan, 175 W. 12 St., New York 10011)

26-2. International Anesthesia Research

3 FEBRUARY 1967

VICKERS Excellence... The Image-Splitting Measuring Eyepiece



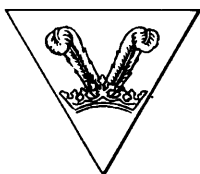
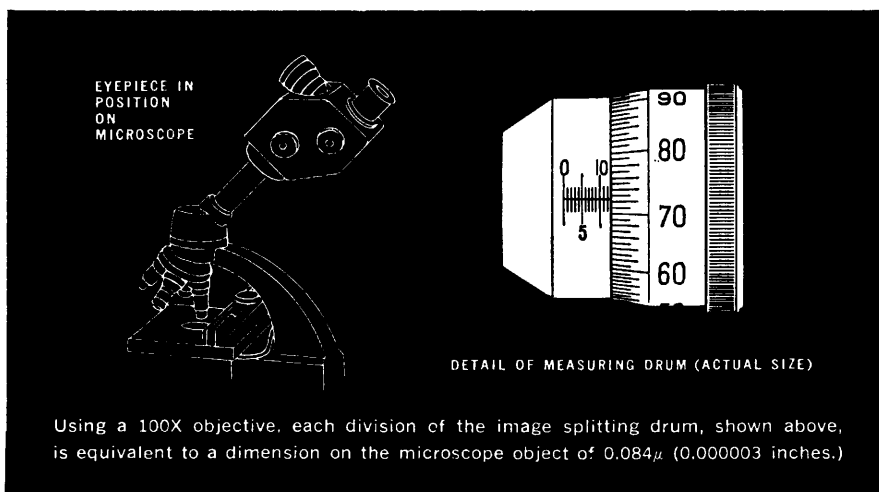
Modification of Gascoigne's Micrometer,
Circa 1700

Three hundred and twenty-seven years ago, William Gascoigne of Yorkshire constructed a micrometer measuring device suitable for use in the relatively crude optical instruments of that day. Since 1639 many refinements have been made upon

Gascoigne's achievement — but these were refinements only. The first basic advance in microscope measurement technique occurred only recently — in 1962 — with the introduction of the Vickers-A.E.I. Image-Splitting Measuring Eyepiece. ▼ The image splitting technique makes obsolete (for nearly all purposes) Gascoigne's family of filar micrometers and eyepiece graticules. The image splitter is much more accurate. It is faster and more convenient to use. It has an entirely unique capability for instantaneous, multiple comparative measurements. ▼ Nearly one thousand Vickers Image Splitters are now being used by your colleagues and competitors. Here are just a few of the things it can do for you.

- Measure with accuracies up to better than 0.1 micron (0.000004")
- "Dial in" sizes so that objects anywhere in the microscope field can be checked for conformity — *without measurement*.
- Make particle size analyses — *without measurement*.
- Measure moving or vibrating objects.
- Measure without the possibility of parallax error or errors due to microscope instability.

If accurate and fast measurement techniques are essential in your work, please let us know. We will immediately send our descriptive brochure.



Member of the Vickers Group

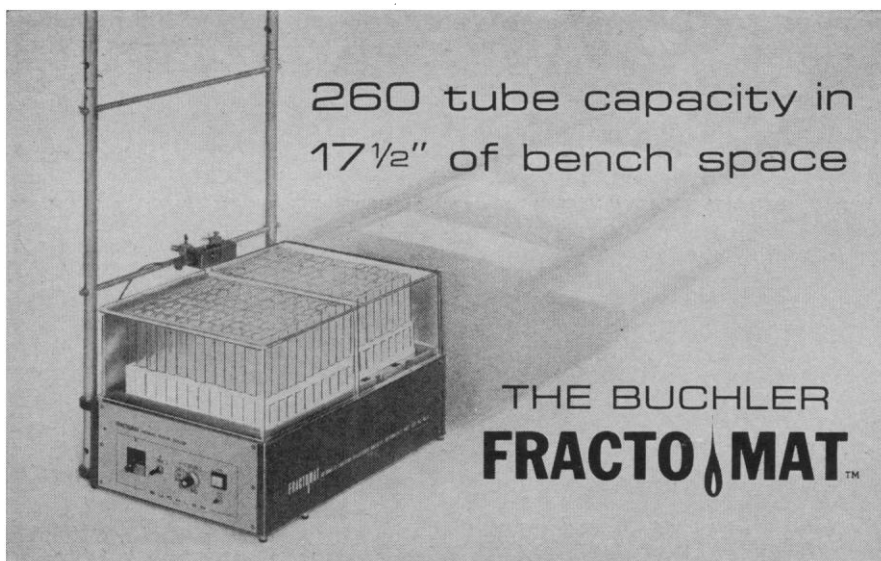
VICKERS

INSTRUMENTS, INCORPORATED

Successors to Cooke, Troughton & Simms, Inc.

15 WAITE COURT, MALDEN, MASS. 02148 • (617) 324-6666

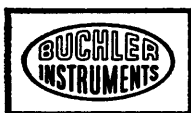
IN CANADA: 1570 MIDLAND AVE., SCARBOROUGH, ONTARIO • (416) 751-4360



linear fraction collector

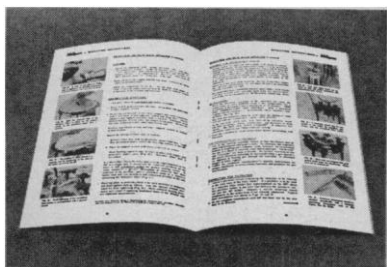
FRACMAT is one of the most compact fraction collectors available, yet offers features not found in larger units. It provides drop, time and volume (syphon or photoelectric) collection directly into an unlimited number of test tubes. A safety teflon valve prevents stray drops falling between test tubes or loss of sample due to power failure. Adapters available for micro-collection.

Request Buchler Bulletin No. S-3-4200



LABORATORY APPARATUS • PRECISION INSTRUMENTS
BUCHLER INSTRUMENTS, INC.
1327 18TH STREET, FORT LEE, NEW JERSEY 07024

discover

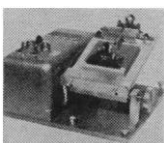


...techniques for using Millipore filters to sterilize pharmaceutical and biological solutions at high flow rates, plus a technique for sterility testing antibiotics in accordance with FDA regulations. Write for a copy of Manual ADM-20, "Sterilizing Filtration and Sterility Testing". 32 pages. Available free of charge from Millipore Corporation, Bedford, Massachusetts 01730.

Millipore®

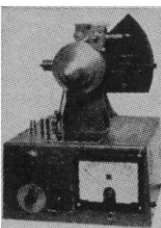
COEFFICIENTS OF FRICTION OF

METAL, PAPER, PLASTICS,
RUBBER, TAPE, YARN, ETC.



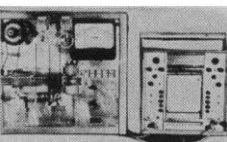
Model CS-152

Slide Angle Tester was developed by St. Regis Paper Co. and provides coefficients of static friction by indicating the critical angle at which the test block slides down a motor driven plane.



Model CS-131

Frictionometer was developed by Bell Telephone Laboratories and measures coefficients of friction through the velocity spectrum from static to 500 cm per second.



Model CS-151

ATLAB Yarn Friction Tester was developed by Atlas Chemical Industries, Inc. and provides friction measurements of likely prospects in search for finishes and lubricants with optimum yarn and fiber processing qualities from 0.1 to 40,000 cm per minute.

Brochures and Price Upon Request

CUSTOM SCIENTIFIC INSTRUMENTS, Inc.
P.O. Box A WHIPPANY, N.J. 07981

Soc., 41st congr., Bal Harbour, Fla. (Executive Secretary, 227 Wade Park Manor, Cleveland, Ohio 44106)

27. **Thermoanalysis**, Chemical Inst. of Canada, symp., Toronto, Ont. (H. G. McAdie, Ontario Research Foundation, Toronto, Ont.)

27-1. **American Astronautical Soc.**, mtg., Huntsville, Ala. (S. S. Hu, Northrop Space Labs., P.O. Box 1484, Huntsville)

27-1. **Fundamental Cancer Research**, 21st annual symp., Houston, Tex. (D. E. Frei, M.D., Anderson Hospital, Univ. of Texas, Houston 77025)

27-1. **Sounding Rocket Vehicle Technology**, conf., American Inst. of Aeronautics and Astronautics, Williamsburg, Va. (C. A. Sandahl, Mail Shop, 214A, NASA, Langley Station, Hampton, Va. 23365)

27-3. **Australian Dental Congr.**, 18th Melbourne. (J. M. Newton, 53 Martin Pl., Sydney, Australia)

27-3. **High Energy Physics and Nuclear Structure**, intern. conf., Rehovoth, Israel. (M. Sela, Weizmann Inst. of Science, Rehovoth)

27-3. **Membrane Structure and Function**, symp., Chemical Inst. of Canada, Ste. Marguerite, P. Q. (K. K. Carroll, Collip Medical Research Lab., Univ. of Western Ontario, London, Ont.)

28-1. **Systems Effectiveness**, 2nd conf., Los Angeles, Calif. (A. M. Wilson, Engineering Dept., Electronic Industries Assoc., 2001 Eye St., NW, Washington, D.C. 20006)

March

1-3. **Effect of Malnutrition on Mental Development, Learning and Behavior**, intern. conf., Cambridge, Mass. (Dept. of Nutrition and Food Science, Massachusetts Inst. of Technology, Cambridge 02139)

1-3. **International Particle Accelerator**, conf., Washington, D.C. (Office of Technical Activities Board, 345 E. 47 St., New York, 10017)

1-3. **Particle Accelerator**, natl. conf., American Physical Soc., Washington, D.C. (J. A. Martin, Oak Ridge Natl. Lab., P.O. Box X, 4500S, S-103, Oak Ridge, Tenn. 37830)

2-4. **Indian Ocean**, symp., New Delhi, India. (N. K. Panikkar, Natl. Inst. of Oceanography, CSIR, Rafi Marg, New Delhi)

2-4. **Nuclear Magnetic Resonance**, conf., Pittsburgh, Pa. (B. L. Shapiro, Dept. of Chemistry, Illinois Inst. of Technology, Chicago, Ill. 60616)

2-10. **Radioactive Dating and Methods of Low-Level Counting**, symp., Vienna, Austria. (J. H. Kane, Conference Branch, Atomic Energy Commission, Washington, D.C. 20545)

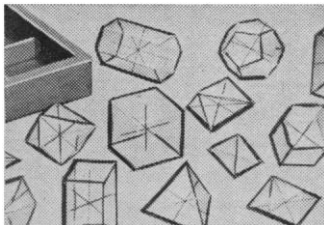
5-9. **International Gas Turbine**, conf., Houston, Tex. (Meetings Manager, 345 E. 47 St., New York 10017)

6-7. **High Speed Testing: The Rheology of Solids**, 6th intern. conf., Boston, Mass. (R. H. Supnik, Plas-Tech Equipment Corp., 4 Mercer Rd., Natick, Mass. 01760)

6-10. **Analytical Chemistry and Applied Spectroscopy**, conf., Pittsburgh, Pa. (G. L.

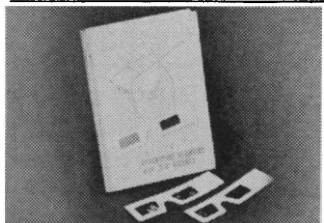
MAIL ORDER INDUSTRIAL MART UNUSUAL VALUES

Products available by mail. Money-back guarantee. Order by Number. Send check, m.o. or open account to rated firms. \$10. minimum order.



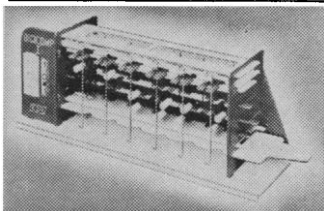
NEW... TRANSPARENT CRYSTAL MODELS

Set of 15 Basic Symmetries with Built-in Crystallographic axes. For lab study, exhibition, demonstration. Colored threads built into each precision-made hollow plastic model show position of all axes. Easily marked with china pencil. Cube measures 1 3/4" - 14 others (see at left) in proportion. Packed in poly bags separately in compartmental wooden case. \$64.00 ppd. Order #70,821W. Edmund Scientific Co., Barrington, New Jersey 08007.



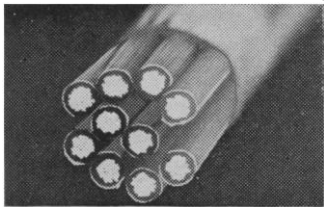
DESCRIPTIVE GEOMETRY— WITH 3-D FIGURES

Unique new text greatly simplifies subject. Original approach quickens and increases comprehension. Reader actually sees 2-color illustrations in sharp 3-D. Contains 284 anaglyph & 235 reg. figures. Forms basis for engineering drawings. Excellent help at any level of technological instruction. Covers Solid Geometry, Curves & Surfaces, Intro. to Axiometric & Perspective Drawings, etc. Imported, 196 p., 9 1/4" x 6 1/2". Two viewers incl. \$12.50 Ppd. Order #9377W. Edmund Scientific Co., Barrington, New Jersey 08007.



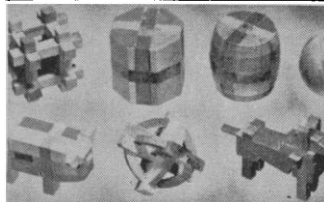
NEW MODEL DIGITAL COMPUTER

Solve problems, tell fortunes; play games with miniature version of giant electronic brains! Adds, subtracts, multiplies, shifts, complements, carries, memorizes. Colored plastic parts easily assembled. 12" x 3 1/4" x 4 1/4". Incl. step-by-step assembly diagrams, 32-p. instruction book covering operation computer language (binary system programming, problems & 15 experiments. \$5.98. Ppd. Order stock #70,683W. Edmund Scientific Co., Barrington, N. J.



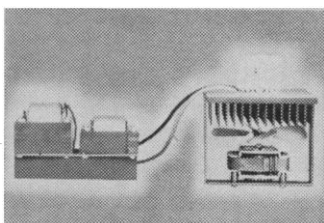
DUPONT PLASTIC LIGHT GUIDE KIT

Experiment with amazing new plastic fiber optic light guides. 1001 uses for mfrs., experimenters, hobbyists. Use for exciting new projects and products. Guides transmit light same as wire conducts electricity. Use to illuminate remote areas, multiple locations from single source, confine light to small areas, conduct sensing and control systems. Incl. 2 guides, source, lens, dyes, connectors. \$10 ppd. Order No. 70,855W. Edmund Scientific Co., Barrington, New Jersey 08007.



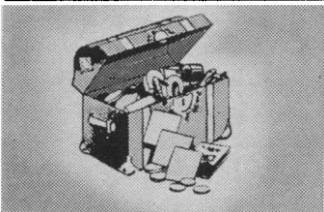
WOODEN SOLID PUZZLES

Here's a fascinating assortment of 12 different puzzles to provide hours of pleasure and stimulate ability to think and reason. Animals and geometric forms. Take them apart and reassemble them. Lots of fun for the whole family—young and old. Will test skill, patience and ability to solve problems. Order yours now. \$3.00 ppd. Order Stock No. 70,205W. Edmund Scientific Company, Barrington, New Jersey 08007.



NEW THERMOELECTRIC COOLING SYSTEM

Complete, solid state unit. Amazingly versatile. Excellent for experimental uses in industry, universities, research lab! Silent, motionless. Simple to operate. No moving parts to wear out. No fluid leakage. At 80°F. ambient temp., unit pumps up to 35 BTU/hr., yet keeps transfer bar at 25°F.—can be cooled to 13°F. Save thousands of dollars in producing prototypes, mock-ups, models. Ideal as spot cooler in instruments, electronic and other industrial equipment. Wt. 3 lbs. Full inst. \$62. Ppd. Order #70,818W. Edmund Scientific Co., Barrington, New Jersey 08007.



SCIENCE TREASURE CHESTS

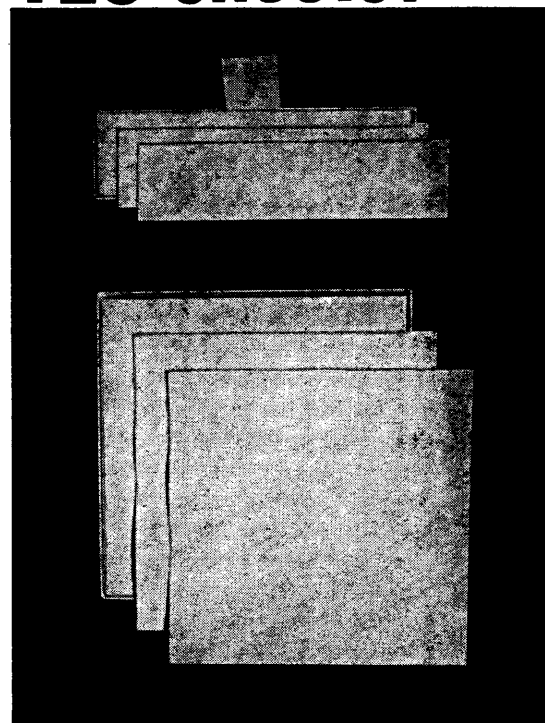
Hundreds of thrilling experiments plus a Ten Lens Kit to make telescopes, microscopes, etc. Incl.: extra powerful magnets, polarizing filters, compass, one-way mirror film, diffraction grating, many other items. \$5.50 ppd. Order Stock No. 70,342W Deluxe Chest: Above plus crystal growing kit, electric motor, molecular set, and lots more. \$10.50 ppd. Order Stock No. 70,343W. Edmund Scientific Co., Barrington, New Jersey 08007.



GIANT FREE CATALOG

Completely new 1987 edition—148 pages. Bargains galore! New categories, items, illustrations. 1,000's of buys for industry—Optics, Science, Math. On-the-job helps, quality control aids. Optics for research labs, design engineers, experimenters. Instruments for checking, measuring, to speed work, improve quality, cut costs. Hard-to-get war surplus bargains. Write for Catalog-W. Edmund Scientific Co., Barrington, New Jersey 08007.

Now—charring techniques with pre-coated TLC sheets!



FOR THE FIRST TIME flexible pre-coated TLC sheets: that may be used for charring techniques at temperatures up to 120°C. ■ that have a binder resistant to sulfuric acid ■ that have a higher capacity. The 0.2 mm. layer is twice as thick as all other previously available sheets.

In addition to the new silica gel layers, both aluminum oxide and cellulose powder are now available as Polygram sheets.

Each sheet can be cut to any desired size or shape with scissors, and all materials are offered in 20x20 and 5x20 cm. sizes.

For complete up-to-date information, request our New Data File on Pre-Coated Systems for TLC.

BRINKMANN INSTRUMENTS
CANTIGUE ROAD, WESTBURY, N.Y. 11590/ED 4-7500

TOUGH

NALGENE® LABWARE OF TEFLON* FEP

Virtually indestructible! Resists almost every known chemical, can be sterilized by most any method, unaffected by freezing or boiling temperatures. In narrow mouth Boston Rounds (4 oz.-½ gal.) and Griffin low form beakers (30-1000 ml). Toughest labware around—and ready to go to work for you.

The name Nalgene, molded right in, is your assurance of highest quality. More labs specify Nalgene Labware than all other brands of plastic labware combined. How about you? Specify Nalgene Labware from your lab supply dealer. Ask for our 1967 Catalog, or write Dept. 2702, Nalgene Labware Division, Rochester, N.Y. 14602.

*DuPont registered trademark.



NALGE
BITTER PFAUDLER CORPORATION

Carlson, Mellon Inst., 4400 Fifth Ave., Pittsburgh 15213)

6-10. **WESTEC**, 4th Western Metal and Tool Exposition and Conf., Los Angeles, Calif. (Director of Engineering Conf., 20501 Ford Rd., Dearborn, Mich. 48128)

8-10. **Viscoelastic Response of Engineering Materials**, mtg., Boston, Mass. (R. H. Supnik, 4 Mercer Rd., Natick, Mass. 01760)

8-22. **United Nations Regional Cartographic Conf.** for Asia and the Far East, Canberra, Australia. (United Nations, New York, N.Y.)

9-11. **National Medicolegal Symp.**, Miami Beach, Fla. (Miss B. Spies, Law Dept., American Medical Assoc., 535 N. Dearborn St., Chicago, Ill. 60610)

10-11. **National Conf. on Rural Health**, Charlotte, N.C. (B. L. Bible, Secretary, American Medical Assoc., 535 No. Dearborn St., Chicago, Ill. 60610)

10-12. **American Assoc. of Pathologists and Bacteriologists**, Washington, D.C. (J. Lowell Orbison, School of Medicine and Dentistry, Univ. of Rochester, 260 Crittenden Blvd., Rochester, N.Y.)

13-14. **Astronautics**, symp., Ottawa, Ont., Canada. (The Secretary, Canadian Aeronautics and Space Inst., 77 Metcalfe St., Ottawa 4, Ont.)

13-15. **32nd North American Wildlife and Natural Resources Conf.**, San Francisco, Calif. (Wildlife Management Inst., 709 Wire Building, Washington, D.C. 20005)

13-17. **International Laboratory Apparatus and Materials Exhibition**, London, England. (U.T.P. Exhibitions Ltd., 3 Racquet Ct., Fleet St., London E.C.4)

13-17. **Use of Plutonium as a Reactor Fuel**, intern. symp., Brussels, Belgium. (J. H. Kane, Div. of Technical Information, U.S. Atomic Energy Commission, Washington, D.C. 20545)

14-15. **American Astronautical Soc.** 5th Goddard Memorial Symp., "The Voyage to the Planets," Washington, D.C. (M. B. Lees, General Electric Co., Defense Programs Div., 777 14th St., NW, Washington, D.C. 20005)

14-15. **Space**, natl. mtg., Los Angeles, Calif. (D. P. Chandler, 3370 Miraloma Ave., Anaheim, Calif. 82803)

14-15. **Temperature Measurements Soc.**, 5th conf., Los Angeles, Calif. (R. A. Finch, Conf. and Exhibit Chairman, Atomics International, P.O. Box 309, Canoga Park, Calif. 91304)

15-17. **Instrumentation for the Iron and Steel Industry**, Natl. Instrument Soc. of America, 17th conf., Pittsburgh, Pa. (F. J. Barchfeld, Jones & Laughlin Steel Corp., 900 Agnew Rd., Pittsburgh 15230)

16-18. **Hydrogeology of the Northeast**, Geological Soc. of America, Boston, Mass. (M. Prinz, Tufts Univ., Medford, Mass.)

16-17. **Hypervelocity Techniques**, 5th symp., Denver, Colo. (A. A. Ezra, Research Inst., Univ. of Denver, Denver 80201)

16-19. **International Assoc. for Dental Research**, 45th general mtg., Washington, D.C. (G. H. Rovelstadt, c/o Navy Dental School, Natl. Naval Medical Center, Bethesda, Md. 20014)

17-21. **National Science Teachers Assoc.**, conv., Detroit, Mich. (Executive Secretary, NSTA, 1201 16th St., NW, Washington, D.C. 20036)

19-24. Southeastern **Surgical Congress**, Bal Harbour, Fla. (A. H. Letton, Executive Secretary, 340 Boulevard N.E., Atlanta, Ga. 30312)

19-26. Canadian-American **Medical and Dental Assoc.**, Vail, Colo. (T. Trapasso, Secretary, 816 Ashmun St., Sault Ste. Marie, Mich. 49783)

20-23. Institute of **Electrical & Electronics Engineers**, intern. conv., New York, N.Y. (A. B. Giordano, The Institute, 345 E. 47 St., New York 10017)

20. **Field-Ion Microscopy**, mtg., Cambridge, England. (Meetings Officer, Inst. of Physics and Physical Society, 47 Belgrave Sq., London S.W.1, England)

20-22. **Physical Electronics**, annual conf., Cambridge, Mass. (Research Lab. of Electronics, Massachusetts Inst. of Technology, Cambridge)

22-24. **Astrogeology**, symp., University of Michigan, Ann Arbor, Mich. (E. W. Heinrich, Dept. of Geology and Mineralogy, Univ. of Michigan, Ann Arbor 48104)

22-24. **Modern Optics**, intern. symp., New York, N.Y. (J. Fox, Polytechnic Inst. of Brooklyn, 333 Jay St., Brooklyn, N.Y. 11201)

23-24. **Seismological Soc. of America**, Santa Barbara, Calif. (D. Tocher, U.S. Earthquake Mechanism Lab./ESSA, 390 Main St., San Francisco, Calif. 94105)

23-24. **Social Facilitation and Imitation Behavior**, symp., Miami Univ., Oxford, Ohio. (E. C. Simmel, Dept. of Psychology, Miami Univ., Oxford 45056)

23-25. Institute of **Mathematical Statistics**, central regional mtg., Columbus, Ohio. (G. E. Nicholson, Jr., Dept. of Statistics, Univ. of North Carolina, Chapel Hill 27515)

23-25. Society of **Toxicology**, Atlanta, Ga. (C. S. Weil, Mellon Inst., 4400 Fifth Ave., Pittsburgh, Pa. 15213)

26-30. Association of American **Geographers**, 63rd annual mtg., St. Louis, Mo. (Executive Officer, 1146 16th St., NW, Washington, D.C. 20036)

27-30. American **Physical Soc.**, Chicago, Ill. (R. G. Sachs, P.O. Box 344, Argonne, Ill.)

27-30. Canadian Inst. of **Mining and Metallurgy**, 69th annual mtg., Ottawa, Ont., Canada. (Secretary, 121 Richmond St. W., Toronto 1, Ont.)

28-30. Engineering Aspects of **Magnetohydrodynamics**, symp., Stanford, Calif. (R. H. Eustis, Stanford Univ., Stanford 94305)

28-30. **Photovoltaic Specialists**, 6th IEEE conf., Cocoa Beach, Fla. (F. A. Shirland, Clevite Research Center, 540 E. 105 St., Cleveland, Ohio 44108)

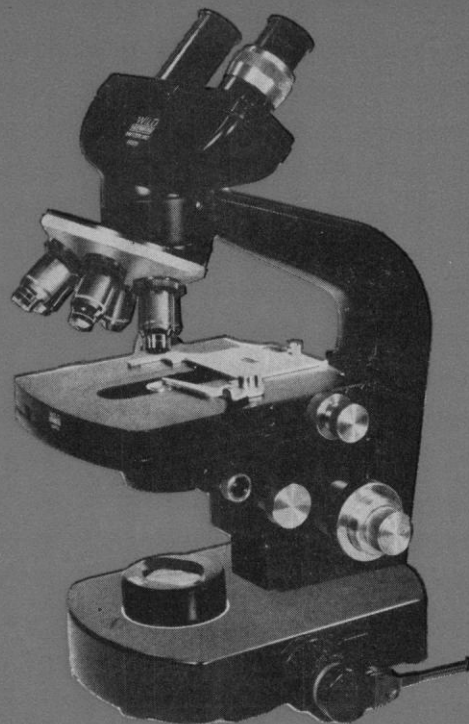
29-30. **Building Research** Advisory Board, research symp., "Performance Concept of Building," New Orleans, La. (R. W. Spangler, Board, Natl. Research Council-Natl. Acad. of Sciences, 2101 Constitution Ave., NW, Washington, D.C. 20418)

29-31. **Immunologic Approaches to Mechanisms of Cutaneous Disease**, New York Univ. Medical Center, New York, N.Y. (Office of Recorder, New York Univ. Post-Graduate Medical School, New York 10016)

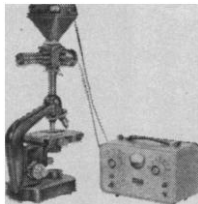
29-31. **The Origins of Schizophrenia**, intern. conf., Rochester, N.Y. (J. Romano, Univ. of Rochester School of Medicine, Rochester 14620)

Some things any optical microscope can do.
Other things some can do.
A few things a few can do.

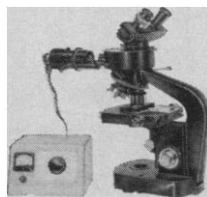
This one does the most.
The Wild* M-20 Research Microscope



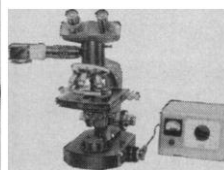
Photoautomat



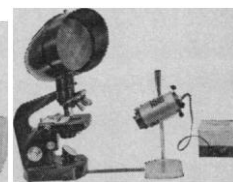
EPI Attachment



Drawing Tube



Projection Head



Illustrated are a few of the numerous accessory combinations. Permits every observation method for your field of research. Precisely. Conveniently.

Write for Bulletin M-20

*First name in a complete line of instruments for Surveying, Photogrammetry and Microscopy.

WILD
HEERBRUGG

WILD HEERBRUGG INSTRUMENTS, INC.
FARMINGDALE, NEW YORK 11735
Full
Factory Services
In Canada: Wild of Canada Ltd.,
881 Lady Ellen Place, Ottawa 3, Ontario

This Blickman cabinet has had its insides out 5 different times

(It's about to be up-to-date again)

Laboratory projects can last for years. Or just days. New people want work areas to suit them, not a tradition.

Storage needs can change overnight. Blickman's Conflex furniture can change a lot faster.

It lets you vary your storage needs to suit a project or personnel.

All it takes is a screw driver and a few minutes.

Change cupboards to drawers. Switch deep drawers to shallow ones. Mix drawer and door sizes.

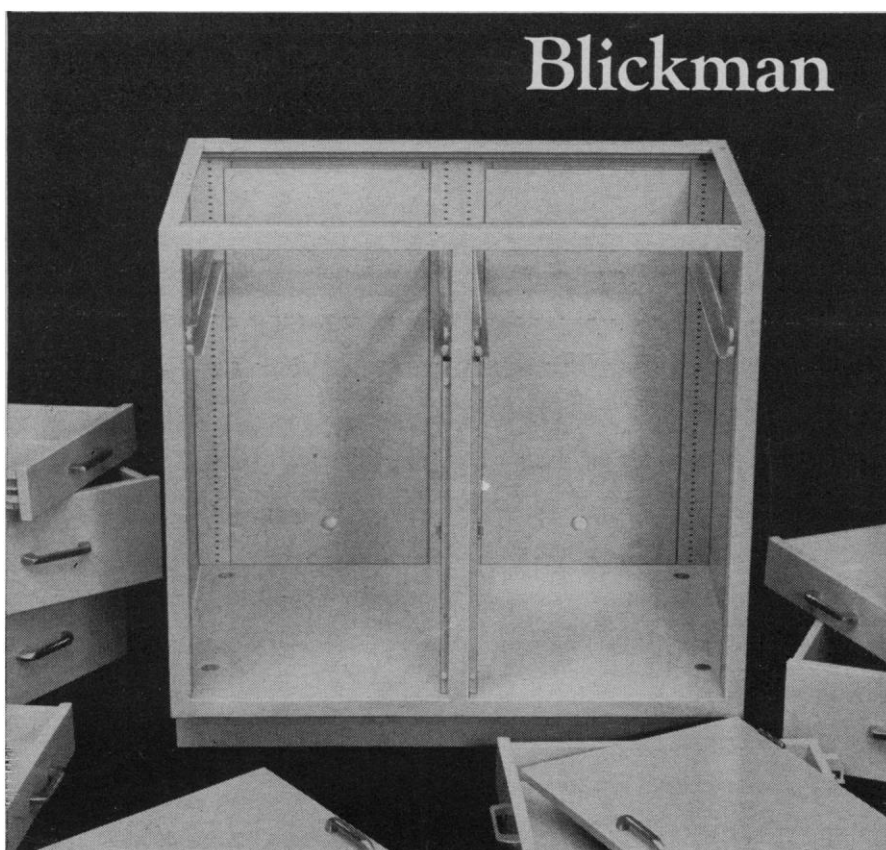
A single Conflex cabinet gives you more than 800 different possible arrangements.

In other words, Conflex furniture doesn't become obsolete when you need different laboratory facilities. Conflex becomes something different.

Use that coupon to find out just how many ways.

S. Blickman, Inc.
6902 Gregory Avenue, Weehawken, N. J. 07087
Please send information on Conflex lab furniture

Name _____ Title _____
Company/Institution _____
Address _____
City _____ State _____ Zip _____



NEW BOOKS

(Continued from page 552)

sky, Eds. Indiana Univ. Press, Bloomington, 1966. 352 pp. Illus. \$7.95. Indiana University Studies in the History and Theory of Linguistics. Twelve papers.

The Concept of Identity. David J. de Levita. Translated from the Dutch edition (The Hague, 1965) by Ian Finlay. Mouton, The Hague, Netherlands; Basic Books, New York, 1966. 221 pp. \$6.

Crystal Structures. vol. 5, *The Structures of Aliphatic Compounds.* Ralph W. G. Wyckoff. Interscience (Wiley), New York, ed. 2, 1966. 793 pp. Illus. \$25.

The Departmental Laboratory Assistant in Biological Science. A book of principles, methods, and techniques. Harold C. Steele. Dorrance, Philadelphia, 1966. 231 pp. \$5.75.

The Dream and Human Societies. Based on the proceedings of the international colloquium (Asnieres-sur-Oise, France), June 1962. G. E. von Grunebaum and Roger Caillois, Eds. Univ. of California Press, Berkeley, 1966. 471 pp. Illus. \$10. Twenty-five papers.

Developments in Psychoanalysis at Columbia University. Proceedings of the Twentieth Anniversary Conference (New York), October 1965. George S. Goldman and Daniel Shapiro, Eds. Hafner, New York, 1966. 373 pp. Illus. \$12.50. Fourteen papers.

Dynamische Biochemie: Grundlagen und moderne Erkenntnisse. Pt. 2. Eberhard Hofmann. Akademie-Verlag, Berlin, 1966. 280 pp. Illus. Paper.

Encyclopedia of Chemical Technology. vol. 11, *Hexanes to Ion Exchange.* Herman F. Mark, John J. McKetta, Jr., and Donald F. Othmer, Eds. Interscience (Wiley), New York, ed. 2, 1966. 913 pp. Illus. \$50.

Encyclopedia of Industrial Chemical Analysis. vol. 3, *General Techniques, P-Z.* Index to Volumes 1-3. Foster D. Snell and Clifford L. Hilton, Eds. Interscience (Wiley), New York, 1966. 857 pp. Illus. \$45; subscription, \$35.

Engine Test Sequences for Evaluating Automotive Lubricants for API Service MS. American Soc. for Testing and Materials, Philadelphia, 1966. 45 pp. Illus. Paper, \$1.75.

Experimental Mechanics. vol. 2. Proceedings of the Second SESA International Congress (Washington, D.C.), September-October 1965. Sponsored by Society for Experimental Stress Analysis. B. E. Rossi, Ed. Pergamon, New York, 1966. 537 pp. Illus. \$27.50. Sixty-four papers.

Family in Transition: A Study of 300 Yugoslav Villages. Vera St. Erlich. Princeton Univ. Press, Princeton, N.J., 1966. 489 pp. Illus. \$12.50.

The Fluid Dynamic Aspects of Space Flight. vol. 1. Proceedings of the AGARD-NATO Specialists' Meeting (Marseille, France), April 1964. Sponsored by the Fluid Dynamics Panel of AGARD. Published for the North Atlantic Treaty Organization. Gordon and Breach, New York, 1966. 416 pp. Illus. \$22.50. Fifteen papers.

Fundamental Concepts of Biology. Gideon E. Nelson, Gerald G. Robinson, and Richard A. Boolootian. Wiley, New York, 1966. 341 pp. Illus. \$7.50.

Infinite Series. Earl D. Rainville. Macmillan, New York, 1967. 279 pp. Illus. \$7.95.

The Influence of Culture on Visual Perception. Marshall H. Segall, Donald T. Campbell, and Melville J. Herskovits. Bobbs-Merrill, New York, 1966. 286 pp. Illus. Paper, \$2.95.

Introduction to Contemporary Algebra. Marvin L. Tomber. Prentice-Hall, Englewood Cliffs, N.J., 1967. 443 pp. Illus. \$7.95. Prentice-Hall Mathematics Series.

Ion Exchange: A Series of Advances. vol. 1. Jacob A. Marinsky, Ed. Dekker, New York, 1966. 436 pp. Illus. \$16.75. Nine papers.

The Logical Structure of the World: Pseudoproblems in Philosophy. Rudolf Carnap. Translated from the German edition by Rolf A. George. Univ. of California Press, Berkeley, 1967. 390 pp. \$8.50.

Low Temperature Oxidation. W. Jost, Ed. Published for the North Atlantic Treaty Organization. Gordon and Breach, New York, 1966. 426 pp. Illus. \$22.50. Eleven papers.

Mathematical Theory of Elementary Particles. Proceedings of a conference (Dedham, Mass.), September 1965. Roe Goodman and Irving Segal, Eds. M.I.T. Press, Cambridge, Mass., 1966. 198 pp. Illus. \$6. Thirteen papers.

Medical Innovation: A Diffusion Study. James S. Coleman, Elihu Katz, and Herbert Menzel. Bobbs-Merrill, New York, 1966. 268 pp. Illus. Paper, \$2.95.

Multi-Sulfur and Sulfur and Oxygen Five- and Six-Membered Heterocycles. Pt. 1. David S. Breslow and Herman Skolnik. Interscience (Wiley), New York, 1966. 632 pp. Illus. \$33. The Chemistry of Heterocyclic Compounds Series.

Neurology. Roy R. Grinker and Adolph L. Sahs. Thomas, Springfield, Ill., ed. 6, 1966. 1645 pp. Illus. \$33.50.

Nobel Lectures in Physics. vol. 1, 1901-1921. Published for the Nobel Foundation. Elsevier, New York, 1967. 510 pp. Illus. \$85 for set of three volumes.

Nonionic Surfactants. Martin J. Schick, Ed. Dekker, New York, 1967. 1111 pp. Illus. \$43.50. Surfactant Science Series, vol. 1. Twenty-eight papers.

Optics and Spectroscopy. Suppls. 1 and 2. Suppl. 1, *Luminescence* (192 pp.); Suppl. 2, *Molecular Spectroscopy* (180 pp.). S. E. Frish, P. O. Feofilov, and L. S. Sazonov, Eds. Translated from the Russian edition (Moscow, 1963). C. W. Garland, Translation Ed. Optical Soc. of America, Washington, D.C., 1966. Illus. Paper, \$15 each volume. 125 papers.

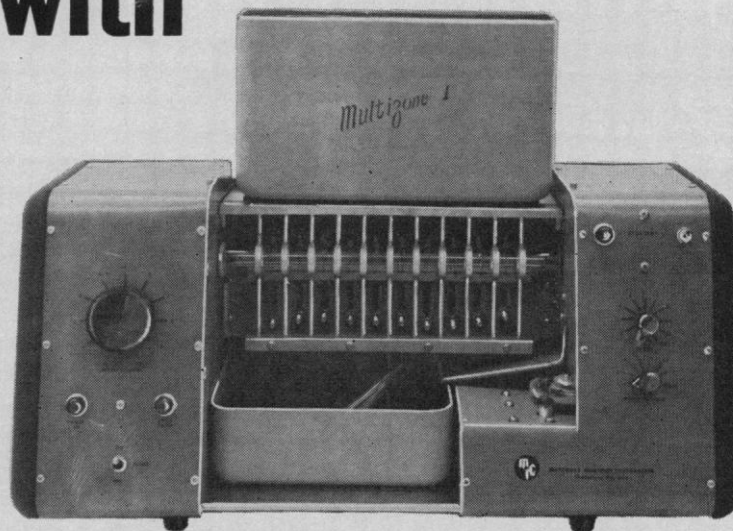
Palaeoecology of Africa and of the Surrounding Islands and Antarctica. vol. 1, *A Re-issue of Palynology in Africa Reports 1-8 (1950-1963)*. E. M. van Zinderen Bakker, Ed. Balkema, Cape Town, 1966. 274 pp. Illus. R 6.00.

Louis Pasteur: The Man and His Theories. Hilaire Cuny. Translated by Patrick Evans. Fawcett, Greenwich, Conn., 1967. 192 pp. Paper, 60¢. Reprint, 1965 edition.

Physical Principles of Magnetism. F. Brailsford. Van Nostrand, Princeton, N.J., 1966. 284 pp. Illus. \$9.75.

The Physiology of Diuretic Agents (*Ann. N.Y. Acad. Sci.* 139). Edward M. Weyer, Ed. New York Acad. of Sciences,

Faster, more efficient Zone Refining with



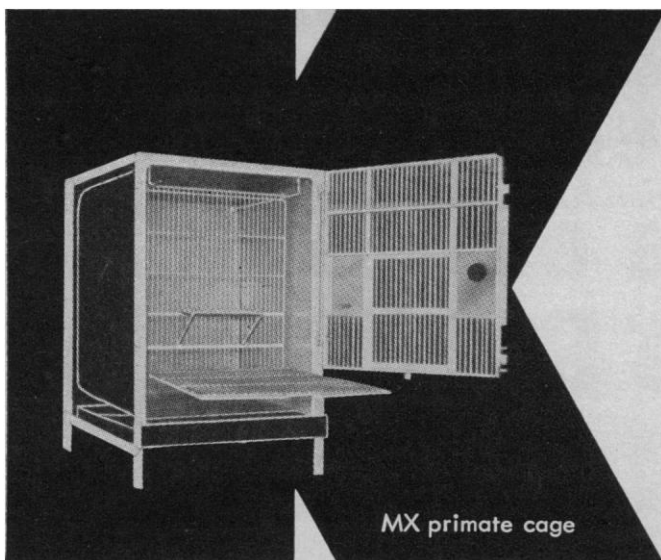
New MRC Multizone I Organic and Chemical Zone Refiner

The MRC Multizone I Organic and Chemical Zone Refiner performs faster and more efficiently than conventional vertical zone refiners! It cuts the critical personnel time usually needed for zone refining . . . improves the end product! The credit for its superior performance goes to new, patented heating and cooling techniques that obtain flat liquid-solid interfaces in combination with short zone lengths and interzone spacing. Multizone I operates with many materials . . . can be used in applications that require zone refining, zone leveling, normal freezing and single crystal growth. For a detailed report on Multizone I, write today to:



**MATERIALS RESEARCH
CORPORATION**

Orangeburg, New York 10962
(914) ELmwood 9-4200



dog & primate cages

Molded seamless construction of rugged fiber glass reinforced plastics... minimum effort required to clean and disinfect... maximum animal comfort... extremely strong doors with fool proof catches... economical to purchase and maintain.... For further information

write:
Department KS *Kirschner*
MANUFACTURING COMPANY
Vashon, Washington

THE KLETT FLUORIMETER

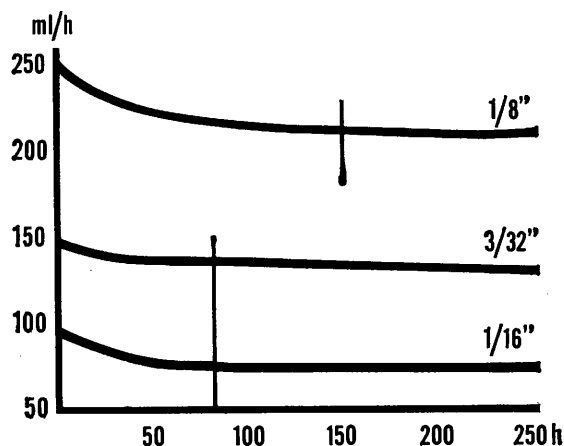
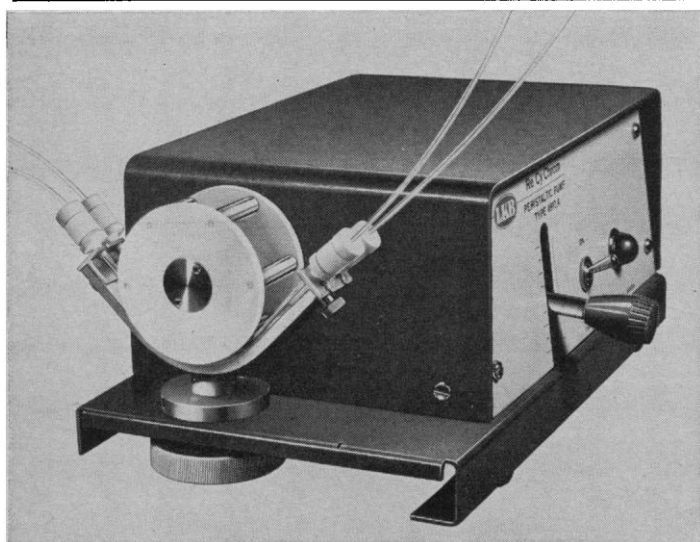


Designed for the rapid and accurate determination of thiamin, riboflavin, and other substances which fluoresce in solution. The sensitivity and stability are such that it has been found particularly useful in determining very small amounts of these substances.

KLETT SCIENTIFIC PRODUCTS

PHOTOELECTRIC COLORIMETERS • BIO-COLORIMETERS
GLASS ABSORPTION CELLS • COLORIMETER NEPHELOMETERS • KLETT REAGENTS • COLONY MARKER AND TALLY

Klett Manufacturing Co., Inc.
179 EAST 87TH STREET, NEW YORK, N. Y.



PumpAbility Plus

- PLUS** Steady flow over long periods
- PLUS** Rugged, Compact, Versatile, Reliable design
- PLUS** Flow rates from 0 to 390 ml/hr/channel
- PLUS** Extremely high flow constancy (fluctuations less than 0.1 % per 24 hrs after initial run in)
- PLUS** Roller change from 6 to 12 to give minimal pulsations even at slowest speeds.

THE LKB PERISTALTIC PUMP

For Liquids (Corrosive and Highly Volatile)—
Emulsions—Slurries—Gases
For the Laboratory and the Process Plant

Write for our illustrated leaflet giving full details of the Peristaltic Pump



LKB INSTRUMENTS INC • 12221 PARKLAWN DRIVE • ROCKVILLE Md 20852

OTHER
HEADQUARTERS
FOR SALES
AND SERVICE

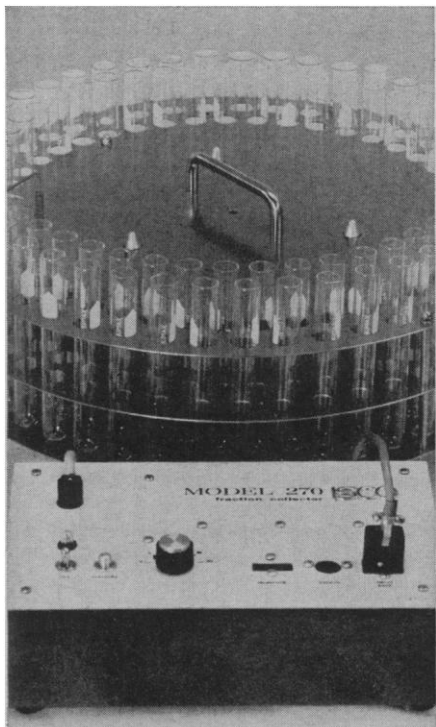
SWEDEN
LKB-Produkter AB
Box 76,
Stockholm—Bromma 1

UK
LKB Instruments Ltd.
LKB House, 137 Anerley Road,
London, S.E. 20

NETHERLANDS
LKB-Produkten N.V.
Zeekant 35,
The Hague

DENMARK
LKB Instrument A/S
Amagerbrogade 34,
Copenhagen S

THIS FRACTION COLLECTOR IS



GOOD NEWS!

When laboratory instruments combine reliable solid state circuitry with low cost and compact size, that's good news. And that's ISCO's Model 270 Fraction Collector.

The highly dependable Model 270 features lift-off reels with 90 or 180 tube capacities and is ideally suited for either classroom or research use. At as little as \$190.00 complete, it is the lowest priced fraction collector available, yet it still incorporates both timed and volumetric control.

ISCO's other Fraction Collectors are good news too! The Model A is available for any combination of timed, drop counting, siphon or Volumeter (adjustable volumetric dispenser) operation and is equipped with a 240 tube reel. The Model AT offers much of the economy of the Model 270 and the flexibility of the Model A. The Model 240 is a preparative Fraction Collector especially designed for large volume collecting. All ISCO Fraction Collectors can be used in a cold room with no modifications and have a one year guarantee.

For more information about ISCO Fraction Collectors, please ask for Brochure FC37L.

INSTRUMENTATION SPECIALITIES COMPANY, INC.

ISCO

5624 SEWARD AVE. • LINCOLN, NEBRASKA 68507, U.S.A.
CABLE: ISCOLAB LINCOLN • PHONE (402) 434-8265

3 FEBRUARY 1967

New York, 1966. 539 pp. Illus. Paper, \$7. Twenty-five papers presented at a conference held in March 1966.

Poisonous and Venomous Marine Animals of the World. vol. 1, *Invertebrates*. Bruce W. Halstead. U.S. Government Printing Office, Washington, D.C., 1965. 1030 pp. Illus. \$50 for set of three volumes.

Political Anthropology. Marc J. Swartz, Victor W. Turner, and Arthur Tuden, Eds. Aldine, Chicago, 1966. 319 pp. \$8.95. Seventeen papers.

Principles of Continua with Applications. L. Albert Scipio. Wiley, New York, 1967. 288 pp. Illus. \$10.95.

Principles of Ideal-Fluid Aerodynamics. Krishnamurty Karamcheti. Wiley, New York, 1966. 654 pp. Illus. \$20.

Les Problèmes Météorologiques de la Stratosphère et de la Mésosphère. Colloque Franco-Belge sous la Présidence de Marcel Nicolet (Paris), March 1965. Presses Universitaires de France, Paris, 1966. 486 pp. Illus. Paper, F 48.

Problems in Differential Equations. J. L. Brenner. Freeman, San Francisco, ed. 2, 1966. 182 pp. Paper, \$2.50.

Problems in Engineering Soils. P. Leonard Capper, W. Fisher Cassie, and J. D. Geddes. Barnes and Noble, New York, 1966. 191 pp. Illus. Paper, \$3.50; cloth, \$5.75.

Progress in the Science and Technology of the Rare Earths. vol. 2. LeRoy Eyring, Ed. Pergamon, New York, 1966. 372 pp. Illus. \$15. Eight papers.

Pumping of Liquids. F. A. Holland and F. S. Chapman. Reinhold, New York, 1966. 412 pp. Illus. \$20.

Radar Techniques for Detection Tracking and Navigation. Proceedings of the Eighth Symposium of the AGARD Avionics Panel (London), September 1964. W. T. Blackband, Ed. Published for the North Atlantic Treaty Organization. Gordon and Breach, New York, 1966. 616 pp. Illus. \$37.50. Thirty-one papers.

Radiation Processes in Plasmas. G. Bekefi. Wiley, New York, 1966. 391 pp. Illus. \$15.75.

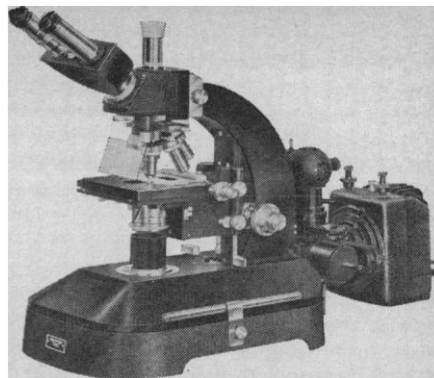
Radio Telescopes. D. V. Skobel'tsyn, Ed. Translated from the Russian edition (Moscow, 1965). Consultants Bureau (Plenum), New York, 1966. 179 pp. Illus. Paper, \$22.50. The Lebedev Physics Institute Series, vol. 28. Seventeen papers.

Radioisotopes for Aerospace. Pt. 2, *Systems and Applications*. Proceedings of the First Symposium on Radioisotope Applications in Aerospace (Dayton, Ohio), February 1966. Sponsored by U.S. Air Force, U.S. Atomic Energy Commission, and Instrument Soc. of America. John C. Dempsey and Paul Polishuk, Eds. Plenum Press, New York, 1966. 476 pp. Illus. Pts. 1 and 2, \$37.50. Twenty-seven papers.

Religion and Politics in Haiti. Harold Courlander and Rémy Bastien. Institute for Cross-Cultural Research, Washington, D.C., 1966. 99 pp. Illus. Paper, \$2; cloth, \$3.

The Remarkable Sine Functions. A. I. Markushevich. Translated from the Russian edition (Moscow, 1965) by Scripta Technica. Leon Ehrenpreis, Translation Ed. Elsevier, New York, 1966. 110 pp. Illus. \$6.50.

Report of the Education Commission,



SIMULTANEOUS CONTRAST FLUORESCENCE MICROSCOPY

exclusively with the

REICHERT
Zetopan

This unique new approach may very well become instrumental in solving some of your intricate microbiological research problems. It can be accomplished with the ingeniously designed Reichert "ZETOPAN" by simultaneous application of white light and ultra-violet illumination supplemented by a newly developed fluorescence contrast condenser.

The combined advantages of Phase or Anoptral Contrast and the fluorescent techniques now appear simultaneously in the microscopic image.

Our constant, self-regulating Power Supplies for operation of the fluorescent light source prolong the lifetime of the Osram burner and insure a steady arc and increased light.

The "ZETOPAN" is a versatile instrument for all microscopic investigations of transmitted, reflected, and mixed illumination. It is a truly universal research microscope.

Hacker

For particulars or demonstration, write to:
WILLIAM J. HACKER & CO., INC.
Box 646, W. Caldwell, N.J., CA 6-8450 (Code 201)

New, Simplified Cryogenic Liquefier Only \$95.00

For demonstrating the principle of gas cooling and liquefaction by adiabatic and Joule-Thomson expansion.

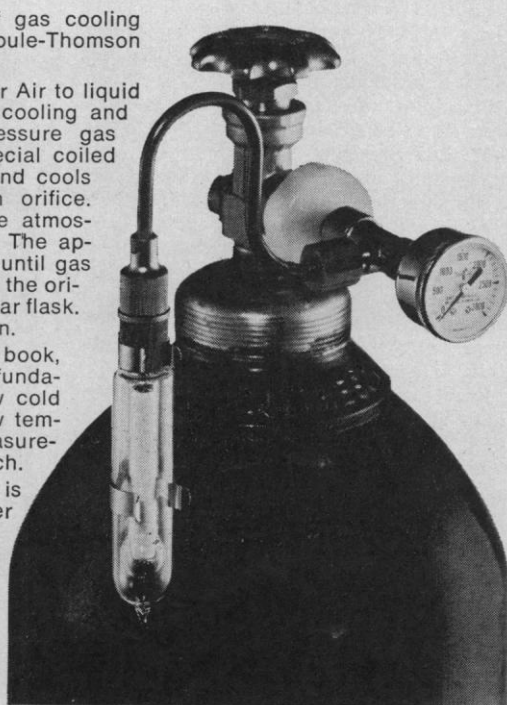
Converts gaseous Argon, Nitrogen or Air to liquid in 1 to 2 minutes, using adiabatic cooling and Joule-Thomson principle. High pressure gas from a cylinder passes through special coiled heat exchanger where it expands and cools on passing through an expansion orifice. The cooled gas then passes to the atmosphere through the heat exchanger. The apparatus cools the gas progressively until gas is condensed upon final expansion at the orifice, and drops into a small glass Dewar flask. No external work is done in operation.

Comes with interesting paperback book, "Near Zero," which discusses the fundamentals of cryogenics showing how cold increases atomic order and why low temperatures enable more precise measurements. Additional copies, \$1.25 each.

The Matheson Cryogenic Liquefier is \$95.00 complete, plus shipping. Order direct from The Matheson Co., Inc., P.O. Box 85N East Rutherford, N. J. Write for Engineering Report and price list.

MATHESON

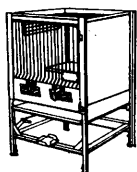
East Rutherford, N. J.; Joliet, Ill.;
La Porte, Texas; Morrow, Ga.;
Newark, Calif.; Matheson of
Canada, Whitby, Ont.



New concepts in
animal cage systems
become a reality
at Harford.

- Primate cages • Poultry cages
- Dog cages • Rodent cages
- Cat cages • Rabbit cages

Custom-Engineered animal
cage systems



Harford

Metal Products, Inc.
Building 101
Aberdeen, Md. 21001
272-3400 (301)



THIS
IS AN

INCUBATOR!

AND IT CONTROLS THE TEMPERATURE OF A
SPECIMEN UNDER A MICROSCOPE FROM AMBIENT
TO 40°C. WITH AN ACCURACY OF $\pm 0.2^\circ\text{C}.$

NEW Accurate temperature control of specimens—with no need for an enclosure...this is the Sage Air Curtain Incubator. Essentially a sensitive air stream temperature gun and controller, this small (4"x4"x8") unit blows a soft stream of warm or ambient air on the specimen as demanded by a thermistor. The Sage Air Curtain Incubator permits complete freedom of microscope handling and use, and it will maintain specimen temperature to much closer tolerances than those which can be achieved by a conventional incubator.

Accurate, reproducible, convenient. Send for complete technical data. **\$395.00**

SAGE INSTRUMENTS, INC.

2 Spring Street, White Plains, N. Y. 10601
914 949-4121

1964-1966. Education and national development. Ministry of Education, Government of India, New Delhi, 1966. 706 pp. Illus. Paper, \$3.60.

Albert Schweitzer. Conférences du Congrès International des Écrivains-Médecins (Debrecen, Hungary), 1966. Hermann Baur and others. Kultura, Budapest, 1966. 211 pp. Paper, \$2.40. Twenty papers.

The Search for Order, 1877-1920. Robert H. Wiebe. Hill and Wang, New York, 1967. 349 pp. \$5.

Selected Papers on the Transfer of Radiation. Donald H. Menzel, Ed. Dover, New York, 1966. 275 pp. Illus. Paper, \$3. Six papers published between 1905 and 1930.

Soil Organic Matter: Its Nature, Its Role in Soil Formation and in Soil Fertility. M. M. Kononova. Translated from the Russian edition (Moscow, 1963) by T. Z. Nowakowski and A. C. D. Newman. Pergamon, New York, ed. 2, 1966. 544 pp. Illus. \$15.

The Sound and the Sea. A guide to northwestern neritic invertebrate zoology. Charles J. Flora and Eugene Fairbanks. Pioneer Printing Company, Bellingham, Wash., ed. 2, 1966. 467 pp. Illus. \$8.50.

The Strawberry: History, Breeding, and Physiology. George M. Darrow. Holt, Rinehart, and Winston, New York, 1966. 463 pp. Illus. \$15.

Strength Under High Transient Loads. Kh. A. Rakhmatulin and Yu. A. Dem'yanov. Translated from the Russian edition (Moscow, 1961) by A. Hananel and A. Baruch. T. Pelz, translation Ed. Israel Program for Scientific Translations, Jerusalem; Davey, New York, 1966. 348 pp. Illus. \$14.

The Stress Corrosion of Metals. Hugh L. Logan. Wiley, New York, 1966. 320 pp. Illus. \$13.95.

Structural Adhesives Bonding. A symposium (Hoboken, N.J.), September 1965. Michael J. Bodnar, Ed. Interscience (Wiley), New York, 1966. 503 pp. Illus. Paper, \$15. Applied Polymer Symposia, No. 3. Thirty-two papers.

Structural Matrix Analysis for the Engineer. John Robinson. Wiley, New York, 1966. 364 pp. Illus. \$11.95.

The Structure of Inorganic Radicals. An application of electron spin resonance to the study of molecular structure. P. W. Atkins and M. C. R. Symons. Elsevier, New York, 1967. 290 pp. Illus. \$21.75.

Studies on the Anatomy and Function of Bones and Joints. F. Gaynor Evans, Ed. Springer-Verlag, New York, 1966. 163 pp. Illus. \$12. Ten papers given at a symposium on Joints and Bones for the Eighth International Congress of Anatomists (Wiesbaden, Germany), August 1965.

Studies on Chemical Structure and Reactivity. J. H. Ridd, Ed. Wiley, New York, 1966. 300 pp. Illus. \$8.25. The volume is presented to Sir Christopher Ingold; includes 14 papers.

Summable Series and Convergence Factors. Charles N. Moore. Dover, New York, 1966. 113 pp. Paper, \$1.50. Reprint, 1938 edition.

System Analysis by Digital Computer. Franklin F. Kuo and James F. Kaiser, Eds. Wiley, New York, 1966. 454 pp. Illus. \$8.95. There are 12 papers.