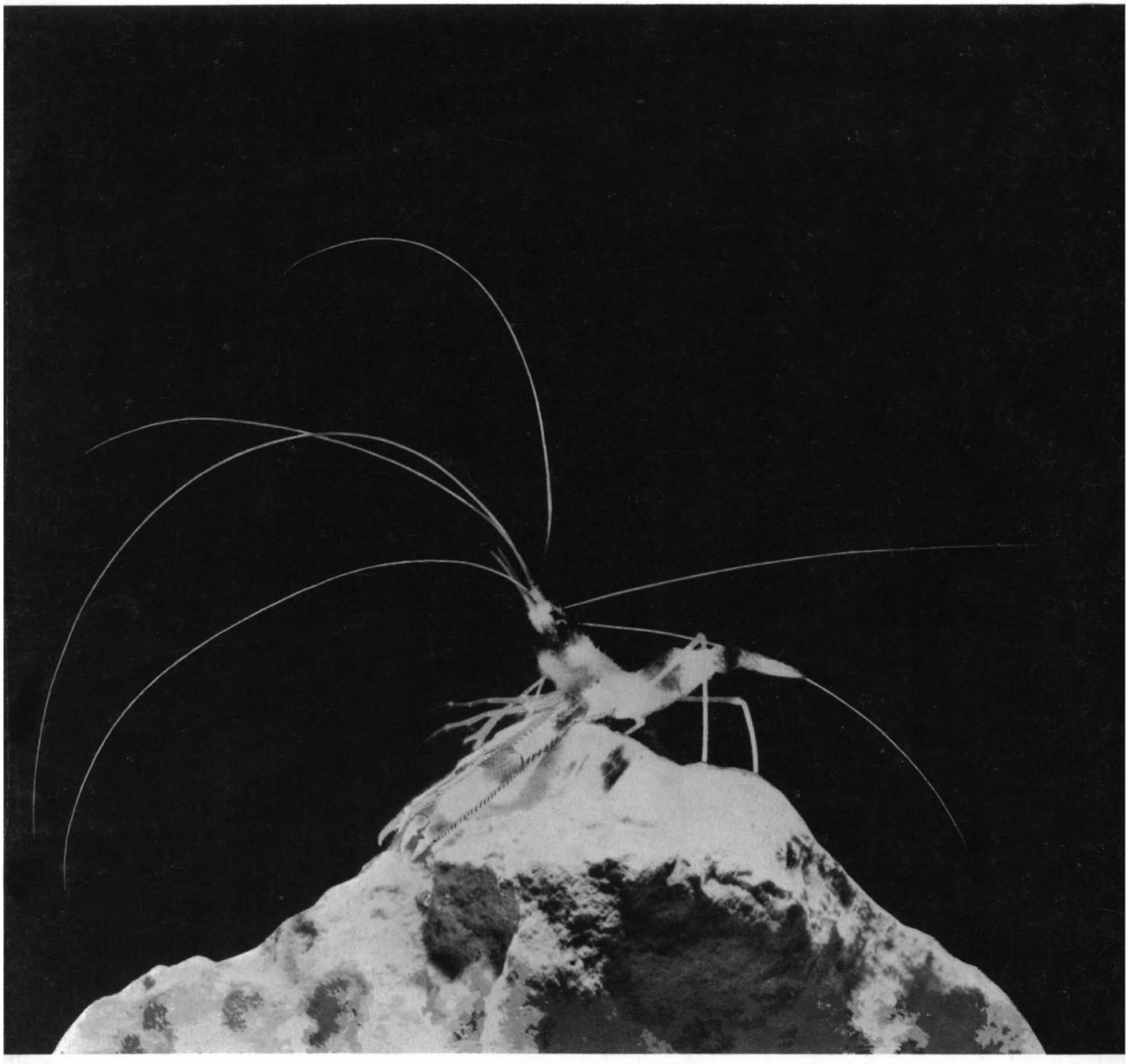
SCIENCE

17 February 1967

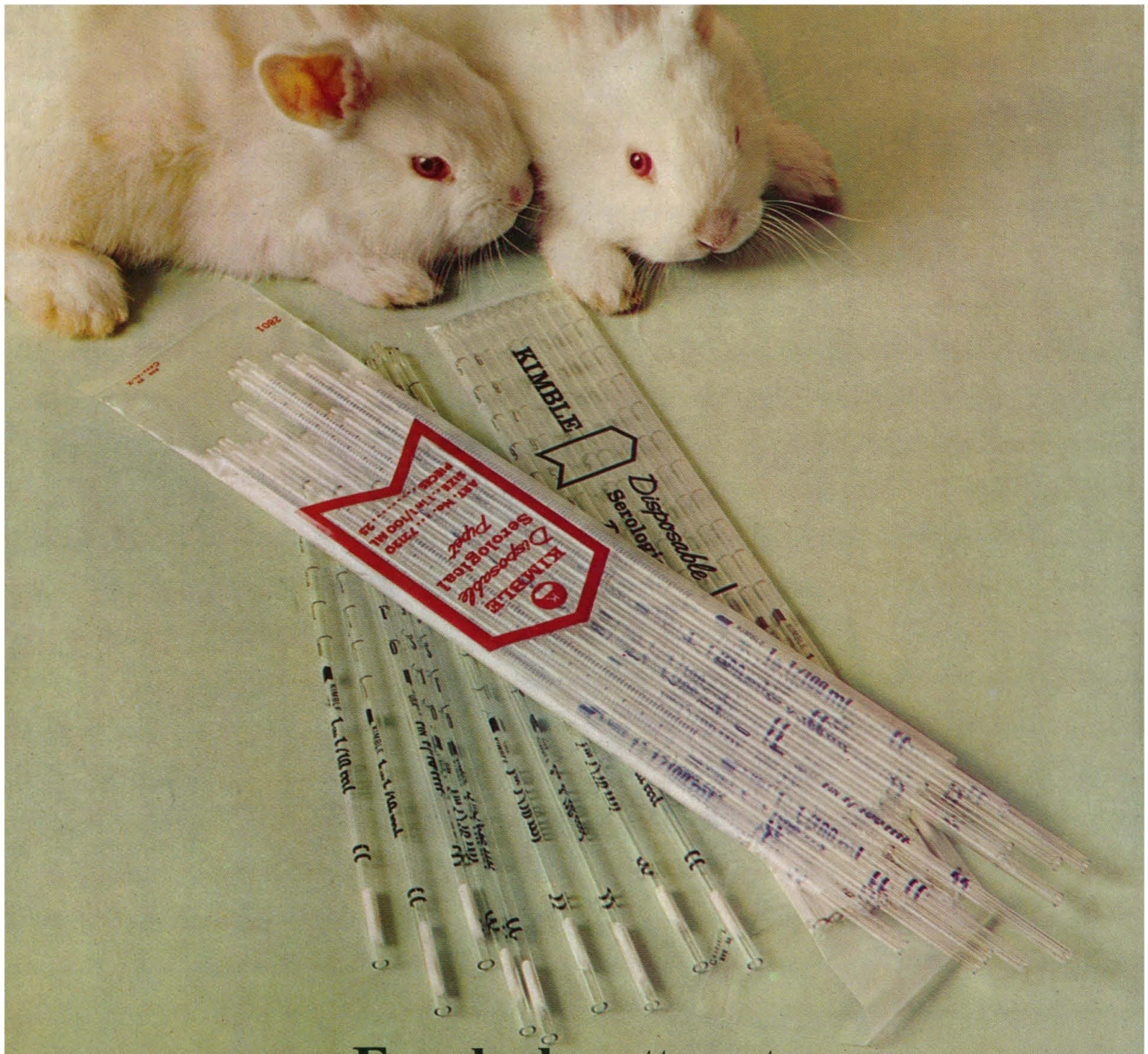
Vol. 155, No. 3764

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



CORAL SHRIMP

Proceedings Issue



Everybody cottons to the new Kimble disposable pipet

Quick as a bunny, these new Kimble disposable pipets have caught on with laboratory technicians. With all the extra features and practical value we've built into them, you'll wonder how they can sell for less than a dime.

Kimble Disposable Serological Pipets are made of fine borosilicate glass: designed with precise, legible graduations. Available in two sizes: 1 ml in 1/10 printed in black, and 1 ml in 1/100 printed in blue for easy size identification. Two styles: sterile, clean and cotton plugged for biological applications; regular, clean for general use.

Other unique Kimble features include short form design for easier handling . . . controlled tips for consistent delivery with ± 2% accuracy. And for extra economy and convenience, sterile pipets are packed 10 to a sealed plastic bag, regulars 25 to a bag. Ideal for benchwork handling.

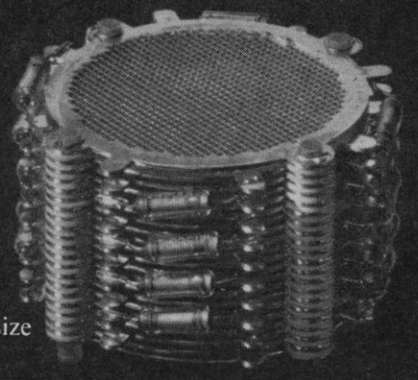
Write today for literature and complimentary sample to Owens-Illinois, Marketing Services Department, Toledo, Ohio 43601.

ANOTHER KIMBLE Disposable PRODUCT

OWENS-ILLINOIS

maker of Kimble Products
Toledo, Ohio 43601

Caution:



actual size

Do not throw this particle multiplier away if the gain drops. We'll reactivate it for you. And reactivate it for you. And reactivate it...

A particle multiplier for the pulse counting or current measurement of electrons, ions, and UV and x-ray photons that actually can be reactivated? And more than once?

Yes. Read on.

First off, we guarantee: at delivery, a gain better than 10^6 at 3 KV. (And 10^8 electrons per electron in pulse counting—with low noise.)

We then guarantee: to reactivate the unit if the gain drops below 10^6 at 3.5 KV.

We also guarantee: that if under normal operation reactivation is required within one year of purchase, this first reactivation will be gratis.

We further guarantee: subsequently to reactivate the unit at a small charge.

Now, having made so much of reactivation, we really should also emphasize the remarkable fundamental *stability* of this particle multiplier. We have yet to see its equal in terms of resistance to gain degradation.

Another important point: our MM-1 Focused Mesh Particle Multiplier forms a surprisingly compact, compatible, *complete system* when combined with our PAD-1 Fast Precision Pre-amplifier-Amplifier-Discriminator and our HV-2 High Voltage Power Supply. A brief description of all three components of this system comes next.

MM-1 Focused Mesh Particle Multiplier (Patented)
This is a high-gain, twenty-stage structure about one fourth as long as typical multipliers (we show it above in its actual size: 2″ diameter by 1¼″ long). The MM-1 is also bakeable (max. 400° C in vacuum), lightweight (2½ oz.), rugged (has functioned in missiles in flight), and has a fast output rise time. It comes complete with integral voltage divider chain.

PAD-1 Fast Precision
Pre-amplifier-Amplifier-Discriminator
PAD-1 is a transistorized, charge-sensitive, low-noise device with a signal delay time of less than 15 nanoseconds and an output pulse of four volts at 50 ohms with a rise time of less than 5 nanoseconds. The discriminator has exceptionally low jitter for timing applications. The unit is compact (only 4″ long by 2″ wide by 1½″ high) for mounting in close proximity to the MM-1.

HV-2 High Voltage Power Supply
A small package (a mere 4″ long by 3¼″ wide by 2⅞″ high) which supplies a stable well-filtered voltage that effectively satisfies the high voltage power supply needs of the system.

To recapitulate all this in a single sentence: we offer a *complete system* for the pulse counting of electrons, ions, or hard photons which is based on our exceptionally stable, uniquely reactivateable (and so guaranteed), high-gain, small-sized MM-1 Particle Multiplier coupled with our PAD-1 and HV-2 units. Current measurements may be made using the MM-1 and the HV-2 combination.

A final reasuring afterthought. We guarantee *this* too: the quality of our workmanship, the quality of the materials we've used. Completely. And with no time limit.

More information follows your request for our file PD-S.

JOHNSTON LABORATORIES, INC.,
3617 Woodland Avenue, Baltimore, Maryland 21215

17 February 1967
Vol. 155, No. 3764

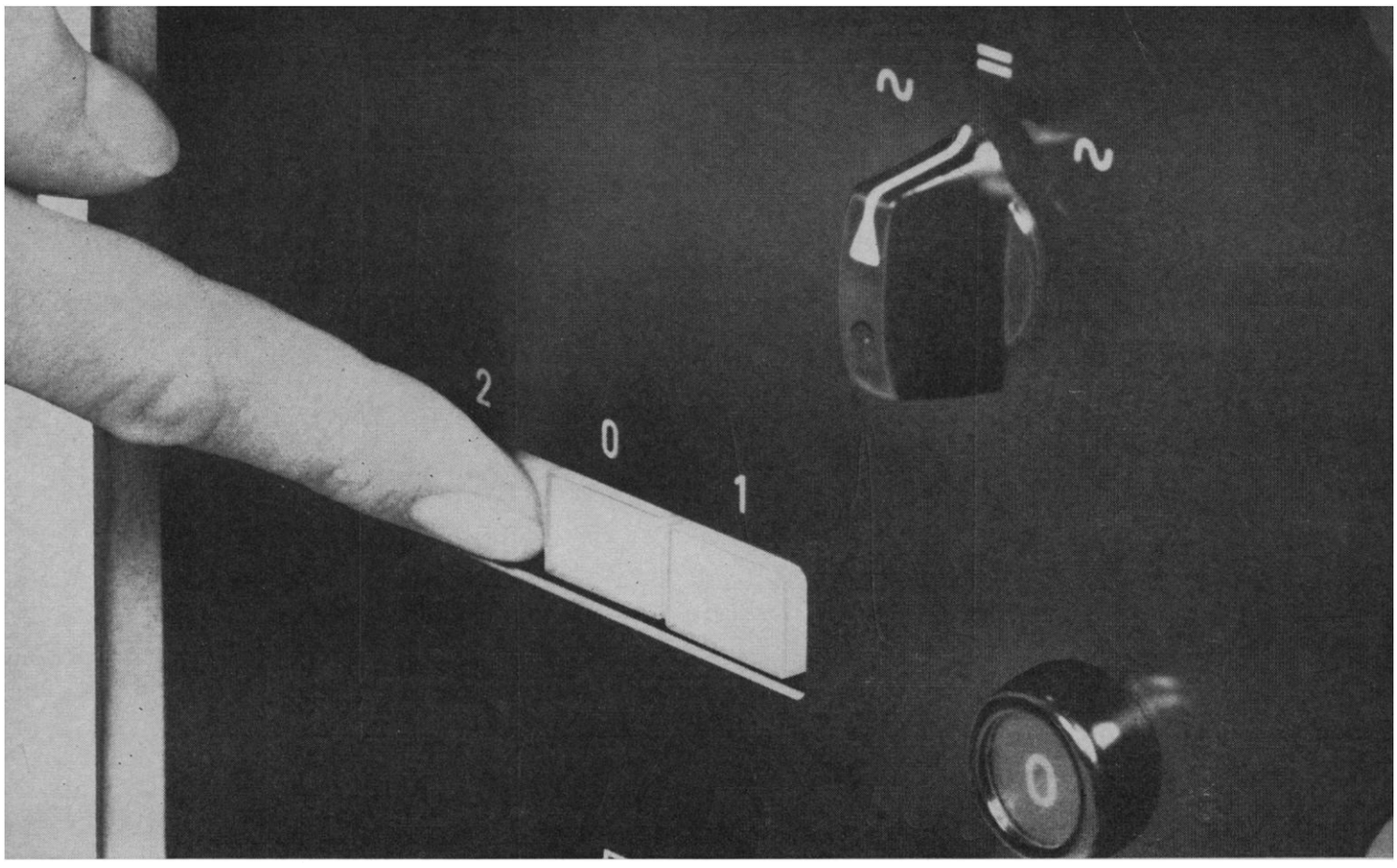
SCIENCE

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. Washington, D.C. 20005. Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C. Advancement of Science. Annual subscriptions $8.50; foreign postage, $1.50; Canadian postage, 75¢; single copies, 35¢, except **Guide to Scientific Instruments**, which 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 address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

The red-banded shrimp (*Stenopus hispidus*), an inhabitant of coral reefs. This animal removes parasites, necrotic tissue, and food particles from the mouths and other parts of the bodies of coral reef fishes. The universal importance of oral hygiene is attested to by recently described oral grooming behavior among such coral reef animals. (From material presented at the symposium on "The Biology of the Mouth," see page 890.) [E. C. L. Maynard, University of Miami]



We took your tip to speed up electron microscopy.

The most important tip on the Zeiss Electron Microscope EM 9A is your fingertip. With it, you can activate time-saving automation never before possible.

Your fingertip gives you complete control of the error-free, automatic vacuum system which saves time during start-up and shutdown.

A flip of your fingertip is all it takes to activate a completely automated photomicrographic system that sets correct exposure, takes the picture, numbers micrographs sequentially and neatly stacks up to 75 negatives without reloading.

You save still more time in several other ways. Alignment is exceptionally fast and stable with the EM 9A's new adjustable single condenser that gives 15 to 20 times more brightness than was possible before.

Specimen airlock is not only fast, but foolproof, too. Specimen exchange can be made within 10 seconds.

Which all adds up to more time to concentrate on microscopy . . . rather than on the microscope.

The EM 9A's resolving power: 10-12Å. Operating range: 900x-40,000x. Astigmatism compensation: new, easy-operating electrostatic stigmator. Focusing: easy, because the unique fine-focusing device with digital read-out combines advantages of both step and continuous focusing. Binocular: 10x with exceptionally high light transmittance; special high-eyepoint eyepieces for people who wear glasses.

For more information, write Carl Zeiss Inc., 444 Fifth Ave., New York, N. Y. 10018. Complete service facilities available.

ZEISS

THE GREAT NAME IN OPTICS

CARL ZEISS WEST GERMANY

ATLANTA, BOSTON, CHICAGO, COLUMBUS, DALLAS, DENVER, DURHAM, LOS ANGELES, ST. LOUIS, SAN FRANCISCO, SEATTLE, WASHINGTON, D. C.

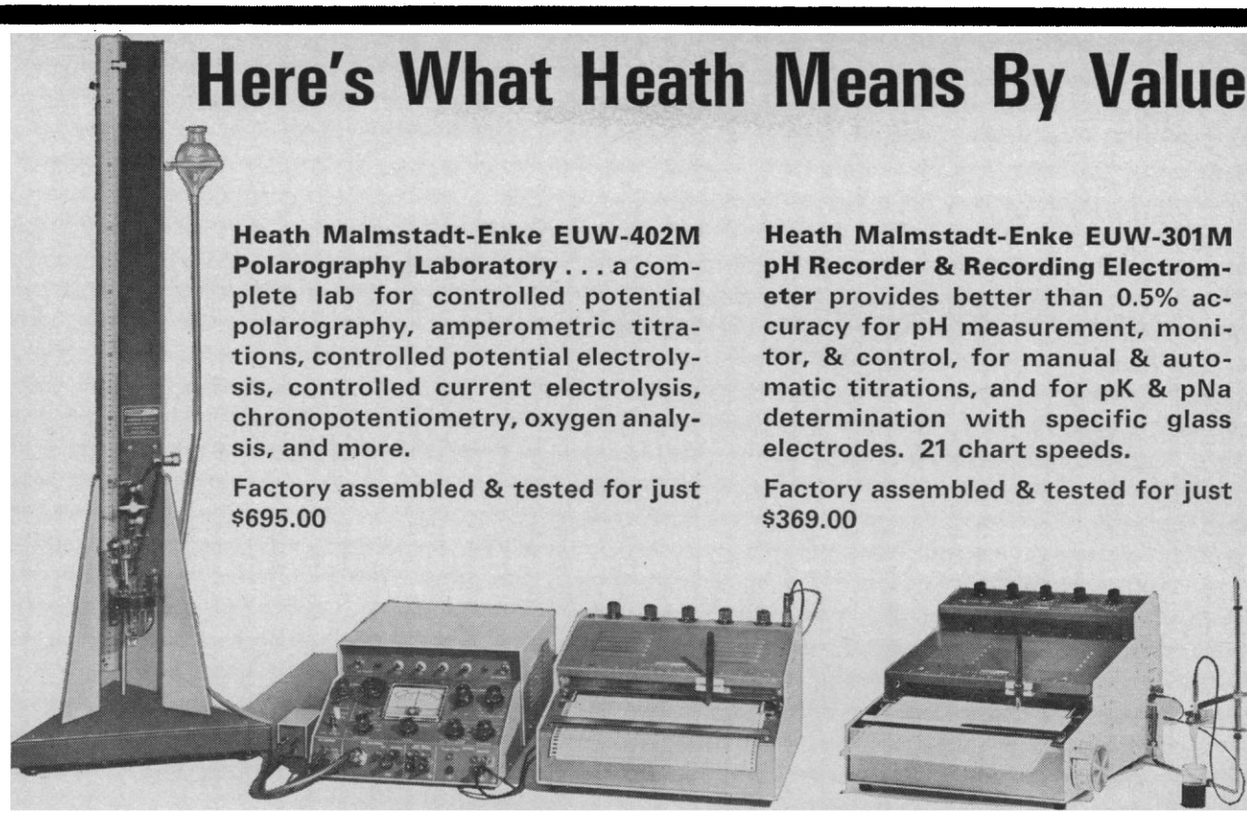
Here's What Heath Means By Value

Heath Malmstadt-Enke EUW-402M Polarography Laboratory . . . a complete lab for controlled potential polarography, amperometric titrations, controlled potential electrolysis, controlled current electrolysis, chronopotentiometry, oxygen analysis, and more.

Factory assembled & tested for just $695.00

Heath Malmstadt-Enke EUW-301M pH Recorder & Recording Electrometer provides better than 0.5% accuracy for pH measurement, monitor, & control, for manual & automatic titrations, and for pK & pNa determination with specific glass electrodes. 21 chart speeds.

Factory assembled & tested for just $369.00



• Includes all apparatus (electrodes, capillary tubing, control valves, electronic instrumentation, multi-speed recorder readout, chart paper, pen, and connecting cables) for 3-electrode controlled potential polarography • Suitable for exact qualitative and accurate quantitative analysis in aqueous and high-resistance organic media • Capable of analysis of ion concentrations as low as 10-7 molar • Easy to set up and operate • Spring-loaded cell holder for quick change of test solutions • Provided with complete, detailed instruction manuals

The Heath Malmstadt-Enke EUW-402M Polarography Laboratory . . . (developed by Dr. Christie Enke of Michigan State University) consists of a highly versatile Dropping Mercury Electrode Apparatus (Heath EUA-19-6); a combination of a Polarography Module (Heath EUA-19-2) and Operational Amplifier System (Heath EUW-19B), which produces the precision controlled electrode voltages and accurate current readout; and a Multi-Speed Servo Chart Recorder (Heath EUW-20M), which provides accurate display of the readout signals over a wide range of time bases. The electronic control instrumentation produces a sweep potential in six 1% calibrated sweep rates from 0.05 to 2 volts/min. and enables d.m.e. currents from 0.5 to 1000 microamperes full scale to be accurately measured. The Heath EUW-402M Polarography Laboratory includes many additional features not found in the most expensive polarographic systems.

EUA-19-6, Dropping Mercury Electrode.....**$149.00**
EUA-19-2, Polarography Module.....**$185.00**
EUW-19B, Operational Amplifier System....**$135.00**
EUW-20M, Multi-Speed Servo Chart Recorder.....**$289.00**
EUW-402M, Complete Laboratory (all of the above instruments).....**$695.00**

Send to Heath for FREE brochures—describing the EUW-402M Polarography Laboratory.

• A pH meter and pH recorder with 10″ linear scale • Five pH ranges: 14, 10, 5, 2, and 1 • Better than 0.5% accuracy — 0.005 pH on the 1 pH range • Control for temperature compensation with provision for automatic temperature compensation by thermistor probe • Accepts all common glass, calomel, and combination electrodes • Switch selection for 5 electrometer ranges: ±50, 100, 200, 500, 1000, and 1400 millivolts • 21 accurate recording speeds from 12″ per minute to 1/2″ per hour • Factory assembled, tested, and complete with manual

The Heath Malmstadt-Enke EUW-301M Multi-Speed pH Recorder and Recording Electrometer Fulfills Many Roles . . . it can be used as a general purpose laboratory pH meter with accuracy as high as 0.005 pH . . . it can be used as a Multi-Speed Recording pH Meter for titrating, monitoring chemical reactions, or for controlling laboratory apparatus . . . and it can be used as a highly accurate measuring or recording electrometer/picoammeter for supplying readout from laboratory instruments with impedances as high as 10,000 megohms. These capabilities plus the wide range of chart speeds enable this instrument to perform data readout from a myriad of chemical processes . . . acid-base titration curves, reaction-rate curves, oxidation-reduction titration curves, stability curves, Karl Fischer titrations, and precipitation and complexation titrations to name a few. Write to Heath for a more complete description of this instrument.

EUW-301M, Multi-Speed pH Recorder.....**$369.00**

EUA-20-16, Thermistor Temperature Probe...**$18.00**

EUA-20-12, pH Test Unit (for alignment and check-out of pH meters).....**$25.00**

Send to Heath for FREE brochures — describing the pH Recorder/Electrometer and accessory items.

FREE! World's Largest Electronic Kit Catalog

Includes a wide array of electronic instruments for the classroom, laboratory, hobbyist, ham, and service technician. See the **Heath Malmstadt/Enke** instruments for electronics & chemistry ... and the **Berkeley Physics Laboratory.**

HEATH

HEATH COMPANY, Dept. 520-19
Benton Harbor, Michigan 49022
In Canada, Daystrom Ltd.

☐ Please send FREE 1967 Heathkit Catalog
☐ Please send more information on_____ (product)

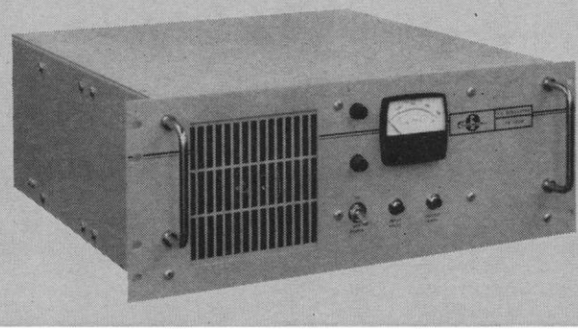
Name_____

Address_____

City_____ State_____ Zip_____

Prices & Specifications Subject to change without notice. EK-218

1. Fast Response — 50 μs
2. Low Distortion — < 0.25%
3. Isolation — 100 db
4. Precise Regulation — ±0.05%
5. Wide Frequency Range — ±3 c/s



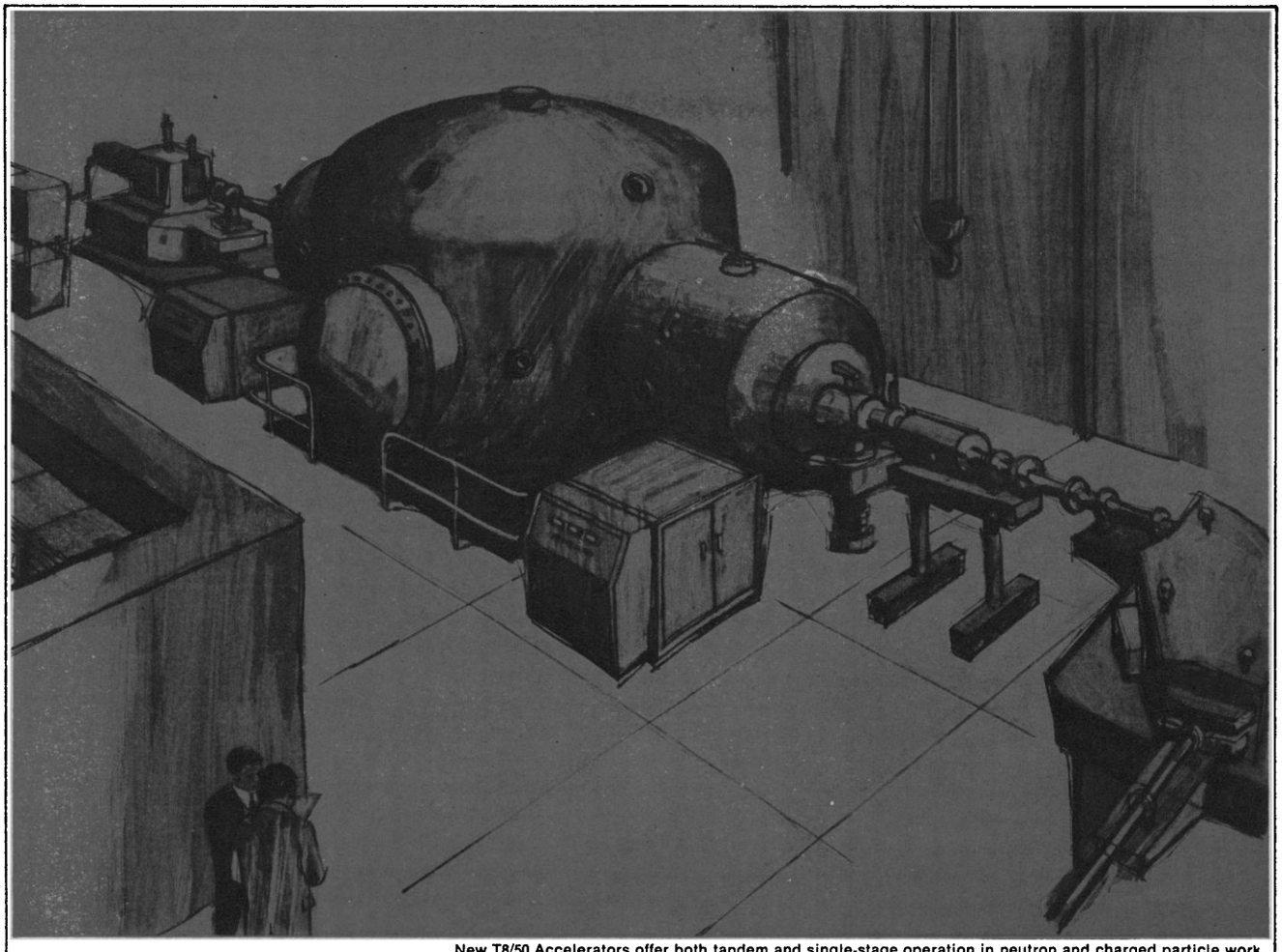
Sorensen High Precision AC Line Regulators

The Sorensen FR Series AC Line Regulators provide pure power for critical circuitry; applications include powering of pulse-type circuits for analog and digital computers where false triggering is not permissible, powering of medical instrumentation, and control of line voltage for spectrographic equipment. Output power is 0 - 1 kVA • Power factor is 0.7 lagging to 0.7 leading • Three switchable input ranges are provided for each model—95-115, 105-125 and 115-135 Vac for FR1000 and FR1020; 190-230, 210-250 and 230-270 Vac for FR1010 and FR1030. Temperature Range 0-55° C. Check the rest of our specifications in the chart below and you'll find that spec for spec, dollar for dollar, the Sorensen FR Series is your best value in precision line regulators. For additional details on the FR Series, or for data on other standard/custom AC line regulators, DC power supplies, high voltage supplies or frequency changers, call your local Sorensen representative, or write: Raytheon Company, Sorensen Operation, Richards Ave., Norwalk, Conn. 06856.

ELECTRICAL SPECIFICATIONS

Model	Output Voltage Vac	Regulation Line & Load Combined	Distortion w/10% Input Harmonics	Response Time μs	Input Frequency c/s	Isolation In/Out db	Price
FR1000	115	± 0.05%	< 0.25%	50	57-63	100	$1425
FR1010	230	± 0.05%	< 0.25%	50	47-53	100	$1650
FR1020	115	± 0.05%	< 1.0%	50	380-420	100	$1525
FR1030	230	± 0.5%	< 0.25%	50	57-63	100	$1650

RAYTHEON



New T8/50 Accelerators offer both tandem and single-stage operation in neutron and charged particle work.

HVEC Van de Graaff systems for many kinds of research:

This one offers previously unattainable currents at proton energies up to 8 MeV with tandem precision.

High Voltage Engineering Corporation, recognized leader in the design and development of particle accelerators, now offers a new, high-precision system — the T8/50 — for use in expanding university physics research and teaching programs.

Designed for tandem and single-stage operation in neutron and charged particle work, the T8/50 has a guaranteed performance rating of 50 μA of protons at 8 MeV in the tandem operation with a design aim of 200 μA; and in single-stage operation, a guaranteed performance rating of 600 μA of protons at 4 MeV.

The new T8/50 features High Voltage Engineering's direct extraction negative-ion source, which has already demonstrated its extraordinary capability in producing large quantities of heavy ions up to uranium.

The T8/50 is compatible with present and planned developments from HVEC, such as improved power supplies, stripping techniques, and sources.

For a comprehensive, detailed description of the T8/50 accelerator, and a copy of our "Technical Note #16" on the diode source, write: High Voltage Engineering Corporation, Burlington, Massachusetts 08103, or Amersfoort, The Netherlands.

HIGH VOLTAGE ENGINEERING

Measure...Check...Calibrate...Test... with L&N's new Panel-Mounted Bridges and Potentiometers.

We've just developed a new line of 19-inch-wide rack-. or panel-mounted instruments—13 in all.

They combine the basic circuit features of our widely-used potentiometers and bridges (resistance and temperature) with convenience features for panel-mounting.

Line-operation, for example, to eliminate the need for batteries or standard cells. Detector terminals to provide the choice of an external galvanometer, null detector, null-balance recorder or control amplifier. Rear-mounted terminals to permit neat back-of-panel connections. Multi-point switching (and multiple input terminals) on potentiometers. Accessories (shunt, volt box, run-up box) redesigned for rack mounting—three to a rack.

The result? A new family of instruments that offer unusual possibilities in combination. We can suggest a few:

Process Measurements: For differential measurements, using a zero-center recorder or a digital voltmeter as continuous "readout" of the difference from input. For supervisory measurements—selected periodic indications from one or more remote locations. For production measurements—in plating, molding, mixing, drying, baking, etc.

Check-out and Calibration: For transducer calibration and thermocouple checking. For recorder check-out. For wattmeter, ammeter, and voltmeter calibration. In calibration stands for amplifiers, power supplies and oscilloscopes.

Research and Development: For highly precise laboratory temperature control. For auxiliary, supplementary or ambient measurements in physical, chemical and biological research. As ranging devices for AZAR (adjustable-zero, adjustable range) recorders.

Testing: As elements of pilot-plant instrumentation. For dynamic measurements in mobile vehicles. For efficiency measurements in heat exchangers and cryogenic installations. For motor, generator and bearing temperature measurements. For life tests of electronic components. For repetitive product testing (of resistors, etc.) by percent deviation.

Sound interesting? We think so. If you agree, just call your nearby L&N Field Office for full information...or write us directly for descriptive literature, at **4926** Stenton Avenue, Philadelphia, Pa., 19144.

LEEDS & NORTHRUP
Philadelphia 44 • Pioneers in Precision

Recent AAAS Symposium Volumes

#82. **Civil Defense**

1966. 154 pages, paper. Editor: Henry Eyring. Scientists report their findings on problems related to modern warfare and passive civil defense systems.

Price: $4.00. *AAAS Member's Cash Price:* $3.50.

#81. **Environmental Variables in Oral Disease**

1966. 328 pages. Editors: S. J. Kreshover, F. J. McClure. Contents: Geographical and clinical considerations; the oral environment—nutrition and dental caries; experimental considerations in oral soft lesions; prenatally occurring influences.

Price: $8.75. *AAAS Member's Cash Price:* $7.75.

#80. **Air Conservation**

1965. 348 pages. "The result of a 2-year study by the AAAS Air Conservation Commission, all aspects–sociological, technical, political and biological—of air pollution are considered concisely." (*Chemical Processing for Operating Management*, May 1966)

Price: $8.00. *AAAS Member's Cash Price:* $7.00.

#79. **Science in Japan**

1965. 496 pages. Editor: Arthur H. Livermore. A broad and detailed review of recent scientific and technological developments in Japan.

Price: $13.00. *AAAS Member's Cash Price:* $11.00.

#78. **Man, Culture, and Animals**

1965. 304 pages. Editors: Anthony Leeds and Andrew P. Vayda. "This volume contains articles pertaining to the relationship between man and animals in different parts of the world, covering the influence of domesticated and non–domesticated animals on a variety of cultures." (*Biological Abstracts*, 1 February 1966)

Price: $8.00. *AAAS Member's Cash Price:* $7.00.

#77. **Food Quality**

1965. 306 pages. Editors: George W. Irving, Jr., and Sam R. Hoover. "It is an excellent, well-edited review of the agronomical production and processing problems of the basic commodities, fruits and vegetables, cereals, dairy products, poultry and eggs, and meat products." (*Cereal Science Today*, November 1965)

Price: $8.50. *AAAS Member's Cash Price:* $7.50.

#76. **Agricultural Sciences for the Developing Nations**

1964. 230 pages. Editor: Albert H. Moseman. "The book . . . is especially useful because of the author's combined experience with the situations and problems of agriculture in the less developed countries. . . . This book will be a valuable reference for many years." (*BioScience*, March 1966)

Price: $6.75. *AAAS Member's Cash Price:* $6.00.

#75. **Mechanisms of Hard Tissue Destruction**

1963. 776 pages, 430 illustrations. Editor: R. F. Sognnaes. "Scientists in the fields of dentistry, medicine, and zoology presented a multidisciplinary symposium in 1962, dealing with varied but cognate topics such as coral reefs, dental caries, deer antlers, osteoclastic diseases, bone metabolism, chelation. It is a refreshingly well-planned, well-edited, and interesting symposium." (*Journal of the American Medical Association*, July 1964)

Price: $13.00. *AAAS Member's Cash Price:* $11.00.

#74. **Aridity and Man**

1963; 2nd printing, 1965. 604 pages, 98 illustrations. Editors: Carle Hodge and Peter C. Duisberg. "Best collection of background material . . . well balanced and highly readable . . . probably the broadest and most nearly complete treatment of arid lands yet published." (*Journal of Forestry*, May 1964)

Price: $12.00. *AAAS Member's Cash Price:* $10.00.

72. **Spermatozoan Motility**

1962. 322 pages, 113 illustrations. Editor: David W. Bishop. "This book is an excellent assemblage of recent findings and reports of new data relative to the perplexing problem of sperm motility and includes the opinions and ideas of cytologists, biophysicists, biochemists and physiologists." (*Journal of Animal Sciences*, March 1963)

Price: $7.50. *AAAS Member's Cash Price:* $6.50.

#71. **Great Lakes Basin**

1962. 320 pages, 92 illustrations. Editor: Howard J. Pincus. "It is difficult to do justice to all the topics covered in a book as rich as this one in content, interpretation, and discussion. . . . Highly recommended to scientist and layman alike." (*Transactions*, Amer. Geophysical Union, December 1963)

Price: $7.50. *AAAS Member's Cash Price:* $6.50.

#70. **Fundamentals of Keratinization**

1962. 202 pages, 136 illustrations. Editors: E. O. Butcher and R. F. Sognnaes. "This book . . . makes fascinating reading for all clinicians and research workers interested in keratinising tissues" (*British Dental Journal*, 15 January 1963)

Price: $6.50. *AAAS Member's Cash Price:* $5.75.

#67. **Oceanography**

1961; 4th printing, 1966. 665 pages, 146 illustrations. Editor: Mary Sears. "*Oceanography* is a milestone in oceanographic advance, a worthy publication to come out of the first international congress of its kind." (*Geographical Review*, Vol. 52, No. 3)

Price: $14.75. *AAAS Member's Cash Price:* $12.50.

British Agents: Bailey Bros. & Swinfen, Ltd., Warner House 48 Upper Thames Street, London, E.C.4

Clip out this Form. Fill in and Mail Today

Circle Volumes You Wish To Order . . .

		82
81	80	79
78	77	76
75	74	72
71	70	67

American Association for the Advancement of Science
1515 Massachusetts Avenue, NW
Washington, D.C. 20005

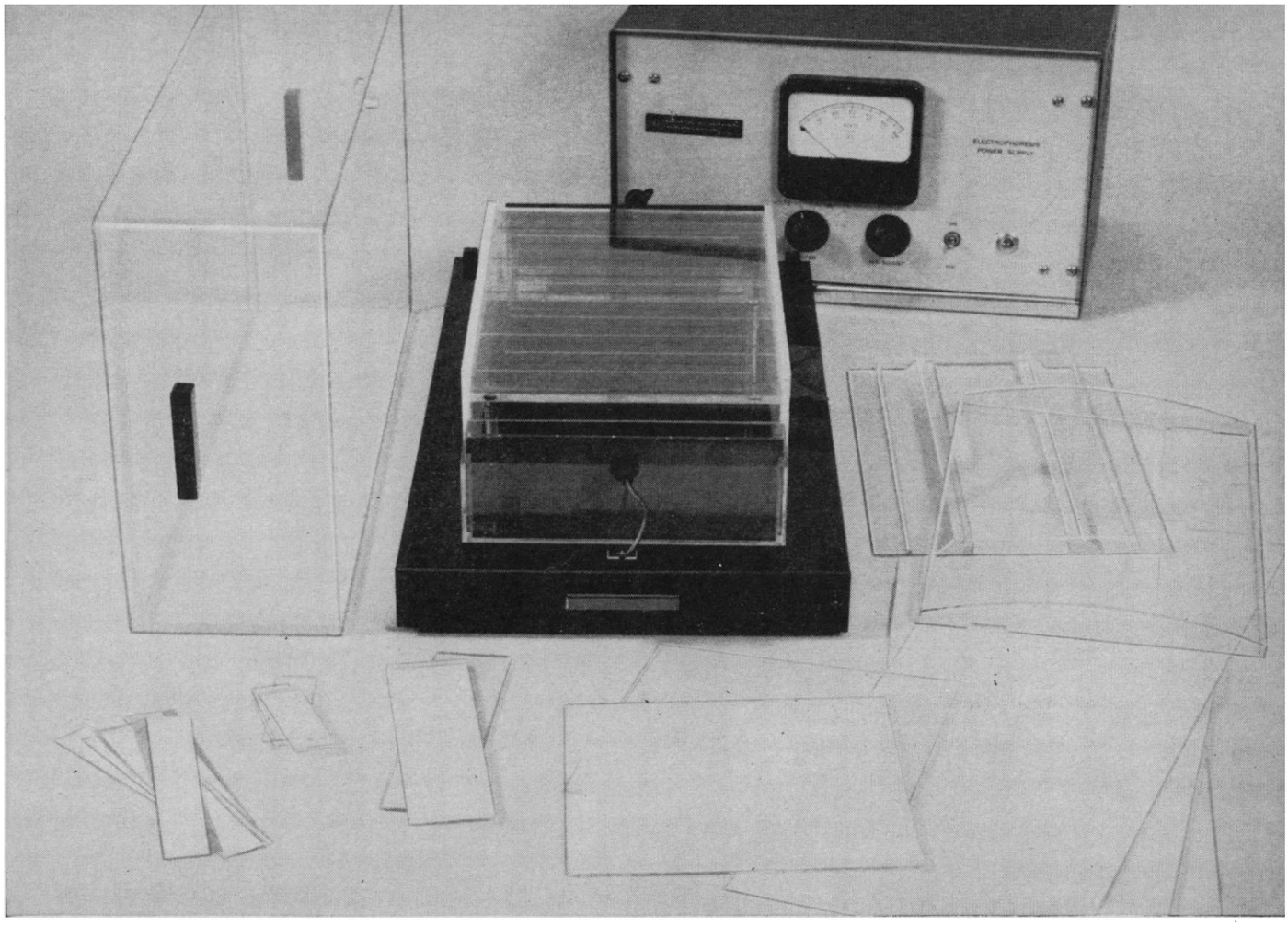
Please send the symposium volumes circled on this form, to:

Name .....

Address .....

City ..... State ..... Zip Code .....

Note: Special prices are allowed only to AAAS members for orders submitted directly to AAAS with payment. Individual membership at $8.50 per year includes a subscription to SCIENCE.



WOULD YOU BELIEVE...

an electrophoresis system so versatile you can use **any** media?

It's true. Warner-Chilcott's Electrophoresis system Model 08000, handles all currently used media—paper, starch block, agar gel, thin-layer plates, and cellulose acetate strips. A proven performer in research laboratories, the Warner-Chilcott Electrophoresis system has now been adapted for such routine separations as proteins, hemoglobins, isoenzyme fractionations, and immuno-electrophoresis. No other electrophoresis system is as versatile. No other system is as economical if you use more than one medium.

Key to versatile operation of this system lies in the Model 08000 migration chamber which is large enough to accommodate all presently-used media, yet also designed for convenient use of cellulose acetate for routine separations.

Continuous cooling of the media by means of a water table in the chamber provides effective heat dissipation. Safety is built in—you can't get a shock. A new rack adapter and cover make possible the use of up to ten 1" x 6" cellulose acetate strips for hemoglobin, protein, and LDH isoenzyme fractionations.

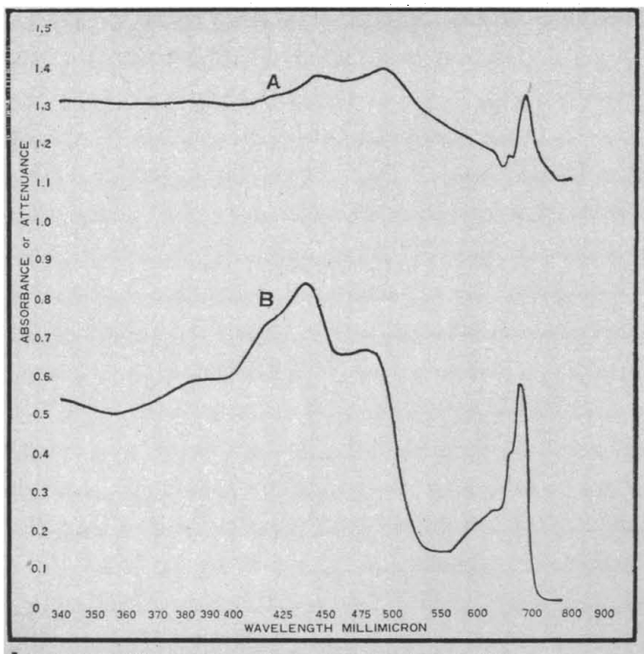
The other half of the Warner-Chilcott Electrophoresis system, the Model 01910 power supply, delivers up to 600 volts regulated to less than 1% change in output within line voltage variations of 10%. For accurate control of test conditions a dual-purpose meter allows monitoring of both voltage and current.

Please send for details on equipment (plate sizes, etc.) and specific separation methods for various media.

Write to:
Warner-Chilcott Laboratories Instruments Division,
200 South Garrard Blvd., Richmond, California, 94804.

WARNER-CHILCOTT LABORATORIES INSTRUMENTS DIVISION

Richmond, California / Morris Plains, New Jersey available from your authorized Warner-Chilcott instruments distributor



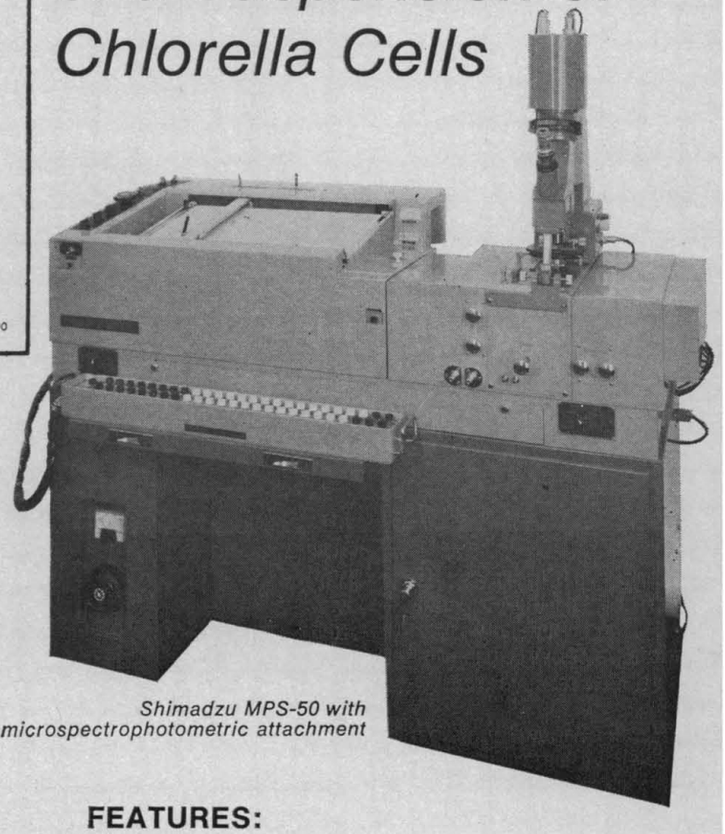
A *produced by a conventional spectrophotometer*
B *produced by the*

Compare These Absorption Spectra of a Suspension of Chlorella Cells

Shimadzu MPS-50

Multipurpose Recording Spectrophotometer

The **Shimadzu Model MPS-50** Multipurpose Recording Spectrophotometer provides distinct absorption bands of highly turbid, translucent, and opaque, as well as transparent, materials, over a range of 190 to 2500 mμ.



Shimadzu MPS-50 with microspectrophotometric attachment

An important feature is the double detection system, utilizing two large end-on photomultiplier tubes located in close proximity to the sample and reference cells. This configuration increases greatly the fraction of light incident upon the photomultiplier, permitting the analysis of highly turbid media.

An equally important feature is a microspectrophotometric attachment (shown mounted on instrument) that utilizes reflecting optics, and has its own separate detector and baseline adjusting system. This accessory provides unique capabilities, e.g., it permits scanning a single red blood cell as it is moved across a light beam of fixed wavelength, or recording the absorption of a portion of a cell as the wavelength is varied.

FEATURES:

- **Baseline compensation** over the entire range (190 mμ to 2500 mμ) by easily adjustable potentiometers
- **Makes possible** the measurement of high absorbance values (A = 0 — 5)
- **Records difference spectra** on an expanded absorbance scale (A = 0.2)
- **Accessories are available** for microspectrophotometry, derivative spectrophotometry, chromatogram scanning, double-beam fluorometry, absolute turbidimetry, photometric titration, flow dichromism, etc.

AMINCO IS SOLE DISTRIBUTOR IN THE U.S. AND CANADA

The **Shimadzu Model MPS-50 Spectrophotometer** is distributed exclusively in North America by the American Instrument Co., Inc. To arrange for a demonstration and/or demonstration sample analysis contact the Analytical Instruments Applications Laboratory at Aminco.

Write Aminco to receive literature describing the MPS-50 in full detail.

AMINCO

AMERICAN INSTRUMENT CO., INC.

8030 Georgia Avenue, Silver Spring, Maryland 20910

The 400-foot Bolex

So many people have told us that our Rex-4 16mm camera takes such great pictures, we hated to see them stop shooting. Even if it was just to reload.

That's why we decided to create the 400-foot Bolex.

We simply designed the Rex-5 so that it accommodated our 400-foot magazine. And we did it without upsetting a hair of the precision and versatility of the traditional Bolex 16.

In fact, we made 400-foot cameras more manageable.

Our magazine is lighter and adds very little bulk or weight to the camera.

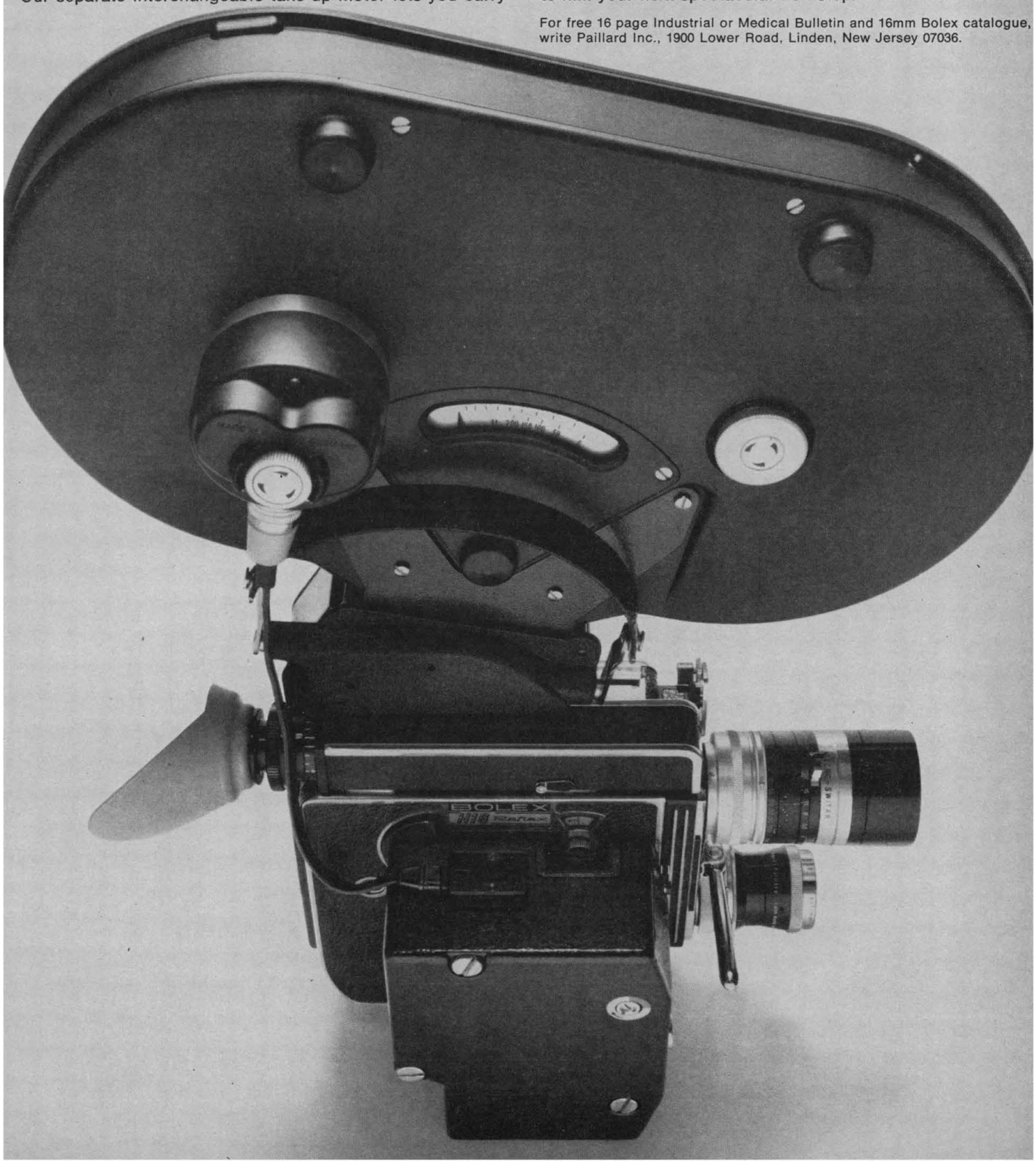
Our separate interchangeable take-up motor lets you carry three or four extra magazines without breaking your back. (It also lets you buy them without denting your wallet.)

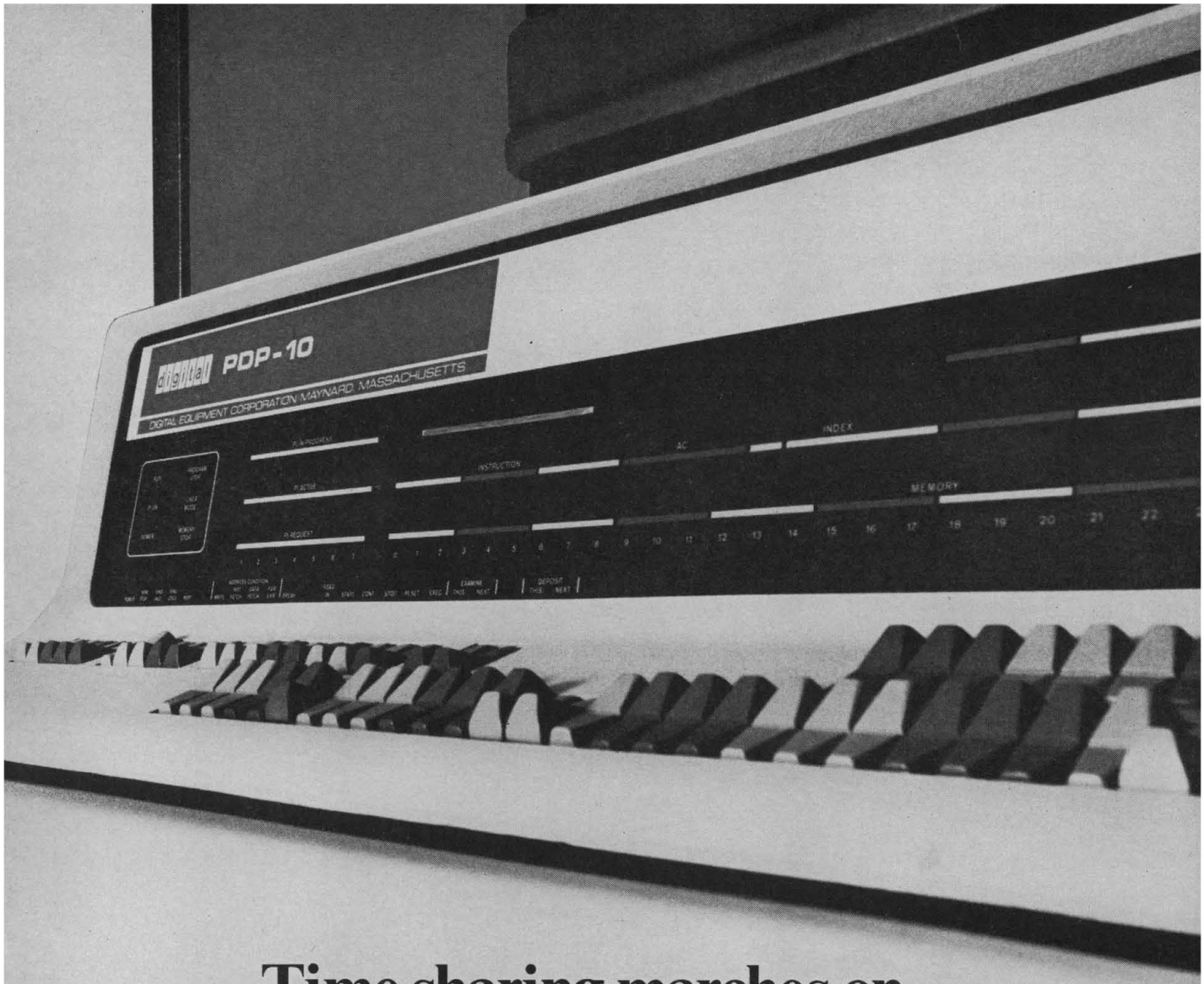
Our electric grip makes "hand-held" filming easier on the hands.

The 400-foot Bolex comes equipped with a sync-sound motor and lightweight rechargeable power pack. You can also build it into the most complete system you can buy. With prime lenses from 10mm to 150mm. Macrotelephotos. A full range of zooms, including automatic zoom. And anything else you can think of. (You can even use it as a 100-footer.)

Think about it. With the 400-foot Bolex, you might even plan to film your next spectacular non-stop.

For free 16 page Industrial or Medical Bulletin and 16mm Bolex catalogue, write Paillard Inc., 1900 Lower Road, Linden, New Jersey 07036.





Time sharing marches on...

PDP-10 is still the leader.

DIGITAL started time-sharing some time ago. With the PDP-6. Hardware and software. PDP-10 is our second step.

The reason that's important is this: our first step is behind us. Two years' continuous work on the software. Nearly two dozen installations using it. Improving it. Refining it. That's all done.

When the PDP-10 hardware arrives in September (five versions, five software packages, upwards compatible, truly modular), it will be more than cabinets filled with electronics. It will be a working, problem-solving, 36-bit word, 1 μsec, expandable, scientifically oriented computing system with memory from 8 to 262 thousand words.

Two of those versions will offer time-sharing. Second generation time-sharing. Complete, general purpose, simultaneous multiusage, "time-slicing", "time-splicing" time-sharing.

Disc swapping. Batch processing. And in the hardware, 365 powerful instructions. 16 general purpose registers. 7 fully nested interrupt levels. 16 accumulators. 15 index registers. High speed multiplexer channels. 64 programmed operators. Modular mnemonics. Flexible I/O bus structure. Programmed priority-interrupt system. All 16 Boolean operations, each in four modes.

PDP-10 is big. Powerful. In the several million dollar class just a few years ago. But it's little, too. Little enough for a scientist to put the system on-line with his experiment as his personal research tool. Little enough for a physics department with time-sharing needs. And little in price, too. Nearest competitor wants 50% more. Write.

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

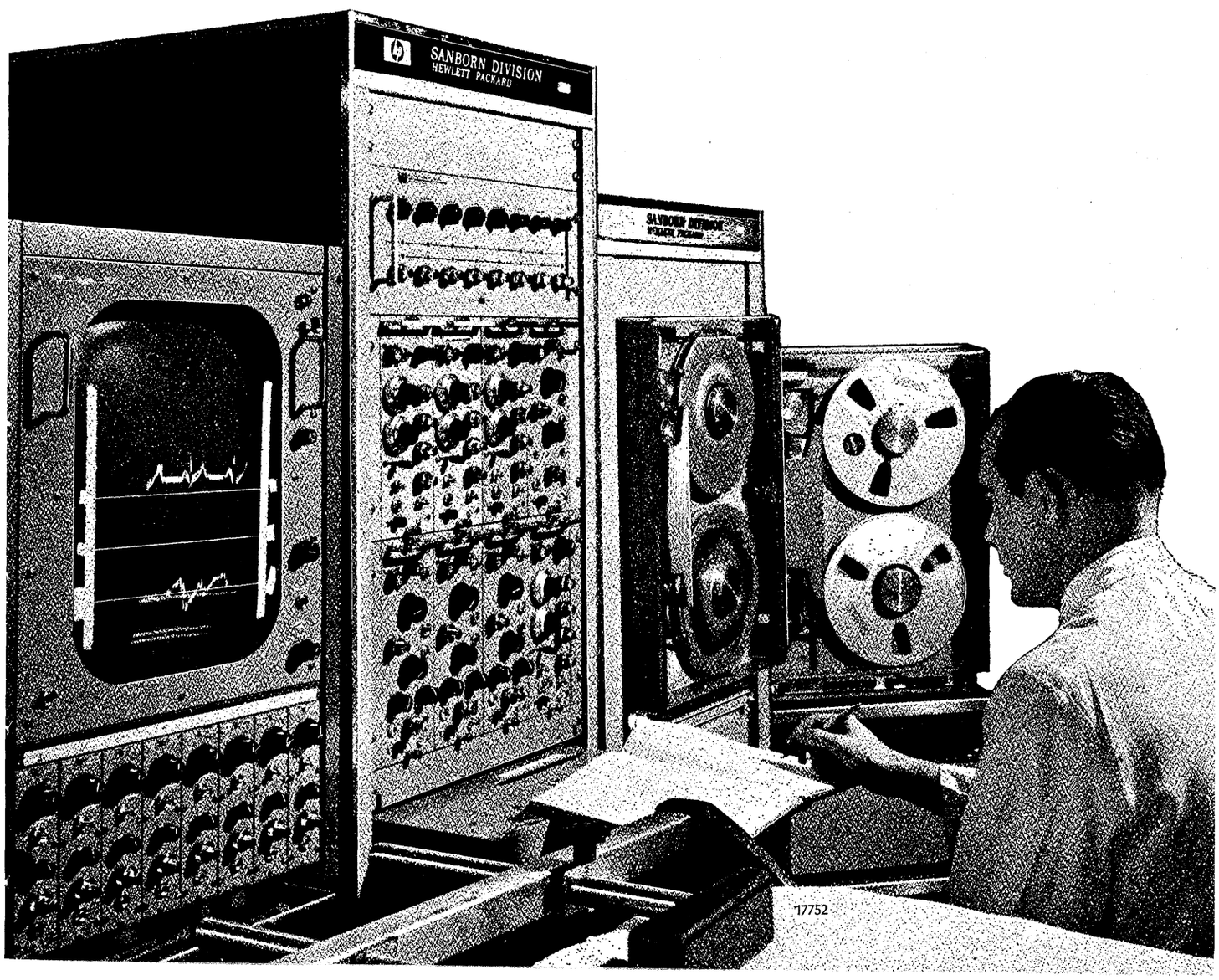
Think what you may want to measure tomorrow

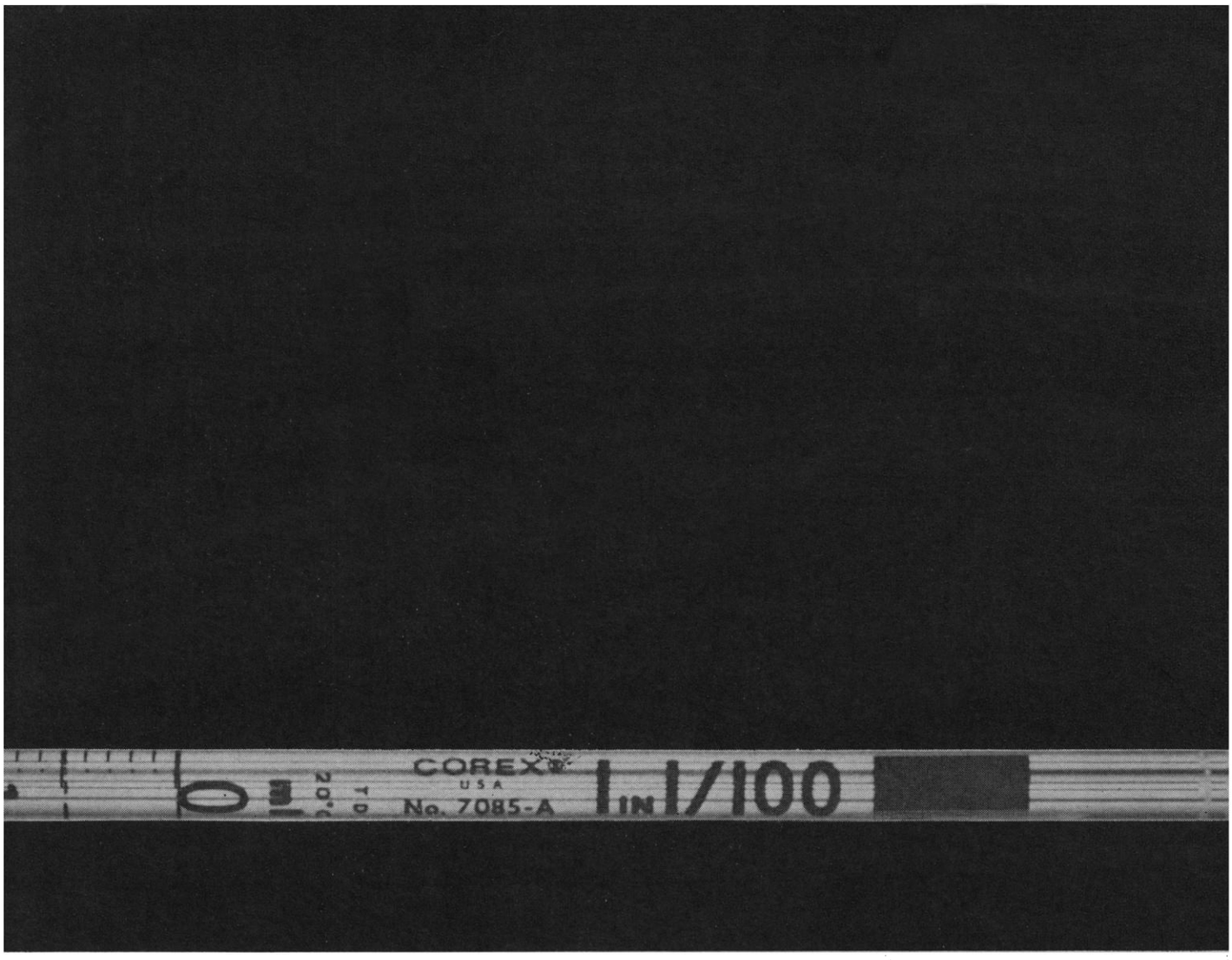
...before you buy a research recording system today

Hewlett-Packard recording systems give you the greatest *long-term* value for your investment because of two important characteristics: (1) you have the choice of the *specific* combination of signal conditioning, tape and chart recording, and display instrumentation most suitable for your *present* investigations . . . and (2) entirely different or additional phenomena can be measured and analyzed in the future without "rebuilding" the system or obsoleting major elements of the system. Simplified operation and "custom" capabilities carry no penalty of limited applicability when you change to new input signal levels, want to perform different operations on the data — or alter the type of readout or display.

This freedom of instrumentation choice from HP means: 9 different series of transducers . . . heat, photographic and ultraviolet-writing oscillographs . . . 21 plug-in signal conditioners specifically for medical and biophysical phenomena . . . scopes for one to 8 channels, with 3" to 17" screens, and a variable-persistence "image retaining" model . . . FM and Direct Record/Reproduce magnetic tape systems with 7 or 14 channels, bandwidths to 100 and 250 kHz. All are *standard* HP products, *compatible* with each other — manufactured, installed, warranted and serviced by a single source serving you *locally* through 47 field offices in the U.S. alone, more than 100 throughout the free world. Call your local HP medical field engineer for complete information and knowledgeable application assistance. Hewlett-Packard Company, Sanborn Division, Waltham, Mass. 02154. In Europe: 54 Route des Acacias, Geneva.

HEWLETT hp PACKARD





ONLY $3.00

We say "only" because that's half the cost of any other reusable pipet.
Figure it out.
A COREX® pipet, made in our exclusive *chemical* tempering process, lasts in your lab a full 6 times longer than any other pipet.
Yet, the price of a COREX pipet is only 3 times that of any other pipet.
So you save half with this new standard.

The new standards come from CORNING
LABORATORY PRODUCTS

This is a new automatic pipette.

Among other things, it doesn't touch the liquid it pipettes.

(How's that again?)

When using the BIOPETTE automatic pipette, all of the measured aliquot is held in the disposable plastic tip. The liquid never has to enter the housing of the BIOPETTE itself. Hence, the BIOPETTE stays clean, can't contaminate anything else, and doesn't need washing. And to switch from one liquid to another: just put in a new disposable tip. Period.

Fast? It takes approximately 2 seconds for *both* filling and discharging. Without sacrificing accuracy.

Safe? Safety is inherent in the design. Liquid does not come in contact with operator.

Reproducible delivery volume? Using the same instrument: ±1%.

Easy to use? Yes. With virtually no training. Requires no special "touch" or technique. (Goodbye meniscus.) Weighs less than 2 oz. with tip.

Economical? If time *is* money, yes. Two ways: greatly reduces time for pipetting; totally eliminates time required for the washing ritual. (Special bonuses: no broken or contaminated glass pipettes.)

Useful? Without doubt. Interesting current animal care applications include, for example, forced feeding, artificial insemination, blood dilutions, and so forth.

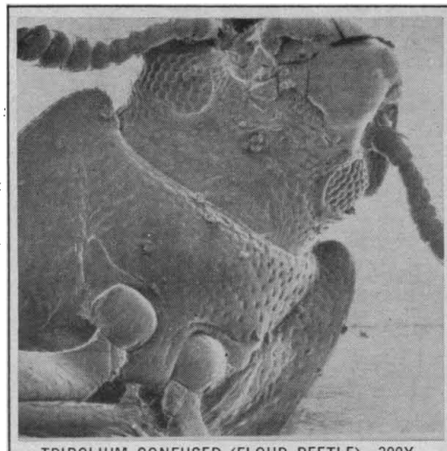
Guarantee? A real one, lasting ten years. If a problem develops (unlikely), we will immediately send you a replacement BIOPETTE automatic pipette while we fix yours for you. Or we'll throw yours away and let you keep the replacement.

For further information and prices, please write: Lab Cages Inc., 126 John St., Hackensack, New Jersey 07602. (And why not ask for our new, interesting catalog also?)

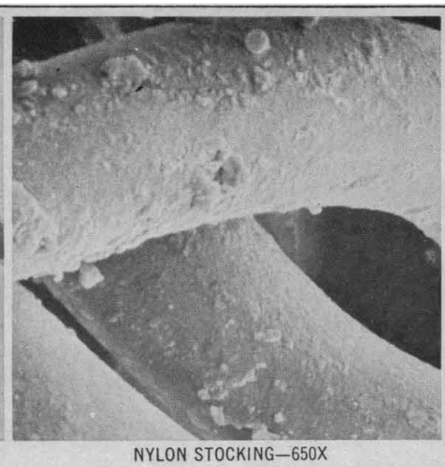
lab cages inc.

A SUBSIDIARY OF BECTON, DICKINSON AND COMPANY

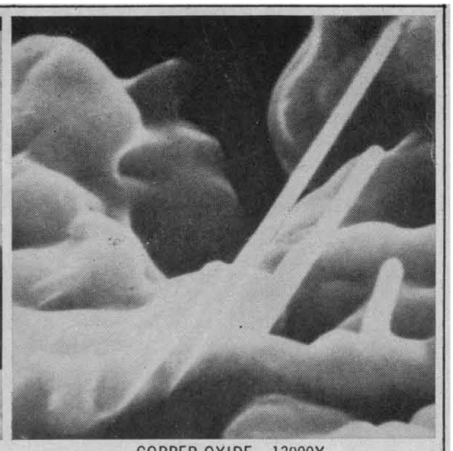
BIOPETTE is a trademark of Becton, Dickinson and Company.



TRIBOLIUM CONFUSED (FLOUR BEETLE)—300X
(uncoated at 1 kV)



NYLON STOCKING—650X



COPPER OXIDE—13000X
(Note Whisker Growth)

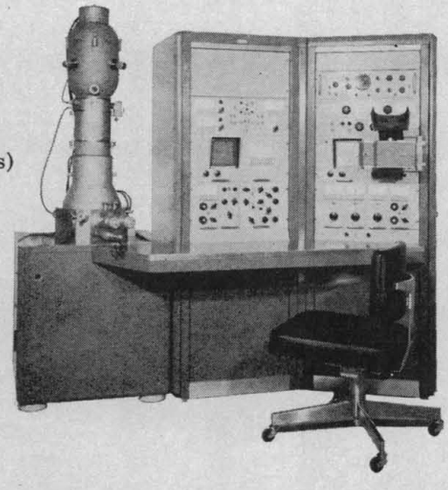
26-14

EXPLORE SURFACES DIRECT...**"IN-DEPTH"**
WITH HIGHEST IMAGE QUALITY AND RESOLUTION!

STEREOSCAN®
SCANNING ELECTRON MICROSCOPE...

for the study of specimens in the fields of biology, ceramics, entomology, geology, metallurgy, micro-circuitry, paper, plastics, textiles, etc.

- Extreme depth of focus . . . at least 300X better than optical microscope
- 20X to 50,000X practical magnification
- Accelerating potential from 1 kV
  (Especially useful for non-conducting uncoated specimens)
- Dual cathode ray tube display for simultaneous viewing and recording
- Permanently aligned 3 lens system—3 interchangeable apertures for immediate selection
- Universal specimen stage X, Y, Z motion, rotation, and tilt



Stereoscan, scanning electron microscope, a product of Cambridge Instrument Co., Ltd., London, England, is sold and serviced exclusively in the U.S.A. by Engis Equipment Company.

Write to Engis Scientific Instrumentation Div., for Publication S102—Contains detailed information and applications.

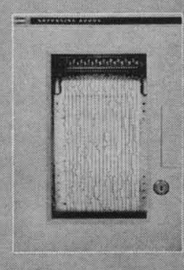
The Engis microtopography laboratory is prepared to produce specimen micrographs . . . direct all inquiries to DEPARTMENT 101

Engis
SCIENTIFIC INSTRUMENTATION DIVISION
ENGIS EQUIPMENT COMPANY
8035 Austin Ave. • Morton Grove, Ill. 60053 • Phone: 312—966-5600

Want to record the activities of fish?

Not only fish, but snakes, rabbits and humans have had their behavior studied with the help of Esterline Angus Event Recorders. ■ Event Recorders also monitor idle machine time, productivity, life tests, telephone usage and any other operation where "on-off" or "yes-no" records plotted against time are required. ■ A single instrument can monitor up to 20 events. Writing elements deflect with the application or absence of a voltage lasting only 15 milliseconds. These elements will even follow telephone dial pulses and other signals up to 10 "on-off" cycles per second. ■ Our new High Impedance DC Voltage Sensing Event Recorder can be bridged onto low power circuits without upsetting their operation. ■ You can choose the case style (portable, flush, desk top, wall mounted, twin with 40 channels), chart speeds (up to 14 immediately dialable) and writing system (inkless or ink) best suited to your requirements. You also get ten day delivery* and prices as low as $380. ■ More people buy Esterline Angus Event Recorders than buy all other makes combined. Discover the reasons! ■ Write for our informative Event Recorder Catalog or call your Esterline Angus sales engineer. ■ **Quick delivery is possible on certain Event Recorder models which have become so popular we have them in production at all times.*

You can do it with an Esterline Angus Event Recorder



ESTERLINE ANGUS INSTRUMENT COMPANY, INC.
BOX 24000 • INDIANAPOLIS, INDIANA 46224

Nikon EFM Microflex brings new ease and versatility to photomicrography

The Nikon EFM will adapt any standard microscope for photography, and will produce high quality, vibration-free photomicrographic negatives, prints and projection slides, as well as movies, in color or black-and-white.

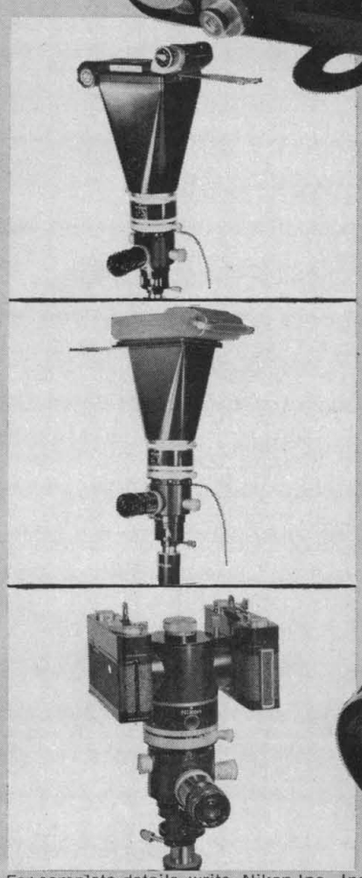
It has a built-in electric eye system which virtually eliminates the uncertainties of exposure determination, reducing the entire operation to an almost automatic procedure.

The "eye," a sensitive CdS cell, measures the aggregate light passing through the specimen. It is coupled to the shutter speed selector ring and a meter needle. As the ring is rotated, the needle moves. The correct setting is indicated when the needle is centered, at which point the exposure is made.

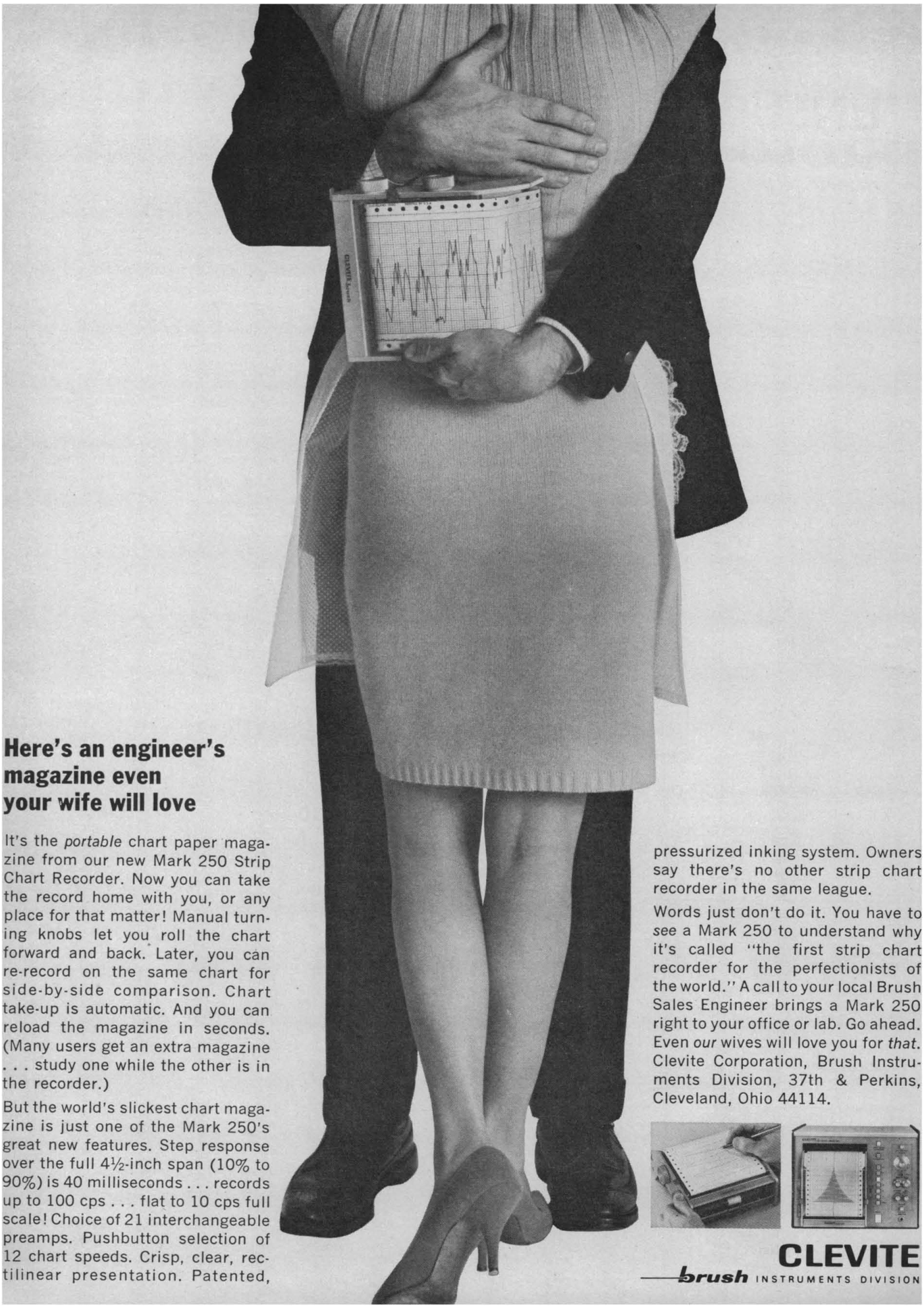
The EFM accepts Nikon F and Nikkormat camera bodies, and the Nikon M-35 camera back. It can be adapted for use with other 35mm cameras, as well. Three large-format camera backs are also available: a Graflok back which accepts 4 x 5 film pack and sheet film holders, a 120 roll film back for 2¼ x 3¼, and the Polaroid M-100 back for making instant 3¼ x 4¼ photomicrographs.

Another unique and ingenious accessory for the EFM, known as the EFM Bicam Adapter, permits two 35mm camera bodies or two M-35 camera backs to be mounted in tandem. One may be loaded with color and the other with black-and-white, or with any other two emulsion types desired. A rotating, internal prism reflects the image rays into one camera body or the other, permitting both to be exposed in quick succession with minimum lapse of time.

The EFM is also applicable to cine-photomicrography. It is equipped with interchangeable relay lenses for the various formats. A finder telescope is furnished for focusing and orienting the specimen image in the picture area.



For complete details, write: Nikon Inc., Instrument Division,
Subsidiary of Ehrenreich Photo-Optical Industries, Inc. Garden City, N.Y. 11533



Here's an engineer's magazine even your wife will love

It's the *portable* chart paper magazine from our new Mark 250 Strip Chart Recorder. Now you can take the record home with you, or any place for that matter! Manual turning knobs let you roll the chart forward and back. Later, you can re-record on the same chart for side-by-side comparison. Chart take-up is automatic. And you can reload the magazine in seconds. (Many users get an extra magazine . . . study one while the other is in the recorder.)

But the world's slickest chart magazine is just one of the Mark 250's great new features. Step response over the full 4½-inch span (10% to 90%) is 40 milliseconds . . . records up to 100 cps . . . flat to 10 cps full scale! Choice of 21 interchangeable preamps. Pushbutton selection of 12 chart speeds. Crisp, clear, rectilinear presentation. Patented, pressurized inking system. Owners say there's no other strip chart recorder in the same league.

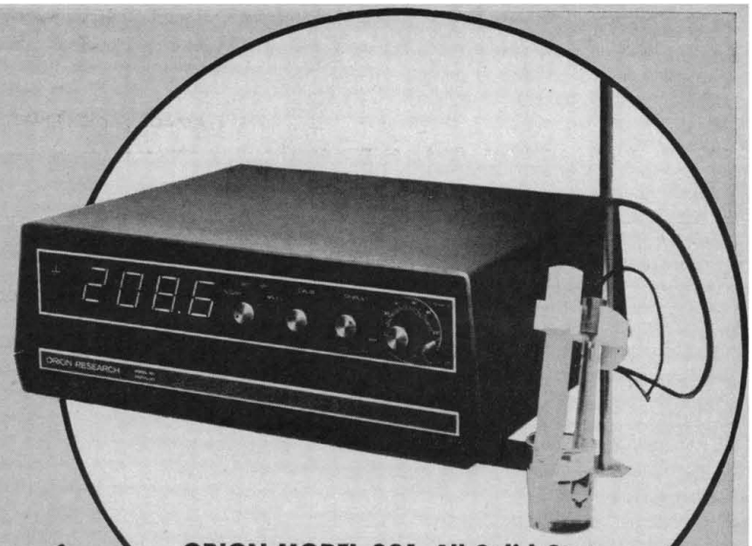
Words just don't do it. You have to *see* a Mark 250 to understand why it's called "the first strip chart recorder for the perfectionists of the world." A call to your local Brush Sales Engineer brings a Mark 250 right to your office or lab. Go ahead. Even *our* wives will love you for *that*. Clevite Corporation, Brush Instruments Division, 37th & Perkins, Cleveland, Ohio 44114.

CLEVITE

brush INSTRUMENTS DIVISION

UNSURPASSED...

for critical clinical and research pH determinations!



ORION MODEL 801 *All Solid-State*
DIGITAL DISPLAY pH METER

Here, for the first time, is a digital pH meter with a completely electronic display system for the precise measurement of pH and specific ion electrode potentials. In fact, the "801" is so truly digital, it can be interfaced with digital printers, computer typewriters, or time-shared computers, if you wish.

The numbers on this sophisticated instrument are an inch high — clearly visible even at a distance thirty feet away . . . in pitch darkness or in broad daylight.

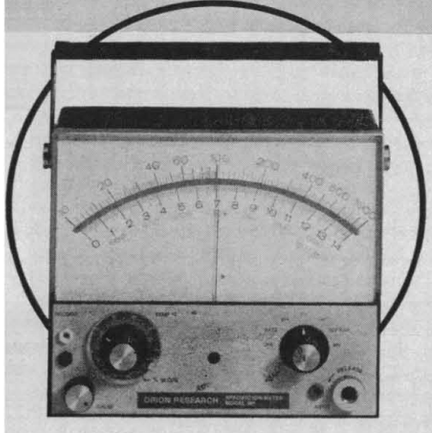
Continuous millivolt readings are taken without polarity switching, range selection or scale interpolation. Polarity indication is automatic.

You can vary the display time to suit your convenience . . . from 0.6 to 6.0 seconds, or until *you* have an opportunity to record the reading. *There are no moving parts in the entire display system.*

Because of the outstanding repeatability obtained with Model 801, it cannot be surpassed for critical clinical and research pH determinations . . . or for accurate specific ion activity measurements, especially when Orion's new series of electrodes are used. Why not ask us for details on this revolutionary new pH meter?

- **Range (Continuous):** 0.000 to 13.999 pH, −999.9 to +999.9 mv
- **Repeatability:** ±0.001 pH; ± 0.1 mv
- **Relative Accuracy:** ±0.002 pH units
- **Amplifier Drift:** less than 0.002 pH units/day, non-cumulative
- **Input Impedance:** 10^{14} ohms
- **Numerical Display:** 1" high 7-segment, long-life neon lamps; automatic decimal point indication
- **Karl Fischer Polarizing Current:** −10 microamperes
- **Recorder Output:** Adjustable 10-100 mv for ±1000 mv or ±7 pH units; output nominally zero at pH 7
- **Digital Output:** 8-4-2-1 binary-coded decimal true and complementary; 5 v nominal level; 4 bit code indicates function, sign, over or under range. Input for computation inhibit

H-4480X Orion Model 801 Digital Display pH Meter. Overall dimensions: 15⅜" x 12" x 6³⁄₁₆". Weight 16 pounds. For 115/230 volts, 50/60 cycles, 25 watts. Price (without electrodes) $995.00



ORION MODEL 401
SPECIFIC ION METER

OPERATES ON TWO 80¢ RADIO BATTERIES FOR 6-12 MONTHS

measures total water hardness • fluoridation levels • calcium, cupric, chloride, bromide, perchlorate and iodide ions • pH and redox potentials

This all solid-state meter is designed especially for use with Orion's growing series of specific ion electrodes. It can be used either in the "lab" or in the field — both winter and summer. Boasts many features found only in the best expanded pH meters. Repeatability is ±0.015 pH and ±0.15 mv on expanded scale. Comes in a handy carrying case with two batteries, support rod, electrode holder, bottles and plastic beakers. Ask us for bulletin 401.

H-5485X Orion Specific Ion Meter, 6¾"x7¾"x3⅞", weight 4½ lbs. Price (without electrodes) $330.00

SCIENTIFIC GLASS APPARATUS CO., INC.
BLOOMFIELD, NEW JERSEY

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

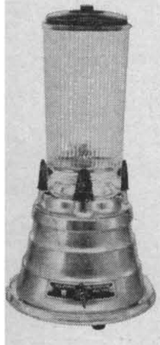
Branches: Boston 16 Mass. · Danbury Conn. · Elk Grove Village Ill. · Fullerton Calif. · Philadelphia 2 Penna. · Silver Spring Md. · Syracuse 2 N. Y.

GIANT!

AND HOW!

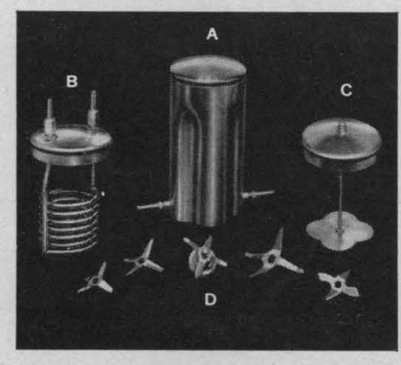
NEW! WARING'S ONE-GALLON LABORATORY BLENDOR IS THE ONLY ONE OF ITS KIND IN THE WORLD!

This is the first and only one-gallon blendor engineered specifically for use in the laboratory. It will mix, grind, blend, emulsify or homogenize—all in seconds. Designed for perfect mass processing or for experimental use, its Cloverleaf shaped stainless steel container gives total blending action on low, medium or high speed. Two-piece lid with molded vinyl gasket provides a complete seal. Removable center allows sampling or adding ingredients. This superbly constructed Waring Blendor answers every laboratory blending problem efficiently, quickly, safely. Depend upon it. **$295.00** (No. CB-5)



THIS 32 OZ. WARING COMMERCIAL BLENDOR IS USED 4 TO 1 OVER ALL OTHER BLENDORS. NO. 702-CR. $47.95

- For hospital, institutional and scientific labs.
- Cloverleaf design and whirlpool action blend up to 4 times more efficiently.
- Eliminates "Blind Spots," blend-resistant eddies and stratification.
- Container can be autoclaved.
- Two-speed superpower performance.



NEW! BLENDOR CONTAINER AND ACCESSORIES FOR SS510 SERIES CONTAINERS

(A) STAINLESS STEEL CONTAINER NO. SS510CB WITH BEARING COOLED BASE
Type 302 stainless steel container and cover. Jacketed base allows for long period blending of substances without deterioration due to excessive heating. Temperature control is positive. **$79.95**

(B) STAINLESS STEEL TEMPERATURE CONTROL COIL NO. SS510TCC
All stainless steel coil accessory for temperature control of container contents. Construction allows free flow of material to blades for unhindered blending action. **$49.95**

(C) STAINLESS STEEL FOAM ARRESTER NO. SS510FA
All stainless steel accessory prevents introduction of atmospheres into mixtures where excess foaming is not desirable. **$16.95**

(D) BLADES FOR SPECIAL BLENDING PROBLEMS

WARING PRODUCTS CO.
Division of
DYNAMICS CORPORATION of AMERICA
WINSTED, CONN.

Please write for full specifications or for answers to any questions.

WORTHINGTON

XOP ECHP RT$_1$

Worthington adds three new high-purity research enzymes to its list of 187

Worthington Biochemical Corporation has added three new specially purified enzymes to its broad list of products for biochemical research:

— XANTHINE OXIDASE (XOP) has minimum specific activity of 0.30 units per milligram protein and a 280 mμ/450 mμ absorbancy ratio of approximately 6.0. Chromatographically prepared, it is not less than 90% homogeneous on polyacrylamide gel disc electrophoresis.

— ACETYLCHOLINESTERASE (ECHP) has minimum specific activity of 1000 units per milligram. It is an authentic acetylcholinesterase from *Electrophorous electricus* purified by chromatography as well as by gel filtration.

— RIBONUCLEASE T$_1$ (RT$_1$) has specific activity of approximately 3 x 10^5 units per milligram, twice that of other commercial products. It is homogeneous and has its purity verified by enzymatic, chromatographic, electrophoretic and amino acid analyses.

Technical data sheets on these specially-prepared enzymes are available on request to update your copy of the comprehensive Worthington manual. Use the following coupon to request copies of these or the complete list of Worthington products for biochemical research.

Worthington Biochemical Corporation
Dept. A
Freehold, New Jersey 07728

Please send the following bulletins:

☐ XOP ☐ ECHP ☐ RT$_1$

☐ Catalog of Worthington Enzymes for Research

Name

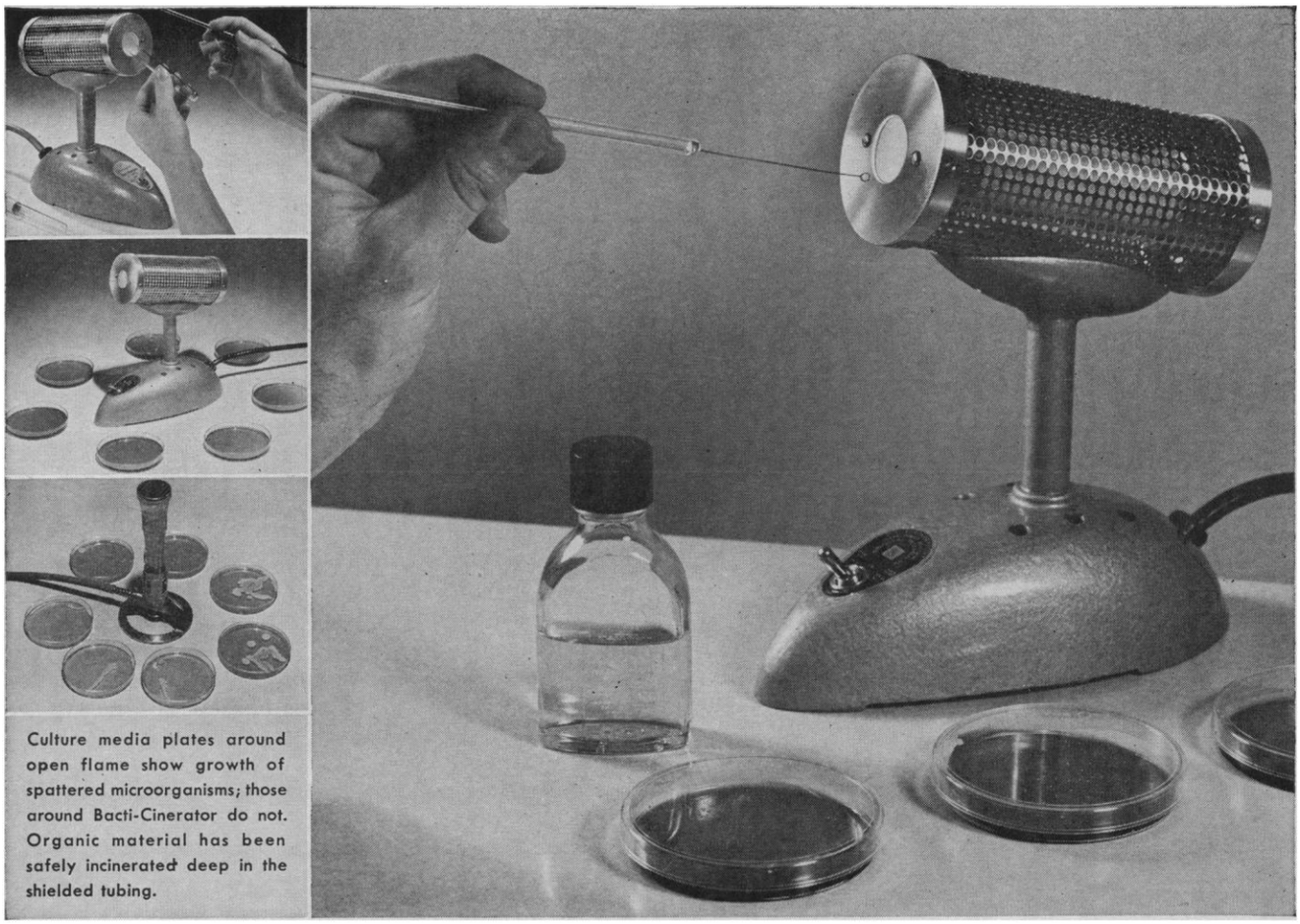
Title

Institution

Address

City

State ZIP



Culture media plates around open flame show growth of spattered microorganisms; those around Bacti-Cinerator do not. Organic material has been safely incinerated deep in the shielded tubing.

ELIMINATE INFECTIOUS SPATTER

NEW! Sensaur Bacti-Cinerator®

- *Stop Cross Contamination — Safeguard Laboratory Personnel*
- *Safely Sterilize Loops, Needles and Culture Tube Mouths*

With the new Sensaur Bacti-Cinerator, sterilization of loops and needles is possible without the dangerous, widespread spattering of microorganisms, and because the opening of the Bacti-Cinerator is now flared outward into a funnel, you can also sterilize culture tube mouths. Complete sterilization by infrared heat is accomplished within 5 to 7 seconds.

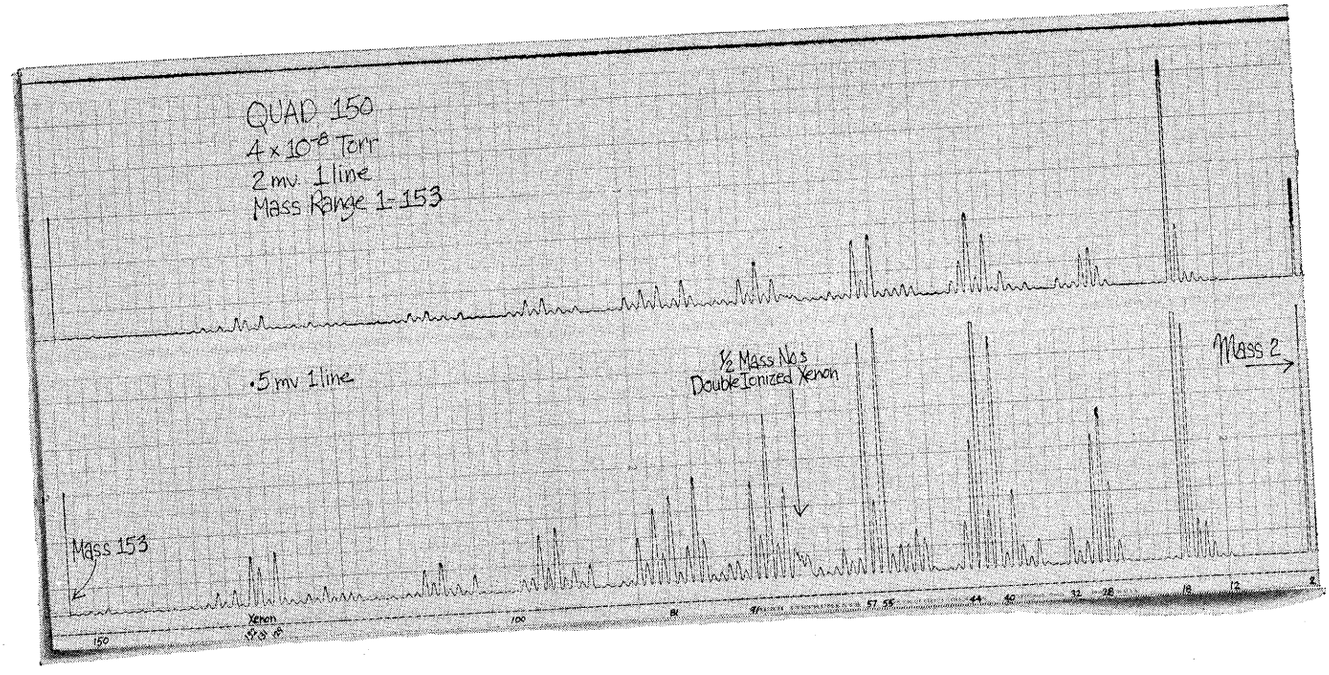
Coors Series AD99 ceramic tubing, which is inert in a carbonaceous atmosphere and highly resistant to alkaline and other fluxes, allows rapid and uniform heat transfer. Optimum sterilizing temperature (1600°F) is reached within 10 to 12 minutes. Stainless steel, perforated guard rapidly dissipates heat. Cast aluminum stand is finished in baked hammerloid enamel. Stability is provided by the extra-heavy base which also provides handy storage for 6 needle holders. Original price and operating expense are low. Uses less than 0.9 amps. Power consumption is 110 watts at 120 volts. Only $45.00. For further information, write: Aloe Scientific, Dept. RK, 1831 Olive Street, St. Louis 3, Missouri.

HEALTH AND SCIENCE DIVISION BRUNSWICK CORPORATION

ALOE SCIENTIFIC

Serving the Sciences that Serve Mankind

Get this kind of RGA sensitivity and resolution...

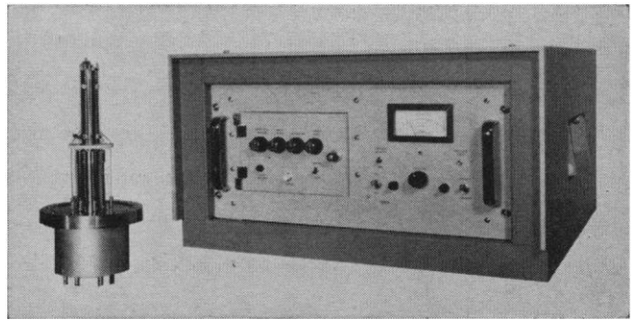


from a Quadrupole system priced at $7950.

- **1-150 amu in one mass range**
- **Greater than unit resolution* at 150 amu**
- **5x10⁻¹⁴ torr partial pressure sensitivity**
- **130 millisecond scan with linear mass separation**

Ultek/EAI QUAD™150

The new QUAD 150 Residual Gas Analyzer can sweep the entire mass range from mass 1 to mass 150 in 130 milliseconds. This high speed scan permits the user to analyze the kinds and quantities of the various molecules contributing to the system pressure, and follow their dynamic pressure changes. A continuously variable scan speed allows the setting of a sweep compatible with any recording system used, up to a 10-minute sweep. The single mass monitoring feature permits the dc level of any one mass peak to be recorded or observed on an oscilloscope for long periods of time. The system consists of a Quadrupole axial-beam ionizer assembly (bakeable to 400°C, and operable to 250°C) and a controller unit which can be removed from cabinet and mounted in a standard 19" rack. The QUAD 150 is manufactured by Electronic Associates Incorporated and marketed exclusively by Ultek. Send for complete specifications. Write Ultek Corp., Box 10920, Palo Alto, California 94303.



ULTEK

* Resolution is defined as two peaks, one mass unit apart, and of equal height, and with a valley between them with a depth of 90% of the height of the peaks.

QUAD is trademark of Electronics Associates, Inc.

This is a pipette?

This is a hundred pipettes...even more.

This is a Warner-Chilcott AUTO SPENSER™ Pipetter. And what a welcome change from that drawerful of pipettes—all extremely fragile, all different sizes, and all slightly different from each other, even those that should be identical.

50% FASTER. The AUTO-SPENSER pipetter enables you to pipette and dispense at least 50% faster than you can by comparable manual methods. Not merely a diluter—although it can be used as one—the AUTO-SPENSER Pipetter is ideally suited for semi-automatic chemistries because it eliminates variations in individual pipetting techniques. Micrometer-controlled pumps draw in and deliver precise volumes—over and over again. And, no visual meniscus-reading is required.

FAST CHANGE-OVER. You can change over to a completely *new* group of chemical procedures with different reagents and volumes—*in only 10 seconds*—by making two simple adjustments on the micrometer pumps. That means you can use the AUTO-SPENSER Pipetter for such tests as glucose, calcium, and preparation of protein-free filtrates—a hundred *different* tests in an afternoon.

Don't buy pipettes—buy the AUTO-SPENSER Pipetter for semi-automatic chemistries. Price $195.

BRIEF SPECIFICATIONS

Volume Ranges		Reproducibility
Sample	20-250 μl	$\pm$ 0.5 μl or $\pm$ 1% (whichever is greater)
Reagent	0.5-5 ml	$\pm$ 0.005 ml or $\pm$ 0.5% (whichever is greater)

For more details write Warner-Chilcott Instruments Division, 200 South Garrard Blvd., Richmond, California.

WARNER-CHILCOTT INSTRUMENTS DIVISION

Cut cost of ultra-pure separations to two cents per ml of throughput with new flame detector

Now that it is available with a flame ionization detector, the Model 775 Preparative Gas Chromatograph performs completely satisfactorily with nitrogen carrier gas, eliminating the need for expensive helium. Because of its unique combination of high capacity and flame detection, the Model 775 now steps to the head of the class as the most economical-to-operate of all prep instruments.

Here are the facts. You can now operate the Model 775 equipped with four-inch OD columns for a full 24 hours on less than $10.00 worth of carrier gas. During this period, your 775 will separate as much as 2½ liters of sample into its pure components at an operating cost of about two cents per ml of throughput.

Compare this with the cost of making separations with any other instrument or even any other method . . . and you will agree that the 775 has no equal in operating economy. And the new flame detector tells only part of the story.

Remember that the 775 is the most versatile of all prep gc's, equally effective for high-resolution and trace-component as for large-capacity separations, because it accommodates any column from ⅜ to 4 inches OD.

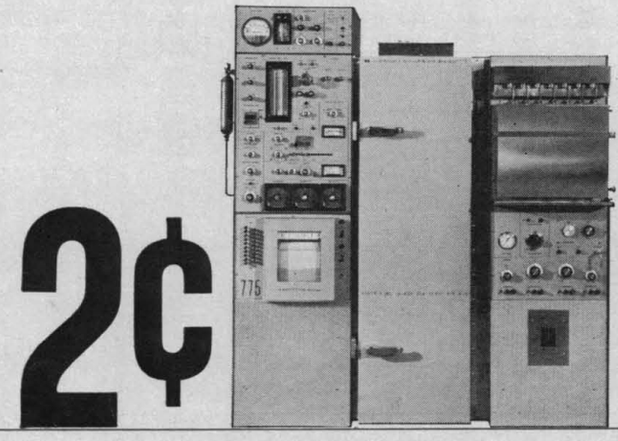
Remember that the 775 has built-in analytical capability so that you can use it to do all your scouting work before doing the prep separation.

Remember also that the 775 is a fully automatic instrument, uniquely equipped with the sample and collection capacity required for truly unattended operation even over weekends.

Write for our new Data Sheet 775/6 for a full discussion of the characteristics and advantages of the Model 775 . . . and its manual version, the Model 776. Or call the chemical instrumentation sales representative at the nearest H-P sales office.

Hewlett-Packard, F & M Scientific Division, Route 41, Avondale, Pennsylvania 19311. In Europe: F & M Scientific Europa N. V., Basisweg, Amsterdam, Holland.

HEWLETT PACKARD hp F&M SCIENTIFIC DIVISION

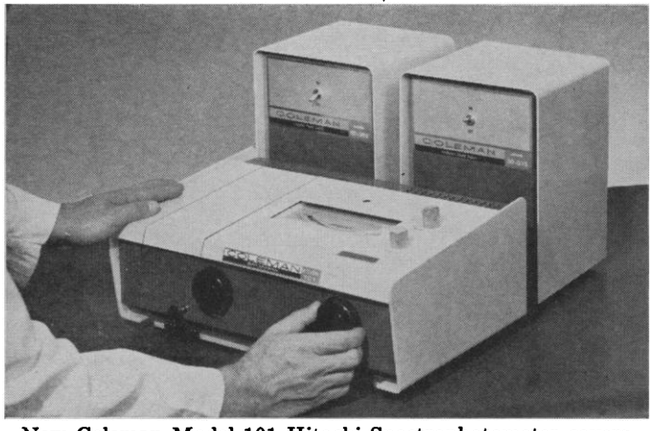


2¢ ml

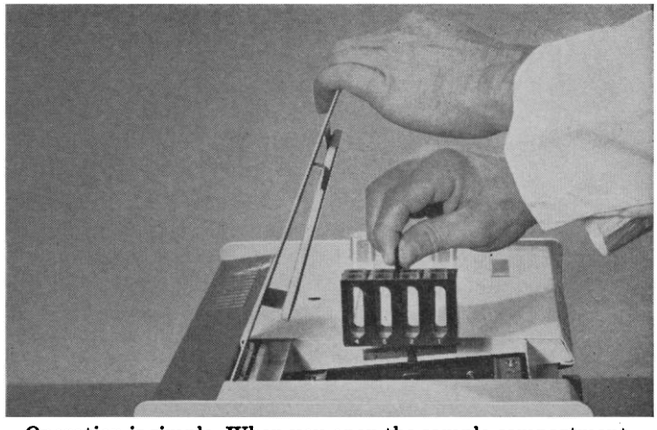
43702

Fast, new UV-Visible spectrophotometer under $1700

Coleman demonstrates an excellent instrument for parts-per-million analysis, trace contaminant detection and routine industrial control.

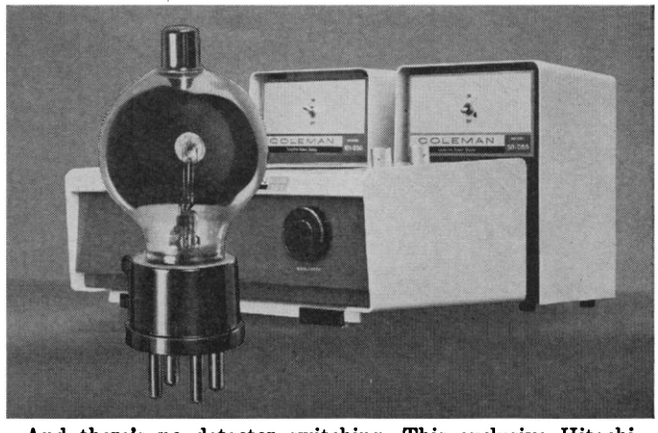


New Coleman Model 101 Hitachi Spectrophotometer covers the range from 220 to 900 mμ, where 95% of all analytical spectrophotometric data is obtained. Its photometric accuracy and stray light characteristics are the equal of instruments costing twice as much.



Operation is simple. When you open the sample compartment, an interlock mechanism automatically protects the optical system. You insert the cell holder, containing reference and three sample cells, and adjust for zero without any further manipulations.

Then shut the compartment, set 100% T and run three determinations in rapid sequence without re-opening the sample compartment. Wavelength scale is linear. The digital wavelength readout is located right next to the transmittance/absorbance meter.



And there's no detector switching. This exclusive Hitachi dual-range phototube covers the complete UV-Visible range of Model 101, eliminates time-consuming stops in the middle of an operation. It prevents errors due to faulty tube positioning.

Coleman Model 101 will fit handily on your workbench. Its largest dimension is only 16". The monochromator weighs just 28 lbs. Call your Coleman distributor. He'll be glad to tuck one under his arm and bring it in for a demonstration.

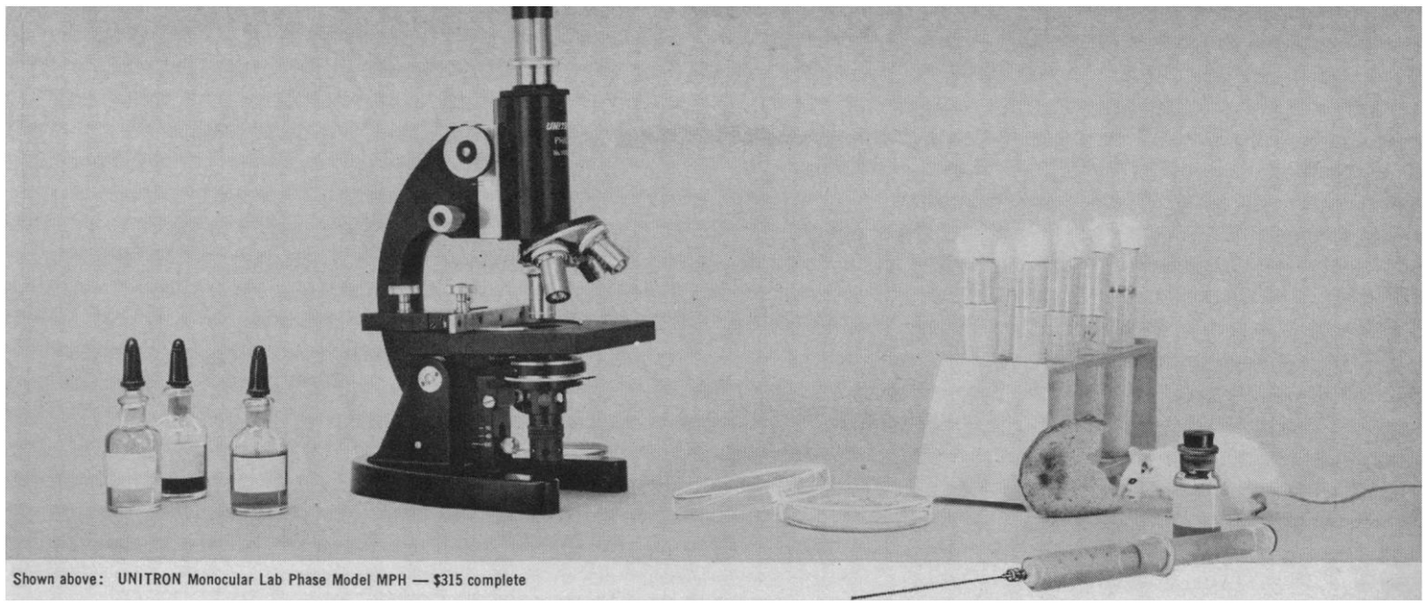
Other interesting features: Accommodates four, 5, 10, or 20 mm light path cells, available from Coleman; 10 mv recorder output jack. *Can be purchased three ways:* For UV work only, for Visible work only, or complete for full-range operation.

Send for brochure SB-305

COLEMAN

COLEMAN INSTRUMENTS • 42 MADISON ST. • MAYWOOD, ILLINOIS 60153

A Division of The Perkin-Elmer Corporation



Shown above: UNITRON Monocular Lab Phase Model MPH — $315 complete

There are 3 microscopes in this picture

...at a distinctly singular UNITRON price

Most lab microscopes are used for ordinary *brightfield* studies.

So is UNITRON's MPH.

Some lab microscopes can also be used for *darkfield.*

So can UNITRON's MPH.

Still other lab microscopes offer *phase contrast* to aid in the study of *living, unstained* material.

So does UNITRON's MPH.

Until now, no lab microscope has provided all 3 for the price of 1.

UNITRON's MPH does. The 3 most important techniques of microscopy are built-in, yet the MPH costs less than many single-purpose microscopes.

That's not all. UNITRON's MPH gives you more than just the advantages of 3 specialized microscopes. It unites them in "Continuous-Transition Microscopy." With a turn of the condenser knob, you change from *brightfield* to *darkfield* to *phase contrast,* all in rapid succession. Operation is so easy, it's almost automatic. There are no accessories to attach and no time-consuming adjustments to make. Everything has been factory-centered for you. Even the light source is built-in and permanently aligned

Have cost and complexity kept you in the dark about phase? If so, you're in for a treat UNITRON phase contrast will impress you all the more if you've tried to study *unstained, living* material with ordinary brightfield microscopes. There's no need to close the iris to pinhole size, reducing resolution and detail. Gone are those ghostly artificial images.

UNITRON Phase Contrast provides optical staining. You get the benefits of chemical staining, without the time-consuming preparation. And what's more, you see material *alive* with vivid contrast and pin-point detail. With phase, even your stained slides show unsuspected details. All this, without any special effort.

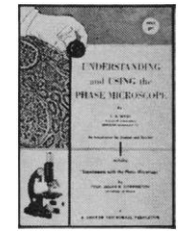
There's more. UNITRON's built-in illuminator provides five intensities . . . more than enough to meet your visual and photographic needs. Even the eyepieces are special . . . the widefield type for comfortable viewing.

And now, the moment of truth. The price. Only $315 for UNITRON's Monocular Laboratory Phase Model MPH . . . less than you pay for many ordinary brightfield lab microscopes. The Binocular Model BPH, with several additional features of its own, costs only $527.

UNITRON prices include everything but the specimens. In addition to all the special features of our phase models, you'll find everything else you expect in a good lab microscope. Four achromatic objectives (including high-power oil-immersion), mechanical stage, focusable substage condenser with iris diaphragm and filter system, fitted cabinet, etc. These, and all the other features we've described, are standard equipment with UNITRON. *There are no hidden extras to buy.*

Too good to be true? You needn't take our word for it. Borrow a UNITRON Monocular MPH or Binocular BPH for 10 days. No cost or obligation. (We'll even pay shipping charges for a chance to let you put our microscope through its paces.) Give this UNITRON an opportunity to prove its value in your lab. We think it will sell itself.

Teachers will be interested to learn that UNITRON even offers *student phase models* for as little as $99. To introduce phase to the student lab, and to other areas where it has been a stranger, UNITRON has published a fully illustrated 64-page booklet, *Understanding and Using the Phase Microscope.* The text includes a special chapter of experiments written by Professor Julian D. Corrington of the University of Miami. Other subjects are covered, including the optical theory of microscopes in general. The booklet normally sells for $1.00 but we will be glad to send a free copy to any interested teacher or researcher

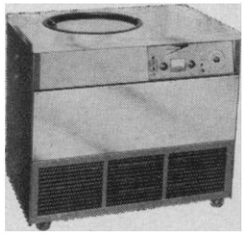


Ask for a free 10-day trial. Please specify whether you want to try Model MPH or BPH. A phase booklet is shipped with each microscope . . . or, you may request the booklet separately.

UNITRON INSTRUMENT COMPANY
MICROSCOPE SALES DIVISION • DEPARTMENT 4-E
66 NEEDHAM STREET, NEWTON HIGHLANDS 61, MASS.

Some people believe you should be able to get a better centrifuge ...and pay a little less.

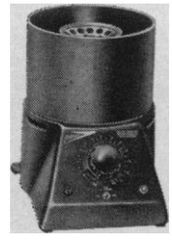
They are right.
You can . . . if you specify LOURDES.



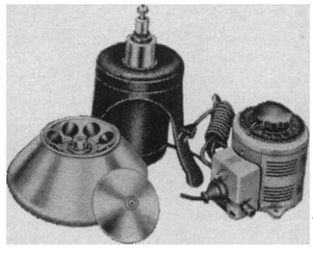
LOURDES Clini-Fuge 30-R
Combines low speed, super speed and ultra speed operations in one unit. Only one attachment is needed to increase maximum rpm from 6,000 to 25,000. Automatic, Refrigerated. Contains all safety features as in Beta-Fuge. The price is $2,775.00; high speed attachment only $385.00. Non-refrigerated model (No. 30)—$840.00.

LOURDES Beta-Fuge A-2
Capacity to 3,300 ml; forces to 41,300 X G. Automatic, Refrigerated. Temperature control ±1° C. Many safety features such as "Fail-Safe" brush life control to prevent motor damage, automatic imbalance trip to stop the unit if there is excessive vibration, double independent shafts so rotors cannot fly off, etc. The price is $2,570.00 with rotor.

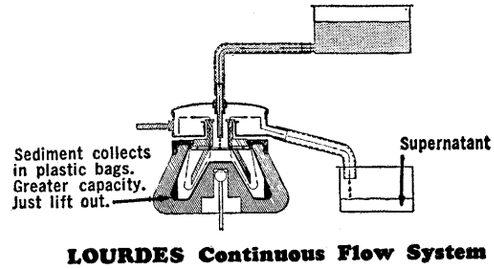
LOURDES Series LC
Bench type Centrifuges, automatic and non-automatic, with speed, volume and force combinations for every requirement. Prices — $760.00 and $925.00.



LOURDES Versa-Fuge
Super speed, versatile bench type centrifuge for batch and continous flow operations. Speeds to 17,000 rpm; forces to 34,800 x G. Only $420.00.



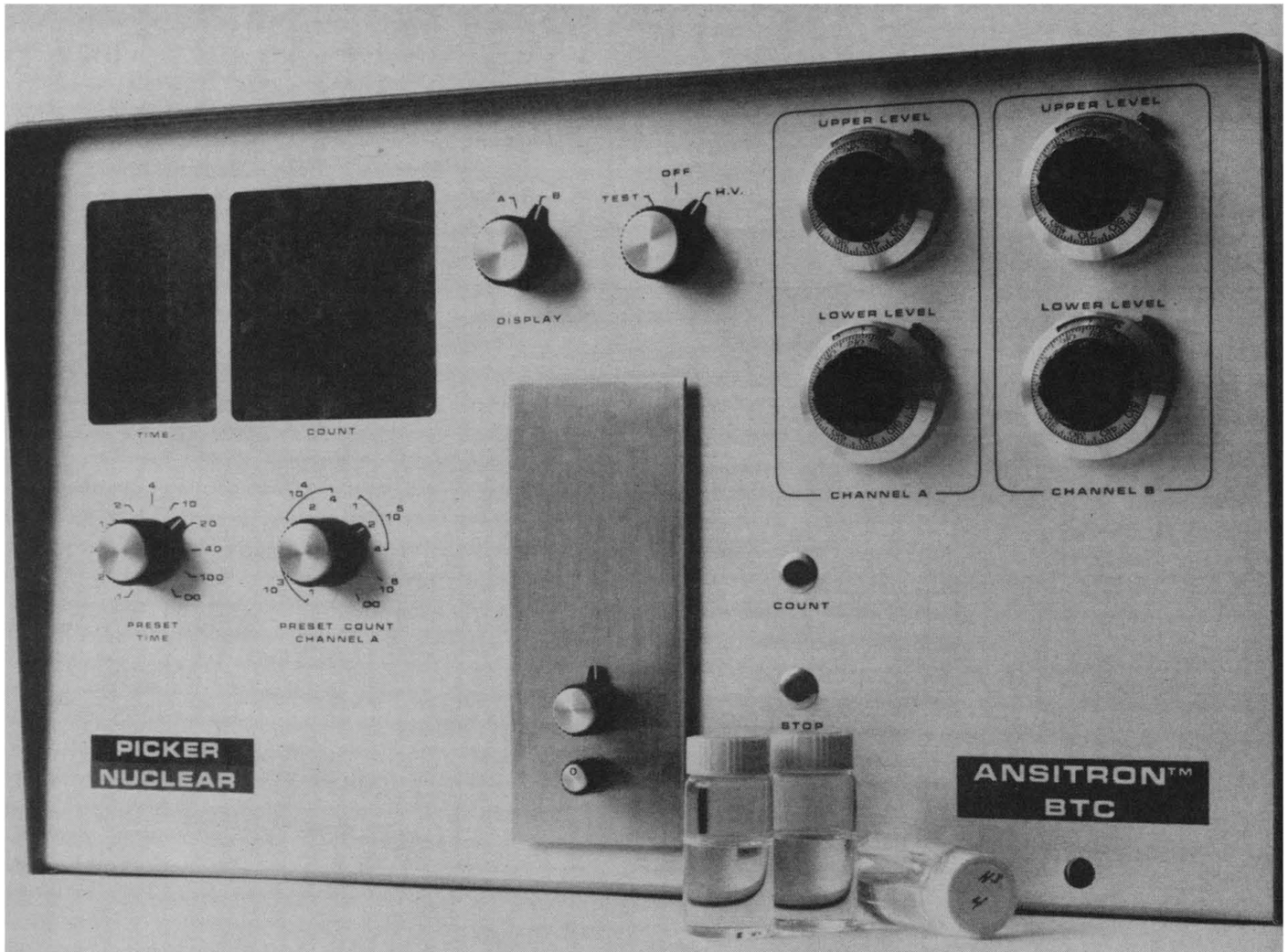
LOURDES Model AX
16,500 rpm with up to 400 ml; forces to 34,800 x G. Only $265.00.



LOURDES Continuous Flow System
Increased efficiency in separating solids from large volumes of liquids. Faster separation; larger sediment capacity; simpler operation.

SEND FOR THE FACTS. Detailed data sheets available on request. Ask for Bulletin S-2-7

LOURDES 148 Sweet Hollow Road, Old Bethpage, N. Y. 11804 • (516) 694-8686



10 good things you can do with our new $4000 liquid scintillation counter.

1. Buy it without a major grant or a convocation of your Board of Directors.

2. Put it on a laboratory bench even if you don't have much room left.

3. Count a single or double labeled sample manually at ambient temperatures.

4. Move it, without undue strain, if you want to.

5. Teach students with it.

6. Use it without waiting for the automatic liquid scintillation counter down the hall to become available.

7. Employ it for quick checks before committing manifold samples to your automatic system.

8. Adapt it (easily) for continuous flow monitoring.

9. Admire its features: external standardization for quench correction, log amplification for simple operation, preset count and preset time operation, timer and scaler display, and counting on both channels simultaneously.

10. Remember its name: Ansitron™ BTC—and tell your friends about it.

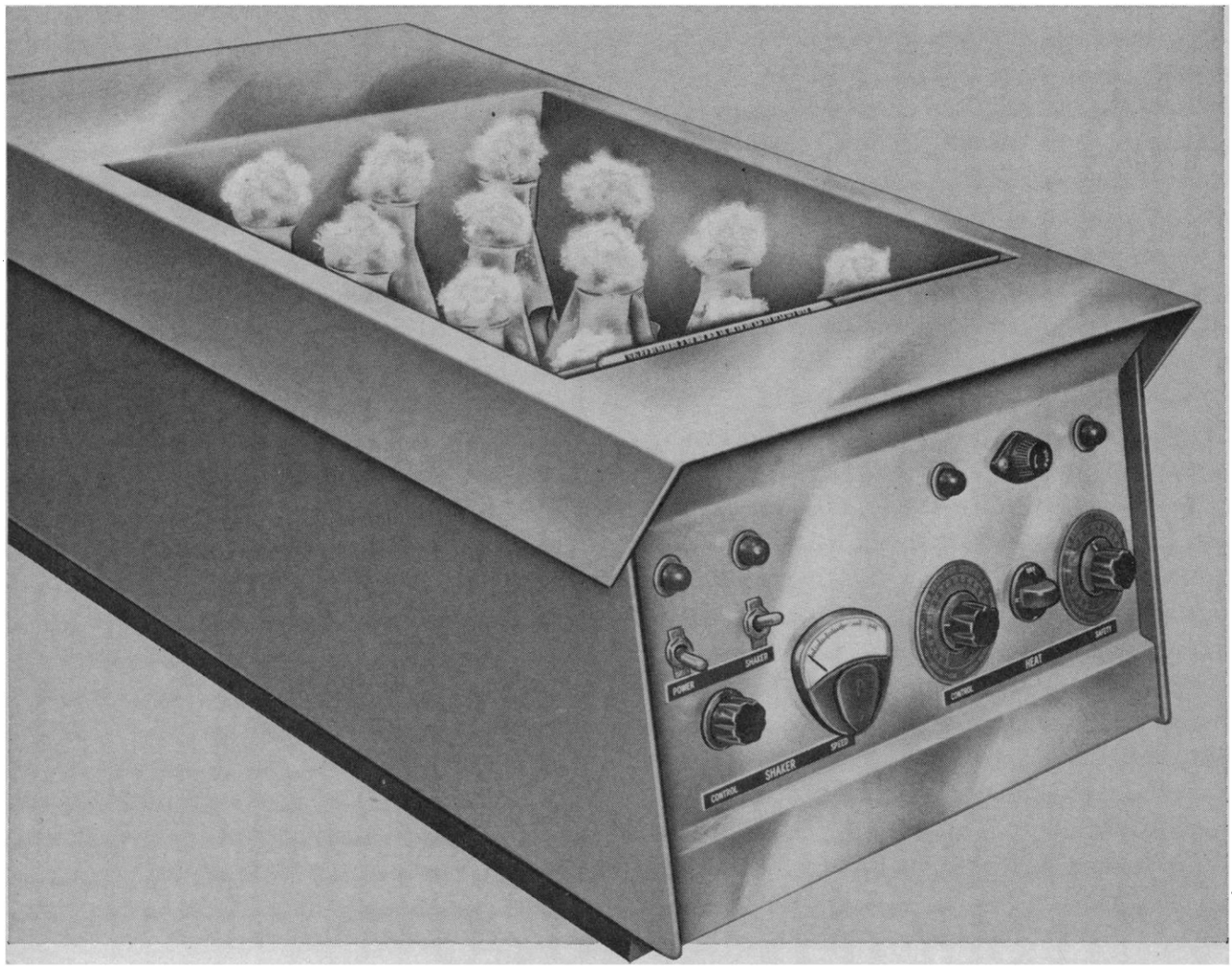
Complete details? Ask for file 105

PL 67-105

Picker Nuclear: 1275 Mamaroneck Avenue, White Plains, New York 10605

PICKERNUCLEAR

New ELECTRONICALLY Controlled Water Bath Shaker!



Controls Temperature ELECTRONICALLY within ±0.25° C!

Controls Agitation ELECTRONICALLY from 40-400 rpm!

Controls Water Level ELECTRONICALLY!

Controls Heating and Tap-Water Cooling ELECTRONICALLY!

Other new engineering features: Auxiliary safety thermostat protects against overheating. Safety lock-knobs prevent accidental change of thermostat settings. Right-angle mercury thermometer is designed for easier reading without removal, and is also protected against breakage. Extra large shaker capacity.

Send for catalog 2-17-67

New Brunswick Scientific Company, Inc.
1130 Somerset Street, New Brunswick, N. J. 08903

	A Adenylic Acid	C Cytidylic Acid	I Inosinic Acid	U Uridylic Acid	G Guanylic Acid
A Adenylic Acid	Poly A $C^{14}H^3$	Poly AC $C^{14}H^3$	Poly AI C^{14}	Poly AU $C^{14}H^3$	Poly AG
C Cytidylic Acid	Poly AC $C^{14}H^3$	Poly C $C^{14}H^3$	Poly CI C^{14}	Poly CU $C^{14}H^3$	Poly CG
I Inosinic Acid	Poly AI C^{14}	Poly CI C^{14}	Poly I C^{14}	Poly UI C^{14}	Poly IG
U Uridylic Acid	Poly AU $C^{14}H^3$	Poly CU $C^{14}H^3$	Poly UI C^{14}	Poly U $C^{14}H^3$	Poly UG
G Guanylic Acid	Poly AG	Poly CG	Poly IG	Poly UG	

Also available: Poly AUC (other 3-base copolymers coming; keep in touch)

NB: All of above available unlabeled *and* labeled as indicated

Polyribonucleotides

(synthetic template RNAs from Schwarz)

The checkerboard above shows the polyribonucleotides that we are now manufacturing. (Forgive the checkerboard's redundancy, this being the inevitable nature of such grids.) In any case, note that the first item in the first column—either horizontally or vertically—is a homopolymer, as is the second item in the second column, the third in the third, and, finally, the fourth in the fourth. All others, of course, are copolymers. Everything shown is available *unlabeled.* But some are *also* available labeled with C^{14} (in the purine-8 and/or pyrimidine-2 positions) or H^3 (in the purine or pyrimidine moieties); the grid shows this too. Accordingly, red means that *both* hot and cold versions are available, whereas black signifies that the compound is only available in the unlabeled form.

Our polyribonucleotides are potassium salts that come to you in the vials in which they have been lyophilized. They are free of nucleases and of low molecular weight materials including nucleosides and nucleotides. Their apparent average molecular weights run in the order of 10^5 to 10^6.

These compounds are sold on the basis of the polynucleotide phosphorus present (which helps eliminate several unnecessary ambiguities). Each vial contains 2.5 μMoles of polynucleotide phosphorus per milligram of nominal polymer weight.

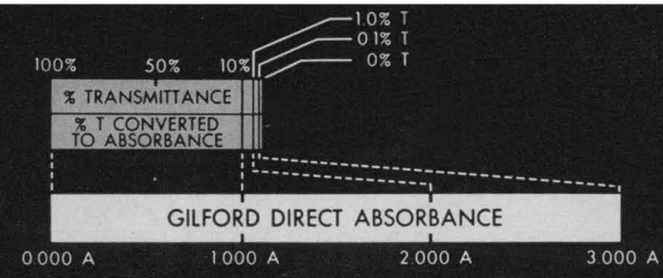
To reduce other possible ambiguities, we give you a reassuring Product Analysis Report which recounts the analytical data that we've developed on the specific material you receive. For example: the exact base ratios of the isolated copolymers. And a great deal more.

So: if your research is leading, or has led, into these intriguing areas, consider the possible advantages of using our pure, carefully characterized polyribonucleotides. Such consideration can now be abetted by asking us for two things: (1) more data on our polyribonucleotides, and (2) a selected list of relevant references. And while you're at it, why not ask for our complete 80-page catalog? Your move, please.

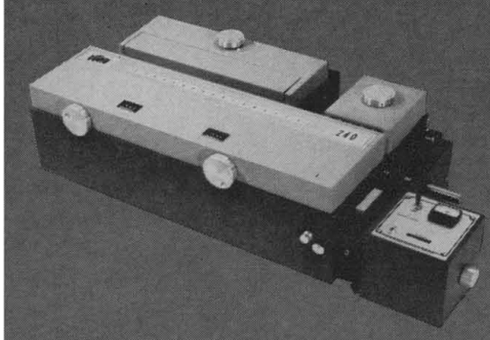
Schwarz BioResearch, Inc.
Orangeburg, New York 10962

gilford®

SPECTROPHOTOMETERS

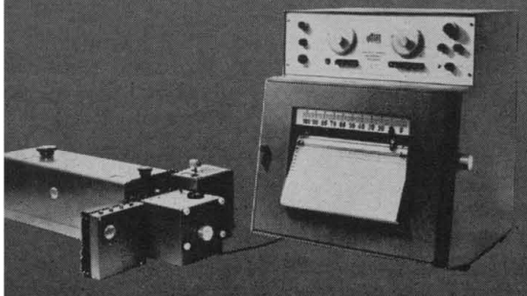


Gilford Spectrophotometers utilize a unique principle to measure Absorbance ***directly.*** The second and third decades, severely compressed in %—transmittance instruments, are fully expanded in Gilford Instruments—for equal accuracy and resolution throughout the complete range. Absorbance is presented digitally to 0.001 **A** —from 0.000 **A** to 3.000 **A** — or it can be readily recorded. Concentration is measurable directly over a 1000:1 range.



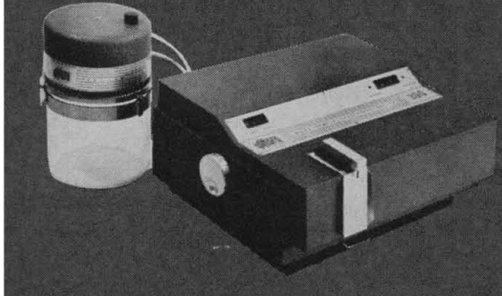
MODEL 240 SPECTROPHOTOMETER

The Model 240 spectrophotometer combines a quality Gilford-designed monochromator with the dependable Gilford photometric system. This combination has produced an instrument of unusual accuracy, range, and versatility—simple to operate and highly productive. The optical system, characterized by low stray light and high UV efficiency, features linear wavelength and slit width controls with numerical indication. A rugged optical-bench accessory mount and clear, uncluttered exit aperture plane promote easy alignment and quick interchange of attachments. The wide range—0.000 to 3.000 A—photometer is a linear absorbance measuring system of high resolution. Stabilizers for the photometer and dual-lamp source are contained in a single solid state supply module. Equipped with a four-position manual cell positioner.



MODEL 2000 AUTOMATIC SPECTROPHOTOMETER

The Model 2000 is a versatile, all-purpose spectrophotometer of superior range, stability, and photometric resolution. It is packaged into two self-contained units: (1) The lamp source, monochromator, automatic cuvette positioner, and photometer/indicator unit. (2) The main console with controls, recorder, power source, photometric circuit, line-voltage regulator, extended cuvette dwell-timer (up to 15 minutes), and circuitry and connections for additional accessories. The Model 2000 is particularly suited for determining time-dependent reaction rates and for automatic, quantitative monitoring of effluents from multiple chromatographic columns or density gradient tubes. Other applications include observation of dissolution and polymerization changes, spectrophotometric titration, precision turbidimetry and colorimetry, large-scale clinical testing, and industrial process and quality control.



MODEL 300 MICRO-SAMPLE SPECTROPHOTOMETER

The Model 300 is a new concept in precision absorbance spectrophotometry. It is a moderately priced, compact, integrated system whose photometric range and accuracy, combined with a unique rapid sampling system, provide a versatility and simplicity of operation unmatched by complex and costly instruments. The unusual capability of the Model 300 is achieved through the use of three new Gilford elements: a solid-state photometer, an excellent optical system, and a vacuum-driven sampling system coupled to a digital absorbance indicator. Accurately metered samples of 500 microliters or less may be analyzed at a rate of 4 to 6 per minute. The sample cell is filled, the absorbance measured, and the cell flushed by means of a single control lever. Absorbance range extends from 0.000 to 2.000A.

Write or call for specifications and quotation.

GILFORD INSTRUMENT LABORATORIES INCORPORATED

Oberlin, Ohio 44074 • Telephone: (216) 774-1041 • Cable: GILLAB

8) The entire spirit of the contracts is now so ambiguous that people have a terrible time determining whether what they are doing is compatible with them. This is quite independent of effort or time reporting, and even though one may have found it convenient for 10 years to operate in this ambiguity, things have progressed to a point where it cannot be tolerated anymore.

Various people are struck in different ways by the above points, and give them different emphases, but I believe they are all worth mentioning. Furthermore, they involve much more than the immediate problem of effort and time reports. They involve the nature and extent of government subsidies to universities in the foreseeable future. There is no doubt that if the universities of this country are to continue at the same level of achievement and intellectual productivity as in the past 10 years, then there will have to be a large financial contribution to their budgets from tax money. It does *not* follow, however, that this should imply a corresponding loss of intellectual and political freedom, although we may well be forced to reconsider the very basic structure of the present means of channeling tax money into the universities. This, of course, can be done by dialogue, and I don't see anyone needing to accuse anyone else of treason or sinister designs for suggesting the need for such considerations.

The need does exist, and it is urgent. The situation has evolved to the point where professors who refuse to sign a meaningless document, which is nothing but double-talk, are pressured by their administrations for financial reasons. As Palais wrote to the coordinator of sponsored research at Brandeis: "We are greatly disturbed by the fact that the Universities have allowed themselves to be maneuvered into a position where their professors can be blackmailed into an action contrary to their institutions' traditions and to their own best interests. We now feel that we must fill out these effort reports, retroactively and for the immediate future, in order to protect Brandeis from the possibility of having to pay back large sums which it has received from the government and already disbursed or committed. We wish to make it clear that this is done under strong protest, and as a temporary measure to protect the University's financial interests. It does not imply on our part an acquiescence to the principle of effort reporting." At Berkeley, the chairman of the department of mathematics, Leon Henkin, refused to fill out the forms, and stated: "When the University or supporting agencies require preposterous forms to be completed, it inevitably weakens the respect with which their serious policies are treated."

Various math departments are seriously considering substantial curtailments of their activities because of the obnoxious accounting practices now imposed. The problem obviously transcends the present crisis provoked by the revision of A-21, dated March 1965. But if the only choice given to us is to curtail, or lose past freedoms, then let us curtail.

SERGE LANG

Department of Mathematics,
Columbia University,
New York 10027

The Genesis of Creativity

Students are the best judges of an instructor's ability to present the subject matter in a clear and interesting manner as Denenberg has suggested (23 Dec., p. 1504). But is lucidity of presentation a sufficient or even a necessary condition for the development of creativity?

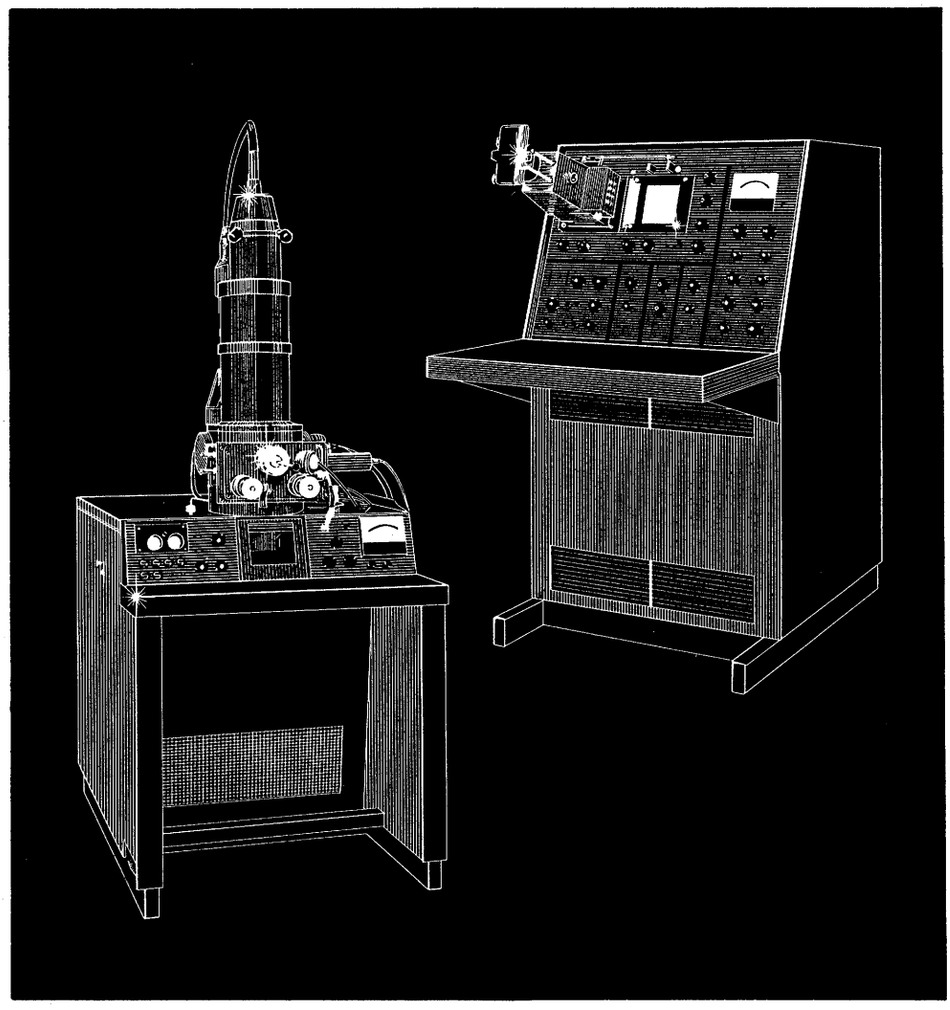
The primary function of a scientist is to solve problems, not merely to recognize relationships that have been elucidated by others. Too frequently students bemoan the effort they must exert in a given course and in the process they postulate an inverse proportionality between the pedagogical skill of their instructor and the magnitude of the effort they must expend to learn a subject. Actually, it is by this very expenditure of effort that students develop the ability to solve problems.

The ideal teacher is one who can stimulate the student to make this effort. He will know when to leave certain concepts unemphasized and then assign problems whose solution requires a comprehension of these concepts.

The question remains, however, whether his contribution to the intellectual development of his students will be appreciated, or even recognized by them. "The undisturbed oyster produces no pearl," but is the oyster aware of this?

GEORGE J. BEICHL

Department of Chemistry,
Saint Joseph's College,
Philadelphia 31, Pennsylvania



JSM SCANNING ELECTRON MICROSCOPE

Extreme depth of focus permits direct observation of micro areas of irregular specimen surfaces . . . high resolution images presented *in depth* on cathode ray tubes . . . up to 25 x 10 mm specimens . . . ideal for study of metal fractures, semi-conductors, paper surfaces, polymers, fibers, biologicals, etc.

For information or specimen analysis, write to your nearest JEOLCO office or applications center.

JEOLCO (U.S.A.), Inc. • Applications centers at Medford, Massachusetts and Burlingame, California
Branch offices at Atlanta, Chicago and Montreal

jeol

Benefactor for Science in the Liberal Arts Colleges

Wolfle's editorial (12 Aug., p. 697) notes this foundation's long interest in the liberal arts colleges, and his thoughtful and succinct analysis has led us to a review and projection of Research Corporation's activities directed specifically toward aiding science programs in the liberal arts colleges during the decade of the sixties.

Since 1960, when the foundation began its broad program of grants to strengthen science departments, grantee institutions have acquired additional faculty and research equipment, achieving both numerical and qualitative gains in the sciences. Many of the colleges have been able to attract faculty of high caliber and to provide new opportunities for research and creative scholarship. Some reports indicate an infusion of research-orientation into academic departments other than the sciences following the spur of these grants.

In the period 1960–66, grants of $3.4 million have been made for science departments in about 80 liberal arts colleges, and project grants of slightly over $1 million were made to 172 liberal arts colleges. In the next 3 years, at the cost of invading its limited resources, the foundation has budgeted about $2.6 million for further contributions to the science departments of the liberal arts colleges. Thus, in this decade, about $7 million will be committed by the foundation in the conviction that strong science is an integral aspect of a vigorous liberal education, and that the liberal arts colleges are vital to higher education in this country. With others now turning to this area, Research Corporation looks to the seventies as a decade of new challenges.

CHARLES H. SCHAUER
Research Corporation,
405 Lexington Avenue,
New York 10017

History's Grant Swingers

The enchanting adventures of Grant Swinger described by Greenberg (News and Comment, 16 Dec., p. 1424) are an injustice to the scientist who has been an asset to science. Promoters of scientific enterprise should not be looked upon askance. Francis Bacon had a grand scheme for scientific research. A recent biographer of Galileo [L. Geymonat, *Galileo Galilei* (McGraw-Hill, New York, 1965)] calls him the Tom Paine of science. Count Rumford may have been a scoundrel in other affairs but he was a grant swinger, a promoter of science. George Ellery Hale never met ridicule in promoting the construction of large telescopes. On the basis of the success of their projects, most scientists are grant swingers; only a very small percentage of research comes to a successful conclusion. That many institutions are blessed with people who know how to acquire grants is a discredit neither to the institution nor the person. If the projects are faulty from the start, it is the disbursing agency and the review boards who are to blame.

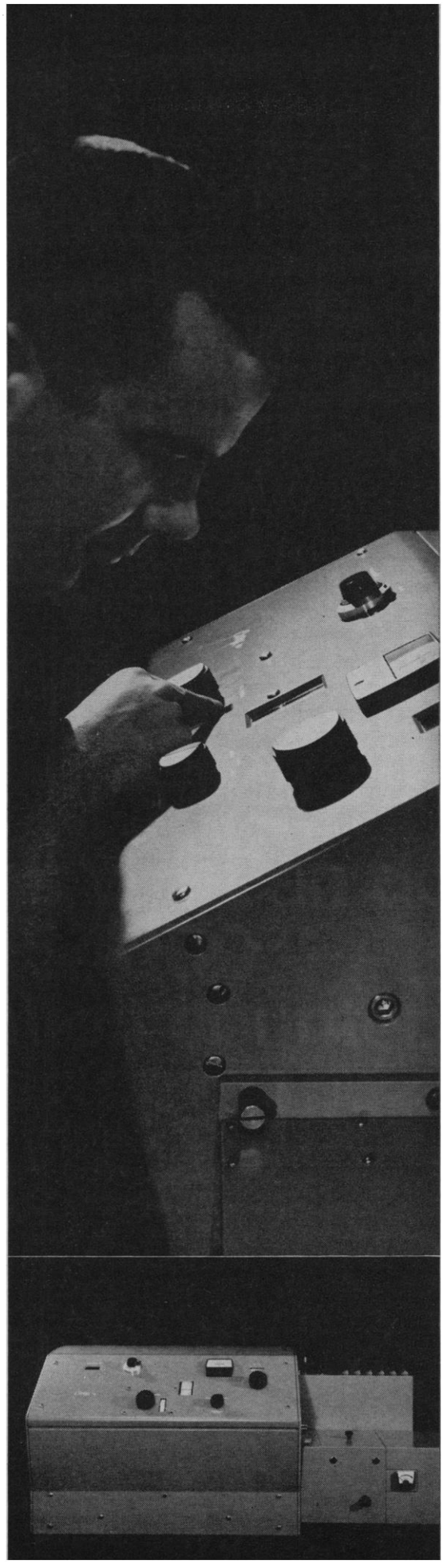
MORRIS GORAN
Roosevelt University,
430 South Michigan Avenue,
Chicago, Illinois 60605

Reprints Unlimited

In a recent editorial (7 Oct., p. 74) Abelson commented on the services made available commercially by the Institute for Scientific Information, which publishes, among other things, *Current Contents*, to which I subscribe (out of my own pocket) and which provides extremely useful information about the existence of work of possible interest to me. By this means I can keep a comprehensive current bibliography, and I send for reprints only when I expect to have frequent and continuing occasion to consult the works in question.

I also personally pay for reprints of my own publications (as do many of my European colleagues), although postage is generally met by the university. The title of a recent article of mine appeared in *Current Contents* and shortly after, reprint requests began to arrive in far larger numbers than I had expected. A particular error in my address occurred in two-thirds of the request cards and it was the identical error which appeared with the citation of my article in the ISI list. Also, half of the reprint requests came from medical schools or hospitals, despite the fact that the paper concerned observations on a marine invertebrate, which suggests that the writers had not seen the original paper, but were only using such key words in the title as "histochemical," "monoamines" or "nervous system" as sufficient clues to warrant sending for a reprint. I am not

the most accurate Spectro-photometer built



THE MOST ACCURATE MANUAL SPECTRO-PHOTOMETER ON THE MARKET IS THE NEW CARY MODEL 16.

Why? 0.00024 absorbance near zero, 0.001 near one, that's why. **Five times better than the present state of the art.** For an $8400 instrument, that's something.

What else? Deep UV penetration...down to 1700Å. The deepest of **any** manual spectrophotometer. At the least, that means highly efficient operation from 1800Å to 2000Å.

There's more: The CARY 16 is the only manual spectrophotometer with a double beam and double monochromator system. You get low stray light for working with highly absorbing samples. Fewer time consuming dilutions. Ample accuracy without frequent zero absorbance rechecks. And, continuous blank compensation. Automatically.

The CARY 16's unique beam geometry allows normal sample handling down to one-half milliliter. With beam masking, samples can be reduced to micro-volume. Moreover, beam reduction by 8 produces a reduction of signal-to-noise of only 2. Result: retention of extremely high accuracy.

Controls? Simplified. To save you several extra steps. Every hour. Every day.

Versatility is extended even further by a broad selection of attachments and sample handling devices.

For 20 years, quality instrumentation has been the cornerstone of the CARY philosophy. This concern for quality has been paramount in the CARY 16's development.

Send for the CARY 16 brochure **E-601-27**

CARY®
instruments • a varian subsidiary
2724 South Peck Road, Monrovia, Calif. 91016

UV/VIS/IR/Raman Recording Spectrophotometers
Manual Spectrophotometers • Spectropolarimeters
Vibrating Reed Electrometers & Amplifiers

trying to single out any group as worse than another in making indiscriminate reprint requests, and no doubt some of those researching in medical centers *are* doing broadly-based comparative work. Moreover, small libraries don't carry many journals, and reprints are especially useful to some people for this reason. But how does one identify those who are really interested when no information comes on the card? I honestly want to send reprints to those who are going to use them, but I can't afford to supply everyone who thinks he might just possibly be interested. Has anyone else solved this problem?

MARY E. CLARK
Department of Zoology,
University of Newcastle upon Tyne,
Newcastle upon Tyne, England

Progress in Academic Freedoms

In "Academic freedom: lessons from the crisis at St. John's," (16 Dec., p. 1428) Carter states: "In October 1965, the AAUP chapter [American Association of University Professors], though it was later to fall under the domination of administration sympathizers. . . ."

As president of the AAUP chapter at St. John's University, I disagree with the implications of the statement. When the 1965–66 executive committee of the AAUP chapter at St. John's resigned at the 2 February 1966 meeting, a new group of officers was elected in accordance with the national and local AAUP constitution. Furthermore, a new executive committee was elected at the June 1966 meeting for the academic year 1966–67.

Some of these elected officers were hardly what one might term "administration sympathizers." There were then and are now many shades of opinion as to the action taken by the board of trustees of St. John's, not to mention some of the administration policies prior to December 1965. Merely to agree with the administration of an institution when such agreement is justified does not imply that one is an "administration sympathizer." On the other hand, to indicate justifiable disagreement with an administration policy or procedure does not imply that one is "anti-administration."

When the February 1966 meeting took place, there were over 250 faculty members of the AAUP chapter at St. John's and, except for those who were also members of the United Federa-

tion of College Teachers, many members of the AAUP were opposed to the chapter's "political maneuvers" at St. John's. For example, not a single general membership meeting of the AAUP was called from October 1965 to February 1966. During this time, one need not review what happened at St. John's. However, though opposed to administrative policies, many AAUP chapter members are working to improve the situation by participating in the University Senate (since March 1966), departmental committees, and other university committees.

ANTHONY H. SARNO
Department of Mathematics,
St. John's University,
Jamaica, New York 11432

Readers of Carter's article may be interested in the policy statement, adopted in October 1966, by the Federation of Regional Accrediting Commissions of Higher Education for the guidance of the regional commissions in their work of evaluating colleges and universities:

"By academic tradition and by philosophical principle an institution of higher learning is committed to the pursuit of truth and to its communication to others.

To carry out this essential commitment calls for institutional integrity in the way a college or university manages its affairs—specifies its goals, selects and retains its faculty, admits students, establishes curricula, determines programs of research, fixes its fields of service.

The maintenance and exercise of such institutional integrity postulates and requires appropriate autonomy and freedom.

Put positively this is the freedom to examine data, to question assumptions, to be guided by evidence, to teach what one knows—to be a learner and a scholar. Put negatively this is a freedom from unwarranted harassment which hinders or prevents a college or university from getting on with its essential work.

A college or university must be managed well and remain solvent, but it is not a business nor industry. It must be concerned with the needs of its community and state and country, but an institution of higher learning is not a political party nor a social service. It must be morally responsible, but even when church related, it is not a religion nor a church.

A college or university is an institution of higher learning. Those within it have as a first concern evidence and truth rather than particular judgments of institutional benefactors, concerns of churchmen, public opinion, social pressure, or political proscription.

Relating to this general concern and corresponding to intellectual and academic freedom are correlative responsibilities. On the part of trustees and administrators there is the obligation to protect faculty and students from inappropriate pressures or destructive harassments.

On the part of the faculty there is the obligation to distinguish personal conviction from proven conclusions and to present relevant data fairly to students because this same freedom asserts their rights to know the facts.

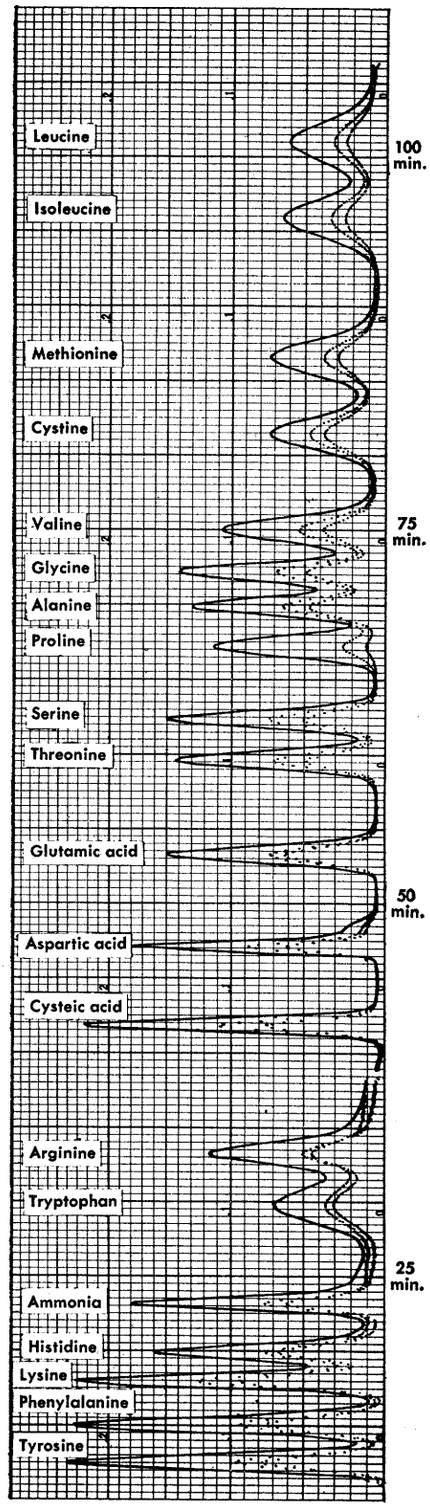
On the part of students there is the obligation to sift and to question, to be actively involved in the life of the institution but involved as learners at appropriate levels. The determination and exercise of proper responsibilities will be related to the students' status as undergraduate, professional, or graduate students.

Intellectual freedom does not rule out commitment; rather it makes it possible and personal. Freedom does not require neutrality on the part of the individual nor the educational institution—certainly not towards the task of inquiry and learning, nor toward the value systems which may guide them as persons or as schools.

Hence institutions may hold to a particular political, social, or religious philosophy as may individual faculty members or students. But to be true to what they profess academically, individuals and institutions must remain intellectually free and allow others the same freedom to pursue truth and to distinguish the pursuit of it from a commitment to it.

All concerned with the good of colleges and universities will seek for ways to support their institutional integrity and the exercise of their appropriate autonomy and freedom. In particular, the Federation and the regional commissions, which have a particular responsibility to look at an institution in its totality, will always give serious attention to this aspect and quality of institutional life so necessary for its well-being and vitality."

E. J. DRUMMOND
St. Louis University Medical Center, St. Louis, Missouri 63104



This complete separation of amino acids in a protein hydrolyzate is made in 105 minutes using the Ligand Exchange System exclusive with Hitachi Perkin-Elmer's new Model KLA-3B Liquid Chromatograph. Unprecedented speed of analysis, excellent resolution, and a reliable flat baseline are all demonstrated in this run.

Summer Research Subsidies

Wolfle's editorial (12 Aug., p. 697) pointed out the difficulties that "undernourished small colleges" have in obtaining financial assistance for improving their staffs and facilities. As a teacher in one of the lowest categories of "college" (a California junior college), I would like to add that there is even more difficulty encountered by a junior college teacher who desires to do research. The school district from which I write has loudly proclaimed its antagonism to "federal aid," thereby curtailing many programs. Likewise, it is apparently opposed to research by the faculty (it refuses to reply to questions on the subject, and it rejected a sabbatical leave for research). As Wolfle said, " . . . the administrators of some small colleges were uninterested in faculty research. Some were even hostile." Perhaps this attitude is to be expected when there is not a single Ph.D. in the administration of the entire school district under discussion.

If the latter are any criteria, then it would seem advantageous to institute financial support for research during summers only. If a teacher could be given a year's leave, he might apply for NSF grants for scientific research, but my state education office has not answered two letters requesting information about such a leave. Further, a junior college with emphasis entirely on teaching is not considered an "appropriate" institution for purposes of research association. Perhaps NSF Senior Postdoctoral or Science Faculty Fellowships could be used, but, "It is not . . . the purpose of these fellowships to provide support for research projects as such." Inquiries to the National Research Council, National Academy of Sciences, and the Research Corporation have all been fruitless.

Since there are undoubtedly many worthwhile research projects in progress or envisioned, it seems senseless not to have some source of support available. Therefore, I recommend that some agency establish a "consecutive summers" support plan for those teachers who have no other time or help for their research. Such a plan may be a part of the "Research in Washington: plans afoot for advanced study center" (23 Dec., p. 1530) project, but that is in the far future.

CHARLES G. DANFORTH
Glendale College,
Glendale, California 91208

The Original "Krow"

It was with a singular sense of honor that I read the recent suggestion (Letters, 6 Jan.) that my work be used as a model for evaluating research productivity ("Krow" units: a new evaluation). As I hope to complete my thesis this year, the sought-after standard for research output should soon be universally available.

GRANT KROW
Frick Chemical Laboratory, Princeton University, Princeton, New Jersey

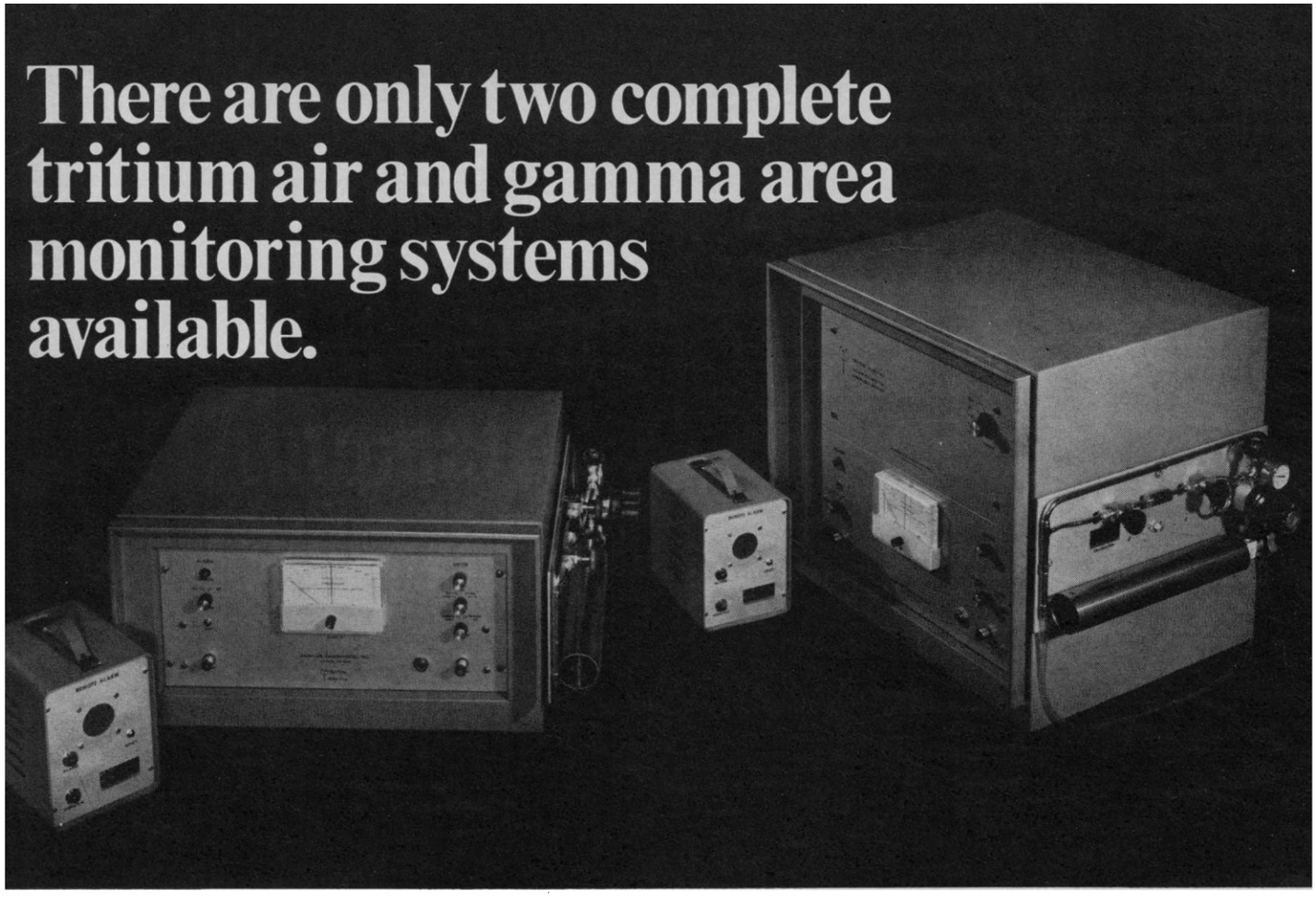
Wanted: Seasonal Naturalists

The opinions of Calder (Letters, 2 Dec.) on the National Park Service were very similar to those I formed while spending three summers as a seasonal naturalist. I am not certain that the desire to do, or competence in scientific research is a prerequisite to a successful park naturalist. That progress in the naturalist programs has lagged behind progress in other fields of biology and geology may be due to the quality of personnel available for employment —particularly the seasonal naturalist. The job does not appeal to high school and college teachers primarily because of the GS-4 salary scale and the general lack of facilities for married individuals with families. If the parks are to be staffed with high-quality summer personnel, they must be graduate and undergraduate students. But talented students in "field biology" are attracted to other summer programs and the experimental or "laboratory biologist" seems to consider such experience outside his field and of little value.

I agree with Calder that the colleges and universities need to encourage students to consider this sort of experience. For anyone eventually intending to teach, whether as a "field or laboratory" specialist, experience as a seasonal naturalist is easily worth the sacrifices. On the other hand, the NPS needs to introduce a program which keeps college students aware of the employment opportunities by advertising on college bulletin boards for their seasonal personnel. If the schools don't encourage such employment and the NPS doesn't advertise it, how can we be assured that our national heritage will be in the hands of our best personnel?

JOHN E. BUTLER
Department of Zoology,
University of Kansas, Lawrence 66044

There are only two complete tritium air and gamma area monitoring systems available.



Ours. And ours.

The systems shown are unique: they are the only ones available that combine tritium air and gamma area monitors with calibrators and remote alarm stations. (But before we go on, please note that calling these systems "tritium air and gamma area monitors" really gives you no hint as to their true and unusual versatility. *Both* of these systems can also monitor argon-41, carbon-14, chlorine-36, fluorine-18, krypton-85, radon-222, sulfur-35, xenon-133 and xenon-135. And we provide conversion tables with either instrument which readily enable you to use them in this way.) Also: both systems feature advanced design which provides primary gamma compensation and insensitivity to cigarette smoke and airborne dust. Finally, the accuracy and reliability of these instruments provide a maximum of confidence when monitoring: nuclear reactors, neutron generators, stack gas, isotope laboratories, and the like. Now the systems.

Triton 755 B System (shown on left).
The model 755 B Triton accurately monitors airborne tritium or ambient low-level gamma radiation. (Or the other beta-emitting isotopes shown above.) The design of this instrument eliminates the errors usually associated with tritium air monitors and provides a new high level of accuracy and reliability. Its exceptional stability and sensitivity also permit analytical applications when incorporated into the closed atmospheric circuits of controlled environmental experiments. As a low-level gamma monitor it has much higher sensitivity than most gamma survey meters. The calibrator is shown attached to the right side of the console, while the remote alarm with visual and audible signals is on the left.

Triton 855 System (shown on right).
The model 855 Triton is more sensitive than its progenitor above and is ideal where the monitoring of extremely small amounts of gaseous radioactive contamination is a necessity. This instrument is particularly suited for monitoring the maximum permissible concentration of tritium in air ($5\mu c/M^3$) since the sensitivity is 10 $\mu c/M^3$ full scale. It can also serve to measure other beta emitters and is a very sensitive gamma area monitor too (0.05 mr/hr. full scale).

For complete information on these tritium air and gamma area and argon-41 and carbon-14 and chlorine-36 and fluorine-18 and krypton-85 and radon-222 and sulfur-35 and xenon-133 and xenon-135 monitors, please write and request file Triton-S.

JOHNSTON LABORATORIES, INC.,
3617 Woodland Avenue, Baltimore, Maryland 21215

17 February 1967, Volume 155, Number 3764

SCIENCE

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.

European Discontent with the "Technology Gap"

When Charles de Gaulle began his anti-American campaign, leaders of other Western European states were slow to join. Recently, however, a focus for common discontent has appeared in the slogan "technology gap." In many fields, Europe's technology is at least equal to that of the United States, but in some highly visible areas, such as aerospace, electronics, and computers, America is preeminent. European leaders feel that the technology gap is growing, and some foresee an "underdeveloped continent" dependent upon the United States.

Many factors contribute to American success, but in Europe two are emphasized. The large U.S. market encourages investments, such as the $130 million that RCA poured into color television, and the U.S. devotes a greater fraction of its large gross national product to research and development than Western Europe does.

Less talked about are other differences between us. One is a matter of education. In Germany only 8 percent of college-age youths enter universities, while in the United States 40 percent do so. This contrast contributes to a difference in managerial skill. Middle levels of American management are more competent than their European counterparts.

Some of the most important factors in the technology gap are differences in social attitudes. An illustration was provided me by an official of a large European-based oil company that operates laboratories on both sides of the Atlantic. The company had discovered that the cost of performing comparable work on the two continents was the same despite much higher salaries being paid in the United States. The man's explanation was this: in Europe scientists directed the work of technicians while in the United States scientists personally made the measurements. Moreover, in America top scientists were willing to eat cafeteria-style. In Europe, a leisurely lunch must be served, on a white tablecloth.

In a consideration of the technology gap, developments in Japan are relevant. For more than a decade the Japanese have achieved the fastest economic growth of any major nation (about 10 percent per year). Japan has become strong in the production of electronics devices, optical instruments, steel, and chemicals. Today Japan is the leading shipbuilder, and the Japanese have been pioneering in the construction of gigantic oil tankers and bulk carriers. Japan has become a leading exporter of steel, despite the fact that it must import iron ore from overseas and much of its coking coal from West Virginia. Japan did not discover or develop any principal plastic material, yet today it is second only to the United States in the production of plastics. In achieving this progress Japan utilized foreign R & D, purchasing technical know-how and encouraging the establishment of foreign-owned subsidiaries.

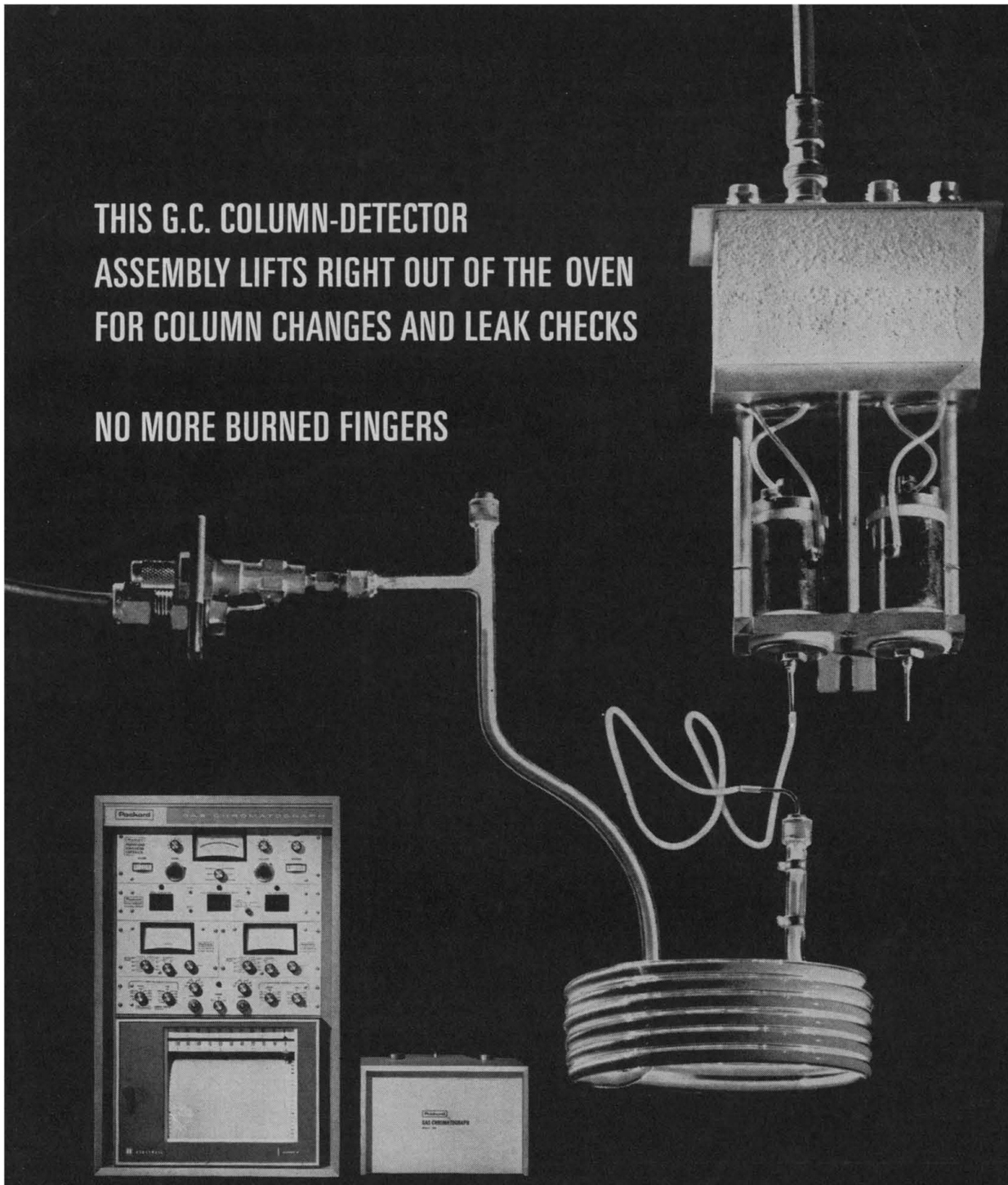
In part, the Japanese success is due to a willingness—even an eagerness—to work. In part, it is due to a policy of using and improving on the best ideas of others. Another important factor is educational policy. The Japanese educate a larger proportion of their youth than the Europeans do. More than 80 percent of the top industrial managers in Japan have a university education, as compared with 30 percent in Britain.

European politicians are looking for easy ways to fill the technology gap. They talk of forming a European Technological Community, but this will not suffice. They should consider an additional course—study of and improvement on the best elements of Japanese and American procedures.

—PHILIP H. ABELSON

THIS G.C. COLUMN-DETECTOR ASSEMBLY LIFTS RIGHT OUT OF THE OVEN FOR COLUMN CHANGES AND LEAK CHECKS

NO MORE BURNED FINGERS



You can remove the entire column-detector assembly from a Packard Gas Chromatograph in about 30 seconds . . . without tools . . . without touching heated oven surfaces. (Putting it back is just as easy.) This lets you work *outside* the heated oven area when you change columns and detectors, replace septums or make leak checks. And columns can be changed without disconnecting carrier gas lines, eliminating the risk of column contamination. ■ Other features of this modular line of instruments include: programmed temperature or isothermal operation; separate heat controls at inlet, outlet and detector; interchangeable argon ionization, flame ionization, electron capture and thermal conductivity detectors; water-cooled oven. ■ Every Packard Gas Chromatograph is installed by a trained factory representative and carries a full one-year warranty. For complete information call your Packard Sales Engineer or write Packard Instrument Company, Inc., 2200 Warrenville Road, Downers Grove, Illinois.

Packard

...e New York ...
...and Monkeys Are Trai...
...Serve as Coconut Pic...
pig-tailed macaque, an agile agricultural labo...
...s Hopkins Psychologist Repo...
...hat the Macaque Works 6 Hours a Day to Avoid Punishment
By JANE E. BRODY
...t on up there and pick coconuts."
...equivalent of that order his Southeast Asian ...r will send any properly ...d pig-tailed monkey scur... to the nearest treetop.
Thai villagers I interviewed ... Miss Bertrand explained tha... right from the start, th... monkey learns by punishmer... who is master. Once the traine... has asserted his dominance, h... can "expect his subordinate t... do what he requires," she add...
U.S. SAID TO STUDY DISEASE WA...
Late last newspaper re... break of a s... ous illness inv...
Effort to Adapt Ins... Maladies Is Re...
The Washington Post
One Poor Fish's Poison Is Its Own Secretion
Special to The New Y...
WASHINGTON, ... Some American s... gaged in biological ... search, are trying ... rious insect-borne ... that they can be ... from person to pe... the air, according ... in Science magazi... Science, the weel... the American As... the Advancement ... this week began a ... ries on chemical ... cal warfare resea... A large share of ... is secret, but some ... been described in ... scientific publicat... tial work on alter... mission character... jor diseases.
Among these ... ver, Rocky Mount ... ver and at least ... encephalitis — d... dinarily transmit ... son to person th... Yellow fever a... equine encephalit... are normally tra... squitoes, while R... spotted fever is ... ried by ticks.
Research
The report in Science, written ... by Elinor Langer, a staff writ... er, says that the secrecy sur...
Two chemists at the Uni... versity of Hawaii have found ... that the polka-dotted boxfish ... —long considered a delicacy ... in the South Seas—secretes a ... poison so lethal that the box... fish himself is not entirely ... safe from it.
In the current issue of ... Science magazine, David B. ... Boylan and Paul J. Scheuer ... report that the ... boxfish (a me... trunkfish family ... self from larger ... not unlike that ... But instead ... black ink to blin... the boxfish secr... and mucous-lik... that is "lethal ... the vicinity."
Curious, the H... ists netted sever... tory for further ... — d... there, the two ... that they were ... the fish's secret... tually to repro... selves.
What the fish ... two chemists re... roid which the ... the choline chl...
3-acetoxyhexadecanoic ... In giving the poison the n... pahutoxin, the two che... say it is the "first ch... identification of an al... or repellent substanc... marine organism."
How the poison w... two chemists do n... but they believe it ... ways, one by paral...
PANEL DENOUNCES BUGGING DEVICES
White House Group Charges Invasion of Privacy
WASHINGTON (UPI) — A... White House panel reported to... day that the individual's "in... alienable" right to privacy had ... been undermined in recent ... years by electronic and other ... kinds of snooping.
The panel members said they ... had been "dismayed to observe ... the disregard for human values" ... manifested by those in govern... ment and industry who employ ... eavesdropping and lie detection ... devices "without clear justifi... cation."
The panel was appointed in ... January, 1966, by the White ... House Office of Science and ... Technology to investigate pri... threats to privacy posed ...
Dark-Skinned Animals Nee... Less Food, Lab Tests Show
By Martin Weil
Washington Post Staff Writer
Animals with dark skins ... may need less food and oxy... gen than their white-pelted ... brethren, according to experi... ments conducted by two Cali... fornia zoologists.
On the basis of studies with ... white birds that ... dyed black...
the University of California, ... are described in the Jan. 13 ... issue of Science magazine.
Scientists know that dark... colored objects absorb more ... radiant energy than ... ored objects...
dyed birds used 22.9 per... less oxygen.
What it means, the... that it ...
TO INFINITELY SMA... TO INFINITELY V...
By RALPH DIGHTON
Associated Press Science ... way galax...
Evening Sta...
WITH SUNDAY MOR...
COLD, ALMOST AIRLESS
Scientists Call Mars No Spot for Vacatio...
By WILLIAM HINES
Star Staff Writer
Scientists with experimental equipment abroad the space-craft Mariner-4 have just published detailed reports confirming their earlier findings that Mars would be no place for a restful vacation.
The little red planet, visited briefly by Mariner last July 14, ...
greater than 1/20 of 1 per... the strength of earth's ma... field.
2. There is no appre... "Van Allen" belt of tr... radiation around Mars — ... that seems to go hand-i... with the absence of a ma... field.
3. The surface of Mars ... be unprotected from the ...

See it first in *Science*

Science is one of the world's most quoted publications—both in the scientific literature and in the daily press. Each week **Science** makes news because it brings you, quickly and authoritatively, reports of important new research findings.

Researchers all over the world are choosing **Science** for publication of important results because:

- **Science** now reaches 130,000 workers
- Fast handling assures rapid publication

Science is included along with many other benefits in annual AAAS membership dues of only $8.50. Scientists in other countries are cordially invited to join at the same annual dues as that paid by scientists in the U.S. For benefits, see the other side of this page.

Many of the world's most productive scientists find **Science** indispensable. Why not join them?

American Association for the Advancement of Science
1515 Massachusetts Avenue, NW
Washington, D. C. 20005

( ) **I apply for AAAS membership at $8.50 annual dues:**

Full name .....

Address .....

City ..... State ..... ZIP .....

☐ **Please bill me** ☐ **Check enclosed**

Your signature .....

( ) **I propose for AAAS membership:**

Full name .....

Address .....

City ..... State ..... ZIP .....

An invitation to join AAAS will be sent to any colleague you may wish to propose. Sign below if we may use your name in extending this invitation.

Your signature .....

D

N. R. Farbman photo of AAAS annual meeting. Courtesy Life Magazine. © Time In

Shouldn't you be in this picture?

The most eminent men of science have been members of the American Association for the Advancement of Science since its origin in 1848. More than 75% of the members of the National Academy of Sciences are AAAS members, as are 70% of all U.S. Nobel Laureates in science. Among the many benefits in which members share, at an annual dues of $8.50, are:

52 issues of Science, including more than • 1000 brief reports of new research findings in all the major fields. • 160 review articles, written by innovators in specific lines of research. • 400 book reviews, each prepared by a specialist whose appraisal is a reliable guide to the value of the book to you. • Nobel lectures of all the prize winners in science. • News & Comment —weekly analysis by science-oriented reporters of the mutual impact of science and politics.

Annual meetings, known as the "world series of science." The 1967 meeting will be in New York City, December 26-31.

Fellowship in the AAAS, honoring meritorious contributions to science. Fellows are nominated annually from among the membership.

The satisfaction of sharing in the purposes of AAAS membership. These are to: • Further the work of scientists. • Facilitate cooperation among scientists. • Improve the effectiveness of science in the promotion of human welfare. • Increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

You are cordially invited to join AAAS by sending in the card.

FIRST CLASS
Permit No. 31125
Washington, D. C.

BUSINESS REPLY MAIL
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

POSTAGE WILL BE PAID BY

American Association for the Advancement of Science
1515 Massachusetts Avenue, NW
WASHINGTON, D.C. 20005

Readers' Service Card 17 February 1967 (Expires 17 April 1967) Print name and address on front of card

Page		Key No.	Page		Key No.	Page		Key No.
FC	Owens-Illinois	1	766	Coleman	30	896	Vickers	60
735	Johnston	2	767	Unitron	31	897	Scientronics	61
738	Zeiss	3	769	Picker Nuclear	32	897	Tracerlab	62
739	Heath	4	769	Picker Nuclear	33	898	EMI	63
740	Sorensen	5	770	New Brunswick	34	898	Sobotka	64
741	High Voltage	6	771	Schwarz	35	898	Williams & W.	65
742	Fisher	7	772	Gilford	36	900	Brinkmann	66
743	Leeds & Northrup	8	774	Chem Rubber	37	900	Blickstone	67
748	Warner-Chilcott	9	775	JEOLCO	38	901	E-C	68
748	Amer. Instr.	10	776	Orion	39	901	Prof Tape	69
747	Pallard	11	777	Cary	40	902	Yellow Springs	70
748	Digital	12	778	Labindustries	41	902	Oxford	71
748	Hewlett Packard	13	778	Nalge	42	903	Bausch & Lomb	72
750	Corning	14	779	Pharmacia	43	904	Hitachi	73
751	Lab Cages	15	780	Perkin-Elmer	44	905	Instr. Assoc.	74
752	Engis	16	782	Johnston	45	905	Mettler	75
752	Esterline Angus	17	784	Packard	46	905	Hyland	76
753	Sci Products	18	833	Bausch & Lomb	47	906	Systron	77
754	Nikon	19	834	Phipps & Baird	48	907	Bronwill	78
755	Brush	20	891	Sigma	49	908	Thermoflex	80
756	Sci Glass	21	891	Buchler	50	908	Mistaire	81
757	Labconco	22	892	Laboconco	51	908	Manostat	82
758	Waring	23	892	Fish-Schurman	52	909	Carver	83
759	Worthington	24	892	Dimco-Gray	53	909	Sigmamotor	84
760	Aloe	25	892	Kiett	54	909	E & M	85
761	Ulbek	26	893	Bausch & Lomb	55	910	ISCO	86
762	Gla-Col	27	894	IEC	56	910	Thermolyne	87
763	Warner-Chilcott	28	894	Photo-Research	57	911	Mathatronics	88
763	Tracerlab	29	895	BRS	58	912	NRL	89
761	F & M		895	Hamilton	59			

For more information about ads in this issue, circle Key No. and return above card.

FIRST CLASS
PERMIT NO. 12711
NEW YORK, N.Y.

BUSINESS REPLY MAIL

No postage stamps necessary if mailed in the United States

— Postage will be paid by —

SCIENCE MAGAZINE
Room 1740, Readers' Service
11 West 42 Street
New York, N.Y. 10036

Are you a member of the AAAS? Yes...... No......

Address .... Zip ......

Employer ....

Position .... Department ....

Name ....

Please print and include title

FIRST CLASS
PERMIT NO. 12711
NEW YORK, N.Y.

BUSINESS REPLY MAIL

No postage stamps necessary if mailed in the United States

— Postage will be paid by —

SCIENCE MAGAZINE
Room 1740, Readers' Service
11 West 42 Street
New York, N.Y. 10036

Are you a member of the AAAS? Yes...... No......

Address .... Zip ......

Employer ....

Position .... Department ....

Name ....

Please print and include title

measure smooth muscle contraction with the
PHIPPS & BIRD

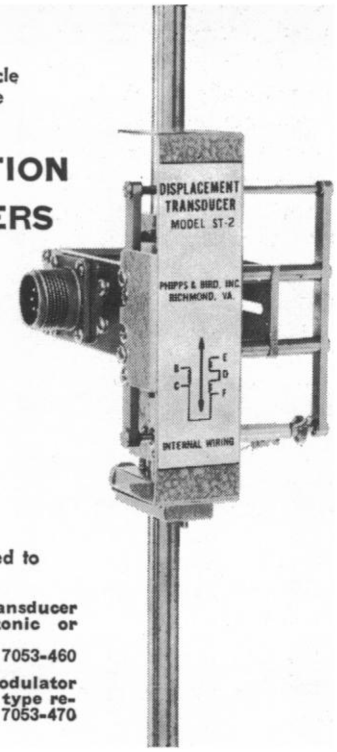
LINEAR MOTION TRANSDUCERS

FEATURES

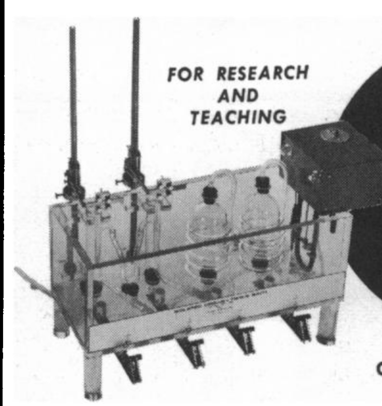
1. Allows linear recording of motion
2. Ideal for measuring a minimum of motion at low frequency
3. Low friction (50 mgcm)
4. High sensitivity
5. Reliable and accurate
6. The ST2 can be connected to any suitable recorder

ST2 Linear Motion Transducer without micrometer—Isotonic or Isometric Measurement Cat. No. 7053-460

Converter—An exciter-demodulator for use with D.C. or Servo type recorders Cat. No. 7053-470



FOR RESEARCH AND TEACHING



PHIPPS & BIRD

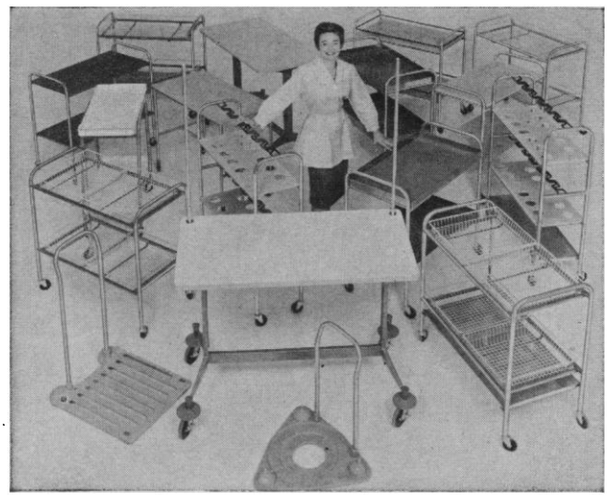
ISOLATED ORGAN-TISSUE BATH

Catalog No. 7053-400

- Designed for the purpose of studying the effect of drugs or electrical stimuli on isolated organs and smooth muscle segments.
- For use with mechanical or electronic recording systems.
- Allows quick, easy attachment of tissue.
- Tissue can be washed without exposure to air or chamber can be drained.
- Diffusion between chamber and reservoir prevented by check valve.
- Allows accurate recording of tissue contraction.
- Water temperature precisely controlled.

PHIPPS & BIRD, INC.
Manufacturers & Distributors of Scientific Equipment
6th & Byrd Streets Richmond, Virginia

Circle 834 on Readers' Service Card



Only Labconco makes 21 different laboratory carts

This is the only line of carts designed specifically for use in the laboratory. They're made of heavy steel, welded for extra strength. There are no rivets or bolts to work loose. All steel parts are light green epoxy coated.

Typical materials used in making Labconco carts are fiberglass, compressed asbestos, and polyvinyl. These materials are chemically inert, easy to maintain.

Labconco carts start as low as $45. For a fully-illustrated brochure, write Labconco Corporation or see your laboratory supply dealer.

LAB CON CO.
8805 Prospect, K.C., Mo. 64132

SCHOTT

Narrow-Band Optical Interference Filters

310 to 2000nm. Transmission up to 60%.
Half-band width down to 5nm.

All Schott narrow-band metal filters are furnished with cemented solid-colored (absorption type) glasses to remove undesired side-band transmission. Standard size 2" by 2" or 2" diam. Special sizes available, prices on request. (fob New Rochelle)
Ultraviolet "IL" 310-349nm $64. each; 350-389nm $37. each.
Infrared Filter "IR-AL" 1000-2000nm $68. each.
The "IL" (Line Filter) is available in wavelengths between 390-800nm, nominal value tol. 1% but at least ±5nm, Tmax 30%; HW abt. 10nm; TW/HW 1.7, $31. each.

Continuous WEDGE Variable Filter

Range: 400-700nm type S-60 (25 x 60mm) $42;
type S-200 (25 x 200mm) $177.
Range: 700-1200nm type SL-200 (25 x 60mm) $185.
Prices include calibration certificate.

A full range of metal transmitting-type filters is available in various half-band widths and transmission tolerances.

Write for Bulletin 3701-E

UV-R-250 REFLECTING-TYPE FILTER

in ultraviolet region peaked at 250, 280 and 310nm. While this filter works on a reflecting principle, it results in an in-line transmitter in ultraviolet and opaque in the visible and infrared.

Write for Bulletin 3700-E

NEUTRAL DENSITY SOLID GLASS FILTERS

Made of Schott Glass, for use with high energy lasers without bleaching or damaging effect when irradiated with lm sec. pulses of 300 joules per square cm. Density: 1-1.0 in increments of 0.1, also 2.0, 3.0 & 4.0. 2" square or round. Set of 10: $150.

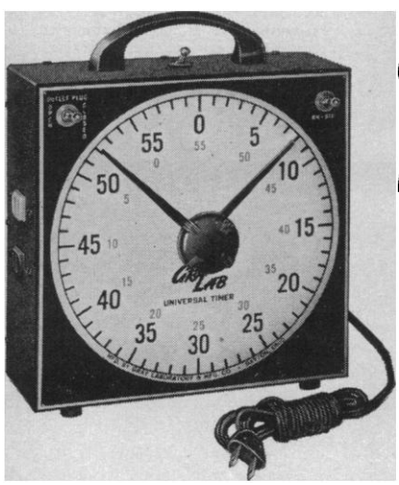
Write for Bulletin ND-419

U.S. Importers and Distributors of Schott Glass for over 40 years.

FISH-SCHURMAN CORPORATION
74 Portman Road, New Rochelle, N.Y. 10802

Fish-Schurman

TIME YOUR TESTS IN SPLIT-SECONDS!



GRA-LAB

ALL PURPOSE LABORATORY TIMERS

MODELS AT $26.00 to $33.00

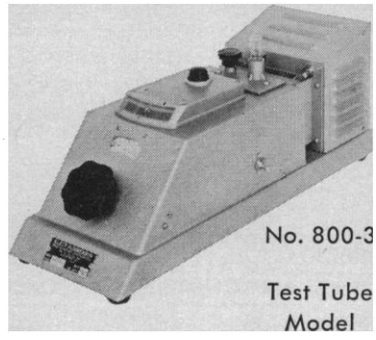
You can set the large 8" dial for any desired time period within an unusually wide range of 3600 possible settings, (ie., 1 sec. to 60 min., 1 min. to 60 hrs., etc.). At end of preset interval, alarm sounds and external load is automatically switched on or off.

GRA-LAB MICRO TIMERS, Electric Stop Clocks, are available in 1/10 sec. or 1/1000 min. graduations for split-second measurements of elapsed time in laboratory or production operations. Price $42.00

WRITE FOR COMPLETE CATALOG!

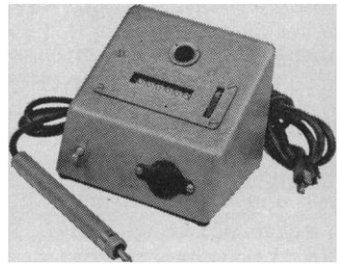
DIMCO-GRAY COMPANY
203 E Sixth St.
DAYTON 2, OHIO

Klett Summerson Photoelectric Colorimeter



KLETT COLONY MARKER and TALLY

This instrument takes the drudgery and error out of the counting of bacterial colonies.



Klett MANUFACTURING CO., INC.,
179 East 87th Street, New York, 28, N.Y.

lagen and elastin with especial attention to involvement of aldehyde components in such processes. The symposium was summarized by P. Person who concluded that the dental profession was coming to realize that the mouth was too important for it to rely solely upon its own efforts for advances and new knowledge, and that this meeting represented an attempt to recruit new research colleagues from other disciplines in all the sciences.

The respective presiding officers at the sessions were A. A. Dahlberg, M. L. Moss, B. Eichel, M. B. Engel, and M. U. Nylen. The meeting was supported in part by a grant from the Warner-Lambert Research Institute and American Chicle Research Department.

PHILIP PERSON
Veterans Administration Hospital, Brooklyn, New York

Pharmaceutical Sciences (Np)

Section Np held eight sessions which included 26 contributed papers, one symposium, the vice-presidential address, and the distinguished lecture.

There were 11 contributed papers in the general area of hospital pharmacy. W. L. Guess (University of Texas) discussed the use of cell culture in investigating the subtle toxicity of certain plastic components used in the manufacture of polyvinyls for potential use as packaging material for foods, drugs, and devices used as supportive therapy in the treatment of disease. His group demonstrated that toxic effects of certain compounds could be demonstrated on cells in culture, whereas the usual animal tests indicated that these substances were relatively nontoxic; they concluded that there was a great need for further research into the relationships between various levels of toxicity evaluation to potential harm in the human subject.

George Archambault (pharmacy liaison officer to the Office of the Surgean General) discussed (i) the dangers in making comparisons in reported pharmacy costs without adequate definitions of what constitutes the cost and work load elements, (ii) the showing of values in specific reports when properly used, and (iii) the presentation of a 10-year drug and workload cost analysis of a chain of hospitals.

A. G. Isack (U.S. Public Health Service) discussed the opportunities for the advancement of quality through Medicare and indicated that Congress

has given and will continue to give new incentives to move with the mainstream of modern medical care through the efforts of governmental and voluntary agencies working as a team, and that the main result of the health insurance program for the aged will be a definite and positive effect on health care not only for the aged but also for the entire population.

André Archambault presented the vice-presidential address entitled "Pharmaceutical education: a dual challenge." He stressed the need for all pharmaceutical scientists and all pharmacists to do more thinking and more research with the problems that emerge from the professional and social changes which affect pharmacy and which may therefore influence pharmaceutical education. He emphasized that it was not only the challenge of the educator to prepare the graduates in the pharmaceutical sciences for the future, but also to help them to identify the specifics of quantity, quality, and content of what should be taught, and, in particular, of what they should learn, and that the responsibilities of the health workers do not only consist of providing professional services to the patient but also involve the problems and interests of the whole community and even the future of mankind.

Fifteen contributed papers in the areas of pharmacology, physical pharmacy, pharmaceutical chemistry, and clinical pharmacology were presented during the sixth session. L. H. Block and P. P. Lamy (University of Maryland) reported that the effect of polymers on the transfer rate was postulated to be the result of viscosity, an interaction with drugs, or a change in interfacial properties: data suggested that the substantial increase in viscosity, after the addition of macromolecules, plays a dominant role in the depression of drug transfer within the gastrointestinal tract fluid. R. L. Powell and J. P. Buckley (University of Pittsburgh) reported that phenformin HCl protected experimental animals subjected to chronic exposure to an altitude of 29,000 feet. They suggested that the compound may not only be of value in situations of exposure to low oxygen tension at high altitudes but also in many clinical conditions where the disease state leads to oxygen deficiency. F. T. Galysh and B. M. Regan (Baxter Laboratories, Inc., Morton Grove, Illinois) reported that 2-(3′-benzamidopropyl)-1-cyclohexyl-2-thiopseudourea HCl is a potent, local an-

esthetic extremely effective on topical application with a higher therapeutic index than local anesthetics currently in use. D. Gorde and R. A. Heiser (Squibb Institute for Medical Research) reported on the clinical effectiveness of intraoral bandages as a surgical or protective dressing on oral surfaces after surgical procedures.

A. Grollman (University of Texas Southwestern Medical School, Dallas) presented the Section Np distinguished lecture on hypertension. He discussed the role of the kidney in maintaining a normal blood pressure and the importance of the kidney in preventing the development of hypertension. He indicated that cardiovascular hypertension is currently one of the major causes of death in the United States and although the cause may be listed as congestive heart failure or cerebral accident, the actual cause of death is chronic hypertension.

The last session was the symposium entitled "Therapeutic incompatibilities involved in drug dosage" arranged by W. J. Kinnard, Jr. (University of Pittsburgh). J. D. McEvilla (University of Pittsburgh) discussed recent surveys on the incidence of adverse drug reactions and noted the need for more exact measurements of the problem. J. R. Gillett (National Heart Institute) discussed in detail actions of drugs on various enzyme systems within the body and the mechanisms by which one drug can either potentiate or inhibit the pharmacological or therapeutic activity of another drug. K. H. Beyer (Merck, Sharp & Dohme Research Laboratories) discussed the importance of preclinical predictiveness of abnormal drug interaction, and emphasized the importance of altering drug dosages when one compound has been demonstrated to potentiate the action of a second compound on laboratory animals. He specifically emphasized the actions of the thiazide diuretics on electrolyte metabolism and the control of the congestive heart failure patient with digitalis drugs. L. E. Cluff (University of Florida) discussed the adverse reactions occurring at the Johns Hopkins Medical Center and indicated that these occur mainly in those patients who were receiving large numbers of therapeutic agents (12 to 22 different compounds).

The officers and representatives of the sponsoring societies met to elect new officers and to formulate the 1967 meeting in New York. Curtis Waldon (Brooklyn College of Pharmacy) is

the new vice president and chairman of Section Np for 1967; and W. L. Guess (University of Texas) was elected committeeman-at-large.

Luncheon and dinner were sponsored by E. R. Squibb & Sons and McKesson & Robbins, respectively.

JOSEPH P. BUCKLEY
University of Pittsburgh, Pittsburgh, Pennsylvania

Agriculture (O)

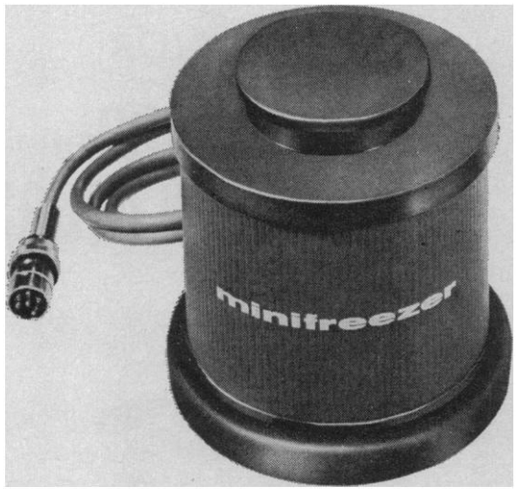
Agriculture and the Quality of Our Environment

The thirty-five papers presented in the symposium on "Agriculture and the Quality of Our Environment" were nearly equally divided among three aspects of environmental quality. A large number of papers were presented on the effects of environmental pollution on the soil, on crops, and on livestock. The deleterious effects on plants of polluted air from industrial firms has been known for more than a century. The crops affected include almost the entire range from cereal grains and grasses to vegetables, orchard trees, and forests. Among the important chemicals causing the injury are chlorine, sulfur dioxide, ethylene, and ozone. Animals too have suffered from the effects of toxic gases and particularly from the contamination of feed crops with fluorides. Two papers were presented on the potential and actual effects of radioactive fallout on plants and animals. The existing and recommended controls to prevent or minimize the injury to agriculture from environmental pollutants were discussed.

On the other hand, another group of papers presented the evidence or lack of it which indicated the extent to which agricultural contributes to environmental quality. The positive contributions of agriculture in the form of a plentiful and varied food supply, in the ornamentals that decorate our homes and parks, and in the beautiful national forests and recreational parks were pointed out. The dust storms of the past resulting from poor soil conservation practices were recalled. The present-day problems growing out of the widespread use of pesticides were thoroughly presented. The extent to which fertilizers contribute to the excessive nitrate content of the water was debated.

One paper indicated cattle feedlots

WHAT IS THE SHAPE OF COLD?



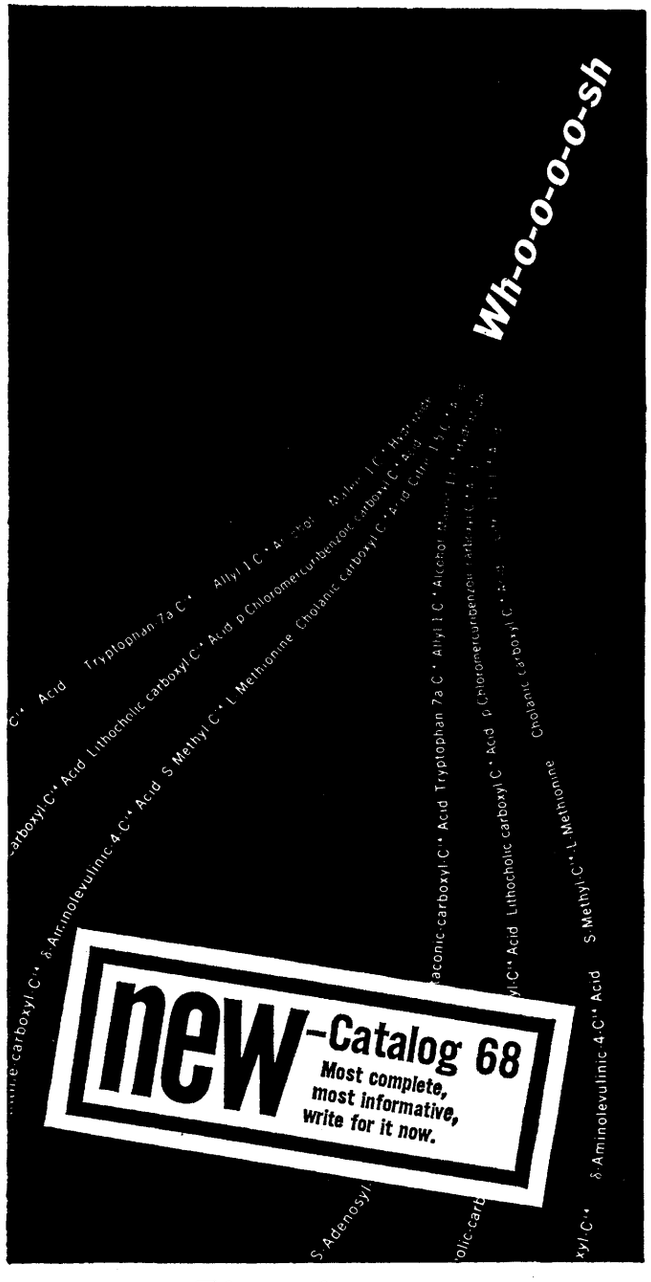
The answer depends on your needs and not on an attempt to dimensionalize sensation. That is, do you want it small, medium or large? Minifreezer solves the small requirement. An island of cold in a tiny container, Minifreezer is a controlled temperature chamber that can be used anywhere to save time, effort, money and space.

Consider the advantages of having a self-contained freezer that will take the temperature as low as —55°C and yet is about the size of a standard thermos bottle. No trips to a big freezer — quick freezing of samples where they are gathered — environmental testing — storage — you name it. Capacities range from 80 ml to 1500 ml and you can control the temperature set point directly.

If the dimension of cold for your needs runs around the size of a cocktail shaker, you ought to see the Minifreezer. Catalogs on request. Cocktails, if you are brave enough to ask for a demonstration.

SCIENTRONICS INC.
SUBSIDIARY OF HOKE INC.

2 TENAKILL PARK / CRESSKILL, N. J.



There it goes... another radiochemical shipment from Tracerlab

Our records show that our current speed record from receipt of order in Waltham, Mass. to delivery in Berkeley, Calif. now stands at 19 hours. The way we're going, it isn't going to stand very long. Speed is just naturally part of the Tracerlab radiochemicals service — along with superlative purity, widest range (more than 900 stock compounds at last count), and friendly, personal attention to your every need.

Prove it to yourself. Call Dr. John Leak at TW 4-6600, area code 617 . . . and help us break a new record in speed and service.

LFE | TRACERLAB
A Division of Laboratory For Electronics, Inc.
WALTHAM, MASSACHUSETTS 02154

Film Badge Service • Health Physics • Bioassays • Sources • Nuclear Instrumentation • Radiochemicals
Radioactive Waste Disposal • Radiation Monitoring Instrumentation • Isotope Applications

and other livestock installations as the more important sources of nitrate in water supplies. A session of the symposium concentrated primarily on the disposal of the livestock wastes. The enormity of the problem was emphasized. No satisfactory chemical or bacteriological methods for reducing or disposing of these wastes has been found to date. Incineration produces odor problems. The most generally accepted procedures involve methods of putting the manures back on the land. Soil is considered by several to be the natural and thus far the best filter for animal wastes.

The third type of papers was concerned with the overall problem of environmental pollution, both rural and urban. Air pollution in the cities was discussed in terms of its being a contributor to the respiratory disease complex of humans. The sediment load of the country's streams and rivers was shown to be largely from sheet erosion, some from gully erosion, and an important portion from construction for industry or residences. Data on the salinity contributed by midwest and eastern rivers indicates that these waters collectively carry more salts than the major western rivers even though the salinity problem has been more acute in the West. The role that automobiles play in air and soil pollution was dramatically portrayed by the results of time-lapse photography and analytical data. One speaker stated that the conventional auto engine must be modified beyond what appears presently feasible if the pollution effects are to be controlled. The impact of pollution on recreation and commercial fishing in lakes, estuaries and coastal marine waters was presented. The need was expressed for experimental cities in order to try out new ideas of pollution control and other aspects of urban planning.

The attendance at the seven half-day sessions averaged more than 100. N. C. Brady (Cornell University) arranged the program.

NED D. BAYLEY
U.S. Department of Agriculture, Beltsville, Maryland

Industrial Science (P)

Operations Research in Branches of the Government

The Operations Research Society of America and the Institute of Manage-

ment Sciences, in cosponsorship with Section P, held several symposia. According to this symposium (27 December 1966), operations research, systems analysis, and multidisciplinary problem solving have carried the approaches into the nondefense agencies of the Federal Government. This extension of operations research techniques to other areas of public expenditure promises new surprises, both in substance and method.

In the nondefense agencies of the Executive Branch of the federal government, there is an emerging but dispersed investment in operations research. The Legislative Branch is providing further impetus in the form of initiating bills to give financial support to the application of systems analysis to pressing public problems. Although the Judiciary has gone on record as indicating a desire to use these techniques, developments are still at a primitive stage, with emphasis on court calendaring being predominant. Finally, state governments are becoming aware of the need for operations research, and have been able to initiate some work as a result of the availability of federal planning grants. Because so much of the action program of the Federal Government is actually administered at state, county, and local levels, it becomes increasingly apparent that analyses of federal programs and development of measures of effectiveness will require innovation beyond that which characterizes defense and industrial studies.

Prospects and Problems for Improved Health Systems in the United States

A great deal of introductory research has been conducted on systems analysis of health programs in the United States. The time is now ripe for an early synthesis. The speakers in this session (29 December 1966) proceeded rapidly from an exciting description of a production line physical examination procedure for a West Coast health plan to a consideration of ways in which health systems could be better studied. In the third year of operation of the health plan, some 100,000 health records had been generated and a large volume of the diagnostic work was being performed automatically. Questions of information processing and procedures for clinical decision-making represented great fields for new discoveries. The concluding paper described the pro-

gram planning activities of The Surgeon General in determining resource allocations strategies for the improvement of health levels in the United States.

W. E. CUSHEN
National Bureau of Standards, Washington, D.C.

Quantitative Studies in Research and Development Management

This session (29 December 1966) consisted of presentations by four outstanding research workers who are concerned with representative types of problems of a quantitative nature facing the R&D manager.

The application of quantitative techniques and methods of analysis to management problems has been an accepted practice for many years now. Virtually every major industrial organization and most components of the U.S. government have operations research or management science activities to do just this job for various levels of management. Most forward looking managers use this type of assistance as inputs to their decision-making activities.

In the area of research and development management, however, it has only recently been seriously suggested that similar quantitative techniques might be available to assist the manager in making decisions. Much has been written and discussed about R&D management since World War II, but most of this has been of a general qualitative nature, placing the field in the category of an art.

However, it is the opinion of an increasing number of managers, scientists, engineers, and analysts that quantitative techniques should prove to be of assistance to the manager in making his decisions. Many of the decisions that the manager must make can certainly be expressed in quantitative terms—indeed they must be. Do we support a particular project or don't we? If so, how long should it be supported? At how much money? How many people? These questions require quantitative answers. Quantitative techniques should be applicable to guide the decision makers. The fact that the problems are very complex and not yet completely understood should not preclude the use of models and perhaps simulations as a guide.

There are many large and small problems with regard to the develop-

ment of research and development programs to which analytical scientific methods might well be applicable. There are a considerable number which are currently under study by various investigators.

Burton V. Dean (Case Institute of Technology) discussed the use of mathematical models in helping to allocate R&D funds. Models were discussed which assist in the selection of technical alternatives, the funding of system component development, and the allocation of costs across systems.

Richard S. Rosenbloom (Harvard University) and W. J. Abernathy (University of California, Los Angeles) discussed the economics of parallel and sequential strategies in R&D. They pointed out that it is common in technological development to identify and explore several approaches to a particular objective so that the best approach may be chosen. The outcome of any approach is uncertain; hence it is difficult to choose the best approach at an early date. To deal with this uncertainty, Rosenbloom and Abernathy suggest that two or more approaches to the identified objective may be continued in parallel until a clear choice between approaches can be made, that is, a parallel strategy. Such a strategy can serve the functions of providing better information for a decision, maintaining options, or hedging against the occurrence of an unsatisfactory outcome.

Herman D. Lerner (Bethesda, Maryland) discussed and appraised several recent important studies concerned with communication among research scientists. He pointed out that much of the data used in these studies are inconclusive, that much of the results are inapplicable to the design of information systems, and that little has been done with regard to theoretical advances into the nature of this type of communication.

Professor Edward B. Roberts of M.I.T. discussed the dynamics of R&D organizations. Several feedback models were suggested which approximate the R&D process in a laboratory. Managerial actions taken to solve one problem may have much greater impact on other facets of the laboratory's operation. Empirical data from a government laboratory are currently being gathered to use in the development of these models.

MARSHALL C. YOVITS
Ohio State University, Columbus

Education (Q)

The pervading interrelationships between the biological sciences, agriculture, and renewable natural resources were emphasized during the symposium (27 December 1966) sponsored by the Commission on Education in Agriculture and Natural Resources of the Division of Biology and Agriculture of the National Research Council and Section Q. Undergraduate biological education for the future agricultural scientists should differ little from that for the biology major, according to P. B. Siegel (Virginia Polytechnic Institute). However, rigid core curricula for all agricultural undergraduates, including those who will terminate with the B.S., should not exceed two years, and in Land-Grant universities might appropriately not exceed one year. Introductory biology should illustrate both unity and diversity, and be founded on concepts in chemistry, physics, and mathematics.

Agricultural scientists should be involved in planning and, indeed, in teaching, biology core programs.

Agricultural faculty members frequently argue that biology professors should utilize economic rather than exotic "mountain-top and seashore" species more frequently to illustrate principles (George A. Gries, University of Arizona). It is difficult to predict which will be the most important economic species in the future. However, all students should be exposed to certain biological concepts which may have long-term implications for food production.

Agricultural students might be motivated by one-unit courses, taught concurrently with courses in the biological and physical sciences and mathematics, during which the concepts under study in these courses could be related to agriculture.

The field of "conservation," more appropriately termed "renewable natural resources management," is changing rapidly (L. S. Hamilton, Cornell University). However, many resource professionals are not able to grasp the dimensions of contemporary resource management problems. Too frequently, graduates of baccalaureate programs are performing technician-level tasks; making management recommendations and decisions inappropriate for the present day and are products of curricula that are excessively specialized and are guided by

outmoded professional accreditation and employment policies. Hamilton proposes a broad, basic three-year program for all undergraduates in renewable natural resources, with specialization in forestry and other resource fields coming during the fourth year.

Among the contributed papers of special interest was a report by J. S. Carlson (University of California, Riverside) on an experiment involving second grade pupils. He sought to investigate and resolve the disagreement as to the relative importance of direct experience and verbal instruction in teaching the concept of conservation of substance. He found the concept to be teachable and that when pupils were expected to answer questions with comment including reasons for their answers, instruction involving high verbal levels seemed more effective than low verbal levels. Direct experience and demonstrations were equally effective at both verbal levels.

Of particular interest to those concerned about assistance to foreign education was the work of Francis E. Dart (University of Oregon). In his study of the intellectual background accompanying science courses in Nepal at elementary school levels he found that a dual interpretation of nature was common and that knowledge about natural phenomena was confined to a closed body of unvarying facts. A general lack of familiarity with methods of abstraction and abstract representation assumed by most elementary science courses was noted. The implications suggested included the necessity for the introduction of pre-science teaching in the elementary school and the proposal that science be presented as a "second culture" complementary to that already present rather than a replacement for it.

E. A. Madlon and Warren Wong (IBM Corporation) described an updating educational program in science for mature, experienced scientists in managerial positions. There was general acceptance of the value of such a program taught by college personnel when: the teaching was modified to fit the population involved; special training methods were used; lecture notes were presented to the students in advance, and there was a de-emphasis on competitive grading.

David Vitrogan (Yeshiva University) described the development of a series of twenty units of instruction with space science as a unifying theme. The course was produced with the idea

of permitting teachers with different degrees of ability to adopt as much of the material as they are capable of expanding and using to enrich their current offering at the ninth and tenth grade levels.

During a symposium on perspectives of research in the natural sciences before Section Q-Education and the American Educational Research Association, John A. Easley, Jr. (University of Illinois, Urbana) stated that the use of statistics in educational research has sometimes been a defense that masks the study of interesting and significant phenomena. He stressed the fact that influential statistics has a limited range of applicability in the natural sciences; perhaps it is stressed unduly in educational research to the detriment of more naturalistic views of classroom events. He noted the need for more informal analyses of the pehnomena under study.

Richard E. Schutz (Southwest Regional Laboratory, Los Angeles) on the other hand accented the experimental and self-correcting aspects of natural science, suggesting strongly that we would do well in the field of educational research to attempt emulation of these attributes. He points out that educational research is seldom experimental, and it should be with respect to its methodology, content, and process.

FREDERIC B. DUTTON
Michigan State University, East Lansing

Teacher Education for the Eighties

The 29 December afternoon session of Section Q stressed teacher education. Clarence Boeck, in the vice-presidential address, expressed concern over the quality of current undergraduate science instruction. Rarely does a university professor or teaching assistant, according to the literature and the public press, break through to excite a student's curiosity and to incite him to self-initiated study. Corrective measures are in order. Boeck would have behavioral scientists develop measures of teaching effectiveness and schemes for projecting the personality and insight of productive teacher-scholars. In-service training activities for college teachers of introductory and intermediate level courses have great possibilities for sharing the artistry of teaching, and the sciences of concept building and measurement. Beyond this, committees

on academic promotion should recognize that creativity is as much a part of course design and implementation as it is of research and publication. Effective teaching and effective research are not necessarily counterparts of each other. The future of higher education demands that attention be given to examining the behavior patterns, individualistic as they are, of eminent teacher-scholars. Good teaching, the speaker insisted, is a learned behavior.

James Rutledge, widely known for his Academy Conference activities, stressed the evolutionary character of secondary school science teacher education programs. Innovations in a program envisioned for 1980 will probably be research participation experiences in science, in-service activities sponsored by the school systems, the use of intensive microteaching opportunities early in the professional program, teacher internships or extended student teaching assignments, and courses which stress the method and structure of science. According to Rutledge, students may expect to have large blocks of time allocated to the study of the humanities and social studies, to the sciences in breadth as well as in depth, and to professional studies—educational foundations, adolescent psychology, learning theory and practice, and instructional methods and materials. The 1980 approach will be characterized by attention to the need for interpreting science, for developing a strategy for scientific discovery, and for devising a strategy for teaching. The rapidly evolving culture demands a mastery of generalized skill. Instruction in specifics, by this argument, may be minimized as the real problem is the creative application of knowledge to a variety of situations.

Speaking on the point of teacher education in science for the 1980 elementary school, Willard Jacobson (chairman-elect of the Section) used a different line of reasoning. Social mobility, the exponential growth of knowledge, the promised technological advances, a promised sense of commitment to the individual, a computer-based educational technology, a higher level of support for public education, and a required science sequence through the first two years of the community college, he argued, act to impose a different set of conditions on the professional school emphasizing teacher education. Its students will be better prepared and more highly se-

lected. Its programs will include opportunities for team teaching, for continuing experience with children, for studies in the taxonomy of science information retrieval, for significant experiences with the processes of scientific inquiry, for study of the relationships between science and society, for opportunities to master several styles of teaching, for careful observation of the developmental tasks and characteristics of children, for practice in diagnosing educational difficulties and supervised remediation procedures, and for study of the great number of programmed materials and visual assists available through television consoles. By this model, Jacobson projects a different role for the elementary teacher. Relieved through educational technology of the necessity for conducting drill sessions of prerequisite materials, the "Mrs. Ideal Future"—1980 model teacher—will spend much time in helping children expand their horizons. She will have had the benefit of critiquing her own video recordings, of using the teaching simulator, and of engaging in independent study. The future elementary science teacher education program will be directed toward developing strategies for teaching, a detailed knowledge of alternatives, and practice in the identification of instructional problems. In-service opportunities will be far different from the sterile university classroom; they may be teacher-organized and board-supported; they will surely be at the forefront of teacher needs for the next century.

CRAIG SIPE
George Peabody College for Teachers, Nashville, Tennessee

American Nature Study Society (Q3)

"Broadened Ecological Perspectives for Understanding Man and Nature" was the keynote address by Sanford S. Farness (Michigan State University). Farness emphasized that "we need to achieve and apply a more profound ecological knowledge of man and nature that will make possible higher levels of human life and meaning, and the symbolic expression of these values in the transformed landscapes and settlement patterns of the future." "We need," continued Farness, "to theorize about a higher logic—a higher, multivalued rationalism that can integrate truth, beauty and goodness in concrete environmental forms."

"Ultimately," Farness said, "the resolution of our environmental needs and problems will be dependent upon new ecological understanding and integration of art, science, and religion. This challenge will require a greatly expanded awareness of man's inner environment, the infinite depths of his interior self, as well as extended grasp of his multi-dimensional external environment. . . . The creative, formative cosmic powers have been neglected." Farness proposed a "new type of multipurpose institution focused upon local ecosystems in scale with the human span of attention [and] . . . maintaining three-dimensional scale models of planning units utilizing a range of audio-visual methods for concrete, pictorial representation of landscape components and relationships." Similar now to nature centers, one could visualize inner-city interpretive centers developed as exponents of what Farness was projecting in his paper. Farness concluded by stating: "Amended and new programs should be devised and institutions should be redesigned so as to encourage adaptive planning of the landscape as a beneficent habitat for all biotic life as well as man. Ecological criteria should be applied to all public laws and programs."

M. Rupert Cutler (Wilderness Society) declared the urgent need for teachers and scientists to make supporting statements at public hearings and to undertake research so that the intent of recent national legislation on wilderness can be firmed.

Herbert S. Hiller (Nature Conservancy) presented an orderly and annotated list of management procedures and tools to enhance the use of natural areas and offset unwitting destruction or degradation of dedicated sites.

Summarizing a four-year project, Carl S. Johnson (Ohio State University) defined constructive procedures which should be helpful to agencies and organizations producing inexpensive conservation publications.

The need for naturalists and teachers to work in the field and to make first-hand observations and discoveries was emphasized by Paul E. Goff (Toledo Metropolitan Park District). Goff asked that many current nature center programs be reexamined in this light. His comments were repeated in other manner by several of the speakers in the ANSS Session III.

John W. Brainerd (Springfield College) presented a masterful demonstration of how slides can be used

to stimulate observing and recording.

Through a summer project held at Tuskegee Institute and working with Negro teachers and rural disadvantaged children, Robert L. Vogl (Northern Illinois University) showed how the project took on more universal significance when it was placed into a social and environmental perspective. (Vogl was taped subsequently for a Voice of America program to be beamed at African nations facing similar educational situations.) In this same session, William B. Stapp (University of Michigan) reaffirmed the need to correlate school sites with total curriculum implications. A new film, "An Approach to School Site Development," developed under Stapp's direction, was viewed at the ANSS "Lenses on Nature" program.

In cooperation with NABT and the Association of Interpretive Naturalists and the National Park Service, the ANSS field trippers viewed work underway at the Patuxent Wildlife Research Center near Laurel, Maryland. Here they saw research with species closely related to threatened species and quantified studies on effects of pesticides on wildlife, as well as marsh development. The group visited the Rock Creek park complex and the Nature Center.

During the annual luncheon, retiring president Howard E. Weaver (University of Illinois), offered a eulogy to the late C. M. Goethe of Sacramento and described how Goethe aided in getting interpretive programs started in parks as early as 1919. Six past presidents of ANSS were personally awarded wall plaques. Weaver in his talk as retiring officer of ANSS described the "Past, present and future of ANSS." He illustrated many directions for the future of ANSS as one of the science teaching societies affiliated with AAAS.

All of the ANSS sessions were geared to the AAAS meeting theme: "How Man Has Changed His Planet."

DOUGLAS E. WADE
Northern Illinois University, Oregon

Cooperative Committee on the Teaching of Science and Mathematics (Q7)

Two main themes were discussed during a symposium on "Some Conjectures with Regard to the Future of Science Education" (28 December 1966). The evolution of the business-

sponsored compact for educational developments and the rapidly increasing mechanization of library facilities were noted. The primary aim of the typical compact is to improve education for all people. Noting that the educational "hardware" already is on hand to a satisfactory degree, there is great need for a learning technology in which all the component elements are integrated into the operation most suitable for each individual. Application of a systems approach to learning will necessitate unheard-of flexibility and means for tailoring the education process to each individual, and the availability of a host of equipment and auto-tutorial materials in each learning center. However, the plan should free the teacher of noninstructional tasks while he becomes the source of intellectual stimulus guiding the selection of the means and devices which will be most appropriate to the dynamic educational needs of each individual pupil. The handicapped and the homemaker will share in the benefits of these developments, since the new individualized instruction will make use of as many of the senses as are functional within each person and will facilitate home study through such portable means as instructional tapes.

The major upsurge in mechanization of libraries is now in only its third or fourth year, and the immediate future holds promise of startling, widespread development. Through the use of computer tape to produce catalog cards, some libraries are able to assemble complete book catalogs quickly, which may be distributed to others for their reference. This facilitates interlibrary communication, recently improved even further with the coupling of instrumentation for reproduction onto microfilm. Fully operational systems involving total tie-in with computers are expected in several research libraries within a few years. The availability of data collecting and interrogation terminals now makes possible the effective use of a satellite system in which departmental and college units may have direct access to a major centralized library. Successful indexing of documents and otherwise improving the various elements of information retrieval are undergoing rapid change, particularly with regard to the interaction of the researcher and the data.

EMERY L. WILL
State University College, Oneonta, New York

National Science Teachers Association (Q11)

The National Science Teachers Association, independently and in cooperation with the other science teaching societies, presented four sessions—two dealing with teaching problems and two with science content. One of the former, "After BSCS, What?," didn't answer its own question, but participants predicted more historical aspects of biology, more social relevance, and more quantitative handling of data in the high school biology courses of the future. The other teaching program discussed the need for new approaches for laboratory programs for general education science programs in colleges and in the increasing number of junior colleges. A novel approach to the study of human ecology based on social institutions was presented to a joint session by Stanley A. Cain (Assistant Secretary of the Interior). A symposium on oceanography pointed out that the most important biological characteristic of our entire planet is the presence on its surface of liquid water, sketched some aspects of oceanography today, and then discussed the important energy relationships between the oceans and the atmosphere. As Michael Garstang, the speaker on "Fueling the Air-Sea System," said, "Motions of the atmosphere and oceans are sustained not by energy received directly from the sun, but through a complicated exchange process at the air-sea interface. . . . The intermittent bursts of energy supplied to the atmosphere by the ocean are concentrated in organized atmospheric disturbances." Asked by a member of the audience whether—from this line of reasoning—one might consider hurricanes as safety valves for the release of excess of built-up energy, Garstang said that this might be the case and that, should it become possible to dissipate hurricanes in their early stages, the energy which they normally would transfer to other localities would have to "go somewhere," but did not predict where. The discussions by all of the speakers make it clear that oceanography is an interdisciplinary area of study, research, and action and that distinctions between disciplines are meaningless in oceanography.

MARY E. HAWKINS
The Science Teacher,
Washington, D.C.

Statistics (U)

Experimental Design in Epidemiology

Experimental epidemiology flourished in the nineteen-thirties and early forties. Since that time, despite the promise of the work of Webster, Topley, Wilson, and others, there has been little experimentation aside from vaccine trials. Three aspects of epidemiologic methodology were covered at this meeting (27 December 1966). The first (L. R. Christensen) reported on experiments in the classic tradition of the thirties, the second (A. R. Feinstein) on difficulties encountered in the observational studies which represent the bulk of current epidemiologic research. The third paper, a mathematical model for an infection-disease process, represents a tool which is just attaining real importance in epidemiologic research.

Ectromelia virus produces in mice an acute, exanthamatous, smallpox virus. The present study (L. R. Christensen, New York University) provides evidence that ectromelia can persist in mouse populations for extended periods without producing obvious disease, and that individuals harboring such "silent" infections can transmit the disease to normal contacts. Of particular interest is the evidence indicating that such silent infections do not transmit from female to female, but will transmit from female to male, and male to female. This phenomenon of silent transmission has undoubtedly been responsible for several spontaneous outbreaks. If a similar situation can exist with the other animal and human pox viruses, the implications are obvious.

The iatrotropic stimulus, which provokes a diseased host to seek medical attention, can be a symptom due to the disease under survey, or can arise from various other causes (Alvan R. Feinstein, Yale University School of Medicine). Although prognosis depends on the stage at which a disease is detected, the variations due to different iatrotropic stimuli are not specifically considered in most contemporary statistical analyses of treatment.

Statistics about the occurrence of diverse diseases are also generally erroneous because they fail to make provision for changes in the iatrotropic stimuli to aniatric diseased hosts, and for a changing dissemination of fashions, criteria, and tests used by doctors to establish diagnosis.

Two distinct febrile syndromes are associated with dengue virus types 1-4 infections; classic dengue fever and dengue hemorrhagic fever (DHF) (S. B. Halstead and D. Fisher, Yale University). Studies in Southeast Asia have shown that DHF occurs only in areas where multiple dengue types exist and yearly infection rates are high. Patients manifest secondary antibody response. It has been postulated that DHF may be a response to sequential infection with two dengue viruses. A mathematical model based on this postulate, with constant transmission rates gave a good fit to the age specific hospitalization rates for DHF in Bangkok.

LILA M. ELVEBACK
Mayo Clinic,
Rochester, Minnesota

Science in General

Sigma Delta Epsilon (X4)

In papers presented at the symposium on cancer and infectious disease by Sigma Delta Epsilon members (27 December 1966) it was reported that a pleomorphic, acid-fast bacterium isolated from partially purified Rous virus produced a disease in chickens consonant with Rous disease. Vaccines and rabbit antisera prepared against the organism protected against challenge with Rous virus.

A similar organism isolated from mouse tumors induced an increase in tumor protection under experimental conditions. This bacterium has filterable forms (PPLO? mycoplasm?) and harbors phages that lyse mycobacteria.

The first indication that chemical carcinogens might affect DNA or RNA was the discovery that the isotopic carbon of an alkyl group of administered methylnitrosamine could be found in an alkyl group attached to the 7-nitrogen atom of guanine of tissue nucleic acid. It has been suggested that reaction of a chemical carcinogen or a metabolite of the carcinogen may react with one or more critical macromolecules to induce neoplasia.

One of the few classes of compounds which has enjoyed clinical usefulness in the field of cancer is that of dihydrofolic reductase inhibitors.

Studies on the parasitic wasp, *Habrobracon*, are being used to broaden the knowledge of the basic mechanisms whereby changes in the cell are induced by ionizing radiation. Studies

of the mitotic stages show that oxygen and temperature differences resulted in maximum cell damage induced by radiation.

As man resembles the pig in anatomical structures and physiological processes a small pig was desired for medical research. Development of a pig, one-third the size of conventional swine, solely for research, was initiated in 1949 by the Hormel Institute of the University of Minnesota, under the guidance of the late L. M. Winters.

Since 1956 the miniature pig has been useful in studies of subcutaneous granulomas and carcinogens produced by radiation, of pulmonary granulomas produced by beryllium implants, and of neoplasia in the skin produced by chemical agents.

AGNES HANSEN
University of Minnesota

A Coffee Hour held in the Hospitality Room (26 December 1966) was attended by over 50 women in science. The first Sigma Delta Epsilon symposium, entitled "Cancer and Infectious Disease" featured research by members and was attended by over 100 men and women. Because of its success the Fraternity has decided to make the symposium an annual event of its national meetings. Plans are already under way for 1967.

The annual luncheon for women in science (attended by 48 women on 27 December) was highlighted by a talk by Margaret Stone (second vice president of the Fraternity) on "What is a Hortorium?" She illustrated her talk with colored slides of plants ranging from the Chamaedorea palm to the dainty "upside-down" orchid which attracts insects to it by a maroon "eye spot." The spot secretes a chemical substance which stuns the insect so that it drops to the pollinia where it receives the pollen subsequently used to pollinate other flowers of this species. The Grand Chapter Meeting was held on 29 December; Irene Corey Diller was installed as National Honorary Member of the Fraternity. Reports on their research were presented for two of the three grantees-in-aid in 1966.

The value of the two vice presidents to the Fraternity was demonstrated by the reports of the Chapter Establishment Committee, chaired by the first vice president with the second vice president as one member, and the second vice president's report on her

work as coordinator for the Chapter Liaison Officers. Her work has prompted the National Council to create a Chapter Relations Committee to be chaired by the second vice president with the first vice president as one member. Thus, the continuity of these two interrelated committees will be maintained.

HARRIET M. BOYD
The Fairfax, 43rd and Locust Streets, Philadelphia, Pennsylvania

Forthcoming Events

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. 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 Ashmum 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)

29–31. **Structural Dynamics and Materials**, conf., Palm Springs, Calif. (A. Kaplan, 1 Space Park, Redondo Beach, Calif. 90278)

29–1. **Microcirculation as Related to Shock**, conf., Boston, Mass. (D. Shepro, Boston Univ. Biological Science Center, 2 Cummington St., Boston 02215)

30–31. **Transport Properties of Superconductors**, Canterbury, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

31–5. American **Chemical** Soc., San Francisco, Calif. (B. R. Stanerson, American Chemical Soc., 1155 16th St., NW, Washington, D.C. 20036)

(Continued from page 819)

mentary, from the French edition by Nathaniel Bowditch. Chelsea, Bronx, N.Y., 1966. vol. 1, 938 pp.; vol. 2, 1008 pp.; vol. 3, 940 pp.; vol. 4, 1054 pp. Illus. $79.50 per set. Reprint, 1829, 1832, 1834, 1839 editions.

Chemotaxonomie der Pflanzen. vol. 4, *Dicotyledoneae: Daphniphyllaceae-Lythraceae*. R. Hegnauer. Birkhäuser, Basel, Switzerland, 1966. 551 pp. Illus. F. 106.

Computer Design. Ivan Flores. Prentice-Hall, Englewood Cliffs, N.J., 1967. 477 pp. Illus. $14.

Computer Programming and Related Mathematics. Richard V. Andree. Wiley, New York, 1967. 294 pp. Illus. $6.50.

Concatenated Codes. G. David Forney, Jr. M.I.T. Press, Cambridge, Mass., 1966. 159 pp. Illus. $8.50.

The Control of Environment. Lectures delivered at the second Nobel Conference (St. Peter, Minn.), January 1966. John D. Roslansky, Ed. North-Holland, Amsterdam, 1967. 124 pp. $5. Six papers.

Critical Phenomena. Proceedings of a conference (Washington, D.C.), April 1965. M. S. Green and J. V. Sengers, Eds. Sponsored by National Bureau of Standards, National Science Foundation, and Office of Naval Research. U.S. Department of Commerce, Washington, D.C., 1966 (order from Superintendent of Documents, Washington, D.C.). 256 pp. Illus. $2.50. Thirty-four papers. A report of the conference appears in *Science* **150**, 229 (1965).

Cultural Frontiers of the Peace Corps. Robert B. Textor, Ed. M.I.T. Press, Cambridge, Mass., 1966. 391 pp. Illus. $6.95. Sixteen papers.

Cytological Technique: The Principles Underlying Routine Methods. John R. Baker. Methuen, London; Wiley, New York, ed. 5, 1967. 161 pp. Illus. $4.50.

Design of Thin Concerte Shells. vol. 2, *Negative Curvature Index*. A. M. Haas. Wiley, New York, 1967. 252 pp. Illus. $14.95.

The Development of Medicine as a Profession. Vern L. Bullough. Hafner, New York, 1966. 133 pp. $7.50.

Development and Systematics of Some Pacific Marine Symbiotic Copepods. A study of the biology of the Notodelphyidae, associates of ascidians. Patricia L. Dudley. Univ. of Washington Press, Seattle, 1967. 288 pp. Illus. $6.50.

Diary of the "Discovery" Expedition to the Antarctic Regions 1901–1904. Edward Wilson, Ann Savours, Ed. Humanities Press, New York, 1967. 416 pp. Illus. $22.50.

Dictionary of Inventions and Discoveries. E. F. Carter. Philosophical Library, New York, 1966. 201 pp. $6.

Economic Policies Toward Less Developed Countries. Harry G. Johnson. Brookings Institution, Washington, D.C., 1967. 295 pp. Illus. $6.75.

Electrical Conduction Mechanisms in Thin Insulating Films. D. R. Lamb. Methuen, London; Barnes and Noble, New York, 1967. 130 pp. Illus. $4.50. Methuen's Monographs on Physical Subjects.

Electrons, Neutrons and Protons in Engineering. J. R. Eaton. Pergamon, New York, 1966. 559 pp. Illus. $15. International Series of Monographs on Interdisciplinary and Advanced Topics in Science and Engineering.

Elementary Reactor Physics. P. J. Grant. Pergamon, New York, 1966. 204 pp. Illus. Paper, $5. Commonwealth and International Library.

Engineering Kinematics. Alvin Sloane. Dover, New York, 1966. 320 pp. Illus. Paper, $2.25. Reprint, 1941 edition.

Environmental Quality in a Growing Economy. Essays from the Sixth RFF Forum (Washington, D.C.), March 1966. Henry Jarrett, Ed. Published for Resources for the Future. Johns Hopkins Press, Baltimore, 1966. 189 pp. $5. Twelve papers.

Essays in Mathematical Economics. In honor of Oskar Morgenstern. Martin Shubik, Ed. Princeton Univ. Press, Princeton, N.J., 1967. 495 pp. Illus. $12.50. Twenty-seven papers.

Essentials of Biology. C. Leland Rodgers. Barron's Educational Series, Woodbury, N.Y., 1967. 557 pp. Illus. Paper, $2.50; cloth, $5.95.

Fluid Mechanics, Thermodynamics of Turbomachinery. S. L. Dixon. Pergamon, New York, 1966. 227 pp. Illus. Paper, $6. Commonwealth and International Library.

Sigmund Freud. Francine Klagsbrun. Watts, New York, 1967. 160 pp. $2.95. Immortals of Science Series.

Fundamentals of Quality Control for the Food Industry. Amihud Kramer and Bernard A. Twigg. Avi, Westport, Conn., ed. 2, 1966. 556 pp. Illus. $14.75.

Genetics and the Future of Man. A discussion at the first Nobel Conference (St. Peter, Minn.), January 1965. John D. Roslansky, Ed. Appleton-Century-Crofts, New York, 1966. 216 pp. Illus. $5. Six papers.

Géologie du Pétrole. Alain Perrodon. Presses Universitaires de France, Paris, 1966. 448 pp. Illus. Bibliothèque de l'Ingénieur-Géologue.

Geology of Northern California. Edgar Bailey, Ed. California Division of Mines and Geology, San Francisco, 1966. 520 pp. Illus. $6. Thirty-five papers.

Gnosiology: The Scientific Approach to the Theory of Knowledge. Tadeusz Kotarbinski. Translated from the Polish by Olgierd Wojtasiewicz. G. Bidwell and C. Pinder, Translation Eds. Pergamon, New York, 1966. 562 pp. Illus. $18.50.

The Golden Age of Science. Thirty portraits of the giants of 19th-century science by their scientific contemporaries. Bessie Zaban Jones, Ed. Simon and Schuster, New York, 1967. 697 pp. $12.

Grundriss der allgemeinen Zoologie. Alfred Kühn. Thieme, Stuttgart, 1967 (order from Intercontinental Medical Book Corp., New York). 399 pp. Illus. Paper, DM 9.80.

A Guide to the Minerals of Switzerland. M. Weibel. Interscience (Wiley), New York, 1966. 135 pp. Illus. $6.50.

Handbook of Middle American Indians. vol. 4, *Archaeological Frontiers and External Connections.* Gordon F. Ekholm and Gordon R. Willey, Eds. Univ. of Texas Press, Austin, 1967. 375 pp. Illus. $15. Fifteen papers.

Handbook of Salamanders: The Salamanders of the United States, of Canada, and of Lower California. Sherman C. Bishop. Cornell Univ. Press, Ithaca, N.Y., 1967. 569 pp. Illus. $12.50. Reprint, 1943 edition.

High-Temperature Oxidation of Metals. Per Kofstad. Wiley, New York, 1966. 354 pp. Illus. $13.50. The Corrosion Monograph Series.

An Historical Atlas of China. Albert Herrmann. Aldine, Chicago, 1966. 120 pp. Illus. $12.50. Based on *Historical and Commercial Atlas of China* (1935).

Human Evolution: An Introduction to Man's Adaptations. Bernard G. Campbell. Aldine, Chicago, 1967. 441 pp. Illus. $8.95.

Impact of Space Exploration on Society. Proceedings of the National Meeting of the American Astronomical Society (San Francisco, Calif.), August 1965. William E. Frye, Ed. American Astronomical Soc., Tarzana, Calif., 1966. 382 pp. Illus. $14.25. Twenty-nine papers.

Insect Chemosterilants. Alexej B. Borkovec. Interscience (Wiley), New York, 1966. 153 pp. Illus. $6.95. Advances in Pest Control Research Series, vol. 7.

International Relations Research: Problems of Evaluation and Advancement. E. Raymond Platig. Carnegie Endowment for International Peace, New York, 1967. 187 pp. Paper, $1.

An Introduction to Algorithmic Methods Using the MAD Language. Alan B. Marcovitz and Earl J. Schweppe. Macmillan, New York, 1966. 445 pp. Illus. Paper, $6.95.

Ionization and Breakdown in Gases. F. Llewellyn-Jones. Methuen, London; Barnes and Nobel, New York, 1967. 176 pp. Illus. Paper, $2.35; cloth, $3.75. Reprint, 1957 edition.

An Introduction to Biomechanics. H. M. Frost. Thomas, Springfield, Ill., 1966. 159 pp. Illus. $7.50.

Introduction to Genetics. Norman A. Crowder. Doubleday, Garden City, N.Y., 1967. 278 pp. Illus. $5.95. Tutor Text Series.

Introduction to Statistical Mechanics. Ronald W. Gurney. Dover, New York, 1966. 276 pp. Illus. Paper, $2. Reprint, 1949 edition.

An Introduction to the Calculus of Finite Differences and Difference Equations. Kenneth S. Miller. Dover, New York, 1966 175 pp. Illus. Paper, $1.75. Reprint, 1960 edition.

Introductory Complex Analysis. Richard A. Silverman. Prentice-Hall, Englewood Cliffs, N.J., 1967. 384 pp. Illus. $8.75.

Kekule Centennial. A symposium (Atlantic City, N.J.), September 1965. Sponsored by Division of History of Chemistry, Division of Organic Chemistry, and Division of Chemical Education, American Chemical Society. O. Theodor Benfey, Ed. American Chemical Soc., Washington, D.C., 1966. 206 pp. Illus. $6.50. Advances in Chemistry Series, vol. 61. Ten papers.

Knowledge and Power: Essays on Science and Government. Sanford A. Lakoff, Ed. Free Press, New York, 1966. 512 pp. $9.95. Fifteen papers.

Laplace Transform Theory and Electrical Transients. Stanford Goldman. Dover, New York, 1966. 455 pp. Illus. Paper, $3. Reprint of *Transformation Calculus and Electrical Transients* (1949).

Libel: Rights, Risks, Responsibilities. Robert H. Phelps and E. Douglas Hamilton. Macmillan, New York; Collier-Macmillan, London, 1967. 415 pp. $7.95.

The Life and Death of a Satellite. Alfred Bester. Little, Brown, Boston, 1966. 253 pp. Illus. $5.95.

Liquid Hydrogen (Properties, Production and Applications). Lectures given at Grenoble, France, June 1965. Louis Weil and Paul Perroud, Eds. Pergamon, New York, 1966. 393 pp. Illus. $10. Pure and Applied Cryogenics, vol. 5. Twenty papers.

Magnetic Susceptibility. L. N. Mulay. Interscience (Wiley), New York, 1966. 137 pp. Illus. Paper, $2.95. Reprinted, with additions, from *Treatise on Analytical Chemistry*, pt. 1, vol. 4.

Manpower and the Growth of Producer Services. Harry I. Greenfield. Columbia Univ. Press, New York, 1966. 160 pp. $6.

Mappings of the Plane: With Applications to Trigonometry and Complex Numbers. H. E. Chrestenson. Freeman, San Francisco, 1966. 179 pp. Illus. Paper, $2.50.

Mechanics of Materials. Archie Higdon, Edward H. Ohlsen, William B. Stiles, and John A. Weese. Wiley, New York, ed. 2, 1967. 607 pp. Illus. $10.50.

Membrane Processes for Industry. Proceedings of a symposium (Birmingham, Ala.), May 1966. Southern Research Inst., Birmingham, Ala., 1966. 275 pp. Illus. Paper, $5. Eleven papers.

Men of Physics: Sir Arthur Eddington. C. W. Kilmister. Pergamon, New York, 1966. 287 pp. Illus. Paper, $5.95. Commonwealth and International Library.

Microscopy for Chemists. Harold F. Schaeffer. Dover, New York, 1966. 274 pp. Illus. Paper, $2. Reprint, 1953 edition.

Microwave Spectroscopy. Walter Gordy, William V. Smith, and Ralph F. Trambarulo. Dover, New York, 1966. 460 pp. Illus. Paper, $3. Reprint, 1953 edition.

Monopolistic Competition Theory: Studies in Impact. Essays in honor of Edward H. Chamberlin. Robert E. Kuenne, Ed. Wiley, New York, 1967. 397 pp. Illus. $8.95. Seventeen papers.

Network-Based Management Systems (PERT/CPM). Russell D. Archibald and Richard L. Villoria. Wiley, New York, 1967. 522 pp. Illus. $16.

The New Look of the Universe. Patrick Moore. Norton, New York, 1967. 126 pp. Illus. $3.95.

Nonlinear System Analysis. Austin Blaquière. Academic Press, New York, 1966. 408 pp. Illus. $14.50. Electrical Science, a Series of Monographs and Texts.

Numerical Inversion of the Laplace Transform: Applications to Biology, Economics, Engineering, and Physics. Richard Bellman, Robert E. Kalaba, and Jo Ann Lockett. Elsevier, New York, 1966. 259 pp. Illus. $8.50.

Odour Preferences. R. W. Moncrieff. Wiley, New York, 1966. 357 pp. Illus. $14.95.

Of Molecules and Men. Francis Crick. Univ. of Washington Press, Seattle, 1966. 115 pp. $3.95. John Danz Lectures Series.

Of Scientists and Salamanders. Victor Chandler Twitty. Freeman, San Francisco, 1966. 190 pp. Illus. $4.50.

Optical Illusions and the Visual Arts. Ronald G. Carraher and Jacqueline B. Thurston. Reinhold, New York, 1966. 127 pp. Illus. $7.50.

Organoboron Chemistry. vol. 2, *Boron-Nitrogen and Boron-Phosphorus Compounds*. Howard Steinberg and Robert J. Brotherton. Interscience (Wiley), New York, 1966. 588 pp. Illus. $25.

Overcharge. Lee Metcalf and Vic Reinemer. McKay, New York, 1967. 350 pp. $5.95.

Perturbation Theory for Linear Operators. Tosio Kato. Springer-Verlag, New York, 1966. 612 pp. Illus. $19.80.

Pharmacotherapy of Depression. Jonathan O. Cole and J. R. Wittenborn, Ed. Thomas, Springfield, Ill., 1966. 201 pp. Illus. $8.50. Eight papers.

The Phase Rule and Heterogeneous Equilibrium. John E. Ricci. Dover, New York, 1966. 523 pp. Illus. Paper, $3.25. Reprint, 1951 edition.

The Photochemistry of Gases. William Albert Noyes, Jr., and Philip Albert Leighton. Dover, New York, 1966. 465 pp. Illus. Paper, $3. Reprint, 1941 edition.

Physics and Chemistry of the Earth. vol. 7. L. H. Ahrens, Frank Press, S. K. Runcorn, and H. C. Urey, Eds. Pergamon, New York, 1966. 343 pp. Illus. $17. Three papers.

Planets, Stars and Galaxies: Descriptive Astronomy for Beginners. A. E. Fanning. American edition revised by Donald H. Menzel. Dover, New York, 1966. 189 pp. Illus. Paper, $1.35.

Plants: An Introduction to Modern Botany. Victor A. Greulach and J. Edison Adams. Wiley, New York, ed. 2, 1967. 654 pp. Illus. $7.95.

Practical Guide to Refrigerated Storage. Prepared by members of Commission 5 of the International Institute of Refrigeration. Pergamon, New York, 1966. 241 pp. Paper, $10. In English and French.

Principles of Agronomy. Lorentz C. Pearson. Reinhold, New York, 1967. 448 pp. Illus. $9.50.

Principles of Color Technology. Fred W. Billmeyer, Jr., and Max Saltzman. Interscience (Wiley), New York, 1966. 191 pp. Illus. $11.95.

Probability: A Survey of the Mathematical Theory. John Lamperti. Benjamin, New York, 1966. 160 pp. Illus. Paper, $3.95; cloth, $8.

Public and Private Enterprise. John Jewkes. Univ. of Chicago Press, Chicago, 1966. 100 pp. $2.25. Three Lindsay Memorial Lectures given at the University of Keele, 1964.

Quantum Mechanics. Alexandre Sergeyevitch Davydov. Translated from the Russian (Moscow, 1963) by Irene Verona Schensted. NEO Press, Ann Arbor, Mich., 1966. 677 pp. Illus. Paper, $6.

Race Against Time. Twenty-Third Christmas Holiday lectures and discussions arranged by the Council for Education in World Citizenship. Terence Lawson, Ed. Pergamon, New York, 1966. 103 pp. Paper, $2.50.

Review of Child Development Research. vol. 2. Lois Wladis Hoffman and Martin L. Hoffman, Eds. Russell Sage Foundation, New York, 1966. 610 pp. $8. Eleven papers.

Ribonucleic Acid—Structure and Function. Proceedings of the Second Meeting of the Federation of European Bichemical Societies (Vienna), April 1965. H. Tuppy, Ed. Pergamon, New York, 1966. 156 pp. Illus. $5. Ten papers.