SCIENCE

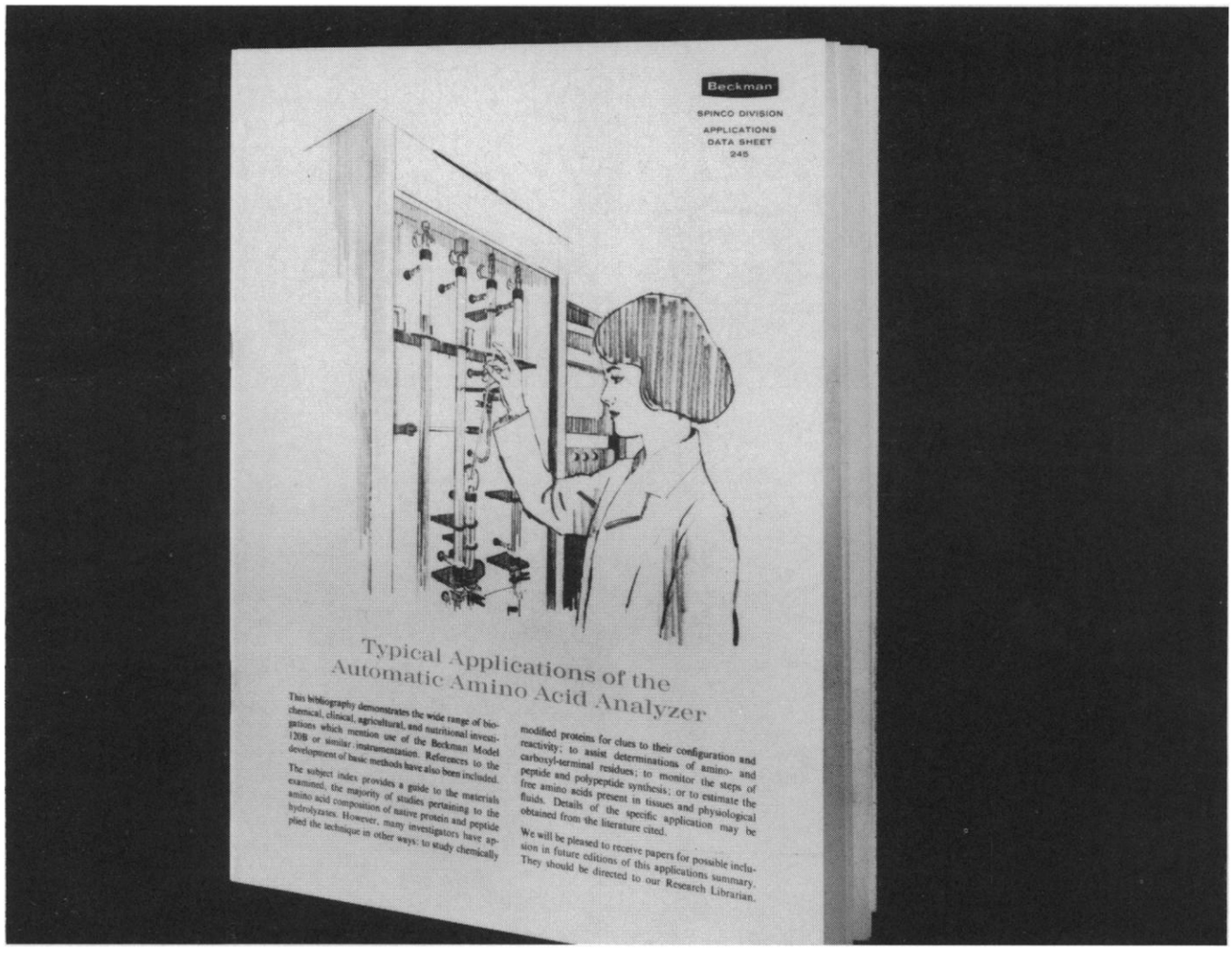
19 February 1965

Vol. 147, No. 3660

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

CONCRETIONS

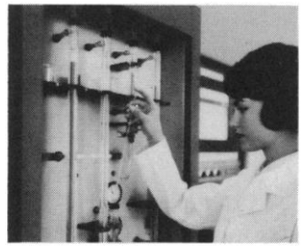
Proceedings Issue



600 ways to use an amino acid analyzer

Here is an extensive bibliography of amino acid investigations in the fields of biochemistry, food chemistry, and clinical medicine. Covering the literature from the original work by Moore, Stein, and Spackman, this is the most complete literature summary ever made on automatic amino acid analysis. References are arranged both by subject and by author to aid you in finding articles of interest.

Our Research Librarian has conscientiously included all the significant references in the over 100 journals she abstracts; nevertheless, don't be surprised when you turn to the original articles to find that our Model 120 Amino Acid Analyzer is the instrument used in most investigations. It's a fact of life.



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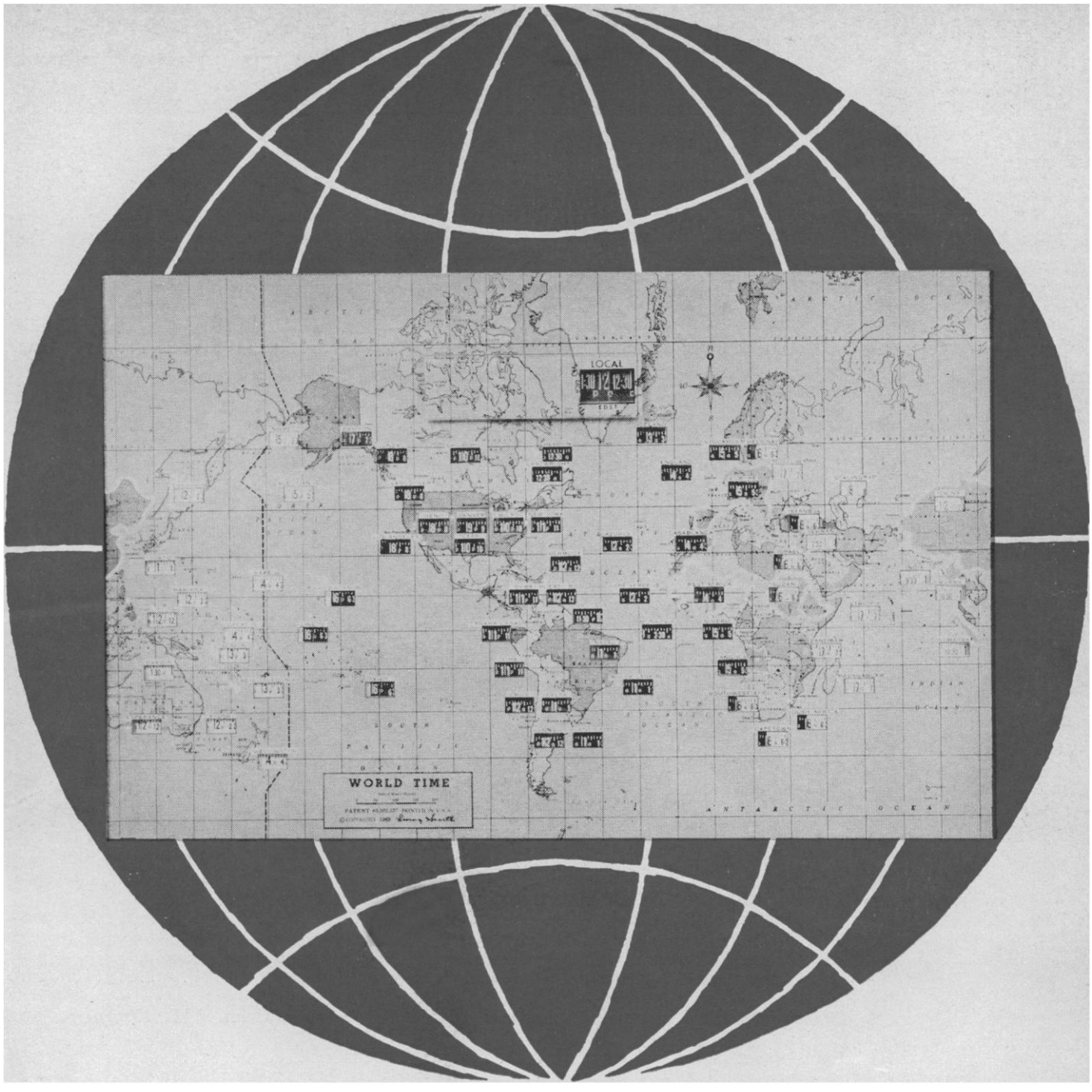

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SCIENCE

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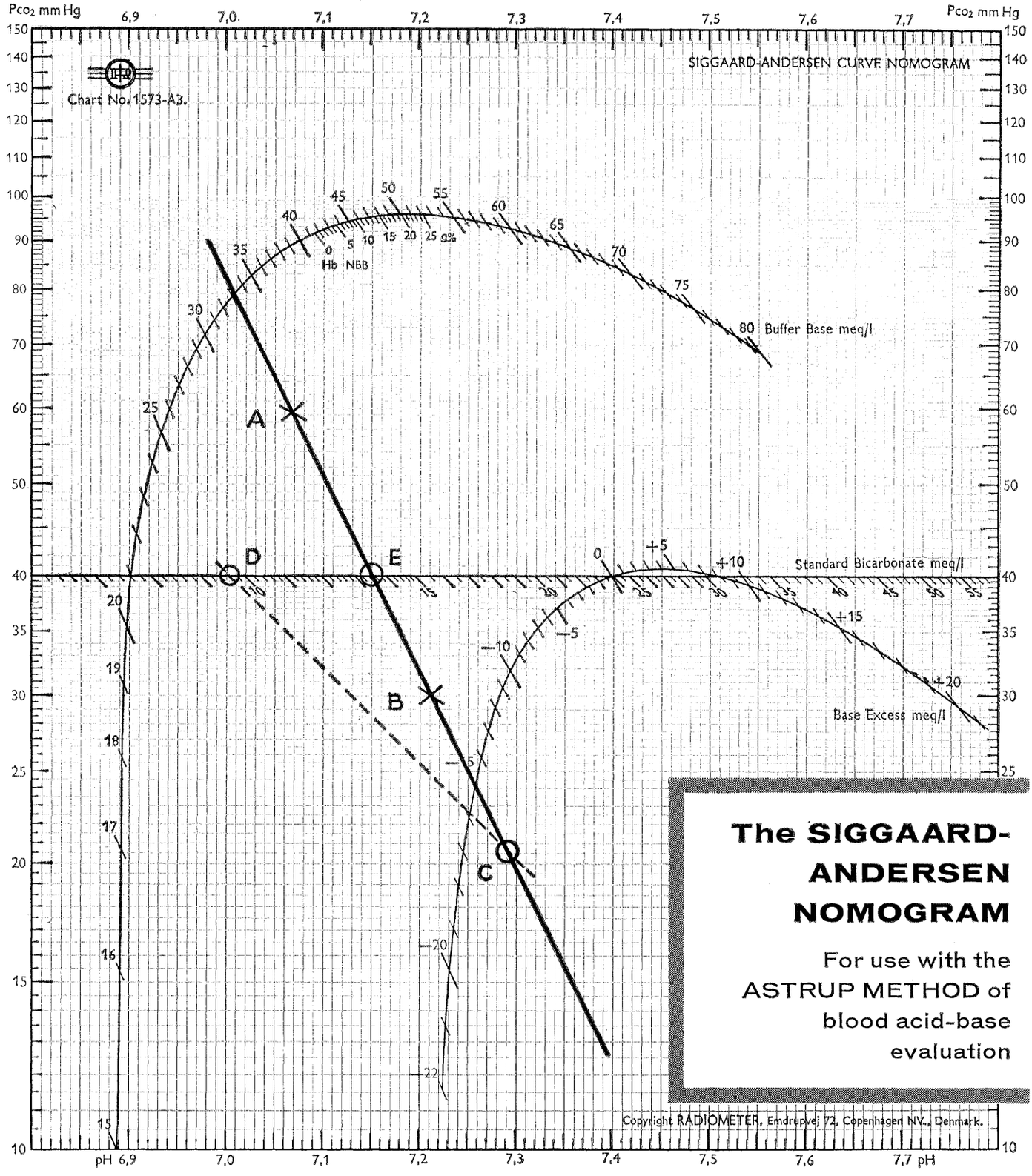
The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding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

COVER

Concretions on the rim of the Kharga Oasis depression in the western desert of Egypt were formed by ground water in an Eocene limestone. They remained after the crumbling rock in which they had been embedded had weathered away. Their surfaces are deeply etched by sandblast. See book review of *The Earth Beneath Us*, page 852. [Tad Nichols, Western Ways Features]



The SIGGAARD-ANDERSEN NOMOGRAM

For use with the ASTRUP METHOD of blood acid-base evaluation

Patient's name: John. W. Smith		Barometric pressure	764 mm Hg	READINGS				RESULTS	
		CO_2 percentage	Cylinder No 1: 8.25 %	Before equilibration	Actual pH: 7.293			Actual Pco_2	20.5 mm Hg
Dept: MB.	Sample No.: 4		Cylinder No 2: 4.20 %					Base Excess	−15 meq/l blood
Date: 28/10/63		CO_2 partial pressure	Cylinder No 1: 58.9 mm Hg	After equilibration	high Pco_2	pH: 7.066		Buffer Base	33 meq/l blood
Hour of Sampling: 8.00 A.M			Cylinder No 2: 30 mm Hg		low Pco_2	pH: 7.212		Standard Bicarb.	13.4 meq/l plasma
Remarks: NONE —		Hemoglobin: 15 g/100 ml		Readings made by: L. N. M.				Actual Bicarb.	9.6 meq/l plasma
		Oxygen Saturation: 100 percent		Signature:				Total CO_2	10.2 meq/l plasma

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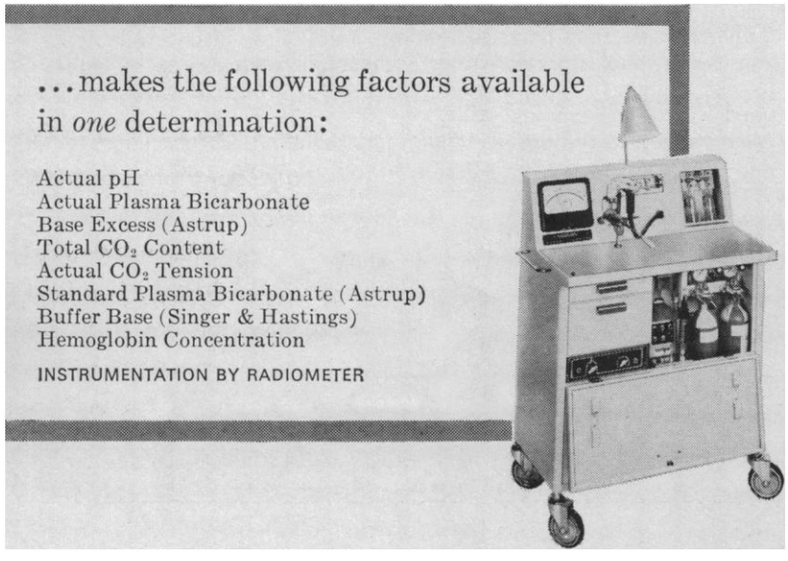
Illustrated is a typical determination. The actual pH is read directly from an anaerobic blood sample. The sample is then equilibrated in a micro-tonometer to two artificial levels of Pco_2 derived from calibrated gas sources—and the resultant pH values measured. On the nomogram these pH values are plotted against their corresponding CO_2 tank tensions, points (A) and (B), and a line drawn between these points. Using the *actual* anaerobic pH value as an entry, the *actual* value of CO_2 tension can be read out from the line just drawn, at point (C).

From the same line the values of Buffer Base, *Standard* Bicarbonate, and Base Excess (the actual net accumulation of fixed acids or bases in the system) are noted from the intersection with their respective scales. *Actual* Bicarbonate Concentration is revealed by drawing a -45° line from point (C) to intersect the bicarbonate scale—and Total CO_2 Content by adding the value of Actual Bicarbonate to Pco_2 x 0.03.

Try it yourself on the nomogram illustrated and note the results obtained. Also note the ease with which one can anticipate new levels of pH should Pco_2 change. Fixed acid changes move the line to the right or left in equal increments on both Base Excess and Buffer Base scales—establishing new relative values of pH and Pco_2.



FREE REFERENCE WALL CHART

If you'd like a glossy finished — full size (17" x 21") copy of this nomogram in a wall hanger form, complete with illustrations of typical acid-base determinations and a host of other useful laboratory data relating to blood chemistry, standard terminology, sampling & storage data, blood value certified buffers etc., just write the factory representative closest to you. You'll find it useful.

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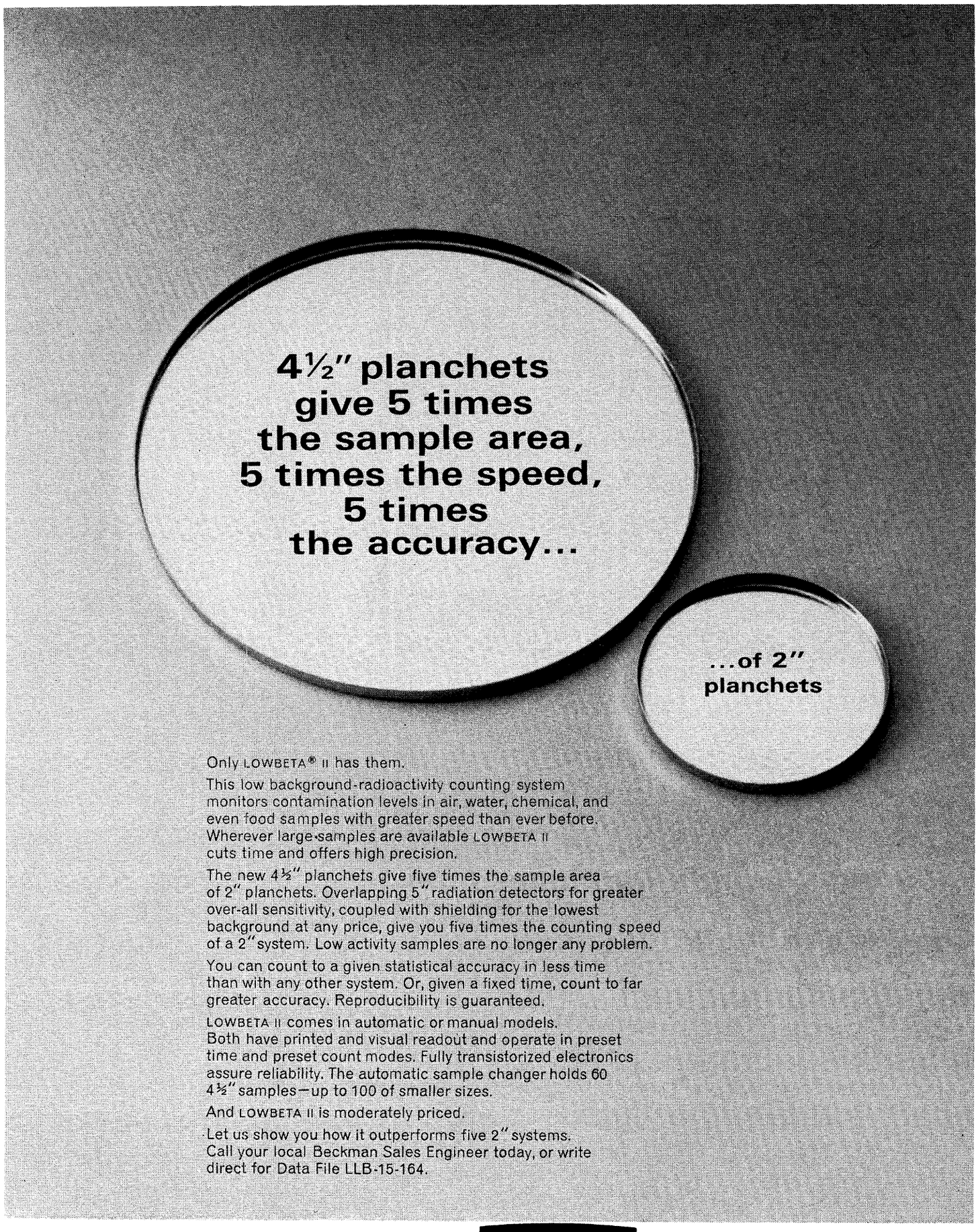

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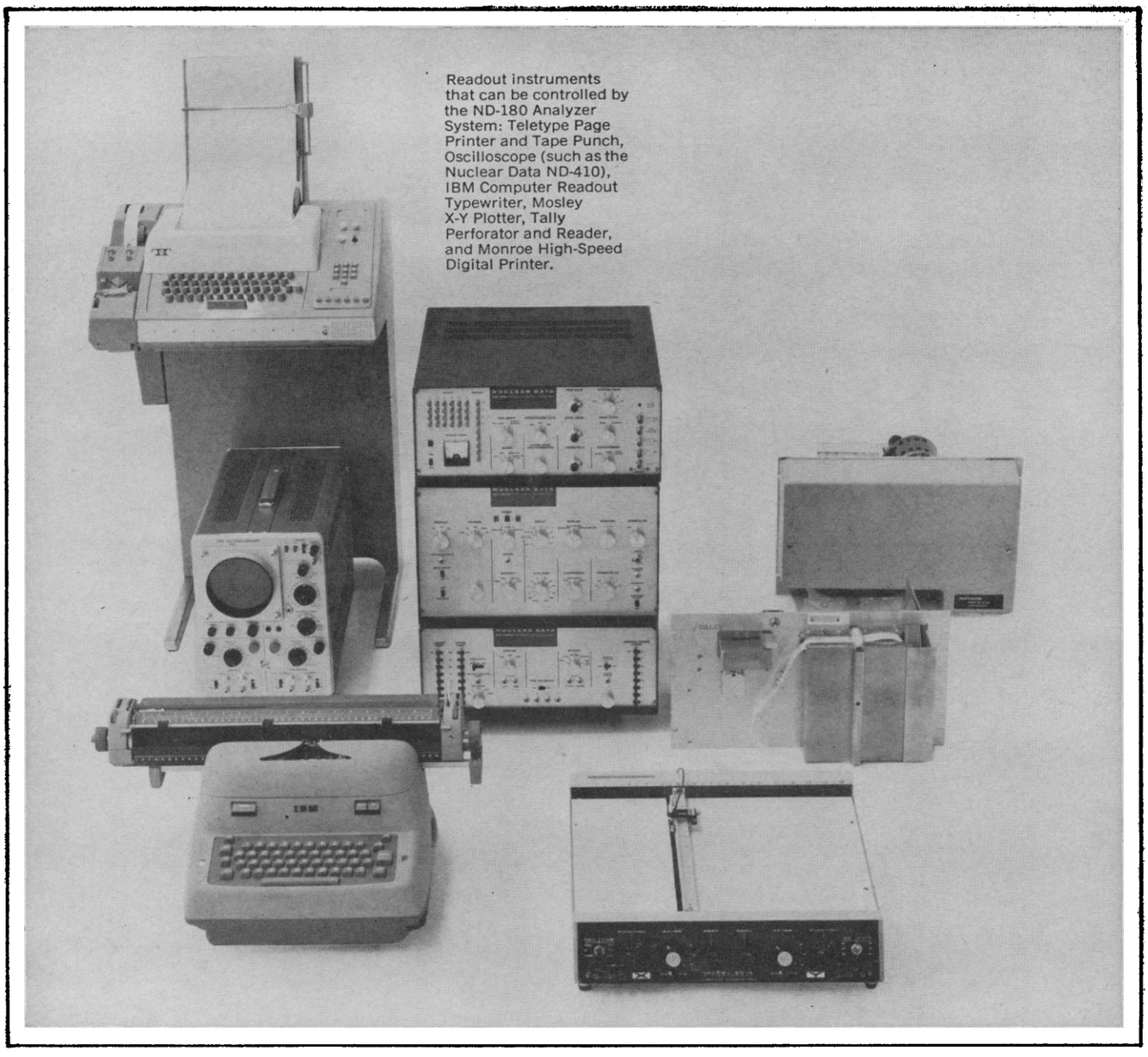

Readout instruments that can be controlled by the ND-180 Analyzer System: Teletype Page Printer and Tape Punch, Oscilloscope (such as the Nuclear Data ND-410), IBM Computer Readout Typewriter, Mosley X-Y Plotter, Tally Perforator and Reader, and Monroe High-Speed Digital Printer.

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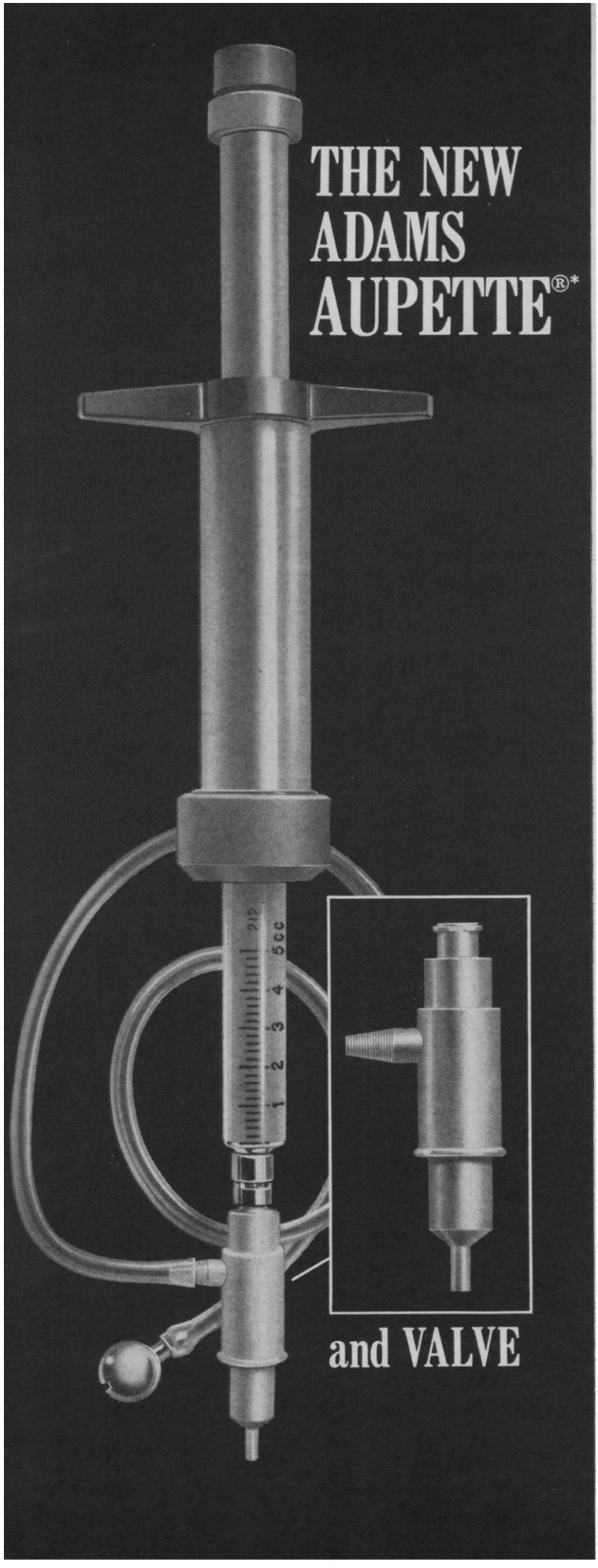

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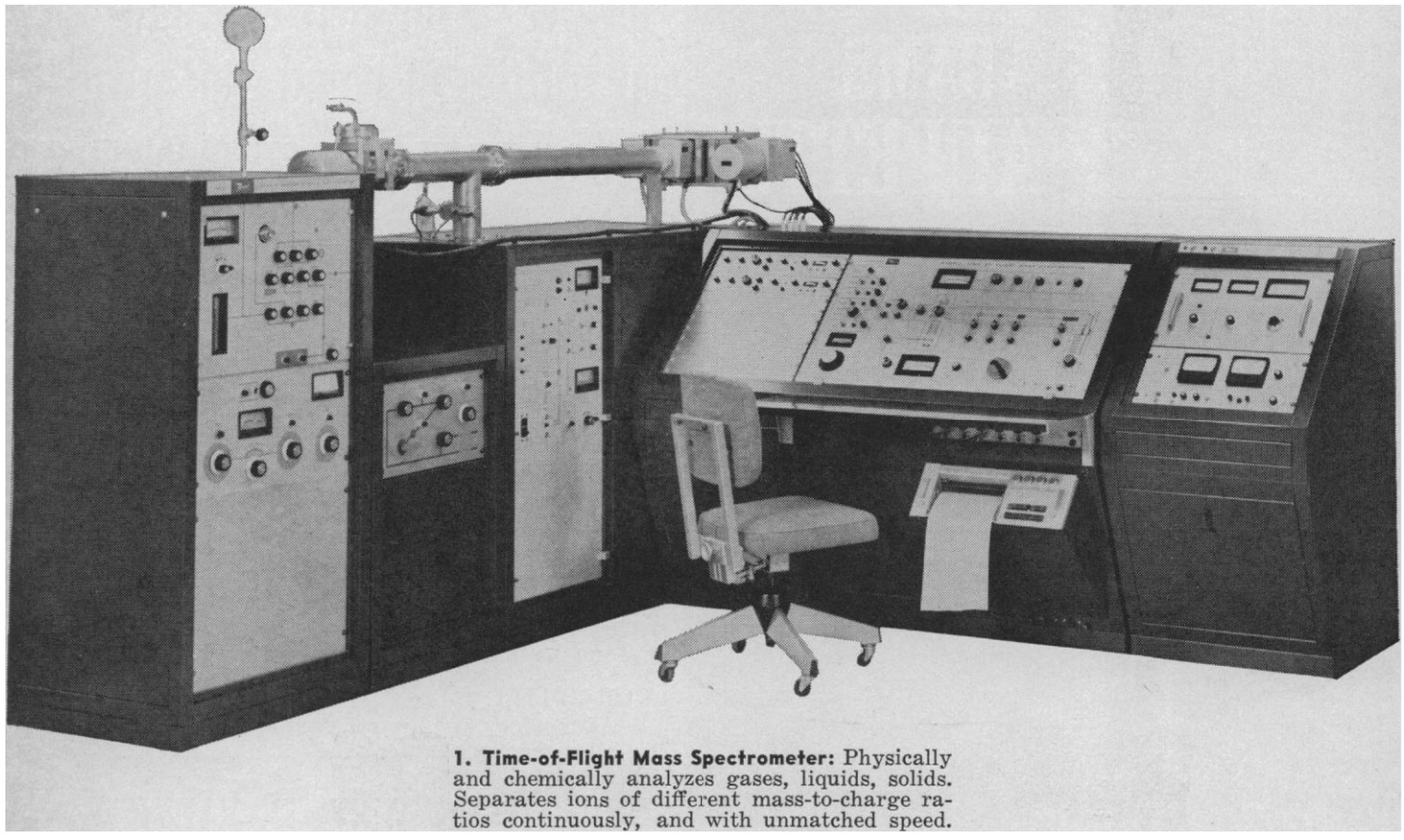

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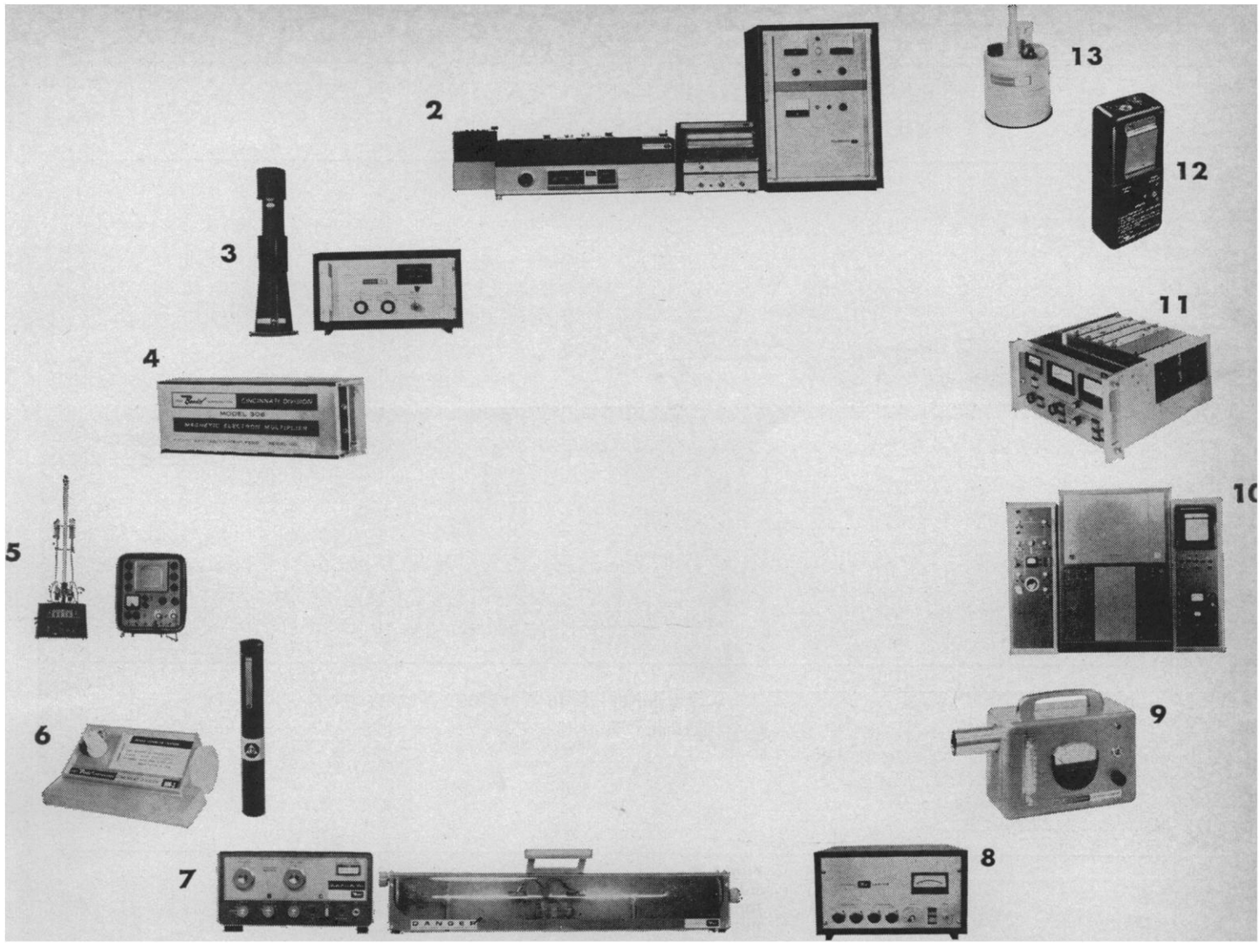

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PROGRAM NO.	PROGRAM TOPIC	PARTICIPATING SOCIETY
1	**Air Pollution Control**	American Chemical Society
2	**Supersonic Air Travel**	American Institute of Aeronautics and Astronautics
3	**Lunar Surface Controversy**	New York Academy of Sciences
4	**Environmental Control**	American Society of Heating, Refrigerating and Air-conditioning Engineers
5	**Observatories in Space**	American Astronomical Society
6	**Seeing Inside Metals**	American Society for Metals
7	**Fiber Optics**	Optical Society of America
8	**Metropolitan Planning and Design**	American Society of Civil Engineers
9	**The Particle Jungle**	American Institute of Physics
10	**Operations Research Techniques**	American Institute of Industrial Engineers
11	**Topology**	Conference Board of the Mathematical Sciences
12	**Traffic Control Techniques**	Institute of Electrical and Electronics Engineers
13	**Conflict Resolution Research**	American Psychological Association
14	**Pursuit of Perfection**	American Society for Quality Control
15	**Cholesterol Fats and Heart Disease**	Federation of American Societies for Experimental Biology
16	**Information for Effective Engineering**	Engineers Joint Council
17	**Communication Among Animals**	American Institute of Biological Sciences
18	**Cryogenics**	American Institute of Chemical Engineers
19	**Man-made Weather Modification**	American Meteorological Society
20	(to be announced)	American Association for the Advancement of Science

PROGRAM SCHEDULE

The "TV Journal" will be seen on most of the nation's educational TV stations on a staggered basis. The series will start on the first group of stations during the week of 28 February, and then on another group of stations during the week of 14 March, and so on. Check your local program guide for day and time of broadcast.

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Wisconsin	Milwaukee

Starts week of 14 March

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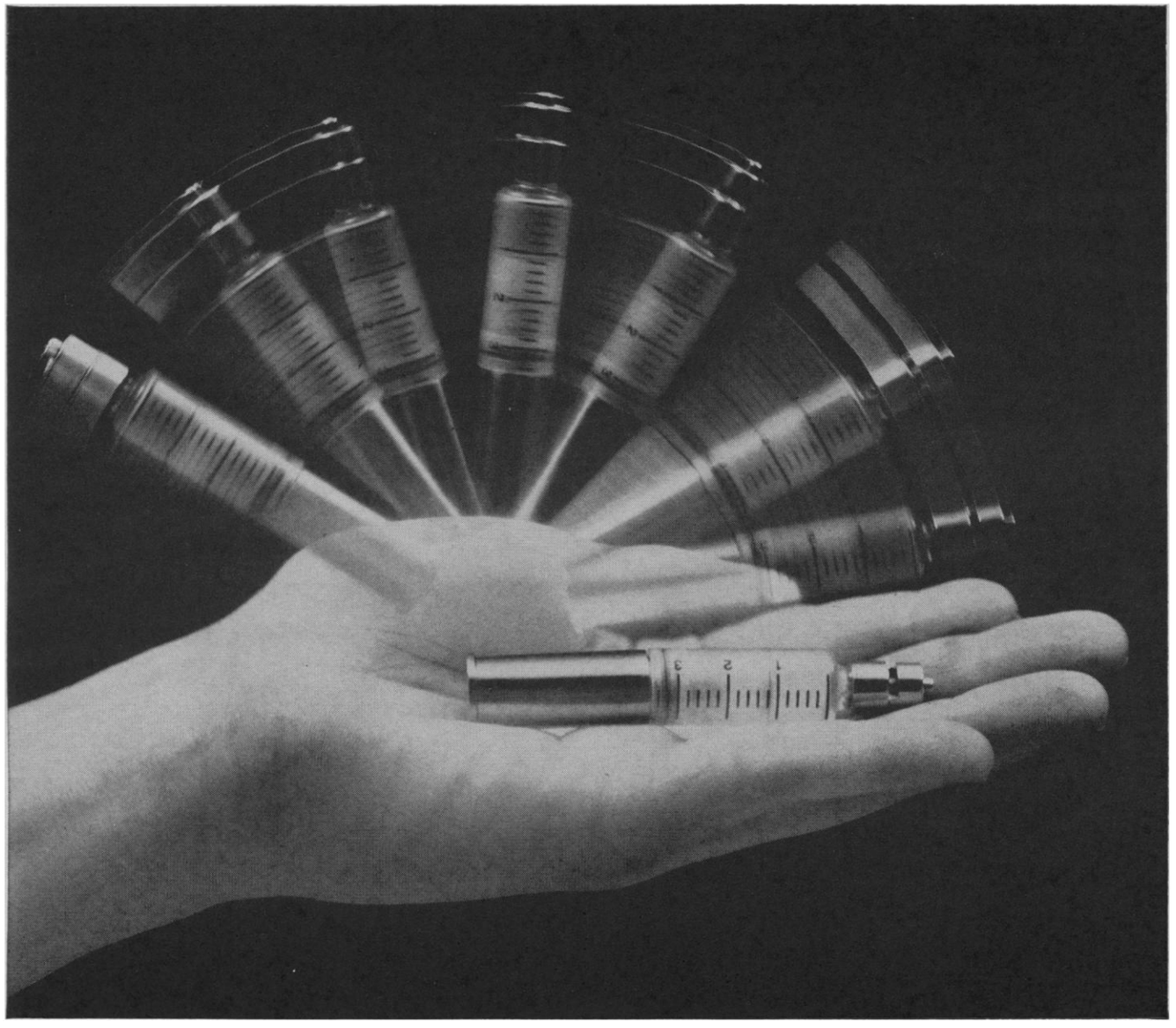

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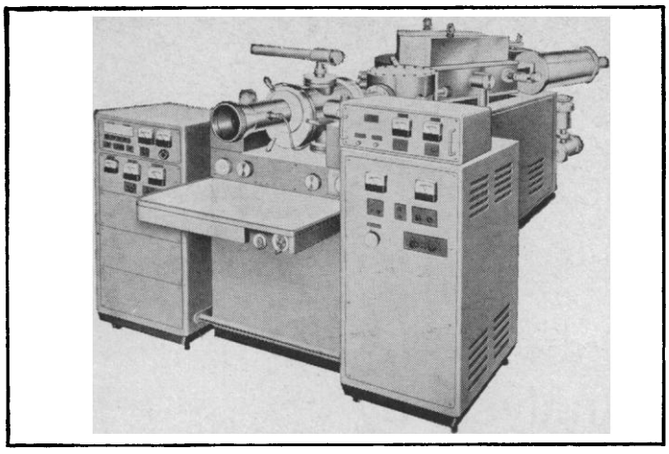

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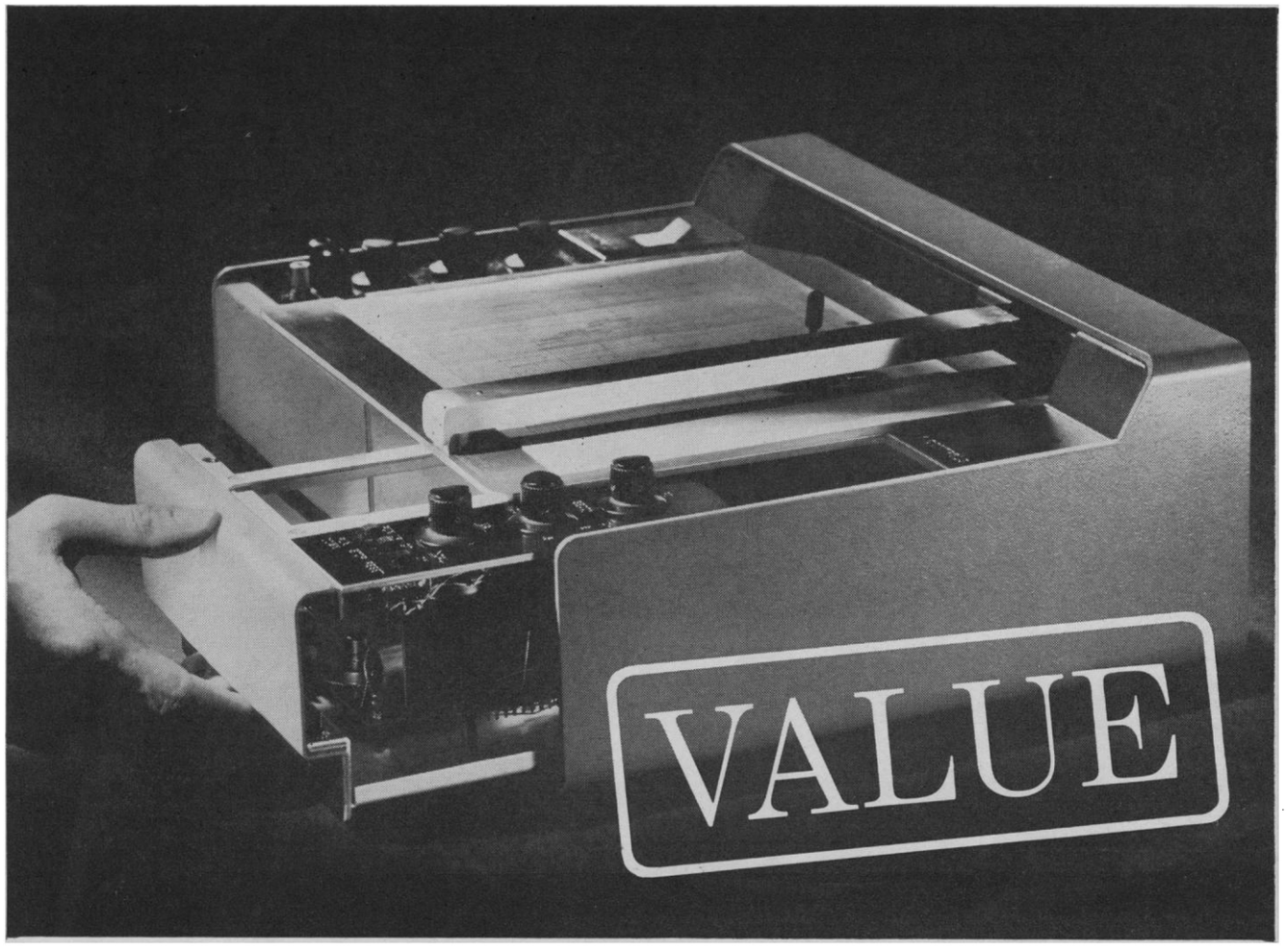

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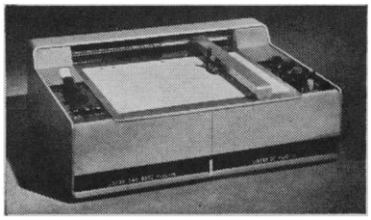
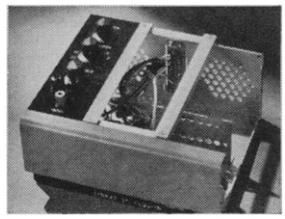
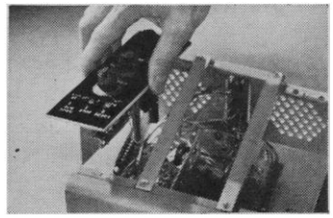
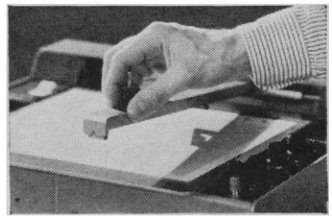





What happened when Rubicon crossed the Mississippi?

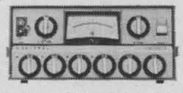
Well, for one thing, the manufacturing of the Rubicon line of Honeywell Laboratory Standards and Test Instruments moved to within 40 miles of the National Bureau of Standards laboratory at Boulder, Colorado. But that was not the main object of moving this important part of Honeywell from Philadelphia to Denver.

Rather, it was to consolidate this division into the scientific instruments manufacturing facilities where Visicorder oscillographs (and tiny precision galvanometers) are being made, along with advanced laboratory magnetic tape systems and other data acquisition and analysis equipment. We certainly agree with Colorado's claim of having an exceptional climate for this type of manufacturing.

Here, high on a hill overlooking Denver, our metrological engineers, instruments craftsmen, and technicians have been designing, testing, and building several new products in addition to the well-established Rubicon items. Our production line has been nearly doubled in capacity, and appropriate new methods have been employed to make our products ever more precise and reliable.

Some of the old standbys are shown or described here—they are reminders of the fine Rubicon heritage to which we cling. We also want to introduce you to some of our newer products, such as:

Model 852 Guarded Potentiometric Voltmeter. Completely solid-state high-precision DC measurement device for 0 to 1,111.1 volts, with infinite impedance throughout entire range. All six dials of the K-V divider are overranging. Long-term limit of error ±.02% of reading for at least one year. $800.



Compact Portable Test Sets. These combinations of portable potentiometers and the Model 2747 Run Up Unit may be used for thermocouple measurements, emf measurements, calibration checks of millivoltmeters and pyrometers.

Model 2802 Laboratory Potentiometer. A four-dial, single range instrument with simplified standardizing procedure and improved single-window readout. Calibrated accuracy ±.0010% of reading +0.1 microvolt. Guaranteed limit of error is ±.003% of reading +0.1 microvolt. Completely self-checking.

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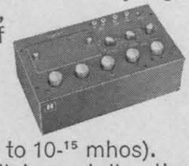

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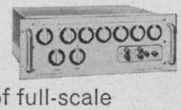

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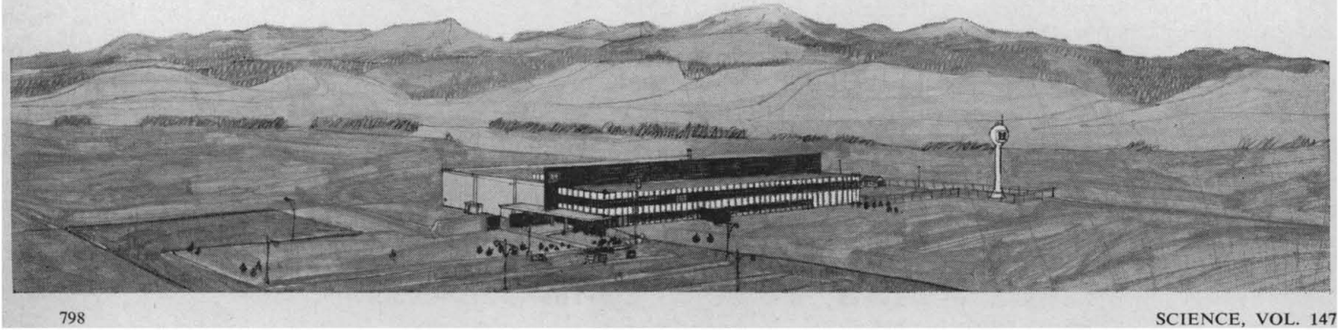

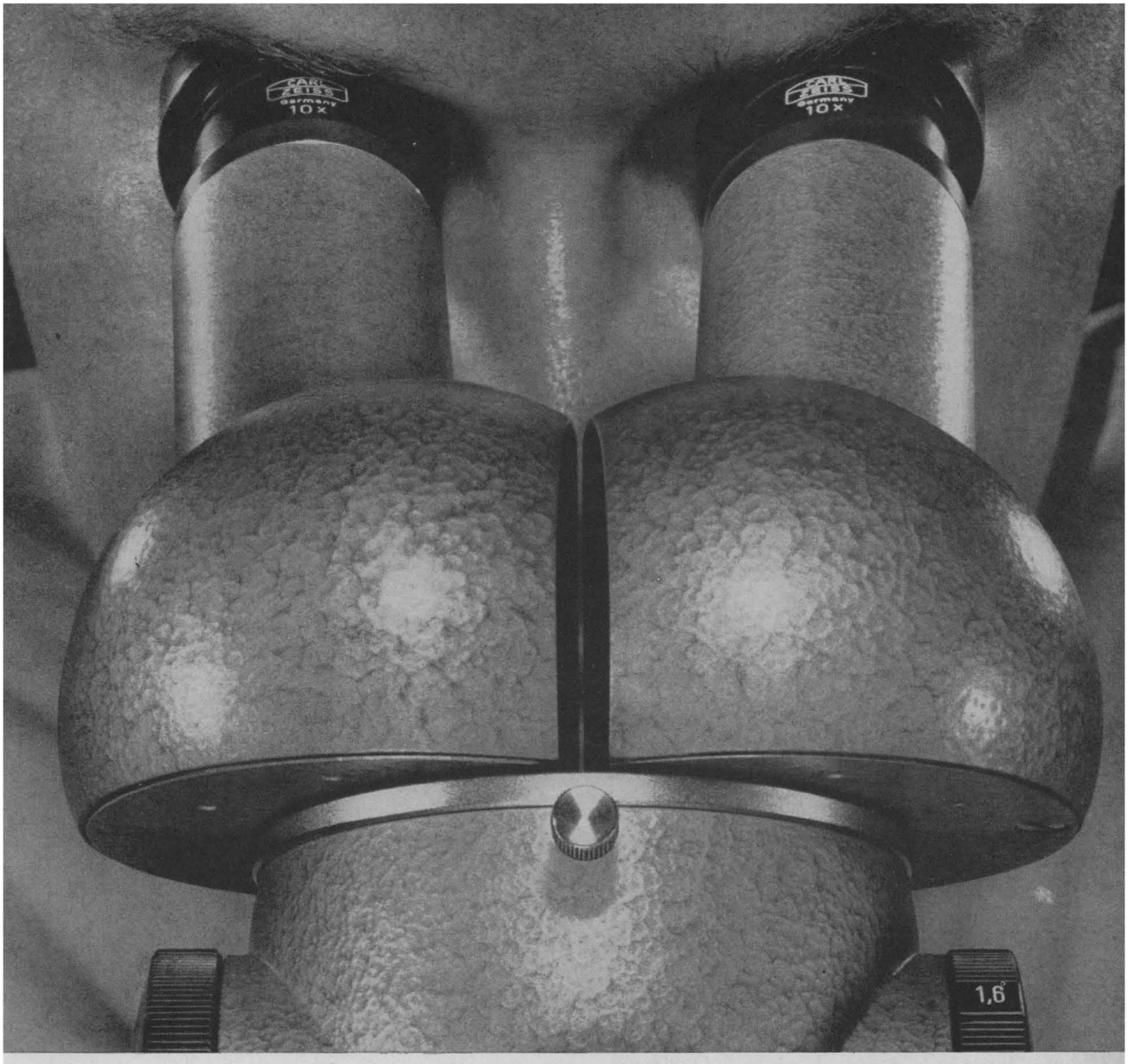

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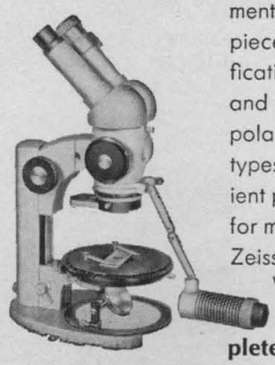

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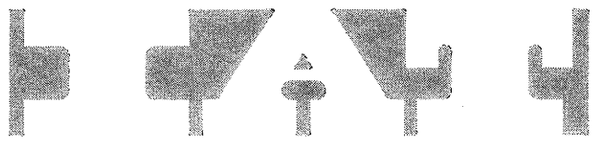

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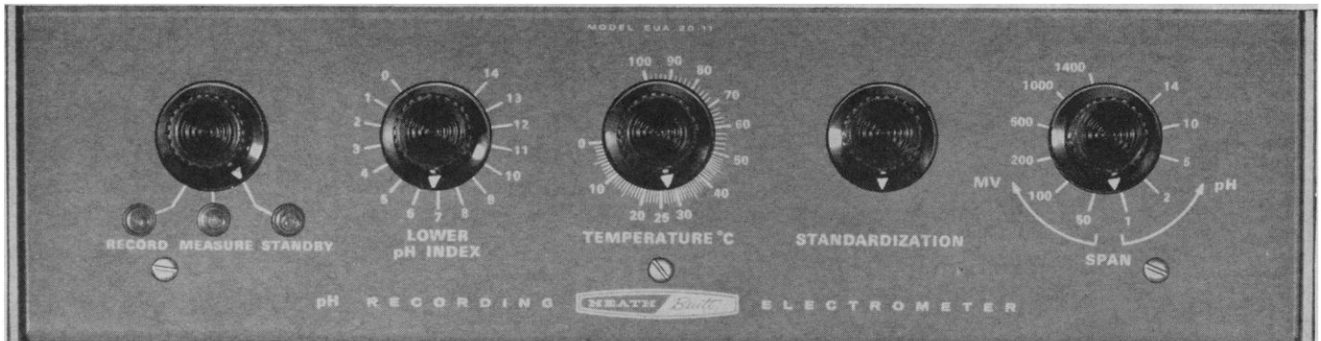

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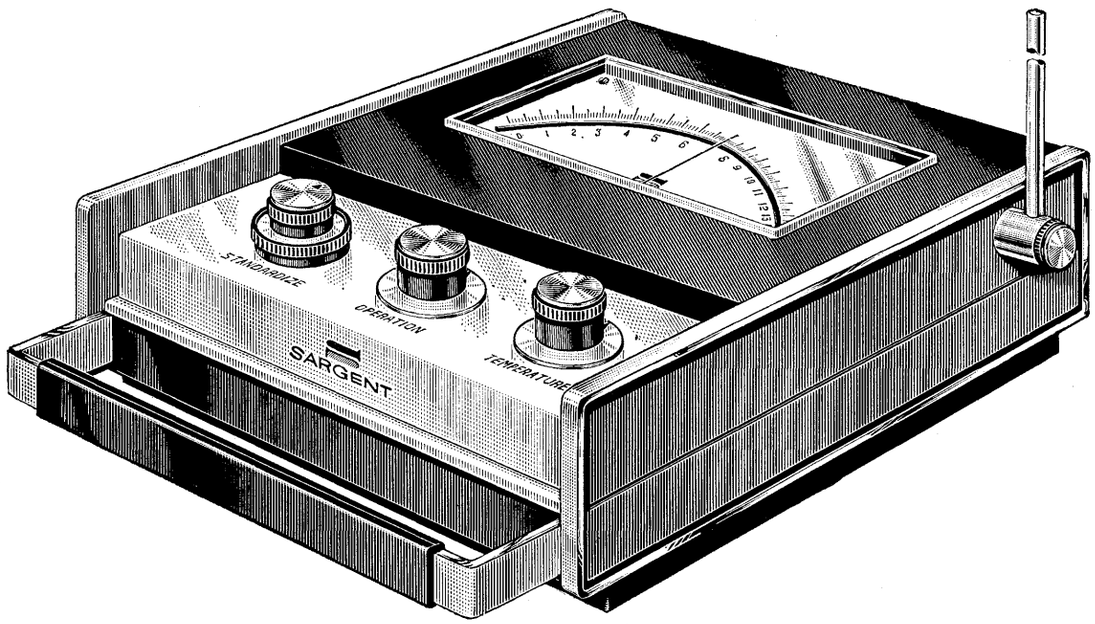

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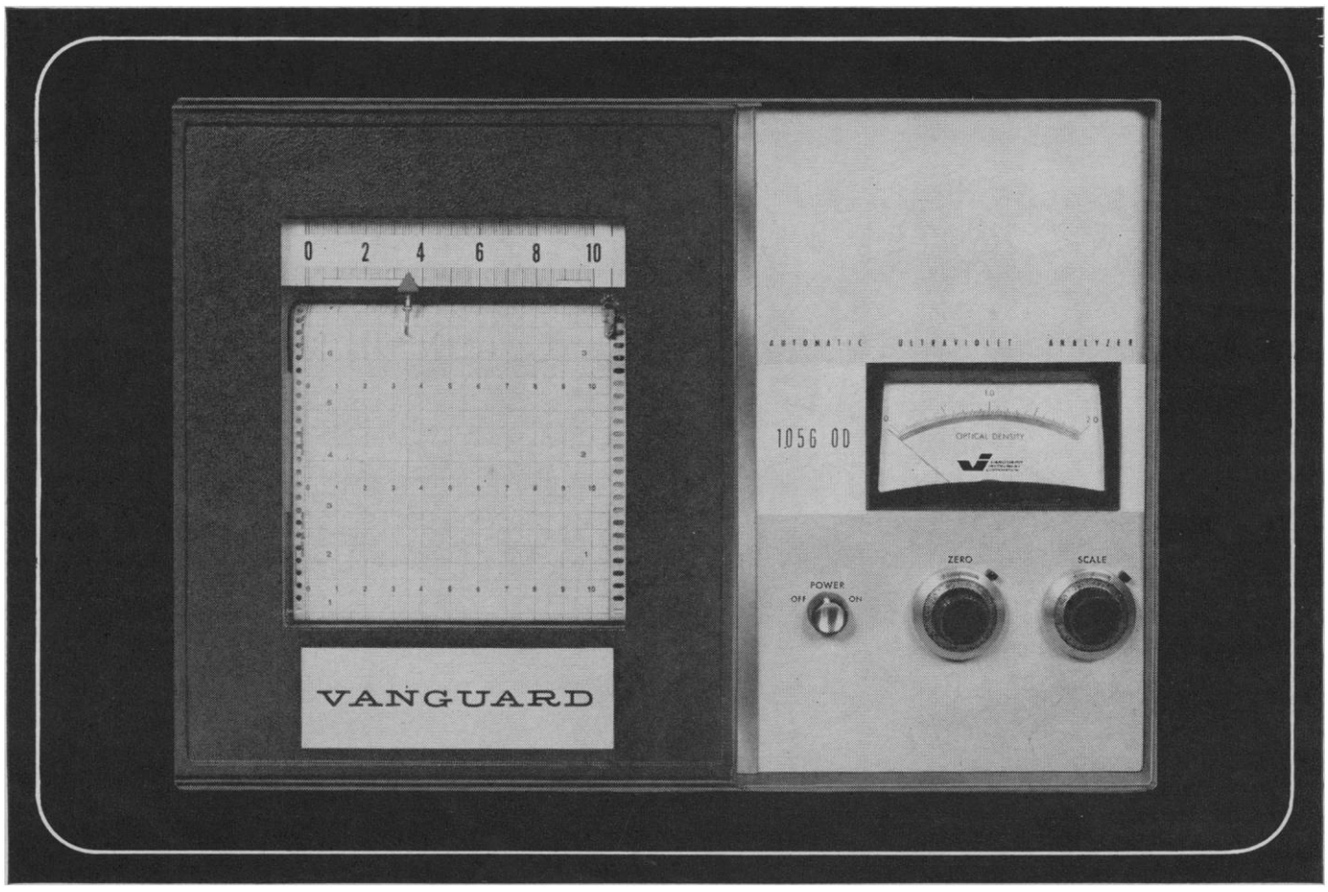

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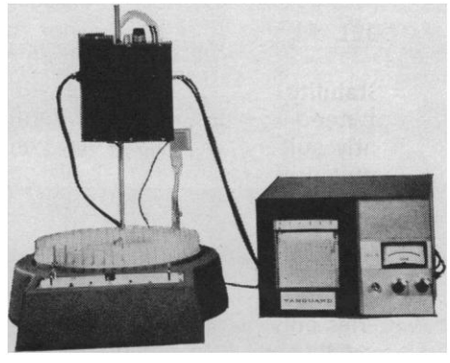

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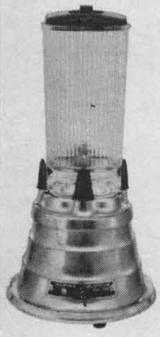

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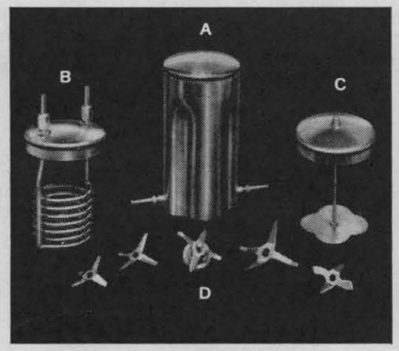

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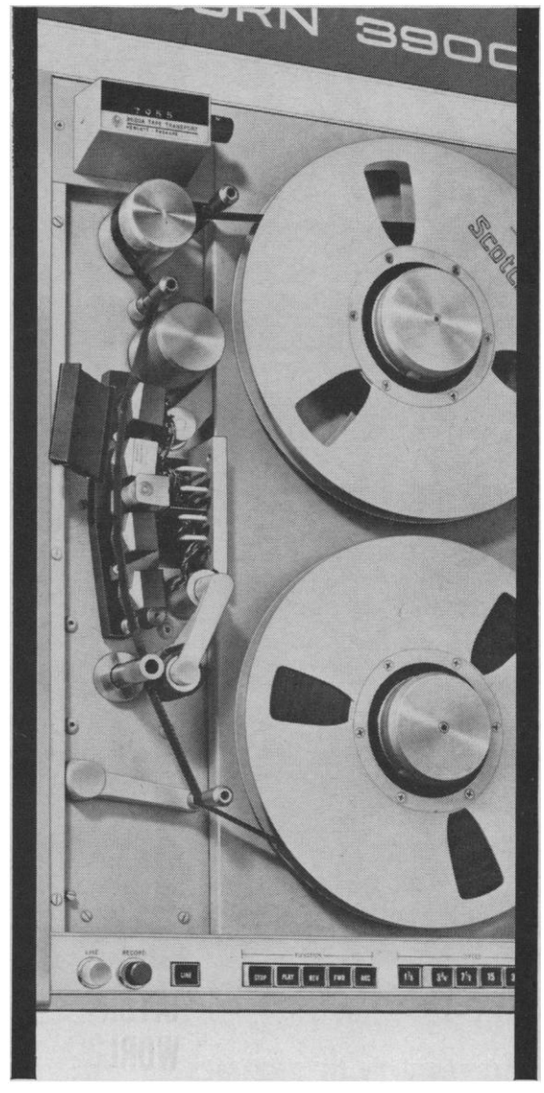

For cardiovascular and neurophysiological studies, OR monitoring, catheterization labs and many other medical applications, the new Sanborn 3900-Series tape systems with Hewlett-Packard transports provide true *instrumentation* performance with IRIG compatibility, low flutter, high signal-to-noise ratio, reduced interchannel crosstalk and greater day-to-day operating dependability—*at prices as low as $8620 for a complete 7-channel system.* With them you can record up to 8½ hours of data on a single reel of tape . . . play back the data graphically on an oscillograph or scope, or process it by computer . . . expand or compress the time scale by a 32:1 ratio, for detailed analysis or scanning large amounts of data . . . repetitively play back the data on endless tape loops as teaching or study aids. Here are the primary features of these modern, economical systems which can valuably extend the scope of your facilities and increase the usefulness of present biomedical data measuring instruments:

- **7 or 14 channels, plus edge track for voice commentary**
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- **bandwidths (at 60 ips): FM, 0-10 KC; Direct, 100-100,000 cps**
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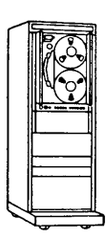
- **adjustable input and output levels, single-ended or optional push-pull inputs, and wide variety of Sanborn coupling and readout devices increases tape system compatibility with existing laboratory instruments**
- **worldwide service from Sanborn/Hewlett-Packard field offices**



TYPICAL SYSTEM PRICES: 7-channels plus voice channel, FM-recording/reproducing, with filters for two (of the six possible) speeds: $8620; same system, but 14-channel, $12,810 (f.o.b. Waltham, Mass.). Call your Sanborn Branch Office now for full details, or write: Manager, Research Instrument Sales, Sanborn Company Medical Division, Waltham, Mass. 02154

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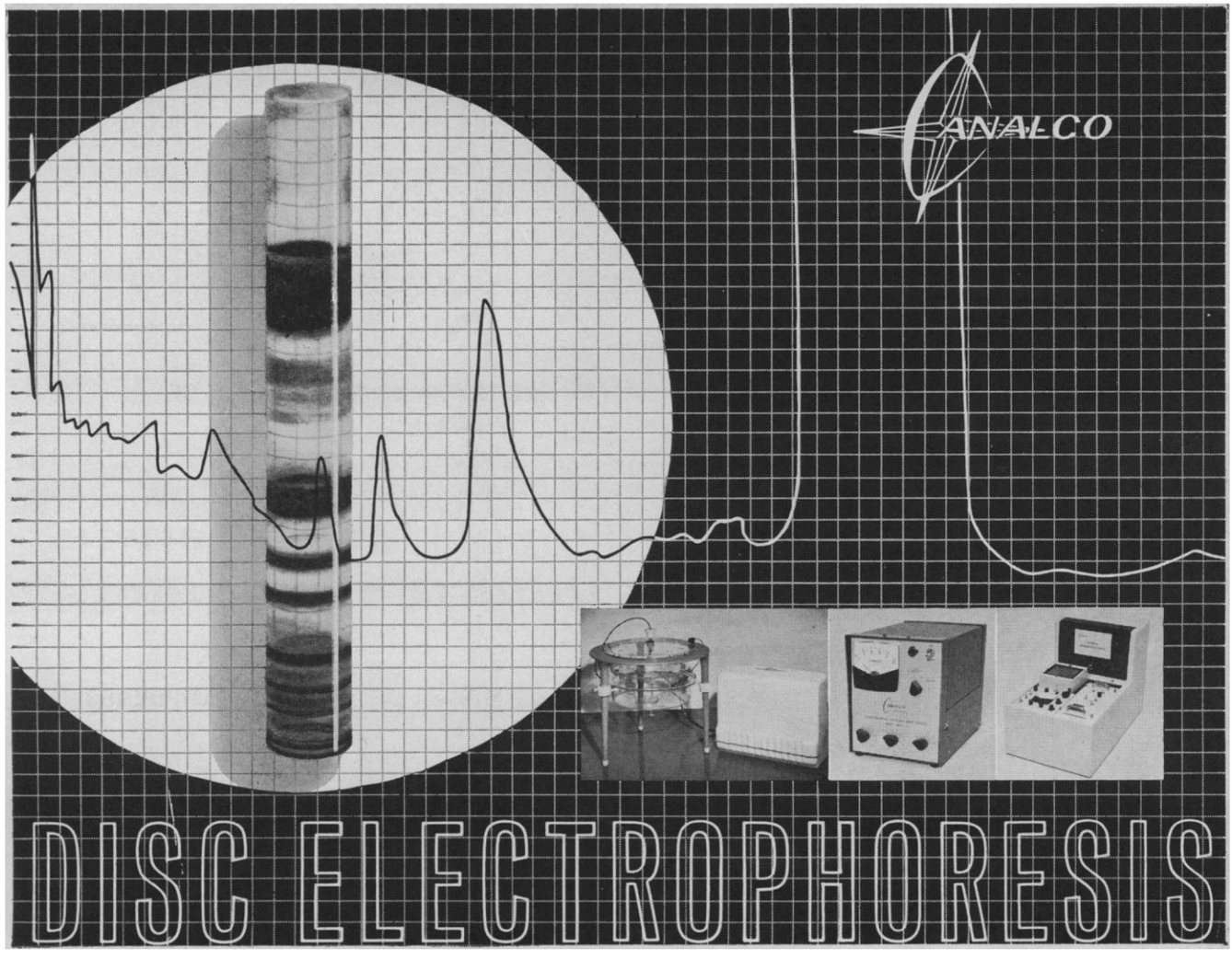

. . . resolves 0.01 ug protein . . . separates 20-30 protein fractions from human serum

One hundred times more sensitive than the starch gel technique, this powerful new method separates large molecular weight substances on 1½-inch long columns of a specially processed gel. More reproducible than either paper or starch, Disc Electrophoresis is also much faster — runs of ½ hour are typical instead of up to 12 hours. And you can actually watch the "front" move.

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

Aloe Scientific is your exclusive laboratory supply dealer for Canalco Disc Electrophoresis Apparatus

Serving the Sciences that Serve Mankind

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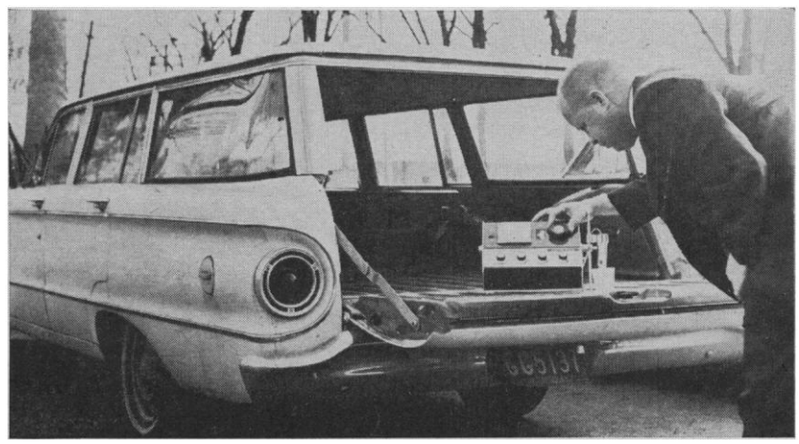
New Coleman Medallion pH Meter serves both research and field requirements



The Coleman Medallion pH Meter is the only high-precision instrument of its type which operates either on a rechargeable battery or on ac power lines.

Operating over the full 0-14 pH range, it provides accuracies of ±0.001 pH at the standardization point and ±0.005 pH over any 3 pH span. This is equal to that of research and expanded-scale instruments that operate solely on batteries *or* on ac power.

Its unique and exclusive feature allows the Medallion to be used as a line-operated laboratory pH meter or to be readily transferred to battery operation for plant or field use. Its ready flexibility from line to battery allows the Medallion to be operated free of stray electrical fields, power line transients, ground loops, and other effects common to laboratory ac power lines.

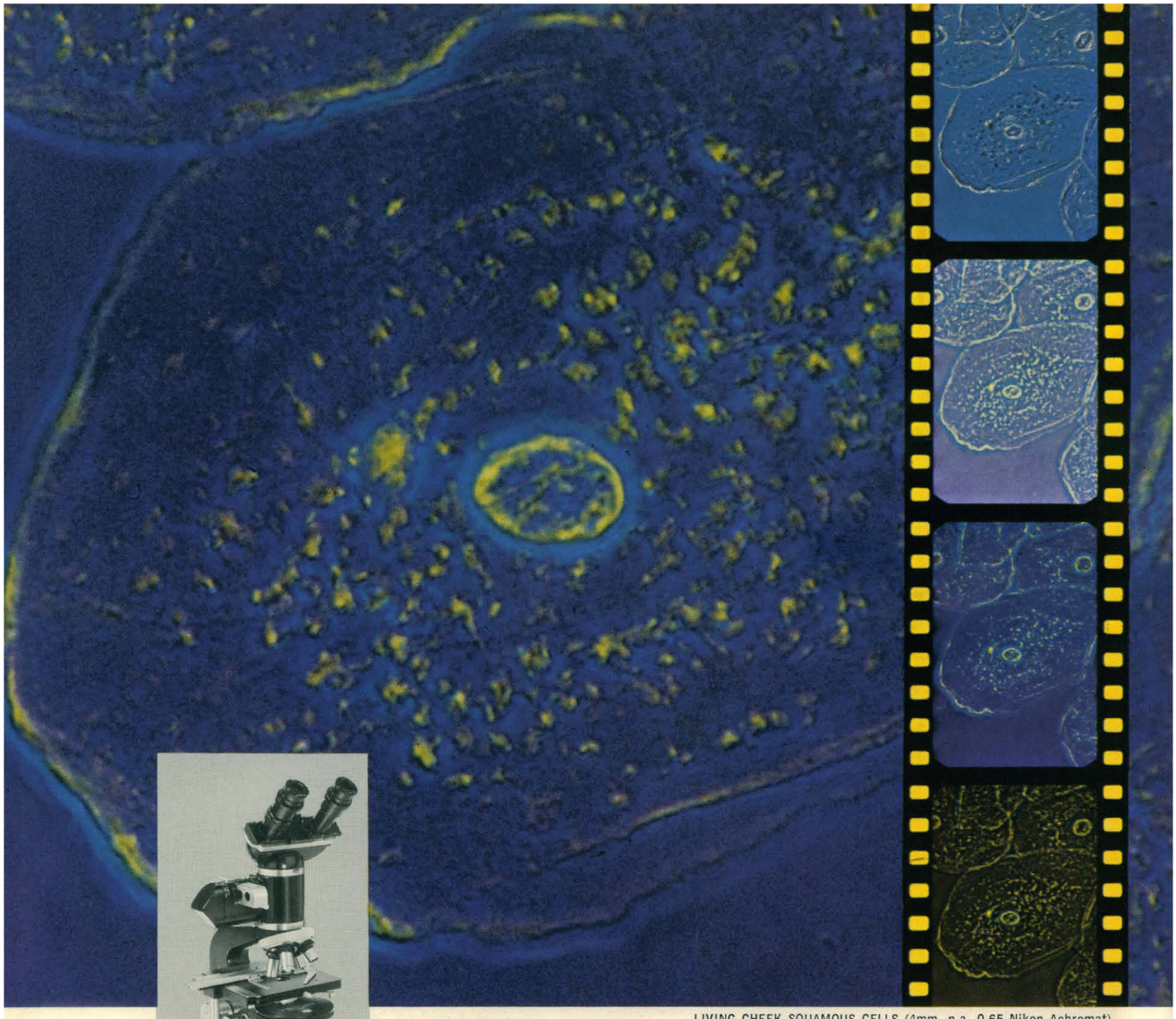
Including its battery, the Medallion weighs only 8.2 lbs. This compactness and inherent portability have been achieved through the use of solid-state circuitry with a single, rechargeable nickel cadmium battery. The battery may be recharged more than 500 times, with each charge affording approximately 20 hours of operation. Under average conditions, the Medallion's battery will last ten years or more; this eliminates the expense and nuisance of frequent battery replacement. Medallion is the only pH meter designed to use the efficient nickel cadmium battery.

The Medallion may be operated in a vertical, horizontal, or tilted position. It is extremely simple to operate—after standardization, only the null-balance control is needed for single or repetitive determinations.

For more information about this research/field, battery/line instrument, write for literature or ask your laboratory supply dealer for a demonstration.

Ask for Bulletin B-296

COLEMAN INSTRUMENTS CORPORATION COLEMAN **MAYWOOD, ILLINOIS**



LIVING CHEEK SQUAMOUS CELLS (4mm, n.a. 0.65 Nikon Achromat)

a new approach to the microscopic investigation of unstained, transparent specimens

The Nikon Interference-Phase Attachment combines all the advantages of phase-contrast and interference microscopy in a single ingenious device.

Easily attached to a conventional Nikon microscope, it enables unstained, transparent specimen details to be observed as distinct differences in color or monochromatic contrast. By measuring phase differences, it also permits the microscopist to calculate specimen thicknesses to 1/50th wavelength accuracy. The color contrast obtainable and the resulting improvement in perception are truly astonishing.

No special phase optics are required. Conventional bright-field objectives are employed. The Interference-Phase Attachment embodies its own optical system, an analyzer control for varying interference or color, and a polarizer control for varying contrast. The attachment need not be removed for conventional bright-field microscopy.

A special condenser is supplied. It is equipped with variable iris suitable for bright field work, and turret-mounted annular phase-rings. A green filter is furnished for monochromatic contrast, and a heat absorbing filter, for use with live specimens.

The attachment is shown mounted on a Nikon SKe microscope. For details, write to NIKON Instrument Div. of Ehrenreich Photo-Optical Industries, Inc. 623 Stewart Avenue, Garden City, N.Y. 11533. In Canada: Anglophoto Ltd. Instrument Div. Rexdale, Ontario

NIKON INTERFERENCE-PHASE ATTACHMENT

Nikon S-ke

integrated Koehler illumination for exacting applications

As important as optical quality is to microscope performance, no less important is the relationship between the illumination system and image-forming optics. Only by cricitally matching the two, can the ultimate in brightness uniformity and image definition be obtained.

This, essentially, is what the SKe accomplishes. It achieves true Koehler illumination over the entire magnifiication range of the microscope, and with a minimum of adjustments.

In so doing, the SKe fulfills the ideal conditions for photomicrography, and brings equally dramatic advantages to visual investigation. The SKe is especially suited for phase-contrast microscopy, interference-phase, and other specialized techniques.

The illumination system is housed in the base of the microscope, forming an optically—as well as physically—integrated instrument. A 30-watt flat-filament lamp serves as the light source, for which a transformer is furnished, equipped with voltmeter and continuously variable brightness control.

The SKe is shown here, ready for photomicrography, equipped with Nikon M-35 camera body and Microflex attachment mounted on a sliding-prism trinocular eyepiece tube. For complete details, write:

Nikon Incorporated Instrument Division Garden City, N.Y.11533
Subsidiary of Ehrenreich Photo-Optical Industries, Inc. In Canada: Anglophoto Ltd. Instrument Division, Rexdale, Ontario

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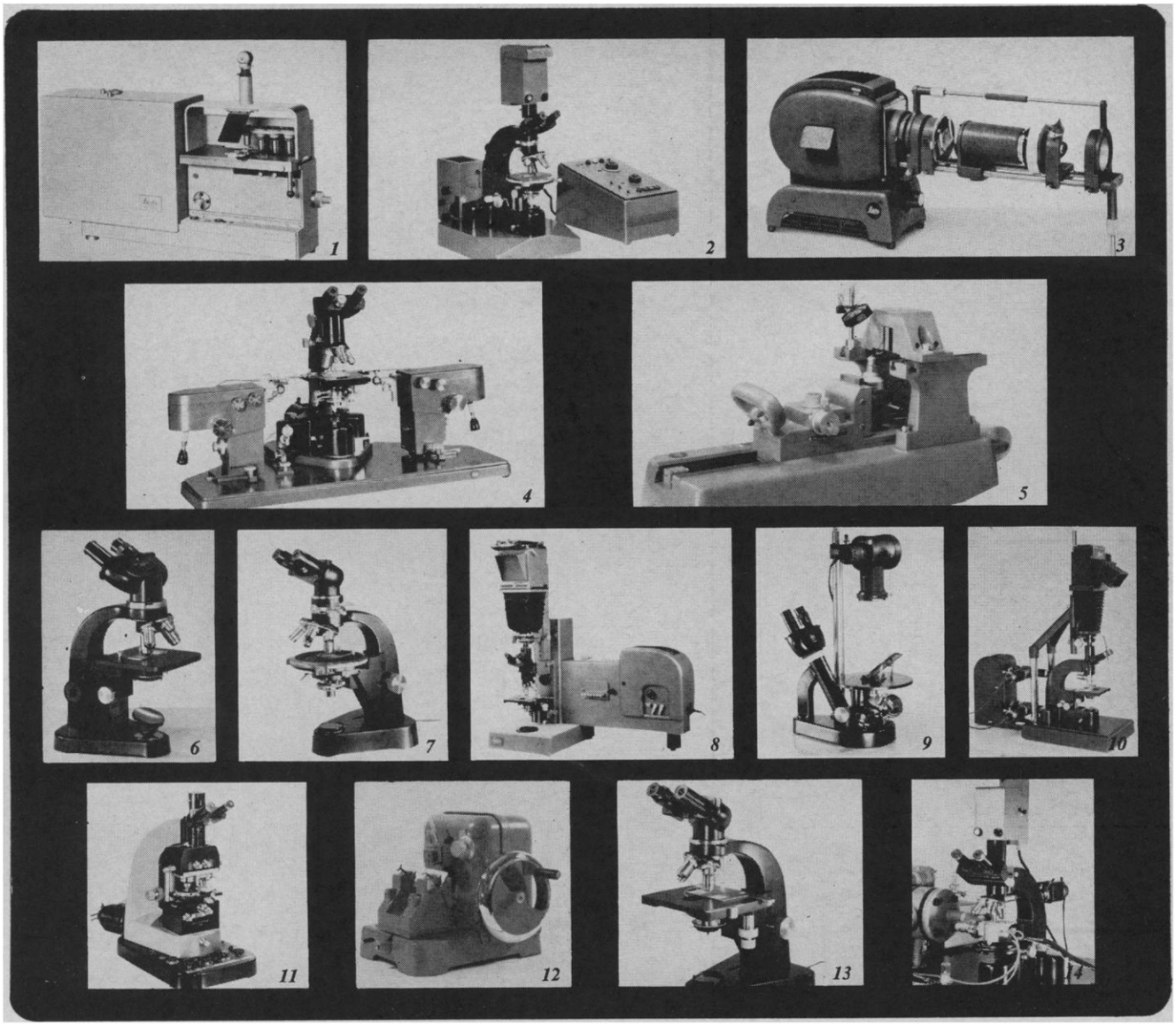

(1) New Microprojector XIc (2) Ortholux Microscope with Orthomat Automatic Micro-camera (3) Prado Microprojector (4) Micromanipulator (5) Base Sledge Microtome (6) SM Microscope (7) Dialux-pol Large Polarizing Microscope (8) Panphot Large Camera Microscope (9) Inverted Microscope (10) Aristophot Universal Photomicrographic and Macrophotographic Camera (11) Interference Microscope (12) Large Minot Rotary Microtome type 1212 (13) Labolux Microscope (14) Ortholux Microscope with Heating Stage

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Every Leitz microscope, from the Universal Research Ortholux to the SM-f, is available equipped for practically limitless applications. Whether you require only bright-field viewing or fluorescent and phase contrast methods, you will find that all Leitz stands can be fitted to handle each technique easily.

Leitz laboratory instrumentation permits research in depth: –A superb micromanipulator with motion reduction to 1:1/800. –Several microtomes are available for the flawless preparation of microsections for applications in electron, phase contrast, research, and routine microscopy. –Heating and cooling stages for high- and low-temperature thermal observations. –The ultimate in microprojection for teaching and conference purposes. –A complete range of photomicrographic cameras—including the exclusive, automatic Orthomat.

These are but a few examples from the complete line of Leitz scientific instruments. Write for complete descriptive information of the individual instrument which you require.

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Breakthrough: an electronic calculator that prints and can be programmed ...Monroe's EPIC 2000™

Never before has there been a desk-top electronic calculator that *prints* its answers. Which means no time wasted and no errors copying answers down each time from an eye-straining, small-sized TV screen.

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But there is now—the EPIC 2000—the first and only desk-top electronic *printing* calculator. For the fastest written answers to virtually any business or scientific application requiring a calculator. The EPIC 2000. By Monroe. For details, call your local Monroe representative. He's listed in your phone book under "Monroe International." And he's awaiting your call *now.*

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The AEI MS10 is deliberately designed to bring first-rate instrumentation for Mass Spectrometry to the academic laboratory at a cost well within its budgetary limitations.

A 180° magnetic deflection type instrument, it provides high sensitivity dial-indicated analyses of **gases or vapors.** For the first time, it offers capability for many analytical ventures hitherto denied the average university laboratory by the high cost of more sophisticated instrumentation.

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is **very compact** (occupies less than 2 sq. ft. of bench space)
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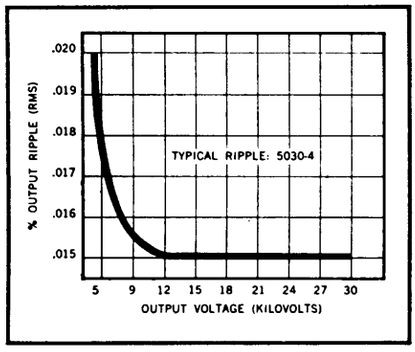
SORENSEN
HIGH VOLTAGE NEWS

VOLUME 1 SOUTH NORWALK, CONN. 1965

PRECISE VOLTAGE REGULATION AND MORE

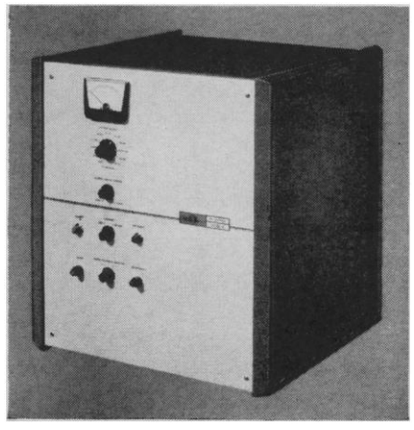
Just a few of the exceptional value features designed into the 5030-4 high-voltage power supply are ±0.005% line regulation and ±0.025% load regulation.

This unit offers continuously variable output voltage between 5 KV and 30 KV, at 4 MA continuous current. Ripple is only 0.015% at full voltage decreasing to 0.020% at low load (see typical curve).



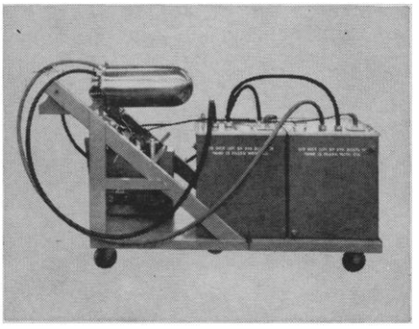
Other features: Easily reversible polarity, a necessity for many research lab and industrial users of high-voltage power supplies; rack mounting or cabinet type for bench operation (optional end bells are available for easy conversion); front panel controls for maximum user convenience.

A modified version of this power supply is in use at satellite tracking stations. The 5030-4 was selected for this application because of the features described here, and because of the unit's exceptional stability, high reliability, and low cost.



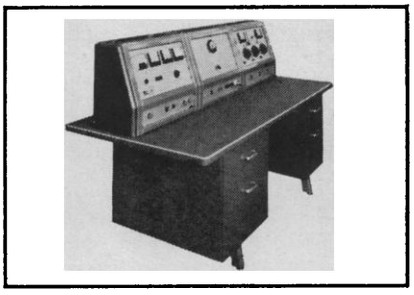
HIGH VOLTAGE SUPPLY POWERS NEUTRON GENERATORS

A relatively inexpensive neutron generator required a power supply that combined low price with performance, safety and compactness. Sorensen was selected to custom-design the supply. The company created a high-voltage unit that provided output voltages of 0 to 155 KV DC at 5 MA, 0 to 50 KV DC at 10 MA, and 0 to 10 KV DC at 20 MA, which could be



operated in series for maximum output voltage of 215 KV DC. This compact unit also included numerous filament transformers.

The power supply was designed to withstand repetitive surges and shorting to ground. Other design features include units that are 25 to 50% smaller than any produced by competitive manufacturers of similar equipment, solid state circuitry and externally accessible spark gap adjustment.



Many safety devices were included in the power supply to protect itself and the operator such as automatic output voltage shorting mechanism, series resistance in the output circuit and spark gap to ground from transformer primaries.

The neutron generator system for which the Sorensen Model 9155-5K power supply was designed is a compact, continuous output system capable of highly versatile research performance. The unit is recommended for investigation by industrial and medical laboratories, nuclear research facilities, colleges and universities and manufacturing quality control facilities in applications such as neutron activation analysis, materials analysis by inelastic scattering, reactor pulsing, neutron radiography, neutron dosimetry, and positive ion acceleration.

Should you have a particular application not described, please consult the Sorensen factory.

STANDARD SAFETY AND CONVENIENCE FEATURES

Sustained or short circuit currents above dangerous values are inherent in the performance requirements of many high-voltage power supplies. Aware of this potential danger, Sorensen includes maximum safety precautions as standard safety features in its designs.

Each class of power supply, considered in terms of output voltage and current, includes convenience features as well as these safety features. Safety features can never be compromised, whereas convenience features, in the interest of economy, frequently are. In the case of special power supplies, the choice lies with the purchaser.

Some of the standard features employed on Sorensen power supplies are: output voltage and current meters, single or multiple range types; provisions for safety interlocks; overload relays; automatic output voltage shorting mechanisms; zero start voltage interlocks, etc.

These safety features are built into all Sorensen high-voltage supplies for maximum personnel protection, as well as for

SEE NEXT PAGE

CONTINUED FROM PRECEDING PAGE

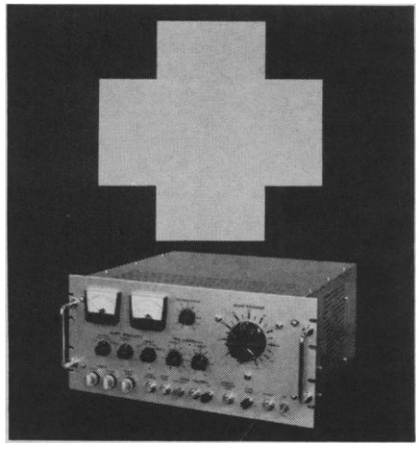
protection of the supply itself. Descriptions of these features follow:

Automatic output shorting mechanism shorts the high voltage to ground through a shorting resistor in case of input power failure, overload, overvoltage, or turn off of the high voltage. This dissipates to ground any energy remaining in the filter capacitors or in the load cable itself. The shorting mechanism is gravity operated, thus insuring fail safe operation.

Series limiting resistor in the output high voltage circuit protects against any major current surges that may be caused by arcing to ground of high voltage, input line surges, component failure or fault in the load.

The zero-start interlock interlocks variable auto-transformer so that it must be set for zero output voltage before high-voltage power can be supplied. A bypass, allowing surge on operation, is provided on units to 60 KV in power levels to 600 watts and to 30 KV in power levels of 3000 watts. This feature may be incorporated in higher voltage units with minor alteration. This bypass feature requires sequential operation with both hands, thus avoiding accidental application.

External interlock terminals are provided for wiring in safety or automatic devices within the customer's system. For example, many high-voltage systems are installed in isolated areas. In these cases, the door to the area would be wired to the supply, thus turning off high voltage whenever the door is opened.



An overcurrent circuit turns off the high voltage whenever DC output current flow exceeds an adjustable preset level. The range is from 20% to 120% of maximum rated current. This feature allows the customer to limit DC output current to meet his specific load requirements.

An overvoltage circuit turns off the high voltage whenever DC output voltage exceeds an adjustable preset level. The range is from 20% to 120% of maximum rated voltage. This feature allows the customer to limit DC output voltage to meet his specific load requirements.

Zener diodes, gas tubes, and spark gaps are installed in all critical areas within the supply to protect components. This includes the primary of the high-voltage transformer, meters and relays. Surges caused by shorts to ground or line transients are thus bypassed without damage to the supply or the load.

Rear access doors are interlocked in both sections of air-insulated units, and on the control section of oil-insulated units. The door interlocks are of the type that can be bypassed by plunger detent setting for servicing, and that reset automatically to the safety operating position the first time the doors are reclosed. Thus, no jumper need be employed across the safety switch during servicing.

Grounded electrostatic shields are wound into all transformers, thus electrostatically shielding primary power from high-voltage secondary power.

Fuses are used widely to protect the main lines, the high-voltage transformer, etc. All fuses are shunted with neon pilot lights to indicate blown fuses. Pilot lights of the neon and incandescent variety are used widely to indicate proper functioning, or malfunctioning, of controls, switches, interlocks, etc.

Ground stud terminals separate from normal line cord grounding are provided to assure thorough cabinet and high-voltage tank grounding to customer's system.

Any questions?

Perhaps we can help. Sorensen's engineering staff includes personnel with experience in the design and development of virtually all types of high-voltage equipment.

If you would like complete information on Sorensen's line of standard high-voltage power supplies, please fill out and mail this publication's reader service card.

If you have a more immediate need, either call or write Jerry Patton, Sorensen, Richards Avenue, South Norwalk, Connecticut (203-838-6571); or, if it is more convenient, contact your local Sorensen representative.

What are some unusual applications of high-voltage power supplies?

Separating the wheat from the chaff (and other matter)... a major producer of breakfast cereals uses Sorensen high-voltage supplies to separate impurities of all types from grain products. High voltage is applied between two separated vertical plates, creating a strong electrostatic field in the horizontal plane. Since impurities have different physical characteristics than the grain, the impurities are deflected into a separate bin as the grain to be cleaned is dropped between the plates. Several such passes remove more than 99% of the impurities.

How deep is the ocean?... An eastern university has used a Sorensen high-voltage supply in underwater surveying of the profile of beds under various harbors. The technique is to discharge a high-voltage capacitor through a spark gap under the surface of the water, and to measure the reflected sound waves. This affords not only the continuous logging of the surface bottom, it also gives an indication of bedrock depth and layering.

Pricking pickles for pleasure and profit... One of the country's largest pickle processors perforates pickles with high voltage, rendering the relatively impervious skin susceptible to rapid absorption of the brine solution, drastically reducing pickling time.

And in the field of electrostatic phenomena... We have power supplies operating in use for: deposition of flocking fibers on textiles; deposition of abrasive granules on cloth and paper; separation of minerals in low-grade ores where conventional methods are not economical; electrostatic paint spraying of automobile parts; separation of impurities from tobacco sweepings so that the tobacco scraps may be processed into homogenized leaf.

High-voltage power supplies continue to be applied more broadly and more imaginatively by an ever-increasing group of users. Subsequent issues of Sorensen High Voltage News will illustrate additional applications, keeping you abreast of the latest developments.

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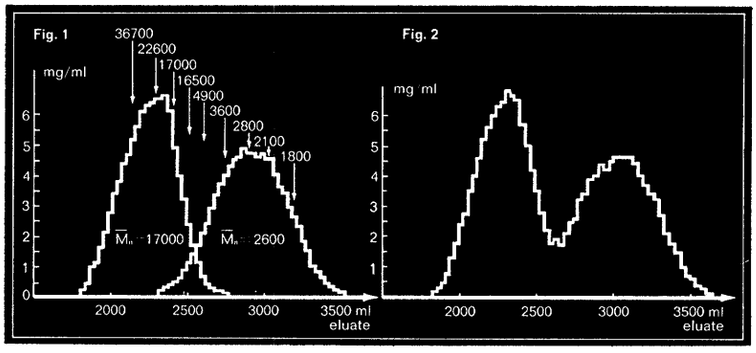
Polymer fractionation with Sephadex®

Gel filtration with Sephadex, which separates molecules according to size and shape, offers a convenient means of fractionating water-soluble polymers.

In many cases a complete separation of the lower members of a homologous series can be effected. With the higher members there is, of course, a smaller relative increase in molecular size between successive members. Efficient fractionation should give at least partial separation of these higher members. In polymer fractionations it is particularly important to use carefully packed, long or recyclic, columns to obtain the necessary high resolution.

Fractionation of a Dextran Mixture



The diagrams show a separation of two fractions with $\bar{M}_n$ 17,000 and 2,600 respectively, chromatographed on two Sephadex G-100 and G-25 columns connected in series.

Figure 1 shows the elution pattern of the separate fractions.
Figure 2 demonstrates the elution pattern of the dextran mixture.

All Sephadex-G Types Now Available in Bead Form

Sephadex Type	Fractionation range (MW)* determined for polysaccharides
G-25 Fine/Coarse	100- 5,000
G-50 Fine/Coarse	500- 10,000
G-75	1,000- 50,000
G-100	5,000-100,000
G-200	5,000-200,000

*For proteins the fractionation range is larger. P. Andrews, Biochem. J. 91:222, (1964).

Sephadex Ion-Exchangers

Sephadex is also available in charged form as DEAE-, CM- and SE-Sephadex. These ion-exchangers have high capacities, low non-specific adsorption, and can be repeatedly regenerated.

Laboratory Columns and Cooling Jackets

Two chromatographic columns (1″x18″ and 1″x40″) especially designed for gel filtration with Sephadex are now available. Cooling jackets for both types are also available.

BLUE DEXTRAN 2000

BLUE DEXTRAN 2000 with a weight average molecular weight of 2,000,000 is completely excluded from all types of Sephadex columns. It is particularly suitable for (1) void volume determinations on beds of all types of Sephadex, (2) checking column packing, and (3) for demonstration purposes.

Sephadex literature or information is available on request. *Address all inquiries to:*

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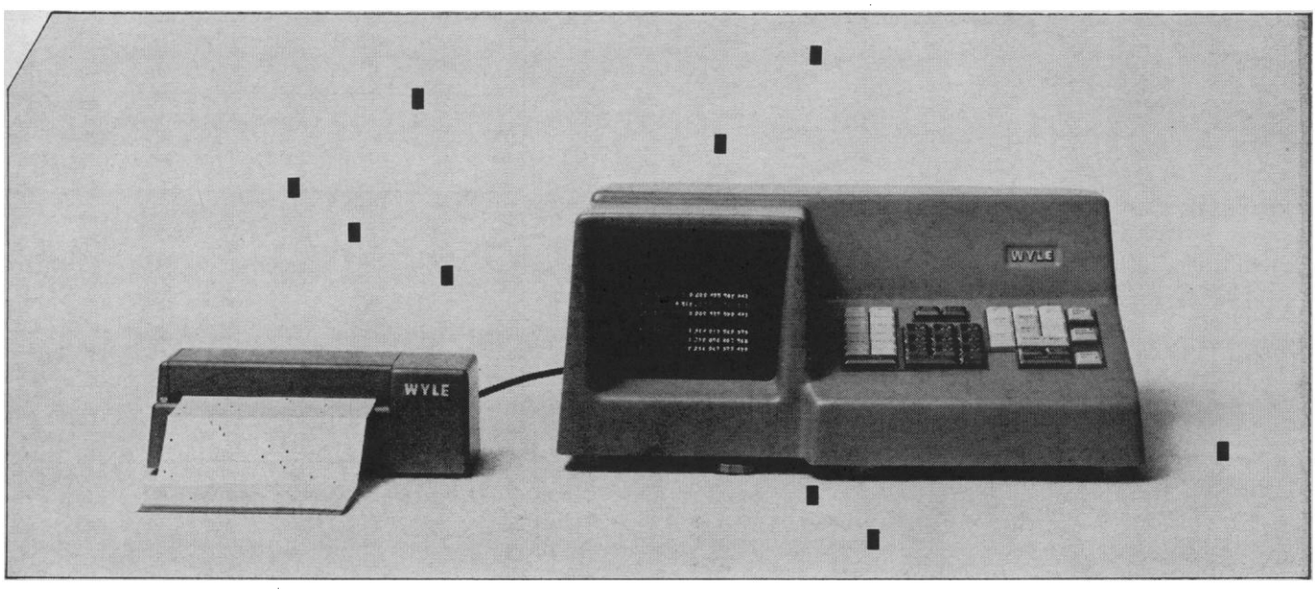

More than a calculator–Almost a computer ...complete with automatic input–$4350

THE WYLE *SCIENTIFIC* IS THE FIRST DESK-TOP COMPUTATIONAL CENTER designed specifically for the solution of complex scientific and engineering problems. Almost as simple to operate as an adding machine, it provides arithmetic capability, efficiency and speed never before available in a calculator.

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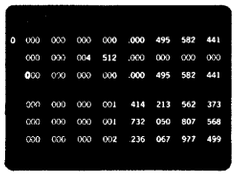
NEVER BEFORE CAPABILITIES LIKE THESE

The contents of all registers are displayed, on an eight-inch cathode ray tube, as indicated in the following diagram.



All parts of a problem are visible. The contents not only of the three active arithmetic registers, but also of the three storage registers are displayed at all times. Numbers entered from the keyboard are seen as they are entered and can be verified before use.

Transcription errors are eliminated through complete versatility of transfer from any register to any other without loss of desired data.

All registers handle 24-digit numbers.

Decimal points are entered the same as digits, using an eleventh key, and all input and answers are correctly aligned with decimal point on the output display.

Automatic square root is provided, as is single entry squaring and multiple subtotals.

The calculator has plug-in compatibility with auxiliary input-output devices including printers, paper tape equipment, and other EDP equipment.

Its operation can be learned in minutes, and it functions with the speed, quiet, and reliability of its solid state design.

These capabilities, combined with automatic entry, for the first time fill the technical and economic gap between calculators and computers.

$4350 complete with automatic input
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Note particularly Series 430. This constant temperature type, while intended for transmission measurements, is available with a slight modification so that the single cell may be used for both transmission and fluorescence. *Special cells can be made to your specifications.* Write for full information.

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Catalog No.	Type	1 mm	2 mm	5 mm	10 mm	40 mm
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S-4820-1X	UG	17.50	17.50	17.50	17.00	22.00
S-4820-2X	VG	—	—	—	9.00	12.00
S-4820-3X	IS	31.00	31.00	31.00	30.00	45.00

Cell with tapered stopper, frame satin-finished, series #500

Catalog No.	Type	1 mm	2 mm	5 mm	10 mm	40 mm
S-4820-5X	US	$46.00	$46.00	$46.00	$45.00	$59.00
S-4820-6X	UG	22.50	22.50	22.50	22.00	30.00
S-4820-7X	IS	40.00	40.00	40.00	39.00	53.00

Code

Material	Type	Color Code	Useful Ranges	Minimum Transmittance	Measured at	Matching Accuracy % Deviation	Measured at**
Far-UV Silica	US	Blue	165-2600 mμ 2850-3600 mμ	Approx. 80%	200 mμ	less than 2%	204 mμ
Near UV Glass	UG	Green	300-1000 mμ	Approx. 75%	320 mμ	less than 1%	322 mμ
Visible Glass	VG	Yellow	360-1000 mμ	Approx. 75%	360 mμ	no matching required	
Infrared Silica*	IS	Red	220-3600 mμ	Approx. 80%	220 mμ	less than 2%	215 mμ

*Standard UV and near IR.

**Such deviations are largest at short wavelengths and decrease as the wavelength increases.

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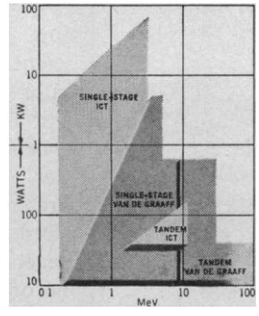
CHARGED PARTICLES

THE ICT CONCEPT:
new high-current machines emerging from HVEC research

Development of higher energy Van de Graaff particle accelerators which retain high beam precision, stability, and homogeneity, remains a continuing contribution by HVEC to "energy-oriented" research.

To provide even greater freedom of experimentation, HVEC is also anticipating the need for the higher beam intensities required in *power*-oriented research projects. Invented by Dr. R. J. Van de Graaff, the new Insulating Core Transformer (ICT) accelerator now provides high beam currents with all the desirable beam characteristics of Van de Graaff machines. As the graph shows, the high power levels available from the ICT accelerator now make possible a new realm of precision experimentation.



The Insulating Core Transformer

The ICT is essentially a three-phase power transformer with multiple secondaries, each of which is insulated from the other. Rectified current from the secondaries is series-connected to achieve total voltage. In the ICT, electrostatic and electromagnetic fields exist in the same space, as contrasted to the conditions in a coventional transformer. The result is a highly efficient dc power source capable of stable operation at elevated potentials *and* power levels.

A number of ICT accelerators and power generation systems are now available.

Single-Stage ICT Accelerators

Two types of single stage ICT accelerators have been developed for research use. The first incorporates an ICT power source coupled to the acceleration assembly through a coaxial cable.

	PROTON ENERGY (KeV)	CURRENT (MAX.) (Analyzed)	TANK HEIGHT Feet	TANK HEIGHT Meters	TANK DIAMETER Feet	TANK DIAMETER Meters
ICT 300	300	15 mA	4'4"	1.32	4	1.2
ICT 500	500	10 mA	5'3"	1.60	4	1.2

The second system utilizes a rigid transmission line to transmit electrical power to the accelerator terminal.

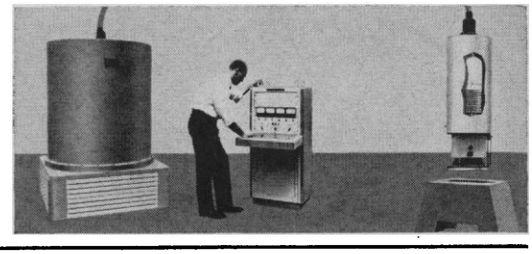
4 MeV ICT	ENERGY (MeV)	CURRENT	DIMENSIONS Length Feet	DIMENSIONS Length Meters
Positive Ions	1.5-4	3 mA	26'6"	8.08
Electron Conversion	1.5-3	10 mA	26'6"	8.08
3 MeV ICT Electrons	1.5-3	20 mA	29'	8.84

8 MeV ICT Tandem Accelerator

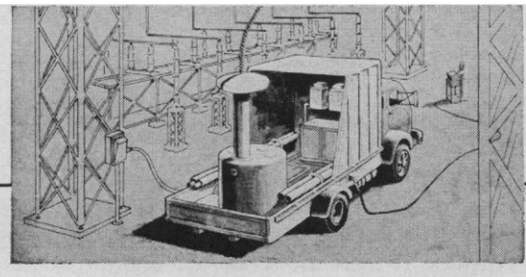
The 8 MeV ICT Tandem provides proton energies continuously variable from 3 to 8 MeV at a maximum guaranteed beam current of 2μA. The ICT power source is capable of providing 12 mA at 4 mv which, in combination with newly developed components emerging from HVEC, will enable the accelerator to keep pace with future research requirements. The 8 MeV Tandem is convertible to single-stage ion or electron operation.

ICT Electron Processing Systems

Developed primarily as high-current sources of electrons for industrial processing applications, these systems allow extreme flexibility of operation. Two models are available: 300 kv at 30 mA maximum beam current and 500 kv at 20 mA maximum beam current.



Series 7 ICT Power Supplies



ICT equipment has crossed many barriers to dc operation at high particle energies and currents. There is no indication that a ceiling exists to further advances of similar importance.

Available with output ratings ranging from 240 kv at 80 mA to 600 kv at 20 mA, these highly stable power sources are suitable for use in high energy beam separator systems, r.f. transmission systems, plasma research and high voltage testing programs.

For detailed information, please write to Technical Sales, High Voltage Engineering Corporation, Burlington, Massachusetts.

HIGH VOLTAGE ENGINEERING

19 February 1965, Volume 147, Number 3660

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.

School Laboratory Supplies

Much money and much effort have gone into the improvement of science teaching in the elementary and secondary grades. One area that now needs special attention is the provision of larger budgets for supplies and equipment, for there is a great gap between the amounts that are available in most schools and the amounts that should be available.

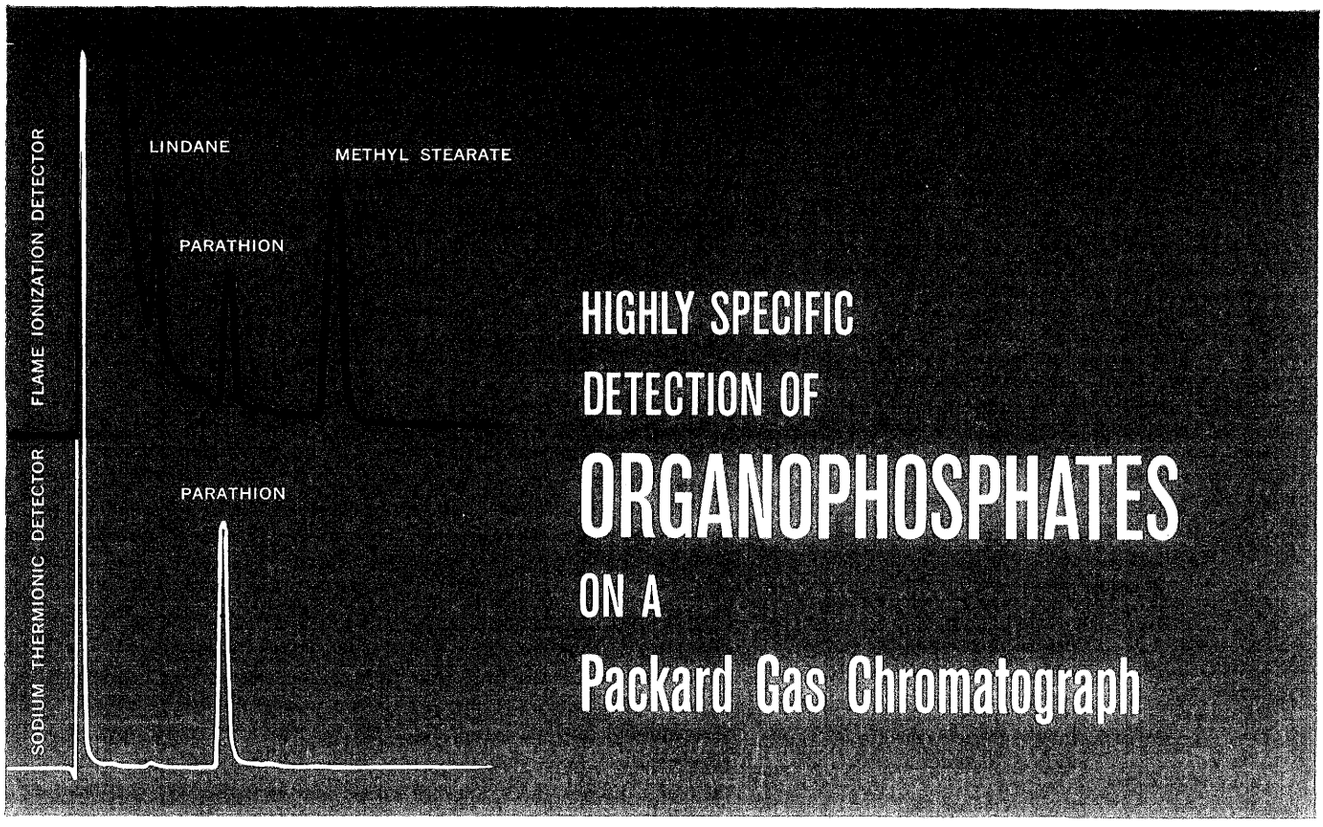
The several groups of scientists and teachers who have been working to improve science teaching have been ingenious in developing inexpensive laboratory equipment and teaching materials. For example, materials for the first four grades of the elementary science teaching program being developed under AAAS auspices cost only about $1 a year per pupil. Costs for the new junior and senior high school programs are substantially higher, but still modest. In contrast, one large midwestern city in a recent year budgeted 6½ cents per child for science teaching materials in the elementary grades. A large eastern city, in one of the states that rates high in its overall budget for teaching supplies, this year has less than 25 cents per pupil for elementary science teaching materials. In another large eastern city the superintendent of schools asked for 54 cents per pupil to cover all laboratory and shop supply and equipment costs (38 cents in the elementary grades, up to 94 cents for the 12th grade), but the Board of Education was unable to appropriate that much.

If these amounts seem atypical, the annual analysis in *School Management* of expenditures in the nation's public elementary and secondary schools provides a broader picture. For 1964–65 the median amount available for teaching materials of all kinds is $14.15 per pupil. Some wealthy districts provide over $36 per pupil, and in three northern states the median is $20.1. But in four southern states the average is $5.60, and in the 10 percent of the poorest districts that spend the least on school supplies it is only $2.11 per pupil. (Strictly speaking, these figures are not on a "per pupil" basis, for there are adjustments for the greater cost of secondary over elementary education and of small over large schools, but the distortion is small.)

These greatly different amounts provide the children of different towns and cities with whatever they have of textbooks (no wonder so many outworn ones are in use!), library books, art and music supplies, shop equipment and materials for vocational education, and whatever equipment and supplies are used for teaching science.

The gap between the amount necessary to provide adequate materials for good science instruction and the amounts now budgeted can perhaps be partially closed by even more ingenuity in developing inexpensive materials. But more money is necessary. Some parent-teacher associations collect funds to supplement school budgets. The National Defense Education Act and other federal legislation provide special funds for science equipment, but the amount for each child is small; federal assistance for all purposes this year amounts to $2.16 out of an average total cost of $373 per pupil. Legislation now being considered in Congress would give additional help, but the major effort must be made locally, for local and state taxes will remain as the chief source of funds for science teaching, as for other school expenses. If there are school children in whose education you have a special interest, you may stimulate improvement by finding out how much is budgeted for science teaching in the schools they attend.

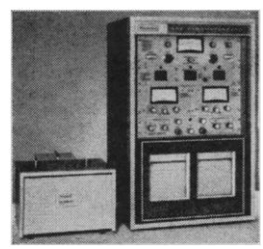
—DAEL WOLFLE



HIGHLY SPECIFIC DETECTION OF ORGANOPHOSPHATES ON A Packard Gas Chromatograph

Phosphorous-containing compounds are one of the most recent groups to yield to a Packard Gas Chromatograph. The chromatogram which is shown above was made on a Packard Model 7611 dual system (dual column oven, dual detectors, dual electronics and dual recorders) and represents an important achievement in simultaneous determination of compounds of widely separated concentration.

A modified flame ionization detector with a sodium emission grid and termed a SODIUM THERMIONIC DETECTOR (STD) has been found to be nearly 1000 times more sensitive to phosphorous-containing pesticides than the standard flame ionization detector (FID). The sample was separated on a single column and passed through a 1:1 ratio stream splitter before simultaneous detection in the normally sensitive FID and the highly sensitive STD. In this manner, all the organic materials were detected in the FID (upper curve) while the trace amount of phosphorous compounds was readily detected in the STD unit (lower curve).



Packard Gas Chromatographs offer many significant advantages to research workers in the biochemical and biomedical disciplines. Fast, stable, highly sensitive determination, versatility and convenience of operation are some of the reasons why you should know more about these superb instruments. Your Packard Sales Engineer can provide complete details and performance criteria. Write for Bulletins and Specifications.

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1 μg lindane
1 μg parathion
2 μg methyl stearate

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SUBSTRATE: 80-90 mesh Anacrom ABS (acid and base washed, and silanized)

CARRIER GAS FLOW RATES:
Nitrogen 60 cc/min
Hydrogen FID 40 cc/min; STD 60 cc/min
Air 300 cc/min

TEMPERATURES:
Inlet Heater 225°C
Column 205°C
Detectors 200°C
Outlet 200°C

DETECTORS: Standard Packard Hydrogen Flame Ionization (FID); Modified Packard Ionization Detector with sodium emission grid (STD).

ELECTROMETER RANGES:
FID 1 x 10^{-9} amperes full scale
STD 3 x 10^{-7} amperes full scale

DETECTOR VOLTAGE: 300 volts

NOISE LEVEL: 1 x 10^{-11} amperes full scale

CHART SPEED: 30 inches/hour

*L. Giuffrida, *J.A.O.A.C.*, 47, No. 2, 293 (1964)

Packard

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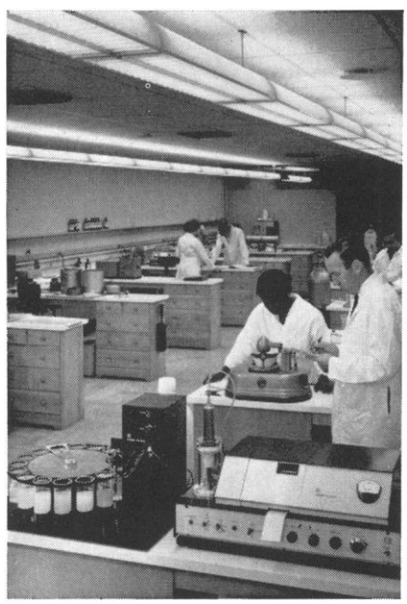
February, 1965

FISHER PRODUCT REPORT

News about instruments, apparatus and reagent chemicals that make your work quicker, surer, safer and easier.



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Scrub, scrub, scrub . . . yet iodine, fresh silver nitrate, potassium permanganate, ball-point ink—all kinds of dyes and stains just won't come off. But they're duck-soup to Fisher's new Stain-Off. Just rub it on until the stain disappears, then wash it off with water. The 8-oz tube costs only $1.80. Try it. Or ask for more details about this vanishing act. ☐

Fisher eliminates need for special "High pH" electrodes.

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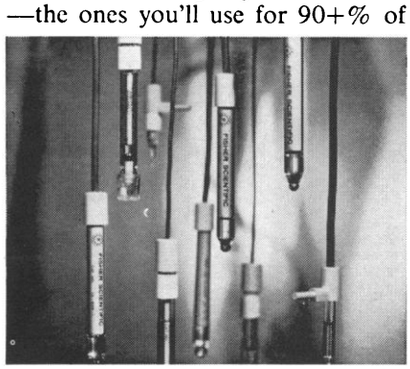

your work—are accurate over the full pH range from 0 to 14, and from −5° to 100°C. There are others for high temperatures and rugged service, plus a full selection of reference and metal electrodes—28 in all. Every electrode is made, tested and guaranteed by Fisher and can be used with any modern direct-reading pH meter calibrated with zero potential at pH 7. You can peruse all the facts in our Bulletin FS-265. ☐

What's your interest? Check the item, tear out this page and send it—with your name and address—to Fisher Scientific Company, 139 Fisher Building, Pittsburgh, Pennsylvania 15219. Naturally, we'd be pleased to send you information on all three. F-419

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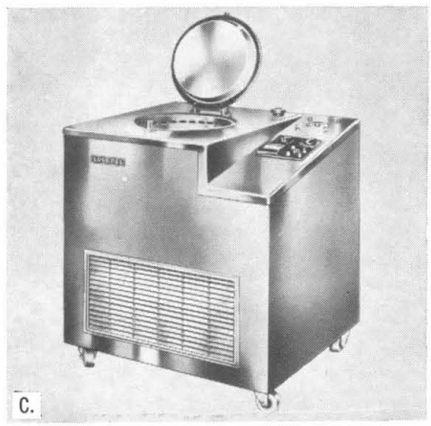
A.

B.



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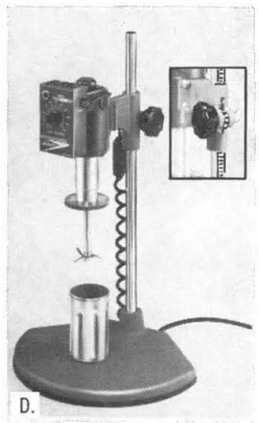

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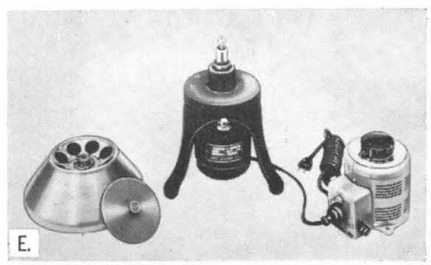

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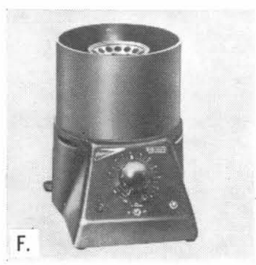

F.

A. Model A "Betafuge", Automatic Superspeed Refrigerated Centrifuge accommodates thirteen interchangeable rotors, including 3300 ml. (6 x 550 ml.) capacity rotor at 14,000 x G; 400 ml. (8 x 50 ml.) rotor at 40,000 x G; temperature control range —20°C to +40°C.

B. Model LCA-2, Non-refrigerated automatic centrifuge, spins 3300 ml. (6 x 550 ml.) capacity rotor at 10,000 x G; 400 ml. (8 x 50 ml.) at 30,000 x G.

C. Model VA-2 "Vacufuge" Automatic Ultraspeed Vacuum Refrigerated centrifuge spins 3300 ml. (6 x 550 ml.) capacity rotor at 33,000 x G; 1500 ml. (6 x 250 ml.) capacity rotor at 65,000 x G. Temperature control range —20°C to +40°C.

D. Model MM-1, Multi-Mix featuring solid state speed control and a rachet and gear mechanism. Sealed homogenizing within stainless steel containers, mason jars, centrifuge bottles, and tubes.

E. Model AX super-speed centrifuge; forces to 34,800 x G; separate RPM-RCF calibrated transformer.

F. Model AA-C "Versa-fuge" table model superspeed centrifuge; spins 400 ml. (8 x 50 ml.) capacity rotor at 34,800 x G; built-in transformer and steel safety guard.

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control of drugs; this responsibility involves complete supervision from the point of inspecting raw material to final product testing and release.

Lee H. MacDonald presented the vice-presidential address, "A look at the future of pharmacy." He emphasized that new drugs are harder to come by than they were in the recent past and that government control of health services is going to increase rapidly.

Sixteen contributed papers in the areas of pharmacology, pharmacy, physical pharmacy, and pharmaceutical chemistry were presented at the seventh session. W. L. Guess, H. F. Berg, G. Wittenbach, and J. Autian (University of Texas) reported on sorption and diffusion of a cationic agent, dicyclomine HCl, with nylon-6,6. N. K. Patel and N. E. Foss utilized equilibrium dialysis technique employing a semipermeable nylon membrane to quantitatively evaluate the degree of intermolecular association occurring in aqueous solution between some benzoic acid derivatives and polysorbate 80 and cetomacrogol 1000. P. Singh, J. K. Guillory, T. D. Sokoloski, and V. N. Bhatia reported on the effect of polyethylene glycol 4000 on the dissolution and absorption rates of certain barbiturates. G. C. Schmidt, J. C. Drach, and T. E. Eling (University of Cincinnati) discussed data obtained in metabolic studies with isotopically labeled atropine. R. C. Leaf and S. A. Muller (Squibb Institute for Medical Research) discussed the effects of amphetamine on initial acquisition of classical and Sidman avoidance responses and on fear conditioning in rats. H. Barry III, J. P. Buckley, W. J. Kinnard, and N. Watzman (University of Pittsburgh) reported on the effects of chlorpromazine on rats subjected to a Sidman schedule utilizing standard Skinner boxes. The measurement of speed of escape was made possible by the use of recently developed technology, including a paper tape punch and high speed computer which automatically recorded and summarized thousands of lever presses in terms of time intervals with accuracy to the nearest 1/10 second. O. S. Ray (Veterans Administration Hospital, Pittsburgh) reported on animal studies which concomitantly monitored behavior under appetative and aversive control using three prototype tranquilizers, chlorpromazine, reserpine, and meprobamate. S. E. Falutz, L. -P. Chenier, and J. D.

McColl (Frank W. Horner, Limited, Montreal) discussed the motor agitation induced by morphine in cats and the use of this response for screening potential psychopharmacological agents.

J. C. Burke and A. G. Ebert (Squibb Institute for Medical Research) described the pharmacology and clinical effects of fluphenazine enanthate, a potent ataractic compound. S. Schreiber (New York University) presented data which indicated that minute doses of ouabain inhibited exchange diffusion resulting in potassium loss in ventral slices from guinea pigs without interfering with active transport. M. Oratz (New York University) discussed the effects of exogenous gamma globulin on albumin synthesis in rabbits. F. Sunahara, T. Bogri, and C. Chappel (Ayerst Research Laboratories, Montreal) dealt with the hypotensive activity of a fatty acid fraction isolated from the renal medulla of rabbits. A. A. Hakim (Armour Pharmaceutical Company) presented data indicating that human plasminogen and fibrinogen are possible inhibitors of the esterase of chymotrypsin and trypsin.

Hans Selyé (University of Montreal) presented Section Np's distinguished lecture entitled "Calciphylaxis," and through the use of a large number of slides demonstrated the marked calcification induced in experimental animals, previously sensitized with vitamin D_2.

The final session was a symposium on drugs and genetics. T. H. Ingalls (School of Medicine, University of Pennsylvania) discussed the facial and head deformities in newborn sheep. Such deformities are apparently induced by the eating of *Veratrum californicum* by the ewes. The deformities included cyclopia, cerocephaly, and mongolism. Werner Kalow (School of Medicine, University of Toronto) presented a paper on pharmacogenetics and emphasized the glucose 6-dehydrogenase deficiency induced by certain drugs. Roger Larose (University of Montreal) reported on Canadian food and drug laws and regulations.

The officers and representatives of the sponsoring societies met to elect new officers and to formulate the program for next year's meeting in Berkeley, California. John E. Christian (Purdue University) is the new vice president and chairman of Section Np for 1965 and Don E. Francke was elected a committeeman-at-large. Lunch, re-

ception, and dinner were sponsored by E. R. Squibb and Sons, Wyeth Laboratories, and McKesson and Robbins, respectively.

JOSEPH P. BUCKLEY, *Secretary*

Agriculture (O)

The program of Section O was a symposium on pest control by chemical, biological, genetic, and physical means. The total attendance at the six half-day sessions (27–30 December 1964) was approximately 600. The discussion periods for each session were fully utilized to develop related aspects of the subjects presented. The exchange of information and concepts between the various contributing disciplines proved to be one of the important benefits of the symposium. For details of this program, see page 916.

The theme for the 1965 symposium to be held at Berkeley is Agricultural Climatology. The 1965 chairman of Section O is R. H. Shaw (Iowa State University). Shaw will develop an interdisciplinary program on this theme. E. F. Knipling, retiring chairman, was elected to a 4-year term as committeeman-at-large for Section O.

E. F. KNIPLING, *Chairman*
H. B. SPRAGUE, *Secretary*

Education (Q)

The Education of Culturally Disadvantaged Children was the topic of a joint session of the Education Section (Q) and the American Educational Research Association (30 December 1964). John Brewer, (Miller Elementary School, Pittsburgh, Pennsylvania) outlined a range of problems in connection with the education of culturally disadvantaged children. He stressed the fact that communication with such children is often difficult, and that misunderstandings often arise on the part of both children and teachers because words are misunderstood. A child says he will bring a "stick" to school. The teacher may not realize that the child is talking about a pencil.

Robert E. Rockwell (Quincy Youth Development Board, Quincy, Illinois) described a special program to introduce children from culturally disadvantaged areas to experiences they do not otherwise ordinarily have. He particularly emphasized the value of field trips in the community.

Moshe Smilansky, (Henrietta Szold

Foundation for Child and Youth Welfare, Jerusalem, Israel) reported on a 10-year program for Oriental Jews in which special school programs resulted in intellectual performance on a par with Jews from European backgrounds. Smilansky made the point that it was easier to make dramatic gains if the children began special programs while quite young, but that improvements in intellectual performance were possible for culturally disadvantaged children at any age.

Edmund W. Gordon (Yeshiva University) warned about possible bandwagon effects of current interest in the education of culturally disadvantaged children. Some programs may be initiated in haste and serve over a 10-year period to limit the effectiveness of the total effort.

Philip Morrison (Cornell University) commented on the papers. His remarks covered a range of topics and included a hope for greater flexibility in teaching approaches for the culturally disadvantaged than is ordinarily found in schools. He also made a strong plea for a more indirect view of educational objectives. That is, perhaps the teaching of reading is not primary—but a means toward some other end. He also commented about the use of standardized tests that were statistically normalized with populations quite different from those found in schools attended by children from culturally disadvantaged areas.

Contributed Papers (27 December 1964). R. Halliburton, Jr. (Northeastern State College, Tahlequah, Oklahoma) presented a very carefully documented picture of the anti-evolution movement from a historian's point of view. The relationship between the social movement and the scientific developments in genetics and other areas was not included.

Leo Gross and Norman Molomut presented some exciting descriptions of preparation of new materials for high school biology projects. They also described a technique of involving teacher–student teams with the result that the students continually prod the teacher into further study. Many unique ideas which were presented seemed worthy of further investigation into curriculum development by biology teachers.

Gloria Wolinsky described the advantages of science instruction as materials stimulating the severely handicapped child to grasp his environment and provide the motivation for in-

creased development of the child's capacity to read, to manipulate, and to communicate.

Laurence E. Vredevoe (University of California, Los Angeles) summarized a long-term study of the effects of segregation upon school discipline. He concludes that other efforts, such as teacher competence and the atmosphere within the school, are of far greater importance in maintaining school discipline.

W. H. Lucow (Dominion Bureau of Statistics, Ottawa) presented an extremely scholarly and clear discussion of the comparative education of Canadian provincial schools. A report on educational planning in Canada is available from Roger Duhamel, Queens Printer and Controller of Stationery, Ottawa. M. M. Chambers (Indiana University) gave a very well documented discussion of the state support of higher education in the U.S. State support has increased greatly during the last 5 years and projections indicate that it will increase considerably in the future. However, a variety of factors must be considered in comparisons of state support.

An initial report of the Single Concept Film Project, designed to identify, catalog, and provide for retrieval of single concept film clips from educational films currently on the market, was described by Julian R. Brandou (Michigan State University). The vice-presidential address, "Economic return from and to education," was delivered by Herbert S. Conrad (U.S. Office of Education).

FREDERIC B. DUTTON, *Secretary*

American Nature Study Society (Q3)

The investigative approach to natural science, or nature study as Bailey described it 60 years ago, is receiving increasing attention both at the local school level and in national programs —the AAAS Process Approach, the Illinois Project, and the Elementary Science Study. However, in Montreal, which may typify much of Canada's public educational organization, there is little if any real elementary science in the curriculum. At the secondary level science instruction is still formal in nature, but is beginning to be modified by an increasing awareness of open inquiry as an important aspect of science learning.

Typical of the process of inquiry that is increasing in popularity in the United States is an independent study

Dissymmetries

Although the standard models of Brice-Phoenix Light Scattering Photometers usually can be utilized in many diversified applications without any modifications or additions, these could become necessary for some specialized purposes. A rather large number of such modifications have been described in the literature, concerning mostly the construction of light scattering cells of various shapes and of special requirements, and with their temperature control. We think it might be of general interest to have the pertinent references collected and systematized in one place in order to demonstrate the easy adaptability and flexibility of Brice-Phoenix photometers.

TEMPERATURE CONTROL

High-temperature thermostats for measurements on polyethylene and polypropylene solutions were described by several authors. In addition to the double-walled cylindrical cell jacket designed by Trementozzi [(J. Polymer Sci., *23*, 887 (1957); *36*, 113 (1959)], that is available as our Catalog No. CCJ-2, thermostating jackets were described by Moore [*ibid.*, *20*, 137 (1956)] and by Kobayashi, Chitale and Frank [*ibid.*, *24*, 156 (1957)]. Tung [ibid., *36*, 287 (1959)] has controlled temperatures as high as 125° C by blowing heated air into the cell compartment and insulating the photomultiplier housing.

Similarly, Cohen and Economou [J. Phys. Chem., *68*, 2801 (1964)] utilized an air bath in their studies of the critical phenomena, and Gellert and Englander [Biochemistry, *2*, 39 (1963)] introduced a stream of cold air into the chamber in order to keep the temperature of myosin solutions at 10–12° C. For the latter temperature range, Rice et al. [Arch. Biochem. Biophys., *105*, 409 (1964)] achieved control of the temperature of tropocollagen solutions by circulating cold water through a copper coil wound about the cell. A cylindrical cell, fitted with a cap and circulating coils inside the cell was used for temperatures up to 90° by Heilweil [J. Colloid Sci., *19*, 105 (1964)], who measured the micellar weights of sodium alkylnaphthalene sulfonates in nonaqueous solvents. A thermoseting double-wall jacket was also described by Boedtker and Doty [J. Phys. Chem., *58*, 968 (1954)]. For the critical opalescence measurements in liquid mixtures, where the temperature control must be within ±0.005° or better, Pancirov and Brumberger [J. Am. Chem. Soc., *86*, 3562 (1964)] have constructed a constant-temperature bath into which the cell was immersed.

The small 1 cm. square cells, convenient when a limited amount of material is available, were utilized by Epstein, Doty and Boyd [*ibid.*, *78*, 3306 (1956)] in a thermodynamic study of hapten-antibody association, and by Timasheff et al. [*ibid.*, *79*, 782 (1957)] in an investigation of charge fluctuations in isoionic serum albumin solutions (these micro cells are available as our Catalog No. T-108 together with a special holder, Catalog No. H-108). The ways of thermostating such small cells for kinetic studies and for other temperature-sensitive reactions have been described by Doty and Myers [Discussions Faraday Soc., *13*, 51 (1953)] and by Frieden [J. Biol. Chem., *237*, 2396 (1962)]. We also have developed a temperature control cell holder for the small 1 cm. square cell, which is available as our Catalog No. SC-200.

SPECIAL PURPOSE CELLS

In order to change the pH in the light scattering cell continuously while allowing constant observation, Thomas and Doty [J. Am. Chem. Soc., *78*, 1854 (1956)] have constructed an arrangement for such purpose for their studies of acidic degradation of DNA. Another development is the small cylindrical cell (our Catalog No. C-105) with built in sintered-glass filter and the corresponding holder as designed by Kronman and Timasheff [J. Polymer Sci., *40*, 573 (1959)]. For studies of the particle size distribution in aerosols, a metal cell through which the aerosol continuously passed during the angular intensity measurements has been constructed by Matijevic, Kitani and Kerker [J. Colloid Sci., *19*, 223 (1964)].

CENTRIFUGABLE CELLS

Finally, we have to mention the adaptation made on Brice-Phoenix photometers in order to permit the use of centrifugable light scattering cells that are employed in ultracentrifugal ultraclarification of solutions and liquids. Originally designed by Danliker and Kraut [J. Am. Chem. Soc., *78*, 2380 (1956)], such an arrangement was further developed by Goring et al. [J. Polymer Sci., *39*, 9 (1959); J. Phys. Chem., *64*, 1426 (1960); Svensk Papperstidning, *63*, 524 (1960)] and applied in the investigation of various macromolecules from wood,

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carried on in a small New York State school where 60 pupils representing grades one to six observed, experimented with, and recorded behavior in dragonfly nymphs. In another study, children in Great Neck public schools made direct observations and measurements to study astronomical relationships. A report on nature study in New York City showed many opportunities for studying biology in the exposed soil between paved areas, in the displays in grocery and flower shops, and even in the subway.

Nature study in schools is often incidental or fragmented, but in museums and camps it is concentrated and continuous. The Cape Cod Museum and the Cold Spring Harbor Laboratory are typical of institutions offering summer nature programs at very modest fees. They include courses in seashore life, entomology, ornithology, and general field biology for pupils of elementary and high school ages. In Canada, the Cercles des Jeunes Explos do laboratory work under the direction of qualified and dedicated leaders and make extensive trips in the Saguenay area to bring youngsters in direct contact with natural history. The Redpath Museum (McGill) in Montreal exemplifies the excellent facilities that should be used more for curricular and extracurricular nature study in urban centers.

Publications offer still another avenue of support for nature study. Increasing in both number and quality are magazines such as *The Curious Naturalist* (Massachusetts Audubon), *The Cornell Science Leaflet* (Cornell University), and *Le Jeune Scientifique* (Canadian counterpart of AAAS), as well as trade books.

The increasing pressure of a burgeoning population demands better and wider nature interpretation. To that end, ANSS will explore affiliation with other interpretive organizations. It will also continue to press for an honest investigation of nature in order to further its aims of creating a wholesome attitude toward the natural world that is vital to scientific study and conservaion efforts.

VERNE N. ROCKCASTLE,
Program Chairman

National Association of Biology Teachers (Q7)

The NABT program was developed in close cooperation with the other sci-

ence teaching societies; three major joint symposia were scheduled.

The symposium on Science Teaching in North America—an Historical View, was arranged by NABT; organized by Myrl C. Lichtenwalter (H. G. Wells High School, Chicago); and moderated by David G. Barry (State University of New York, Albany). It dealt with several historical aspects of biological endeavor in America. Barry keynoted the symposium with a discussion of early American Science and the roots of modern biology. Stanley Norris (University of Alberta) considered the evolution of biology teaching in Canada, while Rev. James F. Lotze (Bellarmine School of Theology, Illinois) discussed the history of biology teaching in American Catholic schools. Jerry Stannard (Rutgers University) concerned himself with sources and resources relative to the history of biology.

The NABT was cosponsor of the symposium, What's Current in American and Canadian Science Teaching. The American Nature Study Society organized this symposium and E. Laurence Palmer was chairman. The NABT was also cosponsor for the symposium, Evaluating Outcomes of Science Teaching, which was directed by J. Darrell Barnard.

In the NABT session of contributed papers, Nancy Stees (Kenneth High School, Pennsylvania) discussed and showed movies of a special biological research project in her school. Pursued after school hours, this team program was supported by grants from the Southeastern Pennsylvania Heart Association. The project stimulated student interest in research and gave students a more intimate experience with biological endeavor. Mother M. Sebastian (Loretto Academy, Chicago) talked about the science achievements of culturally disadvantaged Catholic girl students in the Chicago area, emphasizing that with direction and encouragement such students can compete successfully in science fairs and similar science programs. An ecological food web demonstration by Richard G. Beidleman (Colorado College) employed string links between students who represented different food niches in a community web. Biology teachers in different parts of the country could adapt such a demonstration to their local biotic communities. Stanley L. Weinberg (DeWitt Clinton High School, New York) presented an imaginative format to illustrate biochemical

genetics concepts, pointing out that often the best demonstration materials and techniques are those developed in the classroom by the teacher. DNA organization, for example, could be illustrated with a magnet board and moveable metal molecule designators. Ivor Smith (Courtauld Institute of Biochemistry, London) showed a techniques film on chromatography and electrophoresis on paper and thin layers, noting the particular virtue of thin-layer chromatography. He suggested that there are many simple experiments which can be carried out in the classroom with such techniques. Such techniques could also be applied to student research projects.

At the NABT annual luncheon in a special ceremony, Helen Battle (Western Ontario) and E. Laurence Palmer (Cornell) were recognized with honorary membership in the organization. The luncheon speaker, Louis-Philippe Audet of the Province of Quebec, discussed the problems inherent in the bilingual Quebec educational system and the new reforms, particularly in the fields of mathematics and science, that are planned to ameliorate some of these problems. At the completion of the luncheon meeting, retiring president Ted F. Andrews turned the gravel over to Leland S. McClung, president for 1965.

At the Montreal AAAS meetings, the science teaching societies held a well attended joint mixer, sponsored by Welch Scientific Company. An open house at McGill University's Redpath Museum was arranged by ANSS and sponsored by the Museum and by Ward's Natural Science Establishment.

RICHARD G. BEIDLEMAN,
Program Chairman

National Science Teachers Association (Q8)

The National Science Teachers Association arranged three meetings at the AAAS convention in Montreal. One, a symposium on evaluating outcomes of science teaching (29 December 1964), was held jointly with the American Nature Study Society, the Central Association of Science and Mathematics Teachers, and the National Association of Biology Teachers. The other two were held jointly by NSTA and the Central Association of Science and Mathematics Teachers.

The symposium, "Evaluating outcomes of science teaching," stressed

the importance of stating objectives in behavioral terms in order to develop an inquiry-centered science program. Members of several of the experimental teaching programs discussed the techniques that are being used in evaluating these programs. They stressed the importance of new evaluation techniques, pointing out that the results of existing standardized achievement tests present a one-sided view of the outcomes of the learning process.

The panel presenting the symposium on planning a unified science program (27 December 1964), discussed the new NSTA publication, *Theory Into Action in Science Curriculum Development.* One scientist presented a detailed criticism of the conceptual schemes that appear in the publication. Others pointed out the importance of using a set of basic conceptual schemes in developing a science curriculum and stressed the need for an overall approach to curriculum development, as opposed to the present practice of piecemeal development.

The speakers in the symposium on preparing for science in the elementary school classroom (28 December 1964) pointed out existing inadequacies in the science courses in present teacher education programs. An elementary principal described the science in-service education for the teachers in his school system, demonstrating some of the equipment being used in the inservice program and in the elementary classrooms in his system. A college science teacher described the laboratory-centered courses being developed at one large university that attempted to use scientific techniques in the educational process.

The panel emphasized the need for breaking away from traditional patterns of "cookbook" laboratory exercises and nonlaboratory "science" courses, and in their places substituting carefully organized laboratory work in which students participate in planning and carrying out laboratory projects designed to find answers to real questions. It was emphasized that practices and techniques used in traditional courses are inadequate and do not provide the student an understanding of what science really is. At the present time, most teachers, after leaving college, must take inservice courses that stress the basic principles and nature of science before they are prepared to teach modern science programs. Only by revolutionizing existing courses can we give elementary

teachers an adequate preparation for teaching science.

ALBERT F. EISS, *Program Arranger*

Information and Communication (T)

Current Issues in Communication of Science: I. Editor-Scientist Panel. The Scientific Paper: Can It Survive? was the subject of an informal panel discussion which opened Section T's program on 27 December 1964. Modeled on a format similar to that employed in television's "Open End," the program afforded the opportunity for research scientists to explore with editors the pros and cons of present practices in communication of scientific research.

Robert Anderson (Robert Anderson Associates, Ltd.; consultant on Mass Media to the National Research Council of Canada) served as moderator for the session. In opening the discussion, Anderson brought out a number of the questions currently asked about the scientific paper: Why do scientists write papers? How many papers are published more than once? How valid is the "publish or perish" principle as a basis for advancement today? What is the purpose of publishing papers? Who reads them? What part do publications play in the "grant game?" How much resistance is present among scientists to use of machines? Do journals refuse enough manuscripts? How about the quality of writing? Is the scientific paper an effective vehicle for communicating science today? Should there be a daily newspaper of science? Should there be a science section in the newspapers? Each panelist was then asked to present a brief opening statement of his views on the subject. Frank discussion among the panelists was the next feature of the program. Finally, audience participation was invited.

For the most part the panelists defended the scientific paper while also noting its weaknesses and faults. Panelists and audience were agreed that the scientific paper in nearly its present form is probably here to stay. Despite certain regrettable abuses of the privilege of publishing, scientists need to crystallize their ideas in writing, present their results in detail, and have them judged by editors, reviewers, and their specialist colleagues. The resulting literature serves also as the record of progress of science, open to

the scrutiny of coming generations of scientists. It was also agreed that too many papers are published.

Panel members included: Philip H. Abelson (editor, *Science*), Pierre Dansereau (The New York Botanical Garden), Belver C. Griffith (American Psychological Association), A. Q. Mowbray (editor, *Materials Research and Standards*, American Society for Testing and Materials), and Charles G. Overberger (Polytechnic Institute of Brooklyn). (Peter Gray, University of Pittsburgh, at the last moment was unable to attend because of an accident.)

Science and the Public Mind—Past and Present was the subject of a AAAS interdisciplinary symposium (jointly sponsored by Sections T and L) on 28 December 1964. The session was chaired by William C. Steere (The New York Botanical Garden). In his introduction, Steere stressed the necessity in today's world for conveying to the nonscientist something of the substance, philosophy, and methods of the scientist. Leonard M. Marsak (Rice University) dwelt upon the philosophy and approach of early popularizers of science, particularly Cyrano de Bergerac, Fontenelle, and Condorcet. Curtis A. Williams, Jr. (The Rockefeller Institute) presented the views, organized efforts, and some of the problems of the scientists themselves in communicating results of their own research and that of others. Part of the scientist's effort must go toward countering certain misconceptions about science and scientists that have caused problems. Robert Anderson, producer of psychiatric films used in teaching as well as for viewing by the public, explained how the public's accurate knowledge in a scientific field can affect its progress. Psychiatry had been for the most part a closed community until mental illness and health could be frankly portrayed to the public, as was done, for example, in "The Snake Pit." Victor Cohn (Minneapolis *Tribune*) stressed the importance of the science writer's role in reporting science news accurately and coherently. The job of reporting science news falls mainly to the science writer because other media, for example television, have not yet assumed their full share of the responsibility. Cohn traced the development of science writers and writing as occurring in three waves, each stimulated by an event, the latest being the launching of Sputnik. He commented, also, on the science writer's need for more help

from the scientists themselves. He deplored the enormous number of papers scientists are turning out, and the poor quality of writing that characterizes many of their reports. Scientists tend also to screen themselves from science writers by working through a middle man, a practice that reduces the accuracy and effectiveness of the science writer's reports. Science as news is written for the public, not for the scientist. Science is often dramatic and this part of the flavor must be conveyed.

A Talk about Talk: Some Barriers to Communication was the title of an address by Mel W. Thistle (National Research Council of Canada), at Section T's annual luncheon on 30 December 1964. With the aid of a blackboard Thistle explained in a delightfully whimsical manner the basic background of people differences that make communication virtually impossible except on marginal basis. Added to these differences are the various connotations and emotional charges that many words—even concrete nouns such as dog, cat, money—carry for each individual. Then there is the interest factor in transmitting information; every individual is receptive to what interests him most. It is extremely difficult to communicate ideas and thoughts to someone who lacks even the desire to be receptive. Thistle observed that "we need to know much more about what happens inside the human nervous system when we try to communicate. What resistances are there? We already know that when people are filled with a strong emotion, for instance love, fear, or anger their threshold of interest for other things becomes much higher. To gain their interest you have to shout, use more colorful language or more human appeal.

"We can probably improve our communications by: (i) Respecting the differences in the other fellow's makeup, environment, and history by giving him a chance to talk back and to check what we mean; (ii) respecting his emotional level whether acute or chronic, and taking the time to alter it if necessary and if possible; and (iii) respecting any differences in stages of sophistication, reducing detail accordingly, and taking the trouble to find a suitable analogy for conveying aims."

Who speaks for science? was the topic of an address by Wallace R. Brode (Chairman of Section T). He is eminent-

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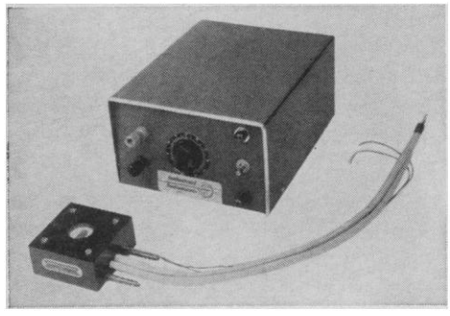

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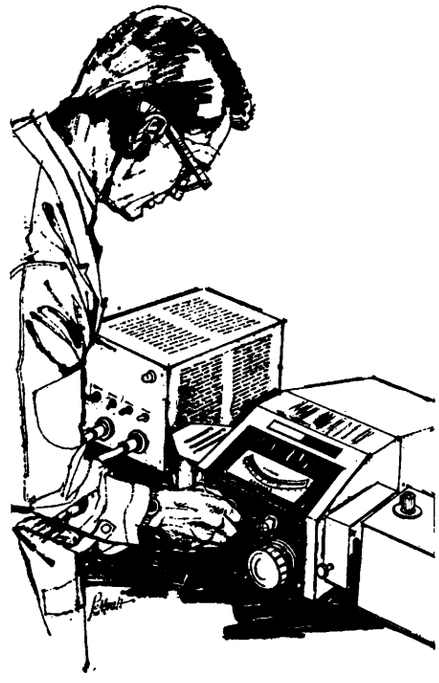

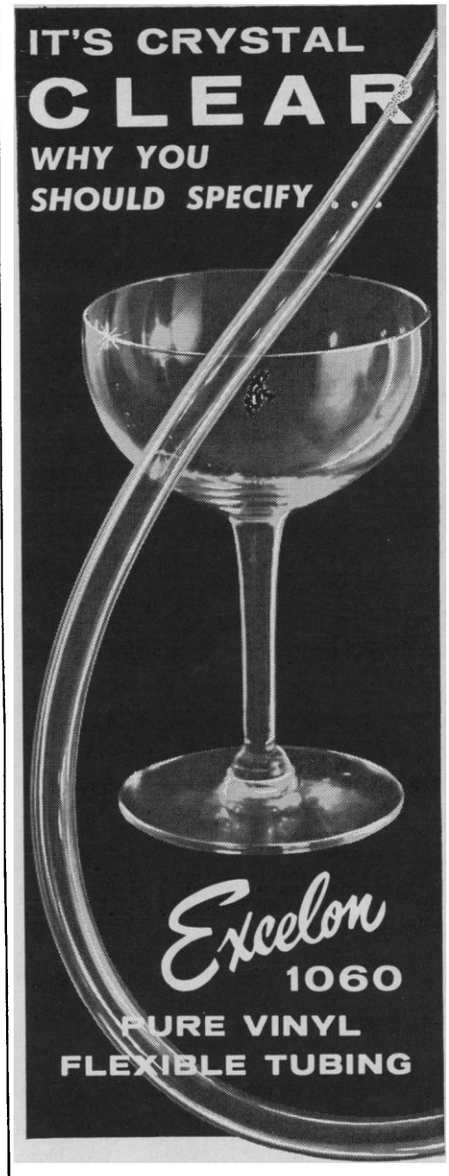

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ly qualified to discuss this subject because of his scientific careers, his varied experiences in government service, and his former presidency of the American Association for the Advancement of Science. Brode illustrated the lack of precision of meaning in many terms we frequently use, and dwelt at some length upon the numerous differences in definitions used and accepted for "science." Particularly in recent years, definitions of the words science and scientist have been broadly interpreted. In large part this is true because more individuals and organizations want to be associated with science now that science is a "successful operation." Administrative decisions have been based on this broader interpretation, specifically within the National Science Foundation where support, once limited to science in the narrower sense, is being extended to include areas commonly labeled social studies. This has come about gradually and perhaps because we lack a National Humanities Foundation. The conflict in interpretations of science and the matter of establishing a National Humanities Foundation are examples of subjects upon which we need a consensus of scientific opinion, even though it may not be unanimous. He pointed out that in problems and questions in many other areas, usually involving one or more possible solutions, we need the analysis and opinion of the scientific community. These questions are related to the national welfare—our emphasis on one or another aspect of education in the sciences, the matter of our distribution of effort in research, our methods of education in mathematics and sciences. On many such general topics, as well as those of technical character, there are conflicting points of view. Policies must often be based on decisions, and such decisions should be made with divergent views considered. But how can the views of the scientific community be presented?

There are publications, meetings, and various other media for communication available to scientists. And the spokesmen for science are the editors, science writers, abstractors, lecturers, almost anyone who can present the scientist's position and has his confidence and respect. Brode concludes, however, that increasing specialization, hence fewer experts in any one field, makes it difficult to obtain a broad opinion that will constitute the voice of science. "Perhaps we need a periodic 'Parliament of Science' or other

forum such as the AAAS has held from time to time on specific subject areas so as to more clearly identify and establish the voice of science."

PHYLLIS V. PARKINS, *Secretary*

Effective Science Communication in Today's Research Environment. Current problems in science communication were presented from several viewpoints and discussed at this session (30 December 1964).

The increasingly important role computers can play in assisting communication among scientists was described by Ambros P. Speiser (IBM Research Laboratory Zurich; currently with IBM's Thomas J. Watson Research Center, Yorktown Heights, New York). Emphasis was placed on "textual data handling," that is, using computers to process and store natural languages, rather than numbers. This is achieved by means of information storage and retrieval and by the mechanical translation of languages. Although computers will increase enormously the speed of research in the years to come, it was stressed that no computer will relieve scientists of the very task which characterizes scientific work, that is, to evaluate critically results of other peoples' research and, based on this understanding, create new knowledge.

Factors that assure maximum effectiveness of internal and external reports and of scientific papers for professional journals were reviewed by Irving H. Jenks (Aluminium Laboratories Limited, Kingston, Ontario). Some key ideas that assist in meeting the demands imposed by the research environment of the space age and other factors that constitute the fundamentals of effective reporting were presented and discussed.

The role of philosophy of science in scientific communication and in the popular dissemination of science was discussed by Arthur J. Samuels (Hunter College of The City University of New York). It was suggested that today only the less complex aspects of science have been investigated. With computers to handle more and more of the routine, noncreative work, man must strive to become increasingly more creative if he is to be truly effective in the future and put to optimum advantage the results of scientific research.

The panel was cosponsored by AAAS (Section T) and the Society

of Technical Writers and Publishers. Gunther Marx (IIT Research Institute, Chicago) arranged for the session and presided at the meeting.

GUNTHER MARX, *Program Chairman*

Statistics (U)

The Section U meeting at the 1964 Montreal meetings were fewer than usual but much better attended than the sessions at the previous annual meetings.

In his vice-presidential address, Churchill Eisenhart (National Bureau of Standards) described the evolution of the arithmetic mean from a number of superficially similar but fundamentally different uses that date back to antiquity. He described uses found in Wesetrn Europe in the 16th century in manuals on assaying ores and coins by cuppelation and in studies of the variations in the magnetic compass. The use of the arithmetic mean became widespread in the 18th century, but today we know of many simple and realistic laws of error for which the arithmetic mean, while "good," is certainly not "best."

A symposium on classification techniques in medical diagnosis (27 December 1964) covered experience with exact methods and computer technology in medical diagnosis. The interpretation of continuous input, in addition to categorical information was discussed. Various techniques of information gathering in hematology and the uses of the data were described. The lack of accuracy imposed as a result of using incidence data based on a limited number of cases was the subject of the final paper.

The session was arranged and chaired by Max Woodbury (New York University) for the Biomedical Information-Processing Organization.

In a two-session symposium on estimation of biological populations, descriptions of the multiple-sample, mark-recapture experiment applied to the estimation of mortality rates in populations of lamprey, trout, crayfish, and nesting birds illustrated both the utility and the limitations of this technique. Criteria for assessing the validity of such estimates were given as integral parts of the analyses of these experiments.

Evidence of the schooling phenomenon was demonstrated through statistical heterogeneity in the size composition of fish catches, and the effect of

schooling upon "catch per unit of effort" as an index of population density was explored through mathematical models.

Procedures were given for estimating classification errors as they might arise in assigning the individuals in a sample to their respective age groups. Other methods considered for estimating population size included those based on the change in sex ratio before and after harvest of an exploited species and those utilizing the extrapolation of repeated, visual, incomplete counts in an area to obtain an estimate of the total number in the area.

This symposium was arranged by Douglas S. Robson (Cornell University) for the Biometrics Society (ENAR). Chairmen were Kenneth D. Carlander (Iowa State University of Science and Technology) and Daniel B. DeLury (University of Toronto).

The section was also cosponsor of the symposium on managing the innovative process, arranged by Burton Dean and Ellis Johnson (Case Institute) for ORSA-TIMS.

MORRIS B. ULLMAN, *Secretary*

Science in General (X)

Science Courses for Baccalaureate Education Project (X4)

The Project's session met on 30 December 1964. V. L. Parsegian (Rensselaer Polytechnic Institute) first reviewed the history and status of the project. A panel of six members then presented specific questions for discussion. Kent D. Lawson (Bennington College) commented on and led discussions on the objectives of the project, and M. Brian Bayly (Rensselaer Polytechnic Institute) on the physical sciences content and approach. William H. Johnson (Rensselaer Polytechnic Institute) and David G. Barry (State University of New York) followed with biological aspects. Edwin J. Holstein and George Goe (Rensselaer Polytechnic Institute) introduced questions from the social sciences and mathematics, respectively.

Members of the Advisory Board of the Project, in addition to the chairman, are David G. Barry, Walter H. Bauer (Rensselaer Polytechnic Institute), Loren Eiseley (University of Pennsylvania) Harry W. Jones (Columbia University School of Law), Adolph Lowe (New School for Social Research), Henry Margneau (Yale

University), Ronald A. H. Mueller (Rensselaer Polytechnic Institute), and Ernest Nagel (Columbia University).

This unusual session gave reports on the goals and activities of a project which aims to develop new approaches to Science Courses for Baccalaureate Education. In the process, the meeting elicited many valuable suggestions from an informed and responsive audience. The program was organized so that the audience could participate in seeking answers to specific questions related to goals and methods. Endowed by the Charles F. Kettering Foundation, the project is organized to include participation on the part of the faculty members from many colleges. The number of colleges participating, in addition to Rensselaer Polytechnic Institute where the project is centered, now exceeds 60.

The projected courses are intended for liberal arts programs and for undergraduates whose studies may lead to professions in law, government, economics, business, anthropology, psychology, theology, and so forth. The courses will contain materials selected from the physical sciences (such as astronomy, earth science, atomic, molecular, and materials sciences), biological sciences, and to some extent from the social sciences. The presentation is intended to identify the continuity, transitions, relationships, and essential differences among disciplines, as well as to emphasize the power and the limitations of scientific methodology.

The objective of the courses is to reveal to the student the essential content, significance, and beauty of selected portions of the physical and biological sciences, and to emphasize the relationship of these sciences to the social sciences and to the student's own professional, social, and personal interests and responsibilities. Tentatively, the courses will be of three-semester duration, probably taken during the junior and senior years. Time limitations require that each topic and its presentation be severely analyzed and selected for maximum effectiveness.

Among the questions discussed were, to what extent can rigorous and quantitative analysis be compromised, in favor of a qualitative view, without losing essential insight? Apparently there is no simple solution to this problem, since one's position can vary from topic to topic. Some natural science topics bring little meaning except as they are treated quantitatively, perhaps

through involvement in an experimental situation. For some areas, a historical approach is preferable, while for others an intellectual process is often best stimulated by introduction through "world we live in" problems or personal experiences. For some students arithmetic and inadequate appreciation for magnitudes of phenomena often pose obstacles which may also be helped by meaningful experiments. The case method is often very good, provided that the larger conceptual interrelationships can be developed effectively. Physical models may, with care, become useful for illustrating both physical and social systems. Motivation of the student is an essential consideration.

Themes, ideas, or concepts which can be clearly traced through more than one of the physical, biological, and social sciences, become especially useful, because they reveal the common aspects of science and the fact that matter and energy have many forms. "Great ideas," current theoretical or practical problems in interdisciplinary areas, and a philosophic approach to these problems all offer real values. It was felt by some that the common topical approach, or the simple listing of all the topics that the course should cover, is the least productive procedure. Topics should be included always with sense of larger purpose. To what extent should "science" be thought of as a noun, and to what extent as a verb or an intellectual process? To a significant extent science may be regarded as a language to give ability to read journals such as the *Scientific American*, and to relate science to political and social issues, without necessarily including ability to write on scientific topics. The cultivation of an open-ended, nondoctrinaire habit of thought with appreciation of rigor constitutes an important task for the courses. This goal can often be approached by stressing the unknowns in science, and by the use of suitable problems and experiments which necessitate student involvement in their formulation as well as in their solution.

Because of recent developments, the courses can pass easily and continuously from the physical sciences to biological phenomena through the major bridges provided by molecular biology, polymer chemistry, and atomic science. Similarly, biological sciences may provide a necessary and useful bridge to the social sciences. A uni-

fied approach to the full scope of physical, biological, and social sciences, extending to the humanities, becomes possible, important, and vastly more personal and significant to the student. These disciplines, in total, give the student a better base from which to govern his own life and contribute more effectively to the management of his social, political, ethical, and physical environment.

The audience commented that whereas other efforts at developing science courses have started with listing of key topics to be treated, this multidisciplinary project has the advantage that it is pursuing ideas, themes, questions, unknowns, and overall shapes and attitudes that may better identify man's place in nature. It was stressed that these courses can contribute to the better education of teachers of elementary and secondary school grades. Parenthetically, a "little knowledge" about some of the topics is likely to be harmful only if the science is taught as disconnected, unrelated packages, and without adequate stress on the unknowns and limitations of science. The opportunities for integration which are inherent to these courses constitute their real strength. But this requires not only inclusion of the social sciences but necessitates probing into the humanities wherever it is pertinent and significant to do so. Approaches that emphasize systems and ecological relationships, offer very great advantages for encompassing broad themes in limited time, often engaging several disciplines within a single system whenever the point of view is made broad and realistic.

The project intends to give considerable attention to the preparation of teachers who can undertake pilot courses at many campuses, beginning with the fall of 1966. Summer institutes for these teachers, and invitations to many more colleges to share in the development and teaching of these courses, are high on the project's list of priorities.

V. L. PARSEGIAN, *Chairman*

Sigma Delta Epsilon (X5)

A tea for all women in science, sponsored by Sigma Delta Epsilon, Graduate Women's Scientific Fraternity, was held on the afternoon of 28 December 1964 and was very well attended by women scientists from the United States and Canada.

The tea was preceded by a lecture on Seed Technology given by Eltora Schroeder (U.S. Department of Agriculture). Miss Schroeder described the work of a seed technologist in the examination of samples of seeds sent to the Department for identification, quality, and viability and the amount of extraneous material in the samples. This work is of great importance to the agriculturists in the U.S. and in other countries for which the USDA serves as consultant.

At a workshop held on 29 December several items of importance to the Fraternity were discussed. These covered changes in the time of the fiscal year, proposed changes in the time of election of officers, Fellowship Awards, and plans for District Meetings.

The dinner and Grand Chapter meeting of the Fraternity were held on 29 December. Lois Almon spoke on "A small college in U.S.A." (Miles College, Alabama). She described the work being done there and the need for assistance in providing and furnishing a science laboratory and staff so that the college could become accredited.

National Honorary Membership in Sigma Delta Epsilon was conferred on one of its members, Lela V. Barton (Boyce Thompson Institute for Plant Research) who has devoted the last 36 years to seed physiology research.

At the business meeting which followed, considerable time was devoted to the report of the Constitution and Parliamentary Procedures Committee. Reports from two of the 1963 Grants-in-Aid recipients were received and money was appropriated for three additional Grants-in-Aid for 1964. A memorial service for those members of the Fraternity who died during the year was conducted by the president, Sue C. Stevens. Finally, the delegates elected and installed the national officers for 1965.

HARRIET M. BOYD, *Secretary*

Animal Behavior Society: New Society Formed at Annual Meeting

A new professional society for animal behavior scientists from all disciplines—the Animal Behavior Society (ABS)—was formed in Montreal on 29 December 1964 at the AAAS meeting. ABS is designed to accommodate the mutual interests of scientists from many disciplines. Among the specialties which will be represented in the new

society are anthropology, ecology, psychology, sociology, wildlife management, and zoology.

The new society is an outgrowth of and partner of the combined Section on Animal Behavior and Sociobiology of the Ecological Society of America (ESA) and Division of Animal Behavior and Sociobiology of the American Society of Zoologists (ASZ). The combined ESA and ASZ group has about 1300 members.

The two major functions of ABS will be publication of the monthly journal, *Animal Behaviour*, and the holding of scientific meetings.

Animal Behaviour will be published jointly by the society and the Association for the Study of Animal Behaviour, United Kingdom. With a print order of 3000, this journal is the major publication available in North America which emphasizes field research on animal behavior. Other psychological journals tend to stress laboratory research. *Animal Behaviour* became a joint North American–European venture in 1948 when the British and North American societies agreed to share the editorial duties. The journal has had two U.S. editors. David E. Davis (Pennsylvania State University) was the first editor; Lester R. Aronson (American Museum of Natural History) is the present editor.

The first regular meeting of the society will be held August 1965 at the University of Illinois, Urbana, with the American Institute of Biological Sciences (AIBS). ABS officials expect to hold two meetings each year—one with AIBS and one with the AAAS.

Membership is open to anyone interested in animal behavior. Annual dues are $8.

Officers for the new society are Edward B. Hale (Pennsylvania State University), president; H. E. Winn (University of Maryland), 1st vice president-elect; Martin W. Schein (Pennsylvania State University), 2nd vice president-elect; John A. King (Michigan State University), secretary; James C. Braddock (Michigan State University), treasurer; and E. M. Banks (University of Toronto), program officer. For further information, contact one of the following: Edward B. Hale, Pennsylvania State University, University Park, Pennsylvania; H. E. Winn, University of Maryland, College Park; or Martin Schein, Pennsylvania State University.

EDWARD B. HALE, MARTIN W. SCHEIN
H. E. WINN

MEETINGS

Forthcoming Events

February

26–27. American **Physical Soc.**, Norman, Okla. (R. G. Sachs, Argonne National Laboratory, Argonne, Ill. 60440)

27–15. Apr. **Commonwealth Mining and Metallurgical** Congr., Australasian Inst. Mining and Metallurgy, Australia and New Zealand. (AIMM, Osborne House, 299 Little Collins St., Melbourne, C.1, Victoria, Australia)

28–3. **Gas Turbine** Conf., American Soc. Mechanical Engineers, Washington, D.C. (D. J. Schneider, ASME, 345 E. 47 St., New York, N.Y. 10017)

28–5. **Analytical Chemistry and Applied Spectroscopy**, conf., Spectroscopy Soc. of Pittsburgh, Pittsburgh, Pa. (W. G. Fateley, Mellon Inst., 4400 Fifth Ave., Pittsburgh)

March

1–2. Systems for the **Intellectual Organization of Information**, seminar, Rutgers Univ., New Brunswick, N.J. (S. Artandi, Graduate School of Library Service, Rutgers Univ., New Brunswick)

1–4. **Unmanned Spacecraft**, Los Angeles, Calif. (R. D. DeLauer, TRW/Space Technology Laboratories, Norton Air Force Base, San Bernardino, Calif.)

1–5. National Council on the **Aging**, 14th annual, Washington, D.C. (NCA, 49 W. 45 St., New York, N.Y. 10036)

1–5. Society of **Plastics Engineers**, annual, Boston, Mass. (G. P. Fong, c/o Sweetheart Plastics Inc., Guildware Park, Wilmington, Mass.)

4–5. Physical Basis of **Radioisotope Applications**, Wantage, England. (C. G. Clayton, U.K. Atomic Energy Authority, Wantage Research Laboratory, Wantage)

4–6. Fundamental **Cancer Research**, 19th annual symp., Univ. of Texas, Houston. (D. N. Ward, Univ. of Texas Medical Center, Houston 77025)

4–6. Central **Surgical** Assoc., Milwaukee, Wis. (C. E. Lischer, 457 N. Kingshighway, St. Louis 8, Mo.)

5–6. **Congenital Malformations of the Central Nervous System**, intern. colloquium, Paris, France. (J. Chevreux, c/o Service de M. le Prof. Leon Michaux, Hôpital de la Salpetrière, Boulevard de l'Hôpital, Paris[13e])

5–7. American Assoc. of **Pathologists and Bacteriologists**, Philadelphia, Pa. (M. I. O'Connor, Williams and Wilkins Co., 428 E. Preston St., Baltimore, Md. 21202)

5–7. National **Wildlife** Federation, 29th annual, Washington, D.C. (T. L. Kimball, 1412 16th St., NW, Washington, D.C.)

7–10. International Acad. of **Pathology**, 54th annual, Philadelphia, Pa. (F. K. Mostofi, Armed Forces Inst. of Pathology, Washington, D.C.)

7–10. **Mineralogical** Assoc. of Canada, 10th annual, Toronto, Ontario. (J. A. Mandarino, Dept. of Mineralogy, Rolay Ontario Museum, 100 Queen's Park, Toronto 5).

8–9. **High Speed Testing**, intern. symp., Boston, Mass. (R. H. Supnik, Plas-Tech Equipment Corp., 4 Mercer Rd., Natick, Mass.)

8–10. **Calibration**, intern. conf., Leipzig, Germany. (Kammer der Technik, Ebertstr. 27, Berlin W.8)

8–10. **Marine Systems**, conf., American Inst. of Aeronautics and Astronautics/U.S. Navy, San Diego, Calif. (AIAA, 1290 Sixth Ave., New York, N.Y. 10019)

8–10. Society of **Toxicology**, annual, Williamsburg, Va. (C. S. Weil, Mellon Inst., 4400 Fifth Ave., Pittsburgh, Pa. 15213)

8–11. American College of **Surgeons**, clinical congr., Seattle, Washington. (S. P. Harbison, 55 E. Erie St., Chicago, Ill.)

8–12. American Soc. of **Civil Engineers**, Mobile, Ala. (W. H. Wisely, ASCE, 345 E. 47 St., New York, N.Y. 10017)

8–12. **Personnel Dosimetry** for Accidental High Level Exposure to External and Internal Radiation, symp., Vienna, Austria. (J. H. Kane, International Conferences Branch, Div. of Special Projects, U.S. Atomic Energy Commission, Washington, D.C. 20545)

9–10. **Arms Control**, first West Coast conf., Los Angeles, Calif. (R. D. DeLauer, TRW Space Technology Laboratories, Redondo Beach, Calif.)

9–11. **Wildlife Management** Inst., Las Vegas, Nev. (C. R. Gutermuth, 709 Wire Bldg., Washington, D.C.)

10–12. **Particle Accelerator**, conf., Washington, D.C. (R. S. Livingston, Oak Ridge Natl. Laboratory, P.O. Box X, Oak Ridge, Tenn.)

13. Experimental Basis for the Current Management of **Portal Hypertension**, Philadelphia, Pa. (B. Sigel, Woman's Medical College of Pennsylvania, 3300 Henry Ave., Philadelphia 19129)

13–18. **Proctology**, 17th annual teaching seminar, New Orleans, La. (A. J. Cantor, 147-41 Stanford Ave., Flushing, L.I., N.Y. 11355)

14–16. Society for the Study of **Development and Growth**, southeastern regional, Univ. of Georgia, Athens. (D. T. Lindsay, Dept. of Zoology, Univ. of Georgia, Athens 30601)

15–17. **Plant Protection**, 2nd intern. conf., Naples, Italy. (Intern. Anti-Parasitic Centre, Via Barberini, 86, Rome, Italy)

15–17. **Solar Energy** Soc., intern. symp., Phoenix, Ariz. (SES, Arizona State Univ., Tempe 85281)

17–19. **Instrumentation** in the Iron and Steel Industry, 15th natl. conf., Pittsburgh, Pa. (R. P. Trauterman, Allegheny-Ludlum Steel Corp. Research Center, Alabama Ave., Backenridge, Pa.)

17–20. **Medical Schools and Teaching Hospitals**: Curriculum, Programming and Planning, New York Academy of Sciences, New York, N.Y. (NYAS, 2 E. 63 St., New York 10021)

17–20. American **Orthopsychiatric** Assoc., New York, N.Y. (E. Harrison, 477 FDR Drive, New York, N.Y.)

18. American **Vacuum** Soc., midwestern section, Houston, Tex. (J. H. Kimzey, Manned Spacecraft Center, 2101 Webster-Seabrook Rd., Houston 77058)

18–19. **Zinc Metabolism**, symp., Detroit, Mich. (A. S. Prasad, School of Medicine, Wayne State Univ., Detroit 48207)

18–20. **Michigan Acad.** of Science, Arts, and Letters, Univ. of Michigan, Ann Arbor. (I. J. Cantrall, Museum of Zoology, Univ. of Michigan, Ann Arbor)

19–20. New York **Microscopical** Soc.,

biennial symp., New York, N.Y. (T. G. Rochow, American Cyanamid Co., Room 467A, Stamford, Conn. 06904)

19–20. British Assoc. of **Physical Medicine**, annual, London, England. (J. P. Mitchell, 21 St. John St., Manchester 3, England)

19–21. American Soc. of **Internal Medicine**, Chicago, Ill. (A. V. Whitehall, 3410 Geary Blvd., San Francisco, Calif.)

20. **Identification of Drugs and Poisons**, symp., Pharmaceutical Soc. of Great Britain, London. (PSGB, 17 Bloomsbury Sq., London, W.C.1)

22–25. **Thermophysical Properties**, 3rd symp., Purdue Univ., Lafayette, Ind. (S. Gratch, Ford Motor Co., P.O. Box 2053, Dearborn, Mich. 48121)

22–26. **Medical Film**, intern. congr., Paris, France. (Dr. Beauchesne, 22, rue Micheli-du-Crest, Geneva, Switzerland)

22–26. Institute of **Electrical and Electronics Engineers**, intern. convention, New York, N.Y. (E. L. Harder, IEEE, Box A, Lenox Hill Station, New York 10021)

22–26. American College of **Physicians**, Chicago, Ill. (E. C. Rosenow, Jr., ACP, 4200 Pine St., Philadelphia, Pa. 19104)

22–26. Physics and Chemistry of **Fission**, symp., Salzburg, Austria. (J. H. Kane, Intern. Conferences Branch, Div. of Special Projects, U.S. Atomic Energy Commission, Washington, D.C. 20545)

23–24. Progress in **Biochemistry and Therapeutics**, 2nd symp., New York, N.Y. (C. Neuberg Soc. for Intern. Scientific Relations, 600 Lafayette Ave., Brooklyn, N.Y. 11216)

23–25. **Asthma**, world conf., Eastbourne, England. (Secretary, Chest and Heart Assoc., Tavistock House North, Tavistock Sq., London, W.C.1, England)

24–26. Society of the **Plastics** Industry, 22nd conf., western section, Coronado, Calif. (SPI 611 S. Catalina, Los Angeles, Calif.)

24–26. National Federation of **Science Abstracting and Indexing Services**, Columbus, Ohio. (C. J. Wessel, Prevention of Deterioration Center, NAS–NRC, 2101 Constitution Ave., Washington, D.C.)

24–27. American **Physical** Soc., Kansas City, Mo. (R. G. Sachs, P.O. Box 344, Argonne, Ill. 60440)

24–27. Society for Research in **Child Development**, biennial, Minneapolis, Minn. (W. Hartup, Inst. for Child Development, Univ. of Minnesota, Minneapolis 55455)

25–26. Advances in **Tracer Methodology**, 10th symp., Zurich, Switzerland. (E. Landegren, New England Nuclear Corp., Ave. de Chailly 28 c, P.O. Box 31, Lausanne 12, Switzerland)

25–27. **Heart and Circulation in the Newborn and Infant**, Chicago, Ill. (D. E. Cassels, Chicago Heart Assoc., 22 W. Madison St., Chicago 60602)

25–27. Mid-Central States **Orthopaedic** Soc., 12th annual, Hot Springs, Ark. (Mrs. P. Lovan, 4101 Westport Lane, Wichita, Kan.)

26. **Marine Environment**, symp. and NDEA workshop, Fullerton, Calif. (M. D. Brown, Fullerton Junior College, Fullerton)

26–27. Association of **Industrial Medical Officers**, spring meeting, London, England. (Joint Secretariat, 47 Lincoln's Inn Fields, London W.C.2)

26–27. **Louisiana Acad.** of Sciences, Natchitoches. (S. M. Weathersby, Dept. of Zoology, Louisiana Polytechnic Inst., Ruston)

26–27. **Rural Health**, 18th natl. conf., Miami Beach, Fla. (B. L. Bible, 535 N. Dearborn St., Chicago, Ill. 60610)

26–2. **Rehabilitation**, natl. conf., Melbourne, Australia. (Intern. Soc. of Rehabilitation of the Disabled, 701 First Ave., New York, N.Y. 10017)

27–31. National **Science Teachers** Assoc., natl. convention, Denver, Colo. (NSTA, 1201 16th St., Washington, D.C. 20036)

27–3. **Developmental Biology**, U.S.–Japan Cooperative Science Program seminar, Tokyo, Japan. (Office of International Science Activities, National Science Foundation, 1951 Constitution Ave., NW, Washington, D.C.)

28. American College of **Apothecaries**, Inc., Detroit, Mich. (R. E. Abrams, Hamilton Court Hotel, 39th and Chestnut Sts., Philadelphia, Pa. 19104)

28–30. American Assoc. of **Colleges of Pharmacy**, Detroit, Mich. (C. W. Bliven, AACP, 1507 M St., NW, Washington, D.C. 20005)

28–30. **Experimental Dermatology**, 4th symp., Palermo, Italy. (A. Tosti, Intern. College of Experimental Dermatology, Ist Dermatologico dell'Universita, Via del Vespro 131, Palermo)

28–31. American Soc. of **Abdominal Surgeons**, Washington, D.C. (B. F. Alfano, 663 Main St., Melrose 76, Mass.)

28–31. Canadian Inst. of **Mining and Metallurgy**, annual, Toronto, Ontario. (E. G. Tapp, CIMM, 906-117 St. Catherine St., W., Montreal 2, Quebec)

28–1. International **Anesthesia Research** Soc., Washington, D.C. (A. W. Friend, 227 Wade Park Manor, Cleveland 6, Ohio)

28–2. American Soc. of **Hospital Pharmacists**, Detroit, Mich. (J. A. Oddis, 2215 Constitution Ave., NW, Washington, D.C.)

28–2. Society of **Motion Picture and Television Engineers**, 97th annual, Los Angeles, Calif. (R. J. Goldberg, Technicolor Corp., Research and Development Div., 2800 West Olive Ave., Burbank, Calif. 91505)

28–2. Chemical Aspects of **Electron Spin Resonance**, intern. conf., Cirencester, England. (D. H. Whiffen, Basic Physics Div., Natl. Physical Laboratory, Teddington, England)

28–3. American Soc. of **Photogrammetry**/American Congress on **Surveying and Mapping**, convention, Washington, D.C. (ASP, 44 Leesburg Pike, Falls Church, Va. 22044)

28–4. North American **Clinical Dermatologic** Soc., Las Vegas, Nev. (E. F. Finnerty, 177 E. 75 St., New York, N.Y. 10021)

29–31. American Assoc. for **Thoracic Surgery**, 45th annual, New Orleans, La. (Miss A. Hanvey, 7730 Carondelet Ave., St. Louis, Mo. 63105)

29–2. American Soc. of **Tool and Manufacturing Engineers**, annual conf., Cleveland, Ohio. (ASTM, 20501 Ford Rd., Dearborn, Mich. 48128)

29–30. **Great Lakes Research**, 8th conf., Ann Arbor, Mich. (J. L. Hough, Great Lakes Research Div., 1077 North Univ. Bldg., Ann Arbor, Mich.)

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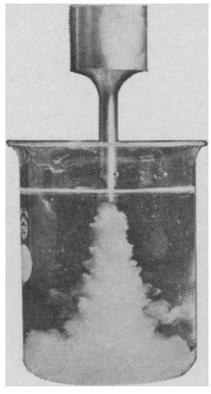

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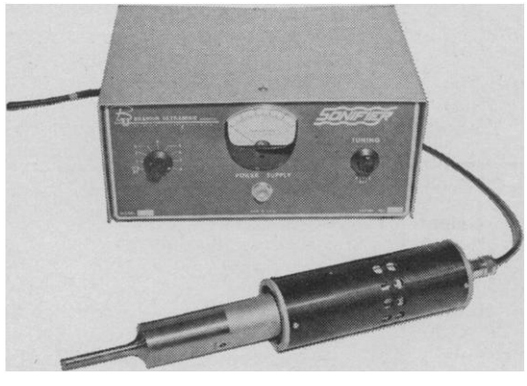

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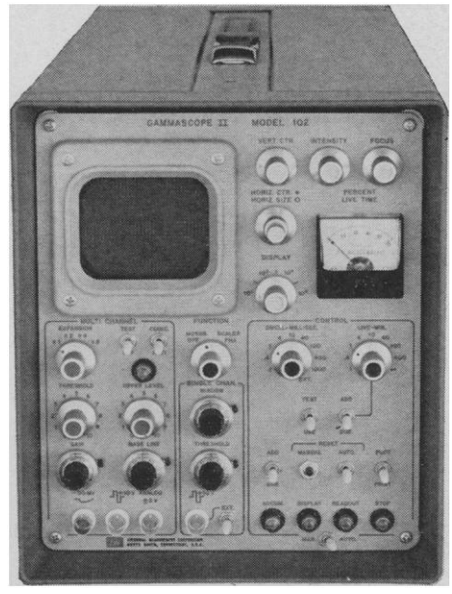

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NEW BOOKS

(Continued from page 857)

W. Sizer; and "A discussion of the training of applied microbiologists" by B. W. Koft and Wayne W. Umbreit.

Algal Cultures and Phytoplankton Ecology. G. E. Fogg. Univ. of Wisconsin Press, Madison, 1965. 140 pp. Illus. $5.50.

Annual Review of Entomology. vol. 10. Ray F. Smith and Thomas E. Mittler. Annual Reviews, Palo Alto, Calif., 1965. 433 pp. Illus. $8.50. Sixteen papers contributed by Reháček; W. C. Reeves; K. R. Norris; H. C. Coppel and D. M. Benjamin; W. Hennig; J. Illies; A. R. Gilby; W. H. Telfer; F. J. Oppenoorth; S. D. Beck; L. Bonnemaison; J. A. Downes; H. E. Welch; R. W. Stark; E. Munroe; and W. Chefurka.

Atlas of Electroencephalography. vol. 3, *Neurological and Psychiatric Disorders.* Frederic A. Gibbs and Erna L. Gibbs. Addison-Wesley, Reading, Mass., 1964. 554 pp. Illus. $75.

Biochemistry and Physiology of Protozoa. vol. 3. S. H. Hutner, Ed. Academic Press, New York, 1964. 632 pp. Illus. $18.50. Thirteen papers: "Environmentally induced growth oscillations in protozoa" by Otto H. Scherbaum and John B. Loeffer; "Protoplasmic movements and locomotion of protozoa" by Theodore L. Jahn and Eugene C. Bovee; "The locomotor apparatus of ciliates and flagellates: Relations between structure and function" by Dorothy R. Pitelka and Frank M. Child; "Nutrition and metabolism of ciliates" by G. G. Holz, Jr.; "Physiological genetics of the ciliates" by R. F. Kimball; "Phototaxis in protozoa" by Per Halldal; "Studies of cell heredity with *Chlamydomonas*" by Ruth Sager; "The plastid pigments of flagellates" by T. W. Goodwin; "Biochemistry of Acrasiales" by Barbara E. Wright; "The physiology of trichomonads" by Mary S. Shorb; "Nutrition and physiology of the Trypanosomatidae" by Helene N. Guttman and Franklin G. Wallace; "The chemotherapy of trypanosomiasis" by L. G. Goodwin; and "The chemotherapy of malaria" by I. M. Rollo.

Chemotherapy of Cancer. Proceedings of the international symposium (Lugano, Switzerland), 1964. Placidus A. Plattner, Ed. Elsevier, New York, 1964. 336 pp. Illus. $14. Thirty-two papers presented at the symposium organized by the Swiss Academy of Sciences.

Comprehensive Biochemistry. vol 12, *Enzymes: General Considerations.* Marcel Florkin and Elmer H. Stotz. Elsevier, New York, 1964. 316 pp. Illus. $15. Nine papers: "Introduction, historical, definitions, general concepts, isoenzymes" by Edwin C. Webb; "Equilibrium and thermodynamic considerations" by R. Wurmser and R. Banerjee; "Oxidation-reduction potentials" by R. Wurmser and R. Banerjee; "Enzyme kinetics (optimum *p*H, temperature, and activation energy)" by Edwin A. Dawes; "Quantitative aspects of enzymes and enzyme systems" by John M. Reiner; "Metal coordination and enzyme action" by Bert L. Vallee and Joseph E. Coleman; "Newer aspects of enzymatic stereospecificity" by H. Hirschmann; "Enzyme structure and function with particular reference

to bovine ribonuclease and chymotrypsin" by C. H. W. Hirs, and "Some aspects of enzyme theory" by I. B. Wilson.

Cytogenetics of Cells in Culture. R. J. C. Harris, Ed. Academic Press, New York, 1964. 325 pp. Illus. $13. Eighteen papers contributed by Georges Barski; Boris Ephrussi, Lawrence J. Scaletta, Morton A. Stenchever, and Michihiro C. Yoshida; C. E. Ford; Yuh H. Nakanishi and Sajiro Makino; Theodore T. Puck; George Yerganian, Ti Ho, and Sah Sook Cho; M. Fraccaro and J. Lindsten; Patricia A. Jacobs; J. Frederic and J. Corin-Frederic; H. Oishi and C. M. Pomerat; Leonard Hayflick and Paul S. Moorhead; J. Herbert Taylor; James German; Waclaw Szybalski, G. Ragni, and Naomi K. Cohn; Elton Stubblefield; A. Lima-de-Faria and J. Reitalu; Warren W. Nichols, Albert Levan, and Bengt A. Kihlman; and Frank H. Ruddle.

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