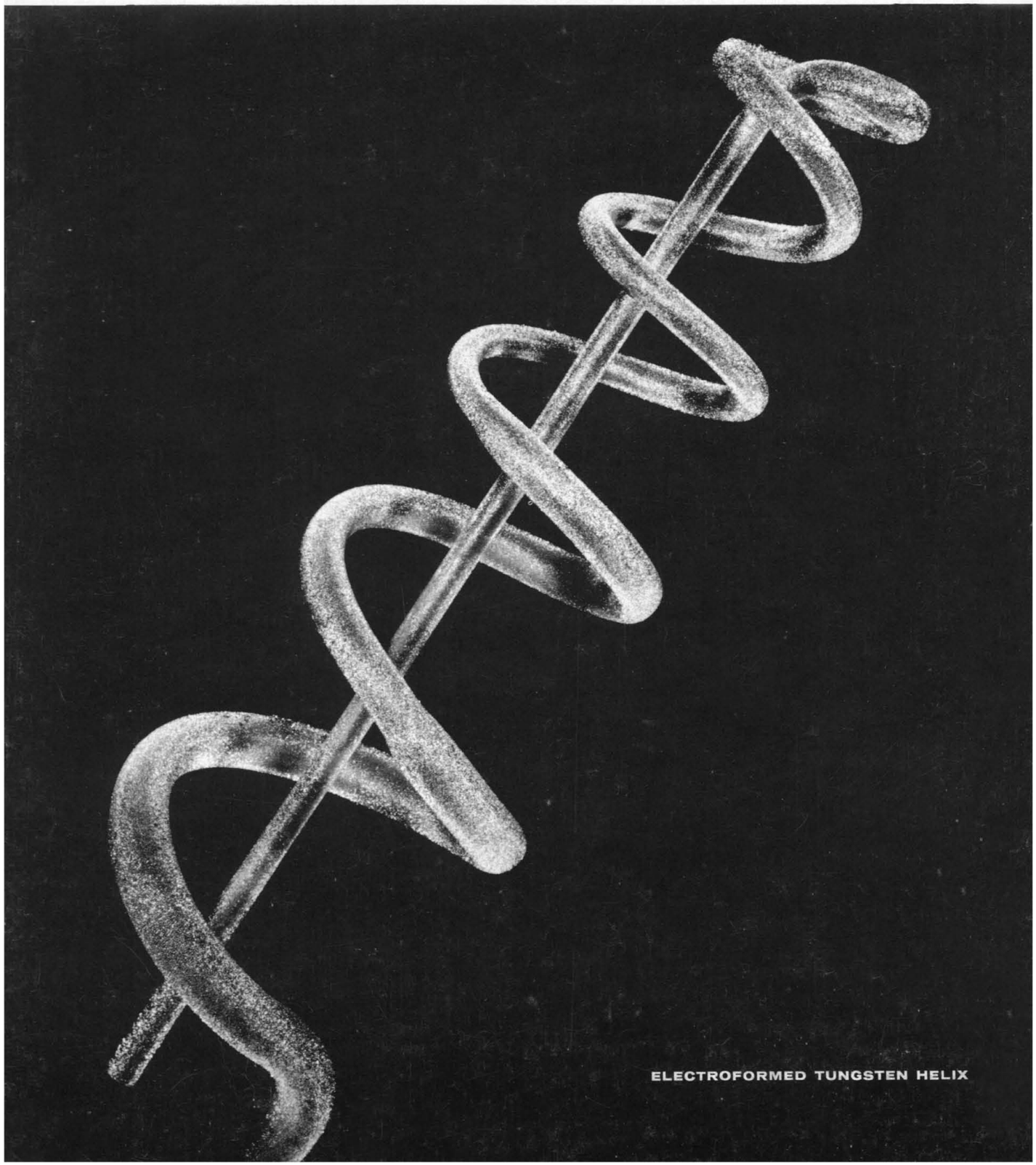
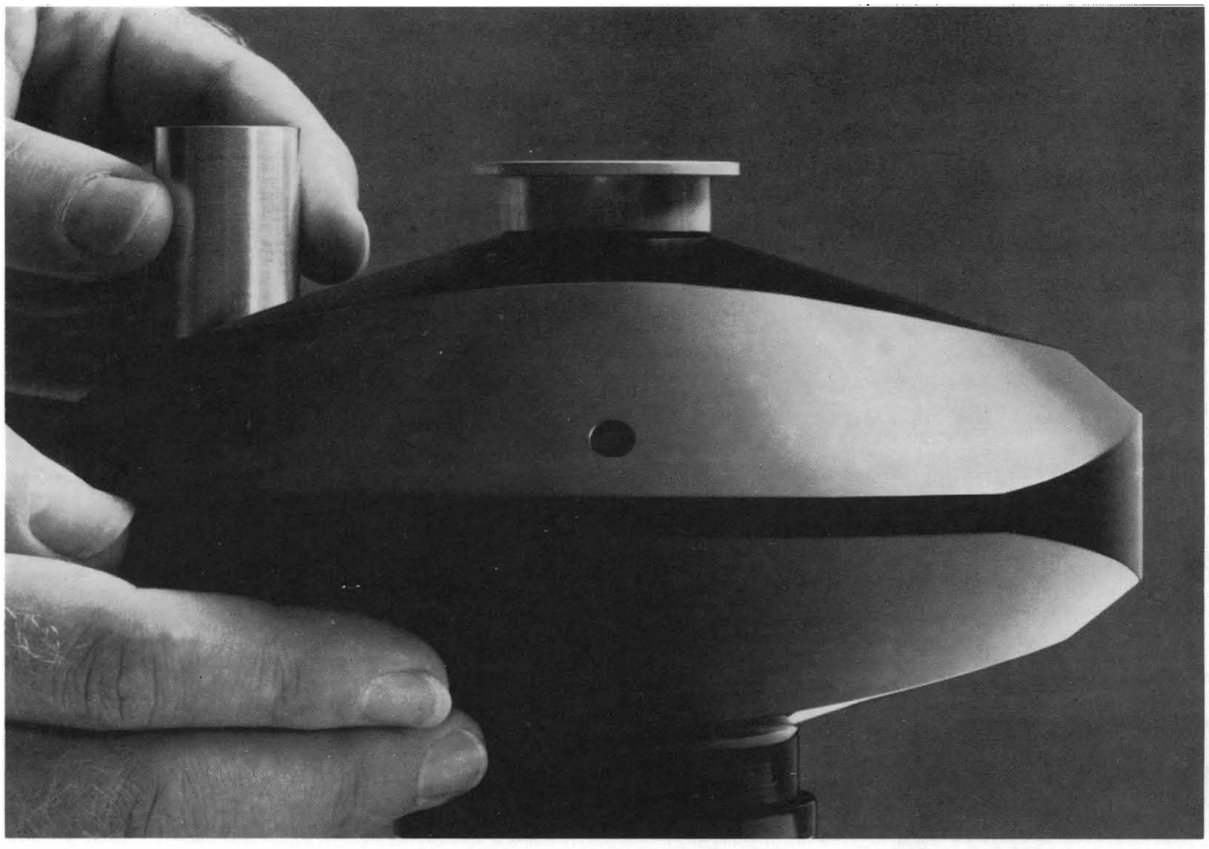
SCIENCE 23 September 1966
Vol. 153, No. 3743
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

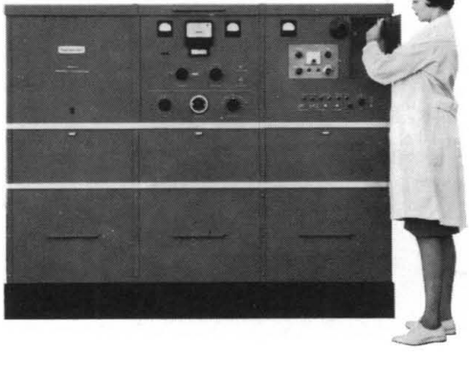


ELECTROFORMED TUNGSTEN HELIX



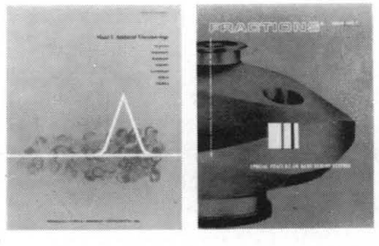
Large molecules and the Analytical Ultracentrifuge

How in touch are you with recent advances in that basic tool for making molecular measurements, the Model E Analytical Ultracentrifuge? Band sedimentation, the short column equilibrium technique, high temperature work with synthetic polymers, the use of computers, direct scanning and recording, higher forces at speeds to 68,000 rpm, lower forces at steady speeds down to 800 rpm for studies of extremely large molecules, new areas of investigation such as the correlation of molecular structure with function—all are steps forward that could very well enable the analytical ultracentrifuge to make a valuable contribution to your research.



Literature Available

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



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

Beckman® INSTRUMENTS, INC.
SPINCO DIVISION
PALO ALTO, CALIFORNIA • 94304

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

SAUNDERS BOOKS

. . . texts that arouse student interest and prompt independent study

New (2nd) Edition! ORR—
Vertebrate Biology

By ROBERT T. ORR, Ph.D., Associate Director, California Academy of Sciences, San Francisco, California.

This *New (2nd) Edition* offers a greatly expanded, thoroughly detailed description of American vertebrates and their ways of life. Anatomical arrangements and functional systems of representative vertebrates in each taxonomic group are vividly described . . . skeletal, muscular, digestive, respiratory, urogenital, sensory, endocrine. Special characteristics of each vertebrate type are fully detailed.

In this beautifully illustrated volume, you'll find explicit discussions covering the full life cycle of the vetrebrate. These include: migration—dispersal—sex recognition—competition—mortality—courtship—the territorial concept—etc. Interesting new topics include those on effects of isolation on speciation—the rate of evolution—interspecific competition—numerical taxonomy—invasion—echolocation—hermaphroditism—the tropical zones of the Americas.

This major yet careful revision enlarges the original volume by more than 100 pages. Over 80 new illustrations provide added clarity and effectiveness to this outstanding text.

About 510 pages • About 230 figures • About $9.00.
New (2nd) Edition—Just Ready!

New! FLOREY—
An Introduction to General & Comparative Animal Physiology

By ERNST FLOREY, Ph.D., University of Washington, Seattle, Washington.

Carefully held to the level of the beginning student, this new text covers the vital terms, concepts, and theories of modern animal physiology. Throughout, equal treatment is given to mammalian and non-mammalian physiology, and the comparative point of view is consistently maintained.

The student is given solid help in relating pertinent principles of general, biological, and physical chemistry to their physiological applications. Separate chapters on these subjects precede the physiologic topics for which they form an indispensable background. For example, chapters on oxidative metabolism, on enzymes, and on the solubility of gases precede the chapter on respiration.

A separate chapter is devoted to the biophysical aspects of bio-electricity and serves as a preparation for chapters on nerve and muscle physiology. New information is included on synaptic transmission, neurosecretion, active transport, and neuropharmacology. Sensory physiology is concisely covered in a single chapter.

713 pages • 481 figures • $10.00
New—Just Published!

W. B. SAUNDERS COMPANY West Washington Square, Philadelphia, Pennsylvania 19105

Please send and bill me:

☐ *Orr*—Vertebrate Biology ..... About $9.00

☐ *Florey*—General and Comparative Animal Physiology $10.00

SC 9/23/66

Name _____ Address _____ Zip _____

23 September 1966
Vol. 153, No. 3743

SCIENCE

SCIENCE is published weekly on Friday and on the fourth Tuesday in November by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C. Annual subscriptions $8.50; foreign postage, $1.50; Canadian postage, 75¢; single copies, 35¢, except **Guide to Scientific Instruments**, which is $1. School year subscriptions: 9 months, $7, 10 months, $7.50. Provide 4 weeks' notice for change of address, giving new and old address and zip numbers. Send a recent address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

Helix made by electroplating tungsten from a molten fluoride solution onto a substrate of tapered copper tubing and then dissolving the copper with nitric acid. The thickness of the wall of the central tube, in spite of the electrical shielding by the outer helix, demonstrates the exceptional "throwing power" of the process. Because tungsten is brittle, machining such an object would be extremely difficult. See page 1475. [S. Senderoff and G. W. Mellors, Union Carbide Corporation]

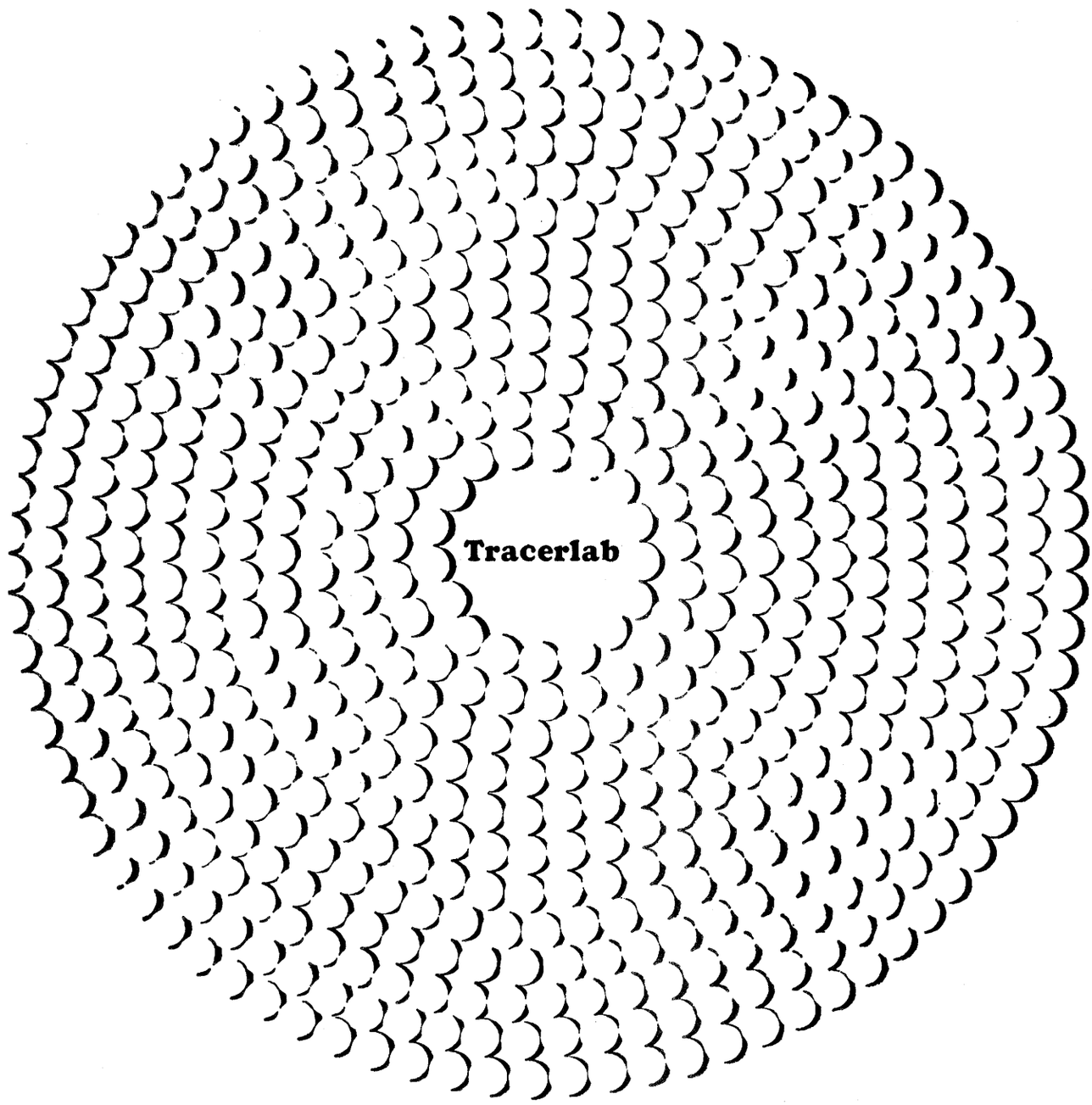
GAS OR STEAM

STERILIZERS

FOR SCIENCE AND INDUSTRY

VACUDYNE®

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



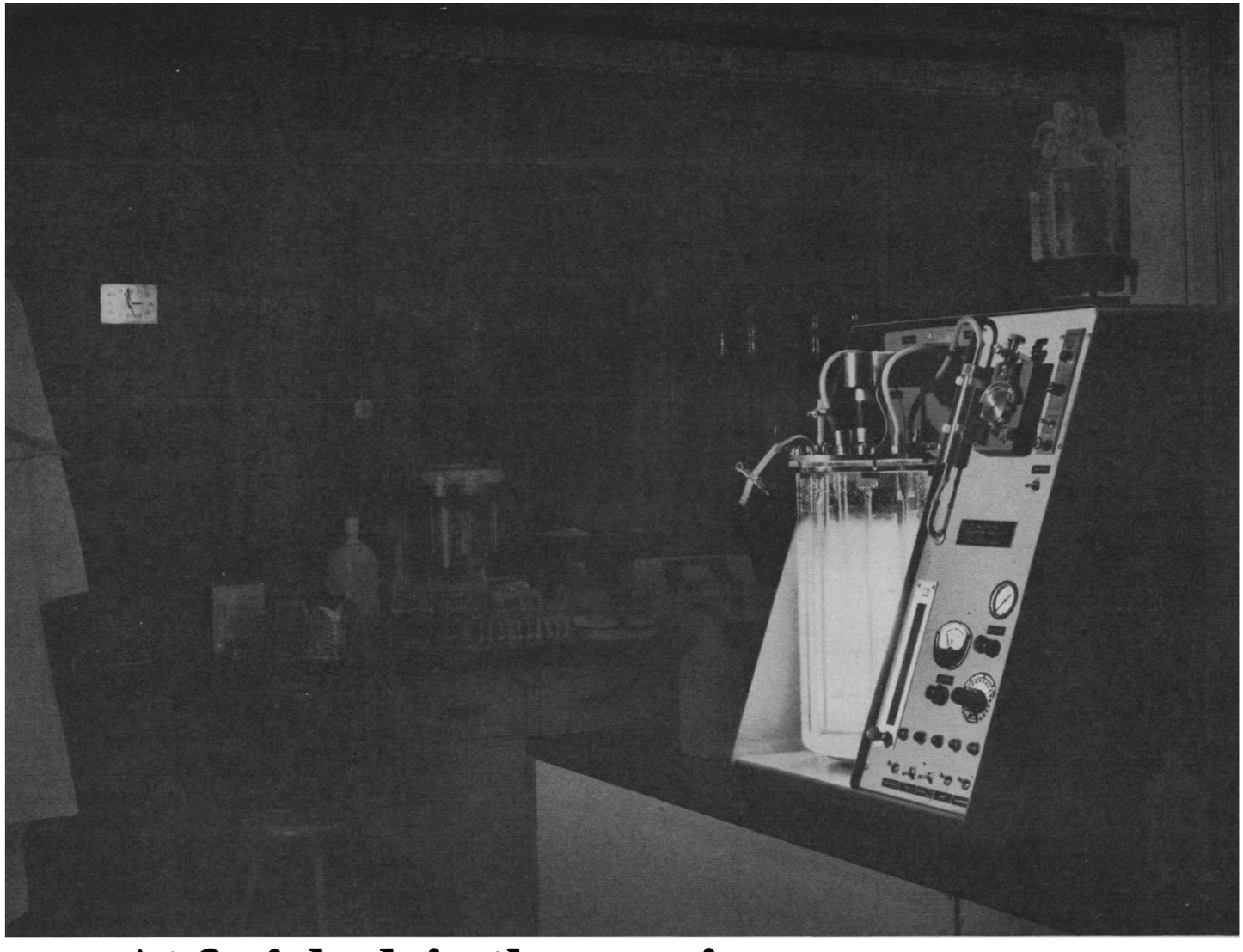
...your single source for so many radiochemicals each one guaranteed for purity

Same-day personal service... overnight delivery by fastest carrier • low prices throughout... dependable technical team always available. For catalog and custom-synthesized compounds, call Dr. John Leak COLLECT: TW 4-6600, area code 617.

LFE | TRACERLAB

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

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



At 3 o'clock in the morning who's minding the spores?

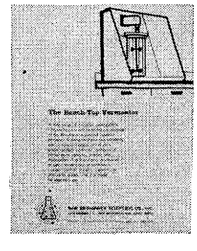
Nobody!
In the dead of night, this new MicroFerm fermentor is alive with productivity, working 24 hours a day, day in, day out, with no laboratory supervision. Simply set the precision controls for the desired growth conditions and this bench-top fermentor takes over. MicroFerm makes over 250 control decisions automatically every hour of the day and night, maintaining temperature and agitation with unusual accuracy and dependability.

Temperature is regulated electronically to within ±0.25°C by a Thermistor controller which allows cool or heated water to circulate on demand through hollow baffles inside the vessel. Rigid control of agitation is assured by a solid state proportional speed controller that adjusts impeller speed to compensate for changes in viscosity and line voltage. Foam problems are eliminated by a new electronic controller that senses and automatically adds defoaming agent as needed.

MicroFerm permits you to conduct realistic pilot studies in the quiet of your own laboratory. Simply connect the unit to water, air and electric outlets for immediate use around the clock.
Accommodates 4 interchangeable fermentors: 2 liters, 5 liters, 7½ liters or 14 liters. Easy to remove. Designed for repeated sterilization in a 20" autoclave.

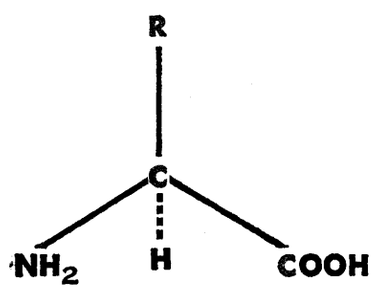
NBS

New Brunswick Scientific Co., Inc.
1130 Somerset Street, New Brunswick, N.J. 08903
West Coast Office: Box 5606, San Jose, California 95150



Look into MicroFerm. Write for Catalog MFS.

Radiochemical reference data. Clip and save.



Amino Acids Uniformly Labelled with Carbon-14

COMPOUND	LOW SPECIFIC ACTIVITY		HIGH SPECIFIC ACTIVITY		PRICES Prepaid air shipment included			
	Order No.	Range mc/mM	Order No.	Range mc/mM	50 μc	0.1 mc	0.5 mc	1.0 mc
L-Alanine-C14 (U)	CFB-7	5-10	CFB-62	75-110	$32	$55	$195	$375
L-Arginine-C14 (U) monohydrochloride	CFB-8	5-10	CFB-63	150-220	40	70	340	645
L-Asparagine-C14 (U)	CFB-45	4-40	CFB-95	80-120	56	112	560	1000
L-Aspartic-C14 (U) acid	CFB-9	5-10	CFB-64	100-150	32	55	195	375
L-Glutamic-C14 (U) acid	CFB-10	5-10	CFB-65	125-180	32	55	195	375
Glycine-C14 (U)	CFB-11	5-10	—	—	21	26	110	200
Glycine-C14 (U)	—	—	CFB-66	50-70	23	28	115	215
L-Leucine-C14 (U)	CFB-13	5-10	CFB-67	150-220	45	80	375	740
L-*iso*Leucine-C14 (U)	CFB-14	5-10	CFB-68	150-220	40	70	340	645
L-Lysine-C14 (U) monohydrochloride	CFB-15	5-10	CFB-69	150-220	45	80	375	740
L-Phenylalanine-C14 (U)	CFB-16	5-10	CFB-70	200-320	40	75	355	700
L-Proline-C14 (U)	CFB-17	5-10	CFB-71	125-180	40	75	355	700
L-Serine-C14 (U)	CFB-18	3-10	CFB-72	75-110	40	70	340	645
L-Threonine-C14 (U)	CFB-19	5-10	CFB-73	100-150	40	70	340	645
L-Tyrosine-C14 (U) hydrochloride	CFB-20	5-10	CFB-74	200-320	40	75	355	700
L-Valine-C14 (U)	CFB-21	5-10	CFB-75	125-180	40	70	340	645

Prices shown are F.O.B. destination. Quantity discounts offered on any one compound. Request prices on larger quantities.

Preparation

These amino acids are prepared from *Chlorella*, grown from a small inoculum on bicarbonate-C14 as the sole source of carbon, thus ensuring uniformity of labelling. After separation by ion-exchange chromatography, the acids are further purified by paper chromatography. Each batch, whatever its specific activity, is then crystallized to ensure the highest possible chemical purity and to eliminate D-forms of the acid.

Purity

The radiochemical purity of each batch is determined by reverse isotope dilution analysis, by chromatographic methods, and by paper electrophoresis at two pH levels. Collectively, these methods offer the greatest possible assurance of a true determination of radiochemical purity.

Packaging

Packaging is chosen to give maximum user convenience consistent with greatest stability. Low specific activity amino acids are supplied freeze-dried in an inert atmosphere. High specific activity amino acids are supplied in sterilized aqueous solutions containing 2% ethanol.

Availability

Quantities of C14 uniformly labelled amino acids are normally in stock. Orders received at the Radiochemical Division by 3:30 PM are air-shipped the same day. Data sheets on current batches will be sent on request.

For prices on quantities other than those listed and for technical consultation with one of our radiochemists, please use our direct-line telephone number.

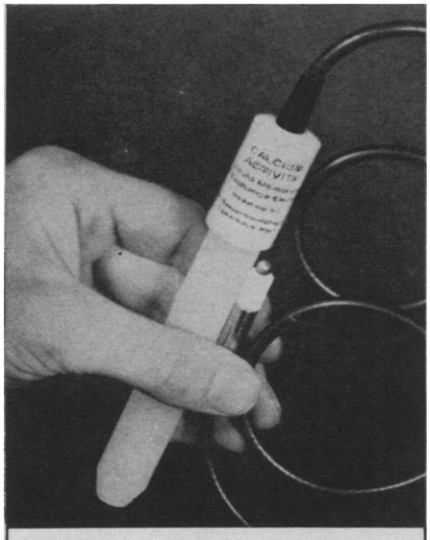
NUC:G-6-259

Direct Telephone Line
312 296-1055
Call Collect

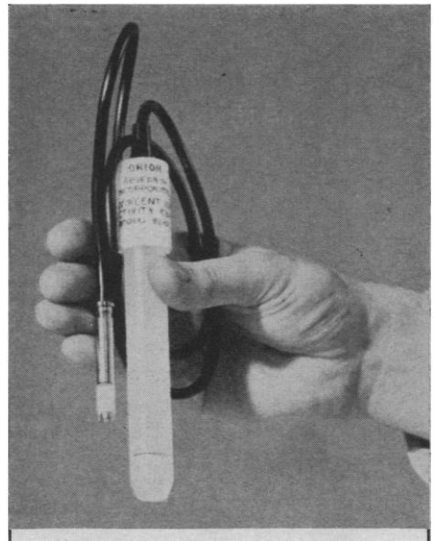
NUCLEAR-CHICAGO CORPORATION
349 East Howard Avenue
Des Plaines, Illinois 60018 U.S.A.
Donker Curtiusstraat 7, Amsterdam W.

NOW... DIRECT, RAPID, *CONTINUOUS* MEASUREMENT OF ION ACTIVITY

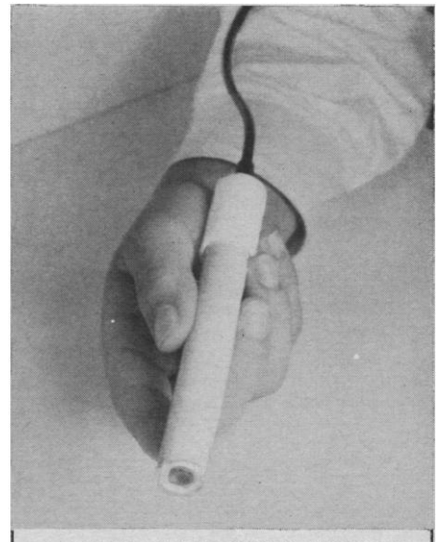
...with any expanded scale pH meter



ORION CALCIUM ACTIVITY ELECTRODE ... for the direct measurement of calcium ion activity.



ORION DIVALENT ION ELECTRODE ... a fast, direct method for measurement of water hardness.



ORION FLUORIDE ACTIVITY ELECTRODE ... for the direct, rapid measurement of fluoride ion activity.

Orion electrodes operate on a new principle of electro-chemical sensing. Potentials are developed across a membrane containing liquid ion exchangers, in the case of the Calcium Activity Electrode and Divalent Ion Electrode; across a synthetic rare-earth doped single crystal for the Fluoride Activity Electrode. Measurement is direct. Response time is rapid. Noise and drift are as low or lower than that of conventional pH electrodes. All three new electrodes are for use in aqueous solutions and are designed to be used with any modern expanded scale pH meter. Being made of fluorocarbon plastic, they're unbreakable, corrosion-resistant. Ask us for complete information.

CONDENSED SPECIFICATIONS AND PRICES

Catalog No.	Electrode	Concentration Range	pH Range	Temperature Range	Electrical Resistance	Price
H-5500X	Calcium Activity	From saturated calcium solutions to 10^{-5} moles/liter	5.5 to 11	0 to 50°C	25 megohms at 25°C	$145.00 per kit*
H-5505-2X	Divalent Ion	From saturated divalent ion solutions to 10^{-5} moles/liter	5 to 11	0 to 50°C	25 megohms at 25°C	$145.00 per kit*
H-5510X	Fluoride Activity	From above 10^{0} down to 10^{-6} moles/liter	1 to 8	−5 to 100°C	25 megohms at 25°C	$160.00

*Kit includes a complete electrode with 30" lead, one vial of ion exchange solution, one vial internal reference solution, two filling syringes, box of 20 membranes, pair of tweezers, set of "O" rings, one micro sample dish, instruction manual, carrying case. Users of the Calcium Ion Electrode can convert to divalent ion measurements by purchasing a replacement kit at $40.00, and vice-versa.

SCIENTIFIC GLASS APPARATUS CO. INC
BLOOMFIELD, NEW JERSEY

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

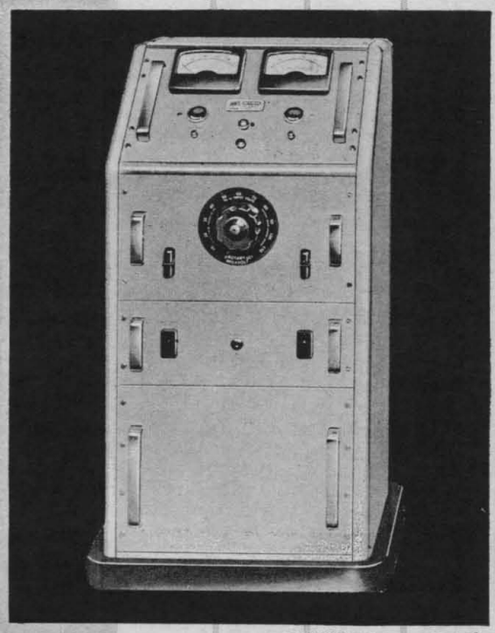
Branches: Boston 16 Mass. · Danbury Conn. · Elk Grove Village Ill. · Fullerton Calif. · Philadelphia 2 Penna. · Silver Spring Md. · Syracuse 2 N. Y.

New and Highly Versatile!

High Voltage Electrophoresis Apparatus

a COLAB *product*

High Voltage Electrophoresis Apparatus



10,000V Power Supply

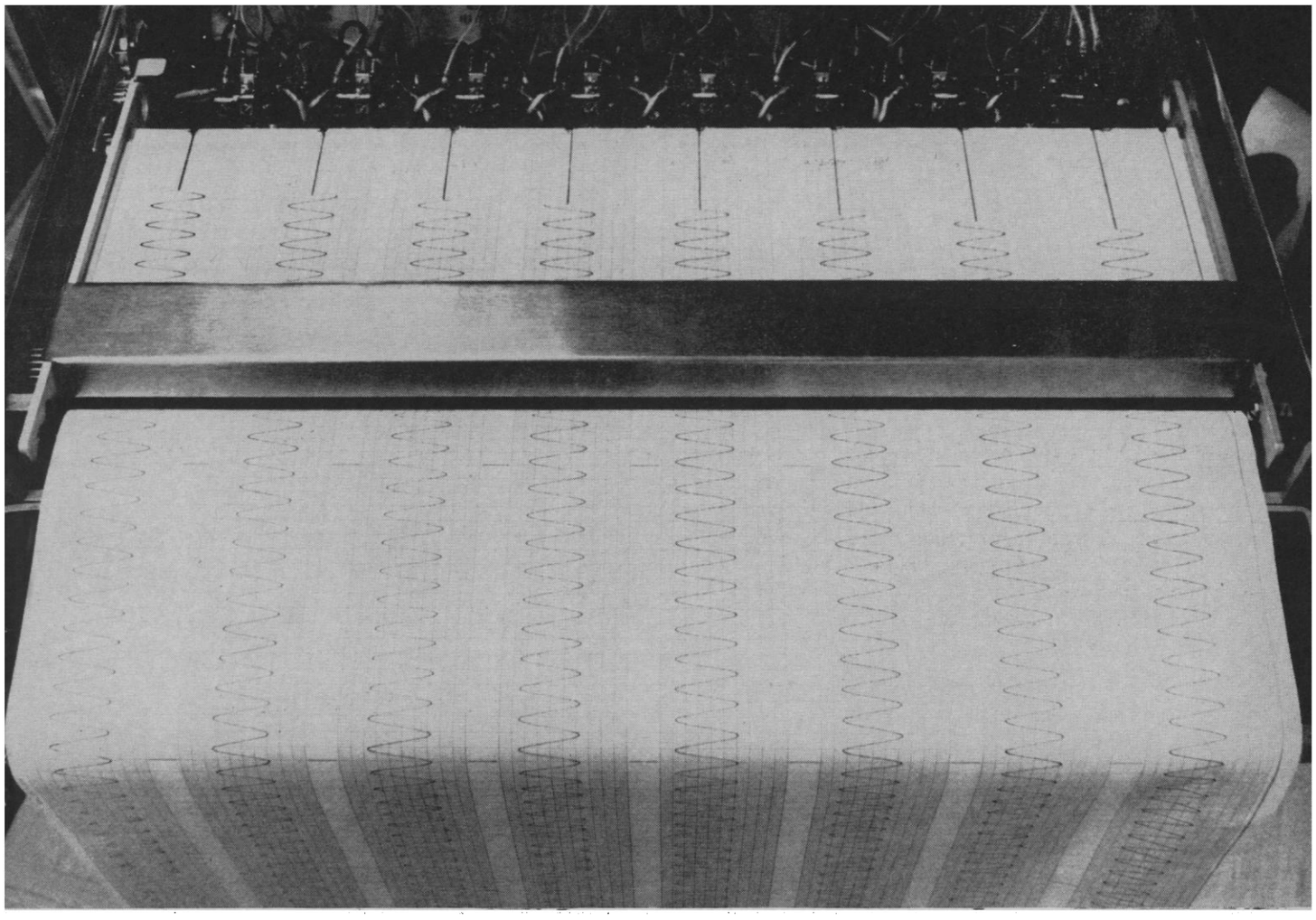
DESIGNED AS MUCH FOR SAFETY AS FOR PERFORMANCE
INSTALLED BY OUR TECHNICIANS

Literature upon Request

COLAB LABORATORIES, Inc.

CHICAGO HEIGHTS, ILLINOIS, U.S.A.

In Canada, order from:
Consolidated Laboratories (Canada) Ltd.
66 Milvan Drive, Weston, Ontario

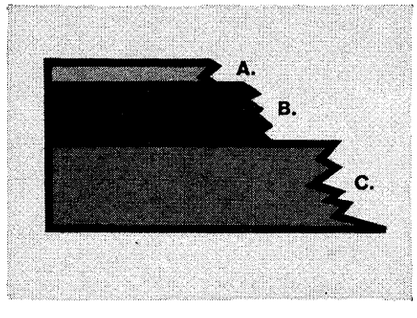


A few lines worth repeating...

Graphic Controls' thermal recording oscillograph charts produce distinct, black, clearly legible trace lines everytime.

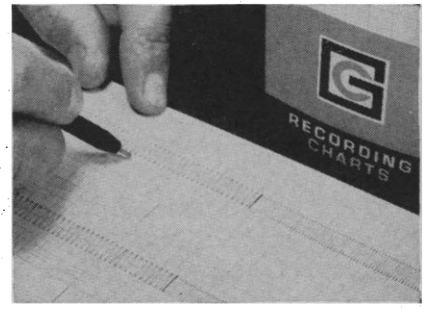
The reason is the unique construction of our paper. We start with a specially processed, high-density undercoating that provides the blackest possible trace. To this we add an unusually sensitive, completely compatible surface coating that lets the stylus glide evenly and smoothly. Many critical areas that are blurred or indistinct on other papers become clear and precise with GC's oscillograph charts. Even the most complex functions and inputs are recorded easily.

Because the surface coating is applied by a new process, there's no variance in thickness from edge-to-edge. The caliper of the paper is constant. Creep is eliminated and uniform paper flow is assured. And at the same cost as the paper you are now using.



A. Thermal-reactant coating
B. Contrast undercoat
C. Substrate

In addition, GC's thermal recording charts are water resistant, durable, yet extremely lightweight. Their consistent performance has been proved in major aerospace, industrial, and scientific research applications.



Check the performance of GC's charts for yourself... and compare them with your present papers. For complete information, contact:

RECORDING CHART DIVISION
GRAPHIC CONTROLS CORPORATION
189 VAN RENSSELAER STREET, BUFFALO, NEW YORK 14210

This is a system. Not to be confused with a camera.

"The system" does what cameras never dreamed of. Because "the system" is just that. A system. A unique and complete system of interchangeable components that gives you greater precision, greater versatility than anything called "camera".

Hasselblad 500 C with 150 mm lens, focusing handle, light meter knob.

Take interchangeable lenses, for instance. "The system" has seven. 50, 80, 120, 120s, 150, 250, and 500 mm. All Zeiss. All with Synchro-Compur shutter, automatic and manual diaphragm and coupled EVS system. All with resolving powers that permit greater enlargements than any other lenses made.

Eye-level pentaprism (left), magnifying hood (right.)

And take film backs. Ever see a "camera" that lets you switch from black and white to color mid-roll? We think not. But that's "the system" for you. A choice of 4 separate and interchangeable magazines. 3 for roll film. Each in a different format. 1 for cut film. And viewfinders. "Cameras" have them, right? One. "The system"—five. Eye-level prisms, sports viewfinders, magnifying hoods—the works. And sunshades. And filters. And proxars. And extension tubes. Exposure meters. Microscope adaptors. You name it.

Now you might ask "why the system?" Why an interchangeable everything? We did. We asked Timothy Galfas. His answer: "Versatility. 'The system' lets me do what I want, when I want. I don't find myself wishing for something extra. Or scraping to make do. I know that it will be optically right. You might say that 'the system' is versatile enough to act as an extension of myself. I can't ask for more than that."

Left to right: Zeiss 150 mm; 250 mm; 80 mm; and film magazine.

Now you know what we mean by "the system". And you know why we cringe when people confuse us with our more limited look-alikes. Let there be no confusion. "Cameras" take pictures, "the system" takes pictures, the resemblance stops there. Write for literature to your dealer or to Paillard Incorporated, 1900 Lower Road, Linden, N. J.

Timothy Galfas, noted New York editorial and fashion photographer, with "the system."

HASSELBLAD
PART OF THE MANNED SPACE PROGRAM

Interchangeable, plug-in modules provide for future expansion...defy obsolescence

Long, useful life of an instrument depends on how up-to-date its capabilities remain as time accumulates. The entirely-new EMU-4 instrument anticipates yet-unimagined electronic innovations by including internal space and facilities to accept these ideas. These facilities are *modularized* electronics: functional grouping of the various circuits, packaged in plug-in modules. As the new ideas come to light, they'll be packaged in compatible modules. (Some 40 per cent of the module space within the instrument is reserved for future updating or expansion of the electronics.)

Modular construction is exclusive with the EMU-4 instrument and virtually all of the electronics are transistorized... another innovation in electron microscopes.

Transistorization and modular construction are but two of many innovations that are "standard" for the EMU-4 Microscope: an automatically-sequenced column-pumpdown facility; an exclusive selected-area-diffraction feature; a heated objective aperture that rejects contamination, and others.

For more information, write RCA Scientific Instruments, Building 15-5, Camden, New Jersey 08102. In Canada: RCA Victor Company Ltd., Montreal.

Nationwide service available through RCA Service Company. Offices in major cities.

The Most Trusted Name in Electronics

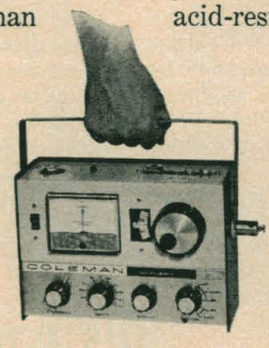
New solid-state pH meters. The only meters you can buy today that will still be guaranteed in 1968.

You'll get the industry's first two-year guarantee with your new solid-state Coleman pH meter.

You also get a choice of three attractive new models. Each is 100% solid state. We've simplified the circuitry and eliminated many traditional limitations in design to achieve a better pH meter. We think a better instrument is worth a better guarantee.

More important is what these new Coleman pH/millivolt meters will *do*.

Model 39 above, shows many of the new Coleman features. It operates without warm-up and provides drift-free readings accurate to ± 0.03 pH. You read from a wide-scale taut-suspension meter with mirrored backing. The tapered rear panel is accessible from the front, and has a new kind of "pop-out" electrode jack for fast electrode changes. All this in a new, acid-resistant case.



Portable Model 37A

provides ± 0.005 pH precision. This is the only precision portable pH meter that operates either from an AC line *or* from a rechargeable battery. You can run it for 40 hours between charges. Model 37A weighs just 8½ lbs., needs only 12″ of working space and stores in a drawer (or in its own optional carrying case).

Including—an expanded scale model that presents 1.0 pH across the full width of the meter.

An expanded-scale meter that makes sense. That's the new Coleman Model 38 above.

This meter provides a 1.0 full-scale expansion in any desired 1.0 pH range. For example, when you turn the scale selector to the digit 5, the 5-6 pH range is expanded across the full 7″ meter width. No calculations required. You read directly with ± 0.005 pH precision.

Model 38 makes sense in a lot of other ways, too. You can standardize at one point and make accurate expanded-scale readings in other ranges *without further buffering*. The more complex your pH work gets, the more time this instrument will save.

SEND FOR OUR NEW pH CATALOG SB-289. Precision pH . . . millivolt measurement . . . portable meters . . . solid state . . . expanded scale readings . . . automatic titrations . . . buffers . . . electrodes and accessories . . . for everything from routine control to research applications.

Now one electrode does the work of three.

New Coleman Tri-Purpose Electrodes do general-purpose, high-alkaline and high temperature work. One electrode measures from 0 to 14 pH, at temperatures from 0 to 100° C.

And remember that Coleman Reference Electrodes have money-saving replaceable reservoirs. Save up to $12 on the replacement cost; when you break a reservoir, you need not replace the entire electrode.

COLEMAN

COLEMAN INSTRUMENTS CORPORATION

MAYWOOD, ILLINOIS 60153

A Subsidiary of The Perkin-Elmer Corporation

ANALOG MONOLOGUE

On Means for Modelling, Measuring, Manipulating, & Much Else

INTENTIONALLY-NONLINEAR ELECTRONIC CIRCUITS

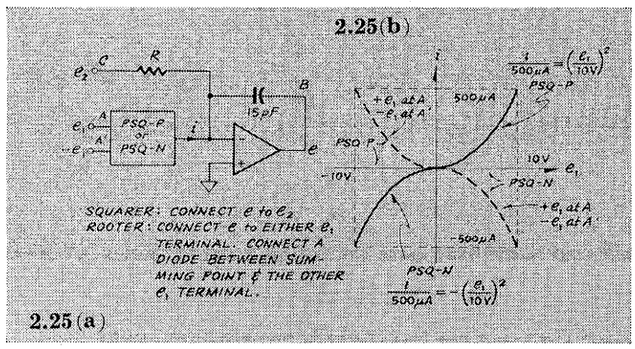
Imagine, for a moment, that your mathematical training had ended somewhere in the first year of Algebra, before you had mastered anything more complicated than a first-order linear equation. Imagine also that you had no knowledge of trigonometry, logarithms, or exponentials. Would such mathematical innocence hamper your present work?

Probably it would — unless your role is supervisory, speculative, or purely empirical. And even then, would you be able to discuss and evaluate the work of others, without a grasp of the everyday mathematical language in which they thought, wrote, and spoke? Of course not.

So it is with electronic measurement and data manipulation . . . for what is measurement, but a form of understanding? (. . . to paraphrase Lord Kelvin.) If the circuits one uses are limited to the handful that are linear in response (useful and powerful as they are), the range of measurement and data processing one can perform with them is correspondingly limited. Fortunately, we need not accept such a crippling restriction; hundreds of practical nonlinear circuits already exist, having been devised and perfected for use in the Analog Computing realm.

The kind of nonlinearity we mean is a deliberate, precisely-controlled relationship in a circuit — for example, a logarithmic input/output response — and *not* the unintentional, unavoidable, and undesired deviation of a nominally-linear circuit from perfect linearity . . . an imperfection to be avoided or minimized by careful design. Useful nonlinearity may be as natural to a circuit as is a linear response, and $y = A\,(x + B)^2$ may be reproduced with almost as great fidelity as $y = A\,(x + B)$.

The circuit below, one of more than 200 in the Philbrick *Applications Manual*, shows how the function $A\,x^2$ may be embodied, using an Operational Amplifier and a Quadratic Transconductor. It also indicates the almost trivial circuit change required for square root computations.



Nonlinear circuits are neither as simple conceptually nor as economical as linear adders or voltage-to-current transducers — but, thanks to the creative efforts of workers in many fields, *they are just as easy to use.* Standard hardware, in the form of nonlinear feedback-network packages, is available for the generation of almost any conventional nonlinear higher-order response, whether or not it can be described by a simple equation.

Table 1 indicates (but by no means covers) the range and variety of useful nonlinear functions and operations that may be constructed with standard Philbrick Amplifiers and Transconductors.

Exponential and Root Functions
Multiplication and Division
Linearization of Transducer Outputs
Trigonometric Functions
Coordinate Transformations
Vector Resolution and Composition
Logarithmic Compression and Expansion
True RMS Computation

Table 1

Table 2 lists the most popular of our Transconductors.

(P)PL1	Dual Logarithmic Transconductor (diode or transdiode)
(P)PL2	Quadruple Logarithmic Transconductor (transdiode)
(P)PL3	Quadruple Logarithmic Transconductor (diode)
PPL4	Logarithmic Transconductor temperature compensated
SPL4	Logarithmic Transconductor temperature compensated (built-in control)
SPL4A	Logarithmic Transconductor — temperature compensated (built-in control and amplifier)
SPLR	Log-Ratio Transconductor
SPLRA	Log-Ratio Transconductor (built-in amplifier)
SPLOG	Logarithmic Transconductor
PSQ	Quadratic Transconductor
SPSIN	Sinusoidal Transconductor
SPCOS	Sinusoidal Transconductor
SPFX	Arbitrary Function Fitter (adjustable)

Note: All standard designs, except (P)PL3 are available in either negative or positive polarity.

Table 2

Perhaps this space has been barely sufficient to communicate to you the power of nonlinear instrument circuits. If so, it only serves to underscore our underlying thesis — that the uses of electronic analog technology deserve far greater exposition, and hence appreciation, than they now enjoy . . . despite their many conquests.

You can start today to put more mathematical versatility into your measurements and data processing. Send for our free literature package MBA 2. Better (and faster) yet — call your nearest Philbrick Field Engineer. He'll give you the straight story on nonlinearity. Or write to Philbrick Researches, Inc., 25-S Allied Drive at Route 128, Dedham, Massachusetts. Phone (617) 329-1600.

**A Transconductor is an active or passive network of which the short-circuit output current is a specific, accurately known, often non-linear function of the input voltage.*

PHILBRICK

AUTOMATIC PRE-WEIGHING rah! rah! rah!

A digital student balance with automatic pre-weighing system for $550.

Something for both chemistry student and instructors to cheer about (whether they be at Harvard, the State University, Municipal Junior College, or Central High School.) The most advanced analytical weighing technology at a cost consistent with your department budget.

Sartorius Model 2743 is the only all digital student balance with automatic pre-weighing—the fastest, simplest ever developed. You get coarse weight (to the nearest gram) instantly without time-consuming trial-and-error dialing. Up to 80% faster than conventional single pan balances, any weighing can be completed in less than 15 seconds.

All Sartorius Series 2700 Student Balances offer important features of the latest research instruments: 1000 mg optical range; table-level controls; unobstructed weighing chamber without pan-arrest pin (pan dampened from brake above).

For further information, write to

sartorius student balance model 2743

Division of Brinkmann Instruments, Cantiague Road, Westbury, L. I., New York 11590

September, 1966

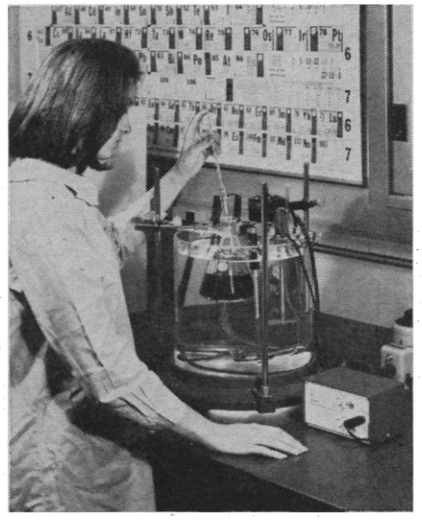
FISHER PRODUCT REPORT

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

FOR WATER BATHS WITH TEMPERATURE CONTROL YOU CAN COUNT ON... AND FOR INEXPENSIVE, DO-IT-YOURSELF NUMBERS, CHECK FISHER RIGHT AWAY.

FISHER ISOTEMP® BATH

Temperature within a 10-gallon tank is electronically controlled and held to ±0.005° C when water is the medium. With other media, you can have controlled temperatures as high as 107° C or as low as −5° C (with an auxiliary cooling coil). You set the temperature you want with three controls. Once you have the exact setting, you can reproduce the temperature day after day. This reproducibility and close control make the Isotemp bath particularly suited to measuring temperature-sensitive properties, like viscosity and specific gravity, and calibrating thermoregulators and thermometers. The entire bath area is free and clear, because heaters, stirrers and control mechanisms are housed in a central column. The Fisher Isotemp water bath costs $1200, and our free brochure can help you decide to take the plunge.
(a) ☐

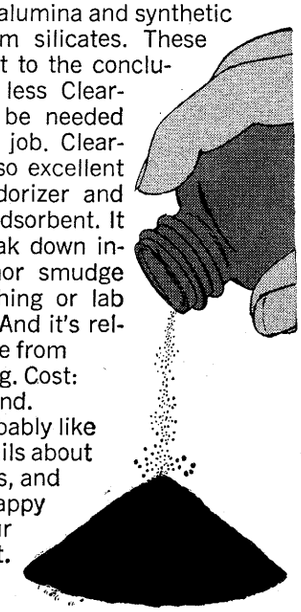


FISHER UNITIZED BATHS

When you're less concerned about very close control, Fisher *Unitized* baths are the means to low-cost baths suitable for many uses. You buy only the standard components that will give you the capacity and control you need. There's a cast-iron base, with sockets for three support rods; it accepts three sizes of Pyrex® glass bath jar. There are four sizes of immersion heater, three sizes of cooling coil, four types of thermoregulators, a solid-state controller, a selection of stirrers and Castaloy®-R clamps, and a fluorescent illuminator. Look up the complete listing in your Fisher apparatus catalog. If you haven't one, make your mark, and we'll reserve a copy of the new edition for you.
(b) ☐

USE LESS FISHER CLEARSORB™ TO DECOLORIZE MORE EFFECTIVELY, MUCH FASTER.

New Clearsorb—fine aluminum oxide particles with an outer layer of vegetable charcoal—combines a high absorptive and adsorptive capacity with a high eluate flow rate. Tests at our Fair Lawn chemical plant prove that when it comes to decolorizing effectiveness *and* speed, Clearsorb beats charcoal, alumina and synthetic magnesium silicates. These tests point to the conclusion that less Clearsorb will be needed to do the job. Clearsorb is also excellent as a deodorizer and as a gas adsorbent. It won't break down into dust nor smudge skin, clothing or lab surfaces. And it's relatively free from channeling. Cost: $12 a pound. You'd probably like more details about those tests, and we'd be happy to send our data sheet.
(c) ☐



PLEASE LET US KNOW

what additional information you'd like. Indicate your areas of interest, and then mail this page, along with your name and address, to Fisher Scientific Co., 139 Fisher Building, Pittsburgh, Pa. 15219.

F-570

FISHER SCIENTIFIC CO.

Instruments, Apparatus, Furniture and Chemicals for Laboratories

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

there are many laboratory animal cages for sale, but...

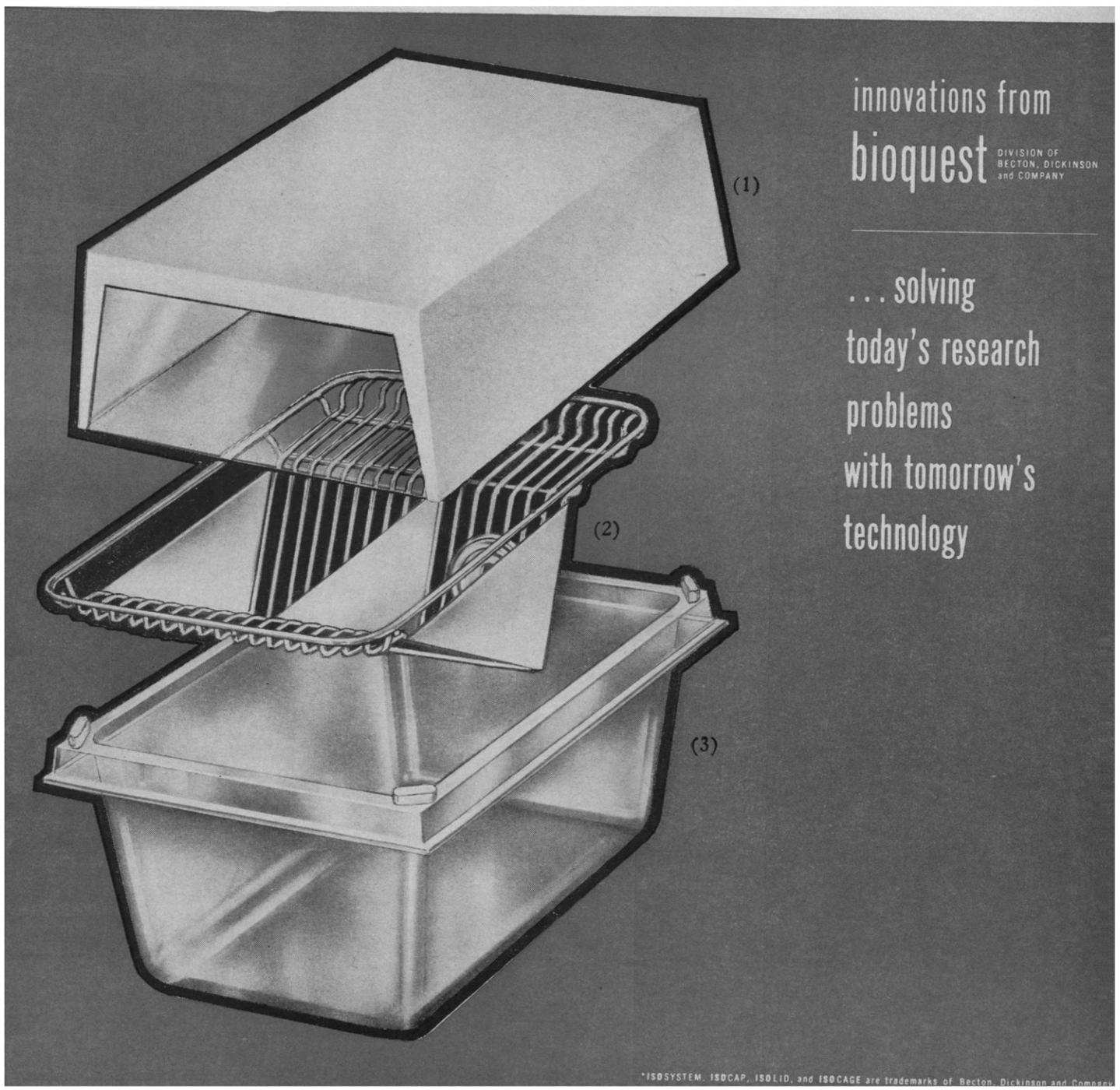
ONLY ONE ISOSYSTEM™...

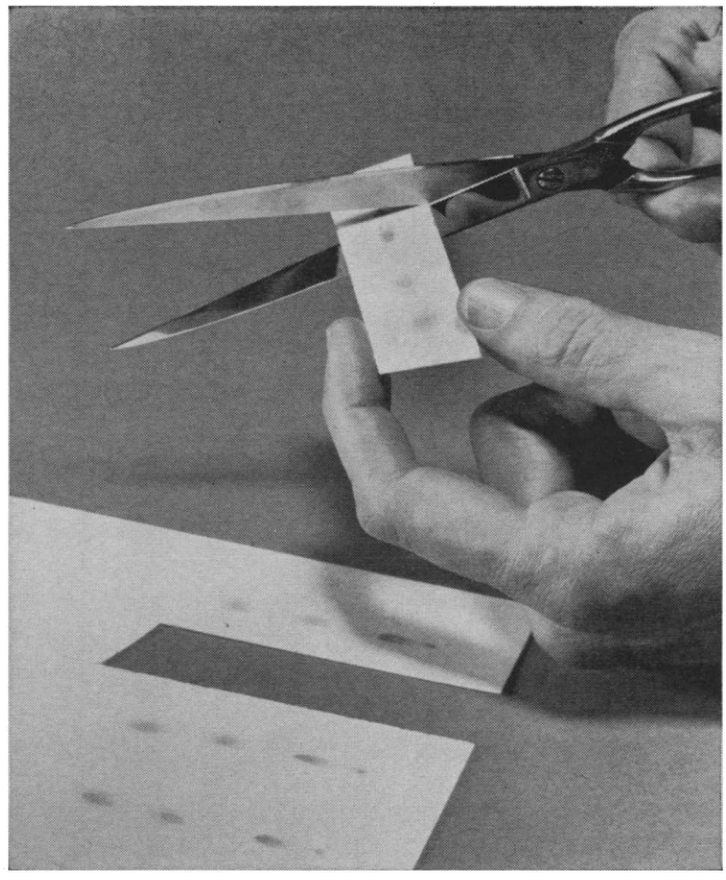
If you're looking for a way to reduce cross-contamination and safeguard experiments, now is the time to try the versatile new **ISO**SYSTEM, animal housing system engineered by Bioquest. **ISO**SYSTEM is the only one ready-made to control the spread of airborne infections. And it is compact and easy to use. Overall dimensions with filter cap in place are only 12¾ x 8 x 8 inches.

This new compact **ISO**SYSTEM coordinates: (1) **ISO**CAP*, the disposable efficient filter cap, a fibreglass-plastic web, with clear vinyl end windows; (2) made-to-measure **ISO**LID*, laboratory cage lid of stainless steel or chrome plated with divider separating food and water bottle (lids nest for storage); and (3) **ISO**CAGE*, featuring the narrow molded flange for snug fit of component systems—in clear polycarbonate, opaque polypropylene or clear styrene acrylonitrile (SAN)—design permits nesting 8 cages to one foot, twice the usual number of plastic cages.

Write or call us for full details: LAB CAGES, INC.
126 John St., Hackensack, N. J. 07602 201-487-6266

lab cages, inc.
SUBSIDIARY OF BECTON, DICKINSON and COMPANY





Scissors—the sharp-cutting new tool of separations chemistry

(and we don't even make scissors)

W. H. Curtin & Company
Atlanta, Ga., Dallas, Tex.
Houston, Tex., Jacksonville, Fla.
New Orleans, La., Tulsa, Okla.

Fisher Scientific Co.
Atlanta, Ga., Chicago, Ill.
Cleveland, Ohio, Houston, Tex.
King of Prussia, Pa., Medford, Mass.
New York, N.Y., Pittsburgh, Pa.
Silver Spring, Md., St. Louis, Mo.
Union, N.J.

General Chemical Div.
Allied Chemical Corp.
Fairfield, Ala., Philadelphia, Pa.

Howe & French, Inc.
Boston, Mass.

North Strong, Inc.
Rockville, Md.

E. H. Sargent & Co.
Anaheim, Calif., Birmingham, Ala.
Chicago, Ill., Cincinnati, Ohio
Cleveland, Ohio, Dallas, Tex.
Denver, Colo., Detroit, Mich.
Springfield, N.J.

Van Waters & Rogers, Inc.
Denver, Colo., Los Angeles, Calif.
Phoenix, Ariz., Salt Lake City, Utah
San Francisco, Calif., Seattle, Wash.

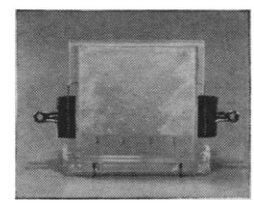
George T. Walker & Co.
Minneapolis, Minn.

Will Scientific, Inc.
Ann Arbor, Mich., Atlanta, Ga.
Baltimore, Md., Buffalo, N.Y.
Cambridge, Mass., Columbus, Ohio
New York, N.Y., Rochester, N.Y.
South Charleston, W. Va.

What we do offer is the EASTMAN® CHROMAGRAM® System of thin-layer chromatography—silica gel or alumina—on flexible polyester support. As soon as you start using it, your innovative talents are stimulated. How quickly you learn to think of the quick snip that separates A from B, C, D, and E, or separates what's wanted from what's not wanted!

Yet this is not paper chromatography. It is genuine thin-layer chromatography with all its advantages in resolution, speed, and responsiveness to choice of variables. All that's missing is the messing with powders to coat plates in the first place and to scrape the coating off afterwards when the separated zones need scintillation counting, elution, or further study. Just snip instead. For some materials the scissors even provides an actual separation to affix to the notebook page, supplementing the written word with ultimate reality. The tight coating on CHROMAGRAM Sheet resists abrasion to permit this.

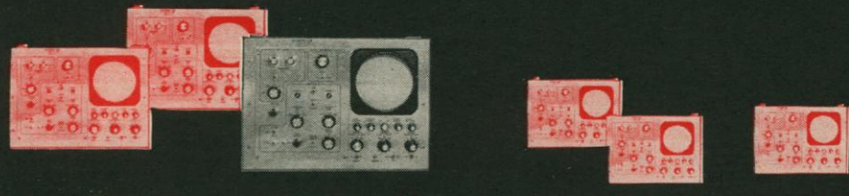
EASTMAN CHROMAGRAM Developing Apparatus assembles in a moment when needed, quickly equilibrates solvent vapor.



Distillation Products Industries (Division of Eastman Kodak Company) Rochester, N. Y. 14603 (phone 716-458-4080) sells the CHROMAGRAM Developing Apparatus for $35.50 and CHROMAGRAM Sheet at a new low price of $17.60 for 20 8″x8″ sheets. Send for technical data. Or just ask one of the dealers at left.

Prices subject to change without notice.

Kodak



BY ALL MEANS **BUY** A SMALL ANALYZER. BUT GET **BIG** ANALYZER PERFORMANCE.

PIP-400*

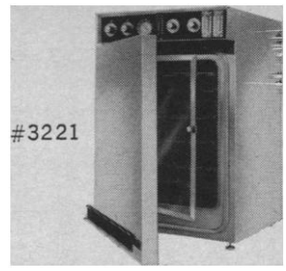
Multichannel Pulse Height Analyzer

Why compromise . . . On 100, 128, or even 256 channels? PIP-400 is the only "small" analyzer that's 400-channels . . . BIG! (10^6-1 count capacity, standard). Parallel, BCD logic. Transfer and subgrouping. PHA and multi-scale modes. Rapid 4 MC digitizing rate. Built-in single channel analyzer, amplifier and Mössbauer input. Serial or parallel, and analog readout capability. Silicon semiconductors used exclusively. 5" CRT live display. Don't compromise on a small analyzer. You can get the "small" PIP-400 with the BIG analyzer features.

* Inexpensive, too.

THE VICTOREEN INSTRUMENT COMPANY
5857 West 95th Street • Oak Lawn, Illinois
EUROPEAN SALES OFFICE: GROVE HOUSE, LONDON RD, ISLEWORTH, MIDDLESEX, ENGLAND

TULLAMORE DIVISION
VICTOREEN



National's Water-Jacketed CO_2 Incubator now comes equipped with a purge-recovery unit.

What is a "purge-recovery" unit?
(We're glad you asked!)

A purge-recovery unit rapidly replaces the CO_2 that is lost when incubator doors are opened, without having to wait for the normal flow rate to build back to the original concentration.

NATIONAL's purge-recovery unit consists of a timer and a button to release a predetermined amount of gas so that the CO_2 tension is quickly built up to the desired level.

It's another good reason why NATIONAL incubators are the logical choice when efficiency and versatility are demanded. Some of the other reasons are:

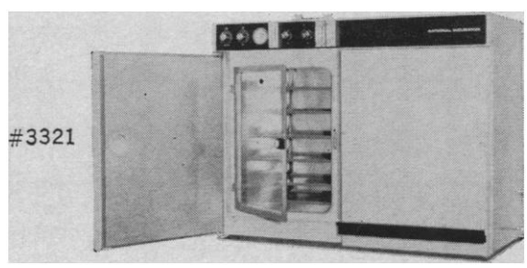
- Full water jacket for accurate temperature control
- Built-in CO_2 air-mixing device at no extra cost
- Pre-heater for gas mixture to protect work
- Corrosion-proof construction inside and out
- High humidity without condensation on inner walls
- No-stick-no-click non-magnetic door mechanism

The new purge-recovery unit is a result of the research and development that goes into every NATIONAL product . . . and this is why NATIONAL incubators and other laboratory apparatus continue to lead the field.

Your franchised NATIONAL dealer can obtain one of these units for you in short order — or, write for a fully illustrated brochure.

National na

NATIONAL APPLIANCE COMPANY
Home Office and Factory: Box 23008, Portland, Oregon 97223
Eastern Sales Office: Box 3102, Stamford, Connecticut 06905
Midwest Sales Office: 2602 E. Devon Ave., Des Plaines, Ill. 60018



Equip your ICU with the exact monitoring capabilities you need

You can have a system "tailored" to your needs — *using standard HP Sanborn monitoring modules* — whether it involves a few conditions for a few patients . . . or many patient conditions, eight or more beds, and complete central station alarm/display/recording facilities. Start with 780-series modules for monitoring the ECG and heart rate, for example (shown above), and as needs and budget enlarge, add "780" modules to monitor more functions, more patients or both. (Illustration below shows the addition of temperature, respiration rate, systolic and diastolic pressure monitoring functions, plus pacemaker, to the original two functions.) System suitability, economy, future functional and location adaptability, and rapid staff training are the continuing benefits of modular "780" systems.

Specific capabilities of these units, in addition to those mentioned, include venous pressure monitoring . . . internal/external DC defibrillation . . . and continuous ECG recording on endless loop magnetic tape units, with automatic readout on alarm of data immediately preceding distress condition. Wall Mount Brackets are available to free space around beds, or two styles of "780" carts give complete instrumentation mobility. For Central Station use, a wide choice of units is available for visual display, audible alarm, signal switching, graphic and tape recording.

When complete cardiac function monitoring is needed, with automatic ECG recording at selected intervals or on distress, the 780B Viso-Monitor provides it in a single bedside unit. Indicators display heart rate, QRS event, bradycardia, tachycardia, pulse loss and arrest; internal/external pacemaker is built in. Companion unit supplies visual display and audible alarm of all conditions monitored by the Viso-Monitor.

HP/Sanborn field offices can give you valuable help in system planning, installation and staff training — and provide continuing, local service. For details, send the coupon to Hewlett-Packard Company, Sanborn Division, Waltham, Mass. 02154. In Europe, H.P. S.A., 54 Route des Acacias, Geneva.

HEWLETT PACKARD hp SANBORN DIVISION

Measuring for Medicine and the Life Sciences

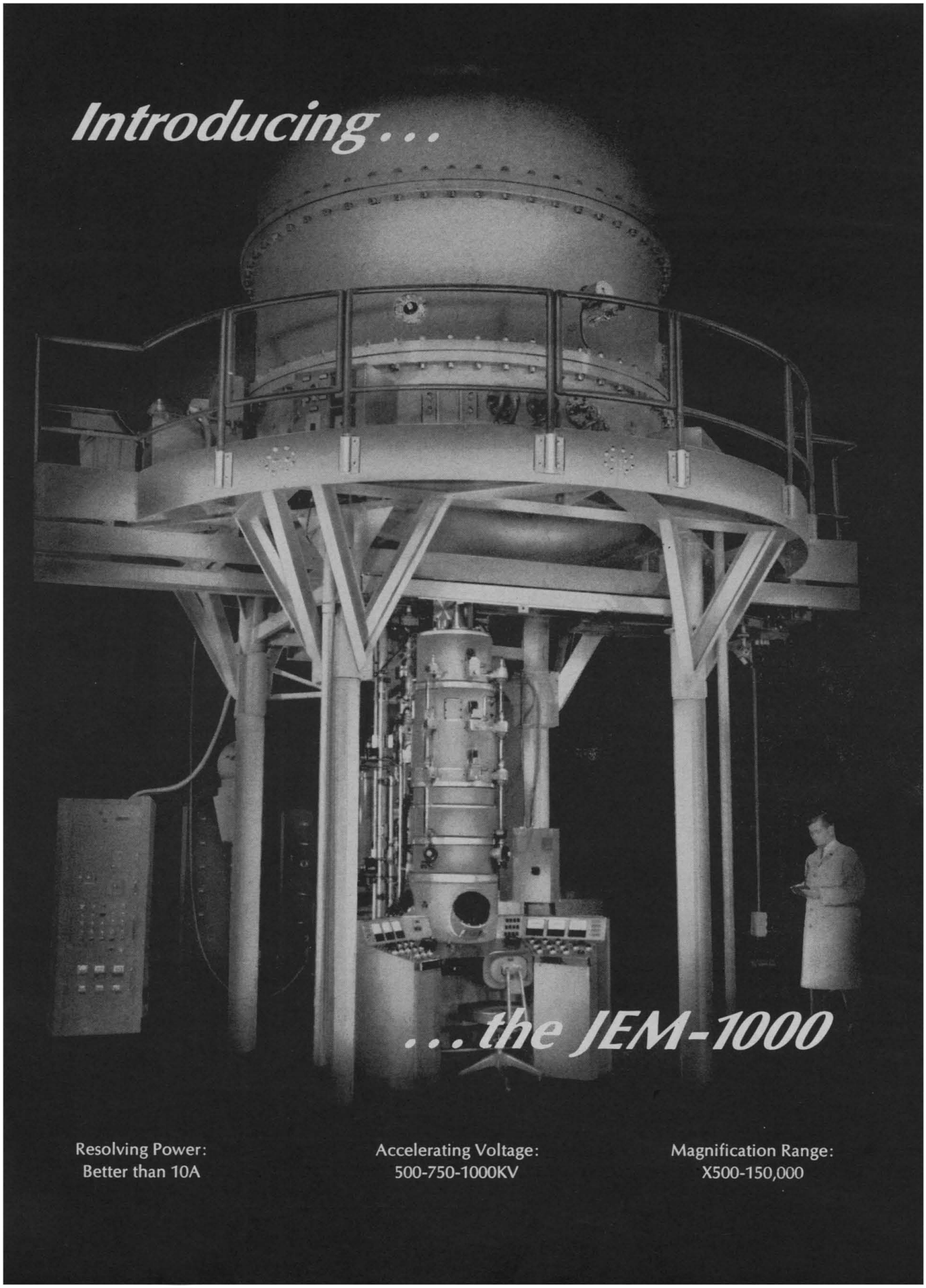
0-740

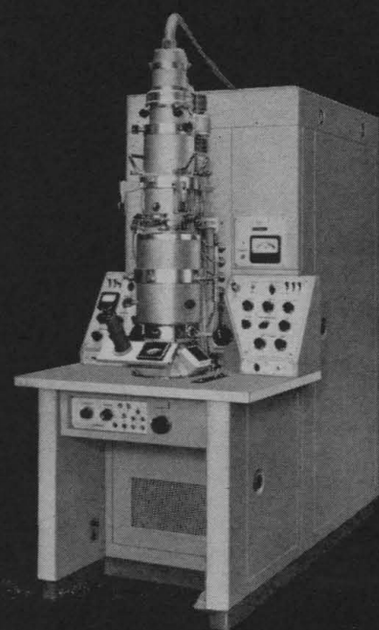
Send detailed data on Sanborn 780 Series Patient Monitoring Systems to:

(name) (hospital)

(address)

(city) (state) (zip code)


Introducing...
...the JEM-1000
Resolving Power:
Better than 10A
Accelerating Voltage:
500-750-1000KV
Magnification Range:
X500-150,000



...by the manufacturers of the JEM-7A

The electron microscope which allows simultaneous performance of these accessories:

- Electromagnetic high-resolution dark field
- Heating — tilting
- Anti-contamination cold finger

JEOLCO (U.S.A.), INC.
APPLICATIONS CENTERS AT MEDFORD, MASSACHUSETTS AND BURLINGAME, CALIFORNIA
BRANCH OFFICES AT ATLANTA, CHICAGO AND MONTREAL

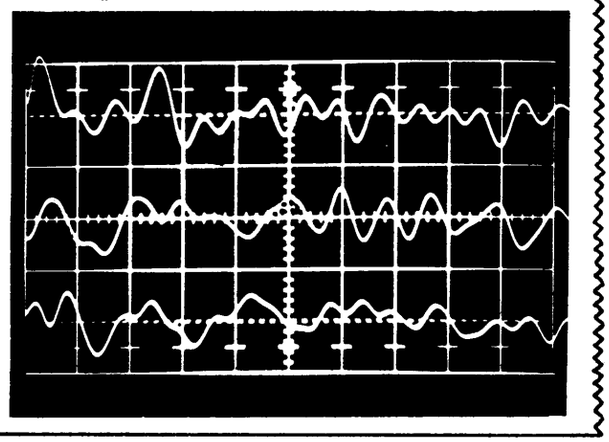
jeol

Solve Your Noise Problems...

fish out those elusive weak signals from gooey backgrounds of noise

. . . Since our first "solve-your-noise-problems" advertisements ran, we've sold a lot of PAR Lock-In Amplifiers and helped to solve a lot of noise problems. **But** — we couldn't help everybody . . .

PHOTO #1

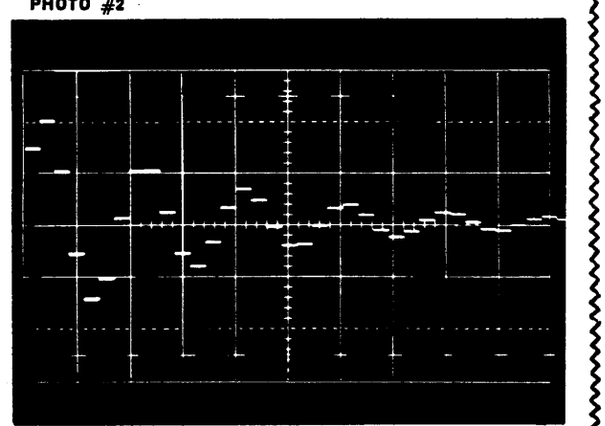


Three traces of a repetitive 50kHz signal buried in noise. Time: 10 μsec/cm

certain applications require "fishing out" a faithful reproduction of the waveform of the desired signal and the lock-ins just didn't quite do this.

Heretofore — if the frequency was low, and the customer had lots of money, some sort of reproduction could be obtained with Brand X and similar types of complicated and expensive types of signal averaging machines.

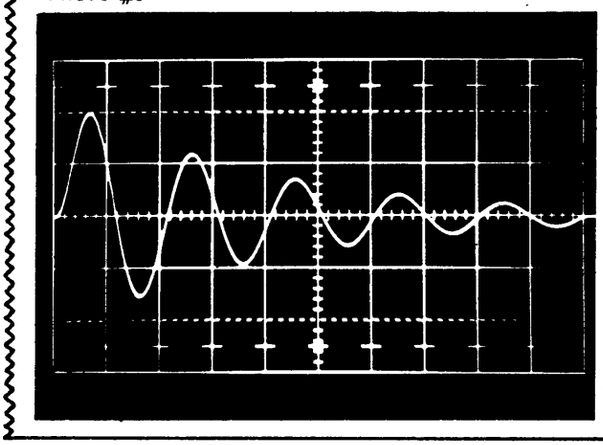
PHOTO #2



Output of Brand X at max. sweep with similar shaped waveform as signal input. As Brand X did not work with the 50 kHz signal, the input frequency had to be reduced to 5 kHz. Time: 100 μsec/cm

NOW — good news for searchers for small signals — the PAR team has again broken the noise barrier.

PHOTO #3

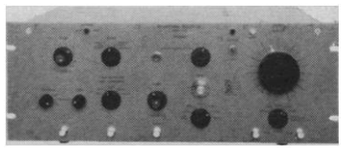


Output of PAR TDH-9 Waveform Eductor with the noisy 50 kHz signal shown in Photo #1 as input. Time: 10 μsec/cm

Using an entirely new principle (an old PAR dodge), the PAR TDH-9 Waveform Eductor offers much faster speeds, much higher frequency response, all at a much lower cost! In the Waveform Eductor, special active filters combine the latest in field-effect and high-speed-switching techniques to get information into and out of information storage channels in nanoseconds. Thus, you can put 100 separate channels across one cycle of a 10 kHz signal or, on slower signals, these narrow channels can be used to study portions of the waveform in great detail for unexcelled resolution.

You can purchase a PAR Waveform Eductor for only $4,200 and, of course get, for free, application help from the world's foremost noisy signal processing specialists.

TDH-9 Specification Summary:
Averaging Time—1 to 100 sec
Averages up to—10^5 separate scans
Sweep Duration—100 μsec to 11 sec
Operates from —0.1 Hz to 100 kHz
Outputs—Fixed and variable for oscilloscopes and/or recorders.



PAR Model TDH-9 Waveform Eductor

Write for Bulletin #126 to:

PRINCETON APPLIED RESEARCH CORP.
Dept. G
Box 565, Princeton, N. J. Tel. (609) 924-6835

ing several hundred reprint requests to the wastebasket leaves a sense of guilt at frustrating legitimate attempts by scientists to cover the world literature. It is interesting to note that the number of requests per paper correlates with the number of key words in its title and not its length. Please accept this letter as my personal apology for discourtesy engendered by circumstances which may not be peculiar to our Institute.

F. C. GREENWOOD
Imperial Cancer Research Fund,
Lincoln's Inn Fields,
London, W.C.2, England

Art in Science: Another Protagonist

The letters on the subject of art in science (20 May, 11 March, and 10 December) point up the abysmal ruts into which the concept of art is being channeled these days. To equate a mechanically derived photograph of a natural phenomenon with art reveals a basic misconception of what we call art.

We have gone a long way from such narrow opinions as propounded by such men as Aristotle or Tolstoy who held the view that imitation of nature is the highest aim of art, or that a work of art must be sugarcoated to be beautiful. The imitation of an apple or a tree as seen by the naked eye, or the path of an electron in a cloud chamber as revealed by the electron microscope, can never be more than mere facts of nature. The reasons why similarities exist between the appearance of an amoeba or an exploding galaxy and certain forms that appear in abstract paintings are twofold: either the abstract artist became acquainted with certain forms as revealed by the microscope or telescope and used them as raw materials in the same way as the general lines of the human body or as the arrow were used by artists of Paleolithic times; or else, the artists in their search for rhythmically related forms have discovered and predicted the existence of such forms in nature unperceived by the naked eye. In either case, the creative effort consists not in the forms employed but in the design of a rhythmic configuration so organized as to constitute an esthetic unity. The accidental apparent unities which are sometimes found in nature such as driftwood, stone, or photomicrographs, must never be confused with works of art, which are man's effort to recreate and give meaning to life experience.

The aim that art and science have in common, though they take different paths to accomplish it, is to create order out of chaos. The Albany Exhibit would have been far more instructive and much less confusing to the general public if the mechanically derived works were separated from man's efforts to create works of art. The mechanically derived photographic works could stimulate and inspire artists in their creative efforts and would therefore be of value, especially to those who have little access to scientific journals or books.

I have derived much esthetic pleasure and stimulation from many of the photographs that have appeared in *Science*. To mention a few, I would like to point out the cover designs, Fibrillar Nylon (31 Dec.), Alaskan Island, aerial view (15 April), and Lightning (28 Jan.), the photograph of a particle of interplanetary dust (7 Jan., p. 36), and chemiluminous trails (20 May, p. 1020).

MORTIMER BORNE
107 South Broadway, Nyack, New York

Automotive Watchdog

It is with great surprise that I watch the continuation of the debate on Nader's *Unsafe at Any Speed* (Letters, 21 Jan. and 25 Mar.), especially the letters from scientifically trained readers. . . . anyone who has followed "Uncle" Tom McCahill in *Mechanics Illustrated* for the last 20 years will find nothing new or surprising in *Unsafe at Any Speed*. Other automotive reporters say much the same but without "Uncle Tom's" humor. Year after year McCahill is given access to the automobile company proving grounds and latest model cars. He tests and reports on each, carefully telling what dealer options and private modifications would make the car more safe operationally. He reports statements from engineers who repeatedly show bad sales data on models where engineering took precedence over styling. He is bitterly critical of automobile company management, but admits that they have little choice. An interview with Tom McCahill would be most enlightening.

LOUIS E. FAY III
Bishop's House, Monrovia, Liberia

Read to 0.001 pH at 30 feet in pitch darkness

The Orion Model 801 all solid state, digital pH meter gives continuous numerical readings from pH 0.000 to 13.999 — in numerals so large they can be seen at thirty feet in pitch darkness or broad daylight.

Continuous millivolt readings

For potentiometric measurements, the instrument provides automatic polarity indication and continuous coverage from +999.9 to —999.9 mv in 0.1 mv increments. Readings are taken without polarity switching, range selection or scale interpolation.

Research measurements

The instrument's repeatability of ±0.001 pH makes it ideal for critical clinical and research pH determinations. Direct reading to 0.1 mv makes possible more accurate specific ion measurements with Orion's new series of membrane and single crystal electrodes.

Computerized circuitry

The Model 801 uses high-reliability, high-speed computer type integrated circuits. A recorder output is provided in addition to a binary coded decimal output for printer or computer interfacing.

Availability

The Orion Model 801, priced at $895 without electrodes, is available from major laboratory supply dealers. Ask for descriptive literature or a demonstration.

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

☐ Please send a copy of the 801 bulletin.
☐ Please arrange a demonstration.

Name _____

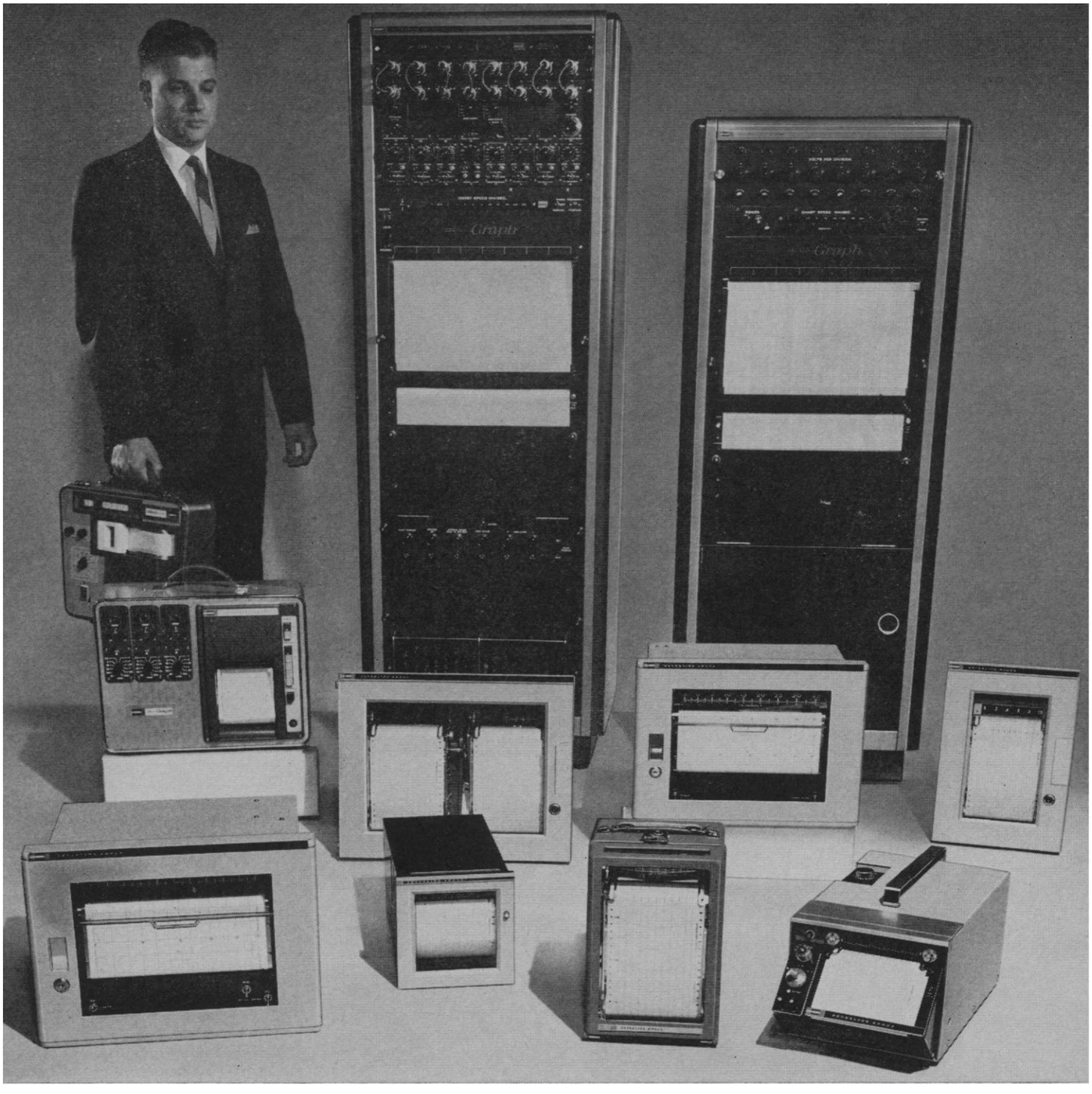
Organization _____

Street _____

City _____

State _____ ZIP _____

Laboratory Supply Dealer _____



Esterline Angus doesn't keep handing you the same old line!

We keep developing new graphic recorders and new features to incorporate in established recorders . . . to satisfy your needs.

We've developed a trouble-free servo motor with only one moving part. No pulleys, drive cords or gears. It delivers 2/10 second response over a 10" span and 1/8 second response over a 4½" span.

Our new Multipoint has an exclusive Programmed Printing option. It lets you select points electrically with switches.

You can now order our Permanent-Magnet Moving-Coil recorders with magnetic amplifiers (to increase sensitivity) or with power transducers (to measure watts, volts, amperes, vars . . .).

We've designed a Rapid Response (1/10 second) Voltmeter. It records 100 millisecond voltage transients with full accuracy . . . especially valuable in monitoring power supplied to data processing units.

In addition to our best selling Ink Type Event Recorders are new Inkless and High Impedance Event Recorders. The high impedance instrument can be bridged into low power (i.e., telephone) circuits without upsetting their operation.

Want to record more than one channel of information on the same chart? We now have six types of two-channel recorders, plus an Analog-Event Recorder which provides one channel of analog information and eight channels of event information.

Oscillo Graphs? Choose from nine units including portables and cabinet models. All with frequency response above 125 cps.

Write for our full line brochure. You'll discover we make more kinds of graphic recorders than just about anybody else.

Esterline Angus Instrument Co., Inc.
Box 24000L • Indianapolis, Ind. 46224

ESTERLINE ANGUS
EXCELLENCE IN INSTRUMENTATION FOR OVER 60 YEARS

23 September 1966, Volume 153, Number 3743 **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.

Science, and the Scientific Community

In an age of narrowly specialized scientific journals, *Science* publishes an unusually broad collection of material. As a weekly magazine presenting important late developments, we face the same deadlines and experience the same pressures as the great news magazines. Yet we must seek to maintain the high standards of technical quality expected of a scientific journal.

In the work of producing *Science* we are especially grateful for the warm response of the scientific community. This response is manifested in the growth of circulation and in the devoted efforts of the thousands of scientists who make most of the judgments that determine the content of the journal.

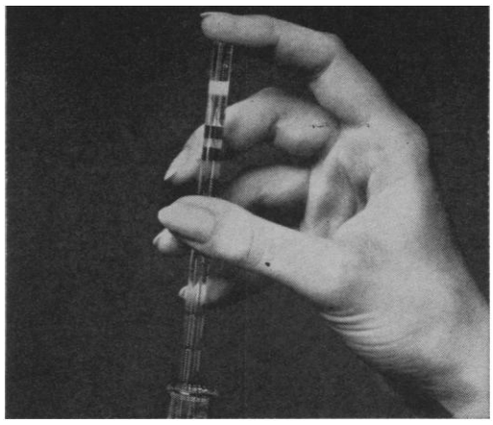
Science continues to experience increasing and broad acceptance by an audience of high quality. During the past 4 years readership has grown by more than 60 percent, and it has now reached 126,000 paid subscriptions. The highest growth rate has been in foreign circulation, now over 11,000. The educational level of readers is high; about 60 percent have either a Ph.D. or an M.D. degree. All disciplines are represented, including the physical sciences. Among chemists, circulation of *Science* is greater than that of the *Journal of the American Chemical Society*.

Because of this broad and large audience, many contributors are attracted to *Science*. Pressure for space is especially great in areas of biology, medicine, psychology, and the earth sciences where publication is slow and journal circulation is often small. In some of these areas, we receive five times as many research reports as we can publish. In other areas we receive very few manuscripts. To improve the balance of content, some papers, particularly articles, are invited. Such material is sought on the basis of suggestions made by the Editorial Board supplemented by suggestions from hundreds of additional advisers. Currently we receive over 3000 articles and reports a year, besides 1500 other contributions—technical comments, letters, book reviews, and meeting reports. Most of the manuscripts submitted are of publishable quality. If all were printed, *Science* each week would be as thick as a metropolitan telephone book. This would be impractical financially, and such a mass of material would be burdensome to readers.

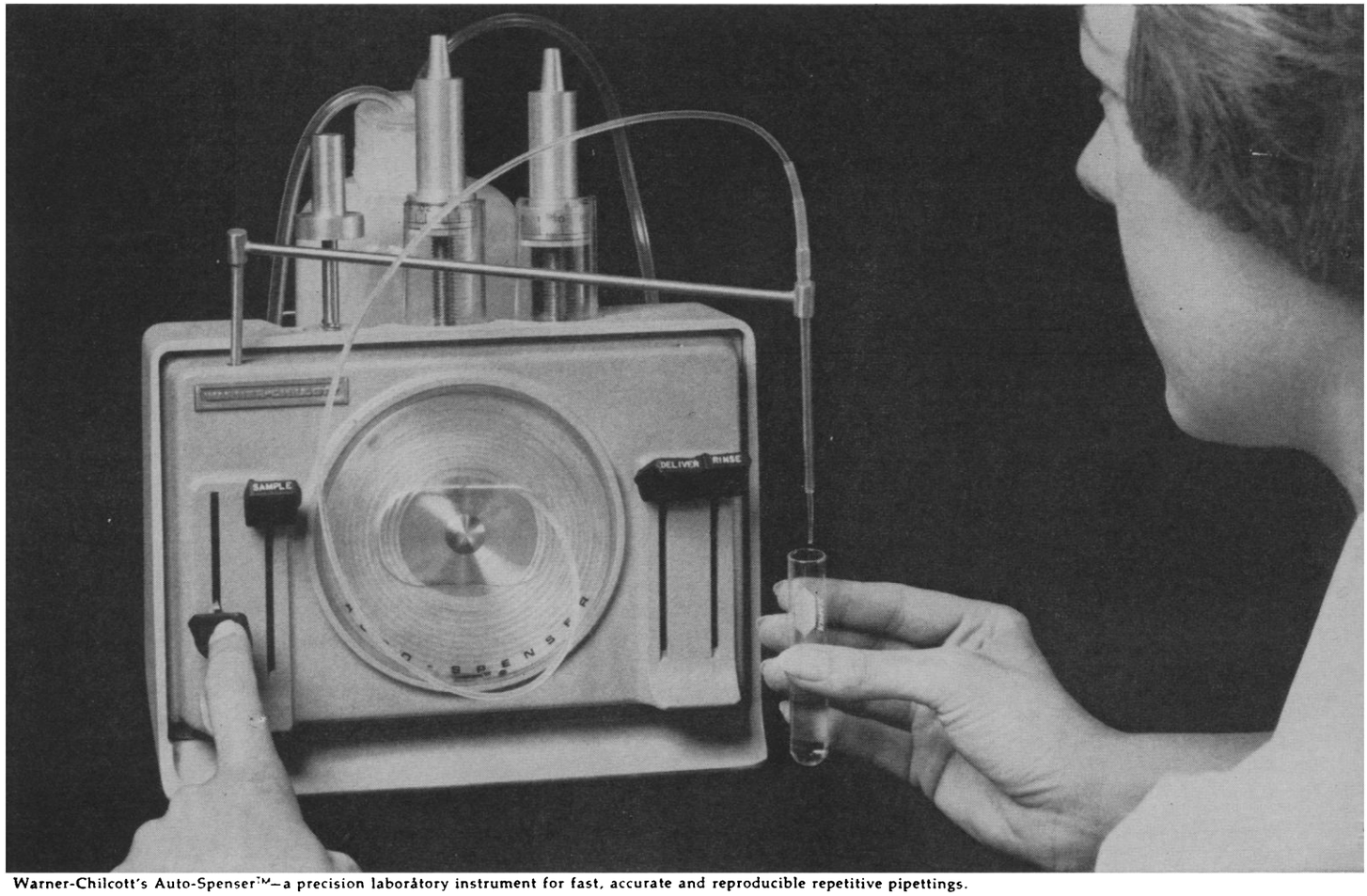
The problem of selection from among many deserving manuscripts is extraordinarily difficult. The diversity of the subject content makes it unfeasible for a small editorial staff or even a moderate-sized editorial board to do justice to the task. Selection of material for *Science* is a major effort that involves 4000 reviewers.

With rare exceptions, all scientific material, including invited articles, that appears in *Science* has been approved by at least two reviewers. Reviewers' comments are essential to sound staff judgment; the comments usually lead, also, to improvements in manuscripts. Most of the reviewers are very conscientious. In some instances constructive comments concerning a manuscript have exceeded the manuscript itself in length.

In the production of *Science* the staff of 35 is but a tiny fraction of the host of participants. The real work of *Science* is done by some of the best elements of the scientific community. Given their continued generosity and professional pride, the stature and value of *Science* will continue to increase.—PHILIP H. ABELSON



It's really a lot faster this way.



Warner-Chilcott's Auto-Spenser™—a precision laboratory instrument for fast, accurate and reproducible repetitive pipettings.

It takes only 15 seconds—or less—to pipette, add a reagent or diluent, and dispense, with Warner-Chilcott's Auto-Spenser.™ It's not only faster and safer than manual methods, but far simpler—you simply depress a lever. No pipettes to wash. You just depress a lever for that, too, and your Auto-Spenser rinses itself. Add to this the high accuracy and reproducibility of the instrument, and you'll see why we feel the Auto-Spenser belongs in every laboratory that performs repetitive pipettings. Time saved will quickly pay for its modest $195 cost!

Versatile, Trouble-Free

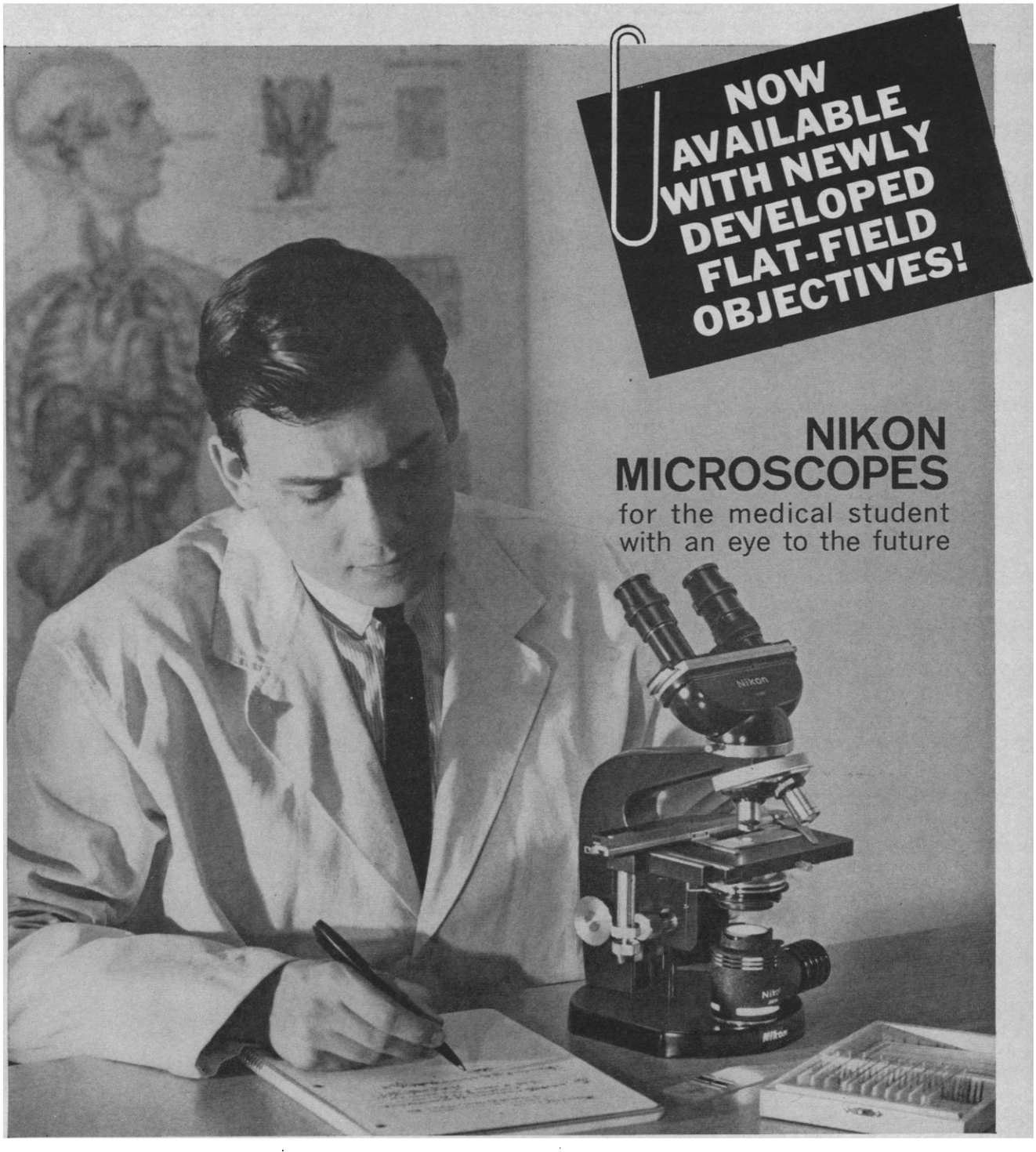
You can use your Auto-Spenser for pipetting, diluting, or dispensing. The self-wash feature lets you change reagents in seconds. Two micrometer-controlled pumps handle a wide range of sample and reagent volumes. It's easy to set and read sample volumes to one-half microliter—with no visual checking of liquid levels. The compact, rugged Auto-Spenser is completely mechanical. There's no electrical power needed, virtually nothing to break or replace, and no way for sample or reagent to enter the mechanism. It's practically foolproof!

Brief Specifications

Practical Volume Ranges: Sample, 20-250 μl; Reagent, 0.5-5.0 ml. Sampling Reproducibility: ± 0.5 μl or $\pm 1\%$, whichever greater. Reagent Delivery Reproducibility: ± 0.005 ml or $\pm 0.5\%$, whichever greater.

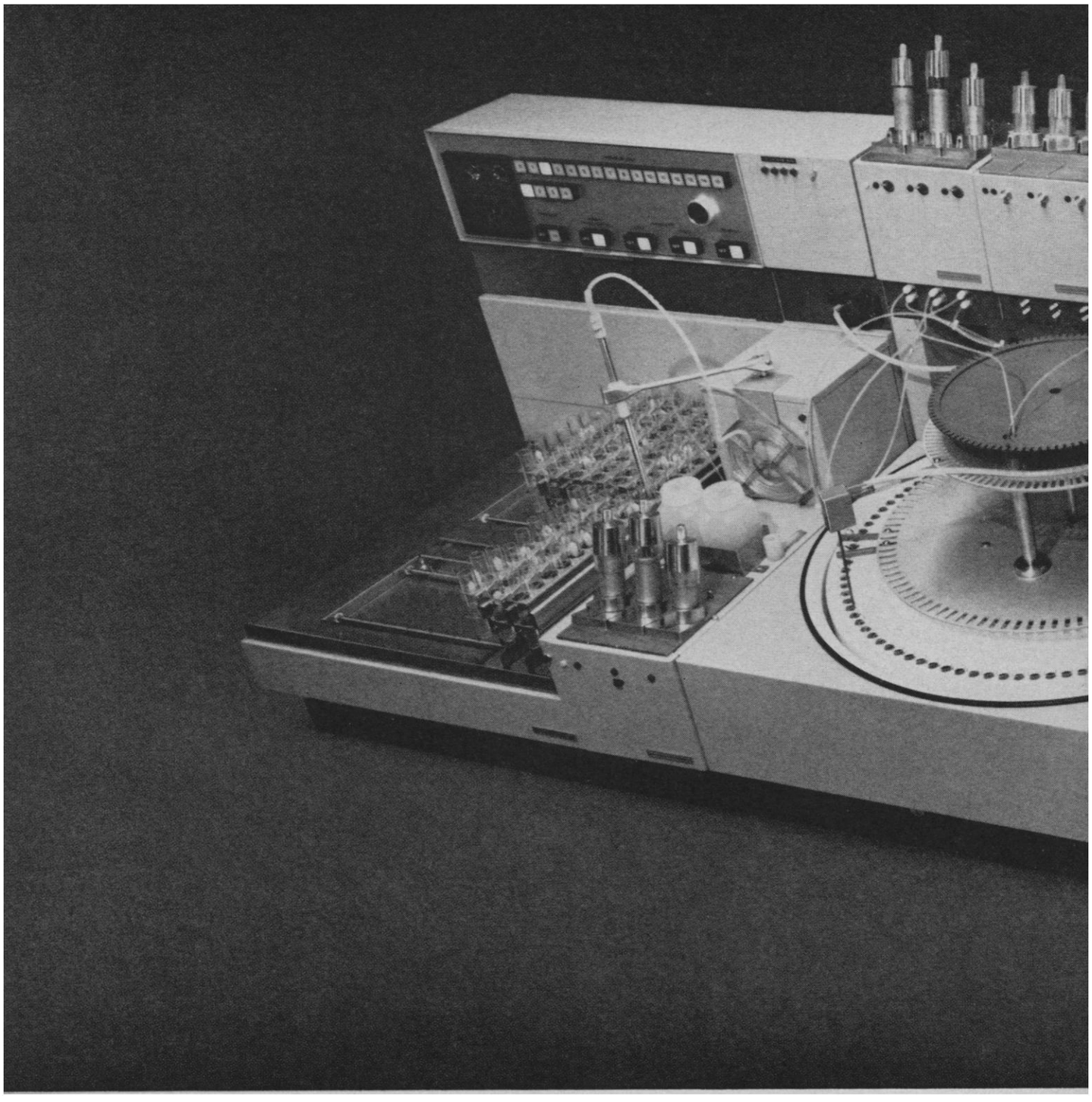
Please write for details on Model 26500 Auto-Spenser. Address Warner-Chilcott Laboratories Instruments Division, 200 South Garrard Blvd., Richmond, California **94804**

WARNER-CHILCOTT LABORATORIES
INSTRUMENTS DIVISION
Richmond, California



There are no Nikon *student* microscopes, in the sense of limited quality or usefulness. They are all professional units built around the same basic system, and differ only in the type of stage and eyepiece employed.
Complete interchangeability of these components, and other attachments, give each instrument a flexibility capable of serving the most specialized requirements of professional use long after it has served the student's needs at medical school.
The flat-field objectives, newly developed by Nikon, further enhance this versatility. They achieve extreme flatness-of-field without impairment of image quality or resolution. Moreover, they can be used with any Nikon microscope without modification or change in the instrument.
The SBR, shown above, is one of the models most favored by medical students. It is a sophisticated unit, widely used in schools, hospitals and research laboratories.

For medical student microscope catalog, write:
Nikon Inc., Instrument Div., Garden City, N.Y. 11533, Subsidiary of Ehrenreich Photo-Optical Industries, Inc.
Visit Nikon Booth #76—NIH Show

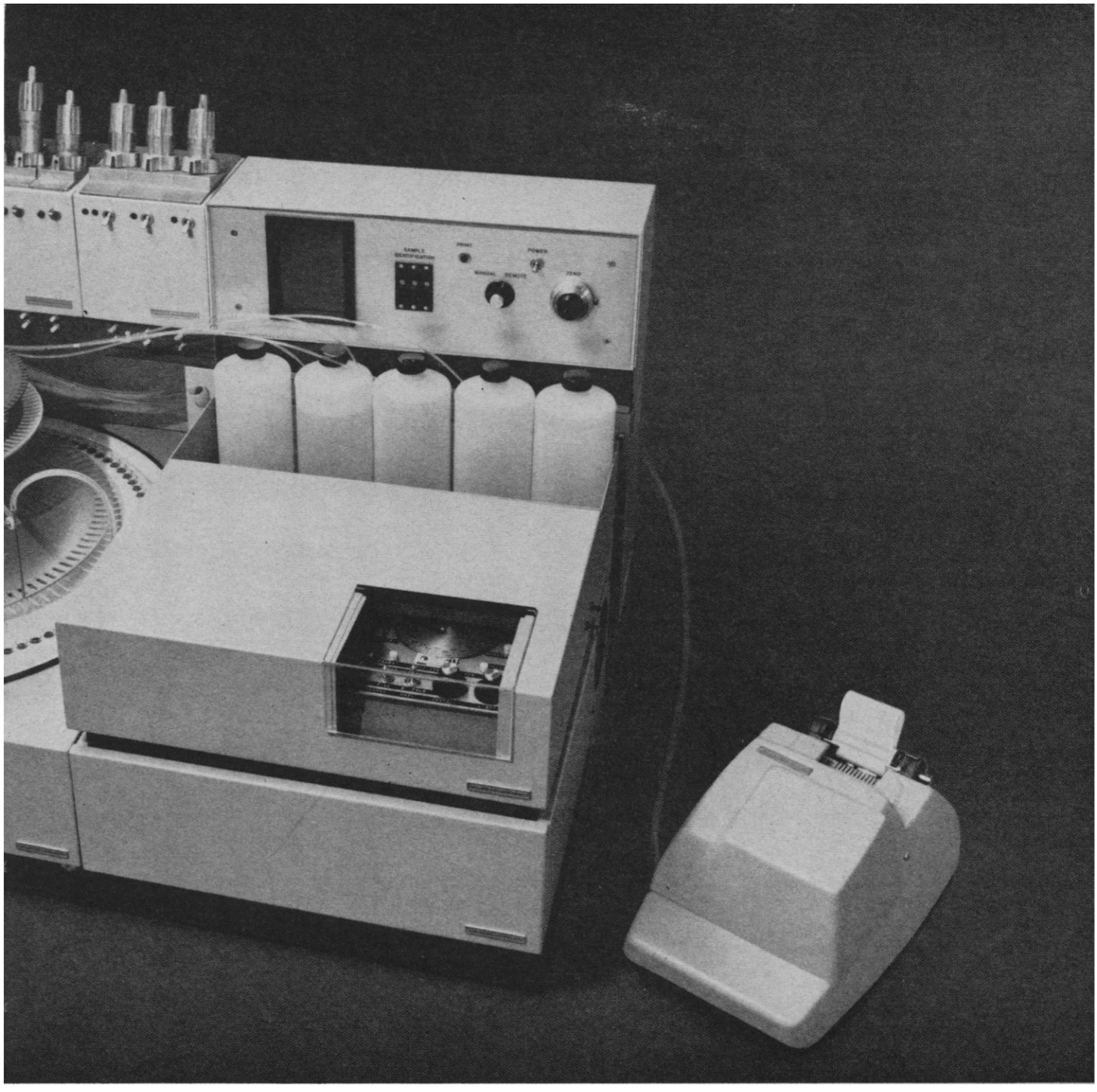


What your chemists should know about our chemist.

This is Warner-Chilcott's new Robot Chemist—The Automated Test Tube. If you're a believer in automation, you should know that:

The Robot can automate up to 120 repetitive wet chemical analyses per hour. That's far more work than any other automated system can turn out!

Equally important, the Robot's micrometer dispenser pumps and dual-beam spectrophotometer—combined with discrete sampling which virtually eliminates cross contamination—give you high accuracy and reproducibility. If you need dependable data, put your money on the Robot.



MEET THE AUTOMATED TEST TUBE

Just what is this newest workhorse for bioanalytical laboratories?

The Robot Chemist is an instrument that behaves like a chemist. It samples, dilutes, adds and mixes reagents, incubates, reads, and prints out a test result. Then, it rinses, washes, dries itself, and gets ready for the next sample. **All at your command.**

You can pick up samples from 20 μl to 5 ml with 1% accuracy; add up to 7 reagents with 0.5% accuracy; incubate for precise periods of time with a thermal stability of $\pm 0.1^{\circ}$C at 37°C or $\pm 0.5^{\circ}$C up to 95°C; and, measure through a spectrophotometer range of 340 to 1000 nanometers. It's ideal for enzyme and other analyses that require precise control of variables!

COUPLE THE ROBOT CHEMIST'S RESULTS TO A COMPUTER

When you're running the Robot Chemist at full capacity, you'll get a printed test result every 30 seconds in **digital form**—along with positive sample identification. Computer compatibility? Yes.

Get a hard worker like the Robot Chemist for your laboratory! For more information, please fill out the coupon.

WARNER-CHILCOTT LABORATORIES
INSTRUMENTS DIVISION
200 South Garrard Boulevard
Richmond, California 94804

Gentlemen: Please send me details on your Robot Chemist, including price and delivery.

Name_____

Title_____

Company/Institution_____

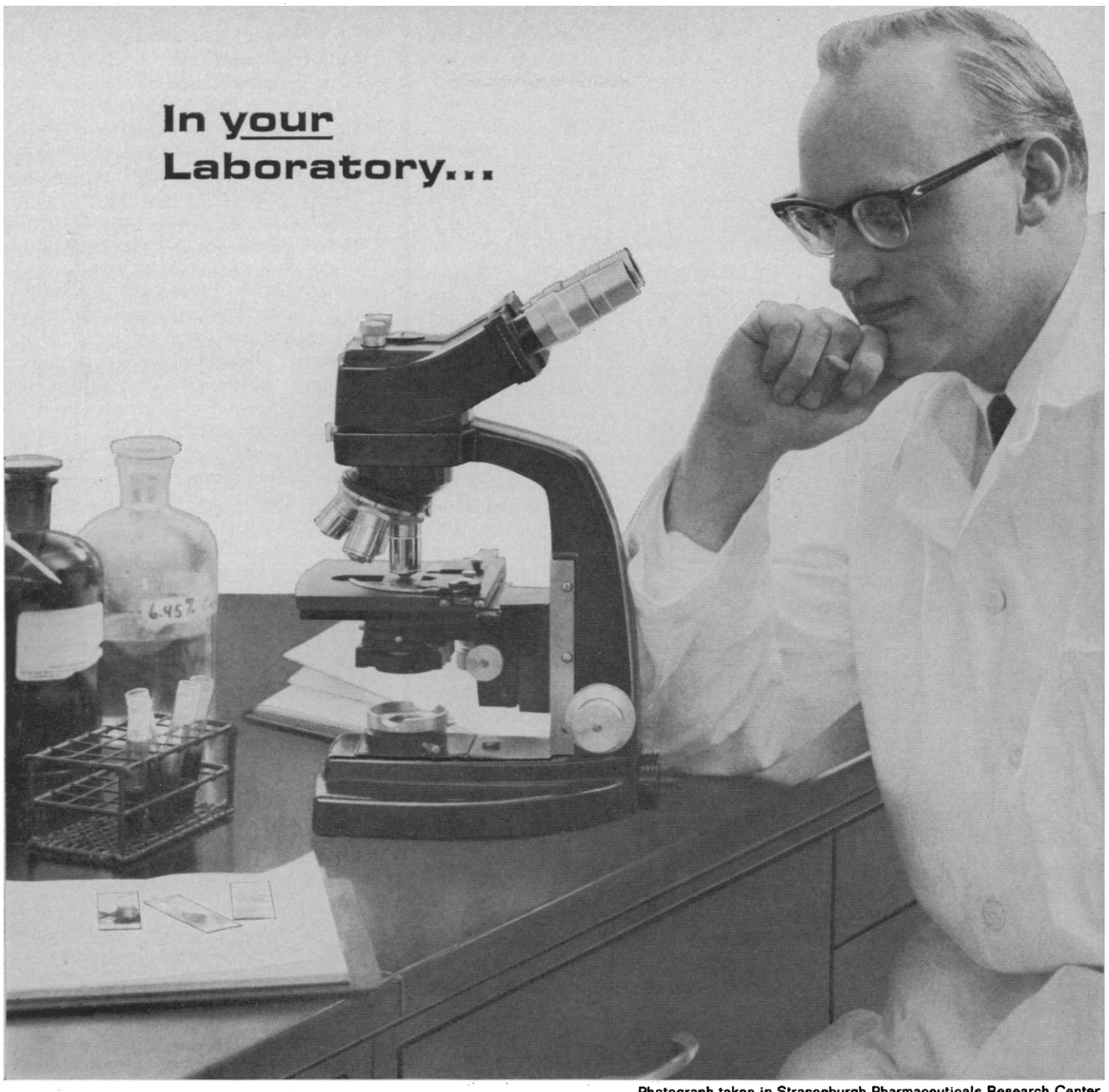
Street_____

Phone_____

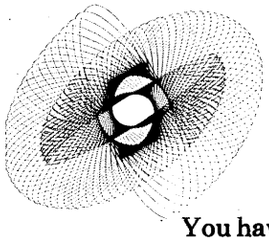
City_____

State_____ Zip_____

My application is_____



Photograph taken in Strasenburgh Pharmaceuticals Research Center,
Division Wallace & Tiernan Inc., Rochester, N.Y.



LET YOUR OWN EYES DECIDE

You have to see a Bausch & Lomb Flat Field Dynazoom® Microscope perform to get the full impact of its two new optical systems.

The Dynazoom Achromatic Flat Field System gives you focal plane sharpness center to edge with all objectives. When you focus with your Flat Field objective the whole field of view is crisp, clear and sharp.

Continuously Variable Zoom Magnification lets you select the power just right for your own eyes and specimen. While changing magnification with Dynazoom you maintain constant, in-focus, visual contact with the specimen.

The sum of Bausch & Lomb Dynazoom and the Flat Field system is the perfect answer to the most demanding laboratory microscope challenge. Give Dynazoom a chance to prove its value. Then you will fully appreciate what Bausch & Lomb means when we say "For Better Microvision—Flat Field Dynazoom".

Ask for a demonstration. Send for brochure 31-185. Write Bausch & Lomb, 64233 Bausch St., Rochester, New York 14602.

BAUSCH & LOMB

ler) will aid considerably in the description of these phenomena in eucaryotes in general. Kappy (University of Wisconsin) noted that an "uptake" mutant resistant to ethionine had a weaker cell membrane, as indicated by osmotic treatments of protoplasts. DeBusk (Florida State University) reported that conidia normally contain transport systems for all amino acids except proline. Several workers were able to lend confirmation to Wiley's (Batelle-Northwest Laboratory) suggestion that the maintenance of active uptake systems is strongly dependent upon continued protein synthesis.

Travel funds for some participants, including the foreign visitors, were generously provided by the National Science Foundation through a grant (NSF-GB4471) to the University of Michigan. Planning and operating expenses were defrayed in part by an allocation from the Institute of Science and Technology, University of Michigan, and the host institution, the Biology Division of the Oak Ridge National Laboratory, provided essential facilities, space for the last session, and a reception for the participants.

A more definitive report of the conference has been published in *Neurospora Newsletter*, Number 9, June 1966.

ROWLAND H. DAVIS
Department of Botany, University of Michigan, Ann Arbor

Forthcoming Events

October

23. **Research in Medical Education,** 5th annual conf., Assoc. of American Medical Colleges, San Francisco, Calif. (P. J. Sanazaro, Div. of Education, Assoc. of American Medical Colleges, 2530 Ridge Ave., Evanston, Ill. 60201)

23–25. **Vacuum Microbalance Techniques,** 6th informal conf., Newport Beach, Calif. (7500 Jefferson St., Paramount, Calif. 90723)

23–29. **Cancer** 9th intern. congr., Tokyo, Japan. (Secretariat, Cancer Inst., Nishisugamo, Toshima-ku, Tokyo)

24. American Assoc. of **Poison Control Centers,** 9th annual mtg., Chicago, Ill. (M. S. McIntire, The Association, 44th and Dewey Ave., Omaha, Nebr. 68105)

24–26. Canadian Assoc. for **Applied Spectroscopy,** natl. mtg., Montreal, Que. (S. Barabas, Research Center, 240 Hymus Blvd., Pointe Claire, Que.)

24–26. **Medical Education,** symp., Beirut, Lebanon. (B. Thurston, American Univ. of Beirut, Beirut)

24–27. **Instrument** Soc. of America, 21st annual conf., New York, N.Y. (ISA, 530 William Penn Pl., Pittsburgh, Pa.)

24–27. **Oak Ridge** Inst. of Nuclear Studies, Medical Div., 10th medical symp., "Compartments, Pools, and Spaces," Oak Ridge, Tenn. (Chairman's Office, Medical Division, ORINS, Oak Ridge, Tenn.)

24–28. **Botany**, 3rd Mexican congr., Botanical Soc. of Mexico, Mexico City. (J. Sarukhan K., P.O. Box 19140, Mexico 19, D.F.)

24–28. Synthesis and Characteristics of **Organic Radicals**, symp., Mittenwald, West Germany. (W. Fritsche, Gesellschaft Deutscher Chemiker, Postfach 9075, 6 Frankfurt am Main)

24–28. **Surgery, Orthopedics, and Traumatology**, intern. conf., Budapest, Hungary. (V. Hönig, Országos Traumatological Intézet, Mezö Imre út 17, Budapest 8)

25–28. American Assoc. of **Blood Banks**, 19th annual mtg., Los Angeles, Calif. (The Association, 30 N. Michigan Ave., Chicago, Ill. 60602)

25–30. **Plant Stimulation**, symp., Sofia, Bulgaria. (C. I. Popoff, M. Popoff Inst. of Plant Physiology, Bulgarian Acad. of Sciences, 2 Latinka str., Sofia 13)

26–28. **Electron Devices**, intern. mtg., Inst. of Electrical and Electronics Engineers, electron devices group, Washington, D.C. (J. F. Hull, Litton Industries, 960 Industrial Rd., San Carlos, Calif.)

26–28. **Switching and Automata Theory** symp., Univ. of California, Berkeley. (Engineering Extension, Univ. of California, Berkeley)

26–28. American **Vacuum** Soc., 13th annual symp., San Francisco, Calif. (E. E. Donaldson, Dept. of Physics, Washington State Univ., Pullman 99163)

26–29. Society of Photographic Scientists and Engineers, intern. colloquium on **Photographic Interaction Between Radiation and Matter**, Washington D.C. (W. S. Dempsey, Huston Fearless Corp., 1413 K St., NW, Washington 20005)

27–28. **Educational Records** Bureau, 31st annual conf., New York, N.Y. (W. S. Litterick, Educational Records Bureau, 21 Audobon Ave., New York 10032)

27–28. **Growth Hormone**, conf., New York Acad. of Sciences, New York. (E. M. Miner, The Academy, 2 E. 63 St., New York 10021)

27–29. American **Chemical** Soc., southeastern regional mtg., Louisville, Ky. (G. L. Shoemaker, Dept. of Chemistry, Univ. of Louisville, Belknap Campus, Louisville, Ky. 40208)

28–29. Society for **Scientific Study of Religion**, annual mtg., Univ. of Chicago, Chicago, Ill. (S. Z. Klausner, The Society, 1200 17th St., NW, Washington, D.C. 20036)

29–30. **Liver Regeneration**, intern. conf., Montecatini-Terme, Italy. (M. Messini, Postgraduate School for Liver Diseases, Univ. of Rome, Rome, Italy)

30–3. **Metallurgical** Soc. of AIME, fall mtg., Chicago, Ill (American Inst. of Mining, Metallurgical, and Petroleum Engineers, 345 E. 47th St., New York, N.Y. 10017)

31–3. American Soc. for **Metals**, 48th annual congr. and natl. metal exposition, Chicago, Ill. (The Society, Metals Park, Ohio 44073)

31–4. American **Public Health** Assoc., 94th annual mtg., San Francisco, Calif. (The Association, 1790 Broadway, New York, N.Y. 10019)

NEW BOOKS

(*Continued from page 1517*)

Being Mentally Ill: A Sociological Theory. Thomas J. Scheff. Aldine, Chicago, 1966. 222 pp. Illus. $5.75.

Jac. Berzelius: His Life and Work. J. Erik Jorpes. Translated from the Swedish manuscript by Barbara Steele. Almqvist and Wiksell, Stockholm, 1966. 156 pp. Illus.

A Bibliography in Neuropsychology: Review and Books 1960–1965. Prepared by Richard T. Louttit. U.S. Department of Health, Education, and Welfare, Natl. Institutes of Health, Bethesda, Md., 1966. 28 pp. Paper.

The Birth of Language: The Case History of a Non-verbal Child. Shulamith Kastein and Barbara Trace. Thomas, Springfield, Ill., 1966. 192 pp. Illus. $6.75.

Catalogue of Technical and Scientific Films. Edited by the Film Section of the Information Service of OECD. Organisation for Economic Co-operation and Development, Paris, 1966. 355 pp. Contains a section on film data and description, a title index, a subject index, and a list of national film centers in various countries; lists over 4500 films.

The Cautionary Scientists: Priestley, Lavoisier, and the Founding of Modern Chemistry. Kenneth S. Davis. Putnam, New York, 1966. 256 pp. Illus. $5.75.

Civil War Medicine. Stewart Brooks. Thomas, Springfield, Ill., 1966. 160 pp. Illus. $6.

Climates of the World and Their Agricultural Potentialities. J. Papadakis. The Author, Av. Cordoba 4564, Buenos Aires, Argentina, 1966. 184 pp. Illus. Paper.

Clinical Epidemiology. John R. Paul. Univ. of Chicago Press, Chicago, ed. 2, 1966. 325 pp. Illus. $7.50.

Communication Switching Systems. Murry Rubin and C. E. Haller. Reinhold, New York, 1966. 400 pp. Illus. $16.50.

Ecuador. Betty J. Meggers. Praeger, New York, 1966. 220 pp. Illus. $7.50.

The Education of Catholic Americans. Andrew M. Greeley and Peter H. Rossi. Aldine, Chicago, 1966. 390 pp. Illus. $8.95.

Electronics: A Bibliographical Guide. vol. 2. C. K. Moore and K. J. Spencer. Plenum Press, New York, 1965. 385 pp. $18. Covers the literature between 1959 and 1964.

Engineer: Ingenious Contriver of the Instruments of Civilization. S. C. Hollister. Macmillan, New York, 1966. 155 pp. $3.95. Career Book Series.

Evaluating Development Projects. Samuel P. Hayes, Jr. Unesco, Paris, ed. 2, 1966 (order from Unesco Publications Center, New York). 116 pp. Illus. Paper, $2.50.

The Focal Encyclopedia of Photography. vols. 1 and 2. L. A. Mannheim *et al.*, Eds. Focal Press, New York, ed. 2, 1966. vol. 1, 864 pp.; vol. 2, 891 pp. Illus. $39 set. More than 2400 articles contributed by 281 authors.

The Forests of the U.S.S.R. V. P. Tseplyaev. Translated from the Russian edition (Moscow, 1961) by A. Gourevitch. Israel Program for Scientific Translations, Jerusalem, 1965; Davey, New York, 1966. 527 pp. Illus. $19.

Gas Chromatography Abstracts, 1965. C. E. H. Knapman, Ed. Published by the Institute of Petroleum, London. Elsevier, New York, 1966. 314 pp. $12.

General Physical Geography. Pierre Birot. Translated from the French edition (1959) by Margaret Ledésert. Wiley, New York, 1966. 360 pp. Illus. $8.50.

Group Practice and Prepayment of Medical Care. William A. MacColl. Public Affairs Press, Washington, D.C., 1966. 267 pp. Paper, $2.50; cloth, $4.50.

Hands on the Past: Pioneer Archaeologists Tell Their Own Story. C. W. Ceram, Ed. Knopf, New York, 1966. 434 pp. Illus. $8.95. Contributors are J. M. Allegro, G. B. Belzoni, T. G. Bibby, H, Bingham, H. Bossert, P. E. Botta, R. L. S. Bruce-Mitford, E. A. Budge, J. L. Burckhardt, H. Carter, J. Y. Cousteau, O. G. Crawford, E. Curtius, G. Dennis, D. V. Denon, F. K. Dörner, A. Edwards, A. J. Evans, N. Glueck, A. Goldsmidt, Z. Goneim, H. V. Hilprecht, C. Humann, A. Kircher, R. Koldewey, A. H. Layard, C. M. Lerici, P. Mackendrick, A. F. Mariette, G. C. Maspero, L. Matouš, W. F. Petrie, A. Posnansky, H. C. Rawlinson, C. J. Rich, A. Ruz, C. F. Schaeffer, H. Schliemann, E. Seler, H. Sloane, G. Smith, G. Elliott Smith, C. P. Smyth, J. L. Stephens, C. Tarral, W. Taylour, T. H. Turner, V. W. von Hagen, A. von Humboldt, J. M. Waldeck, H. Walpole, H. Winckler, C. L. Woolley, and W. Wright.

High-Speed Photography. R. F. Saxe. Focal Press, New York, 1966. 137 pp. Illus. $15.

An Historical Outline of Architectural Science. Henry J. Cowan. Elsevier, New York, 1966. 185 pp. Illus. Paper, $5.75. Elsevier Architectural Science Series, vol. 1.

History of Analytical Chemistry. Ferenc Szabadváry. Translated from the Hungarian edition (Budapest, 1960) by Gyula Svehla. Pergamon, New York, 1966. 429 pp. Illus. $18.50. International Series of Monographs in Analytical Chemistry, vol. 26.

A History of Space Flight. Eugene M. Emme. Holt, Rinehart, and Winston, New York, 1966. 224 pp. Illus. $2.95.

Hortulus. Walahfrid Strabo. Translated from the 9th century manuscript by Raef Payne. Commentary by Wilfrid Blunt. Hunt Botanical Library, Pittsburgh, Pa., 1966. 103 pp. Illus. $12.

The Human Body in Equipment Design. Albert Damon, Howard W. Stoudt, and Ross A. McFarland. Harvard Univ. Press, Cambridge, Mass., 1966. 380 pp. Illus. $11.95.

In the Name of Science. H. L. Nieburg. Quadrangle Books, Chicago, 1966. 443 pp. $7.95.

Index Kewensis: Plantarum Phanerogamarum. Supplement 13. Compiled by George Taylor. Oxford Univ. Press, New York, 1966. 153 pp. $18.50. Covers the data between 1956 and 1960.

Indian Culture and European Trade Goods. The archaeology of the historic period in the western Great Lakes region. George Irving Quimby. Univ. of Wisconsin Press, Madison, 1966. 231 pp. Illus. $5.

Insects and Their World. Harold Oldroyd. British Museum (Natural History), London, ed. 2, 1966. 152 pp. Illus. Paper, 7s 6d.

Intelligence in the Universe. Roger A. MacGowan and Frederick I. Ordway, III. Prentice-Hall, Englewood Cliffs, N.J., 1966. 416 pp. Illus. $13.50.

International Politics since World War II: A Short History. Charles L. Robertson. Wiley, New York, 1966. 397 pp. Paper, $3.95; cloth, $6.95.

Into Work. Michael Carter. Penguin Books, Baltimore, 1966. 239 pp. Paper, $1.25.

Is Reality Meaningful? Kelvin Van Nuys. Philosophical Library, New York, 1966. 624 pp. $10.

Land under the Pole Star: A Voyage to the Norse Settlements of Greenland and the Saga of the People That Vanished. Helge Ingstad. Translated from the Norwegian edition (1959) by Naomi Walford. St. Martin's Press, New York, 1966. 381 pp. Illus. $10.

Law and Administration. Jerry L. Weinstein, Ed. Pergamon, New York, 1966. 426 pp. $15. Progress in Nuclear Energy Series, vol. 4. Nine papers: "The Vienna International Conference on Civil Liability for Nuclear Damage" by Karlfritz Wolff; "The Paris Supplementary Convention" by Raffaello Fornasier; "International Conventions on Civil Liability and Latin American Legislations" by Enrique Zaldivar; "Liability Legislation in Japan" by Shunji Shimoyama; "Some factors influencing the regulation of nuclear health and safety" by Ian Williams; "Reactor sites and safety" by C. Rogers McCullough; "Private ownership of special nuclear material in the United States" by Gerald Charnoff; "Legal and administrative problems arising from the implementation of International Atomic Energy Agency safeguards" by Paul C. Szasz; and "Liability of operators of nuclear ships: The 1962 Brussels Convention and its alternatives" by Peider Könz. There are 13 appendices containing the texts of the conventions and various documents.

Lectures on Geology: Including Hydrography, Mineralogy, and Meteorology with an Introduction to Biology. John Walker. Harold W. Scott, Ed. Univ. of Chicago Press, Chicago, 1966. 326 pp. Illus. $8.50. Most of the papers are dated between 1782 and 1796.

The Living World of the Sea. William J. Cromie. Prentice-Hall, Englewood Cliffs, N.J., 1966. 349 pp. Illus. $6.95.

Mariner IV to Mars. Willy Ley. New American Library, New York, 1966. 157 pp. Illus. Paper, 60¢.

Mathematics for Everyone. F. Klinger. Based on a translation of the French edition. Philosophical Library, New York, 1966. 207 pp. Illus. $4.75.

Medical Practice in Modern England: The Impact of Specialization and State Medicine. Rosemary Stevens. Yale Univ. Press, New Haven, Conn., 1966. 415 pp. Illus. $10.

Medicine in America: Historical Essays. Richard Harrison Shryock. Johns Hopkins Press, Baltimore, 1966. 366 pp. $7.50.

Medicine in Modern Society. Medical planning based on evaluation of medical achievement. Thomas McKeown. Hafner, New York, 1966. 234 pp. Illus. $5.25.

Men, Machines and History. The story of tools and machines in relation to social progress. S. Lilley. International Publishers, New York, 1966. 366 pp. Illus. $7.50.

Mind and Cosmos. Essays in contemporary science and philosophy. Robert C. Colodny, Ed. Univ. of Pittsburgh Press, Pittsburgh, Pa., 1966. 380 pp. Illus. $8. Ten essays by Herbert A. Simon, Dudley Shapere, Sylvain Bromberger, Carl G. Hempel, Wesley C. Salmon, Joseph T. Clark, Thomas Gold, and Henry Margenau.

Multilingual Dictionary of Important Terms in Molecular Spectroscopy. Prepared by the Subcommission on Units and Terminology. Gerhard Herzberg, chairman. Commission on Molecular Structure and Spectroscopy, National Research Council of Canada, Ottawa, 1966. 227 pp. Illus. Paper. Available free to spectroscopists, librarians, and other interested scientists on request to the Secretary, National Research Council of Canada. The dictionary is divided into five sections, English, French, German, Japanese, and Russian, with the equivalent of each word or phrase given in the other four languages.

Mycenae and the Mycenaean Age. George E. Mylonas. Princeton Univ. Press, Princeton, N.J., 1966. 340 pp. Illus. Plates. $18.50.

The New Field Book of Freshwater Life. Elsie B. Klots. Putnam, New York, 1966. 398 pp. Illus. $4.95.

New Light on Prehistoric China. Cheng Te-K'un. Heffer, Cambridge, England; Univ. of Toronto Press, Toronto, 1966. 63 pp. Illus. $5. Archaeology in China, supplement to vol. 1.

The New Technology and Human Values. John G. Burke, Ed. Wadsworth, Belmont, Calif., 1966. 416 pp. Paper, $3.95; cloth, $5.25. Sixty-two papers on the following topics: Science, Technology, and Society (19 papers); Automation—A Creation of the New Technology (13 papers); The New Technology and Emerging Issues (16 papers); and Science, Technology, and the Policy-Making Process (14 papers).

New Universities in the Modern World. Murray G. Ross, Ed. Macmillan, London; St. Martin's Press, New York, 1966. 200 pp. Illus. $5. Eleven papers.

Our World and the Universe Around It. vols. 1 to 4. vol. 1, *The Universe* (167 pp.); vol. 2, *The Earth* (169 pp.); vol. 3, *Matter and Energy* (136 pp.); vol. 4, *Life* (141 pp.). Ginestra Amaldi. Translation based on the Italian edition by Norman Rudnick. Abradale Press, New York, 1966. Illus. $40 set.

Pastoral Plants of the Riverine Plain. J. H. Leigh and W. E. Mulham. Jacaranda Press, Brisbane, Australia, 1966. 186 pp. Illus. $10.50.

Patterns of Life: The Unseen World of Plants. William M. Harlow. Harper and Row, New York, 1966. 128 pp. Illus. $6.95.

Peabody Museum Papers, vol. 57, No. 1, *Craniometry and Multivariate Analysis: The Jomon Population of Japan, A Study by Discriminant Analysis of Japanese and Ainu Crania*, W. W. Howells; *A Multiple Discriminant Analysis of Egyptian and African Negro Crania*, J. M. Crichton. Peabody Museum, Cambridge, Mass., 1966. 75 pp. Illus. Paper, $3.50.

Percentage Baseball. Earnshaw Cook. M.I.T. Press, Cambridge, Mass., ed. 2, 1966. 431 pp. Illus. $9.95.

Philosophy of Natural Science. Carl G. Hempel. Prentice-Hall, Englewood Cliffs, N.J., 1966. 128 pp. Paper, $1.75. Foundations of Philosophy Series.

The Physiological Basis of Habituation. E. M. Glaser. Oxford Univ. Press, New York, 1966. 112 pp. Illus. Paper, $3.50.

Prehistoric and Primitive Man. Andreas Lommel. McGraw-Hill, New York, 1966. 176 pp. Illus. $5.95.

Probability, Confirmation, and Simplicity. Readings in the philosophy of inductive logic. Marguerite H. Foster and Michael L. Martin, Eds. Odyssey Press, New York, 1966. 480 pp. Illus. $7.25. Thirty-six papers on the following topics: The Meaning of Probability (12 papers); Problems of Confirmation Theory (5 papers); Simplicity (6 papers); and The Justification of Induction (13 papers).

A Proposed Model for Visual Information Processing in the Human Brain. Matthew Kabrisky. Univ. of Illinois Press, Urbana, 1966. 112 pp. Illus. $6.75.

Recommendations of the International Commission on Radiological Protection. Published for The International Commission on Radiological Protection. Pergamon, New York, 1966. 31 pp. $1.75.

Report of the International Clearinghouse on Science and Mathematics Curricular Developments. Compiled under the direction of J. David Lockard. American Assoc. for the Advancement of Science and Science Teaching Center, Univ. of Maryland, College Park, 1966. 311 pp. Paper. Available free from J. D. Lockard, Science Teaching Center.

Roman Africa in Color. Mortimer Wheeler. McGraw-Hill, New York, 1966. 160 pp. Plates. $25.

Russian-English Dictionary of Prestressed Concrete and Concrete Construction. Ben C. Gerwick, Jr., and Peter V. Peters, Eds. Gordon and Breach, New York, 1966. 119 pp. $20.

Science and the Modern World. Lectures presented at Georgetown University, Washington, D.C. on the occasion of its 175th anniversary, October 1963–May 1964. Jacinto Steinhardt, Ed. Plenum Press, New York, 1966. 235 pp. Illus. $7.50. Ten papers: "New developments in our knowledge of the universe" by G. C. McVittie; "Biological evolution and human equality" by Theodosius Dobzhansky; "Limits of scientific enquiry" by Ernan McMullin; "The socialization of science" by James McCormack; "Practical uses of atomic energy" by Arthur E. Ruark; "Population trends and population control" by Ansley J. Coale; "The impact of new materials and new instrumentation on our foreseeable technology" by E. R. Piore; "Design for a brain" by Philip M. Morse; "The revolution in biology and medicine" by Bentley Glass; and "Is there life on other worlds?" by Carl C. Kiess.

The Science of Science. Maurice Goldsmith and Alan MacKay. Penguin Books, Hammondsworth, England, ed. 2, 1966. 317 pp. Illus. Paper, 6d. Sixteen papers contributed by C. P. Snow, E. H. S. Burhop, P. M. S. Blackett, Gerard Piel, C. F. Powell, Herbert Coblans, Peter Kapitsa, Alexander King, Joseph Needham, J. B. S. Haldane, N. W. Pirie, R. L. M. Synge, Maurice Korach, D. J. de S. Price, Stevan Dedijer, and J. D. Bernal.

The Sciences and the Humanities: Conflict and Reconciliation. W. T. Jones. Univ. of California Press, Berkeley, 1965. 294 pp. Illus. $6.50.

Scientific and Managerial Manpower in Nuclear Industry. James W. Kuhn. Columbia Univ. Press, New York, 1966. 229 pp. $7.50.

Selected Logic Papers. W. V. Quine. Random House, New York, 1966. 260 pp. Illus. $6.95. Contains 23 papers written between 1934 and 1960.

Seven States of Matter. Milton Gootlieb, Max Garbuny, and Werner Emmerich. Walker, New York, 1966. 255 pp. Illus. $5.95.

Shell Collecting: An Illustrated History. S. Peter Dance. Univ. of California Press, Berkeley, 1966. 378 pp. Illus. $10.

A Social History of Engineering. W. H. G. Armytage. M.I.T. Press, Cambridge, Mass., 1966. 378 pp. Illus. $10.

La Soif du Monde et le Dessalement des Eaux. Cyril Gomella. Presses Universitaires de France, Paris, 1966. 245 pp. Illus. Paper, F. 16. La Science Vivante Series.

Solid State Chemistry: Whence, Where and Whither. J. Arvid Hedvall. Elsevier, New York, 1966. 108 pp. Illus. $6.50.

Le Solutréen en France. Philip E. L. Smith. Laboratory of Prehistory, Univ. of Bordeaux, Bordeaux, France, 1966. 465 pp. Illus. Paper, F. 120.

The Territorial Imperative. A personal inquiry into the animal origins of property and nations. Robert Ardrey. Atheneum, New York, 1966. 404 pp. Illus. $6.95.

The Thread of Life. An introduction to molecular biology. John C. Kendrew. Harvard Univ. Press, Cambridge, Mass., 1966. 142 pp. Illus. $4.

The Travel Diaries of Thomas Robert Mathus. Patricia James, Ed. Cambridge Univ. Press, New York, 1966. 332 pp. Illus. $8.50.

Treatise on Invertebrate Paleontology. pt. U, *Echinodermata 3*, vols. 1 and 2. Raymond C. Moore, Ed. Geological Soc. of America, New York; Univ. of Kansas Press, Lawrence, 1966. vol. 1, 396 pp.; vol. 2, 331 pp. Illus. $18.50 set.

Ultraviolet and Visible Absorption Spectra: Index for 1960–1963. Including also references to optical rotatory dispersion and circular dichroism spectra. Herbert M. Hershenson. Academic Press, New York, 1966. 245 pp. $14.

United States Government Organization Manual, 1966–1967. Office of the Federal Register, General Services Administration, Washington, D.C., 1966 (order from Superintendent of Documents, Washington, D.C.). 819 pp. Paper, $2.

United States Merchant Shipping Policies and Politics. Samuel A. Lawrence. Brookings Institution, Washington, D.C., 1966. 419 pp. $8.75.

The Use of Computers in Business Organizations. Frederic G. Withington. Addison-Wesley, Reading, Mass., 1966. 253 pp. Illus. $7.95.

The Validity of Occupational Aptitude Tests. Edwin E. Ghiselli. Wiley, New York, 1966. 165 pp. Illus. $7.95.

World List of Scientific Periodicals. Scientific medical and technical entries from the British Union Catalogue of Periodicals. Kenneth I. Porter, Ed. Butterworth,

Washington, D.C., 1966. 212 pp. $24. Records new periodical titles for the period in and after 1960.

Conference and Symposium Reports

Acquisition of Skill. Proceedings of a conference (New Orleans, La.), March 1965. Edward A. Bilodeau, Ed. Academic Press, New York, 1966. 555 pp. Illus. $12.50. Ten papers: "A brief history of research on the acquisition of skill" by Arthur L. Irion; "Selective learning" by Clyde E. Noble; "Individual differences" by Marshall B. Jones; "Some mechanisms of motor responding: An examination of attention" by Jack A. Adams; "Facilitation and interference" by William F. Battig; "Information feedback" by Ina McD. Bilodeau; "Retention" by Edward A. Bilodeau; "Tracking behavior" by E. C. Poulton; "Cybernetic theory and analysis of learning" by Karl U. Smith; and "Motor-skills learning and verbal learning: Some observations" by Benton J. Underwood.

Advances in X-Ray Analysis. vol. 9. Proceedings of the Fourteenth Annual Conference on Applications of X-ray Analysis (Denver, Colo.), August 1965. Gavin R. Mallett, Marie Fay, and William M. Mueller, Eds. Plenum Press, New York, 1966. 554 pp. Illus. $22.50. Forty-seven papers.

Aspects of Comparative Ophthalmology. Proceedings of a symposium organized by the British Small Animal Veterinary Association (London), June 1965. Oliver Graham-Jones, Ed. Pergamon, New York, 1966. 357 pp. Illus. $13. Twenty-seven papers.

Biological Membranes: Recent Progress. (*Ann. N.Y. Acad. Sci.* **137**). Edward M. Weyer, Ed. New York Academy of Sciences, New York, 1966. 646 pp. Illus. Paper, $12. Forty-six papers presented at a conference held in October 1965.

Biosynthesis of Aromatic Compounds. vol. 3. Proceedings of the Second Meeting of the Federation of European Biochemical Societies (Vienna), April 1965. G. Billek, Ed. Pergamon, New York, 1966. 152 pp. Illus. $4.50. Thirteen papers.

Breeding Pest-Resistant Trees. Proceedings of a N.A.T.O. and N.S.F. Advanced Study Institute (University Park, Pa.), August-September 1964. H. D. Gerhold, R. E. McDermott, E. J. Schreiner, and J. A. Winieski, Eds. Pergamon, New York, 1966. 515 pp. Illus. $24. Fifty-eight papers.

Cell Differentiation and Morphogenesis. International Lecture Course (Wageningen, The Netherlands), April 1965. W. Beermann, R. J. Gautheret, P. D. Nieuwkoop, C. W. Wardlaw, V. B. Wigglesworth, E. Wolff, and J. A. D. Zeevaart. North-Holland, Amsterdam; Interscience (Wiley), New York, 1966. 217 pp. Illus. $9.75.

Chromosome Manipulations and Plant Genetics. Contributions to a symposium held during the Tenth International Botanical Congress (Edinburgh), August 1964. Ralph Riley and K. R. Lewis, Eds. Plenum Press, New York, 1966. 131 pp.

Illus. $8. Nine papers: "Some experimental applications of aneuploidy in *Nicotiana*" by D. R. Cameron; "Chromosome engineering in *Lycopersicon*" by Charles M. Rick and Gurdev S. Khush; "Haploidy as a new approach to the cytogenetics and breeding of *Solanum tuberosum*" by S. J. Peloquin, R. W. Hougas, and A. C. Gabert; "Nullisomic-tetrasomic combinations in hexaploid wheat" by E. R. Sears; "Estimates of the homoeology of wheat chromosomes by measurements of differential affinity at meiosis" by Ralph Riley and Victor Chapman; "Biometrical analysis using chromosome substitutions within a species" by C. N. Law; "Establishing a monosomic series in *Avena sativa* L" by R. C. McGinnis; "Attributes of intra- and inter-specific aneuploidy in *Gossypium*" by Meta S. Brown; and "Aspects of chromosome manipulation: a résumé" by D. U. Gerstel and T. J. Mann.

Civil Defense. A symposium. AAAS Publication No. 82. Henry Eyring, Ed. AAAS, Washington, D.C., 1966. 144 pp. Paper, members, $3.50; others, $4. Seven papers: "The basic case for civil defense" by Fred A. Payne; "Civil defense as insurance and as military strategy" by Wolfgang K. H. Panofsky; "The effect of civil defense on strategic planning" by Owen Chamberlain; "The possible effectiveness of civil defense" by Eugene P. Wigner; "Medical aspects of civil defense" by Victor W. Sidel; "The agricultural problems in civil defense" by John H. Rust; and "Feasibility of biological recovery from nuclear attack" by Barry Commoner.

The Cnidaria and Their Evolution. Proceedings of a symposium (London), March 1965. W. J. Rees, Ed. Published for the Zoological Society of London. Academic Press, New York, 1966. 467 pp. Illus. $17.50. Eighteen papers.

Data/Information Availability. Papers presented at an institute under the auspices of the Center for Technology and Administration, American University (Washington, D.C.). Ralph I. Cole, Ed. Thompson, Washington, D.C., 1966. 199 pp. Illus. $8.50. Thirteen papers.

Diagnostic Ultrasound. Proceedings of the First International Conference (Pittsburgh, Pa.), 1965. Charles C. Grossman, Joseph H. Holmes, Claude Joyner, and Edward W. Purnell, Eds. Plenum Press, New York, 1966. 533 pp. Illus. $11.50. Thirty-three papers.

The Earth-Moon System. Proceedings of an international conference (New York), January 1964. B. G. Marsden and A. G. W. Cameron, Eds. Plenum Press, New York, 1966. 302 pp. Illus. $12.50. Sixteen papers.

The Economics of Air Pollution. A symposium. Harold Wolozin, Ed. Norton, New York, 1966. 318 pp. Illus. $5. Nine papers: "Air pollution—General background and some economic aspects" by Allen V. Kneese; "Economic incentives in air-pollution control" by Edwin S. Mills; "Risks versus costs in environmental health" by Leslie A. Chambers; "The structuring of atmospheric pollution control systems" by Thomas D. Crocker; "Strategies for measuring the cost of air pollution" by Ronald G. Ridker; "The

use of government statistics in air-pollution control" by Edward T. Crowder; "The use of consumer-expenditure data in air-pollution control" by Helen H. Lamale; "Air-pollution control in the metropolitan Boston area: A case study in public policy formation" by Lester Goldner; and "Setting criteria for public expenditures on air-pollution abatement: Theoretical foundations and limitations" by Harold Wolozin.

The Economics of Education. Proceedings of a conference held by the International Economic Assoc. (Menthon-St.-Bernard, France), 1963. E. A. G. Robinson and J. E. Vaizey, Eds. Macmillan, London; St. Martin's Press, New York, 1966. 800 pp. Illus. $16. Twenty-four papers on the following topics: General Problems of Education (3 papers); Education and Economic Progress (7 papers); Demand and Supply (3 papers); The Cost and Financing of Education (4 papers); Balance Between Different Forms of Education (5 papers); International Aid in Education (2 papers); and a Report on the Proceedings.

The Education of a Physicist. An international conference (London), July 1965. Sanborn C. Brown and Norman Clarke, Eds. M.I.T. Press, Cambridge, Mass., 1966. 195 pp. Illus. $7.50. Fifteen papers on the following topics: First-Degree Courses (4 papers); Special Problem Areas (5 papers); Practical Work, Films, and Television (2 papers); Technical Universities (1 paper); and Relationships Between Government, Industry, and the University (3 papers).

Electron Spin Resonance and the Effects of Radiation on Biological Systems. Proceedings of a conference (Gatlinburg, Tenn.), May 1965. Wallace Snipes, Ed. Natl. Acad. of Sciences–Natl. Research Council, Washington, D.C., 1966. 206 pp. Illus. Paper, $4. Eight papers: "Summary of electron spin resonance technique as applied to radiation-produced radicals" by Ralph Livingston; "Radiation-produced electron spin resonance signals in nucleic acids" by Adolph Müller; "Electron spin resonance of irradiated deoxyribonucleic acid" by R. G. Shulman, R. O. Rahn, P. S. Pershan, J. W. Longworth, and J. Eisinger; "Electron spin resonance signals in irradiated proteins" by Thormod Henriksen; "Radiation chemistry of proteins in the dry state" by Bert M. Tolbert; "Contributions of electron paramagnetic resonance techniques to the understanding of radiation biology" by E. L. Powers; "The significance of electron spin resonance measurements on irradiated biological macromolecules" by Peter Alexander; and "Biological damage and free radicals in irradiated seeds" by Alan D. Conger.

The Evolution of Canada's Flora. A colloquium commemorating the founding meeting of the Canadian Botanical Association (Ottawa), May 1965. Roy L. Taylor and R. A. Ludwig, Eds. Univ. of Toronto Press, Toronto, 1966. 145 pp. Illus. $5.50. Eight papers: "Personal recollections of Frère Marie-Victorin" by Marcel Raymond; "Phytogeographic zonation: An ecological appreciation" by J. S. Rowe; "Evolutionary and phytogeographic patterns in the Canadian moss flora"

by Howard Crum; "Reproductive specialization as a factor in the evolution of the Canadian flora" Theodore Mosquin; "Aspects of the late-Pleistocene history of the Canadian flora" by J. C. Ritchie; "Movement of plants under the influence of man" by Jacques Rousseau; "Development of marine benthic algal communities on Vancouver Island, British Columbia" by Robert K. S. Lee; and "Vegetative propagation in relation to the aggressiveness of species" by T. A. Steeves, R. T. Coupland, and M. V. S. Raju.

The Evolving Society. Proceedings of the First Annual Conference on the Cybercultural Revolution—Cybernetics and Automation. Alice Mary Hilton, Ed. Institute for Cybercultural Research, New York, 1966. 424 pp. Illus. $8.95. Twenty-nine papers on the following topics: Basic Assumptions (4 papers); Computing Machines and Cybernated Systems (6 papers); The Evolving Society (8 papers); The Future Society—Concepts (7 papers); The Future Society—Reasons for Hope and Causes for Fear (4 papers).

First International Congress of Parasitology, Proceedings (Rome), September 1964. vols. 1 and 2. Augusto Corradetti, Ed. Tamburini Editore, Milan; Pergamon, New York, 1966. vol. 1, 656 pp.; vol. 2, 496 pp. Illus. $45 set. The papers are in various languages.

Full Cycles of High Temperature Gas-Cooled Reactors. Proceedings of a conference (Brussels), June 1965. D. Tytgat, Ed. European Atomic Energy Community, Brussels, 1965. 662 pp. Illus $12. Twenty-six papers.

Head Injury. Proceedings of a conference (Chicago), February 1966. William F. Caveness and A. Earl Walker, Eds. Lippincott, Philadelphia, 1966. 589 pp. Illus. $15. Forty papers.

Heat Flow Below 100°K and Its Technical Applications. Proceedings of the International Institute of Refrigeration (Grenoble, France), June 1965. Louis Weil, Ed. Pergamon, New York, 1966. 364 pp. Illus. $12. Thirty-two papers on the following topics: Heat Transfer in Solids (11 papers); Heat Transfer in Liquids (1 paper); Heat Transfer in Powders (1 paper); Heat Transfer to Liquid Nitrogen and Hydrogen (4 papers); Heat Transfer in Missiles and Space Operations (3 papers); Heat Transfer to Liquid Helium (8 papers); and miscellaneous (4 papers). Papers are in English or French, with a summary of each in both French and English.

How to Collect Shells. Based on symposia given at meetings of the American Malacological Union during the last 25 years. American Malacological Union, Marinette, Wis., ed. 3, 1966. 105 pp. Illus. Paper, $2. Twenty-five papers.

Insect Behaviour. A symposium (London), September 1965. P. T. Haskell, Ed. Royal Entomological Society, London, 1966. 121 pp. Illus. £2 5s. Eight papers: "Orientation behaviour in insects and factors which influence it" by G. Birukow; "The role of rhythms in insect behaviour" by P. S. Corbet; "Flight behaviour" by P. T. Haskell; "Feeding behaviour" by V. G. Dethier; "Sexual behaviour" by A. Manning; "Insect communication" by J. D. Carthy; "Behaviour