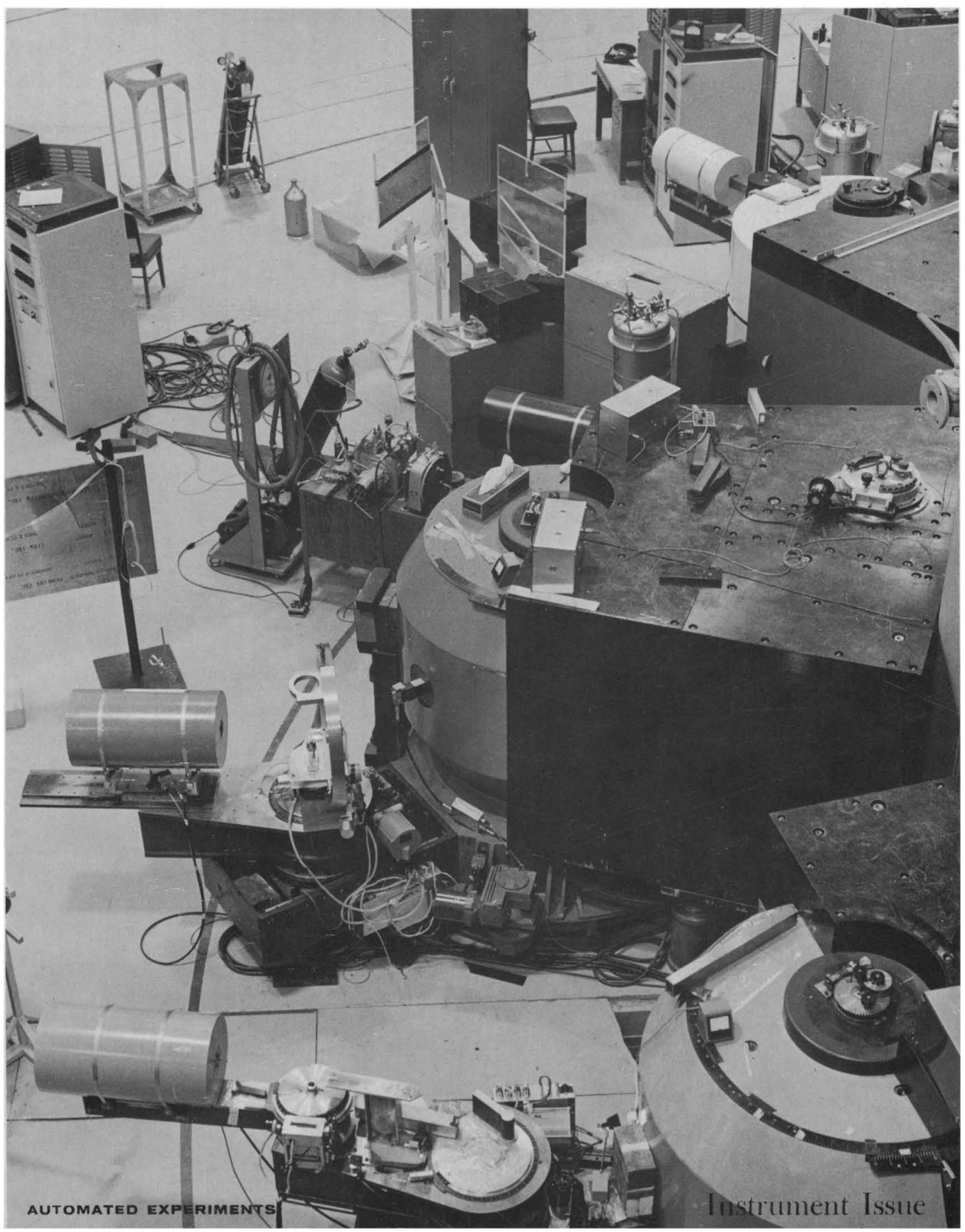
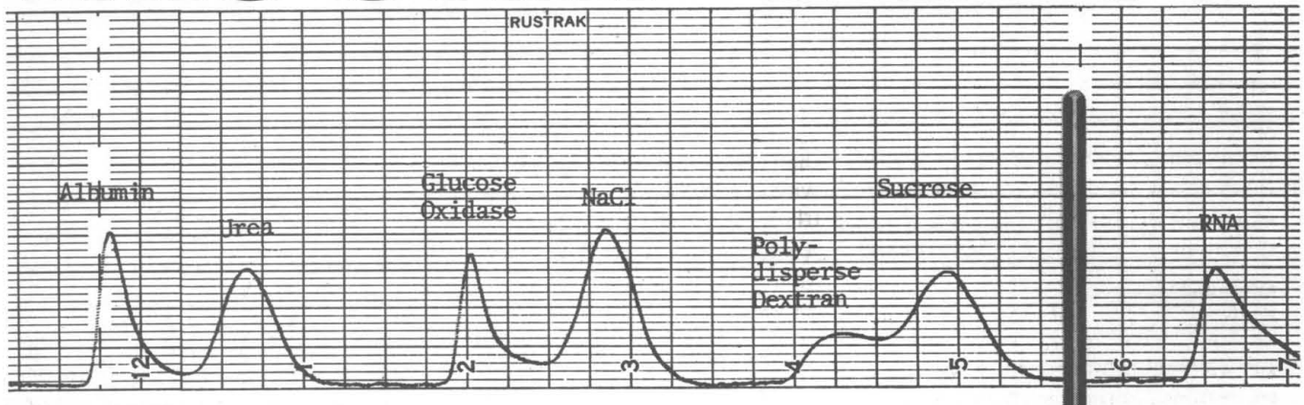
SCIENCE 6 October 1967
Vol. 158, No. 3797
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



AUTOMATED EXPERIMENTS

Instrument Issue

WHAT IS MISSING FROM THIS STRIP CHART?



Carbohydrates? Polysaccarides? Polypeptides? Indoles? Alkaloids? True—But the **E-C COLUMN MONITOR** won't miss them if they're there.

This new instrument will detect changes in concentration of *any* solute—without damaging the sample.

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- Monolithic integrated circuits incorporated into a simple design which guarantees a consistent performance.

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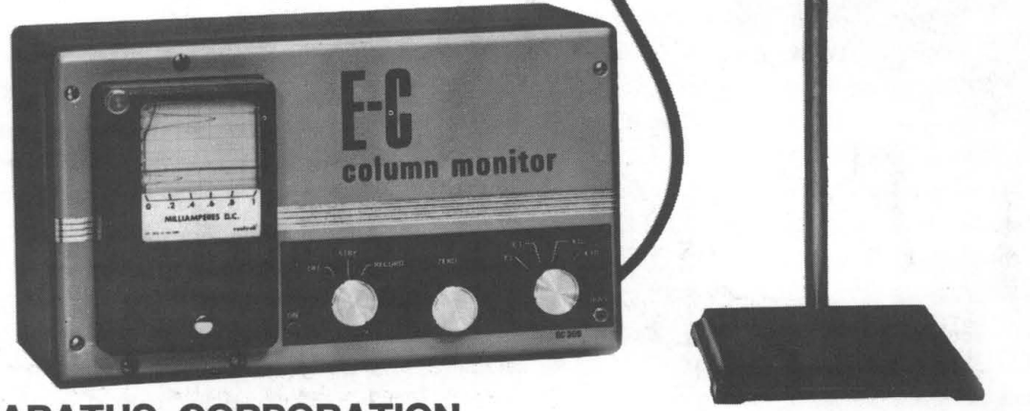

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Films, filmstrips, transparencies...

New Mettler teaching aids make straight the way of the educator

The first few hours of beginning chemistry require the wisest use of teaching talent – you've got to teach your entire class how to get valid results from your balances. Because weighing is really a one-man thing, community efforts lead to short tempers, long faces and general lack of accomplishment.

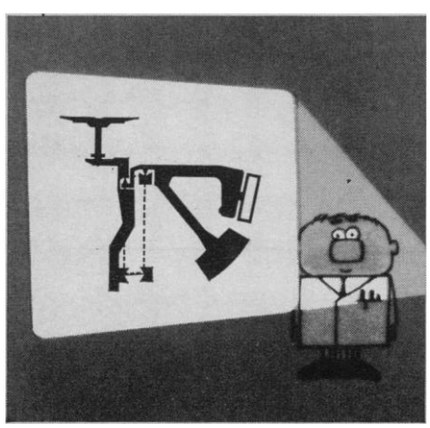
FRET NOT . . .
PEEK INTO OUR ARMAMENTARIUM

Things now are better than they were before. We at Mettler have produced, in response to requests from educators in the same fix as you, teaching aids including sound films in color, filmstrips, transparencies and student weighing instructions. We call our collection the Mettler Armamentarium.

Our teaching aids are yours on the most attractive terms imaginable . . . films on free loan, filmstrips and transparencies at cost, and student weighing instructions for free.

SOUND FILMS IN COLOR

Newest is the 21-minute 16mm color film, "The Top-loading Balance." Covering theory, application and use of

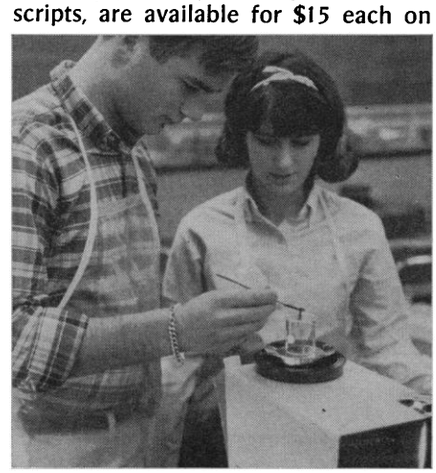


Mettler P-type balances, this film helps you convey the complete story in minimum time and with maximum impact. This film is particularly timely, now that the top-loader is gaining ever wider acceptance in research, industrial and academic fields.

A film we produced last year, "The Modern Balance," has been viewed by hundreds of thousands of students. It covers the history of the balance from Babylonian to modern times through works of art and sculpture. It also provides a brief review of weighing theory and instruction on using the modern analytical balance. It treats the modern single-pan balance, a Mettler innovation, sympathetically. Running time is sixteen minutes.

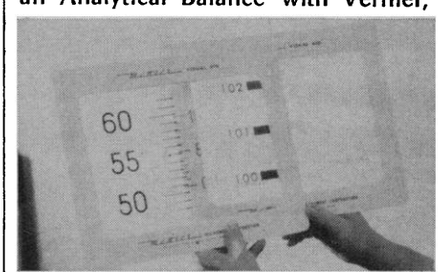
SINGLE-CONCEPT TEACHING AIDS

Filmstrips, accompanied by records and scripts, are available for $15 each on



the following subjects: how to use Mettler P120, P1000, or P1200 top-loading balances; how to use Mettler H6 Digital or H15 analytical balances; top-loading balance theory; analytical balance theory; and sources of weighing errors. These permit individual students or small groups to cover a single topic in only eight minutes.

Transparencies for overhead projection, yours for $5 each, enable you to get across a relatively small subject to a large group in a brief period. They include "Substitution Weighing Theory," "Reading a Top-loading Balance Optical Scale with Pointer," "Reading an Analytical Balance with Vernier,"



and exact reproductions of any Mettler balance readout.

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AND NOW . . . THE FREEBIES

We will supply you, at no charge, suitable quantities of the following: student weighing instructions for Mettler P120 top-loading balances; student weighing instructions for Mettler Model H analytical balances; instructions for lecture demonstration of theory of weighing; and experiment on balance use and measurement technique.

Write us, on your school letterhead, detailing the items you would like to receive. We are Mettler Instrument Corporation, 20 Nassau St., Princeton, New Jersey 08540.

Mettler®

6 October 1967
Vol. 158, No. 3797

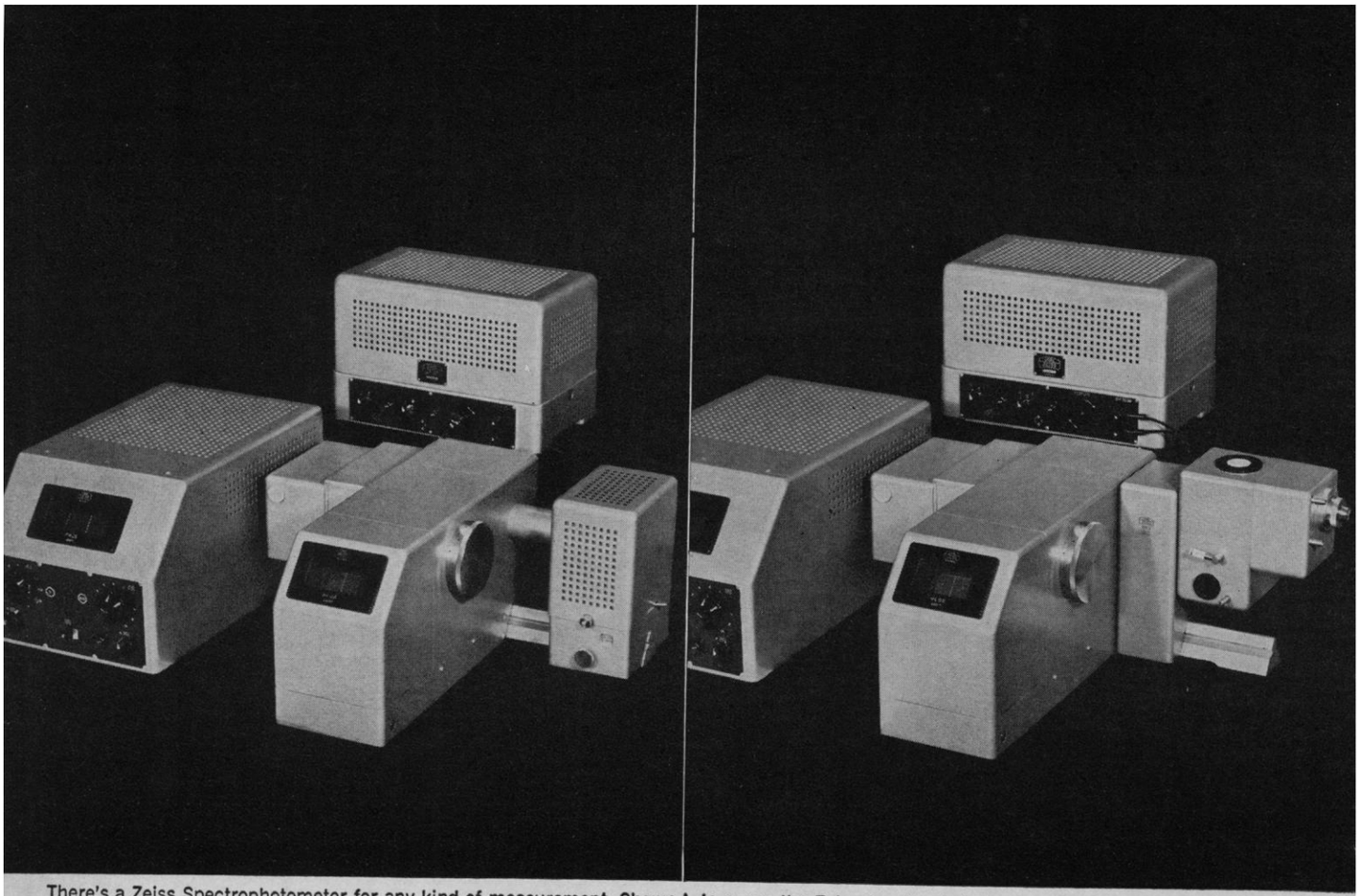
SCIENCE

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, 50¢ (back issues, $1), except **Guide to Scientific Instruments**, which is $2. School year subscriptions: 9 months, $7, 10 months, $7.50. New rates effective 1 January 1968: Annual subscriptions $12.00; foreign postage: Americas $3 overseas $5; single copies, 50¢ (back issues, $1), except **Guide to Scientific Instruments**, which is $2. School year subscriptions: 9 months, $9; 10 months, $10. Provide 4 weeks notice for change of address, giving new and old address and zip codes. Send a recent address label. SCIENCE is indexed in the **Reader's Guide to Periodical Literature**.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

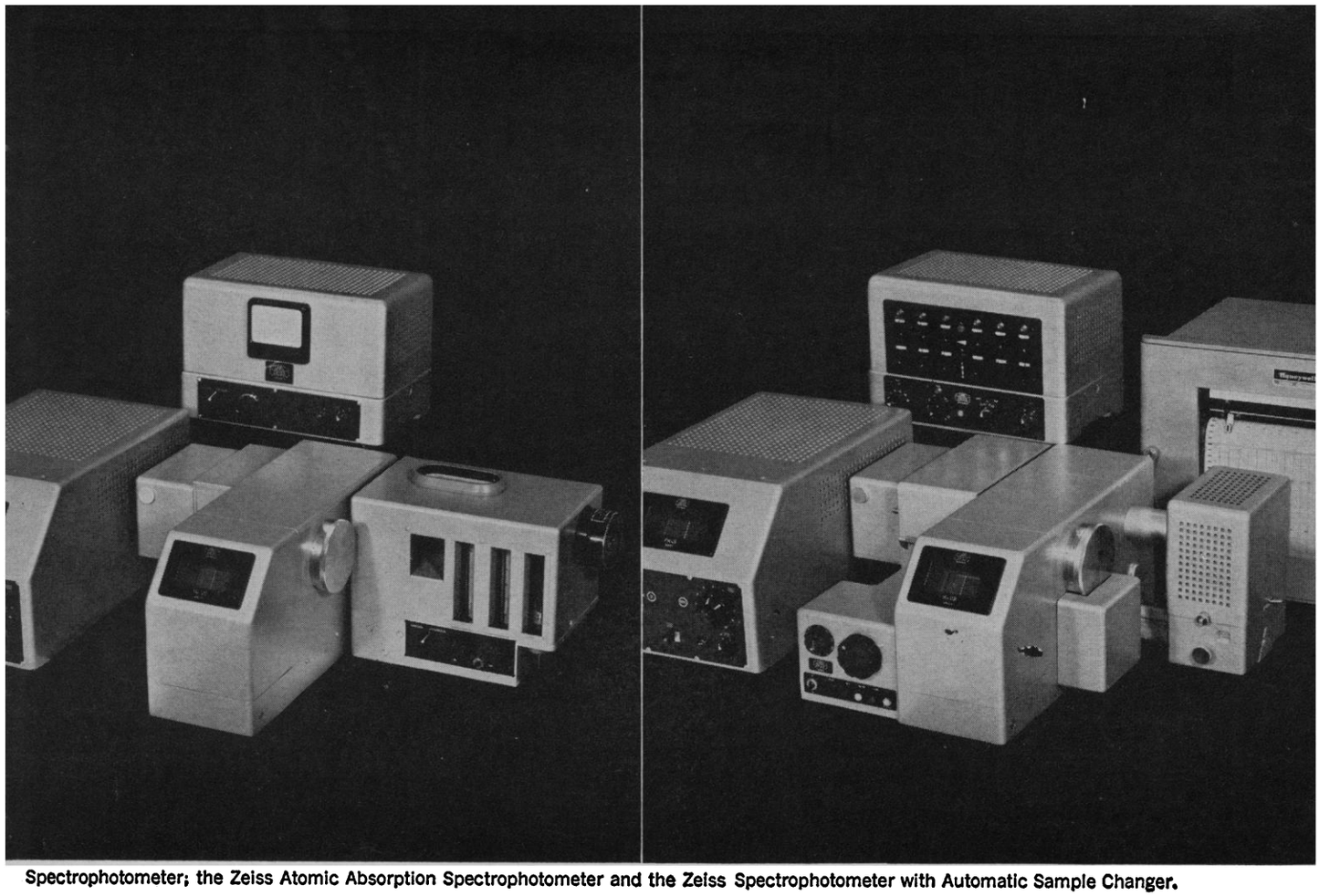
COVER

Automated spectrometers at Brookhaven National Laboratory's High Flux Beam Reactor. With on-line computers, experiments can be run even when specialists are not present. This scene is typical of a normal working day. See page 55. [Brookhaven National Laboratory, Upton, New York]



There's a Zeiss Spectrophotometer for any kind of measurement. Shown **l.** to **r.** are the Zeiss Spectrophotometer PMQ II; the Zeiss Reflectance

Ask us embarrassing questions about Spectrophotometers



Spectrophotometer; the Zeiss Atomic Absorption Spectrophotometer and the Zeiss Spectrophotometer with Automatic Sample Changer.

You'll find that no question can embarrass the Zeiss spectrophotometers.

Because they offer unparalleled capability, quality and precision, whatever your spectrophotometric requirements might be.

But you'll want proof of that claim. Which is why we hope you'll let us answer your questions about our remarkable line of single-prism instruments. Because they *are* single-prism, you might ask:

"Why do the Zeiss spectrophotometers have a prism instead of a grating?"

Because the single quartz prism can cover the wavelength range from far ultraviolet to near infrared. From 185 to 2,500 mμ.

"But doesn't it lose resolving power in the compressed visible range?"

No. Zeiss spectrophotometers can even resolve the sodium doublet—and do it with a single monochromator.

"How do they manage such high resolving power?"

With a slit width that can be kept exceptionally narrow because chopped light is amplified up to 15,000 times. With no visible hum.

"Will the Zeiss Spectrophotometers give me true wavelength settings for the entire range, even with only one dispersing element?"

Absolutely. Because Zeiss Spectrophotometers are so precise we've been able to use a much longer (180cm) parallax-free, direct-reading projection scale that gives you unmatched accuracy. And unmatched repeatability.

"With automatic 100% setting, can Zeiss Spectrophotometers reproduce any slit width within 0.5 microns?"

No. Within ± 0.1 micron.

"And how's your photometric accuracy?"

Completely linear. The 40cm-long projection scale gives you absolutely reliable direct absorption and transmission readings at all times. We've never had to service a single one of the Zeiss optical projection systems.

But you'll want to ask many more questions specifically related to the type of work you're doing. Whether it's flame, fluorescence, reflectance, absorption, atomic-absorption or automatic-kinetics-absorption work, there's a Zeiss spectrophotometer that can help you do better work.

For complete information, a demonstration, or a face-to-face question-answer session, write to Carl Zeiss Inc., 444 Fifth Ave., New York, N. Y. 10018. Complete service facilities available.

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CF IS A TRADE MARK

SOFICA light scattering photometer assures consistent research data

Many critical variables in light scattering photometry limit the accuracy of the polymer chemist's weight-average molecular weight and radius of gyration determinations. One way to minimize this problem is to find a highly skilled operator and give him all the time in the world to do his job; a better way is to use an instrument that has built-in safeguards against these variables. The Model 701 SOFICA Light Scattering Photometer is such an instrument.

The 701 has a dual photomultiplier whose *reference* unit measures fluctuations in light source intensity and continuously compensates for them through a dynode feedback to the *measuring* unit. It does this job so well that a 50% variation in light source intensity has less than a 1% effect on measurements.

The 701 uses fluid-immersed optics to eliminate the stray light problems that plague air-bath instruments, to drastically reduce the dependence of accuracy on cell cleanliness, and to eliminate many reflected light corrections from the computation. The liquid bath also improves temperature control of the sample cell which may be operated up to 150°C using the built-in controller. An external controller can also be used for more accurate temperature control and an external cooler for sub-ambient operation.

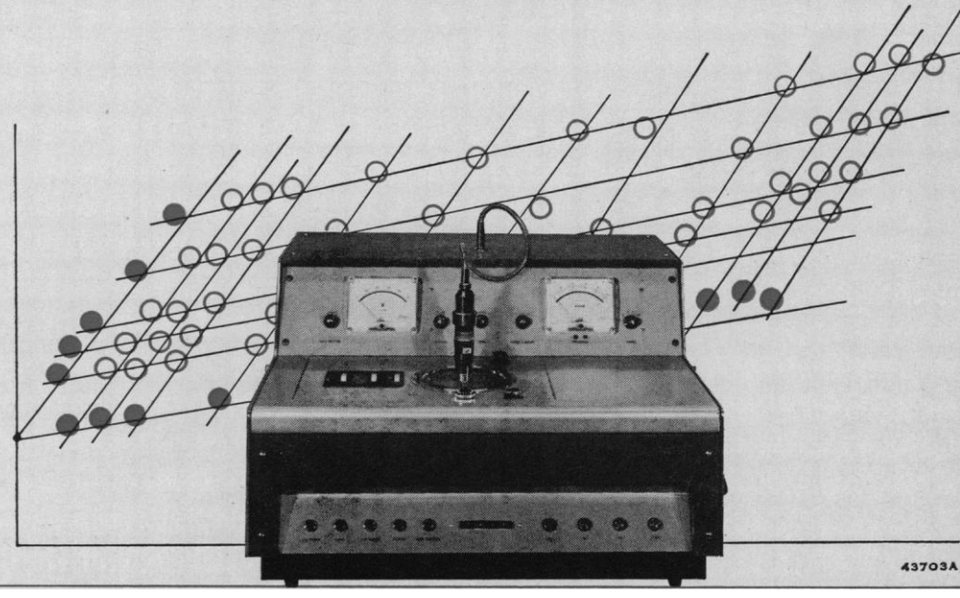
The 701 is automated to reduce the possibility of operator error. The measuring photomultiplier is automatically positioned at any of thirteen preselected angles by a motor-magnetic clutch mechanism (intermediate angles are available by manual setting). Scattered light intensities are read on a built-in meter with a stability within $\pm \frac{1}{2}\%$ over several hours and a sensitivity of 1×10^{-10} ampere. Recorder output is provided if a permanent record of intensity is required, or if kinetic measurements are being made. Incident light intensity is readily changed through a continuously adjustable slit. A manual shutter permits changing samples without interrupting high voltage supply to the measuring and reference photomultiplier tubes.

Prices start at $10,120. For more information write for data sheet 701 or call your local Hewlett-Packard sales office. (The SOFICA is sold and serviced in the U.S.A. exclusively by Hewlett-Packard.)

Hewlett-Packard, Route 41, Avondale, Pennsylvania 19311.

HEWLETT hp PACKARD

ANALYTICAL INSTRUMENTS

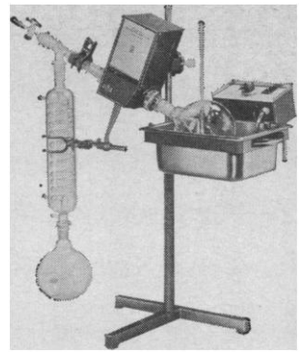


What else is new at Precision Scientific?

A great many things! These are but a few of the new and improved products designed to help you solve basic problems faster, more efficiently and with more positive results. Keep an eye on "Precision"... a variety of significant developments are in the making. And, keep in touch with your nearby Precision Scientific Distributor for fast, dependable service. Consult him on these products, or write us for the Bulletins mentioned below.

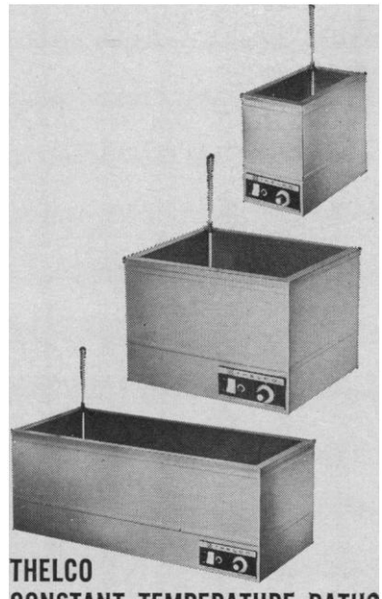
PRECISION VACUUM PUMPS

Newest, broadest line in the industry! Twelve brand new, internal vane vacuum pumps, with capacity ranges from 25 to 1500 liters/minute, at prices ranging from $100 to $1500. Guaranteed ultimate vacuum to 0.1 micron of mercury. Highly efficient, exceptionally quiet, surprisingly compact! Complete information in 24-page Bulletin 650.



FLASH EVAPORATORS

All new, highly versatile line of rotating thin-film evaporators with a full complement of modular, expandable accessories. Add a 1,000 or 2,000 ml flask to the basic unit then select your condensing means, a spiral condenser, Dewar condenser or a flask. Also a controlled heating bath. Fixed speed model at 120 rpm or a variable speed, 30 to 250 rpm. All-glass-and-Teflon® evaporating system for contamination-free performance. Request Bulletin 653.

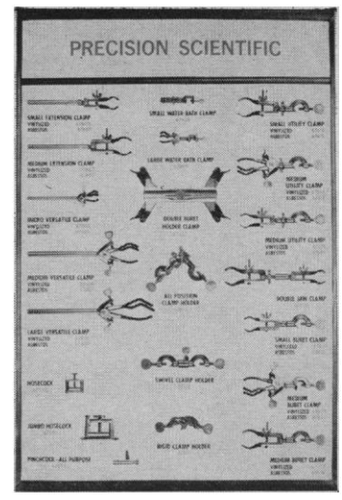


THELCO CONSTANT TEMPERATURE BATHS

There's a completely restyled Thelco constant temperature bath sized just right for your application, from a Micro size, holding just over a half-gallon, to the Large size, holding 9 gallons. All are double walled stainless steel—outside as well as inside—for corrosion-free performance, handsome appearance, long life and simple maintenance.

Thelco baths have been known to serve for 20 years and more. Why? Because only gravity convection is used. No moving parts to wear out or become noisy. Temperature uniformity is an excellent ±0.3 or better at 56°C.

Lo-Drift heaters respond promptly, and their rapid heat transfer insures quick warm-up and long heater life. Heaters will not burn out should bath go dry. Temperatures from ambient to 100°C. Ask for Bulletin 617.



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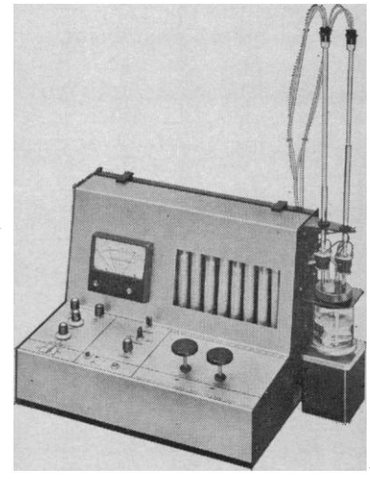
A complete line with the right clamp for your every laboratory need. Extension clamps, utility clamps, buret and double buret clamps and supports, support clamps, double jaw clamps, bath clamps, hose clamps and clamp holders. You name it... Precision's got it! Plus unique Lab-Frames® for sturdy, versatile lab set-ups. Constructed of PS Alloy® for unsurpassed strength, durability and corrosion resistance. Ask for Bulletin 641.



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Automates standard Karl Fischer methods to give you quick, accurate results, reproducible to ±0.025 ml of titrant. Selector switch gives you "direct" or "back" titrations without interchange of solution bottles. Each burette has its own electromagnetic glass-sealed valves. No diaphragms or stopcocks. "End point hold" and adjustable transfer from "continuous" to "pulse" feed also automatic. The last word in completely automatic water determinations. Get complete information in Bulletin 642.

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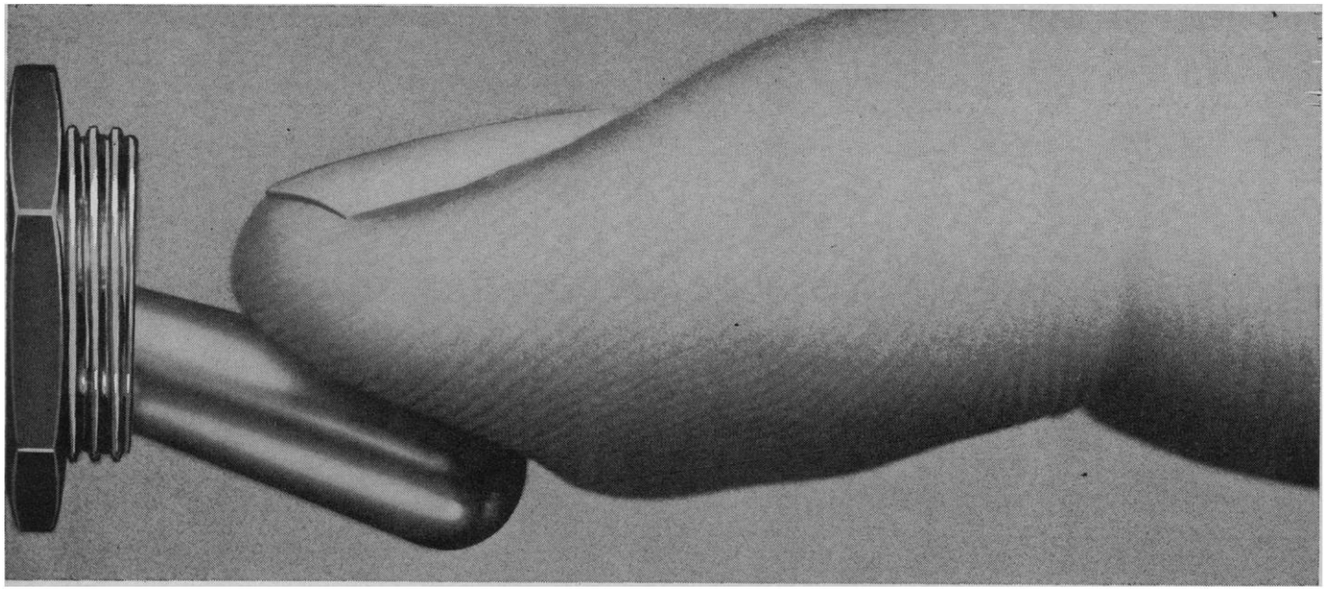
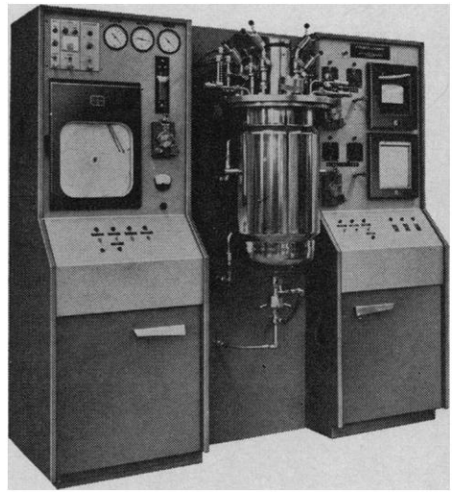


You throw the switches...



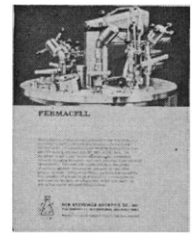
Let this new fermentor do the rest!

Growing cultures in the new Fermacell fermentor can now be achieved with push-button convenience. Set the dials—throw the switches—and a series of sequential operations control steam sterilization and environmental growth conditions. You enjoy simple, semi-automated, up-front control from initial sterilization to final harvesting—including inlet and outlet sterilization, agitation, aeration, temperature, pressure, foam and pH. The switches are electrically interlocked to operate in perfect sequence no matter which switch is energized first.

Fermacell is available in three sizes for working volumes of 40, 100 or 200 liters. One person can remove the fermentor vessel for cleaning, emptying or refilling in less than 3 minutes. Designed for basic laboratory research, this pilot-plant fermentor is used to grow aerobic and anaerobic bacteria, streptomycetes, molds and yeasts, as well as mammalian and plant tissue cultures. A wide range of accessories is available.

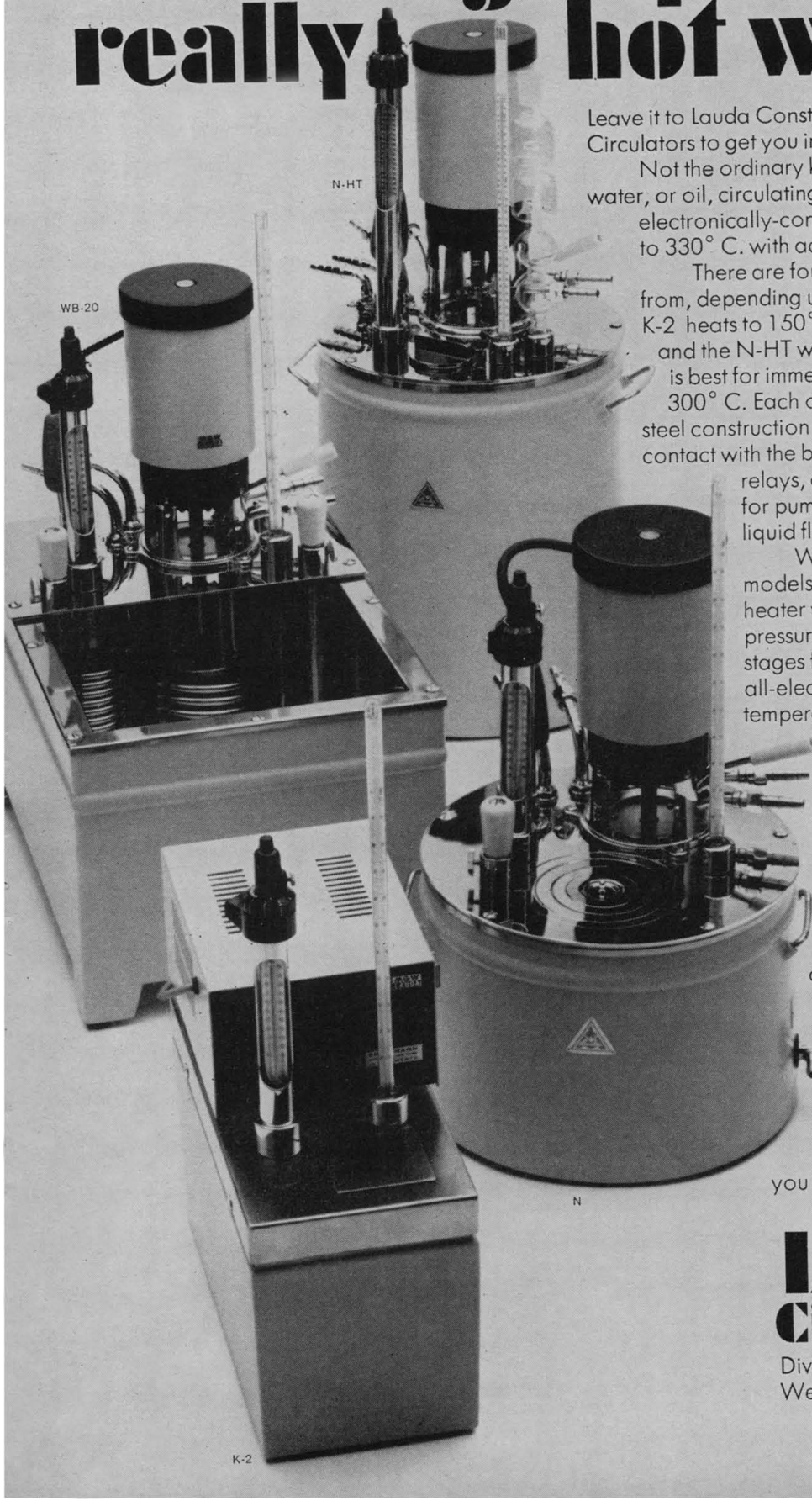
NBS

New Brunswick Scientific Co., Inc.
1130 Somerset Street, New Brunswick, N.J.
West Coast Office, San Jose, Calif. 09515



Ready for a switch?
Write today for Catalog FMS/1067

We can get you into really hot water!



Leave it to Lauda Constant Temperature Circulators to get you into hot water.

Not the ordinary kind, but really hot water, or oil, circulating at constant, electronically-controlled temperatures up to 330° C. with accuracy to ± .01° C.

There are four Lauda series to choose from, depending upon how hot you like it. The K-2 heats to 150° C., the N heats to 200° C., and the N-HT will heat to 330° C. The WB-20 is best for immersion while heating up to 300° C. Each of these models features stainless steel construction of all components that come into contact with the bath liquid, solid-state electronic relays, automatic excess load protection for pump, and manual drainage and liquid flow control valves.

With the exception of the K-2 series, all models also employ continuously variable heater wattage control, pressure only or pressure/suction pumps, and adjustable internal stages for immersion of samples. Optional all-electronic thermoregulators, excess temperature and liquid-level safety systems are also available.

A word about our N-HT high-temperature models. They are specifically engineered for superior performance at temperatures over 200° C. and incorporate many unique features, such as special high-temperature glass thermoregulators, fully sealed housing, water-cooled cover plate and special insulation.

There are lots of ways to get into hot water. Our new 32-page Lauda catalog will show you a few. It's free and it also provides information on refrigerated models that cool to —120° C.

We'd be happy to send you a copy on request.

Write:

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Westbury, N.Y. 11590

WORTHINGTON

New catalog from Worthington describes enzymes for research

A newly-published 20-page booklet, *Worthington Enzymes for Research,* covers all products offered by Worthington Biochemical Corporation. It includes:

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- enzymes specially purified by free flow electrophoresis and column chromatography;
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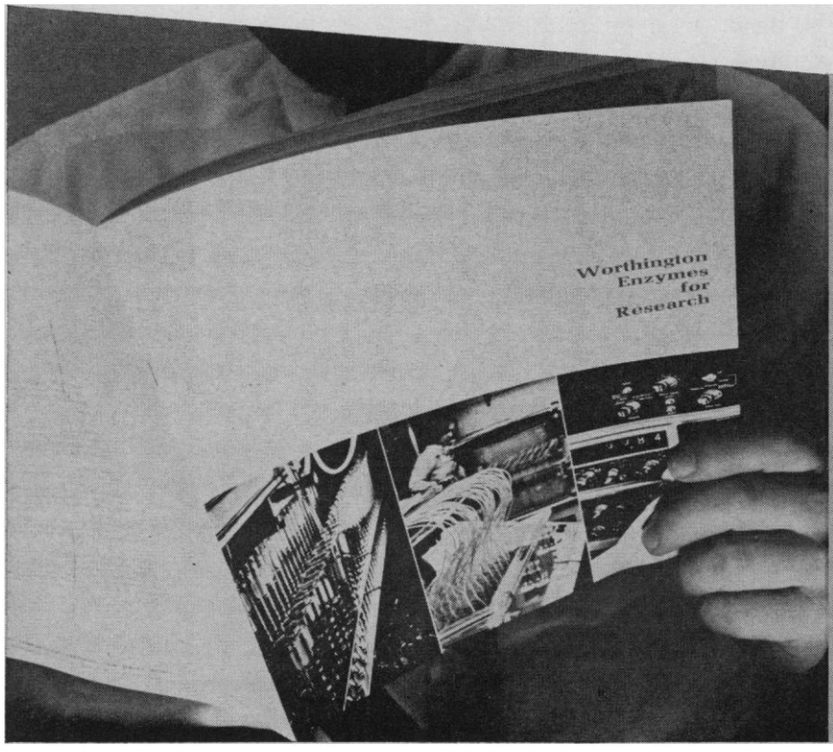
Unlike other suppliers of enzymes who are merely re-sellers, we manufacture virtually all our products, carrying them from raw materials through processing, purification and packaging. This gives you important guarantees of product reliability, integrity and purity. It also gives you direct contact with our personnel directly responsible for preparing any particular batch of material.

Use the attached coupon to request your copy of *Worthington Enzymes for Research* or other literature.



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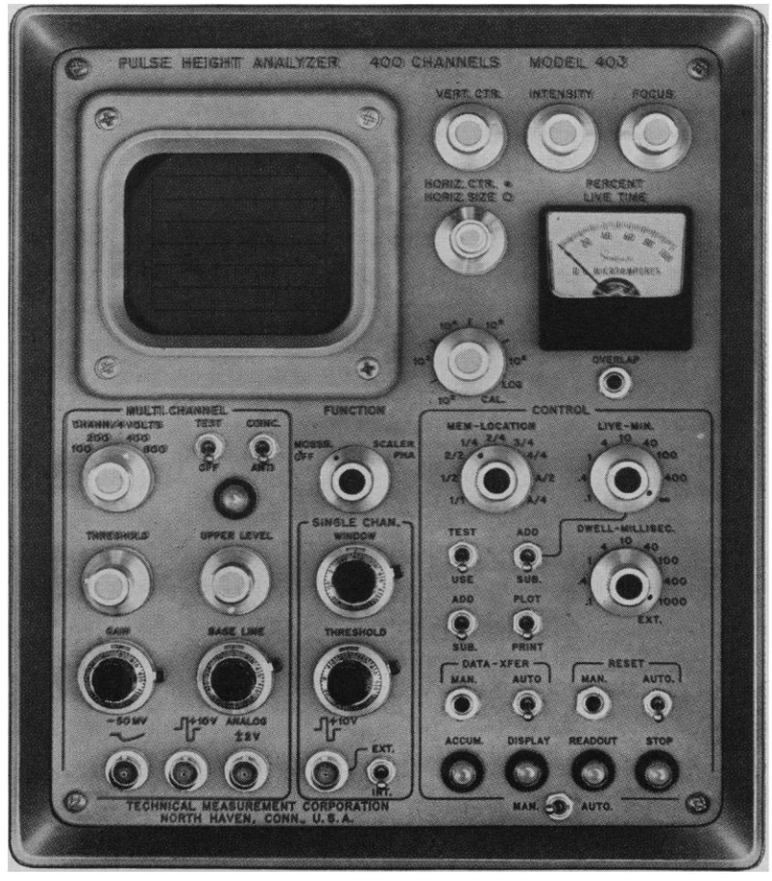

New TMC 400-Channel Analyzer

If the price of the 400-channel analyzer you really want is just too rich for your budget, and you won't settle for less, then the Model 403 has come to the right place.

Despite its rock-bottom price of $5600, the portable Model 403 is built with the same uncompromising standards of performance and quality you're normally willing to pay TMC a little more for.

The 403 has the capabilities you need — 400-channel memory, with 10^6-1 counts per channel; low level input; built-in CRT and single channel analyzer; internal multi-scaling; automatic data transfer between memory halves or between quarters in the same half, to single out a few. And you can easily add on capabilities for logarithmic display, resolving, integration, Mössbauer effect analysis, and external routing.

As you'd expect, the Model 403 is fully compatible with all standard TMC accessories and readouts — resolver/integrators, printers, X-Y plotters, paper tape punches, typewriters and computer-compatible magnetic tape.

But to really appreciate 403, you've got to see it in action! For complete details and/or a demonstration, contact: Technical Measurement Corporation, 441 Washington Avenue, North Haven, Connecticut 06473.

TMC TECHNICAL MEASUREMENT CORPORATION

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It's a basic engineering principle: Simplify design, make it all solid state circuitry throughout and you get improved performance and dependability with reduced maintenance. That's what we've done with these two new Mini-Pak Power Supplies designed and built expressly for low to medium voltage utilized in electrophoresis applications.

This compact twosome will meet any laboratory's exacting power supply requirements. We know: we've tested them.

Find out how Mini-Paks save you time and improve over-all efficiency of your laboratory power supply procedures in our new, fully descriptive literature No. MPS-80. Better yet, try both in your own lab and see for yourself.

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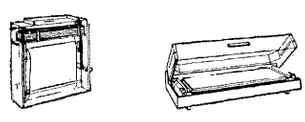

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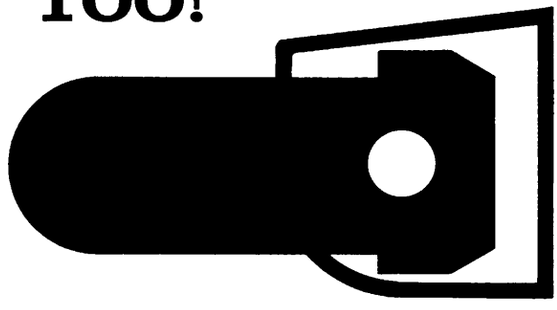

Whether you centrifuge at superspeeds with an Angle Rotor (up to 49,500 x G — 48,200 x G with standard 8 x 50 ml Angle Rotor), or at lower speeds with a Horizontal Rotor, we can meet your requirements. Take our HB-4 Rotor, for instance. Of Titanium alloy and aluminum construction, the HB-4 offers four 50 ml buckets, and accepts most of the tubes and adapters normally used with our standard 8 x 50 ml Angle Rotor. And you can use a lot of other SORVALL Rotors in both refrigerated and non-refrigerated SORVALL Centrifuges. It's a fact — we offer more versatility and reliability where it counts — in performance — than any other manufacturer. You know this if you have a SORVALL Centrifuge. If you don't, you owe it to your lab work to get one. The instrument illustrated is our well-known RC2-B Automatic Superspeed Refrigerated model. Literature? Just write: Ivan Sorvall, Inc., Norwalk, Connecticut, 06852.

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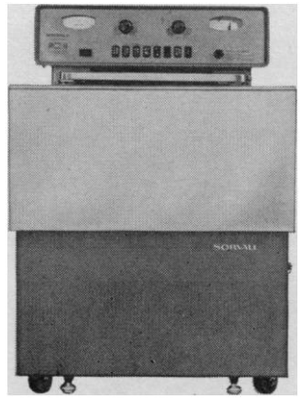
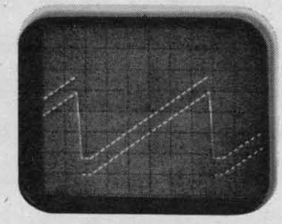
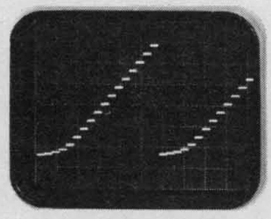


For additional information ask for Bulletin SC-10/ARC-2

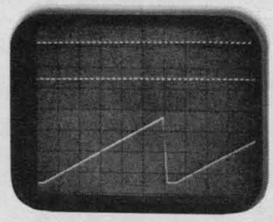
4 ways to view displays with the Tektronix Type 564 split-screen storage oscilloscope



Entire screen can be used for a stored display.

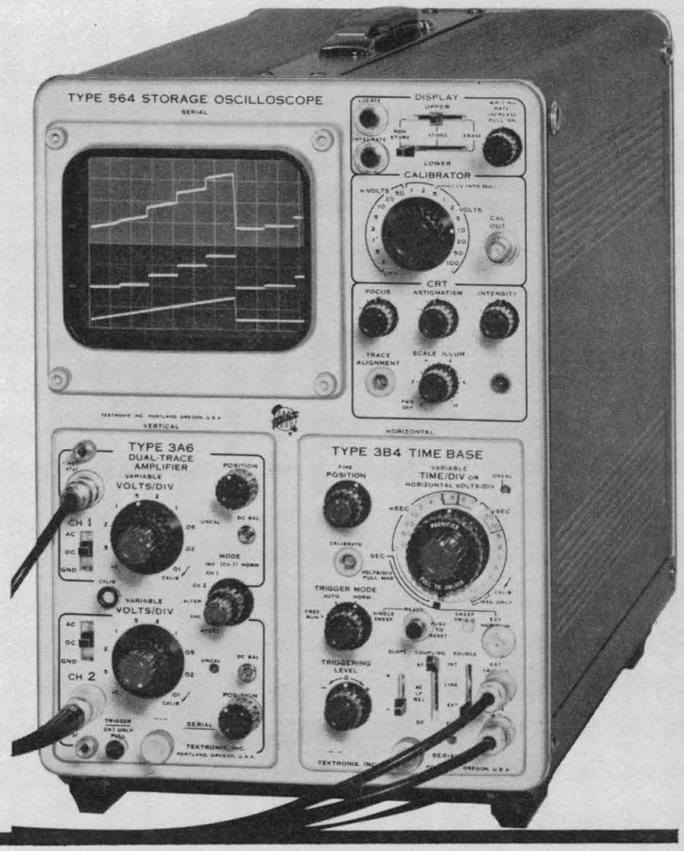


Entire screen can be used for a nonstored display.



Each half of split-screen can be used independently for stored displays.

Either half of the split-screen can be used for a stored display, the other half for a nonstored display. (Shown below).



The Tektronix Type 564 is virtually two instruments in one. It offers all the advantages of a storage oscilloscope plus those of a conventional oscilloscope.

Split-Screen Displays

An unique split-screen display area enables you to simultaneously use either half of the screen for storage and the other half for conventional displays, or use the entire area for stored or conventional displays.

Independent control of both halves of the screen permits you to take full advantage of the storage facilities. For example, you can use half the screen to store a reference waveform, the other half to display waveforms for comparison. You can erase or retain either half of the display area as you choose.

Bistable Storage Advantages

With bistable storage oscilloscopes, such as the Type 564 and Type 549, the contrast ratio and brightness of stored displays are constant and independent of the viewing time, writing and sweep speeds, or signal repetition rates. This also simplifies waveform photography. Once initial camera settings are made for photographs of one stored display, no further adjustments are needed for photographs of subsequent stored displays.

Storage time is up to one hour, and erase time is less than 250 milliseconds. An illuminated 8 cm by 10 cm graticule facilitates measurements and aids in taking photographs with well-defined graticule lines. Adding to the operating ease is a trace position locater that indicates, in a nonstore area, the vertical position of the next trace or traces.

Tektronix bistable storage cathode ray tubes are not inherently susceptible to burn-damage and require only the ordinary precautions taken in operating conventional oscilloscopes.

Plug-In Unit Adaptability

The Type 564 accepts Tektronix 2 and 3-series plug-in units for both vertical and horizontal deflection. Display capabilities of these units include single and multi-trace with normal and delayed sweep; single and multiple X-Y; low-level differential; dual-trace sampling; spectrum analysis, and many other general and special purpose measurements.

Type 564, without plug-in units . . . . . $ 925

Rack-Mount RM564 . . . . . $1025
Similar electrical characteristics to Type 564. 7" high.

Type 3A6 Dual-Trace Amplifier Unit . . . . . $ 525
DC to 10 MHz from 10 mV/div to 10 V/div. 5 display modes. Internal signal delay line.

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For a demonstration, contact your nearby Tektronix field engineer or write:
Tektronix, Inc., P. O. Box 500, Beaverton, Oregon 97005.

Computers and Instruments: Unite!

Marrying computers to scientific instruments is relatively new. The truth is, the advantages of doing so were known a long time ago — but, implementation awaited computers that made sense economically, as well as scientifically.

Computers are now frequently justified on a one-computer for one-instrument basis. We know. DIGITAL has sold hundreds of PDP-8 and PDP-8/S computers that way — to manufacturers who buried the computer inside their instruments — spectrometers, diffractometers, gas chromatographs, blood analyzers.

And to scientists in their laboratories, as well. To run one instrument, like a C-H-N analyzer. Or to run several instruments, one at a time. Computer prices have come down that far.

But servicing several different instruments simultaneously — integrating a laboratory full of instruments — takes a larger computer. A PDP-9, for example, or a PDP-10. If you are running investigations where data from one instrument conditions the data of another — or where several of you want to time-share a computer to service several instruments — then these larger computers are a practical necessity.

The capabilities, at the price, are what make sense. PDP-9 is an 8K, 18-bit word machine at $35,000. The PDP-10, with 8K basic memory and a 36-bit word, comes in an expandable configuration from $113,000.

PDP-8 and PDP-8/S are 4,096-word 12-bit core memory machines. The 1.5 μsec PDP-8 sells for $18,000. The PDP-8/S is only $10,000. All speak FORTRAN and are general purpose computers.

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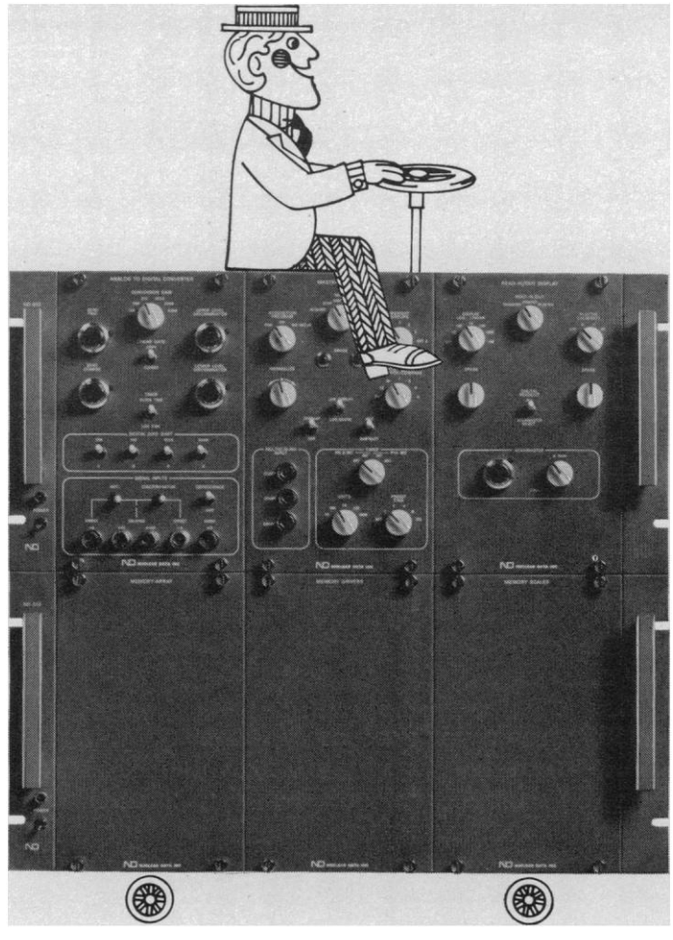

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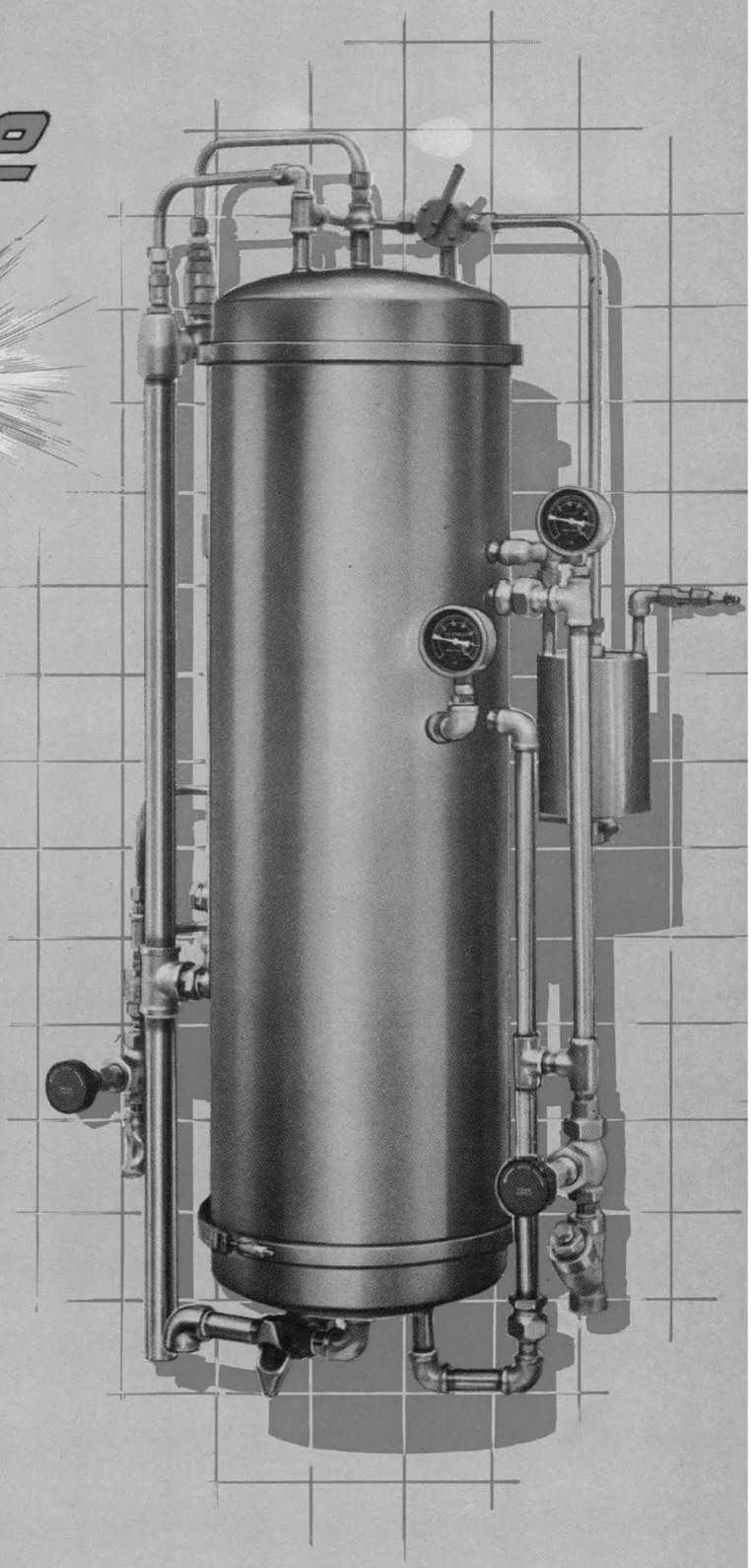

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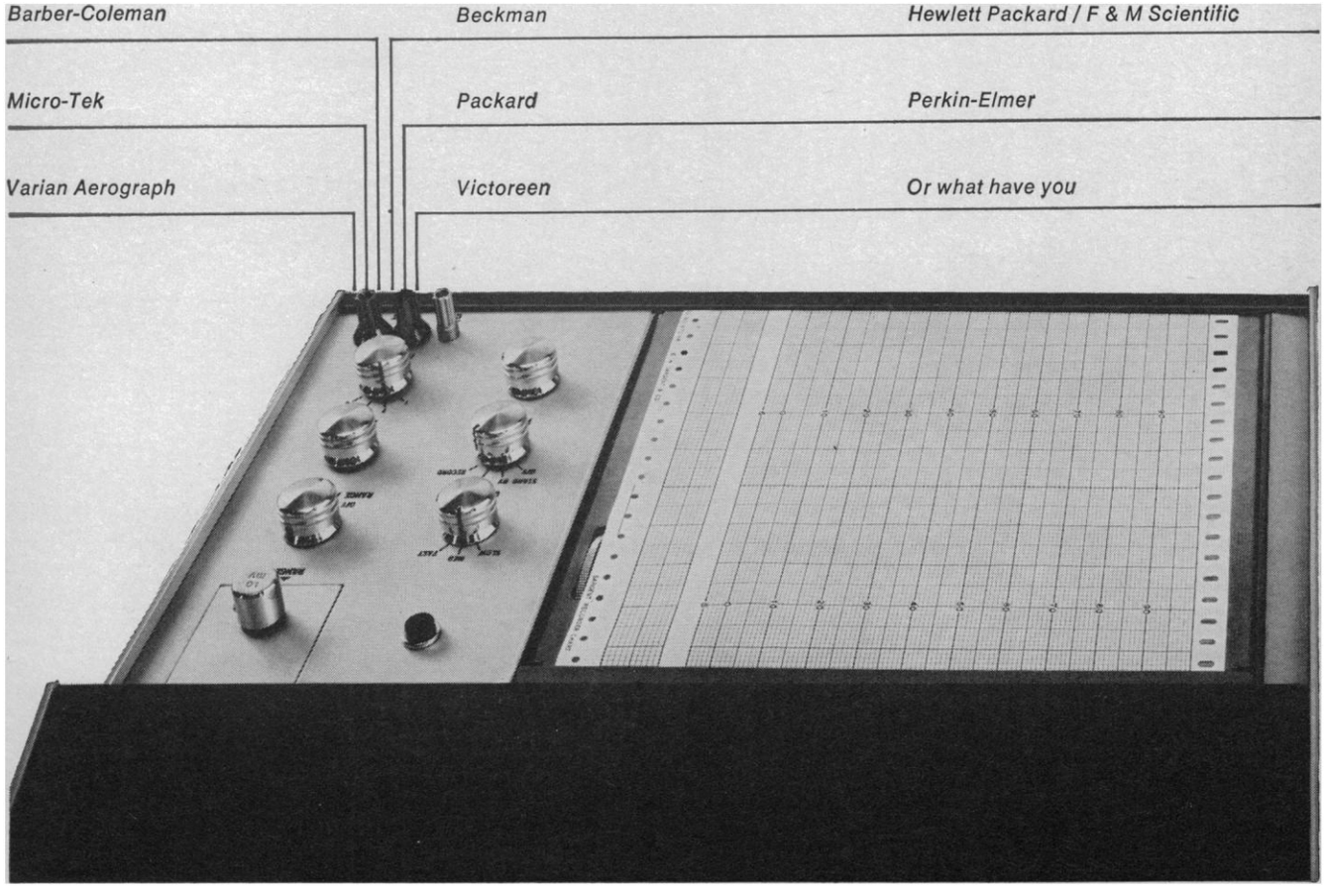

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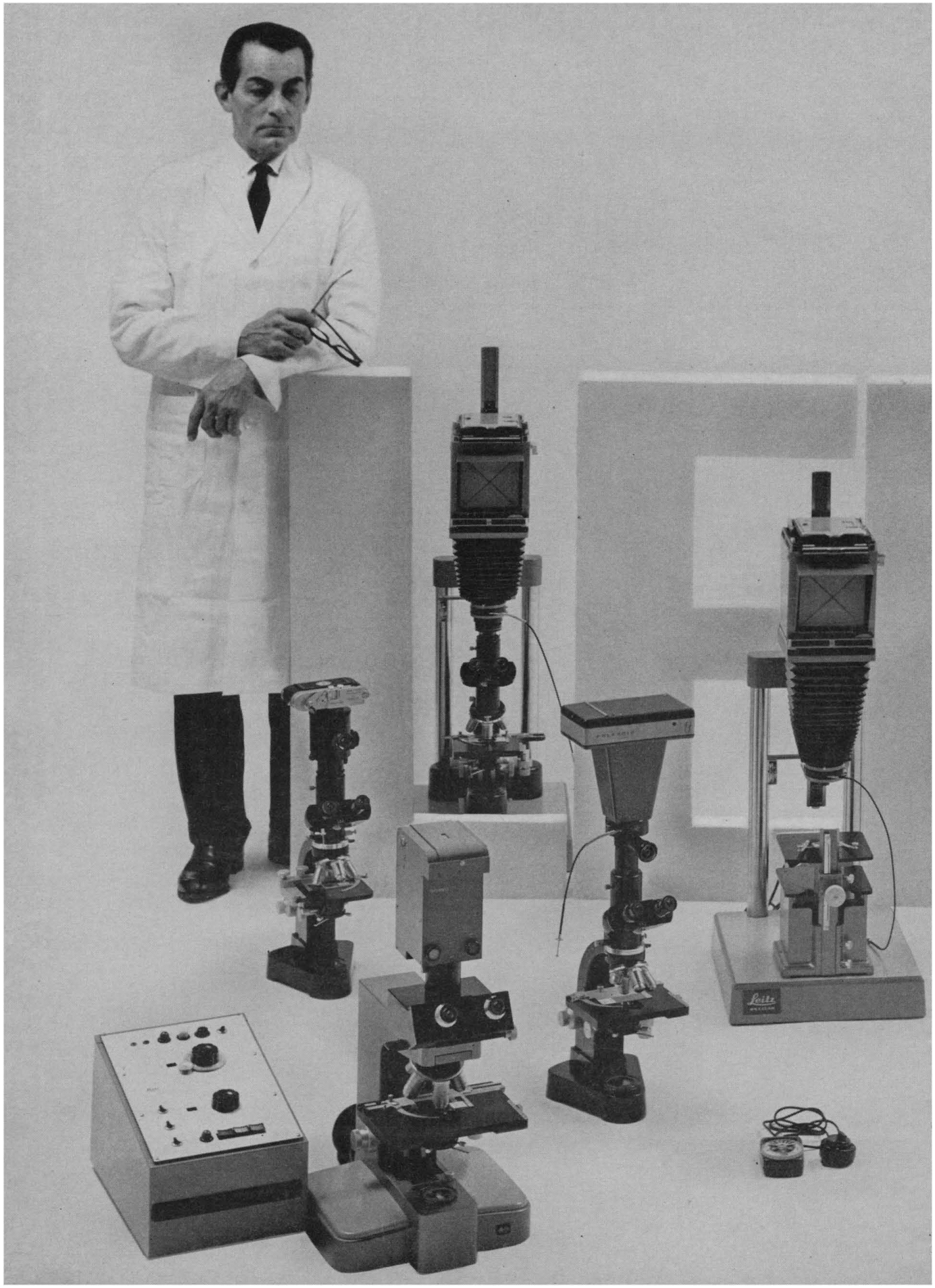
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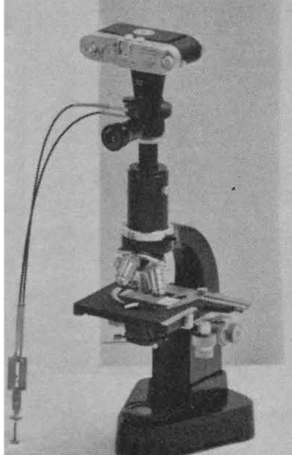

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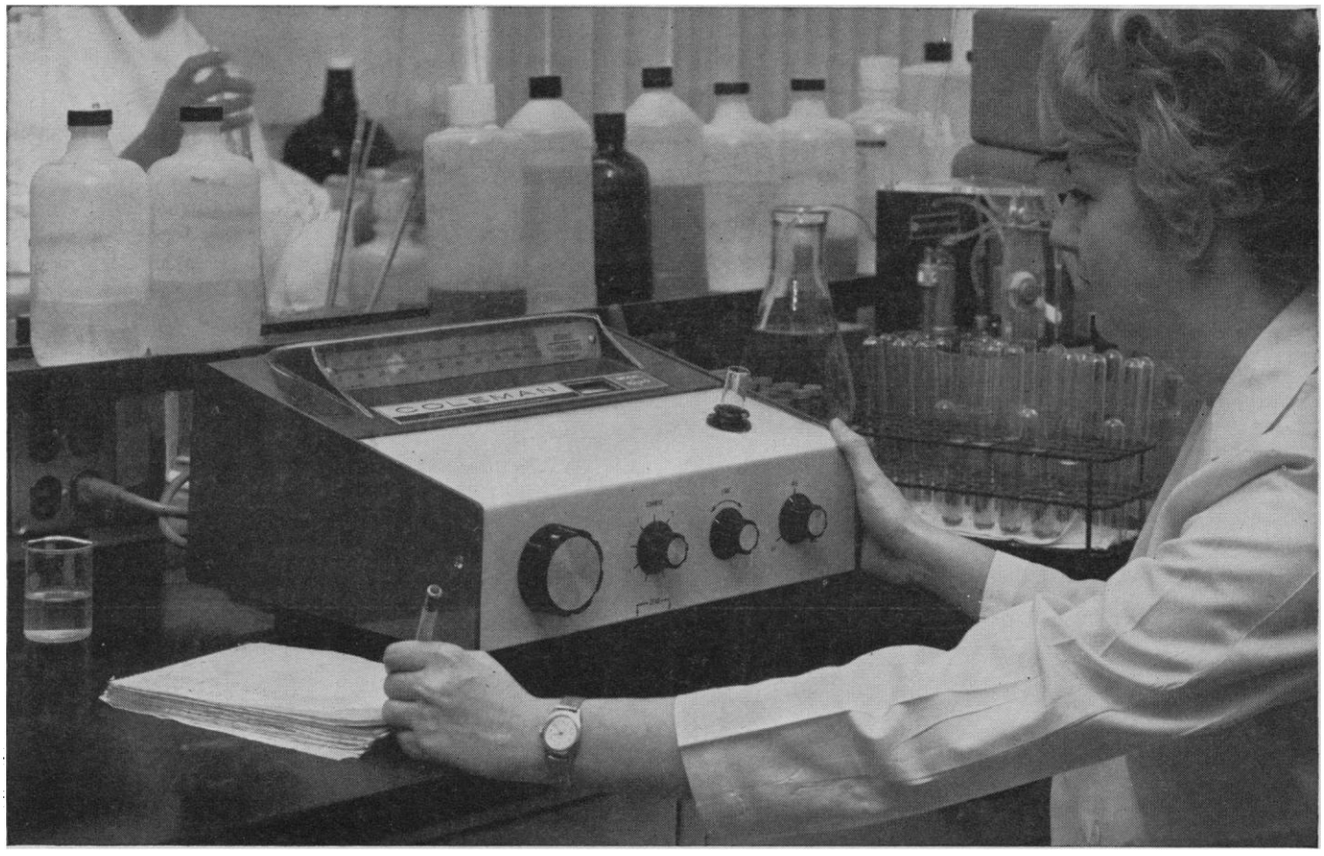

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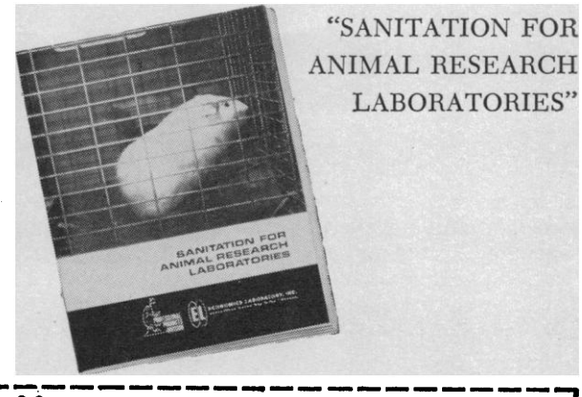

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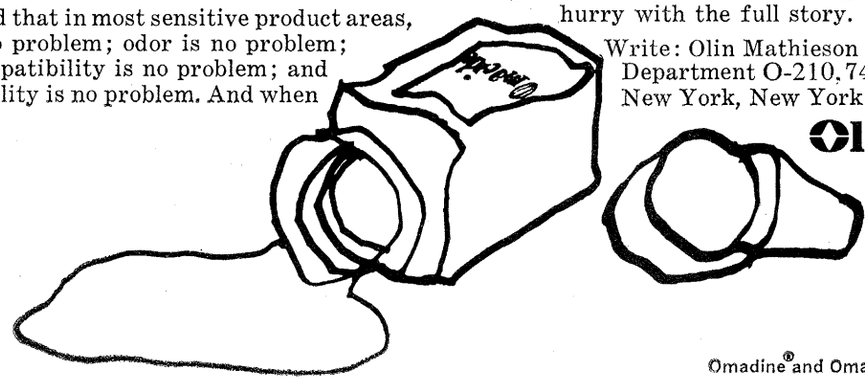

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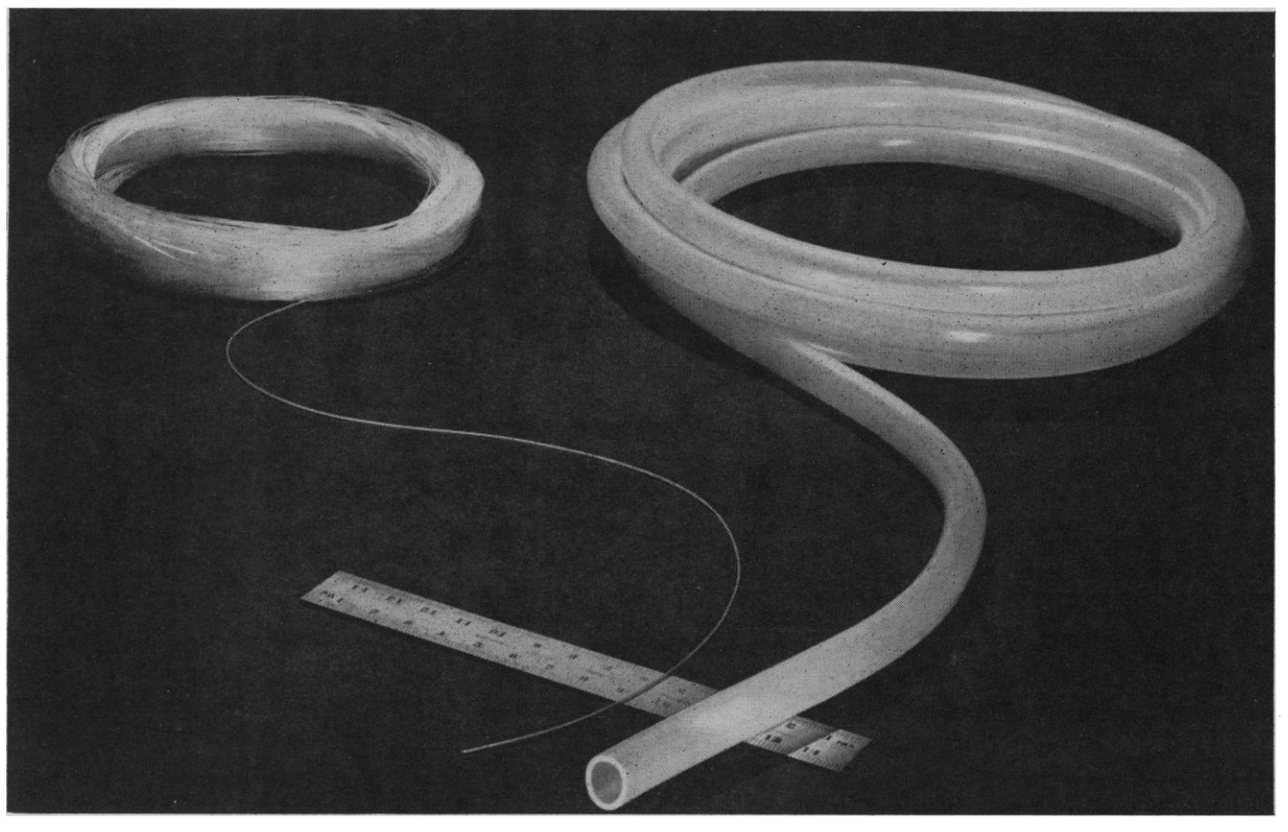

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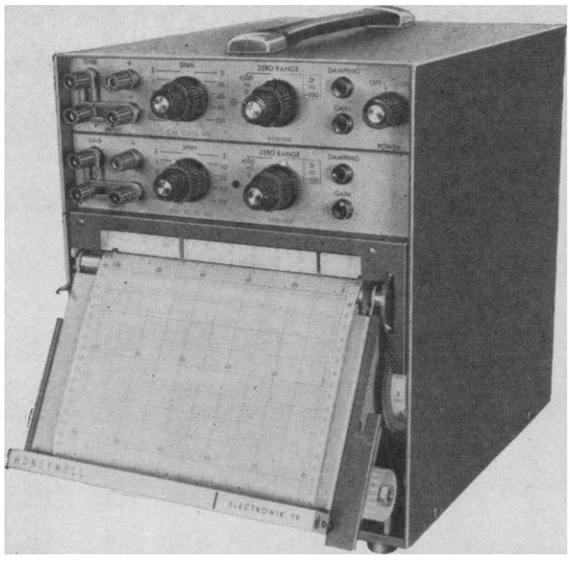

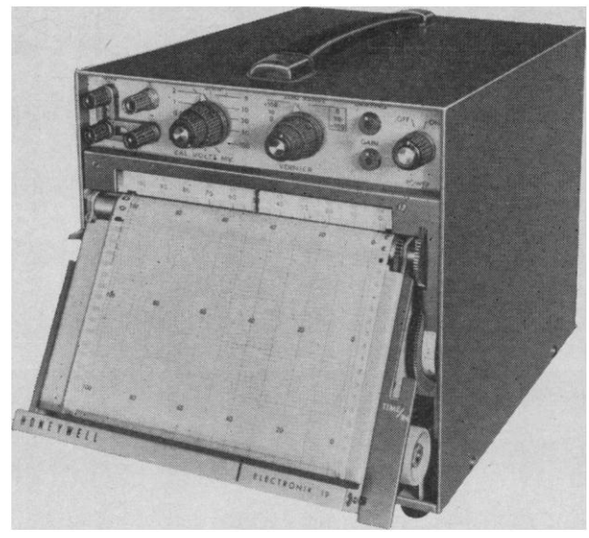

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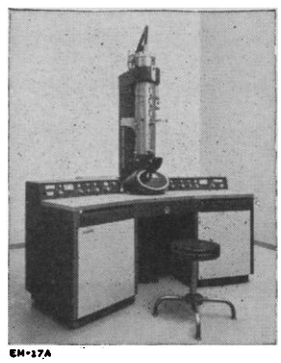

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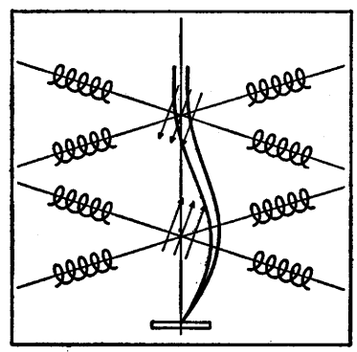

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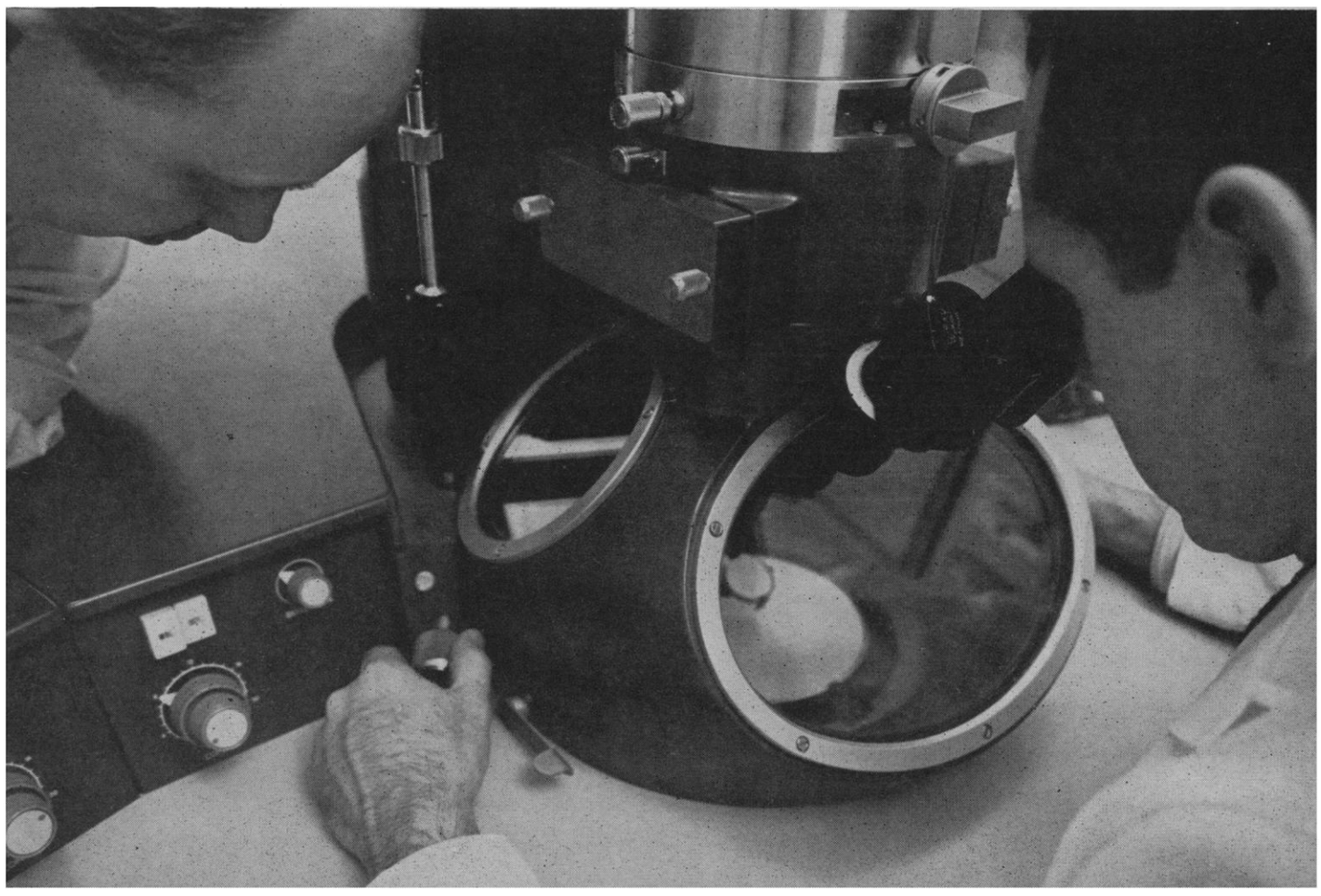

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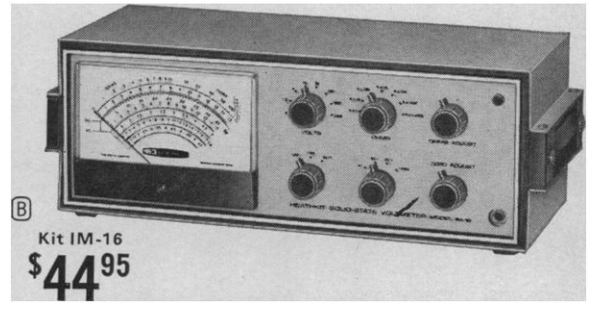

Kit IM-16
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(B) New Solid-State Volt-Ohm Meter ... IM-16

• 8 AC and 8 DC ranges from 0.5 volts to 1500 volts full scale • 7 ohmmeter ranges with 10 ohms at center scale and multipliers of x1, x10, x100, x1k, x10k, x100k, and x1 megohm • 11 megohm input on DC ranges, 1 megohm on AC ranges • Operates on either built-in battery power or 120/240 VAC, 50-60 Hz • Circuit-board construction

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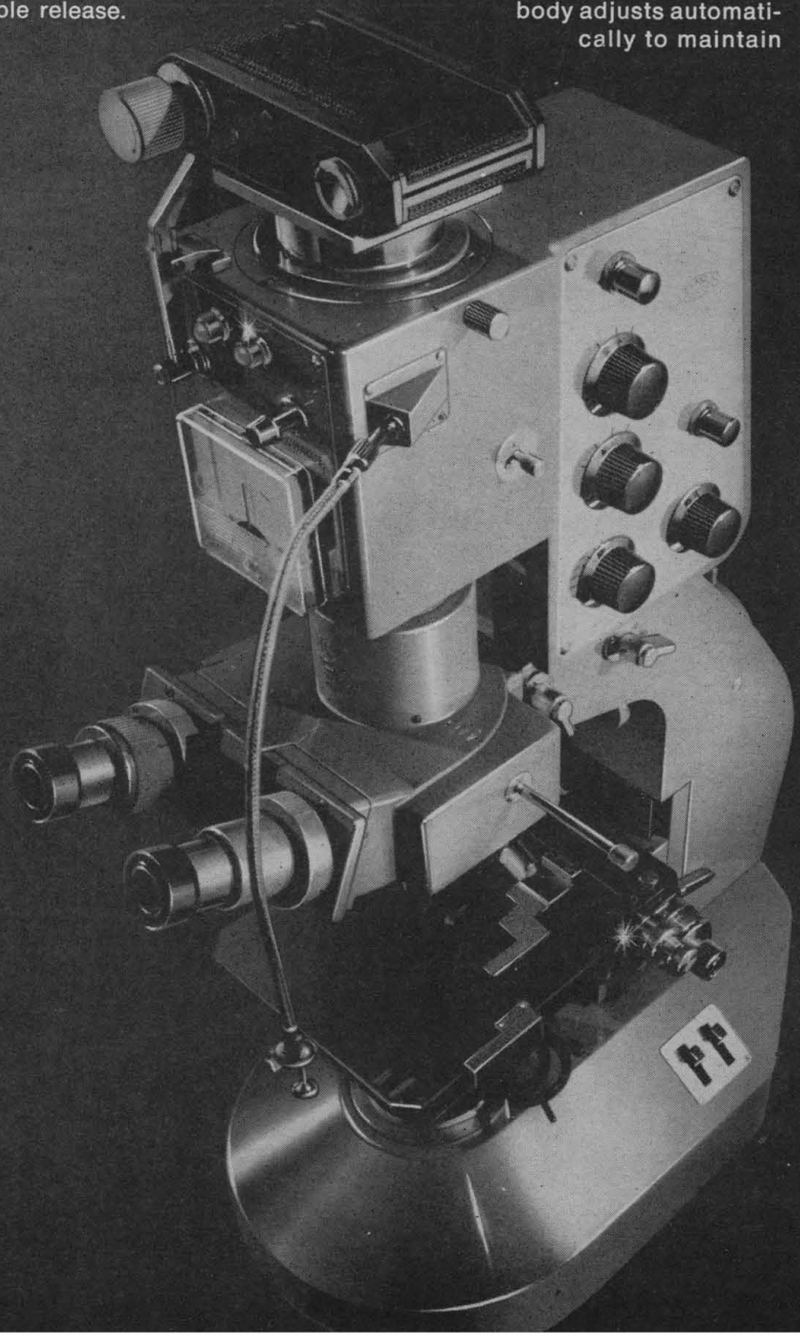

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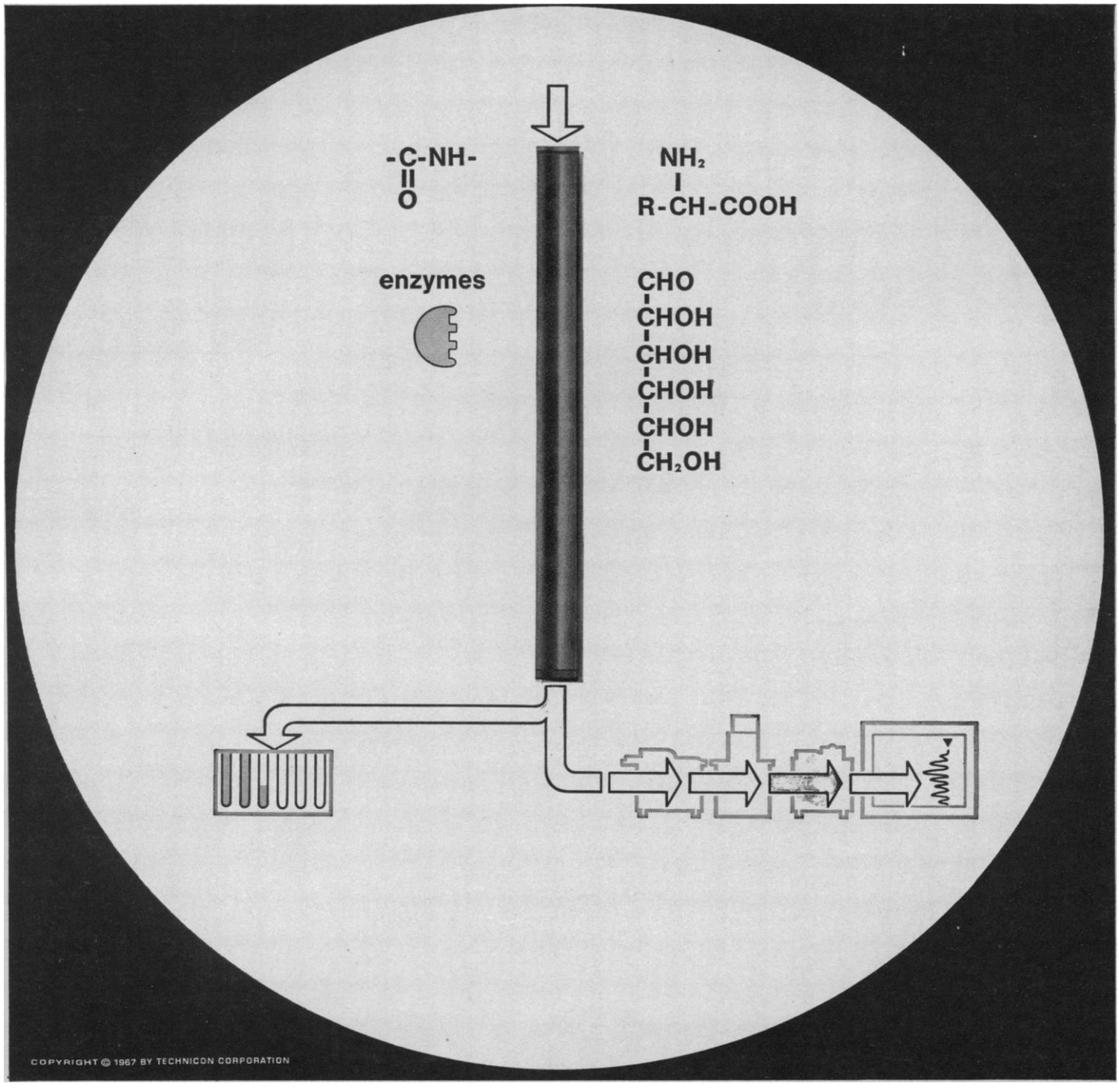

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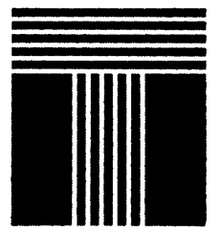

For some time now Bolex has been making and selling (at ¼ to ⅓ less than any one else) the best professional 16mm cine system you can buy.

ONE MAN OPERATION.—Bolex H-16 cameras have become famous for their ruggedness, dependability, quality optics and light weight, making them perfect for one man (Fig. 1) filming operations and eliminating the need for any kind of back-up crew.

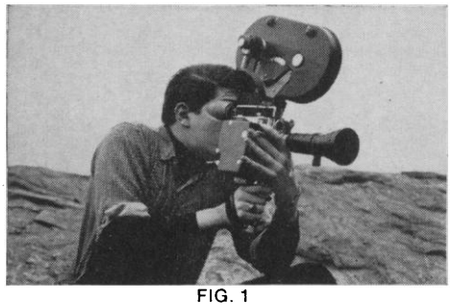

FIG. 1

FILM CAPACITY.—The only thing that Bolex H-16 cameras could be faulted on was that they only had a 100 ft. film capacity.

400 FT. MAGAZINE.—That's why we introduced the Bolex 400 ft. film magazine to fit both the H-16 REX-5 and the H-16 M-5 in the Bolex H-16 cine system.

SYNCHRONIZATION.—Used with the new constant speed motor (24 FPS) with sync output for lip-sync on ¼ inch tape and automatic built in clap-stick for easy synchronization, the 400 ft. magazine with either the H-16 REX-5 or the H-16 M-5, offers the professional user in any branch of movie production, science, industry or education unlimited versatility and scope.

THE TWO BASIC CAMERAS.—The H-16 REX-5 is a three lens turret camera that offers reflex viewing and focusing on ground glass, allowing the photographer complete control of composition, framing and correct evaluation of depth of field. The H-16 M-5, built with economy in mind, is a single lens camera with viewing through a removable optical finder mounted on the side of the camera. The H-16 M-5 takes all standard "C" mount lenses or Pan Cinor and Angenieux zoom lenses, both equipped with reflex viewing and focusing.

LENSES AND ACCESSORIES.—There are 10 fixed focal length lenses from 10mm to 150mm in the H-16 system, and 7 zoom lenses giving a wide range of zooming ratios from 5 to 1 up to 10 to 1, including the Vario Switar 86EE, the world's first and only fully automatic 16mm variable focal length lens, with zoom from 18 to 86mm. Many accessories are available in the H-16 system including motors, close-up attachments, grips, matte box, titler, light meter, carrying cases and both optical sound and optical/magnetic sound projectors.

MANY APPLICATIONS.—Because of its ruggedness, compactness and light weight a single operator can use the Bolex H-16 system for any of the following applications:

Sports filming, including coaching and training films, for club and school use.
Medical photography, surgical and research filming, Cinephotomicrography.
Advertising, promotion and TV work for both studio and location shooting.
Travel and educational filming.
Wild life and nature photography.
Amateur film making.
Industrial filming, including training, recording, research and work study films.
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Instrumentation recording.
All types of sound work.

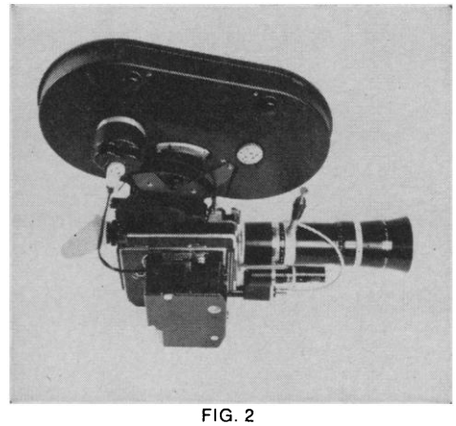

FIG. 2

The H-16 REX-5 camera (Fig. 2), with 400 ft. magazine, 24 FPS constant speed motor, detachable take-up motor on magazine eliminating the use of old fashioned take-up belts. The H-16 REX-5 offers reflex viewing and focusing on ground glass. Variable shutter. Filter slot. Accurate automatic dual frame counters and registrator claw for picture steadiness.

Shown on the camera is a Vario Switar 86EE zoom lens with automatic exposure control and a zoom range of 18 to 86mm. Maximum aperture f/2.5.

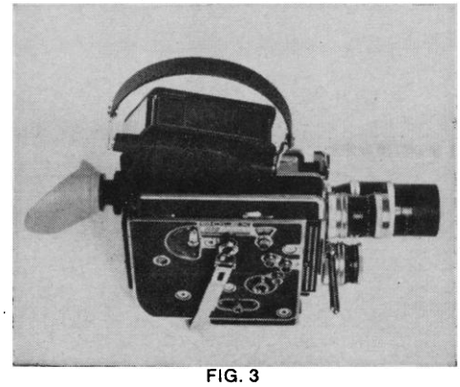

FIG. 3

The H-16 REX-5 (Fig. 3) shown without 400 ft. magazine. The camera takes 100 ft. film loads and has all of the traditional Bolex features such as filter slot, variable shutter for fades, dissolves and greater exposure control, automatic loading and provision to accept the 400 ft. magazine if desired. Lenses shown are Switar 10mm f/1.6, 25mm f/1.4, 75mm f/1.9.

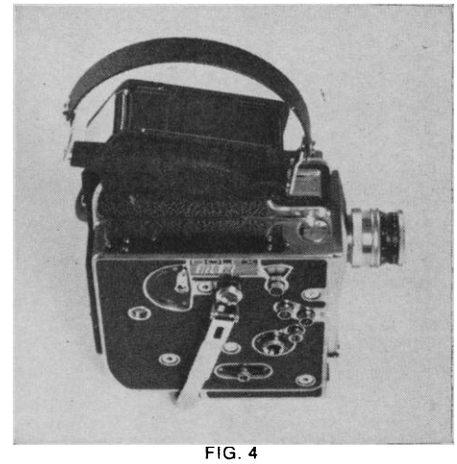

FIG. 4

The Bolex H-16 M-5 (Fig. 4), with single lens mount, an extremely economical, professional quality 16mm camera equipped with such features as variable speeds, single frame shooting, footage and frame counter, unlimited film rewind and automatic threading.

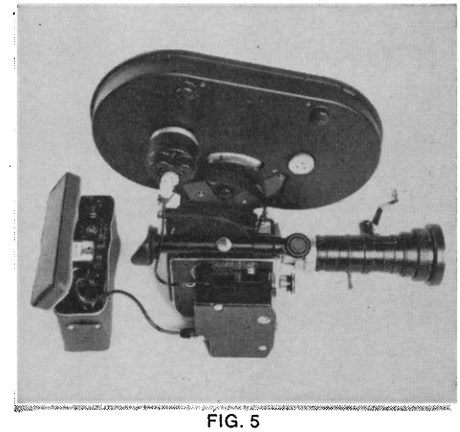

FIG. 5

The H-16 M-5 (Fig. 5) can also be used in conjunction with the 400 ft. magazine, 24 FPS constant speed motor and rechargeable battery pack. This is an ideal set-up for sports filming where a large film capacity is desirable to avoid loss of action footage.

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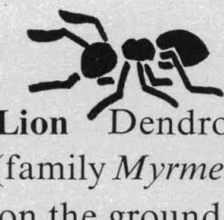

The Ant Lion Dendroleon obsoletum (family *Myrmeleontidae*), lays its eggs on the ground. When one hatches, the larva digs a pit in sandy soil and lives almost completely buried at the bottom of it. Ants and other small insects who fall in are seized by the ant-lion's powerful jaws and devoured. Adult resembles dragonfly. Most prevalent in southwest U.S. and Mexico.

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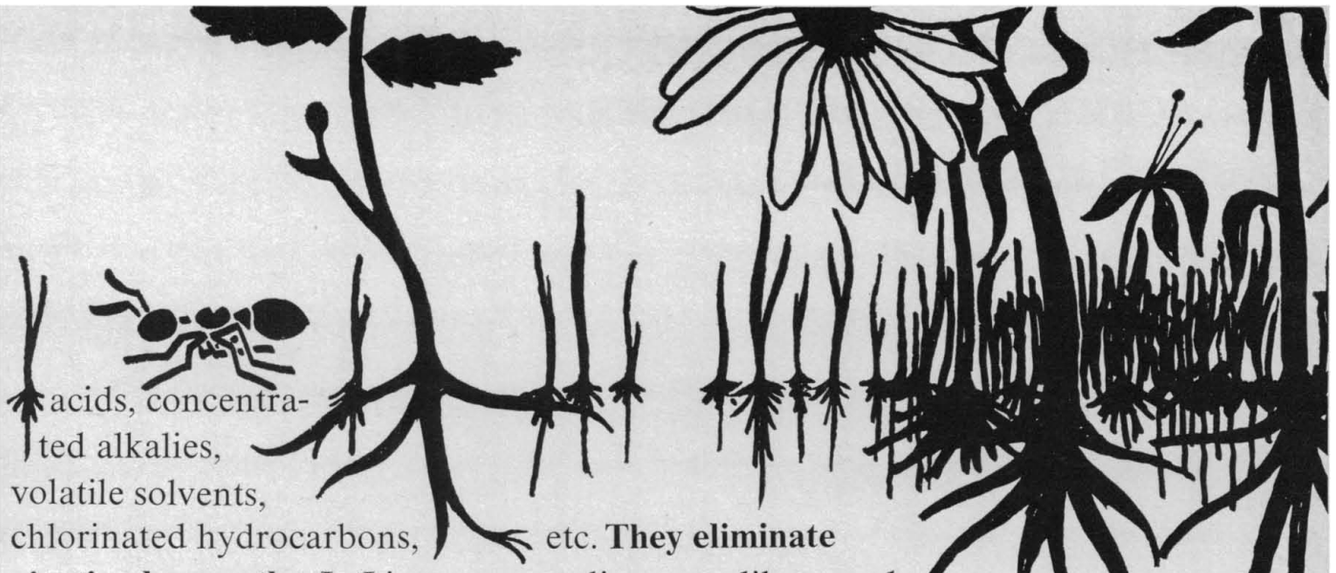

acids, concentrated alkalies, volatile solvents, chlorinated hydrocarbons, etc. **They eliminate pipeting by mouth**—L/I instruments dispense, dilute, and pipet directly from reagent bottles, completely eliminating the hazards of mouth pipeting and the dangerous transfer of reagents. **They prevent cross-contamination**—There is no carry-over of material from sample to sample. The self-cleaning action in Dilutors washes out all aspirated material before a new sample is aspirated. **They keep reagents pure**—All instruments have an air inlet to which filters may be connected to exclude particulates, moisture, carbon dioxide, or oxygen. **They pay for themselves**—L/I REPIPETS cost $47.50; Automatic Dilutors $89.50. It pays to have one on every reagent bottle. **They handle all volumes**—Each instrument is adjustable and accurate over its entire scale. Measure from 1 microliter to a deciliter. REPIPETS and Dilutors are supplied in 1, 5, 10, 20, and 50 ml sizes. Each Dilutor is furnished with aspirator tips to efficiently cover the entire range of the instrument. **Water Determinations In 4 Minutes!** L/I Aquametry Apparatus measures water content in foods, drugs, organics—all materials. It measures from 1 ppm. to 100% water without adjustment. Accuracy is 1%. Price $235. For more details, contact your dealer salesman or write to: 1802H Second Street Berkeley, California 94710 Phone: (415) 843-0220

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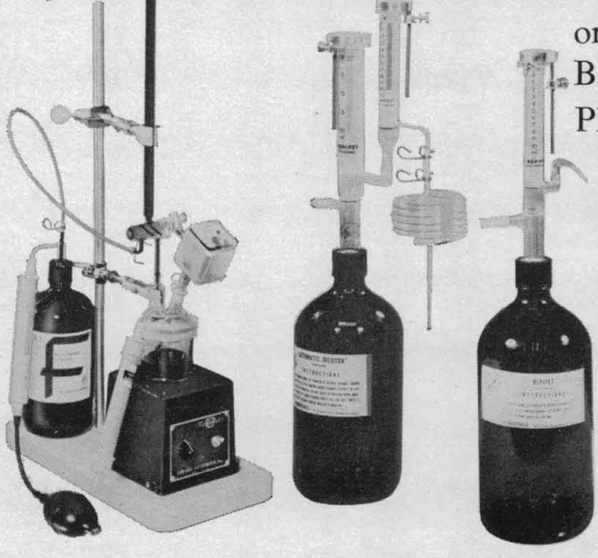

Left to right are 5 ml REPIPET, Aquametry Apparatus, 10 and 5 ml Automatic Dilutor, and 10 ml REPIPET.

Advanced computing technique gives scientists and engineers faster job turnaround.

Many engineers and scientists raise the question "Why does it take so long to get answers to problems that require only a few minutes of computer time?"

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Part of the problem is the fact that there are many more people using the computer. Their jobs are more varied. The computer spends more time performing input/output and general "housekeeping" routines.

How can you reduce turnaround time and get results faster? Rocketdyne, a Division of North American Aviation, Inc. cuts turnaround time with a multiprocessor system which operates under the control of an extension to Operating System/360.

Rocketdyne's IBM SYSTEM/360 includes a Model 40 computer coupled to a Model 65. The Model 40 handles system input/output operations, assigns job priorities and automatically schedules jobs into the Model 65. It was the first such system installed. Using the Model 40 in this fashion frees the more powerful central processing unit of the larger computer to process on a practically continuous basis the various mathematical calculations of each job queued into it.

This CPU can take full advantage of its large memory and higher processing speed without allocating time or space to support functions.

The benefits of increased throughput, namely faster turnaround and higher system performance, accrue because of this balanced division of labor between the two computers. The coupled computers are controlled by a multiprocessor operating system called the Attached Support Processor (ASP), which provides a compatible extension to Operating System/360.

The Rocketdyne computer center operates on an open shop basis. Over 400 engineers submit their own FORTRAN programs. The center handles an average of about 500 jobs per day with each job averaging 2½ minutes of computer time.

A large part of Rocketdyne's computing consists of numerous runs in which rocket test data are reduced and analyzed. Calculations average 5-20 minutes for each such job placed into the computer.

Data are transmitted from F-1 engine firings at the Edwards Field Laboratory; from J-2 engines and F-1 components and attitude control engines at the Santa Susana Field Laboratory; from solid rocket operations firings at McGregor, Texas; and from H-1 Thor and Atlas firings at Neosho, Missouri.

Data communications systems carry these data to the computer center at Rocketdyne's facilities at Canoga Park, California.

Results are returned in as little as 30 minutes for action by Rocketdyne's engineers. No waiting hours for the job to reach the front of the queue.

The overall result for Rocketdyne's engineers and scientists is that the computer is now a much more useful tool for them.

Engines may be refired or removed from static test stands at an increased tempo and with greater precision.

The concept of directly coupled systems was first proposed and implemented by IBM in the early 1960's using various combinations of 7000 series computers. For example, the first installation at Rocketdyne used a 7044 as support processor for a 7094 II. This was considered one of the most powerful general purpose computers in the country prior to the installation of third generation computers.

If you would like to find out more about the Attached Support Processor Program which IBM provides for use with SYSTEM/360 and how it might help you speed job turnaround time, contact: Director, Scientific Development, IBM Corporation, Department 805-353, 112 East Post Road, White Plains, New York 10601.

IBM®

The intellectuals' association with the activists and street demonstrators in Los Angeles in June is most unfortunate. Admittedly most of the demonstrators were peaceful, but some of them were not, and their willingness to resort to physical assault has been amply demonstrated to administration officials at various points around the country. The ads in the West Coast papers calling for demonstrators were thinly veiled incitements to riot. The Los Angeles police knew this, and they had no intention of permitting the President of the United States to be physically assaulted. As for the peaceful ones: "He who lies down with dogs will rise up with fleas."

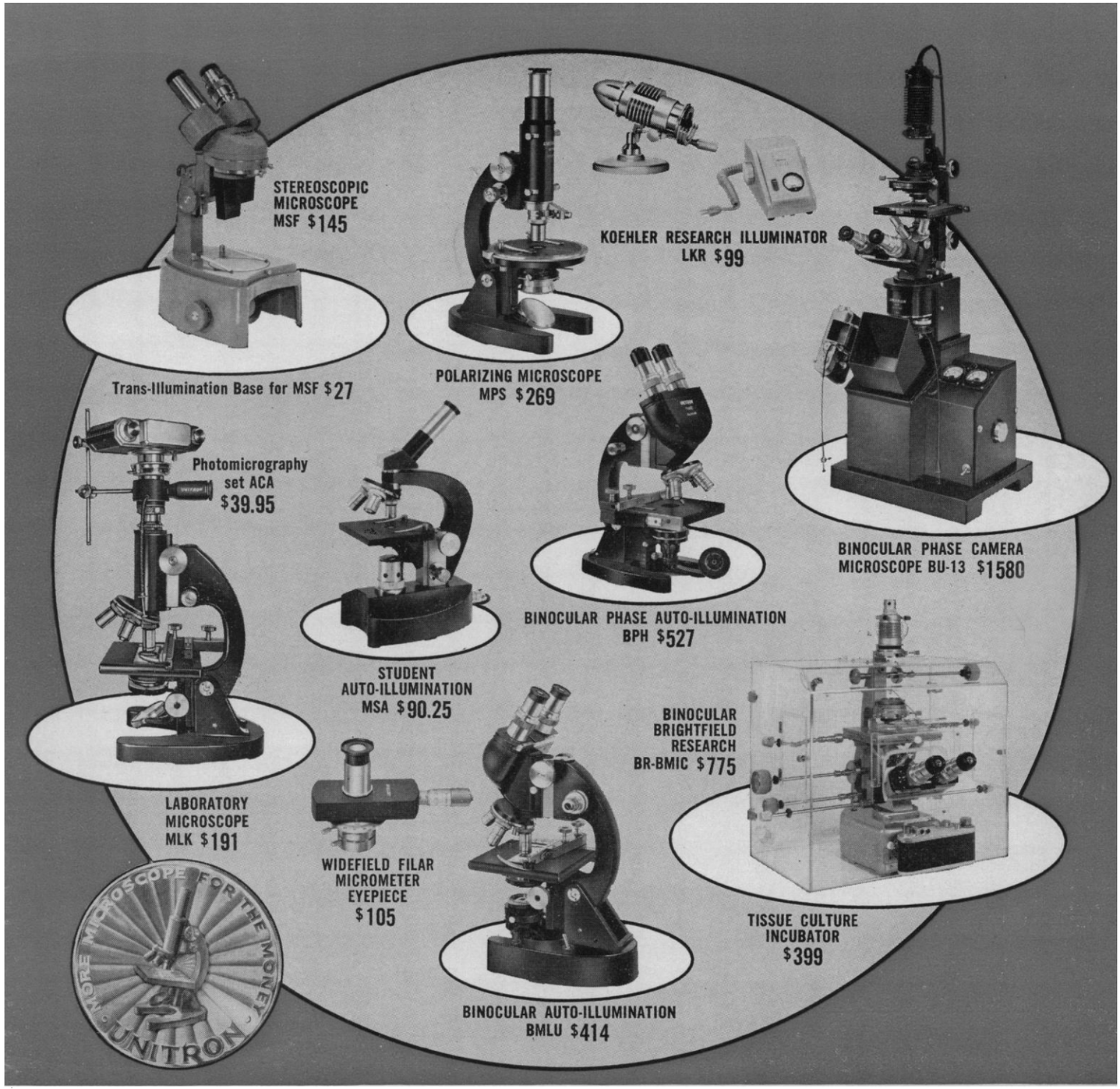
The intellectuals have much to offer the nation, but a Ph.D. does not also confer omniscience and infallibility in world affairs. The harsh realities of politics indicate that Lyndon Johnson will be president until 1972; if the intellectuals wish to serve the nation (and I hope they do) they had best make their peace with him. Without Johnson's acquiescence they will be effectively excluded from the decision-making process of government, to the detriment of us all. Perhaps if the intellectuals stop bombing Johnson now he may negotiate.

ROBERT M. LUKES
223 Bramton Road,
Louisville, Kentucky 40207

Accelerator Project Problems

I was deeply disappointed by the antiscientific flavor of Nelson's commentary (21 July, p. 294) on the 200-Bev accelerator project. Although I have a special interest in this matter, I believe that my disappointment must be shared by anyone who believes, as I do, that basic research is one of the most important, stimulating, and rewarding activities of modern-day man. The New York *Times* editorial of 16 July, which was gratuitously reprinted by you, would have been similarly disturbing except for that newspaper's previous advocacy of the project at a time when the State of New York was still in the running for the site. In view of this reversal of position, one might easily conclude that regionalism was a factor with the New York *Times*. . . .

Also the quote used by Nelson did not come from Wilson's letter to Senator Pastore as claimed, but rather from



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a telegram that he and I jointly sent to Illinois legislators at the time of their consideration of open housing statutes. Thus, although the words are ours, the framework within which they fit is quite different from the one reported in Nelson's article. . . .

We fully intend that the Laboratory shall be aggressive and imaginative in seeking ways to achieve *de facto* open opportunity. Toward this end we have adopted a nondiscriminatory pledge which must be signed by any landlord, owner, or agent who wishes to list housing with the Laboratory. We are actively seeking ways in which the Laboratory will be truly accessible to the labor force and talent of the minority groups now located in Chicago. As the Laboratory recruits employees from these minority groups, it will play an active role in establishing accessible housing in the communities immediately surrounding the Weston site.

EDWIN L. GOLDWASSER
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Because of a production error, for which Nelson was not responsible, the quoted excerpt from the Wilson-Goldwasser telegram to the Illinois legislature was mistakenly described as having come from Wilson's letter to Pastore. The telegram was actually an enclosure in Wilson's letter to Pastore. The error, though small, is regrettable. Also regrettable is the inclination of many persons in the high-energy physics community to brand as "antiscientific" (i) those who do not share their enthusiasm for high-energy physics, in this case the New York *Times*; and (ii) those who reprint the views of those who do not share their enthusiasm. The *Times* editorial was not "gratuitously" reprinted. It was deemed to merit space in the news columns, because, as was stated in an introductory note, the editorial represented a departure from the *Times*'s longstanding, undeviating support of all basic research. Since the *Times* is generally considered to be a publication of some influence, there is every conceivable justification for bringing this turn of events to the attention of the scientific community. The advancement of science, to which *Science* is dedicated, is not served by the perpetuation of fantasy or obliviousness toward attitudes that do not coincide with those held by particular segments of the scientific community.—D.S.G.

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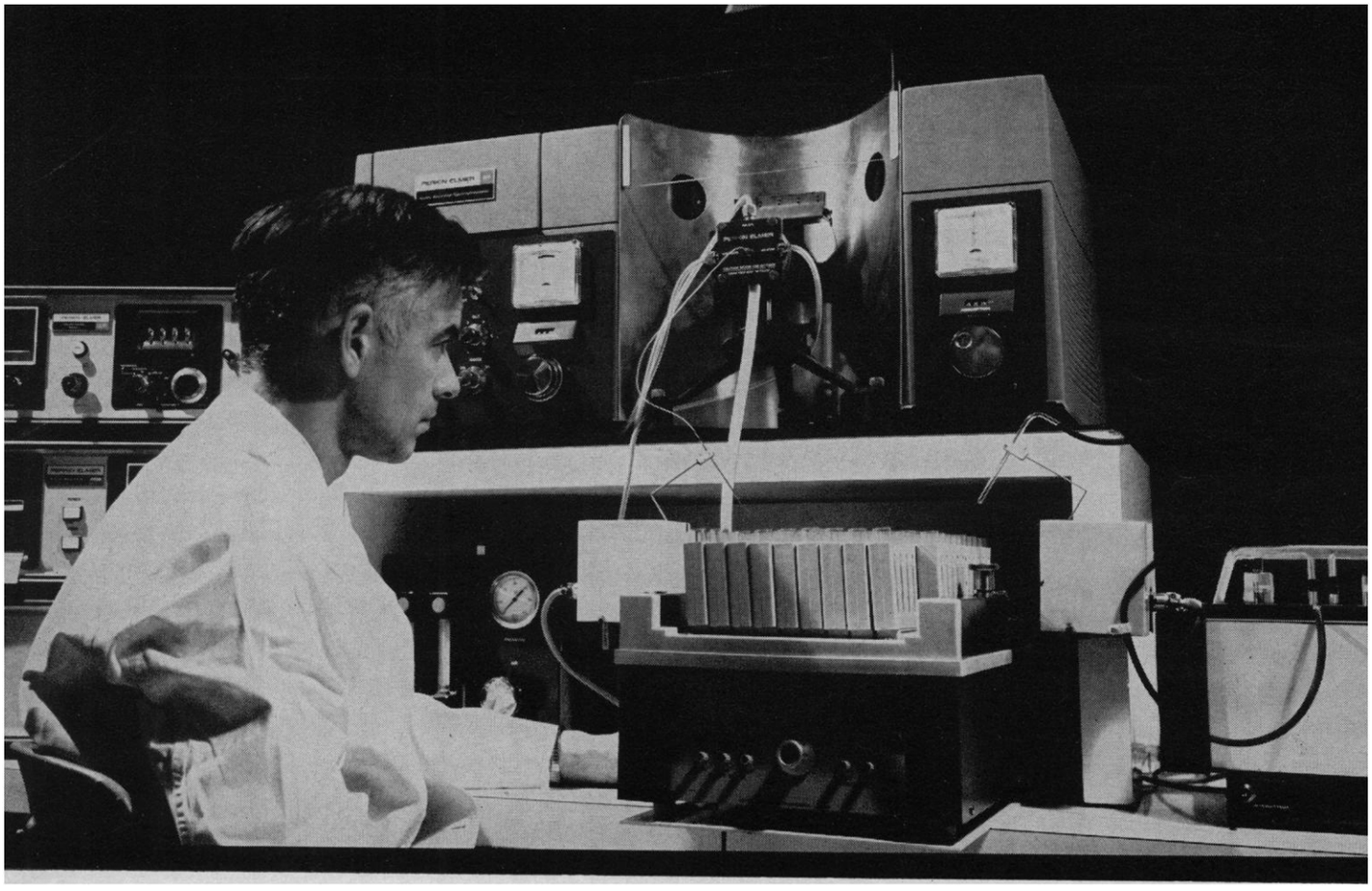

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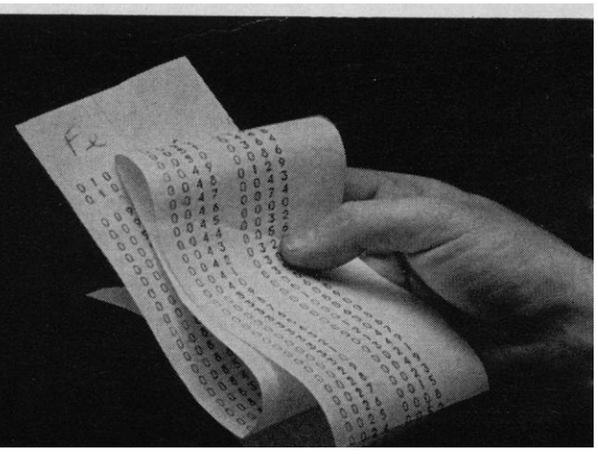

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6 October 1967, Volume 158, Number 3797

SCIENCE

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Advancement of the Nation's Health

In principle, in a democracy all aspects of the performance of the Executive branch of the government should be subject to the informed scrutiny of the electorate. In practice, only a few facets are examined. The agencies of government are in part at fault for not issuing suitable reports. In part the complexities of government operations make thorough examination by the electorate impractical. This is especially true in the domain of science and technology. Thus the agencies operating in scientific areas have a special obligation to prepare simple, readable reports, and at least some scientists should read them.

A report* issued by the National Institutes of Health last July especially merits attention. It represents a major effort to inform the President, the Congress, and the public. It contains information important to policy-making. It presents a broad treatment of matters of great personal significance to every human being. It can be read with profit by any literate person and provides excellent orientation as to the current state of medical progress.

James Shannon, director of NIH, has been an astute and effective advocate of basic research. At the same time he has wisely and consistently protected basic research by emphasizing its relation to efforts to improve the practice of medicine. Nevertheless, at times NIH has been criticized as being insufficiently concerned with the application of the results of its research programs. In June 1966 President Johnson seemed dissatisfied when he said, at a meeting with directors of NIH, "We must make sure that no life-giving discovery is locked up in the laboratory. I plan to meet again in a few months with my health strategy council to review their plans and to establish our goals."

Faced with a major challenge to his policies, Shannon responded thoughtfully and with dignity. His report, prepared with the help of many key scientists in all the Institutes of NIH, is exemplary in its tone. It tells of successes. It describes failures. It avoids flim-flam and hoopla. Each Institute at NIH presents its case, often beginning with a statement of its mission. These statements remind one of the multitude of ills that beset mankind. The incidence of many diseases is surveyed, and their cost to society estimated. Progress toward finding cures for major diseases is described; so are the obstacles. The report also tells what is needed and what is planned in the way of further efforts. It gives many specific examples of medical problems, in which it is evident that hope for progress rests on continuing research. Thus, basic research is defended in an unusually effective way. The report also repeatedly demonstrates that NIH has been adequately concerned with meeting social needs.

Apparently President Johnson was among those who were convinced. At a visit to Bethesda in July 1967 (*Science*, 24 July) he described NIH as a billion-dollar success. Moreover, NIH is the only major agency supporting basic research whose appropriation this fiscal year has an appreciable chance of experiencing a substantial increase.

Medical research is fortunate in having a good case, but it is also fortunate in having spokesmen who, without condescension, can give the public an honest accounting that does not mortgage the future.

—PHILIP H. ABELSON

* *The Advancement of Knowledge for the Nation's Health: A Report to the President on the Research Programs of the National Institutes of Health* (Government Printing Office, Washington, D.C., 1967).

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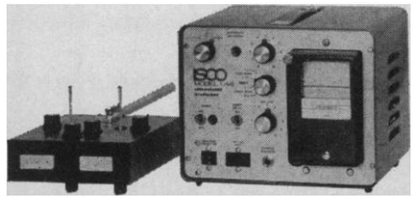

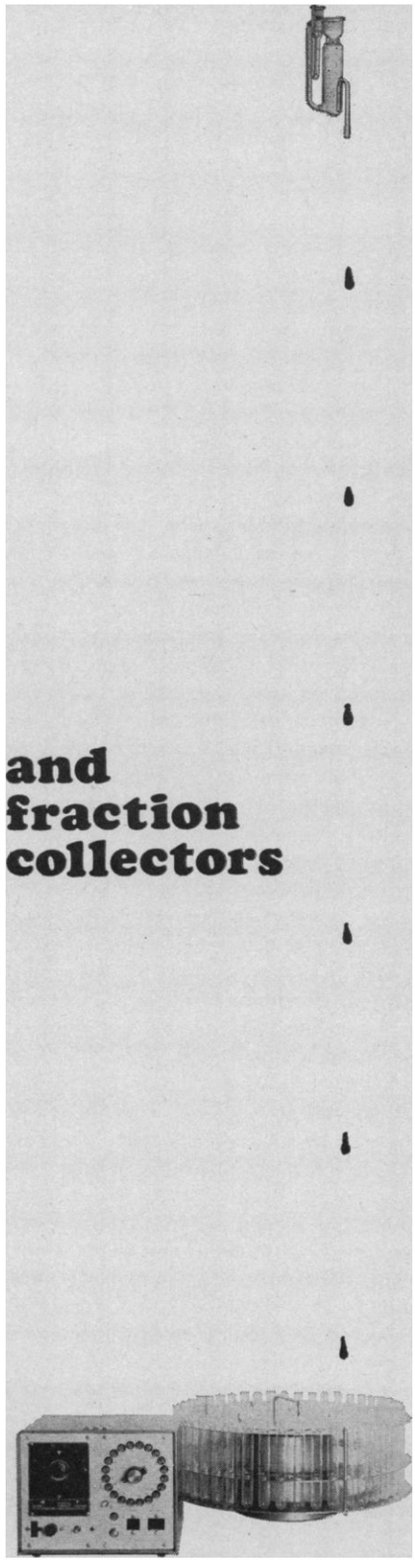

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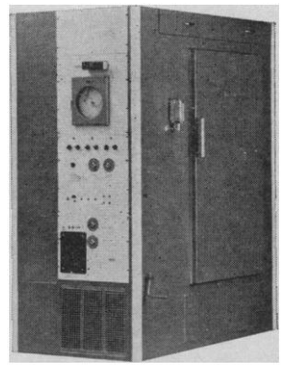

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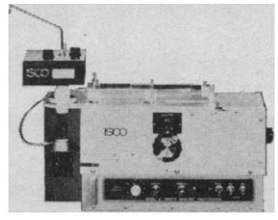

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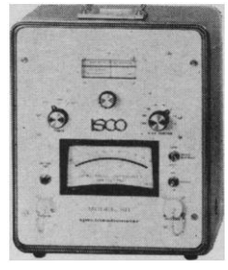

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wise dissimilar myelin lipids. Confirmational relations between cholesterol and any of the other myelin lipids may account for the formation of stable bimolecular complexes which impart order and stability to the myelin sheet. The organization of myelin lipids might serve as a model for membrane systems such as those of the erythrocyte where cholesterol is a major component. But it should be understood that cholesterol is not present at high levels in many membranes.

Some doubts have been expressed concerning the ability of unsaturated phospholipids to form bilayers as they do not form condensed monolayers as easily as saturated ones. However, Vandenheuvel pointed out that the energy situation in bilayers differs considerably from that in monolayers. There is abundant evidence of the spontaneous formation of micelles of bilayers and single bilayers of phospholipid in an aqueous phase. Moreover, there is evidence to indicate that stability of bilayers depends on the presence of unsaturated groups.

A fully unsaturated layer offers no space through which water molecules and small inorganic ions can pass. Even assuming that a random movement of chains will allow the formation of transient pores, the actual porosity will be low. Partial substitution by saturated chains will increase porosity. The ratio of 1 to 2 of saturated to unsaturated chains in mitochondrial lipids would seem to be optimal to give the necessary porosity, fluidity, and stability to the bilayers.

In discussing the lipids of animal cell membranes, G. Rouser (City of Hope Medical Center, Duarte, California) pointed out that analysis of organs of vertebrates and invertebrates shows that all animal cells contain very similar polar (membrane) lipids. Phosphatidyl derivates of choline, ethanolamine, serine, and inositol occur in all animal cells. Sphingomyelin occurs in cells of all vertebrates and many invertebrates, but in some individuals ceramide aminoethyl phosphonate or a related lipid replaces sphingomyelin. Animal cells also contain glycolipids but in widely varying amounts. Any one organ, such as muscle, possesses, qualitatively and quantitatively, the same of a very similar phospholipid composition for all vertebrates. Since whole organ composition is largely a reflection of the components of the mitochondria and endoplasmic reticulum, it is evident that these organelles show very little species variation for any one organ. The composition of brain lipid of various species is very similar though the amount of sphingomyelin is apt to vary. In marked contrast, however, is the large variability in phospholipid composition of different organs of the same species. This variation is due to large differences in the composition of the endoplasmic reticulum of different organs. It seems that the compositions of mitochondria and nuclei of different organs and species are very similar whereas those of the cell surface membranes and endoplasmic reticulum are variable.

C. L. Hannay (Canada Department of Agriculture, London, Ontario) described methods for the preparation of lipid complexes of globular micelles from mixtures of ovalecithin, cholesterol, and saponin. It was found that all the structures, including the double helices, could be formed from all manner of ovalecithins but that there was no certainty that all the structures would be formed in any particular experiment. One variant, for example, was the degree to which the solvent was removed from the lipids before their suspension in saponin solution. The discussion of this problem indicated the complexity, and perhaps the lack of biological reality, of the saponin mixtures.

Turning to bacteria, R. G. E. Murray (University of Western Ontario, London) indicated their manifold advantages in providing systems suitable for biochemical and biophysical studies of membranes and their functions. He discussed the anatomical features of bacterial membranes and the properties of the cell wall and protoplast membranes. He demonstrated the great enlargement of membranes in the developing spore and the continuous intracellular stacked membranes of the vitrifying organisms; he pointed out the structural differentiation of areas in bacterial membranes. Again the question of reality of the structures presented by the electron microscope arose. Are the cells fixed, he asked, in the dynamic state normal to them or do they assume the nearest stable configuration?

The properties of membrane preparations from halophilic organisms *(Halobacterium halobium)* were the subject of comment by C. McClare (Kings College, London, United Kingdom) who was mainly concerned with the bonds existing between the membrane components. In these organisms,


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it was interesting to note, there may be a concentration ratio of potassium ions between cell water and medium of 100 to 1. Whether there is an active ion pump in the bacteria is not yet known with certainty. He showed that the membranes may be isolated by rupturing the cells with glass beads or subjecting them to osmotic shock with 0.02*M* $MgCl_2$. After treatment of the membranes by chloroform-methanol extraction, or by dialysis followed by centrifugation, two types of protein are obtained. However, the major portion of the lipid is found to be associated with one or other of the proteins. This suggested that in vivo lipids are bound to both types of protein by two kinds of bonds which are labile to one or other treatment. One protein has a high proportion of acid (glutamic, aspartic) residues but seems to have a hydrophobic face as it associates with lipids. The other protein type seems to bind the lipids ionically since it is not itself soluble but is taken into chloroform-methanol as a lipoprotein. It would seem that the ionic bond is an intermolecular chelate between the lipid head group, phosphatidyl glycerophosphate, magnesium ions, and a complex of acid and basic groups on the protein. The general properties and similarities of the lipoprotein and proteolipid fractions obtained may be broadly understood in terms of their interactions with water, strong salt solutions, and hydrophobic media.

M. Kates (National Research Council, Ottawa) reviewed the present knowledge of lipid composition in bacterial membranes. Attempts were made to correlate the phospholipid and fatty acid composition with the taxonomic classification of the bacteria. Kates pointed out how there is considerable variation in the composition of bacterial fatty acids and emphasized the dynamic aspects of bacterial membrane composition. This may vary considerably according to the nutritional conditions. Moreover, the degree of saturation of bacterial fatty acids appears to be a function of the time of growth of the organism as well as the temperature. With halobacteria the cell envelopes are high in lipids with but little mucopeptides. Dihydrophytol ethers of D-glycerophosphates are also present in the lipids of all halophilic microorganisms; and such ethers are not present in nonhalophiles.

The phospholipid composition of biological membranes was further dis-

cussed by L. L. M. Van Deenan (University of Utrecht, Netherlands) who described experiments on monolayer interactions between phospholipids and cholesterol. The interactions, though complicated, indicated that cholesterol may contribute to a high degree of molecular organization. Selective lysis of the cell membranes of fungi or erythrocytes, but not bacteria, brought about by application of polyene antibiotics, was studied in mono- and bilayers of different lipid composition. The action of these drugs depends on the ratio of phospholipids to sterols. They bring about reorientation of lipids rich in sterols without affecting lipoproteins such as ATP-ase. Studies were made of the structural requirements of the fatty acid constituents of phospholipids to serve as membrane components. The monoacyl-phosphoglycerides, and possibly lysolecithins, play a role in the regulation of the fatty acid composition of the components. The ratio of differently charged head groups of phospholipids is genetically controlled in mammalian cells such as erythrocytes. In some bacteria (*Staphylococcus aureus* and *Bacillus megaterium*) major changes can be induced in the relative proportions of the phospholipids by changing the *p*H of the nutritional medium. Even the shape and properties of the protoplasts vary according to the *p*H. In *B. megaterium* a glucosamine phosphatidylglyceride is present whose content depends on the nutritional conditions.

A. D. Bangham (Institute of Animal Physiology, Babraham, United Kingdom) discussed phospholipid models for passive diffusion studies. Molecular orientation and dimensions of the membranes are in accord with a bilayer structure. Each membrane forms a closed surface separating one compartment from another. The membranes are permeable to water. However, different phospholipids form membranes exhibiting differential permeabilities to cations and anions, and exchange diffusion can occur. Some membranes can distinguish between K^+ and Na^+; the presence of Ca^{++} may have critical effects on permeability possibly through chelation. Ammonium ions are more freely permeable than K^+ or Na^+.

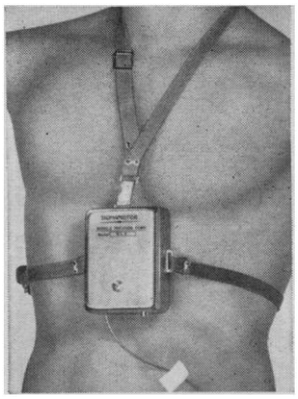
Flux rates of ions across phospholipid layers were described by J. H. Schulman (Columbia University, New York) who pointed to the high rate of flux of iodide as compared with other ions. He has measured fluxes

from an aqueous phase to oil and thence to an aqueous phase and showed how the fluxes are affected by phospholipid layers. Schulman described the ingenious experiments whereby ions may be moved from an aqueous phase into a phase such as pentanol by the use of carriers such as 0.01*M* lauric acid, stearic acid, or lecithin. While such models are of great importance for our knowledge of diffusion through phospholipid layers, we still recall that proteins are present in natural bilayers and that these may well affect the properties of permeability and diffusion.

Turning to problems of ionic transport, Skou (Aarhus University, Denmark) showed that the membrane-bound ATP-ase sensitive to Na^+ and K^+ fulfills many of the requirements of an ion transport system. It is reasonable to conclude that the enzyme plays a major role in the active transport of cations across the cell membrane. The enzyme apparently has two sites with affinities for cations, one where the affinity for Na^+ exceeds that for K^+ and the other where the affinity for K^+ exceeds that for Na^+. The affinities are influenced, in a manner not yet understood, by adenosine triphosphate (ATP) which increases the affinity of Na^+ for the Na site and diminishes that of K^+ for the K site. ATP also affects affinity of the enzyme for strophanthidin.

The cations at the two sites control the manner in which ATP is broken down. With sodium at both sites the hydrolysis of ATP leads to a phosphorylation of an enzyme component. No such phosphorylation is evident with K^+ at one site and Na^+ at the other. The possible conformational changes brought about in the enzyme protein by the cations, and the changed affinities, are problems of great importance which have to be solved. Such solutions are required before acceptable models can be developed. It should be emphasized that the ATP-ase is a lipoprotein which when treated with phospholipase loses its specificity for Na^+ and K^+.

Studies of the membrane-bound ATP-ase, believed to be involved in coupled transport of Na^+ and K^+ in animal tissues, were the subject of discussion by L. E. Hokin (University of Wisconsin, Madison) who has found that its alkylation by diisopropylfluorphosphonate (DFP) is blocked by ATP and other nucleotides at higher concentrations. Either the cardiotonic ste-



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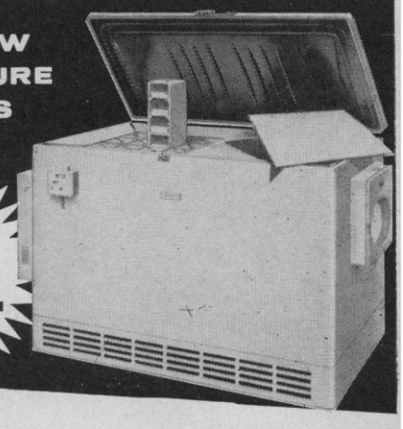

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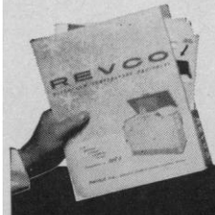

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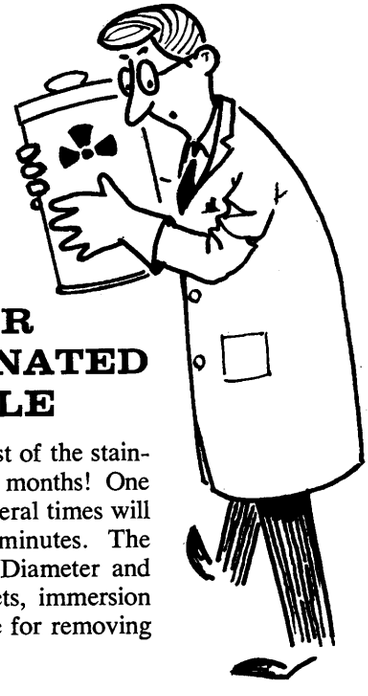

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roids or K^+ potentiate the alkylation by DFP, and K^+ antagonizes protection of the enzyme by ATP. Just as ATP affects the affinity of K^+ for ATP-ase, so does K^+ affect the affinity of ATP for ATP-ase. As the steroid or K^+ acts at the outer surface of the membrane and ATP acts at the inner surface, the former presumably brings about a conformational change affecting the relative affinities of DFP and ATP at the substrate site. Conceivably the steroid may also affect the affinity of K^+ for the enzyme strophanthidin-bromo (or iodo) acetate irreversibly inhibits the enzyme by alkylation at the steroid site. This reaction combined with a triple labeling technique has made it possible to isolate a lipoprotein, on chromatography, with suitable labeling. The molecular weight of such a lipoprotein was calculated to be of the order of 175,000. Assuming one strophanthidin site for each ATP site, the protein was considered to be 50 percent pure.

P. G. Scholefield (McGill University, Montreal) discussed the role of Na^+ in transport reactions. He pointed out that Na^+ is not required for translocation as it is not needed for the process of exchange diffusion, which is also independent of ATP. Moreover, this process may not be affected by substrate analogues that block transport. Thus it is evident that the carriers involved in exchange diffusion and active transport are not necessarily the same. Although, as is well known, Na^+ is needed for many forms of transport, it may not be essential for all transport systems. It is clear also that sodium movement may occur without necessarily having an effect on the transport of an amino acid, as for example, that of aminoisobutyric acid in rat diaphragm. Thus it is evident that Na^+ is required more for the operation of some systems than for others. The sodium effect on transport may in fact be due to conformational changes in the carrier protein that may result in changed transport velocities. Its effect on membrane-bound ATP-ase is doubtless a basic mechanism. However, it was pointed out in discussion that in some bacteria no Na-K-dependent ATP-ase is present though concentrative uptake occurs. It was also pointed out that certain bacterial transport systems are not dependent on Na^+. Discussion indicated the pressing problem of throwing further light on the precise relation between the kinetics of ionic

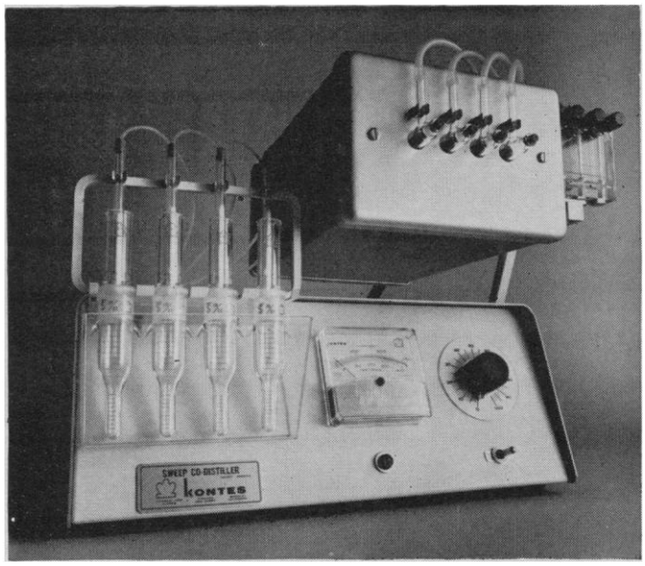
and molecular transport and the molecular architecture of the cell membrane. If there is a relatively small number of transport sites at the membrane they may never be visualized by the electron microscope. It will be necessary to decide as to whether there are active patches for transport or whether there are on the membrane reversible deformational changes that cause changed rates of transport or whether in fact both mechanisms operate.

In considering specific factors involved in molecular transport, E. P. Kennedy (Harvard University, Boston) described work leading to the finding of a protein localized in the membrane-containing fraction of *Escherichia coli* that is an essential component of the lactose transport system. Techniques were devised for labeling this protein. Study of the genetic control of the protein revealed that it is the product of the *y* gene of the *lac* operon. Study of the interaction of the membrane protein with β-galactosides in cell-free systems strongly suggests that the protein must have two distinct sites for binding sugars.

V. P. Cirillo (State University of New York, Stony Brook) described investigations into the mechanism of monosaccharide transport in two strains of *Saccharomyces cerevisiae*, one an asexual diploid and the other a sexual haploid. By use of nonmetabolizable sugars it was found that the mechanism is apparently a carrier-mediated, facilitated diffusion. The process of uptake shows saturation kinetics and exhibits both marked substrate selectivity, and competitive inhibitions, among the transported sugars, as well as counter transport. Both strains have at least two monosaccharide transport systems—a constitutive "glucose" system and an inducible "galactose" system. From analysis of their relative affinity and inhibition constants, the structural requirements for the glucose system and the inducible galactose system were worked out.

Inducibility of the galactose transport system in the haploid strain is under genetic control and in these cells the transport system is equally well induced by D-galactose and by its nonmetabolized analogues D-fucose and L-arabinose.

D. M. Miller (Canada Department of Agriculture, London, Ontario), in discussing sugar transport in human erythrocytes, concluded that the suggestion that the sugar forms a com-



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*Reference—J.O.A.C., Vol. 48, Dec., 1965, "A Sweep Co-Distillation Clean-up Method for Organophosphate Pesticides", by R. W. Storherr & R. R. Watts.
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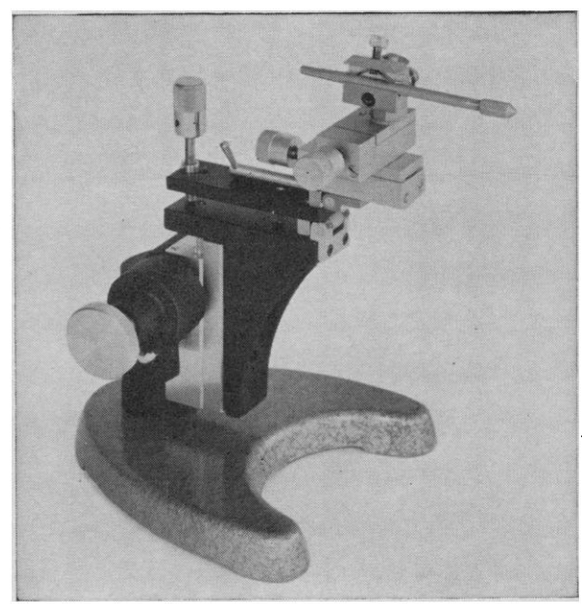

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plex with a carrier moving faster through the membrane than the free carrier is inadequate to account for the present evidence. He considered an alternative mechanism, in which simple carrier transport within the membrane is flanked by two first-order processes (such as slow diffusion layers). Each occurs at each side of the membrane, which would account for the results. He also developed a pore theory in a very ingenious manner that would explain his results; however, this suggestion was not greeted with enthusiasm by the morphological membranologists.

S. Fleischer (Vanderbilt University, Nashville) dealt with the role of lipids in the structure and function of the mitochondria. He showed how extraction of mitochondria with acetone-water leads to a block in electron transfer which can be relieved by the addition of coenzyme Q and not the other neutral lipids. Another method of extraction leads to a condition of block of electron transfer which is reactivated by addition of the appropriate phospholipids as well as coenzyme. Thus, for the first time, a functional requirement of the phospholipids in the electron-transfer chain is demonstrable. Phospholipase treatment can also be used for removal of phospholipids in order to demonstrate their requirement in, say, succinate oxidation. It is of course an old observation that phospholipase A can block succinate oxidation in cell preparations but the reconstitution described by Fleischer is a considerable advance. Gross morphology of the mitochondrial inner membrane is not apparently altered after removal of even 95 percent of the lipid. The "unit membrane" is preserved. It would be necessary to postulate, on the Davson-Danielli model, the presence of cross-links holding the proteins apart. The enzymes of the electron transfer systems in the mitochondria are considered to be an integral part of the membrane proteins.

L. Ernster (Stockholm, Sweden) discussed electron transport in intracellular membranes. He showed how three types of electron transporting systems (the respiratory chain, the NADH-cytochrome b_5 reductase, and the NADPH-linked hydroxylase) are associated with intracellular membrane structures. The respiratory chain is present in all animal tissues except nonnucleated erythrocytes and is associated with the inner mitochondrial membrane. The NADH-cyt b_5 reduc-

tase, occurring abundantly in the liver, is associated both with endoplasmic reticulum and with the outer mitochondrial membrane. The NADPH-linked hydroxylase system is associated, in the liver, with the endoplasmic reticulum and in the endocrine glands with the mitochondria. Association with the membrane structure endows the electron transport systems with properties that distinguish them, both quantitatively and qualitatively, from a random mixture of enzymes. These properties are essential for cell function. Membranes play a basic role in the maintenance and regulation of physiologically adequate levels of electron transport systems, as indicated by studies of thyroxin-induced synthesis of the respiratory chain or the drug-induced synthesis of NADPH-linked hydroxylase.

The conference, which included an address by T. Tearell (University of Uppsala, Sweden) on integrative viewpoints in membranology, made all aware, if they were not already aware, that the biological membrane is much more than a sum of its parts and that it is an entity of as profound importance for the life of the cell as any other organized constituent of the cell. It was evident that the generation of membrane components that control the fluxes of cell constituents is geared to the processes of enzyme syntheses and so to the processes of lipid and protein biosyntheses. How this interdependence is brought about, and the precise nature of the phospholipid-protein associations that control membrane function, are some of the main problems in present-day membranology.

The conference was sponsored by the Biochemistry Division of the Chemical Institute of Canada and the Canadian Biochemical Society.

J. H. QUASTEL
Kinsmen Laboratories of Neurological Research, University of British Columbia, Vancouver, British Columbia, Canada

Drug Information

The first of five projected conferences on drug information was held in Princeton, New Jersey, 4–7 June 1967, and dealt with the drug information which members of the health professions and health services require in order to function efficiently. These conferences, organized by Frank Fremont-Smith, are part of the Program of the

Interdisciplinary Communications Program of the New York Academy of Sciences, which has as its goal multiprofessional discussion in depth in contrast to the usual reading of formal papers.

The discussion was opened by Irving S. Wright, professor of medicine at Cornell University Medical School, New York City. A second session on this subject was opened by William G. Clark, of the Veterans Administration Hospital, Sepulveda, California. The discussions emphasized that members of the health professions and health services want to know what drugs do, and how they may be used satisfactorily in practice, as well as full information on possible side effects of drugs and what toxic reactions are possible or probable.

The second part of the conference explored the matter of what members of the health professions and health services should know about drugs in order to function effectively. Louis Lasagna of the Johns Hopkins Hospital, Baltimore, and Arthur Ruskin of the Food and Drug Administration opened the discussions.

It was emphasized that names are important and that full information on public and various trade names for the same chemical compound should be fully available. Much confusion might be avoided if the public or "generic" name of a drug were used, with the name of the companies producing it, in order to assure its quality. It was pointed out that a serious black market involving gangsters is operating in the drug field. Not only should members of the health professions know the chemical and physical composition of a drug, but also its relationship to other well-known drugs. It was felt that information should be furnished on rates of absorption and distribution of drugs through living matter in connection with rates and methods of the drug's removal from living matter after administration. It was further emphasized that fuller information should be given on what drugs do at all levels of organization of living matter from molecules to ecologies. Also, information should be available on all toxic or untoward reactions from single or repeated administration; the indications for drug use should be given, together with information on clinical effectiveness under conditions of adequately controlled clinical study. On the other hand, the responsibility for using drugs on individual patients re-

mains with the individual member of the health profession, who is responsible for the care of the patient. However, the legal trend is toward full product liability regardless of the person or agent using the drug. The discussion explored sources of drug information including pharmacopeias, advertising material from drug manufacturers, standard reference sources, such as texts, and various reports on drugs from health professions or governmental agencies.

Jean K. Weston of the National Pharmaceutical Council opened the final discussion on difficulties encountered by members of the health professions and health services in obtaining information on drugs. It was pointed out that increasingly hospital pharmacies are functioning as drug information centers. The poison control centers were indicated as sources of information on drug toxicity. The conference discussions were summarized by Maurice L. Tainter of the Sterling Drug Company, New York City.

A subsequent conference is planned on methods of obtaining, analyzing, organizing, and storing drug information, and on ways of prompt and efficient retrieval and distribution of drug information to those who may wish it.

Isaac Welt of American University, Washington, D.C., is editing the proceedings of the conference. These are expected to be published within a year.

The 25 participants in the conference represented academic pharmacologists, toxicologists and clinicians, drug information-gathering media, drug manufacturers, and voluntary and governmental health agencies. The conference was supported by a grant from the National Library of Medicine.

CHAUNCEY D. LEAKE
University of California,
San Francisco Medical Center,
San Francisco

Calendar of Events—October

National Meetings

15–18. American **Oil Chemists** Soc., Chicago, Ill. (D. E. Weber, 35 E. Wacker Dr., Chicago 60601)

15–19. American Assoc. of **Medical Record Librarians**, annual mtg., Los Angeles, Calif. (M. Waterstraat, 211 E. Chicago Ave., Chicago, Ill. 60611)

16–17. **Systems Science and Cybernetics**, conf., Boston, Mass. (M. D. Rubin, Mitre Corp., Bedford, Mass.)

16–18. **Aerospace and Electronic** Systems, conv., Washington, D.C. (M. N.

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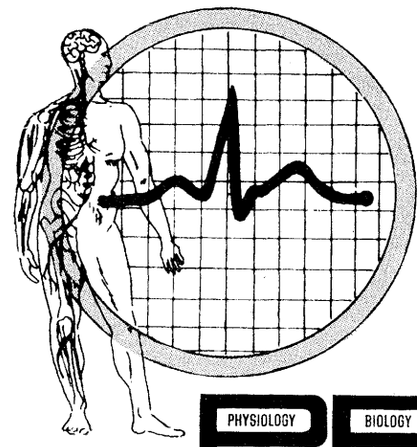

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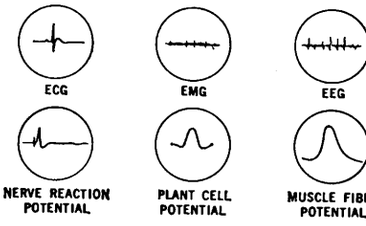

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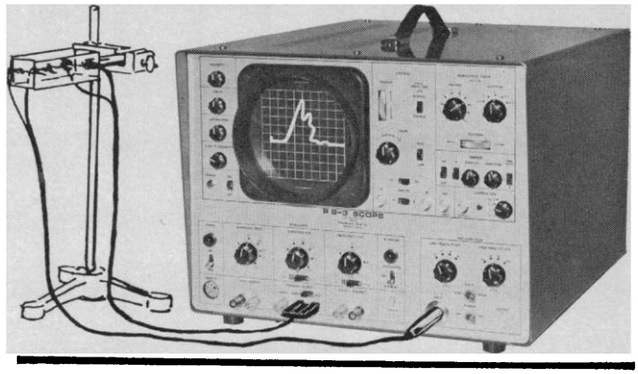

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Abramovich, Washington Technical Consultants, 422 Washington Bldg., Washington 20005)

16–19. **Molecular Dynamics and Structure of Solids**, Gaithersburg, Md. (R. S. Carter, Inst. for Materials Research, National Bureau of Standards, Washington, D.C. 20234)

16–20. **Metallurgical** Soc., fall mtg., Cleveland, Ohio. (J. V. Richard, 345 E. 47 St., New York 10017)

16–20. American Soc. of **Civil Engineers**, annual mtg., and **Water Resources**, engineering conf., New York, N.Y. (W. H. Wisely, ASCE, 345 E. 47 St., New York 10017)

16–20. American Soc. for **Metals**, Cleveland, Ohio. (Meetings Manager, Metals Park, Ohio)

16–20. Society for **Non-Destructive Testing**, Cleveland, Ohio. (SN-DT, 914 Chicago Ave., Evanston, Ill. 60202)

18–20. **Exploding Wire Phenomenon**, 4th conf., Boston, Mass. (W. G. Chase, Air Force Cambridge Research Labs., L. G. Hanscom Field, Bedford, Mass. 01730)

18–22. American Soc. of **Clinical Hypnosis**, 10th annual scientific mtg., New York, N.Y. (F. D. Nowlin, 800 Washington Ave., SE, Minneapolis, Minn. 55414)

19–20. National **Fluid Power** Assoc., Chicago, Ill. (W. R. Smith, 3300 S. Federal St., Chicago 60616)

19–20. **Severe Local Storms**, conf., St. Louis, Mo. (K. C. Spengler, 45 Beacon St., Boston, Mass. 02108)

19–22. American Assoc. of **Textile Chemists and Colorists**, New Orleans, La. (G. P. Paine, AATCC, Box 12215, Research Triangle Park, N.C. 27709)

20–23. American **Heart** Assoc., 40th annual mtg., San Francisco, Calif. (AHA, 44 E. 23 St., New York 10010)

21–23. American Soc. of **Cytology**, Denver, Colo. (W. R. Lang, 1025 Walnut St., Philadelphia, Pa. 19107)

21–26. American Acad. of **Pediatrics**, annual mtg., Washington, D.C. (R. G. Frazier, 1801 Hinman Ave., Evanston, Ill. 60204)

22–26. American **Documentation** Inst., New York, N.Y. (J. E. Bryan, 2000 P St., NW, Washington, D.C. 20036)

22–26. American Soc. of **Sanitary Engineering**, annual mtg., Boston, Mass. (S. Schwartz, 228 Standard Bldg., Cleveland, Ohio 44113)

23–24. American College of **Preventive Medicine**, annual mtg., Miami, Fla. (J. J. Wright, Box 1263, Chapel Hill, N.C. 27514)

23–25. National **Electronics** Conf., Chicago, Ill. (R. J. Napolitan, 228 N. LaSalle St., Chicago 60601)

23–25. Society of **Rheology**, 38th annual mtg., Washington, D.C. (J. C. Miller, Plastics Div., Union Carbide, Bound Brook, N.J.)

23–26. American **Vacuum** Soc., 14th natl. mtg., Kansas City, Mo. (P. J. Bryant, Midwest Research Inst., 425 Volker Bldg., Kansas City, Mo. 64110)

23–27. American Inst. of **Aeronautics and Astronautics**, 4th annual mtg., Anaheim, Calif. (Meetings Manager, AIAA, 1290 Sixth Ave., New York 10019)

23–27. American **Public Health** Assoc., 95th annual mtg., Miami Beach, Fla. (B.

F. Mattison, 1790 Broadway, New York 10019)

25–27. **Antimicrobial Agents and Chemotherapy**, 7th interscience conf., Chicago, Ill. (R. W. Sarber, 115 Huron View Blvd., Ann Arbor, Mich.)

25–27. **Graphics Arts**, 4th conf., Rochester, N.Y. (K. G. Chesley, TAPPI, 360 Lexington Ave., New York 10017)

25–27. Gulf Coast Assoc. of **Geological** Socs./American Assoc. of **Petroleum Geologists**, San Antonio, Tex. (A. M Borland, Sun Oil Co., Box 3308, Lafayette, La.)

25–28. American Acad. of **Periodontology**, 53rd annual mtg., Washington, D.C. (R. G. Keses, 211 E. Chicago Ave., Chicago, Ill. 60611)

25–28. Congress of **Neurological Surgeons**, 17th annual mtg., San Francisco, Calif. (J. M. Thompson, 1955 Blossom Way S, St. Petersburg, Fla. 33712)

26–27. **Planetology and Space Mission Planning**, New York, N.Y. (R. D. Enzmann, 29 Adams St., Lexington, Mass.)

26–28. Unconventional **Photographic Systems**, symp., Washington, D.C. (H. J. Hall, 10 Maguire Rd., Lexington, Mass.)

27–28. American Soc. of **Ophthalmologic and Otorhinolaryngologic Allergy**, annual mtg., Chicago, Ill. (L. El. Morrision, 603 Hume Mansur Bldg., Indianapolis, Ind.)

26–29. **Photographic Interaction between Radiation and Matter**, colloquium, Washington, D.C. (Society of Photographic Scientists and Engineers, 1330 Massachusetts Ave., NW, Washington 20005)

28–2. American **Fracture** Assoc., annual mtg., Chicago, Ill. (H. W. Wellmerling, 610 Griesheim Bldg., Bloomington, Ill. 61701)

29–1. Association for **Research in Ophthalmology**, annual mtg., Chicago, Ill. (Secretary-Treasurer, Univ. of Florida, College of Medicine, Gainesville 32603)

29–4. American College of **Gastroenterology**, 32nd annual conv., Los Angeles, Calif. (D. Weiss, 33 W. 60 St., New York 10023)

30–2. American **Dental** Assoc., 108th annual mtg., Washington, D.C. (H. Hillenbrand, 211 E. Chicago Ave., Chicago, Ill.)

30–2. **Nuclear Science**, 14th symp., Los Angeles, Calif. (R. E. Emberson, 345 E. 47 St., New York 10017)

31–2. **Numercial Prediction**, conf. Monterey, Calif. (K. C. Spengler, 45 Beacon St., Boston, Mass. 02108)

31–3. Society for **Experimental Stress Analysis**, annual mtg., Chicago, Ill. (B. E. Rossi, 21 Bridge Sq., Westport, Conn.)

International and Foreign Meetings

1–4. Gondwana **Stratigraphy and Paleontology**, 1st intern. symp., Mar del Plata, Argentina. (Secretario, L Simposio Internacional Sobre Estratifrafia y Paleontologia del Gondwana, Casilla de Correo 5483, Buenos Aires, Argentina)

1–6. World Federation for **Mental Health**, 20th annual mtg., Los Angeles, Calif. (Administrative Headquarters, 1, rue Gevray, Geneva, Switzerland)

1–14. Field Symp. on the **Granites** of Northeastern Brazil and Their Comparison with Those of West Africa, Recife, Brazil. (J. Lombard, 12, rue de Bourgogne, Paris 7, France)

2–5. **Standardization of Pharmaceutical Preparations**, 3rd intern. cong., Halle an der Saale, Germany. (Sekretariat, Pharmazeutische Gesellschaft in der D.D.R., Weinbergweg., X-402 Halle an der Saale)

2–6. **Disease Epidemiology**, Forecasting and Losses, conf., Rome, Italy. (International Agency Liaison Branch, Office of the Director General, Food and Agricultural Organization, Via Delle Terme di Caracalla, Rome)

2–6. Scientific Society for **Air and Space Travel**/German Soc. for **Rocket Technology** and Space Travel, annual mtg., Karlsruhe, Germany. (Wissenschaftliche Gesellschaft fur Luft- und Raumfahrt, Martinstr. 40-42, 5 Cologne, Germany)

3–5. International Conf. on **Hydraulic Research**, Brno, Czechoslovakia. (Vysoke Uceni Technicke, Fakulta Stavebni Vedeco Vyzkumny Ustav, Vodniho Stavitelstvi A Hospodarstvi, Rekreacni 1, Brno 35)

3–6. **Psychiatric Problems during Puberty**, symp., Rostock, Germany. (O. Kucera, Nam. Sv. Ceca 13, Prague 10-Vrsovice, Czechoslovakia)

3–7. **Tuberculosis**, 19th intern. conf., Amsterdam, Netherlands. (J. Meijer, Postbus 146, The Hague, Netherlands)

4–6. **Ultrasonics** Symp., Vancouver, B.C., Canada. (B. A. Auld, W. W. Hansen, Labs. of Physics, Stanford Univ., Stanford, Calif. 94305)

4–9. International Academy of **Legal Medicine and of Social Medicine**, 7th cong., Budapest, Hungary. (M. Helpern, 520 First Ave., New York 10016)

5–7. **Protection of Seacoasts against Pollution**, symp., Hamburg, Germany. (L. R. Alldredge, ESSA/IER, Inst. for Earth Sciences, Boulder, Colo. 80302)

8–13. International Congr. of **Plastic Surgery**, Rome, Italy. (G. Francesconi, Via Lamaramora 10, Milan, Italy)

9–11. **Industrial Research** Inst., fall mtg., Quebec, Canada. (G. W. McBride, 100 Park Ave., New York 10017)

11–13. **Hot Atom Chemistry**, intern. mtg., Kyoto, Japan. (N. Saito, Dept. of Chemistry, Univ. of Tokyo, Bunkyo-Ku, Tokyo, Japan)

12–13. **Forest Biology**, conf., Montreal, Canada. (K. G. Chesley, TAPPI, 360 Lexington Ave., New York 10017)

12–13. **Selenium and Tellurium**, intern. symp., Montreal, Canada. (Selenium Tellurium Development Assoc., 11 Broadway, New York 10004)

12–15. **Communications**, 15th intern. congr., Genoa, Italy. (Secretary, Instituto Internazionale Delle Comunicazioni, Viale Brigate Partifiane, 18, Genoa)

13–14. **Neuroendocrinology**, intern. symp., Paris, France. (H. P. Klotz, Hopital Beaujon, 100, Boulevard du General-Leclerc, 92-Clichy, France)

15–19. Society of American **Foresters**, 67th annual mtg., Ottawa, Canada. (Y. W. Rainer, 1010 16th St., NW, Washington, D.C. 20036)

16–18. Canadian **Chemical Engineering**, conf., Niagara Falls, Ont., Canada. (T. H. G. Michael, 151 Slater St., Ottawa 4, Ont., Canada)

16–18. International **Scientific Radio** Union/Inst. of **Electrical Engineers**, fall mtg., Ann Arbor, Mich. (J. Hannaum, USNC-URSI, 2101 Constitution Ave., NW, Washington, D.C. 20418)

BOOKS RECEIVED

(*Continued from page 109*)

gebra. Tom M. Apostol. Blaisdell (Ginn), Waltham, Mass., ed. 2, 1967. 688 pp. Illus. $11.50.

Calculus in the First Three Dimensions. Sherman K. Stein. McGraw-Hill, New York, 1967. 629 pp. Illus. $9.95.

Carbonate Rocks. pts. A and B. pt. A, *Origin, Occurrence, and Classification* (477 pp.); pt. B, *Physical and Chemical Aspects* (423 pp.). George V. Chilingar, Harold J. Bissell, and Rhodes W. Fairbridge, Eds. Elsevier, New York, 1967. Illus. $27 per volume. Developments in Sedimentology Series, vol. 9.

A Catalogue of Latin American Flat Maps, 1956–1964. vol. 1. Palmyra V. M. Monteiro. Univ. of Texas Press, Austin, 1967. 411 pp. $10.

Cell Ultrastructure. William A. Jensen and Roderic B. Park. Wadsworth, Belmont, Calif., 1967. 64 pp. Illus. Paper, $1.95.

The Cerebellum as a Neuronal Machine. John C. Eccles, Masao Ito, and János Szentágothai. Springer-Verlag, New York, 1967. 343 pp. Illus. $17.

A Continent in Danger. Vincent Serventy. Reynal, New York, 1967. 240 pp. Illus. $8.95.

Continental Drift: Is It a Cometary Impact Phenomenon? Allan O. Kelly. The Author, Carlsbad, Calif., 1966. 106 pp. Illus. Paper, $4.95.

Differential Equations and Dynamical Systems. Proceedings of an international symposium (Mayaguez, Puerto Rico), December 1965. Jack K. Hale and Joseph P. LaSalle, Eds. Academic Press, New York, 1967. 564 pp. Illus. $18. Fifty-three papers.

The Discovery of Grounded Theory: Strategies for Qualitative Research. Barney G. Glaser and Anselm L. Strauss. Aldine, Chicago, 1967. 285 pp. Illus. $6.75.

The Dynamic Role of Molecular Constituents in Plant-Parasite Interaction. Proceedings of a conference (Gamagori, Japan), May 1966. C. J. Mirocha and I. Uritani, Eds. American Phytopathological Soc., St. Paul, Minn., 1967. 382 pp. Illus. Paper, $6.50. Twenty-one papers.

Electrical Noise. Robert King. Chapman and Hall, London; Barnes and Noble, New York, 1967. 207 pp. Illus. $5.50. Modern Electrical Studies.

Extinct and Vanishing Animals: A Biology of Extinction and Survival. Vinzenz Sizwiler. Revised English edition by Fred Bunnell and Pille Bunnell. Springer-Verlag, New York, 1967. 143 pp. Illus. Paper, $3.40. Heidelberg Science Library, vol. 2.

Fluid Dynamics and Multiphase Systems. S. L. Soo. Blaisdell (Ginn), Waltham, Mass., 1967. 544 pp. Illus. $16.

Focusing of Charged Particles. vol. 2. Albert Septier, Ed. Academic Press, New York, 1967. 485 pp. Illus. $19. Eleven papers.

Food and Nutrition. William H. Sebrell, Jr., James J. Haggerty and the Editors of *Life.* Time Inc., New York, 1967. 200 pp. Illus. $3.95.

Foundations of Optimization. Douglass J. Wilde and Charles S. Beightler. Pren-

Fundamentals of Physiology. Elbert Tokay. Barnes and Noble, New York, ed. 3, 1967. 342 pp. Illus. Paper, $1.95.

Gas-Chromatographie 1965. A symposium (Berlin), May 1965. Hans Georg Struppe, Ed. Akademie-Verlag, Berlin, 1966. 584 pp. Illus. Abhandlungen der Deutschen Akademie der Wissenschaften zu Berlin.

Gedenkschrift zum 70. Geburtstag von Johannes Dobberstein. Akademie-Verlag, Berlin, 1966. 234 pp. Illus. Abhandlungen der Duetschen Akademie der Wissenschaften zu Berlin.

Germinal Centers in Immune Responses. Proceedings of a symposium (Bern, Switzerland), June 1966. H. Cottier, N. Odartchenko, R. Schindler, and C. C. Congdon, Eds. Springer-Verlag, New York, 1967. 515 pp. Illus. $19.50. Fifty-seven papers.

Handbook of Methods of Applied Statistics. 2 vols. vol. 1, *Techniques of Computation, Descriptive Methods, and Statistical Inference*. (474 pp. $12.95); vol. 2, *Planning of Surveys and Experiments* (170 pp. $9). I. M. Chakravarti, R. G. Laha, and J. Roy. Wiley, New York, 1967. Illus.

Homology of Cell Complexes. Based on lectures by Norman E. Steenrod. George E. Cooke and Ross L. Finney. Princeton Univ. Press, Princeton, N.J., 1967. 264 pp. Illus. Paper, $3.75.

Infancy in Uganda: Infant Care and the Growth of Love. Mary D. Salter Ainsworth. Johns Hopkins Press, Baltimore, 1967. 489 pp. Illus. $12.

Instinct and Intelligence: Behavior of Animals and Man. S. A. Barnett. Prentice-Hall, Englewood Cliffs, N.J., 1967. 238 pp. Illus. $6.95.

Internationaler Kongress für Geburtshilfe und Gynäkologie (Berlin), May-June 1965. Helmut Kraatz, Ed. Akademie-Verlag, Berlin, 1966. 970 pp. Illus. 106. Abhandlungen der Deutschen Akademie der Wissenschaften zu Berlin.

Introduction to Network Analysis. Ben Zeines. Prentice-Hall, Englewood Cliffs, N.J., 1967. 320 pp. Illus. $10.95.

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