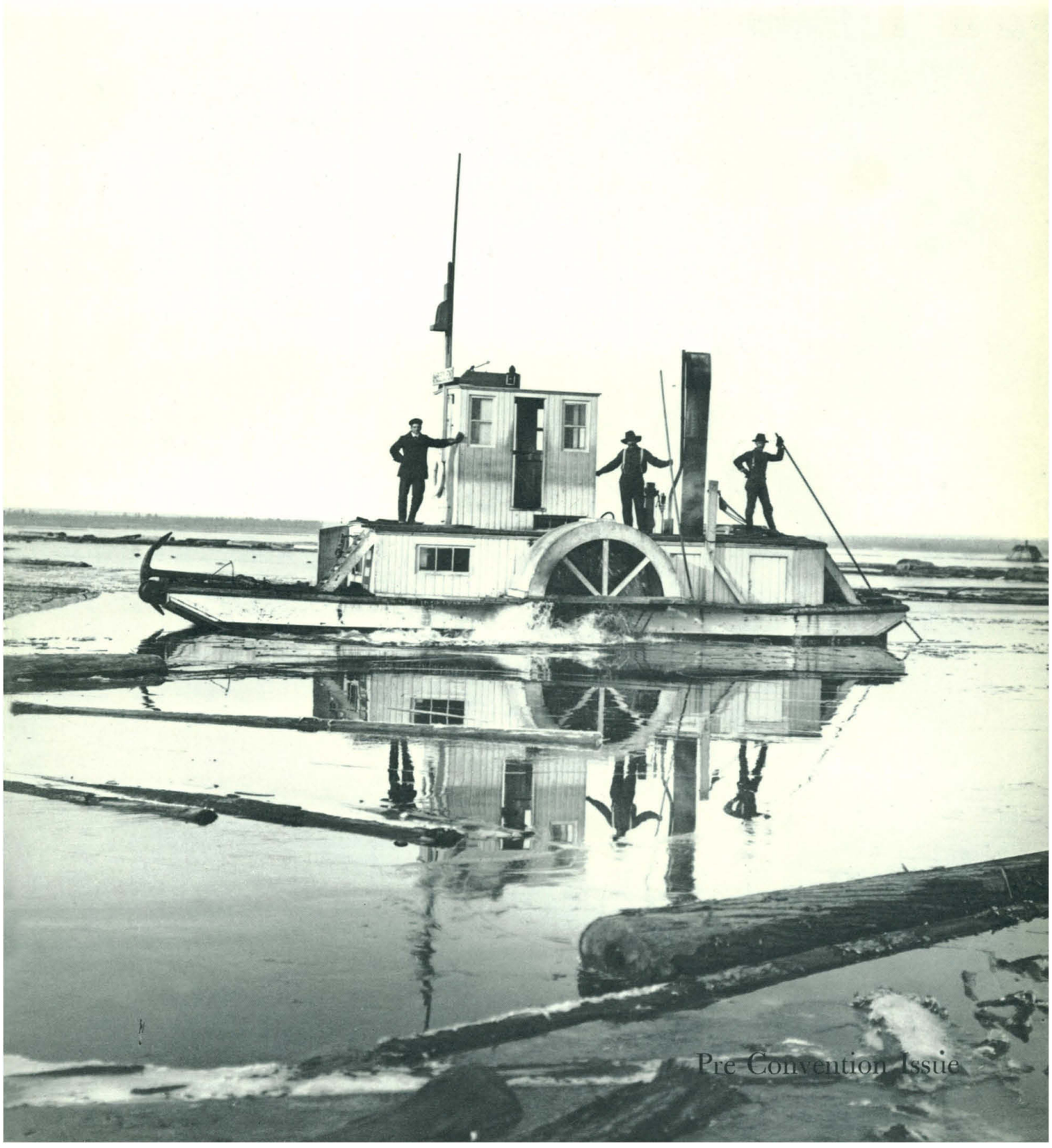
# SCIENCE

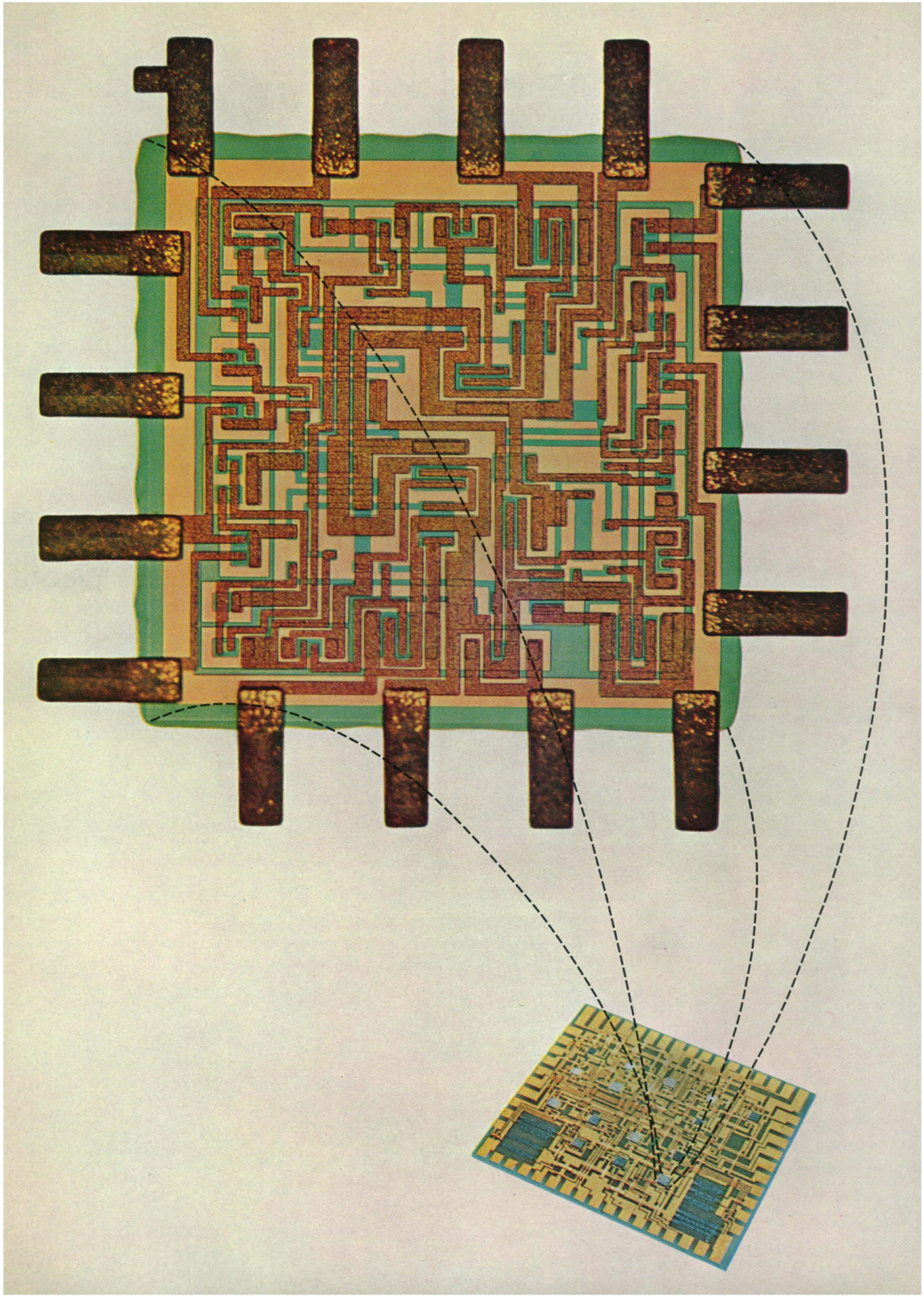
20 November 1970

Vol. 170, No. 3960

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Pre Convention Issue



# Circuits and synergy

To fill a variety of communications needs, Bell Labs and Western Electric have worked together to develop a special kind of integrated circuit. Based on two compatible and complementary technologies—silicon and tantalum—this "hybrid integrated circuit" is hundreds of times smaller and more reliable than circuits using discrete solid-state components.

The silicon portions of the circuit contain active components such as diodes and transistors; some low-precision resistors and the necessary interconnections are also formed on the tiny silicon chips. Hundreds of these chips are fabricated on one silicon slice. Tiny gold conductors—"beam leads"—are formed on each chip at the same time. Then the chips are separated and the beam leads bonded to tantalum thin-film circuits. Typically no more than one or two square inches, tantalum circuits contain precision resistors, capacitors, and interconnections etched into the metal film, previously deposited on glass or ceramic substrates.

Hybrid integrated circuits open new opportunities for circuit designers in many areas of communications systems engineering—telephone equipment, transmission, switching.

In this hybrid integration technology, design and manufacturing are intimately related. Designer and maker must work closely together. The Bell System fosters this concerted action—this synergy—with Bell Labs, for research and development, and Western Electric for manufacturing and supply. At several plants Bell Labs and Western Electric engineers work together in Process Capability Laboratories, speeding new designs into manufacture.

Here are a few examples of their teamwork.

The tantalum portion of a hybrid circuit starts as a 2000-Angstrom layer of tantalum, deposited on glass or ceramic. This process, invented at Bell Labs, was first carried out in a vacuum under bell jars. Western Electric designed and built "open ended" machines. Now, deposition takes place as the glass or ceramic chips move through the machine on a chain.

For highest precision, newly formed tantalum thin-film resistors require adjustment. This is done by removing, electrochemically, just the right amount of tantalum to raise the resistance to the required value. Bell Labs devised the process; Western Electric computerized and automated it.

Silicon circuits are sensitive to impurities such as sodium ions in the air. So, they used to be sealed into expensive evacuated cans. But now, a gold and silicon-nitride shield gives the required protection at low cost. Originated by Bell Labs, it was put to work by Western Electric.

Making connections to integrated circuits once called for individual attachment of fine gold wires. Then Bell Labs came up with "beam leads": gold conductors plated into place on silicon circuits. In addition to being conductors, the leads also give mechanical support. Western Electric developed methods for bonding them to circuits.

Beam leads are fabricated as part of the silicon circuit but their free ends must be attached to other circuitry. Bell Labs and Western Electric have developed thermocompression bonding techniques for this job. With the proper combination of time, temperature, and pressure all leads on the silicon circuit are bonded simultaneously to a thin-film circuit.

In the future, we hope to get more circuitry into less space and to find new functions for the technology. The circuit shown here, for instance, is one of some 200 logic "building blocks" for use in private branch exchanges, data sets, and other customer telephone equipment. It could not have been built with "discrete-component" technology. And we will not stop with silicon and tantalum. For other jobs, other materials may be better. Bell Labs and Western Electric are working together to find and apply them.

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# SCIENCE

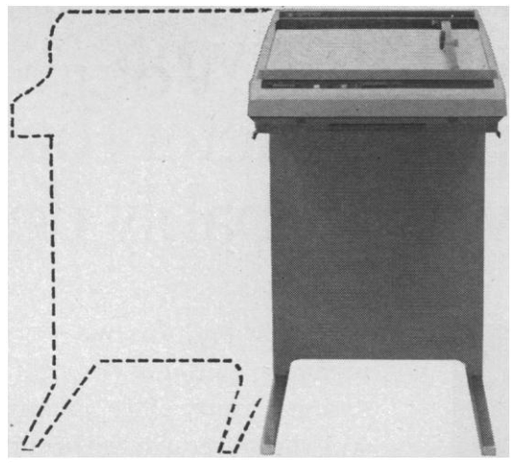




SCIENCE is published weekly on Friday and on the fourth Wednesday in September by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW Washington, D.C. 20005. Now combined with **The Scientific Monthly®**. Second-class postage paid at Washington, D.C.  Annual subscription $12; foreign postage: Americas $3; overseas $5; single copies, 50¢ (back issues, $1) except **Guide to Scientific Instruments** which is $3. School year subscription: 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.**

**COVER**

Sidewheel steam "alligator" tug, *Amable du Fond*, at Arnprior, Ontario. See review of *Science, History and Hudson Bay*, page 841. [Charles Macnamara Collection, Ontario Archives]



# Picture your terminal (even if it's IBM) with our $3,300 graphic plotter.

At last, everybody can see their time-share data plotted in smooth, clear graphs. Hewlett-Packard's Model 7200 Graphic Plotter will add a new visual dimension to any terminal in the business. Now, even if you're partial to IBM's 2741, you can have instant graphic solutions to every type of engineering or mathematical problem.

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You can arrange to add a graphic plotter to your existing time-share terminal by contacting Hewlett-Packard. Buy it at $3,300. Rent it. Lease it. Or lease to buy.

We can match a 7200 with any EIA ASCII terminal in the business . . . or even IBM's 2741..So now, everybody can be the arty type. For details, contact Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.

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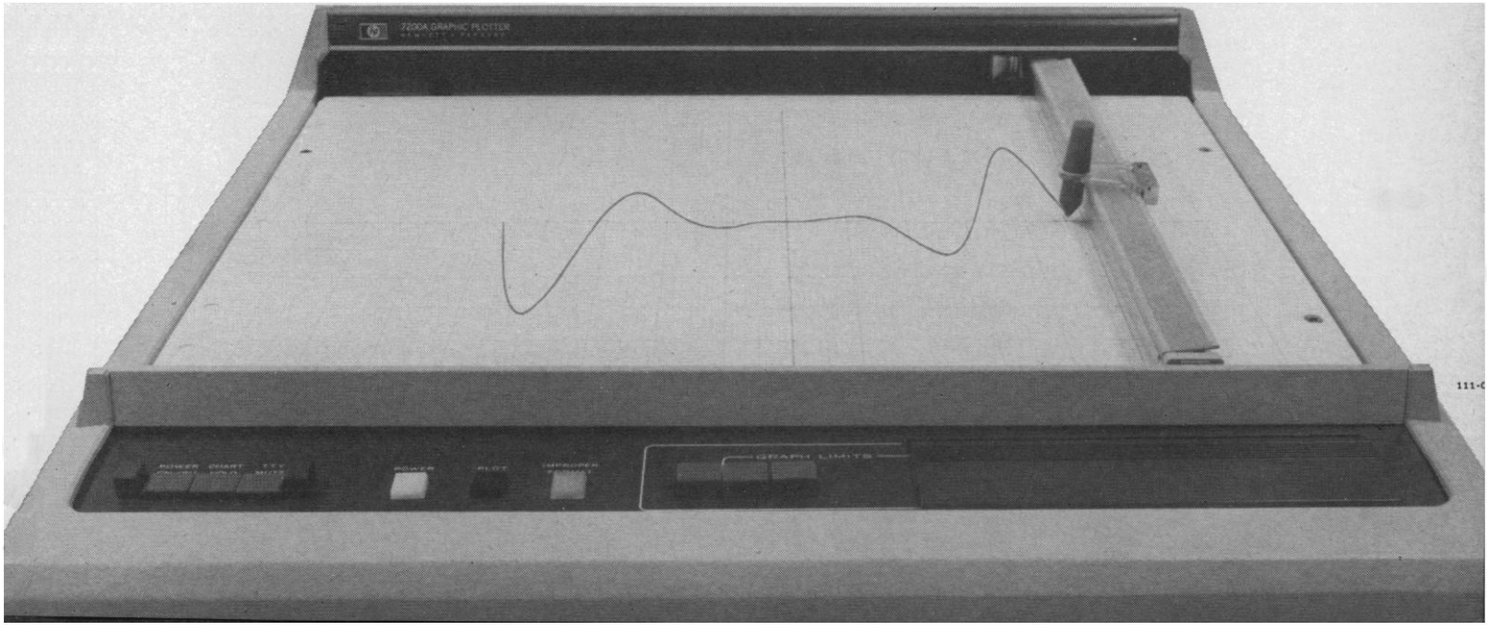
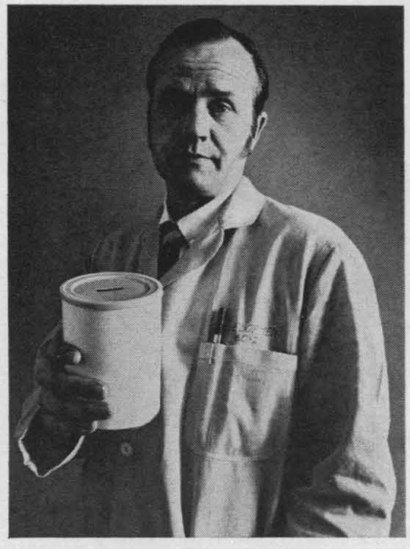


# The new Cary 61. The CD spectropolarimeter that lets you save the money you probably don't have.



We've come up with a way to let you make the most of a tight budget without compromising quality. The new Cary 61 is an all solid-state, high performance CD-only instrument that costs less than $30,000 and can handle any research or routine CD spectropolarimeter problem.

**THE BASIC 61**

Practical design considerations make the new Cary 61 one of the easiest-to-operate instruments of its kind. Simplified controls allow rapid adaption of operating parameters to sample needs and permit savings in instrument set-up time. Built-in features include: dynode voltage recording for deriving the sample's absorption properties; provision for interfacing computer readout and control; and a specially designed, very spacious sample compartment which accommodates a super-conducting magnet for MCD studies, or other sample handling equipment.

The performance-proven double monochromator and special optical design features of the Cary 61: minimize stray light, reduce the occurrence of artifacts, allow penetration into the ultraviolet with complete confidence, and sharply define small spectral details over its entire 185-800 nm range.

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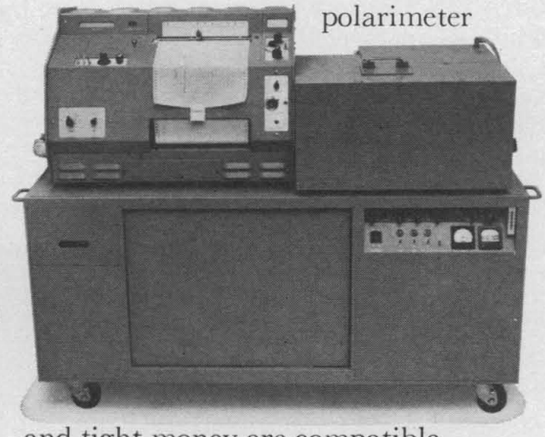
**MORE CD FOR LESS**

Simply add our unique "folded beam" optical accessory and you're set to perform CD difference measurements with extremely high sensitivity. All the while keeping additional expenses to a minimum.

The new Cary 61. Working proof that a good, versatile CD spectropolarimeter

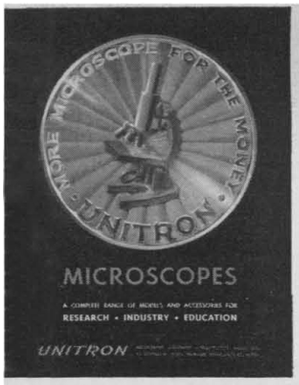


and tight money are compatible.

For complete details or a demonstration, write Cary Instruments, a Varian subsidiary, 2724 South Peck Road, Monrovia, California 91016.

**Ask for data file E007-110.**

cary instruments




# FREE MICROSCOPE BUYING GUIDE

Shown here in miniature are just some of the informative brochures which comprise the UNITRON Catalog . . . your buying guide to quality microscopes at prices within your budget. Whether your application is routine laboratory analysis, advanced biological research, or industrial quality control, you will find the instrument you need in UNITRON's complete line.

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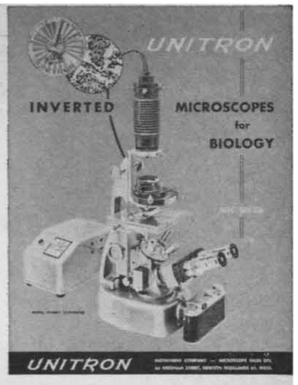





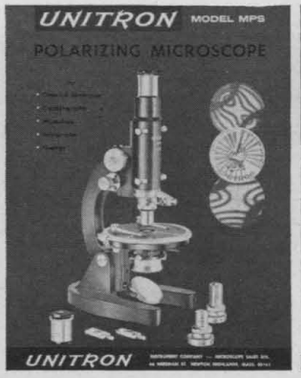



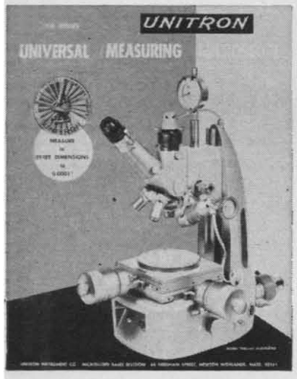


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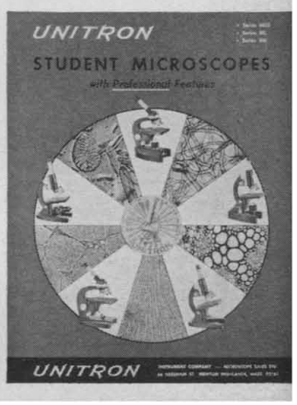
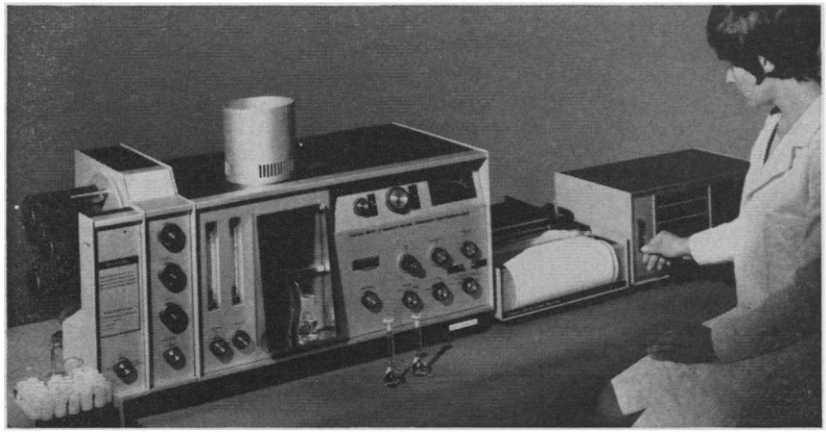


# Tame the elements. Mine the metals.



## Unicam SP90 Series 2 Atomic Absorption Spectrophotometer

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Wide choice of flame and burner systems

High accuracy and precision

Digital readout and printout option

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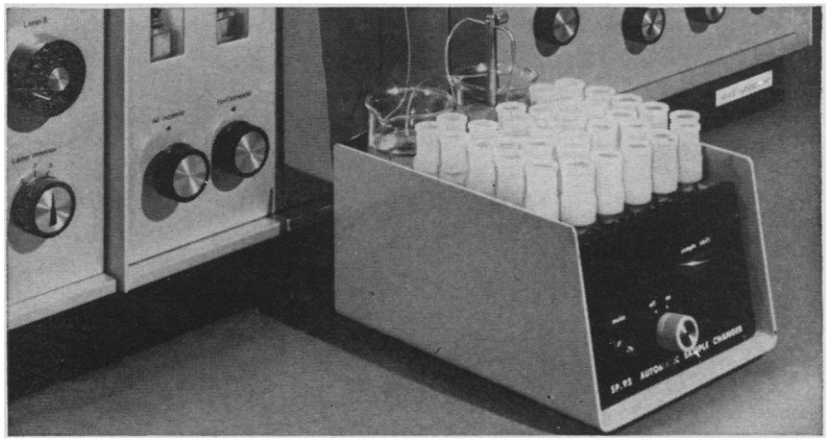
Built-in continuous scale expansion

Complete range of analytical methods



## Unicam SP92 Automatic Sample Changer

Useable with any Atomic Absorption instrument

Provides a trigger signal to operate the typical digital printer associated with AA instruments

Analyzes up to 32 samples in 20 minutes

Alternate sample times available

Between samples reference solution is aspirated from a reservoir


## Model 4 Blood Serum Spectrophotometer

Simultaneous Sodium, Potassium, Calcium and Magnesium analysis

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This sleek, sophisticated new instrument is a phenomenal value. It's the Brinkmann/Metrohm pH-102... the first—and only—digital pH meter in its price range that offers 0.001 pH/0.1 mV sensitivity throughout the full span of 0 to 14 pH and −1.399 to + 1.399 mV.

The price is just $850, complete... and we mean complete—because the price includes shock-resistant combination electrode and stainless steel rod with mounting hardware, buffer solution and KCl.

At $650, model pH-101, delivers the same outstanding features with 0.01 pH and 1.0 mV sensitivity. The luxury look and luxury features are standard equipment in both models:

- Stable, all solid-state circuitry with built-in BCD and recorder output.
- Large, easy-to-use controls for temperature compensation, function, range and slope integration.
- All-digital readout.
- Automatic temperature control

For high precision pH metering, these features, and more, make the Brinkmann/Metrohm pH-101 and pH-102 unique in their field.

For all the facts, please write: Brinkmann Instruments, Cantiague Road, Westbury, N.Y. 11590.

In Canada: 50 Galaxy Boulevard, Rexdale (Toronto), Ontario.

BRINKMANN

# pHantastic

# The best way to measure pH?


# It all depends on how you look at it.

**Perhaps you place portability first in a pH meter.** Look no further than our Model PBL, with its rugged case, taut-band meter, solid-state circuitry. Reads accurately to ±0.1 pH. Battery-operated, of course. Or plug it into an AC power source. Recorder output, Karl Fischer titration, and much more. A lot more than you'd expect in a portable meter priced at $230.

**Maybe you'd like portability plus an expanded scale.** Then you'd like the PBX. Full-scale expansion of as little as 0.7 pH. Accuracy, ±0.005 pH. Ready, too, for measurement of e.m.f. and activities of mono- or divalent ions. Ideal for determining specific-ion pollutants in streams and waterways. Battery-operated or AC-powered. Full-range adaptability. The PBX. The price — $375.

**Are accuracy, sensitivity, and a large scale important to you?** Consider our Model LS — the "laboratory standard." Accurate to ±0.05 pH (with a repeatability of ±0.01 pH). Ultra-stable solid-state circuitry. Big, easy-to-read scale at just the right angle. With buffer adjust, Karl Fischer polarizing output, manual or optional automatic temperature compensation, recorder output. The LS, priced at $355.

**You might be looking for accuracy and sensitivity and a large, expanded scale.** Our Model LSX fills the bill. Accurate to ±0.005 pH in full-scale expansion of 0.7 pH unit. Which you read on a 7½-inch scale. High-precision measurements of pH, e.m.f., and mono- or divalent ion activities. Maximum sensitivity and stability. High input impedance. A variety of built-in input/output adapters. The name: LSX. The price: $425.

**Won't settle for anything less than direct, digital display?** You and our Model DR should find each other. It has a digital counter (plus a graduated scale) for continuous measurements to 0.001 pH. Accurate to ±0.01 pH. Accommodates all electrodes. Lets you use manual or automatic temperature compensation. Solid-state circuitry to keep things trouble-free. The price? $600.

**Or true-electronic, digital, direct reading may be your idea of perfection.** Realized in our Model NX. Big, bright, luminescent numerals. No more parallax errors or interpolations. Readable to four significant figures (the decimal point is always in the right place, automatically). Responds instantly to rapidly changing inputs. With long-life display tubes, plug-in circuit boards, and a price of $595.

Look over the many faces of pH measurement with the help of your Sargent-Welch representative. Then arrange for a demonstration. Or write to us for details on any of our pH meters. 0-217

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## The Polaroid MP-3 Multipurpose Land Camera

Our MP-3 camera system turns out work it normally takes a whole slew of special cameras to do.

1. It can copy beautifully in black-and-white or color.
2. It can do photomicrography.
3. And close-ups.
4. And macrophotography.
5. It can make slides.
6. And copy them in print form.
7. It can copy X-rays.
8. And make ultra-high-contrast line copy prints to size.
9. It's a process camera. You can make screened prints to size, too.
10. It's a studio camera. Turn the whole camera sideways and aim it at people or things.

You don't need a darkroom. (Goodbye chemicals, mixing, washing and all that.)

You can knock off jobs at dizzying speeds—some as fast as 15 seconds. Others take an agonizing two minutes.

And—not least—you can also save money.

The MP-3 is easy to operate and allows you a wide range of films and accessories (lenses, camera backs, etc.). It will handle all 13 Polaroid Land films and most wet process films.

A basic system costs as little as $684. Naturally, the more you add, the more it costs. If you want everything, it can go as high as $1647.

Which is still a bargain compared to 10 cameras, a studio and a darkroom.

For our new brochure on applications or a demonstration, write to Polaroid Corp., Dept. 26-179, Cambridge, Mass. 02139.

**Announcing a scanning electron microscope that puts scanning capability within reach of every laboratory. JSM-S1 from Jeolco.** ☐ Jeolco's new S1 scanning electron microscope. Which puts quality, high-volume scanning capability in only 3 x 4 feet of laboratory floor space. ☐ Our unique way of getting right down to the surface of specimens. ☐ At a price you can afford. With TV scan to help you quickly find the area you're looking for. Continuous magnification from 19 to 100,000X with direct display readout in 8 fixed steps. ☐ And guaranteed resolution of 250 angstroms. ☐ With a unique goniometer stage tilting −5 to +45°, 360° continuous rotation. Air locks. 4 x 5" Polaroid camera. And a fully automatic vacuum system. ☐ With color-coded controls that work like people do. So the JSM-S1 is far simpler to learn and operate. ☐ With completely solid-state modular design that provides high reliability and low maintenance. With a solid-state high-voltage power supply built right into the column. ☐ Which all helps make the Jeolco S1 compact. And simple. ☐ Give it a little room in your lab. ☐ Never will so many owe so much to so little. ☐ For details, please write Jeolco (U.S.A.) Inc., 477 Riverside Avenue, Medford, Massachusetts 02155, Telephone (617) 396-6021.

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# Putting the 70's into focus.

*SERIES 3370A GC INTEGRATOR*

# A ready-made link from gas chromatographs to time-share computers

Time-shared computers can do a lot for the chromatographer—at lower and lower cost—by relieving him from a growing burden of computation. Until now, few laboratories have taken advantage of time-sharing services for GC applications because of the difficulty of programming the computer. □ The HP 3370A GC Integrator is now available with a new hardware-plus-software option that literally eliminates this problem. When equipped with this option, the 3370A produces a punched paper tape record of integrated peak areas and retention times in computer-compatible format. This option also includes a BASIC software package that programs the principal time-shared computers for automatic reduction of the GC data. Thus any chromatographer, even one with no computer know-how, can use the 3370A with its new option to link any gas chromatograph to a time-sharing computer. The end result is the easiest, fastest and most accurate qualitative and quantitative analysis report ever enjoyed by a chromatographer . . . automatically produced by a remote computer that brings powerful computing capability to the laboratory on a strictly pay-as-you-use-it basis. □ The hardware for this new 3370A option consists of a code converter board that directly replaces the BCD output board of a standard instrument and a ASR-33 Teleprinter. Price for the complete package, including the Model 3370A Integrator and BASIC software is $5,850. Details in Bulletin 18988. Hewlett-Packard, Route 41, Avondale, Pa. 19311. In Europe: 1217 Meyrin-Geneva, Switzerland.

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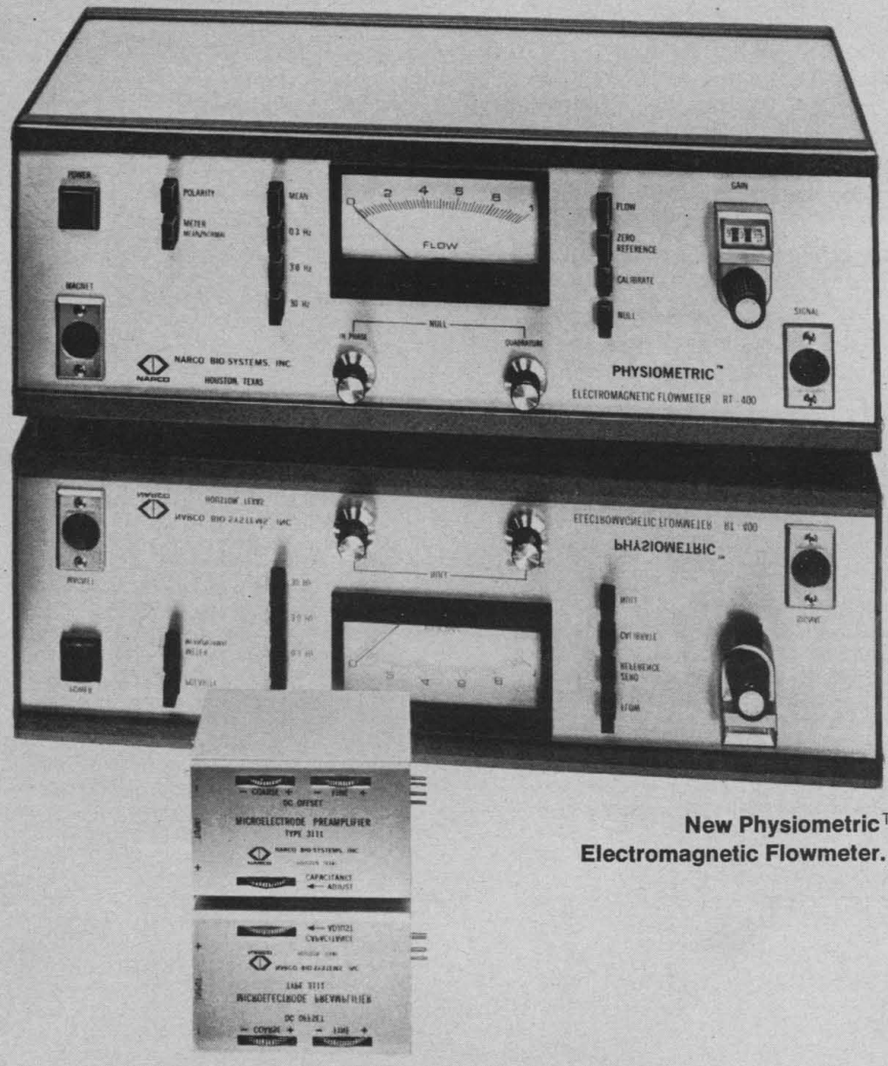
ANALYTICAL INSTRUMENTS

43003

# Applied research:


New Solid-State Channel Amplifier and Couplers,




New Physiometric™ Electromagnetic Flowmeter.




New Microelectrode Preamplifier,

We've applied our research to solve some of the problems in your Applied Research.

And we've come up with some very unique solutions.

For example, we've designed a new solid-state Channel Amplifier and Couplers that'll give you a lot more information. Yet they're just as rugged, reliable and simple to operate as our original ones. They're also compatible with any recorder we've ever built.

So for a little more money, you can have a lot more Physiograph®.

We've come up with some new Microelectrode research components, too. They offer specs that equal or exceed those of equipment costing twice as much.

And, as you might expect, we're offering a complete Microelectrode research system.

What you might not expect is our completely new Physiometric™ Electromagnetic Flowmeter.

It'll give you instant, exact measurements of the flow rate of blood, or any ionic solution, without penetration or occlusion of the vessel through the use of flow transducers and a non-occlusive electronic zero flow reference.

When we changed our name from E & M Instrument Company to Narco Bio-Systems, a lot of people wondered what we were going to do next.

Now you know.

We're applying our research to your problems in Applied Research.

### New Physiometric™ Electromagnetic Flowmeter

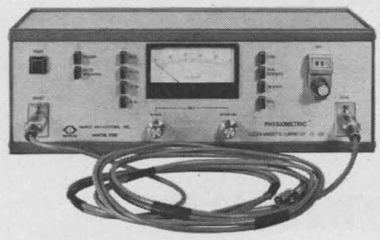
The Physiometric Electromagnetic Flowmeter provides blood flow metering of surgically exposed but intact vessels in vivo, and in in-vitro procedures used with extracorporeal or by-pass devices.

The non-occlusive "electronic zero" feature permits instant checking of zero flow baseline reference without mechanical occlusion of the blood vessel, dialysis tubing, or other fluid conduit.

Input: Differential, with Common Mode Rejection ratio of 100,000:1 (100 db). Input impedance greater than 10 megohms.

Outputs: Single-ended, with pulsatile mean outputs. Output impedance less than 100 ohms.

Flow amplifier gain control: Precision ten turn potentiometer with direct reading dial.



Electronic zero base line accuracy: ± 2% full scale.

Linearity: ± 1% full scale.

Calibration accuracy: ± 2% full scale.

Design: Advanced solid state logic circuitry.

Power dissipation: Less than 16 watts.

Approximate dimensions: 5½" high, 15½" wide, 6½" wide.

Weight: 10.5 lbs. 4.8 Kg.

### New Microelectrode Preamplifier

The Microelectrode Preamplifier is a compact, fixed gain differential dc preamplifier for the quantitative measurement and recording of intra and extracellular biopotentials

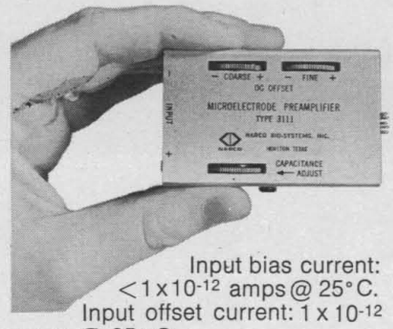
Adjustable controls provide dc offset potential at the input terminals and adjustable negative capacity at the positive input terminal to cancel transducer and/or cable capacitance.

It is designed as a wide band, high performance preamplifier for use with a variety of microelectrodes and high impedance transducers.

Input: Differential.

Gain: x 10 ± 2%.

Input impedance: 1 x $10^{11}$ ohms, differential or single ended.




Input bias current: $<1 \times 10^{-12}$ amps @ 25° C.

Input offset current: $1 \times 10^{-12}$ amps @ 25° C.

Input common mode range: ± 5 volts.

Input common mode rejection: 80 db, @ ± 5 volts and 60 Hz.

Input path to ground: Direct path required.

Drift: 25μ volts/C° typical with 10 megohm source. 50μ volts/C° Maximum. 10μ volts/hour typical.

Differential input range: ± 1.0 volts.

Input offset voltage: Adjustable through zero with fine and course controls, variable to ± 1 volt.

Capacity neutralization: Adjustable to −100 pF, positive (+) input only.

Output impedance: 10 ohms maximum.

Minimum output load resistance: 1k ohms.

Output short circuit duration: Continuous.

Frequency response: Flat, dc to 10k Hz (with capacitance compensation).

Broad band noise figure: 3 db, with 10 megohm source, 10 Hz to 10k Hz.

Power requirements: + 15 volts dc, 40 mA. — 15 volts dc, 15 mA.

Size: 1.8" x 1.4" x 2.8" (4.6 x 3.6 x 7.1 cm).

Weight: 4 oz. (120 grams).

### New Solid-State Channel Amplifier and Coupler

The Solid-State Channel Amplifier is available with a wide range of Transducer Couplers and is compatible with all Physiographs.

Six Couplers are available:

Transducer Coupler: For operation of Narco Bio-Systems' transducers, specialized preamplifiers and accessory units.

GSR Coupler: For use in recording Galvanic Skin Response.

Electrosphygmograph Coupler: For use in recording indirect systolic and diastolic blood pressure in humans or animals.

Strain Gage Coupler: For use with all resistive bridge transducers with resistance of 100 to 10k ohms.

DC-AC Coupler: For use in directly recording cardiac and other high-level biopotentials and signals from instruments such as pH meters, rate meters, blood flow transducers, oxygen analyzers, and temperature meters.

Hi-Gain Coupler: For recording all ranges of bioelectric potentials.

Several more are on the way.

**Narco Bio-Systems, Inc.**

Physiograph Life Science Instrumentation

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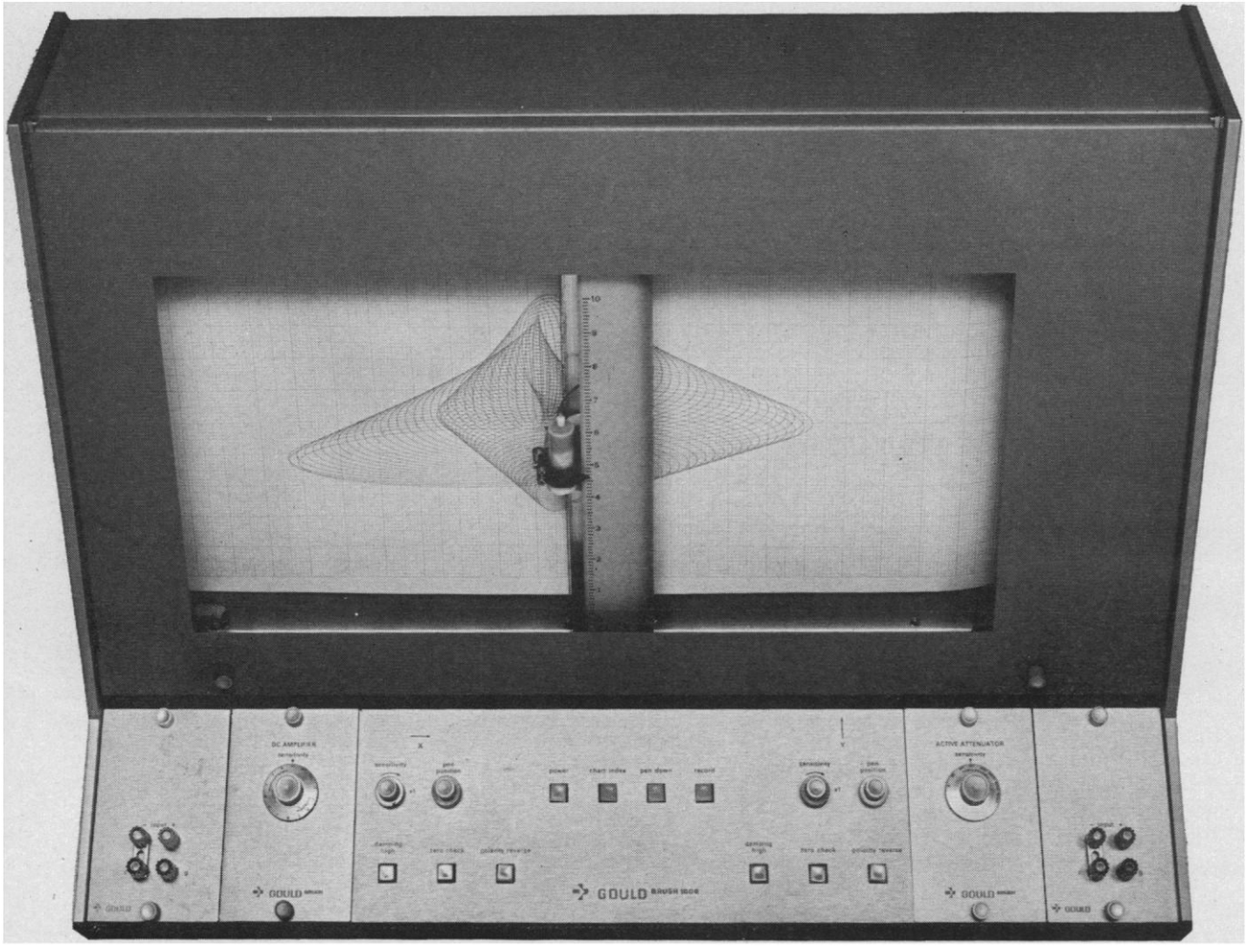
# Brush announces a new X-Y plotter. It's everything you've done without.



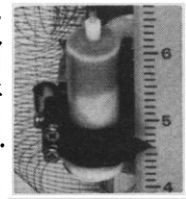
The new Brush 1000 X-Y plotter is all the things that other plotters aren't.

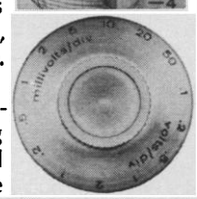
Let's start with the trace.

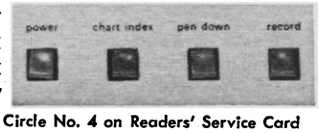
It's sharp and crisp and uniform. There's no jitter, no skips, no puddles, no smears. All because our patented pressurized ink-writing system forces ink into the paper. And pulls it back from the pen point the instant the pen is lifted.

Another thing: we've put the ink supply in a disposable cartridge. It's good for 41 miles of trace. And then, in seconds, you can pop in a new one. It's fussless, mussless.

Our new plotter is very fast, too. High-torque servo-motors produce writing speeds up to 100 inches per second while acceleration is 1750 in/sec$^2$ in the X direction, 2750 in the Y. Our non-contact servo-loop feedback system controls pen movement continuously. It enforces linearity of 99¾%, eliminates slewing, and assures repeatability at any speed. It also gets rid of slide wires, electrical noise and all the pot problems of potentiometric-type feedback systems.








About signal conditioning. Interchangeable pre-amps plug right into the front panel. So that particular problem is no problem at all.

Paper's no problem, either. The built-in supply roll carries 100 feet of it. And you advance a fresh 10" x 15" area by simply pushing a button.

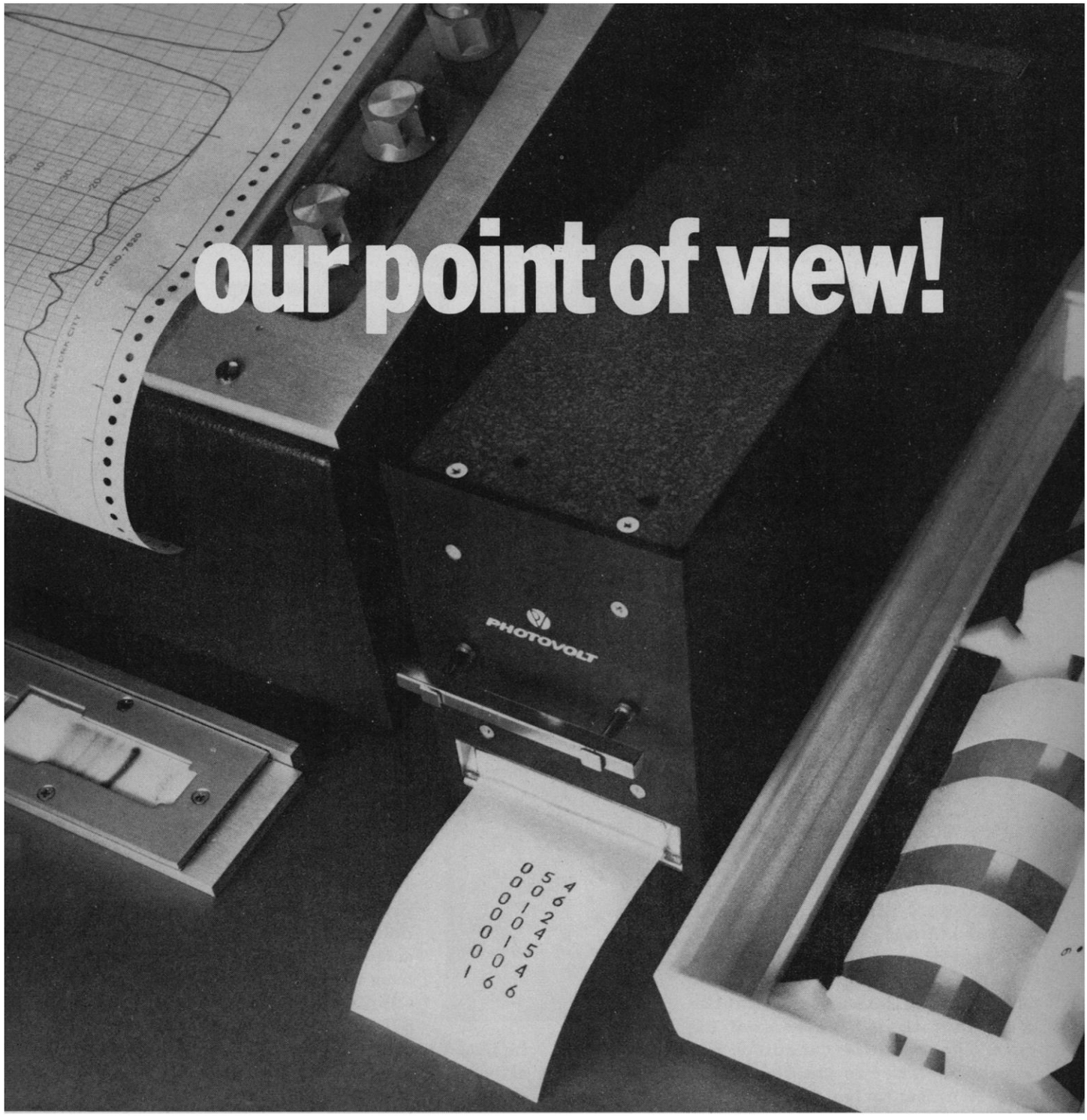
Velvet-smooth. Quiet. Quick. Neat. And accurate. The new Brush 1000 X-Y plotter is all these things. And more.

Get the whole picture. Talk to your Brush representative. Or write: Brush Division, Gould Inc., 3631 Perkins Avenue, Cleveland, Ohio 44114.

GOULD BRUSH



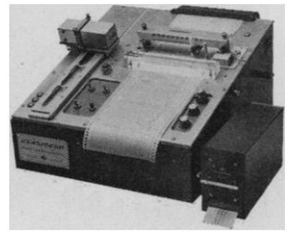
Circle No. 4 on Readers' Service Card




## Now with digital printout we've taken all the fuss out of Electrophoresis.

The readout from Photovolt's NEW DENSICORD provides a permanent patient record which includes...his individual strip...recorder trace... and printout.

The printout is fully automatic, no guessing of fraction separations or tedious counting of integration marks.



Strip preparation with the Photovolt system eliminates...floppy strips...pipetting...variable applications...chemical preparations.

The Photovolt system provides everything you need for routine serum protein electrophoresis.

Now no more fuss or doubt.

**PHOTOVOLT CORPORATION** *1115 Broadway, New York, N.Y 10010 · (212) 989-2900*

Circle No. 24 on Readers' Service Card

Our black box functions as the control unit of the Nikon AFM Auto-Microflex, part of the most advanced photomicrographic system in the field. Together with the AFM microscope attachment, it comprises a sophisticated instrument that produces high quality photomicrographs simply, surely and automatically. And it attaches to any standard microscope.

The control unit translates the information received from the CdS light sensor in the microscope attachment into required exposure and shutter times. No need for making light measurements or exposure and timing calculations, anymore. Just program the black box for the ASA rating of the film you're using and the Nikon AFM Auto-Microflex takes over from there.

The result: perfect photomicrographs every time. For complete details, write for our 10 page color catalog.

Nikon, Inc., Instrument Division, Subs. Ehrenreich Photo-Optical Industries, Inc., Garden City, N.Y. 11530 (In Canada: Anglophoto, Ltd. Ont.)

**Nikon AFM Auto-Microflex**

# Nikon's black box.

## It's a solid state, analog computer that guarantees perfect photomicrographs every time.


Circle No. 5 on Readers' Service Card

Now there's a 19" long x 10½" wide plastic cage that allows an adult rat to assume a normal standing position. A cage that meets all published standards for breeding or housing rats, hamsters and guinea pigs. Even a female guinea pig with a litter.

It's the new Series 140 permanent plastic Econo-Cage. A full 8-inches high, the Series 140 is 2-inches taller than any previously available cage with the same area.

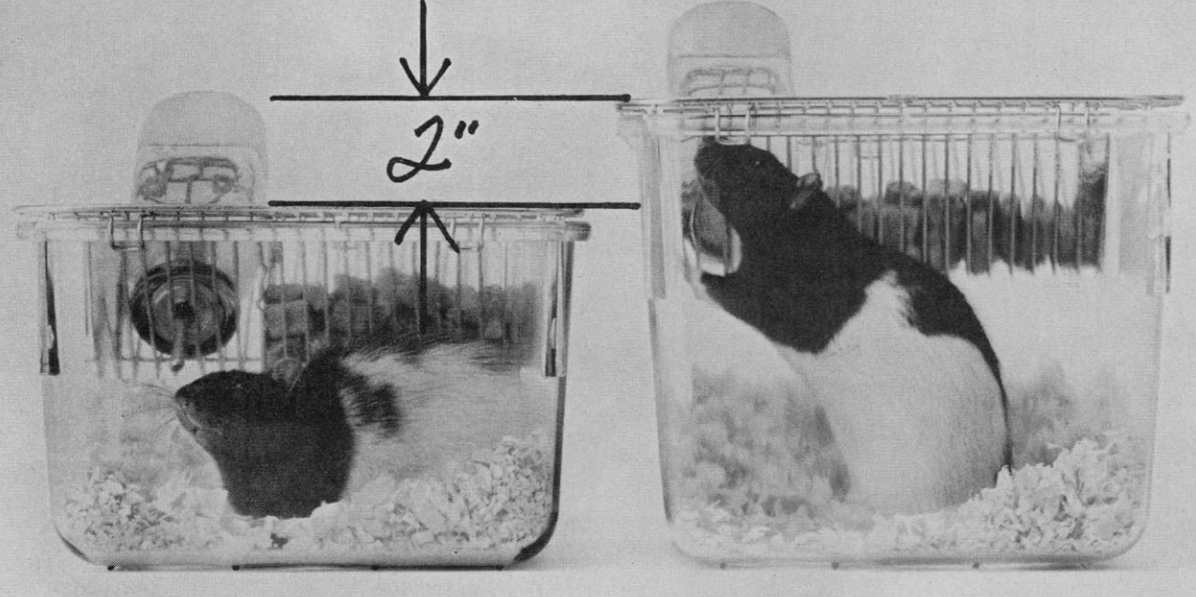
Like all permanent plastic Econo-Cages, Series 140 cages are available in materials to match your animal housing system requirements. Polycarbonate cages are the ultimate. They can be autoclaved, withstanding the complete sterilization cycle up to 290°F. Polypropylene cages resist temperatures to 250°F and can be autoclaved. Polystyrene cages are rated at 170°F which covers most wash cycles.

Special stacking lugs provide convenient nesting and assure free flow of air for drying. The integral lip around the perimeter of the cage increases structural rigidity and facilitates use with hanging as well as stacking systems. Econo-Cage walls are 20% thicker than competitive cages; this means added strength and greater durability in actual laboratory use. These cages are compatible with most disinfectants, cleaning agents and animal wastes and are highly resistant to most toxic chemicals. Either stainless steel, or zinc-plated rust-resistant lids are available.

Series 140 cages are only part of the permanent plastic Econo-Cage line. They all meet NIH, AALAS, and Public Law 89-544 standards and specifications.

For a complete catalog of cages and accessories contact your Econo-Cage Distributor, or write Scientific Division, Maryland Plastics, Inc.
9 East 37th Street, New York, N. Y. 10016. MP

# Introducing the extra two inches that give a rat room to stand up and breed.




EC-P-2

Circle No. 8 on Readers' Service Card

This photo of Taiwan, taken from a NASA Gemini spacecraft, could double that nation's fishing yield.

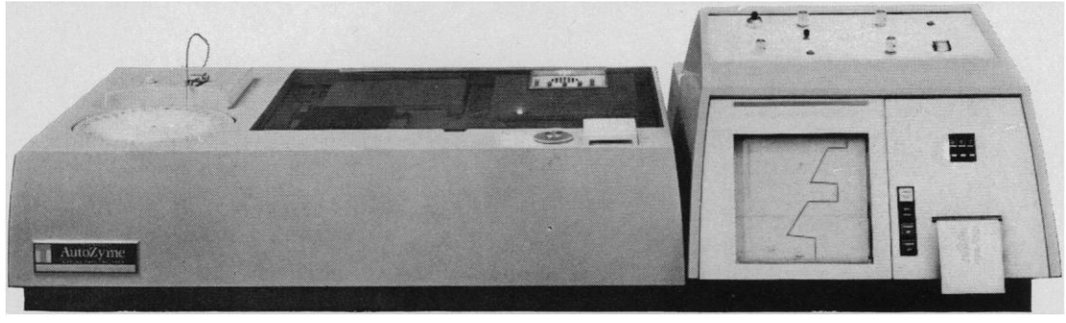
The deep blue water along the upper west coast, an upwelling that raises nutrients from the ocean floor, is an ancestral fishing ground. The similar upwelling on the east coast, discovered by this photo, may prove to be as rich in fish as the traditional grounds.

Orbiting satellites could locate new fishing grounds around the world and help manage and conserve all our ocean resources. It's one of the ways our existing space technologies could benefit all mankind.

Think about the possibilities.

**The Boeing Company.**

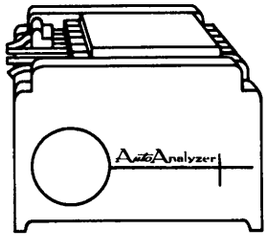
# Zero to Sixty in Ten Seconds...



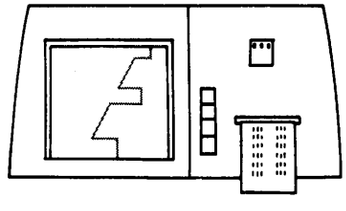

# AutoZyme.™

You won't set any speed records at that rate. But we're not trying to. "Zero to 60 in 10 seconds" is our way of describing the new AutoZyme Enzyme Rate Analyzer from Technicon.

AutoZyme combines the reliability of continuous flow analysis with classical rate reaction techniques to perform automated enzyme analysis in a way never before possible.

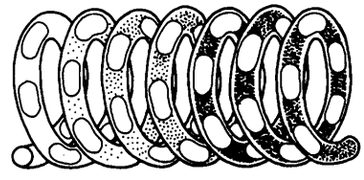



The heart of the AutoZyme Enzyme Rate Analyzer is a 2-speed peristaltic pump which makes it possible to establish a time differential during the incubation cycle, from which a slope is generated on a recorder to measure enzyme rate reaction.

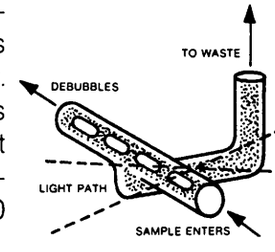


This unique operation is accomplished in the following manner: In continuous flow analysis, each sample flows continuously through the system. It is possible, therefore, to adjust the dwell time of a sample segment during the incubation cycle by changing the speed of the pump so that every point along the sample stream spends more or less time in the incubation bath. (In AutoZyme, the pump is changed to a higher speed in order to decrease the dwell time.)

It is this capability that makes AutoZyme unique. For example: If a sample requires 60 seconds incubation time, it is possible for the beginning of the sample stream to spend a full 60 seconds in the incubation bath, while by changing pump speed the remaining portion of the stream spends increasingly less time in the bath until "0" time is achieved.



Following completion of the incubation bath cycle, the entire sample passes through the colorimeter, where optical density is continuously measured. The slope representing enzyme rate is traced on the recorder. Since the sample flows through the colorimeter at the faster rate, measurement is completed in 10 seconds.




In the 4-channel AutoZyme system, an analog signal from the colorimeter is automatically analyzed to determine the correct slope of the recorder tracing and the enzyme concentration is printed out in International Units.

AutoZyme has unlimited applications. Alone, or as a complement to an SMA®system, it assures the laboratory of consistent results with virtually error-free operation.

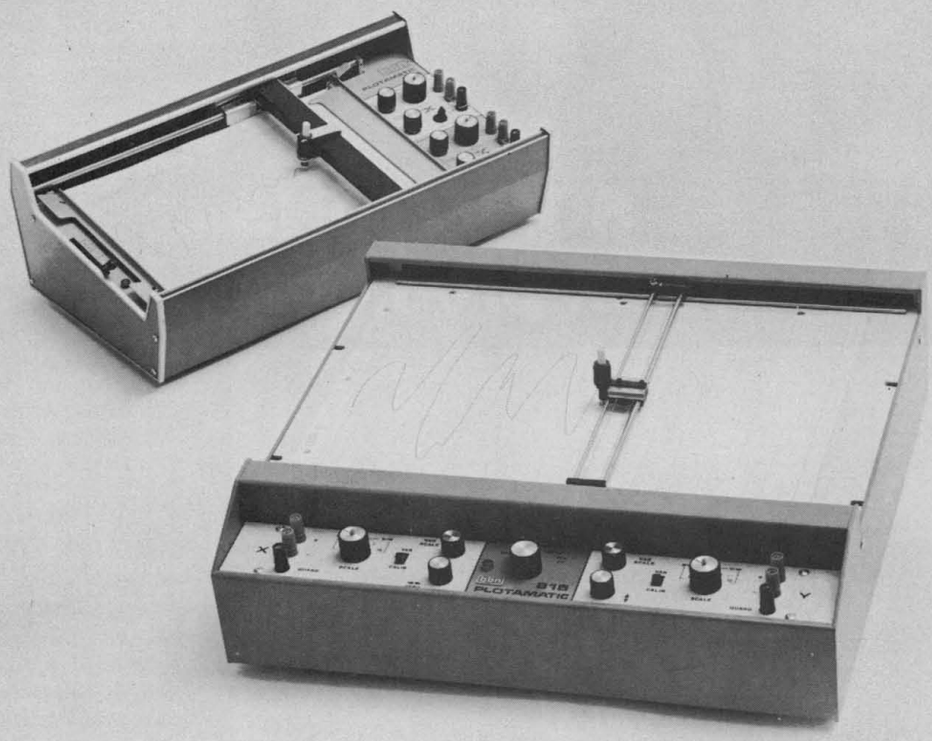
AutoZyme is available for either single-channel or 4-channel operation.

For more information, write to Department 115,

**Technicon Instruments Corporation,**
Tarrytown, New York 10591.

Circle No. 13 on Readers' Service Card

# Top performance. Low cost. Two X-Y sizes.




# (No one else can hand you that line.)

**The BBN/DE PLOTAMATIC 700 series (8½″ x 11″) is priced from $750. The 800 series (11″ x 17″) starts at $850.**

Until now all high-quality X-Y recorders meant a high price. And every low-cost one meant low performance.

If you wanted good performance with an economical price tag, you were just out of luck.

To fill this long-existing gap in the market, we've created our 700 series and 800 series PLOTAMATIC recorders. You might say they're the best of both worlds. High-quality performance at an economy-minded price.

Some of their features usually found only with the higher-priced units (and sometimes not even found there) include: I/C electronic design that eliminates photo and mechanical choppers. No servo compensation or loop gain adjustments. Signal inputs that are differential, guarded, and shielded. Electronic overdrive protection to extend recorder life. Sealed follow-up potentiometers that are buffered for noise immunity. And disposable fiber-tip cartridge pens.

The PAD/LOAD® paper handling system on the series 700 is a BBN/DE exclusive. It actually operates three times faster than conventional single-sheet recorders. Load a 50-sheet pad of paper into the recorder and as each page is consumed, simply tear it off exposing a new sheet. No rezeroing of the pen between plots is required. As another user convenience, the disposable cartridge-pen system eliminates ink handling and pen cleaning. Color changes are made in seconds by a simple replacement.

Designed into the low-cost 700 and 800 series recorders are those engineering features which have proven popular with BBN users for years: zero check push buttons, constant 1 megohm input impedance (fixed or variable scale), modular construction, and a one-year warranty.

In addition, something new has been added for use with the 700 and 800 series. It's the Model 7T Plug-In Time Base Generator. Available for $180, it produces seven calibrated sweep speeds from .5 to 50 seconds/inch. It can be plugged into either the X or Y axis.

We'd be glad to send you full specification data. Write today for a **free** brochure and a personal evaluation test in your own facility.

**BOLT BERANEK AND NEWMAN INC.,**
Data Equipment Division 1762 McGaw Avenue Santa Ana, California 92705 Tel. (714) 546-5300

**Circle No. 21 on Readers' Service Card**

# SOLUTIONS
# to your solution problems


**Problem:**
Rapid determination of molecular weights, or thermodynamic states of synthetic and natural macromolecular substances.

**Solution:**
HELLFRITZ OSMOMETER, one or two chamber types, in glass or metal. 5 to 7 ml required for measurement, which takes only 1½ to 4 hours depending on membrane used. Also good for measurements at higher temperature (up to 130° C). Bulletin 87.

**Problem:**
How to gain fast, accurate pH readings.

**Solution:**
PAN-pH INDICATOR PAPERS. Panpeha gives one of 25 possible pH readings with one dip. Range in half stop readings from 0.1 to 10. Full stop readings from 10 to 14. 200 strips, complete directions, and master chart circumventing box. For field studies or lab testing. Bulletin 45.

**Problem:**
Extra strength faster filtering paper.

**Solution:**
Exceptional high wet-strength, "tear-proof" folded filters with advantage of larger effective filter area than conventional filters. Numerous densities, sizes 12.5 up to 32 cm. Resistant to corrosive and organic solutions. Bulletin 142.

**Problem:**
To extract fats, corrosive liquids and hot gases.

**Solution:**
For fats, 603 seamless, sturdy, cellulose fiber thimbles. Corrosive liquids and hot gases require glass media 703 thimbles.

For additional information contact your laboratory supply dealer, or Schleicher & Schuell, Inc., Keene, New Hampshire 03431. (603) 352-3810

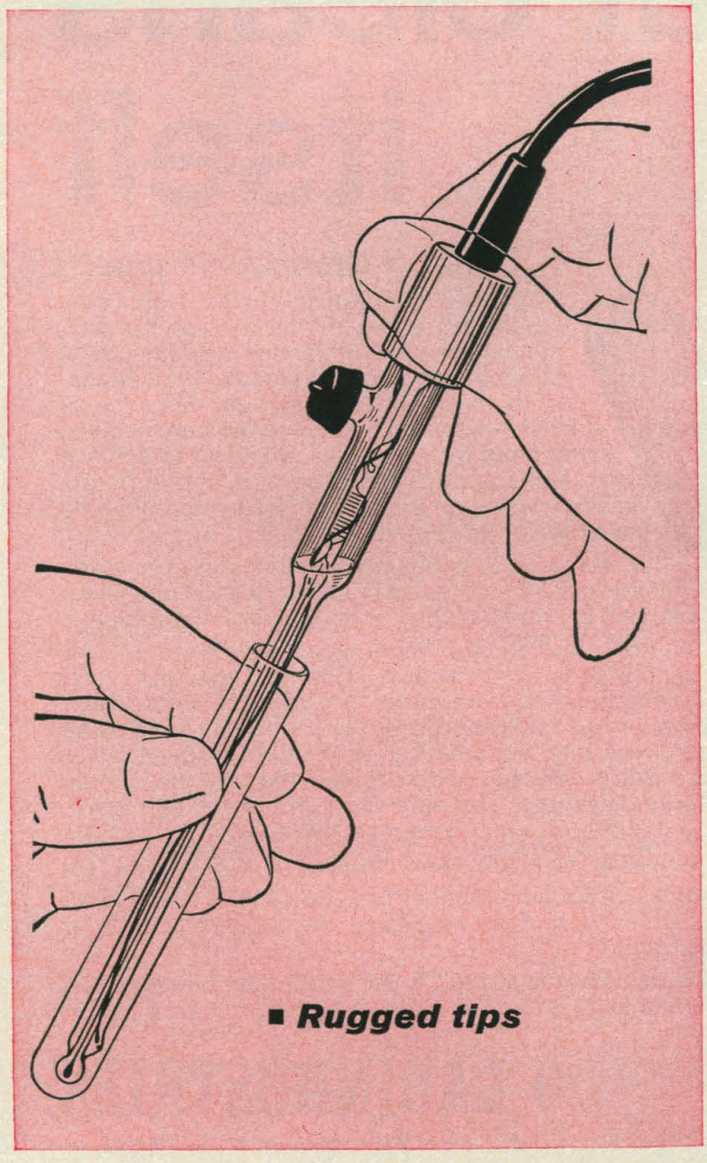
the first name in filtration

**Schleicher & Schuell**

Circle No. 6 on Readers' Service Card

# *Thomas*... COMBINATION pH ELECTRODES

## For samples from 0.2 ml to a tankful




## *FAST... FAST... FAST*

## *with PRECISION*

**COMBINATION ELECTRODES, Thomas.** Consisting of a glass electrode and a silver-silver chloride reference electrode sealed into a single body. Bulb wall thickness and strength provide a sturdier electrode than heretofore available.

The single ¼-inch stem can be used with samples of small volume as well as with larger quantities, and is more convenient for transfer by hand from sample to sample than bringing the sample to electrodes in a fixed position.

The glass electrode inner element is shielded from electrostatic effects and stray electrical fields by the KCl solution of the reference electrode. Port is provided for KCl refill. Liquid junction is made by a sintered oxide plug sealed into the side of the lower stem ⅜-inch above tip.

The stable, fast response of this low resistance glass electrode and the short fixed distance between it and the reference electrode junction make the Thomas Combination Electrode particularly valuable in avoiding endpoint overshooting in electrometric titrations.* The compactness of the design permits use of small vessels and leaves more room for stirrers and buret tips.

Electrodes are each 6 inches long. Upper section is ½-inch diameter for use in standard electrode holders. Stem is ¼-inch diameter over the lower 4-inch length. Can be used with samples as small as 0.2 ml in narrow tubes.

Connector plug of the glass electrode fits into the jacks of most existing pH Meters, either directly or through available adapters.

**4858-L15. Combination Electrode, Thomas,** as above, 6 inches long, range pH 0 to 12, temperature range 0 to 75°C, with 30-inch shielded lead..... **40.00**

**4858-L60. Ditto,** range pH 0 to 14..... **43.00**

*See H. V. Malmstadt and E. H. Piepmeier, *Analytical Chemistry, Vol. 37, No. 1 (January, 1965), p. 34*

***Thomas Laboratory Electrodes, see 1968 catalog pages 468-473, 488.***
***Thomas Industrial Electrodes, information upon request.***

Thomas **ARTHUR H. THOMAS COMPANY**

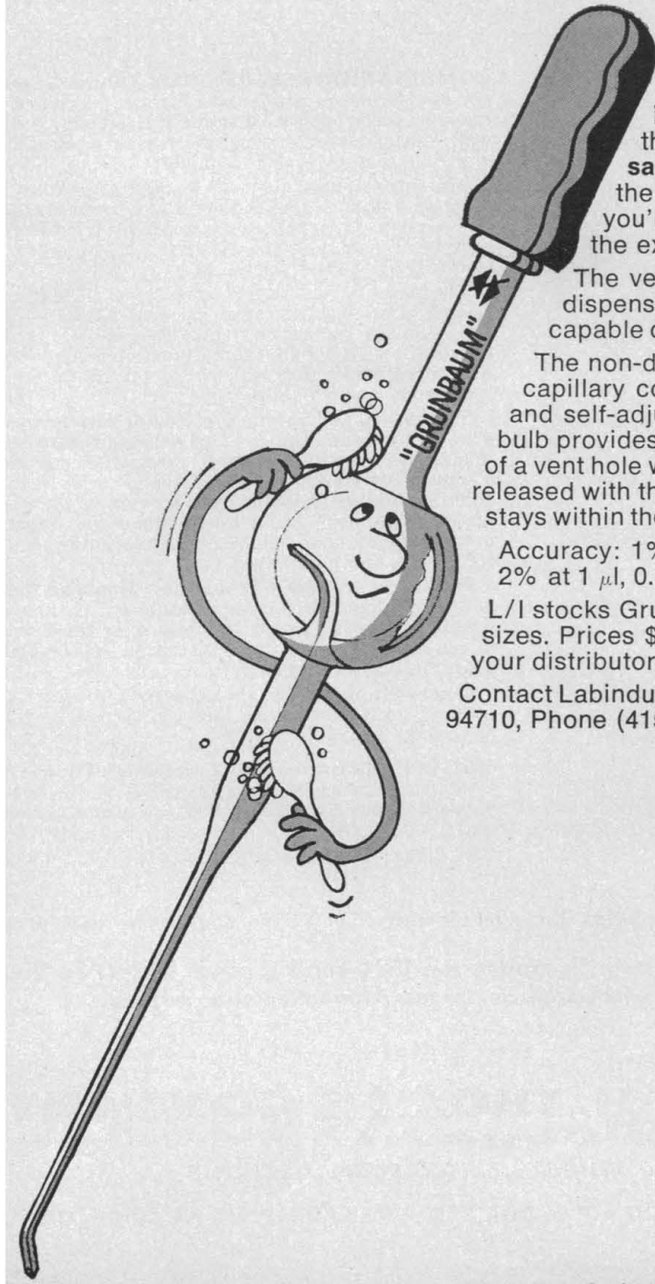
*Scientific Apparatus and Reagents*

**VINE STREET AT 3RD • P.O. BOX 779 • PHILADELPHIA, PA. 19105, U.S.A.**

Circle No. 16 on Readers' Service Card

# The pipet that cleans itself

***(The L/I Grunbaum® pipet!)***




The L/I Grunbaum pipet is the only self-cleaning pipet in the world. It's this simple: sample B washes out sample A. All remaining traces of sample A are deposited in the bulb-like reservoir. Because of this self-cleaning feature, you can use the **same pipet** for sample or unknown to achieve the highest possible accuracy. Furthermore, you'll save on original pipet costs and eliminate the expense for replaceable tips.

The versatile Grunbaum pipet samples, transfers, dispenses, and stores all reagents. It's the only pipet capable of handling ether and highly volatile solvents.

The non-dripping Grunbaum pipet has a fixed volume capillary constricted at both ends for rapid self-filling and self-adjusting from either end. An attached rubber bulb provides sensitive pressure or suction by the closing of a vent hole with the forefinger as the bulb is squeezed or released with thumb and middle finger. 100% of the sample stays within the pipet even when held straight up and down.

Accuracy: 1% at 10 $\mu$l, 0.2% at 500 $\mu$l. Reproducibility: 2% at 1 $\mu$l, 0.1% at 25 $\mu$l and larger.

L/I stocks Grunbaum pipets from 1 to 1000 $\mu$l (1 ml) in 19 sizes. Prices $6 to $10 each. Order from Labindustries or your distributor.

Contact Labindustries at 1802 M Second Street, Berkeley, CA 94710, Phone (415) 843-0220. Cable LABIND.

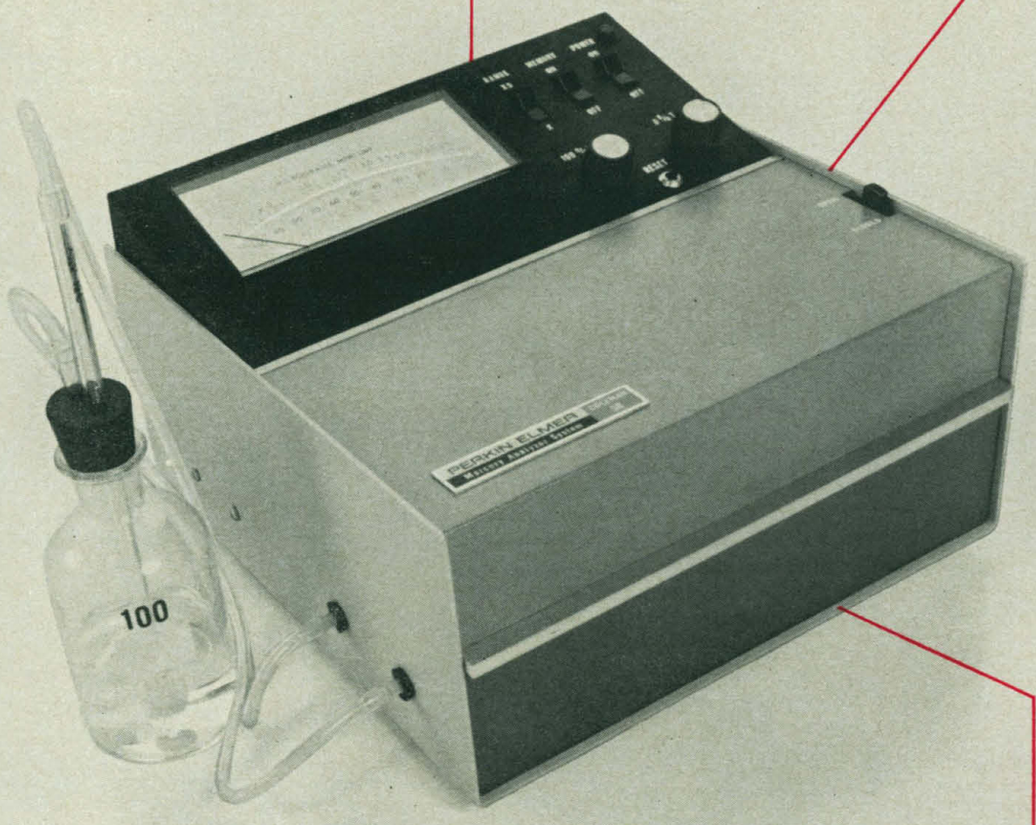
**LABINDUSTRIES**

***The Error Eliminators***



Circle No. 15 on Readers' Service Card

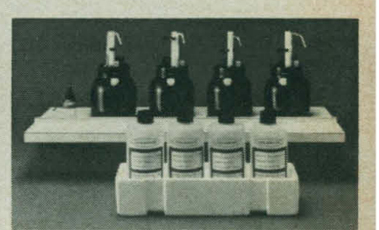
# here is the first complete, self-contained Mercury Analyzer System. Coleman Model MAS-50. $875.




**It can be used in many scientific fields. Pollution: Air, water, food, soil, tissue. Clinical: Urine, blood, tissue. Industrial Control: Food, metal, soil, fertilizer.**

- Sensitivity .01 μg of mercury, equal to or better than A.A.
- Direct reading in μg of mercury.
- Hatch and Ott procedure.

This compact, self-contained, low-cost system makes determination of mercury in solids and solutions, organic or inorganic, or in air an inexpensive routine procedure. Coleman MAS-50 is so easy to operate, no special training is required.



A 5-step reagent and standards kit, capable of 100 determinations, is also available.

**call or write today for free bulletin S-350.**

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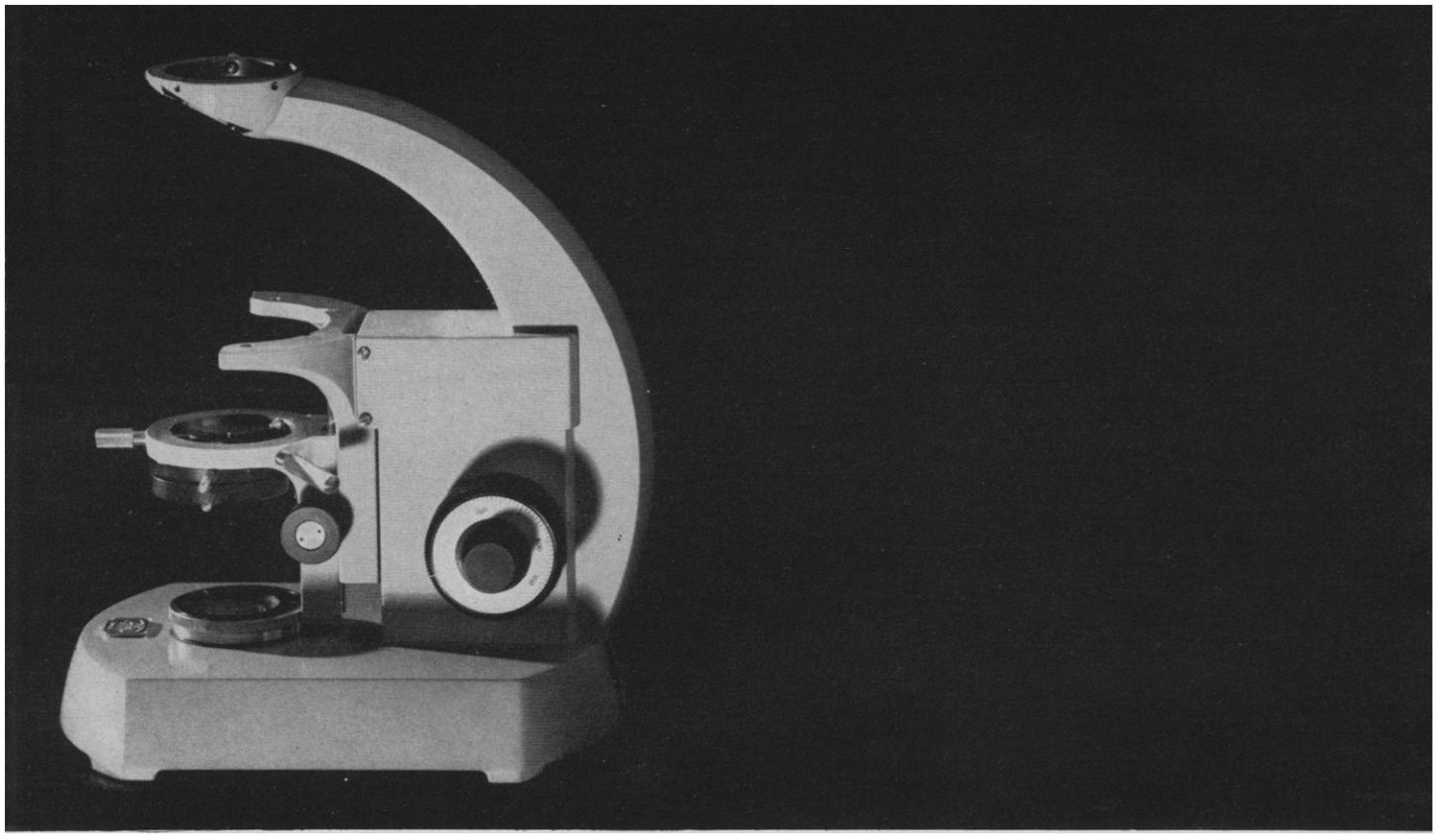

# This stand is where 931,392,000 different ZEISS RA Microscopes begin.

**The RA you need can be made by adding any of:**

**6 Nosepieces** — interchangeable, non-interchangeable, or centrable; quadruple or quintuple.

**2 Magnification Changers**—1.6x or the exclusive OPTOVAR, with factors of 1x, 1.25x, 1.6x, and 2.

**9 Stages**—for any purpose: mechanical, rotating, gliding; with and without graduations; for left hand or right hand.

**5 Body Tubes**—inclined binocular, inclined monocular, combined binocular body and vertical photographic tube with reflecting prism, vertical tube, inclined monocular tube with extension.

**7 Lamps**—for anything you want including polarization, fluorescence and reflected light. The illuminator and the microscope become always an integrated system to eliminate scattered light, stray light, dealigning.

**2 Beam Splitters**—fixed (50% light to each tube) or variable (5 different settings.)

**14 Condensers**—bright field, dark field, phase contrast, fluorescence, fluorescence-phase, Nomarski interference contrast, Jamin-Lebedeff interference microscopy, UV . . . whatever techniques you use.

**50 Objectives** — Planapochromats, Neofluars, Planachromats, Achromats, Epiplans.

**16 Eyepieces**—from 5x to 25x, from 23° to 50°. (Including micrometer eyepieces.)

**11 Other Observation Systems**—2 camera attachments, 4 drawing attachments, 3 viewing screens, 1 television system, 1 projection attachment.

Figure it out for yourself.

For a 28 page catalog giving complete details on these 931,392,000 different RA Microscopes, write Carl Zeiss, Inc., 444 Fifth Ave., New York, N. Y. 10018.

Nationwide service

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# A hare raising tale.

You've been asking for it.

A Charles River COBS® (caesarean-originated, barrier-sustained) rabbit. With the same high quality you find in our other Charles River animals.

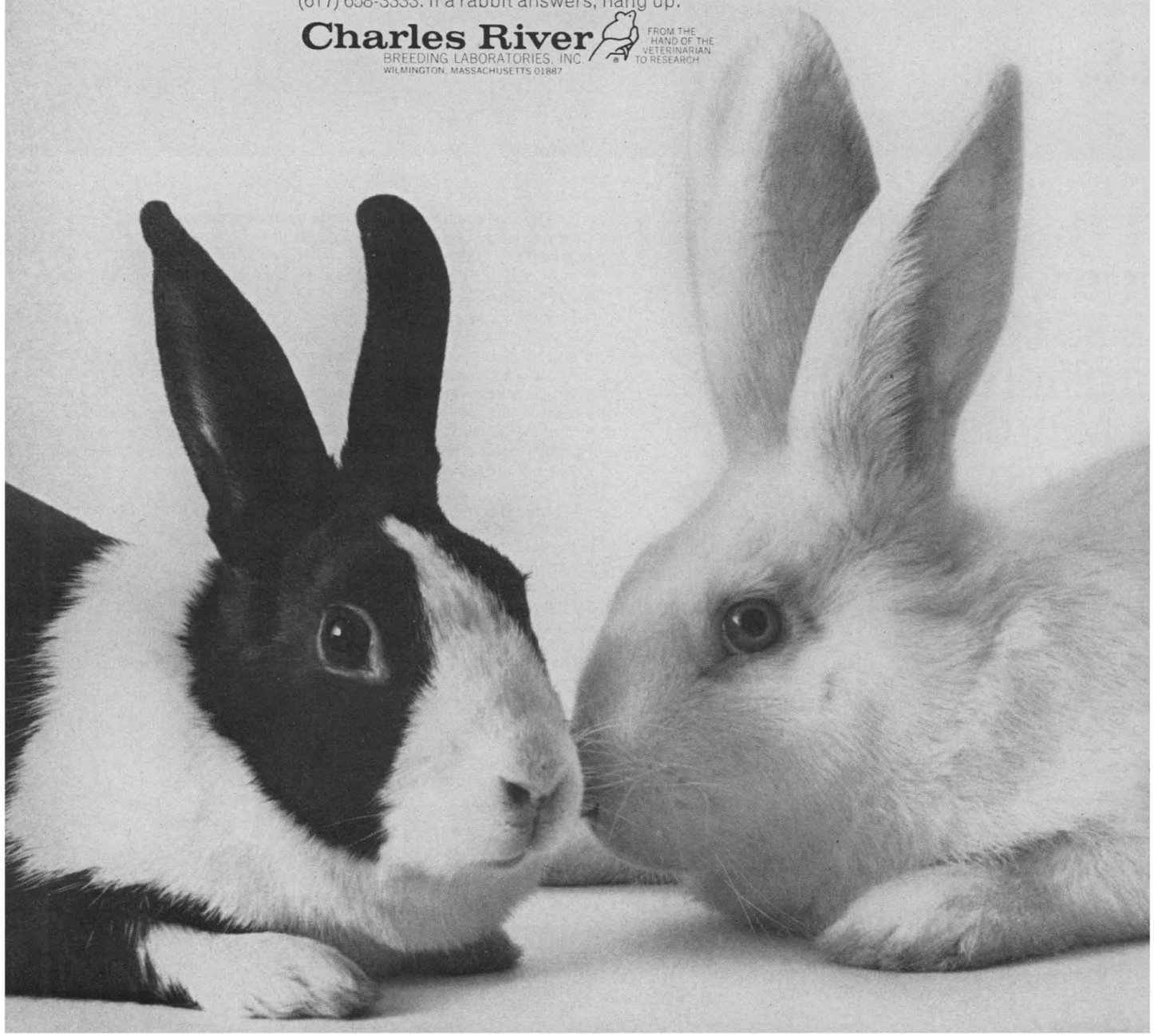
So in February, 1969, we started raising two germfree strains of rabbits by caesarean technique: the New Zealand albino and the black and white Dutch belt. Now, our rabbit-breeding facilities are nearing completion. By 1971 we should be in full production.

Through our new facilities, we will be able to offer the fields of teratology, toxicology and dermatology the first research rabbits produced from a germfree nucleus.
A better animal for better research.

If you'd like more information, please write us at: Charles River Breeding Laboratories, Wilmington, Mass. Or call (617) 658-3333. If a rabbit answers, hang up.

**Charles River**
BREEDING LABORATORIES, INC.
WILMINGTON, MASSACHUSETTS 01887

FROM THE HAND OF THE VETERINARIAN TO RESEARCH



# What would you ask for in a complete Photomicrographic and Photomacrographic Lab?

**1.** The first thing you'd ask for would be an easily operated 4 x 5 camera system. You'd want it to be completely automatic—exposure, film counting, frame-imprinting, everything—so that all you have to do to take a picture is focus and push a button. You might need, too, a fully automatic 35mm camera that's easily and rapidly interchangeable. You'd definitely want utmost stability—the kind that the Zeiss Ultraphot III, with its sliding mirror system (rather than bulky bellows) and its strong shock mounting, gives you. You'd want to use Polaroid® and have a projection head available, and, for metallographic work, special disks for grain size determinations. You might also need a Micro-Hardness Tester and a movie camera. So you'd make sure there was provision for all these.

**2.** You'd insist on the highest quality optics—in other words, Zeiss optics. And you'd want them to be *completely* interchangeable with those on any other Zeiss microscope you may have or plan to add. So you'd have available to you the world's widest line of Planapochromats, Planachromats, Plan-Neofluars, Neofluars, Ultrafluars, Achromats, Epi-plans, and Pol objectives for transmitted and reflected light—not to mention the unequaled Luminars and Epi-Luminars for photomacrography. You'd want, in short, capability for 4 x 5 and 35mm photography at continuous magnifications from 2.5X to the limits of light microscopy, through the finest flat-field optics ever made.

**3.** You'd require a choice of light sources—CSI, Mercury, Xenon, Quartz Iodide, and Tungsten. And you'd find it very convenient that the Ultraphot holds three at the same time so you can switch from one to the other, or combine Mercury and Tungsten for phase-fluorescence, all by a simple flip of a lever.

**4.** You'd expect it to be a simple matter to exchange stages so that you can switch from reflected to transmitted light, or vice-versa, in a matter of seconds. You'd want the same easy exchangeability, too, of eyepieces and condensers.

**5.** You'd want a specially designed instrument table, with ample working space, drawers with fittings for all accessories, and a built-in power supply.

**6.** You'd make sure everything was built into a sturdy and compact stand. And "everything" means "everything": filters, ASA selector for speeds from 2.5 to 8,000, exposure readout window, push-button for exposure, photo-multiplier, beam splitter (so that the light can be directed 100% to the camera, or 100% to the eyepieces, or ⅓ to the eyepieces and ⅔ to the 4 x 5 camera, or 100% to the 35mm camera with its own focusing eyepiece.)

# You'd ask for Ultraphot III.

That's what Zeiss calls it, and it does everything but develop the film. And, if you use Polaroid® film, it does that too. For all light-microscope techniques—brightfield, darkfield, fluorescence, polarization, phase contrast, Nomarski interference contrast and quantitative interference microscopy (Jamin—Lebedeff)—in both reflected and transmitted light—photomicrography and photomacrography—the Ultraphot III is the supreme instrument. Write Carl Zeiss, Inc., 444 Fifth Avenue, New York, New York 10018.

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Circle No. 50 on Readers' Service Card

A lot of people didn't believe it was possible for even Wang to make a calculator the size of the new 700 that would perform so many functions.

Once somebody begins using the 700 their doubts quickly turn to admiration. They find that features like the 16 special function keys actually turn the 700 into their own specially programmed personal calculator. And the 120 register calculating capacity will take care of all their side calculations and then some.

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# Tested by skeptics.

in dealing with it is "control"; specifically, control at the source. The control principle is not new to us in its social applications. Strenuous efforts are being made, for example, to gain acceptance of birth control as the only rational way of keeping human numbers at a manageable level.

If we are to avoid the chaos in information transfer that Baker warns of, it will be by controlling information *before* its publication. This method—"worth control"—requires a human qualitative judgment of the value of the information. If this step were bypassed in favor of channeling the flood of information into better-designed computers for manipulation in a dozen different ways, the real problem would simply be deferred and eventually our entire system of information transfer would collapse. There is no easy answer. The only method is to apply those unique human skills—the ability to evaluate, to judge, and to select—to the problem of controlling publication and dissemination of information. Anything less will speed us toward the time when, like the Sorcerer's Apprentice, we will be swept away by the flood.

ELMER S. NEWMAN

*Sears Library,*
*Case Western Reserve University,*
*Cleveland, Ohio 44106*

**Reference**

1. J. Ziman, *New Sci.* **46**, 212 (1970).

## Blunt Words

Never in a scientific journal have I seen a more irresponsible statement than that by Southwick ("Campus unrest: Which tack for President's commission?" 11 Sept., p. 1061): "His [President Nixon's] decision to invade neutral Cambodia triggered campus violence across the country and led to the deaths of students at Kent and Jackson State."

It is extremely difficult to believe that an undergraduate, even at Harvard, could be so naive as to believe that any single act was responsible for the "explosion" that took place. The "explosive charges" had been planted and the fuses lit weeks, months, if not years, earlier. The Lovers-of-Peace were well organized with respect to bringing war to the campuses.

I wish Southwick could have seen the completely unprovoked assault here

on the State Highway Patrol, which caused grave injury to some of these policemen. Perhaps he could have been persuaded from his irrational supposition that these acts of anarchy were spontaneous or even triggered by any particular historical events.

There remains among some persons incapable of evaluating evidence a most weird belief: That persons attend a "Peaceful Demonstration" armed with an assortment of deadly weapons.

DUNCAN MCCONNELL
*305 West 12 Avenue,*
*Columbus, Ohio 43210*

Southwick's article offers perhaps as clear a statement of the aims of student activists as has yet appeared. One of their spokesmen is quoted as saying: "We don't want more communication. . . . What we want is for him [the President] to give in."

As a comment on this position, it is helpful to review briefly the history of participation in major political decisions in the United States. After the Revolution, such participation was extended to all propertied white males. Gradually it spread to all white males regardless of property, and after the Civil War, de jure at least, to all males regardless of color. In this century it was broadened to include all adults regardless of sex, and recently much (though not enough) has been done to destroy local de facto exclusion of racial and linguistic minorities.

According to Southwick, the student activists would sharply reverse this trend. He says: "The reduction of campus violence depends not on reports but on action. Such action can only be taken by those in power . . ." In other words, the government of the United States is to obey the orders of student activists, regardless of the wishes of the rest of the population, on pain of violence and disruption.

What this amounts to is that the author, in stating so plainly the aims of student activism, has provided a piece of information crucial to all citizens who are in favor of democratic processes.

FREDERICK E. ROMBERG
*Route 9, Box 810,*
*Austin, Texas 78703*

An excellent example of what now passes for logic at our universities is Southwick's statement: "To curb campus disorder . . . [Nixon] has been told . . . end the war in Vietnam . . ." The government of the United States is

just like the administration of a university: give in when radicals threaten violence. Unfortunately, the President does not enjoy the luxury of confronting only one genus of extremists. Should he avert violence by white racists by sending all the blacks to Africa? Should he execute all liberal professors to placate superpatriots? Think about it!

NORMAN H. SLEEP
*Department of Earth and Planetary Sciences, 54-524, Massachusetts Institute of Technology, Cambridge 02139*

### Food Studies and Null Hypotheses

Recently the nutritive value of a number of commercial products has been called into question by studies, the wisdom of which should be questioned. One would predict a priori that a diet of 100 percent "enriched" bread, or breakfast cereal, principally sources of carbohydrate, could hardly be expected to provide all daily requirements for man or rat. . . . (The average consumer believes that the function of bread is to keep the peanut butter off his fingers, and that snap, crackle, and pop may be the greatest reward from cereal.)

Yogurt, for all its usable protein, would not be predicted to be a complete diet, and therefore the experimental result of hypergalactosis is not a likely dietary problem. Diets containing extremely high contents of glutamate, saccharine, or even sodium chloride, should be expected to have deleterious effects. These experimental designs raise a serious question regarding the responsibility of the scientist.

These studies, by their nature, are doomed to public interpretation. The very design lends implicit suggestion that somehow new findings now indicate grave danger or gross inadequacy of foods never before expected to be a dietary panacea, that the reseacher apparently expected a loaf of bread, a flask of wine, and thou to nourish more than the soul. It is imperative that "public" research be designed to be meaningful to the public, and that the investigator keep clearly in mind which is the null hypothesis and which is the alternate hypothesis.

ROBERT E. HENSHAW
*Department of Biology, Pennsylvania State University, University Park 16802*

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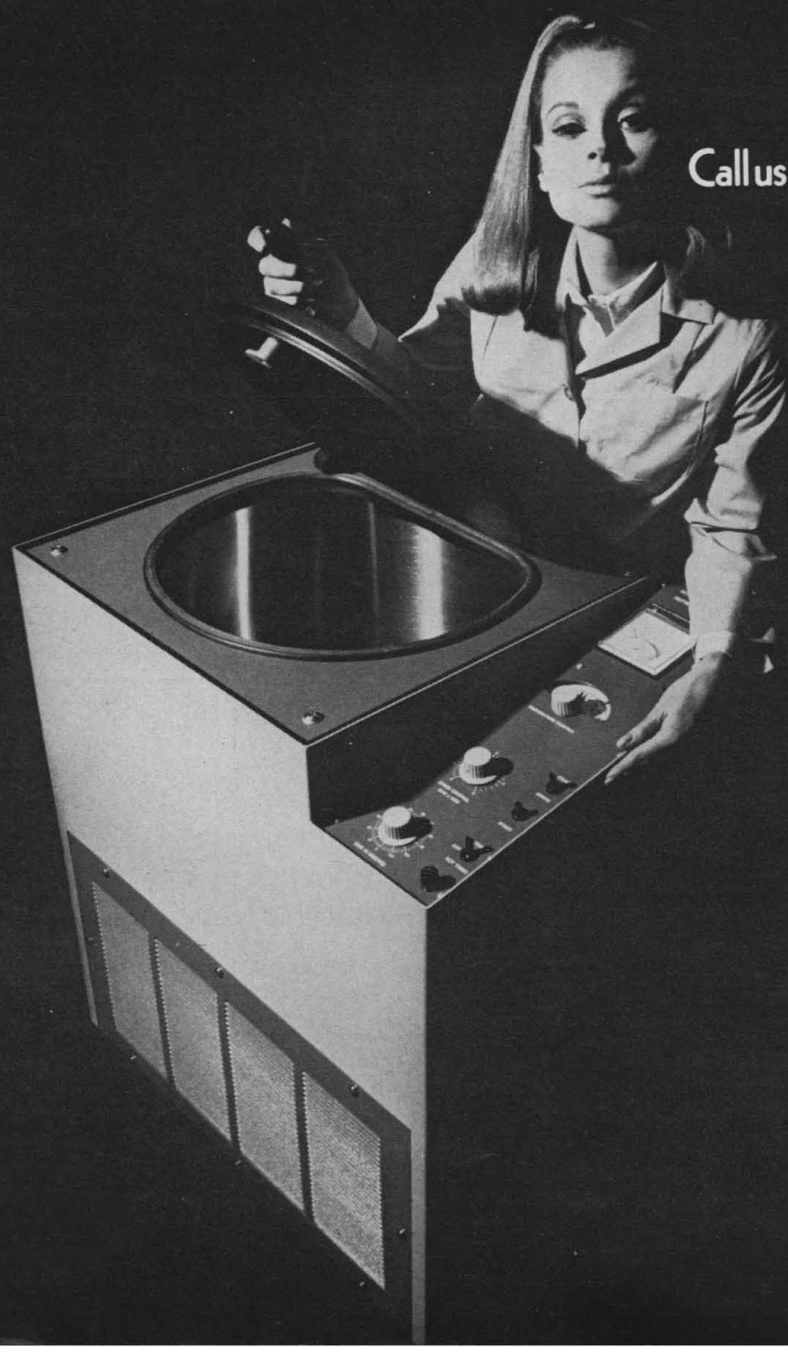

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20 November 1970, Volume 170, Number 3960

SCIENCE



# Communications Satellites

When man's capacities for constructive achievement are implemented, the result can be admirable and impressive. This is well illustrated in the continuing development of long-distance communication by means of geostationary satellites. The state of the art has come a long way since the launching in 1965 of the Early Bird satellite, and indications are that even more striking developments will occur.

Today most of the nations outside the Soviet Bloc are linked together by an effective and highly reliable communications network based on satellites located about 22,300 miles above the equator over the Atlantic, Pacific, and Indian oceans. Three such locations are sufficient to give global coverage.

The satellites are owned by the International Telecommunications Satellite Consortium (INTELSAT), a partnership that includes about 76 nations. Because the United States has been the major user of international communications, it owns about 53 percent of the consortium and has a corresponding share of the voting rights. The interests of the United States are represented by a publicly owned company, the Communications Satellite Corporation (COMSAT). In turn, COMSAT is the operating company for INTELSAT.

In its day, Early Bird (INTELSAT 1) was hailed as quite an achievement. It had a capacity of 240 circuits with annual cost per circuit of $20,000.* Present-day INTELSAT 3 satellites have capacities of 1,200 circuits with an annual cost of $2,000. Under construction for use in 1971 is a new model with a capacity of about 6,000 circuits and an annual cost of $700 per circuit. COMSAT scientists and engineers are working on components and design questions which they feel will permit improvement by at least another factor of 10 both in numbers of circuits and in costs per circuit near the end of this decade.

At present the satellites are principally used for telephonic communication. When the new satellites begin to function, costs of international conversations will drop, gradually approaching those of domestic calls. Prospects are fairly substantial that COMSAT will launch a geostationary satellite for use in communication internal to the United States. Pending is a proposal involving COMSAT and the American Telephone and Telegraph Company.

The communications satellites have a variety of applications, including telephone, telegraph, television, and data and facsimile transmission. One application that will probably be implemented fairly soon is aeronautical and ship communication. Radio works well on line of sight but is undependable at distances greater than 300 miles. Many ships have been lost while radio operators were trying in vain to communicate their peril. Midocean aeronautical navigation represents another growing need which could also be filled.

Satellite enthusiasts point to other potential uses. One of these is Picturephone, which now requires about 100 telephone circuits for a single two-way conversation. High-capacity, low-cost satellite circuits would help to make feasible large-scale use of this device. Perhaps more distant but of great consequence would be exploitation of future inexpensive communications for use in educational television.

Constructive applications of satellites are now a reality, and extension of technological potentials will have profound and global consequences.—PHILIP H. ABELSON

* Additional expenses are incurred in ground stations. See *Report to the President and the Congress*, Communications Satellite Corp., Washington, D.C., 20 April 1970, for additional details.

Total travel and subsistence expenses usually will not be provided.

*Cancellation.* The $30 deposit is forfeited if an approved application is cancelled. This deposit is not transferable to another Conference or conferee.

*Membership.* Requests for membership in the Conferences or for additional information should be addressed to: Alexander M. Cruickshank, Director, Gordon Research Conferences, Pastore Chemical Laboratory, University of Rhode Island, Kingston, Rhode Island 02881 (telephone: 401-783-4011).

### PROGRAM

#### Chemical Oceanography

R. M. Pytkowicz, *chairman;* D. W. Hood, *vice chairman.*

*18 January.* Air-sea chemical interactions (H. G. Ostlund, discussion leader): H. Craig, "Dissolved gases and oceanic mixing and transport processes"; B. Benson, "Variations in dissolved gas concentrations." Stable isotopes and radioactivity in the oceans (W. S. Broecker, discussion leader): H. Volchok, "Man-made radioactivity"; H. Craig, "Stable isotopes"; W. S. Broecker, "Natural radioactivity."

*19 January.* Sediment-seawater interactions (R. M. Garrels, discussion leader): R. A. Berner, "Sulfate reduction and iron sulfide formation in sediments"; F. Mannheim, "Pore fluids in oceanic sediments"; A. Lehrman, "Transfer of ionic species across the sediment-water interface." Pollution in the oceans (M. G. Gross, discussion leader): D. H. Klein, "Mercury in the marine environment"; C. Patterson, "Lead in the environment"; J. Prospero, "DDT and wind transport of wastes."

*20 January.* Physical chemistry of seawater (F. Millero, discussion leader): F. Millero, "The importance of ion-water and ion-ion interactions in the physical chemistry of seawater"; R. Horne, "Solute-water interactions in seawater"; J. Gieskes, "Ion-ion interactions in seawater." Organic and biological chemistry of seawater (D. Menzel, discussion leader): P. Williams, "Organic and biological chemistry of seawater: an assessment of the present status"; T. Packard, "The application of enzymology to the analysis of biochemical rate processes"; D. Boylan, "The function of dissolved organics as chemical communicants in the marine environment."

*21 January.* Trace elements in the ocean (D. W. Spencer, discussion leader): P. G. Brewer, "Analytical methods

for trace elements in seawater: some recent intercalibration studies"; T. Lung Ku, "Radium and barium distributions in the oceans." Nutrient chemistry of the oceans and descriptive chemical oceanography (R. Dugdale, discussion leader): J. O'Connor, "Simulation models"; R. Eppley, "The kinetics of nutrient-phytoplankton relationships: methods of measurement"; L. Gordon, "Measuring nutrient concentrations: the new nutrient chemistry."

*22 January.* General review and future plans (D. Carritt, discussion leader).

**Electrochemistry**

James N. Butler, *chairman;* Allen J. Bard, *vice chairman.*

*18 January.* Ion-selective electrodes—mechanisms and new directions: Garry A. Rechnitz, George Eisenman, and Isaac Trachtenberg. Discussion: Richard A. Durst, James W. Ross, Jr., and Edward W. Moore.

*19 January.* Interfaces, metallic and non-metallic: Richard P. Buck, George A. Parks, Douglas W. Fuerstenau, and John Appleby. Discussion: Robert deLevie and Fred C. Anson.

*20 January.* Multicomponent electrolytes and natural waters: David Dyrssen, Robert F. Platford, and M. H. Lietzke. Discussion: R. A. Robinson and R. H. Wood.

*21 January.* Green pastures for applied electrochemistry: Alan Bewick and Douglas N. Bennion. Discussion: Raymond J. Jasinski. An open session will be held in the evening at which presentations not exceeding 15 minutes in length may be given by members of the Conference. Application should be made to the Chairman during the first part of the week.

*22 January.* Biological electrochemistry: Joseph Jordan. Discussion: Edward W. Moore and Allen J. Bard.

**Polymers**

Willard R. MacDonald, *chairman*; Fred E. Bailey, *vice chairman.*

*25 January.* (R. Milkovich, discussion leader): M. Morton, "Properties of polymer reinforced elastomers"; J. L. Koenig, "Laser Raman studies of the interface of glass and graphite fiber composites." (R. Landel, discussion leader): A. E. Oberth, "Viscoelastic effects in composites."

*26 January.* (M. Huggins, discussion leader): W. J. McKnight, "Properties of polyblends"; C. L. Segal, "Recent developments in high temperature polymers." (T. Smith, discussion leader):

J. C. Halpin, "Polymeric composites—an assessment."

*27 January.* (H. D. Keith, discussion leader): F. P. Price. "Crystallization at high supercooling"; G. W. Miller, "A mechanical model for the glassy state of polymers." (C. A. Stephens, discussion leader): E. G. Baker, "Polymer-solute interactions."

*28 January.* (W. T. Barry, discussion leader): H. K. Frensdorff, "Macrocyclic polyethers and their complexes with metal salts"; J. B. Lando, "Synthesis and characterization of stereo-regular poly(methacrylic acid)." (M. T. O'Shaughnessy, discussion leader): Potpourri.

*29 January.* (F. E. Bailey, discussion leader): R. M. Fitch, "Mechanism of particle formation in polymer colloids"; B. J. Lyons, "Radiation effects on polymers."

## Forthcoming Events

### December

*26–29.* Society for the **History of Technology**, Chicago, Ill. (M. Kranzberg, Crawford Hall, Case Western Reserve Univ., Cleveland, Ohio 44106)

*26–30.* Western Soc. of **Naturalists**, Honolulu, Hawaii. (D. H. Montgomery, Dept. of Biological Sciences, California State Polytechnic College, San Luis Obispo 94301)

*26–30.* Society of **Systematic Zoology**, Chicago, Ill. (G. I. Stage, Dept. of Entomology, Natl. Museum of Natural History, Washington, D.C. 20560)

*26–31.* American Assoc. for the **Advancement of Science**, 137th annual, Chicago, Ill. (D. W. Thornhill, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005)

*26–31.* Society for **General Systems Research**, Chicago, Ill. (R. F. Ericson, 2100 Pennsylvania Ave., NW, Room 818, Washington, D.C. 20006)

*26–31.* American **Nature Study** Soc., Chicago, Ill. (Mrs. J. Geisler, Milewood Rd., Verbank, N.Y. 12585)

*26–31.* American Soc. of **Zoologists**, Chicago, Ill. (G. Sprugel, Jr., Illinois Natural History Survey, 179 Natural Resources Bldg., Urbana 61801)

*27.* National Assoc. of **Science Writers**, Chicago, Ill. (Mrs. R. Arctander, Box H, Sea Cliff, N.Y. 11579)

*27–30.* **Archaeological** Inst. of America, 72nd annual, New York, N.Y. (J. S. Ord, AIA, 260 West Broadway, New York 10013)

*27–30.* **Biometric** Soc., eastern North American regional, Detroit, Mich. (D. G. Gosslee, P.O. Box 713, Oak Ridge, Tenn. 37830)

*27–30.* **Sigma Delta Epsilon**, Chicago, Ill. (M. A. Myers, 6234 Mary Lane Dr., San Diego, Calif. 92115)

*27–30.* American **Statistical** Assoc., 130th, Detroit, Mich. (J. W. Lehman,

ASA, 806 15th St., NW, Washington, D.C. 20005)

*28–30.* American **Economic** Assoc., Detroit, Mich. (H. F. Williamson, 629 Noyes St., Evanston, Ill. 60201)

*28–30.* **History of Science Study**, Chicago, Ill. (J. C. Greene, Dept. of History, Univ. of Connecticut, Storrs 06268)

*28–30.* **Linguistic** Soc. of America, Washington, D.C. (T. A. Sebeok, Patton House, Indiana Univ., 516 E. Sixth St., Bloomington 47401)

*28–31.* **Metric** Assoc., Chicago, Ill. (L. F. Sokol, 624 N. Drury Lane, Arlington Heights, Ill. 60004)

*28–31.* American **Physical** Soc., Stanford, Calif. (W. W. Havens, Jr., 335 E. 45 St., New York 10017)

*28–31.* Symposium on **Upper Mantle Project**, 2nd, Hyderabad, India. (S. Balakrishna, Natl. Geophysical Research Inst., Hyderabad-7)

### January

*2–21.* American **College of Surgeons**, scientific winter cruise, San Juan, Puerto Rico; Caracas, Venezuela; and Panama City (American College of Surgeons, 55 E. Erie St., Chicago, Ill. 60611)

*3–8.* Symposium on **Hibernation-Hypothermia**, Snowmass (Aspen), Colo. (F. E. South, Space Sciences Research Center, Univ. of Missouri, Columbia 65201)

*3–9.* Indian **Science** Congr. Assoc., 58th annual, Calcutta. (M. Nagaraj, Dean, Faculty of Science, Bangalore Univ., Bangalore-1, India)

*4–7.* European **Geophysical** Soc., London, England. (C. R. Argent, EGS, 6 Carlton House Terrace, London, S.W.1.)

*4–7.* **Solid State Physics and Applications**, Boca Raton, Fla. (J. S. Blakemore, Physics Dept., Florida Atlantic Univ., Boca Raton 33432)

*5–7.* **Solid State Physics**, 8th annual, Manchester, England. (Meetings Officer, Inst. of Physics and The Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*6–9.* American **Rheumatism** Assoc., Washington, D.C. (Miss M. M. Walsh, Arthritis Foundation, 1212 Avenue of the Americas, New York 10036)

*7–9.* National Conf. on **Cancer of the Colon and Rectum**, San Diego, Calif. (R. N. Grant, American Cancer Soc., 219 E. 42 St., New York 10017)

*7–15.* American Soc. for **Testing and Materials**, technical committee mtgs., Fort Lauderdale, Fla. (H. Hamilton, ASTM, 1916 Race St., Philadelphia, Pa. 19103)

*11–15.* Society of **Automotive Engineers**, Detroit, Mich. (W. I. Marble, 2 Pennsylvania Pl., New York 10001)

*11–15.* **Water Resources Engineering**, Phoenix, Ariz. (Executive Secretary, American Soc. of Civil Engineers, 345 E. 47 St., New York 10017)

*11–22.* **Science, Society, and Our World**, Medford, Mass. (K. A. McCarthy, Graduate School of Arts and Sciences, Tufts Univ., Medford 02155)

*12–14.* Institute of Electrical and Electronics Engineers, **Reliability and Quality Control**, 17th annual symp., Washington, D.C. (Executive Secretary, IEEE, 345 E. 47 St., New York 10017)

*12–14.* **System Sciences**, intern. conf.,

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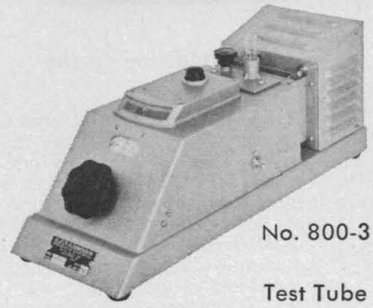

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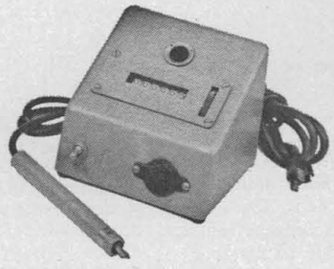

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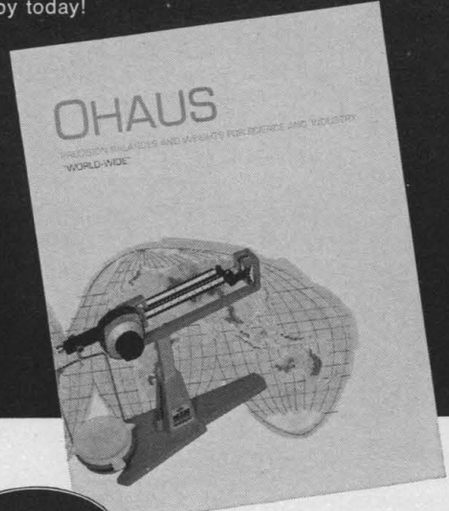


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*12–16.* National Soc. of **Professional Engineers**, Memphis, Tenn. (P. H. Robbins, 2029 K St., NW, Washington, D.C. 20006)

*12–18.* **Marine Biological** Assoc. of India, Cochin. (E. G. Silas, Gopala Prabhu Rd., Ernakulam, Cochin, 11)

*17.* **Human Factors in the Design and Operation of the Highway Transportation System**, 4th annual, Washington, D.C. (B. W. Stephens, Dept. of Transportation, Federal Highway Administration, Office of Research and Development, 35-41.2, Washington, D.C. 20591)

*17–21.* Pan-American Conf. on **Adolescence**, Buenos Aires, Argentina. (S. C. Feinstein, American Soc. for Adolescent Psychiatry, 741 St. Johns, Highland Park, Ill. 60035)

*18–19.* **Nucleic Acid-Protein Interaction**, Miami, Fla. (F. Huijing, Dept. of Biochemistry, Univ. of Miami School of Medicine, P.O. Box 875, Biscayne Annex, Miami 33152)

*18–20.* Society of **Thoracic Surgeons**, Dallas, Tex. (W. G. Purcell, 333 N. Michigan Ave., Chicago, Ill. 60610)

*18–22.* **Highway Research** Board, 50th annual, Washington, D.C. (H. M. Gillespie, Natl. Research Council, 2101 Constitution Ave., NW, Washington, D.C. 20418)

*18–22.* **Metallographic Interpretation**, Dallas, Tex. (J. A. Fellows, American Society of Metals, Metal Park, Ohio 44073)

*18–25.* **Pathological Wilting in Plants**, intern. symp., Madras, India (T. S. Sadasivan, Univ. of Madras, Botany Lab., Madras-5)

*19–21.* **Computer Designers** Conf. and Exhibition, Anaheim, Calif. (F. L. Morritz, Industrial and Scientific Conf. Management, Inc., 222 W. Adams St., Chicago, Ill. 60606)

*19–21.* **Systems, Networks, and Computers**, intern. conf., Oaxtepec, Mexico. (M. A. Murray-Lasso, Instituto de Ingeneria, Ciudad Universitaria, Mexico 20 DF, Mexico)

*21–22.* **Nucleic Acid Synthesis in Viral Infection**, Miami, Fla. (F. Huijing, Dept. of Biochemistry, Univ. of Miami School of Medicine, P.O. Box 875, Biscayne Annex, Miami 33152)

*21–25.* American **Mathematical** Soc., Atlantic City, N.J. (G. L. Walker, P.O. Box 6248, Providence, R.I. 02904)

*21–31.* North American Conf. on **Fertility and Sterility**, Puerto Vallarta, Mexico. (Mrs. F. Royce, 112-44 69th Ave, Forest Hills, N.Y. 11375)

*22.* **Bibliographical** Soc. of America, New York, N.Y. (T. R. Adams, John Carter Brown Library, Brown Univ., Providence, R.I. 02912)

*22–23.* Symposium on **Blood, "Thrombolytic Therapy,"** 19th annual, Detroit, Mich. (E. F. Mammen, Dept. of Physiology and Pharmacology, Wayne State Univ., 1400 Chrysler Expressway, Detroit 48207)

*22–26.* National Assoc. of **Secondary School Principals**, 55th annual, Houston, Tex. (D. W. Hunt, NASSP, 1201 16th St. NW, Washington, D.C. 20036)

*23–26.* Midwinter Conf. of **Immunologists**, 10th annual, Pacific Grove, Calif. (C. J. Stormont, Dept. of Veterinary Microbiology, Univ. of California, Davis 95616)

*24–28.* American Soc. of **Heating, Refrigerating, and Air-Conditioning Engineers**, Philadelphia, Pa. (A. T. Boggs III, 345 E. 47 St., New York 10017)

*25–26.* Symposium on **Metal Carbides**, Cleveland, Ohio. (J. A. Fellows, American Soc. of Metals, Metals Park, Ohio 44073)

*25–27.* **Aerospace Sciences**, 9th mtg., New York, N.Y. (J. Lukasiewicz, College of Engineering, Virginia Polytechnic Inst., Blacksburg 24061)

*25–27.* **Cooling Tower** Inst., Houston, Tex. (Mrs. D. Garrison, Suite 107, 3005 Yales St., Houston 77018)

*26.* **Coloring of Plastics** V, Cleveland, Ohio. (J. E. Simpson, Ferro Corp., 4150 E. 56 St., Cleveland 44105)

*26–29.* Canadian **Pulp and Paper** Assoc., 57th annual, Montreal, P.Q. (D. Jones, 2300 Sun Life Bldg., Montreal)

*28–29.* Annual **College-Industry** Conf. of the **Relations with Industry** Div. of the American Soc. for Engineering Education, Tempe, Ariz. (Mrs. L. Hitch, American Soc. for Engineering Education, Suite 400, 1 Dupont Circle, Washington, D.C. 20036)

*28–3.* **Design and Interpretation of Experiment**, 6th annual, Harriman, N.Y. (S. M. Gross, College of Pharmaceutical Sciences, Columbia Univ., 115 W. 68 St., New York 10023)

*29–31.* Southern **Radiological** Conf., Point Clear, Ala. (M. Eskridge, P.O. Box 7544, Mobile, Ala. 36607)

*31–5.* **Power Group**, Institute of Electrical and Electronics Engineers, New York, N.Y. (J. W. Bean, IEEE, 345 E. 47 St., New York 10017)

*31–6.* Asia and Oceania Congr. of **Endocrinology**, 4th, Auckland, N.Z. (R. J. Seddon, Postgraduate School of Obstetrics and Gynaecology, Auckland, 3)

### February

*1–3.* Society of **Rheology**, Salt Lake City, Utah. (E. B. Christiansen, Dept. of Chemical Engineering, Univ. of Utah, Salt Lake City 84112)

*1–4.* **Arctic Geology**, 2nd annual intern. symp., San Francisco, Calif. (M. G. Pitcher, Continental Oil Co., 1755 Glenarm Pl., Denver, Colo. 80202)

*1–4.* American **Crystallographics** Assoc. Winter Mtg., Columbia, S.C. (E. L. Amma, Dept. of Chemistry, Univ. of South Carolina, Columbia 29208)

*1–4.* American **Physical** Soc., New York, N.Y. (W. W. Havens, 335 E. 45 St., New York 10017)

*1–4.* American Assoc. of **Physics Teachers**, New York, N.Y. (M. W. Zemansky, American Inst. of Physics, 335 E. 45 St., New York 10017)

*1–5.* **Bone-Seeking Radionuclide Contaminations and Radiation Protection**, intern. symp., Grenoble, France. (M. Avargues, CEA, Dept. de la Protection Sanitaire, B.P. No. 6, 92 Fontenay-aus-Roses, France)

*3–6.* American Group **Psychotherapy**

Assoc., Los Angeles, Calif. (L. Kane, 1790 Broadway, New York 10019)

*3–7.* American College of **Cardiology**, Washington, D.C. (W. D. Nelligan, 9650 Rockville Rd., Bethesda, Md. 20014)

*3–10.* Management of **Adolescent Problems**, New York, N.Y. (H. Gershman, American Inst. for Psychoanalysis, 329 E. 62 St., New York 10021)

*4–5.* **Non-Ferrous Tooling for the Plastics Industry**, Newark, N.J. (S. Tatar, Diemold Corp., 2 Getty Ave., Clifton, N.J.)

*4–6.* American **Psychopathological** Assoc., New York, N.Y. (M. Fink, 5 E. 102 St., New York 10029)

*4–7.* American **Educational Research** Assoc., 55th annual, New York, N.Y. (Meeting Coordinator, AERA, 1126 16th St., NW, Washington, D.C. 20036)

*8–10.* American Acad. of **Occupational Medicine**, New York, N.Y. (D. Minard, Dept. of Occupational Health, Graduate School of Public Health, 130 De Soto St., Pittsburgh, Pa. 15213)

*8–10.* Institute of Technological Change and Administration in **Printing, Publishing and Information Services**, 7th annual, Washington, D.C. (L. H. Hattery, School of Government and Public Administration, Ward Circle Bldg., Washington, D.C. 20016)

*9–11.* **Aerospace and Electronic Systems**, 12th annual winter conv., Los Angeles, Calif. (W. H. Herrman, Inst. of Electrical and Electronics Engineers, Inc., Los Angeles Council Office, 3600 Wilshire Blvd., Los Angeles 90005)

*9–11.* Advanced Planning for Industry on **Ships and Marine Systems**, Washington, D.C. (National Security Industrial Assoc., Dept. NM, Suite 700, Union Trust Bldg., 15th and H Sts. NW, Washington, D.C. 20005)

*9–11.* **Weed Science** Soc. of America, Dallas, Tex. (D. L. Klingman, Agricultural Research Service, U.S. Dept. of Agriculture, Beltsville, Md. 20705)

*10–11.* **Vinyl Plastics** II—Fundamentals of Processing Techniques, Atlanta, Ga. (J. Seay, School of Architecture, Georgia Inst. of Technology, 225 North Ave., NW, Atlanta 30332)

*11–13.* Society of **University Surgeons**, New Haven, Conn. (T. Drapanas, Tulane Univ., New Orleans, La. 70112)

*12.* Society of **Teachers of Family Medicine**, Chicago, Ill. (Miss G. Gillespie, Div. of Family Medicine, Box 875, Biscayne Ave., Miami, Fla. 33152)

*14–15.* American Medical Assoc., **Medcal Education**, 67th annual congr., Chicago, Ill. (C. H. W. Ruhe, AMA Council on Medical Education, 535 N. Dearborn St., Chicago 60610)

*14–18.* American Soc. of **Abdominal Surgeons**, New Orleans, La. (B. F. Alfano, ASAS, 675 Main St., Melrose, Mass. 02176)

*14–18.* American Soc. of **Range Management**, 24th annual, Reno, Nev. (F. T. Colbert, ASRM, 2120 S. Birch St., Denver, Colo. 80222)

*15–16.* **Virus and Water Quality**: Occurrence and Control, 13th annual, Urbana, Ill. (V. L. Snoeyink, Dept. of Civil Engineering, Univ. of Illinois, Urbana 61801)

*17–18.* Conference on **Integrated Information Systems**, Palo Alto, Calif. (R. W.

Rector, Cognitive Systems, 319 S. Robertson Blvd., Beverly Hills, Calif. 90211)

*17–19.* **Solid State Circuits**, intern. conf., Philadelphia, Pa. (R. W. Webster, Texas Instruments, P.O. Box 5012, Dallas, Tex. 75222)

*17–24.* **Therapeutic Use of Dreams**, New York, N.Y. (H. Gershman, American Inst. of Psychoanalysis, 329 E. 62 St., New York 10021)

*18–19.* **Theoretical Chemistry and Sulfur Chemistry**, 3rd annual symp., New Orleans, La. (L. P. Gary, Jr., Loyola Univ., New Orleans 70118)

*18–21.* Western **Electroencephalography** Soc., Hawaii, Honolulu. (D. Crowell, Pacific Biochemical Research Center, Univ. of Hawaii, Honolulu 96822)

*19–20.* **Immune Complexes and Disease**, 12th annual symp., New York, N.Y. (I. Saulpaugh, New York Heart Assoc., 2 E. 64 St., New York 10021)

*20–24.* American Acad. of **Allergy**, Chicago, Ill. (J. O. Kelley, 756 N. Milwaukee, Wis. 53202)

*20–27.* American Soc. of **Clinical Pathologists** and College of American Pathologists, Las Vegas, Nev. (A. G. Boeck, 710 S. Wolcott Ave., Chicago, Ill. 60612)

*21–22.* National Assoc. of **Medical Examiners**, Phoenix, Ariz. (A. Z. Hemeli, 3300 Kirkwood Hwy., Wilmington, Del. 19808)

*21–26.* Engineering Foundation Research Conf. on **Environmental Engineering in the Food Industry**, Pacific Grove, Calif. (R. Lachman, Environmental Resources Program, Cornell Univ., Ithaca, N.Y.)

*21–26.* **Stack Gas Emissions and Measurements**, Pacific Grove, Calif. (W. T. Ingram, New York Univ., New York)

*22.* **Efferent Organization and Integrative Behavior**, New Orleans, La. (J. D. Maser, Dept. of Psychology, Tulane Univ., New Orleans 70118)

*22–24.* National Federation of **Science Abstracting and Indexing Services**, Washington, D.C. (NFSAIS, 2102 Arch St., Philadelphia, Pa. 19103)

*22–26.* **Plastic and Reconstructive Surgery**, 5th annual intern. congr., Melbourne, Australia. (J. Snell, Royal Australian College of Surgeons, Spring St., Melbourne 3000)

*23–24.* **Scope of Thermosets**, Chicago, Ill. (P. E. Fina, Box P, Riverdale, Ill.)

*23–25.* **Chemical Marketing Research** Assoc., Chicago, Ill. (C. W. Slade, Jr., CMRA, 100 Church St., New York 10007)

*24–27.* American Acad. of **Forensic Sciences**, Phoenix, Ariz. (A. H. Schatz, 750 Main St., Hartford, Conn. 06103)

*24–27.* Society of **Professors of Education**, Chicago, Ill. (R. Reilly, Shippensburg State College, Shippensburg, Pa. 17257)

*24–28.* American College of **Angiology**, 17th annual, New Orleans, La. (A. Halpern, 381 Park Ave., S., New York 10016)

*26–5.* International Acad. of **Proctology**, Mexico City, Mexico. (A. J. Cantor, 147-41 Sanford Ave., Flushing, N.Y. 11355)

*27.* Oregon Acad. of **Science**, Monmouth. (C. L. Smith, Dept. of Anthropology, Oregon State Univ., Corvallis, 97331)

*28–4.* Symposium of the Pan-American Assoc. of **Biochemical Societies**, Banff, Alberta, Canada. (W. J. Whelan, Dept. of Biochemistry, Univ. of Miami School of Medicine, P.O. Box 875, Biscayne Ave., Miami, Fla. 33152)

*28–4.* American Inst. of **Chemical Engineers**, 6th annual, Houston, Tex. (E. L. Ekholm, Bechtel Corp., P.O. Box 2166, Houston 77001)

*28–5.* **Analytical Chemistry and Applied Spectroscopy**, 22nd annual, Cleveland, Ohio. (W. G. Fateley, Carnegie-Mellon Univ., 4400 Fifth Ave., Pittsburgh, Pa. 15213)

*28–5.* American Assoc. of **Junior Colleges**, 51st annual, Washington, D.C. (W. A. Harper, AAJC, One Dupont Circle, NW, Washington, D.C. 20036)

*28–6.* Florida Midwinter Seminar in **Ophthalmology and Otolaryngology**, Miami Beach, Fla. (K. S. Whitmer, 550 Brickell Ave., Miami, Fla. 33131)

### March

*1–3.* Symposium on **Antibiotics**, Ste. Marguerite, P.Q., Canada. (S. Rakhit, Ayerst Laboratories, P.O. Box 6115, Montreal, P.Q., Canada)

*1–3.* **Particle Accelerator** Conf., Chicago, Ill. (D. A. Carlson, Argonne National Lab., Argonne, Ill. 60439)

*1–3.* American College of **Surgeons**, Phoenix, Ariz. (Communication Div., ACS, 55 E. Erie St., Chicago, Ill. 60611)

*1–6.* Society for **Cryosurgery**, Hollywood, Fla. (M. Trueblood, SC, 30 N. Michigan Ave., Chicago, Ill. 60602)

*3–5.* **Fundamental Cancer Research**, 25th annual symp., Houston, Tex. (F. Goff, Anderson Hospital and Tumor Institute, Univ. of Texas, Houston 77025)

*3–6.* Midwest **Clinical** Conf., Chicago, Ill. (G. F. Lull, 310 S. Michigan Ave., Chicago 60604)

*3–6.* American **Educational Research** Assoc., New York, N.Y. (R. A. Dershimer, AERA, 1126 16th St., NW, Washington, D.C. 20036)

*3–10.* Clinical Conf. on the **Treatment of Emotional Problems in Medical Practice, Case Studies in Child Therapy**, New York, N.Y. (H. Gershman, American Inst. for Psychoanalysis, 329 E. 62 St., New York 10021)

*4–6.* Southern Society of **Anesthesiologists**, Houston, Tex. (R. G. Zepernick, Mercy Hospital, New Orleans, La. 70119)

*4–6.* Society for **Contemporary Ophthalmology**, Hollywood, Fla. (SCO, Room 1629, 30 N. Michigan Ave., Chicago, Ill. 60602)

*4–6.* German **Endocrinological** Soc. 17th annual, Hamburg. (J. Kracht, Pathologisches Institut der Universitat Klinikstrasse 32g, 6300 Gieben, Germany)

*4–6.* Central **Surgical** Assoc., Minneapolis, Minn. (W. J. Fry, Univ. of Michigan Medical School, Ann Arbor 48104)

*5–6.* American Soc. for **Surgery of the Hand**, Los Angeles, Calif. (L. Milford, ASSH, 869 Madison Ave., Memphis, Tenn. 08104)

*5–7.* National **Wildlife** Federation, Portland, Ore. (T. L. Kimball, NWF, 1412 16th St., NW, Washington, D.C. 20036)

*6–11.* American Acad. of **Orthopedic Surgeons**, San Francisco, Calif. (C. V. Heck, AAOS, 430 N. Michigan Ave., Chicago, Ill. 60611)

*6–12.* American **Concrete** Inst., 67th annual, Denver, Colo. (Secretary, Box 4754, Redford Sta., 22400 West Seven Mile Rd., Detroit, Mich. 48219)

*7–9.* American Assoc. of **Pathologists and Bacteriologists**, Montreal, Canada. (K. M. Brinkhous, Dept. of Pathology, Univ. of North Carolina, Chapel Hill 27514)

*7–11.* Society of **Toxicology**, Washington, D.C. (J. F. Borzelleca, Dept. of Pharmacology, Medical College of Virginia, Richmond 23219)

*7–12.* American Soc. of **Photogrammetry**, Washington, D.C. (L. P. Jacobs, 105 N. Virginia Ave., Falls Church, Va. 22046)

*8–10.* **Aerodynamic Testing**, 6th annual conf., Albuquerque, N.M. [J. L. Jones, Aeronautics Div. (227-4), NASA Ames Research Center, Moffett Field, Calif. 94035]

*8–10.* The How-to-Year—The Year for **Continued Professional Development**, New York, N.Y. (R. E. Eddy, Commercial Development Dept., Nalco Chemical Co., 180 N. Michigan Ave., Chicago, Ill. 60601)

*8–12.* Symposium on **Biophysical Aspects of Radiation Quality**, Lucas Heights, N.S.W., Australia. (J. H. Kane, Div. of Technical Information, U.S. Atomic Energy Commission, Washington, D.C. 20545)

*8–12.* Western **Metal and Tool** Exposition Conf., Design and Scientific/Precision Instruments Exhibit (WESTEC), Los Angeles, Calif. (American Soc. for Metals, Metals Park, Ohio)

*8–12.* American Soc. for **Nondestructive Testing**, spring conf., Los Angeles, Calif. (R. E. Turner, Eastman Kodak Co., Rochester, N.Y.)

*9–12.* International Colloquium on the **Exploitation of the Oceans**, Bordeaux, France. (M. M. Vigneaux, c/o CNEXO, Boite Postale 107, Paris 16°, France)

*9–13.* International Exhibitions and Technical Meetings for **Medical Electronics and Bio-Engineering**, Basel, Switzerland. (Sekretariat, MEDEX 72, CH-4000 Basel 21, Schweiz Bankverein, Basel)

*9–13.* International Acad. of **Pathology**, Montreal, Canada. (L. D. Stoddard, Dept. of Pathology, Medical College of Georgia, Augusta 30902)

*10–12.* Society of **Photographic Scientists and Engineers**, Toronto, Ont., Canada. (H. J. Hall, 10 Maguire Rd., Lexington, Mass. 02173)

*10–13.* Latin American Congr. of **Neurosurgery**, 14th annual, Punta del Este, Uruguay. (Secretary, Instituto de Neurologia, Hopital de Clinicas, Montevideo, Uruguay)

*10–13.* **Quality Engineering**, Pacific Grove, Calif. (H. D. Greiner, Engineering Foundation, United Engineering Center, 345 E. 47 St., New York 10017)

*12–19.* Marquette **Medical** Alumni Assoc., clinical conf., Maui, Hawaii. (R. H. Herzog, MMAA, 561 N. 15 St., Milwaukee, Wis. 53233)

*13–17.* California **Medical** Assoc., Anaheim, Calif. (R. L. Thomas, CMA, 693 Sutter St., San Francisco, Calif. 94102)