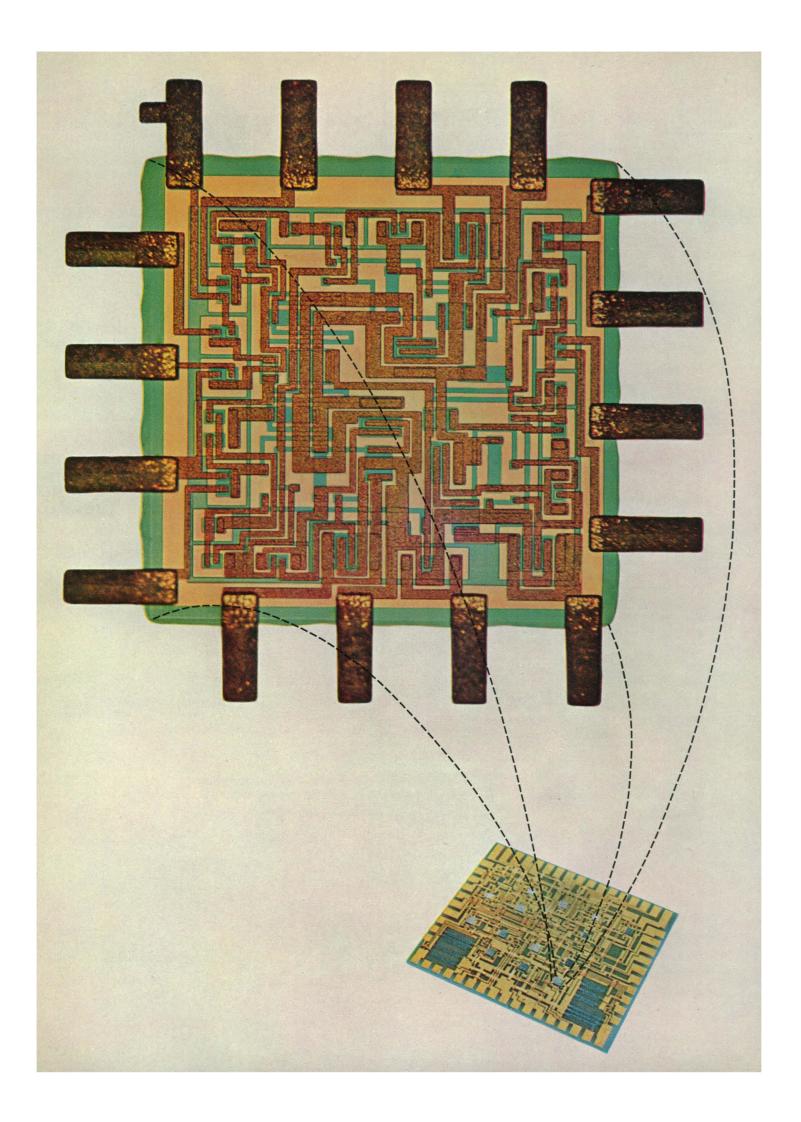
SCIENCE 20 November 1970 Vol. 170, No. 3960

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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 thinfilm 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.



20 November 1970

Vol. 170, No. 3960

· · ·		
LETTERS	Vietnam Refoliation: J. A. Duke and J. T. McGinnis; Stanford: Moot Point: E. L. Grant; Sorcerer's Apprentice Crisis: E. S. Newman; Blunt Words:	
	D. McConnell; F. E. Romberg; N. H. Sleep; Food Studies and Null	
	Hypotheses: R. E. Henshaw	807
EDITORIAL	Communications Satellites	813
ARTICLES	Lessons from a "Primitive" People: J. V. Neel	815
	Sunlight Ultraviolet and Bacterial DNA Base Ratios: C. E. Singer and B. N. Ames	822
	Attention and Psychological Change in the Young Child: J. Kagan	826
	·	
NEWS AND COMMENT	Higher Education: Administration Silent on Institutional Aid	832
	Sex Discrimination: Campuses Face Contract Loss over HEW Demands	834
	Taiwan: United States Tries One-Man Experiment in "Postaid" Assistance	835
BOOK REVIEWS	Pieces of the Action, reviewed by I. Stewart; other reviews by W. A. D. Jackson,	840
	A. W. Galston, T. Estrin, E. Sawicki, V. Salmon	840
REPORTS	Microtektites and Tektites: A Chemical Comparison: F. A. Frey, C. M. Spooner,	
	P. A. Baedecker	845
	Hyalinea baltica and the Plio-Pleistocene Boundary in the Caribbean Sea: W. D. Bock	847

SCIENCE

BOARD OF DIRECTORS	H. BENTLEY GLASS Retiring President, Chairman	ATHELSTAN SPILHAUS President		DAVID BLACKWELL RICHARD H. BOLT	LEWIS M. BRANSCOM BARRY COMMONER
VICE PRESIDENTS AND SECTION SECRETARIES	MATHEMATICS (A) R. P. Boas F. A. Ficken	PHYSICS (B) R. G. Sachs Albert M. Stone	CHEMISTRY (C) Herman S. Bloch Leo Schubert	Heli	RONOMY (D) mut A. Abt U. Landolt
	Margaret Mead Frank V	DLOGY (I) SOCIAL AND V. Finger Robert M. So D. Garvey Harvey Sapols		HISTORY AND PI George Wald Raymond J. Seege	HILOSOPHY OF SCIENCE (
	PHARMACEUTICAL SCIENCES (Np) Don E. Francke Joseph A. Oddis	AGRICULTURE (C Matthias Stelly Michael A. Farrel	Sherwood	IAL SCIENCE (P) L. Fawcett Dean	EDUCATION (Q) Frederic B. Dutton Phillip R. Fordyce
DIVISIONS	ALASKA DIVISION T. Neil Davis Irma Duncan President Executive Secreta	George E. Lindsay	DIVISION Robert C. Miller Secretary	SOUTHWESTERN AND R Loren D. Potter President	OCKY MOUNTAIN DIVISIO Marlowe G. Anderson Executive Secretary

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

	Environmental Mercury: Rapid Determination in Water at Nanogram Levels: R. W. April and D. N. Hume	849
	A High-Pressure Polymorph of Troilite, FeS: L. A. Taylor and H. K. Mao	850
	Condensation Nuclei: Production of Very Large Numbers in Country Air: V. J. Schaefer	851
	Crystal Structure of Serotonin Picrate, a Donor-Acceptor Complex: C. E. Bugg and U. Thewalt	852
	Transfer of Interferon-Producing Macrophages: New Approach to Viral Chemotherapy: L. A. Glasgow	854
	A Growth Inhibitor from Young Expanding Tobacco Leaves: H. G. Cutler	85 6
	Microcloning and Replica Plating of Mammalian Cells: J. A. Robb	857
	Tyrosine Transaminase Induction by Dexamethasone in a New Rat Liver Cell Line: L. E. Gerschenson et al.	859
	Scanning Electron Microscopy of the Organ of Corti: G. Bredberg et al.	861
	Pharmacological Differentiation of Allergic and Classically Conditioned Asthma in the Guinea Pig: D. R. Justesen et al.	864
	Glue Sniffing Causes Heart Block in Mice: G. J. Taylor and W. S. Harris	866
	Sexual Behavior of Male Cats after Administration of Parachlorophenylalanine: A. Zitrin et al.	868
	Technical Comments: Arsenic and Water Pollution Hazard: E. S. Pattison; I. V. Sollins; E. E. Angino et al.; RNA Hybridization: Competition between Species: H. D. Bolch; J. N. Hansen, G. Spiegelman, H. O. Halvorson	870
ASSOCIATION AFFAIRS	A Brief Guide to the 1970 AAAS Annual Meeting: W. G. Berl; AAAS Annual Meeting	873
MEETINGS	Gordon Research Conferences: Winter Program, 1971: A. M. Cruickshank; Forthcoming Events	900

GEOLOGY AND GEOGRAPHY (E) Richard H. Mahard William E. Benson	ZOOLOGICAL SC David Bishop Richard J. Goss	William	CAL SCIENCES (G) A. Jensen Y. Cooper
ENGINEERING (M) Newman A. Hall Raynor L. Duncombe	MEDICAL SCIENCES (N) Leon O. Jacobson F. Douglas Lawrason		Y (Nd) Likins
INFORMATION AND COMMUNICATION (T) R. M. Hayes Scott Adams	STATISTICS (U) Douglas Chapman Ezra Glaser		ID HYDROSPHERIC

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

COVER

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]

AAAS Symposium Volumes

#89. Biology of the Mouth

1968. 320 pages. Editor: Philip Person. A collection of comprehensive, multidisciplinary articles dealing with problems of the biology of the mouth and oral disease and also the borderlands where fundamental approaches and investigations in physics and chemistry relate to, and can be brought to bear on, such problems.

Price: \$10.00. AAAS Member's Cash Price: \$8.75.

#88. Folk Song Style and Culture

1968. 384 pages. A Staff Report on Cantometrics. Alan Lomax. The book affirms that song characteristics trace the main paths of many cultures; it also shows that specific qualities of song performance are directly related to identifiable attributes of ancient, modern, and primitive cultures.

Price: \$16.75. AAAS Member's Cash Price: \$14.50.

#87. Formulation of Research Policies

1967. 218 pages. Editors: Lawrence W. Bass and Bruce S. Old. Collected papers from a Gordon Research Conference held in Santa Barbara, California, in 1966. Goals, accomplishments—and weaknesses—of past and present science policies of nations, government agencies, individ-ual industries, and international organizations are given expert and candid appraisal in this work-the record of an exciting conference.

Price: \$7.75. AAAS Member's Cash Price: \$6.75.

#86. Ground Level Climatology

1967; 2nd printing, 1970. 408 pages. Editor: Robert H. Shaw. Relation of climate to the distribution and abundance of plants and animals; the effects of weather modification on physical processes within the micro-climate; and the effects of moisture, temperature, and energy balance on physiological functions.

Price: \$12.50. AAAS Member's Cash Price: \$10.50

#85. Agriculture and the Quality of Our Environment 1967; 2nd printing, 1970. 480 pages. Editor: N. C. Brady. Damage resulting from air pollutants; extent and consequences to agriculture of salt buildup in soils and water; dangers from radionuclide contamination of soil, water, and air. Extent of pesticide buildup in soil and water and of means to minimize potential hazards from pesticide use; siltation of reservoirs and streams and their nutrient enrichment; disposal of animal wastes. Price: \$13.50. AAAS Member's Cash Price: \$11.50.

#84. Molecular Mechanisms of Temperature Adaptation 1967. 398 pages. Editor: C. Ladd Prosser. A collection of papers on the general physiology of temperature adaptation in cold-blooded animals, plants, and microorganisms.

Price: \$12.50. AAAS Member's Cash Price: \$10.50.

#83. Estuaries

1967; 2nd printing, 1968. 776 pages. Editor: George H. Lauff. The first comprehensive collection of scientific papers covering the comparatively new field of estuarine research. "Estuaries is recommended; it is likely to be the reference compendium on the subject for many years rice: \$27.00. AAAS Member's Cash Price: \$24.00.

#81. Environmental Variables in Oral Disease

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

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

#80. Air Conservation

1965; 3rd printing, 1970. 348 pages. "The result of a 2-year study by the AAAS Air Conservation Commission, all aspects—sociological, technical, political and bio-logical—of air pollution are considered concisely." (Chemical Processing for Operating Management, May 1966)

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

#79. Science in Japan

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

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

#78. Man, Culture, and Animals

1965; 3rd printing, 1970. 304 pages. Editors: Anthony Leeds and Andrew P. Vayda. "This volume contains articles pertaining to the relationship between man and animals in different parts of the world, covering the influence of domesticated and non-domesticated animals on a variety of cultures." (Biological Abstracts, 1 February 1966)

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

#67. Oceanography

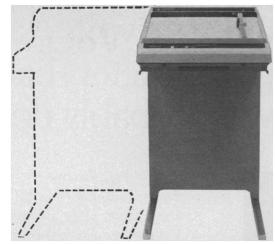
1961; 5th printing, 1969. 665 pages, 146 illustrations. Editor: Mary Sears, A collection of 30 papers presented at the first International Oceanographic Congress by world-renowned authorities. An interdisciplinary refer-ence that deals with some of mankind's most profound questions . . . the origin and history of living things, for example, and the history of our galaxy as recorded in marine sediments. Of interest to both the scientist and the layman concerned with oceans as a potential source of food for an overcrowded planet, the influence of oceans on our weather, and other similar phases of oceanography.

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

British Agents: Bailey Bros. & Swinfen, Ltd., Warner House, Folkestone, Kent, England

Circle Volumes You Wish To Order			American Association for the Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005
89	88	87	Please send the symposium volumes circled on this form, to:
86	85	84	
83	81	80	Name
79	78	67	Address City Code City

SCIENCE, VOL. 170



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

At last, everybody can see their timeshare 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.

There's no special operation or programming knowledge needed. You control the program. Plot numerical data in points, lines, curves, circles, ellipses, bar graphs or pie charts. Or, manipulate and expand computer data and plot in finished graphic form. You get smooth lines—not the staircase drawn by the incremental recorder.

Use the HP 7200 simultaneously with your time-share terminal or silence the terminal and use the plotter alone. Because it goes to work when the data comes in, there's no time lag.

Simple manual controls allow you to set the graph limits to fit any preprinted grid. HP's Autogrip electrostatic holddown firmly grips any graph paper up to 11×17 inches.

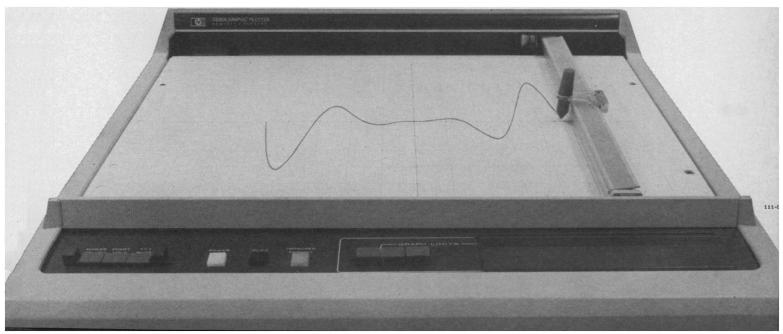
You can arrange to add a graphic plotter to your existing time-share

terminal by contacting Hewlett-Packard. Buy it at \$3,300. Rent it. Lease it. Or lease to buy.

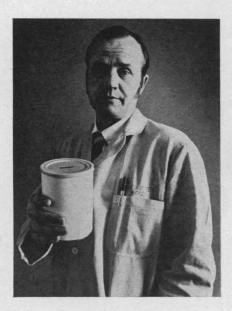
We can match a 7200 with any EIA ASCII terminal in the business... or even IBM's 2741..So now, everybody can be the arty type. For details, contact Hewlett-Packard, Palo Alto, California 94304; Europe: 1217 Meyrin-Geneva, Switzerland.



Circle No. 43 on Readers' Service Card



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 easiestto-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.

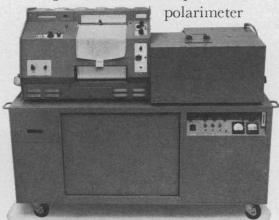
The performance-proven double monochromator and special optical design features of the Cary 61: minimize stray light, reduce the occurrence of artifacts, allow penetration into the ultraviolet with complete confidence, and sharply define small spectral details over its entire 185-800 nm range.

As for CD performance, if the 61 can't do it, nothing else can.

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 spectro-



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.



SCIENCE, VOL. 170

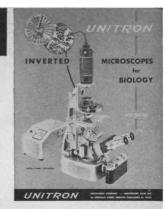


A COMPTHE FAMILY OF INCRESS AND ACCESSIVES FOR RESEARCH - INDUSTRY - EDUCATION

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.

A UNITRON MICROSCOPE CATALOG is Yours for the Asking.













UNITRON

UNITRON



INITRON

TRY ANY UNITRON MICROSCOPE FREE FOR 10 DAYS

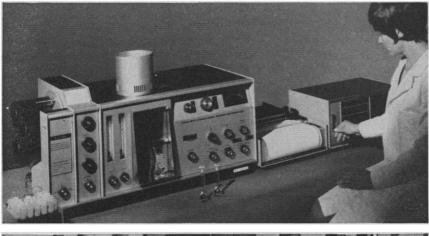
A salesman's demonstration gives you only about 30 minutes to examine a microscope, hardly the best conditions for a critical appraisal. But UNITRON's Free 10 Day Trial gives you the opportunity to evaluate any model in your own laboratory and prove its value in your own application before you decide to purchase. See for yourself, as have thousands of other buyers, why . . .

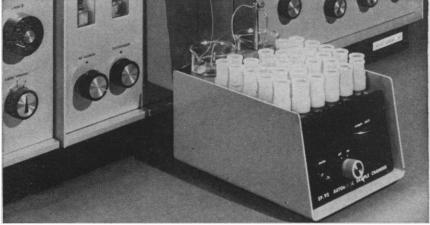
UNITRON Means More Microscope for the Money.



INSTRUMENT COMPAN

Tame the elements. Mine the metals.







Unicam SP90 Series 2 Atomic Absorption Spectrophotometer

Built-in flame emission facility Wide choice of flame and burner systems High accuracy and precision Digital readout and printout option Multiple lamp turret 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 Automatic printout of results in Concentration 0.05 ml blood sample requires only a single dilution



50 S.FULTON AVE, MT. VERNON, N.Y. 10550

Circle No. 44 on Readers' Service Card →

782

Circle No. 1 on Readers' Service Card

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 -1.399to + 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 KCI.

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

pHantastic

825

40 J-L 60 20 O

TEMPERATURE °C

pH-102

FUNCTION

EXP pH pH 0-14

RANGE

SLOPE

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: <u>Brink-</u> mann Instruments, <u>Cantiague Road</u>, <u>Westbury</u>, <u>N.Y. 11590</u>. In Canada: 50 Galaxy Boulevard,

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





The best way to

measure pH?

Perhaps you place portability first in a pH meter. Look no further than our Model PBL, with its rugged case, tautband 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.

5

DR

NX

1 B

LSX

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 7½inch 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. Solidstate circuitry to keep things trouble-free. The price? \$600.

Or true-electronic, digital, direct

Circle No. 22 on Readers' Service Card

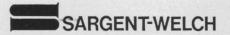
reading may be your idea of perfection.

LS

PBX

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, plugin 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

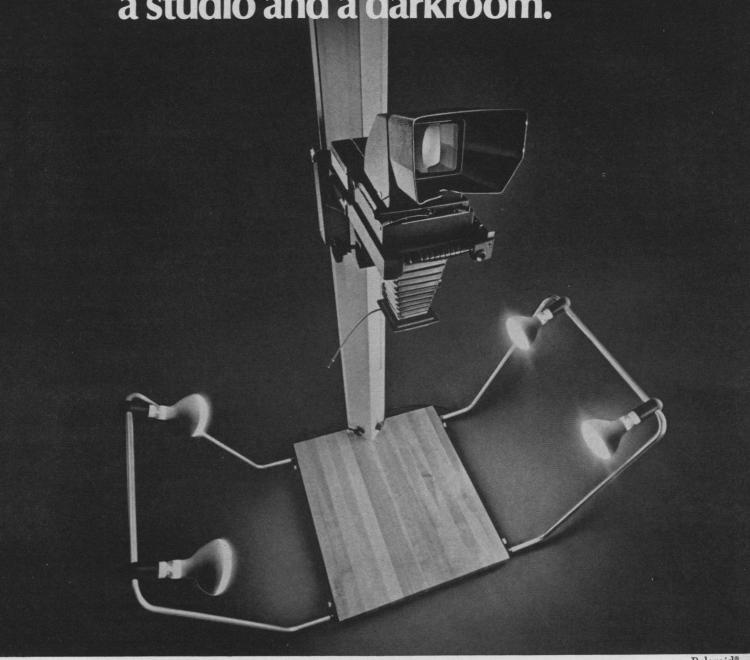


Scientific instruments, apparatus, chemicals. Sargent-Welch Scientific Company 7300 N. Linder Ave.; Skokie, Illinois 60076

Chicago/Anaheim/Birmingham/Cincinnati Cleveland/Dallas/Denver/Detroit Springfield, N.J./Toronto/Montreal/Vancouver SCIENCE, VOL. 170

784

You're looking at 10 cameras, a studio and a darkroom.



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. \Box Jeolco's new S1 scanning electron microscope. Which puts quality, high-volume scanning capability in only 3 x 4 feet of laboratory floor space. \Box Our unique way of getting right down to the surface of specimens. \Box 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. \Box And guaranteed resolution of 250 angstroms. \Box With a unique goniometer stage tilting -5 to $+45^{\circ}$, 360° continuous rotation. Air locks. 4 x 5" Polaroid camera. And a fully automatic vacuum system. \Box With color-coded controls that work like people do. So the JSM-S1 is far simpler to learn and operate. \Box 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. \Box Which all helps make the Jeolco S1 compact. And simple. \Box Give it a little room in your lab. \Box Never will so many owe so much to so little. \Box For details, please write Jeolco (U.S.A.) Inc., 477 Riverside Avenue, Medford, Massachusetts 02155, Telephone (617) 396-6021.

Circle No. 18 on Readers' Service Card

Circle No. 2 on Readers' Service Card -

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-asyou-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.



ANALYTICAL INSTRUMENTS



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 PhysiometricTM 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



20 NOVEMBER 1970

with direct reading dial.

Electronic zero base line accuracy: \pm 2% full scale.

Linearity: ± 1% full scale.

Calibration accuracy: \pm 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 Preampifier 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 \pm 2%.

Input impedance: 1 x 10¹¹ ohms, differential or single ended.



Input bias current: <1 x 10⁻¹² amps@ 25°C. Input offset current: 1 x 10⁻¹² amps@ 25°C.

Input common mode range: \pm 5 volts.

Input common mode rejection: $80 \text{ db}, @\pm 5 \text{ volts and } 60 \text{ Hz}.$

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: \pm 1.0 volts.

Input offset voltage: Adjustable through zero with fine and course controls, variable to \pm 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).

Circle No. 42 on Readers' Service Card

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).

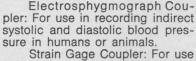
New Solid-State Channel Amplifier and Coupler

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

graphs. 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.



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.

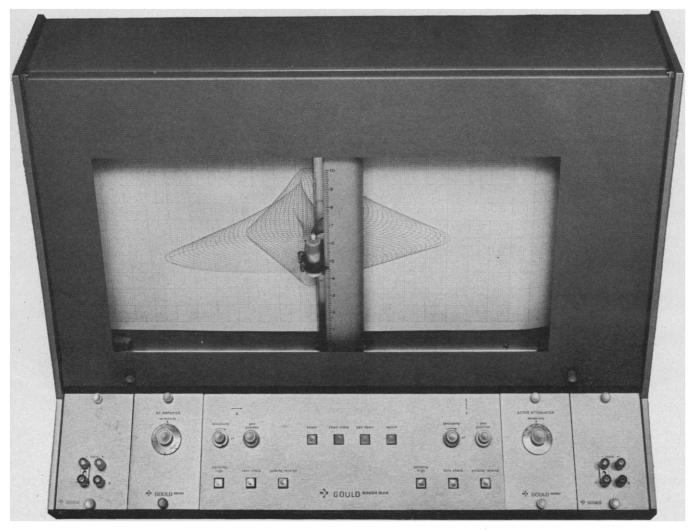
Physiograph Life Science Instrumentation

P. O. BOX 12511, 7651 AIRPORT BOULEVARD, HOUSTON, TEXAS 77017, A/C 713, 644-7521, CABLE: FISIO





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. Hightorque servo-motors produce writing speeds up to 100 inches per second while acceleration is 1750 in/sec² in the X direction, 2750 in the Y. Our non-contact servo-loop feedback system controls pen movement

continuously. It enforces linearity

of 99%%, 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 builtin 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.



Circle No. 4 on Readers' Service Card

SCIENCE, VOL. 170





our point of view!

0

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

0 4

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.



What drives scientists mad?

Lousy customer service, that's what. So S/P did a little research on the subject. Unlike Dr. Jekyll, we found no magic formula for creating two people out of one S/P Representative. So we did the next best thing. We created his

alter ego—the S/P Customer Service Representative. They're trained exactly like your S/P Representative. So when your S/P Representative is out calling on customers like you, your S/P Customer Service Representative stays home to answer your questions and to make sure your order is promptly, accurately filled and delivered. Who knows how many scientists we have kept from going over the edge? If you feel yourself slipping, place a quick call to your S/P Representative. You'll find

us listed in the Yellow Pages in most major cities. S/P...the single source for all laboratory equipment, supplies, scientific instruments. Scientific Products, a division of American Hospital Supply Corporation, 1210 Leon Place, Evanston, Illinois 60201.



Circle No. 7 on Readers' Service Card

SCIENCE, VOL. 170

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^ohigh 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.)

kons



Nikon AFM Auto-Microflex

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

ikor

IME

Now there's a 19" long x $10\frac{1}{2}$ " 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.

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

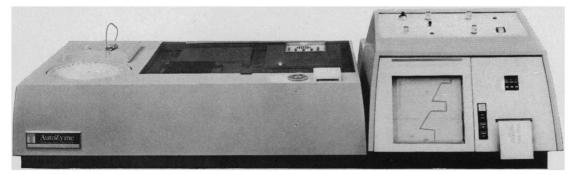
This photo of Taiwan, taken from a NASA Gemini spacecraft, could double that nation's fishing yield.

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.

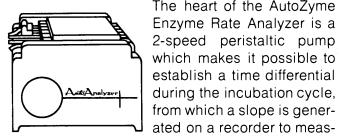
Zero to Sixty in Ten Seconds



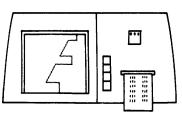
AutoZyme.

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.



This unique operation is accomplished in the following manner: In continuous flow analysis, each sample flows continuously through the system. It



The heart of the AutoZyme

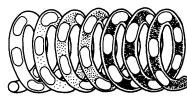
Enzyme Rate Analyzer is a

during the incubation cycle,

ure enzyme rate reaction.

is possible, therefore, to adjust the dwell time of a sample segment <u>during</u> 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.)

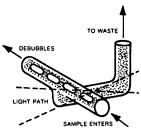
It is this capability that makes AutoZyme unique. For example: If a sample requires 60 seconds incubation time, it is possible for the beginning of. the sample stream to spend a full 60 seconds in the incubation bath, while by changing pump



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 repre-

senting 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.

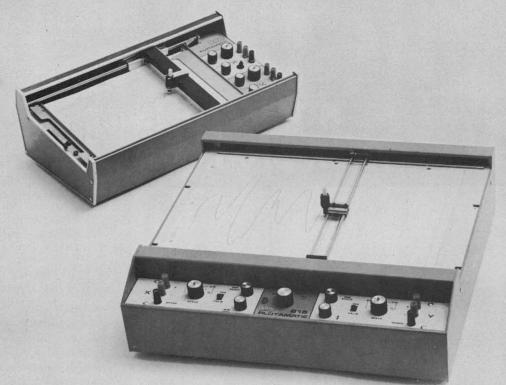
For more information, write to Department 115,



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 $(81/2" \times 11")$ is priced from \$750. The 800 series $(11" \times 17")$ 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.

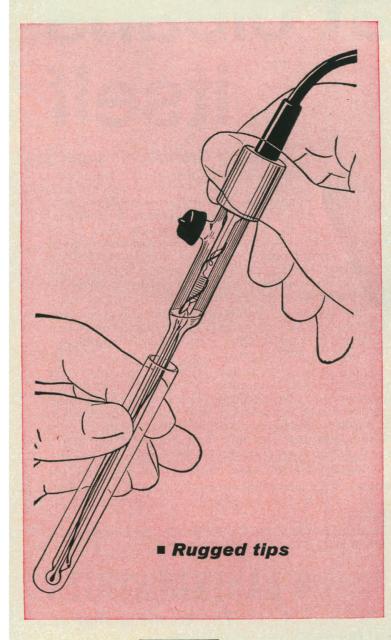
For additional information contact your laboratory supply dealer, or Schleicher & Schuell, Inc., Keene, New Hampshire 03431. (603) 352-3810

the first name in filtration Schleicher & Schuell



homas ... COMBINATION PH ELECTRODES

For samples from 0.2 ml to a tankful



FAST... FAST with PRECISION

FAST...

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 ¹/₄-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 %-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 $\frac{1}{2}$ -inch diameter for use in standard electrode holders. Stem is $\frac{1}{4}$ -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.

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

Circle No. 16 on Readers' Service Card

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

RTHUR H. THOMAS COMPANY

Scientific Apparatus and Reagents VINE STREET AT 3RD • P.O. BOX 779 • PHILADELPHIA, PA. 19105, U.S.A.

20 NOVEMBER 1970

omas

10-5

799

The pipet that cleans itself

(The L/I Grunbaum® pipet!)

The L/I Grunbaum pipet is the only selfcleaning 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 μ l, 0.2% at 500 μ l. Reproducibility: 2% at 1 μ l, 0.1% at 25 μ l and larger.

L/I stocks Grunbaum pipets from 1 to 1000 μl (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 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 determina-tions, is also available.

call or write today for free bulletin S-350.

COLEMAN INSTRUMENTS • 42 MADISON STREET • MAYWOOD, ILLINOIS 60153 • (312) 345-7500 A Division of The Perkin-Elmer Corporation

100

Very simply, we'd like to say that we are introducing a new low cost atomic absorption spectrophotometer and that we'd like to emphasize the combination of price, performance** and features.** Thank you.

 * Under \$3,000.
 ** The new Varian Techtron Model 1000 is not only fully able to handle trace, major constituent and quantitative analyses for more than 66 elements, but is also an excellent teaching tool. With extreme sensitivity in just about any concentration units

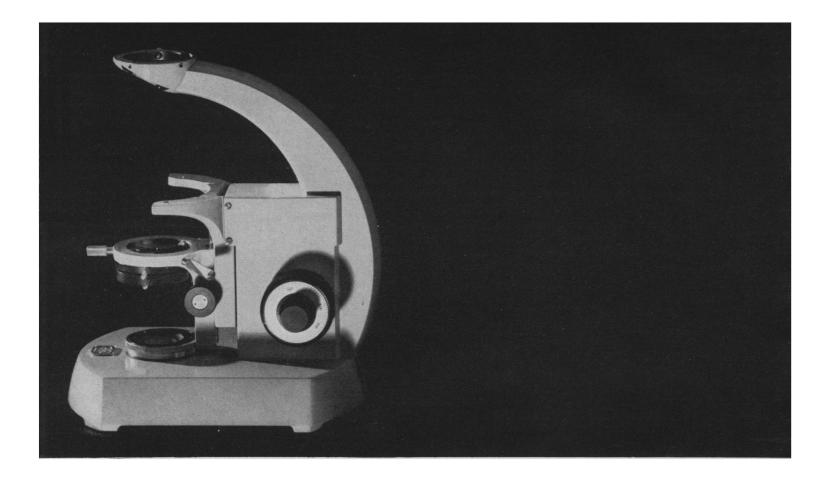
you need. Built-in features include flame emission chopper, variable slits, four-lamp turret, tilt-out meter and automatic baseline correction.



The 1000.

For complete details, or a demonstration, write Varian Techtron, Walnut Creek, California 94598; NEVA Azabudai Bldg., Tokyo, Japan; Malton, Ontario, Canada; Crows Nest, N.S.W., Australia; or Zug, Switzerland.





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



CARL ZEISS WEST GERMANY

A hare raising tale.

You've been asking for it.

A Charles River COBS[®] (caesarean-originated, barriersustained) 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 rabbitbreeding 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.



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 4x5 camera system. You'd want it to be completely automatic —exposure, film counting, frame-imprinting every frame-imprinting,every-thing — so that all you have to do to take a picnave to do to take a pic-ture is focus and push a button. You might need, too, a fully automatic 35mm camera that's easily and rapidly inter-changeable. You'd defi-bitch work streagt sched nitely want utmost stabil-ity-the kind that the Zeiss Ultraphot III, with its sliding mirror system (rather than bulky bel-lows) and its strong shock mounting, gives you. You'd want to use Polaroid® and have a projec-tion head available, and, for metallographic work, special disks for grain

6. You'd make sure everything was built into a sturdy and compact stand. And "everything": filters, ASA selector for speeds from 25 to 2000 evonue. 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 ½ to the eyepieces and ⅔ to the 4 x 5 camera, or 100% to the 35mm camera to the 35mm camera with its own focusing eveniece.)

size determinations. You might also need a Micro-Hardness Tester and a movie camera. So you'd make sure there was pro-vision for all these.

2. You'd insist on the highest quality optics—in other words, Zeiss optics. And you'd want them to And you'd want them to be completely inter-changeable with those on any other Zeiss micro-scope you may have or plan to add. So you'd have available to you the world's widest line of nave available to you the world's widest line of Planapochromats, Plan-achromats, Plan-Neoflu-ars, Neofluars, Ultraflu-ars, Achromats, Epi-plans, and Pol objectives for transmitted and reflected transmitted and reflected light-not to mention the unequaled Luminars and Epi-Luminars for photo-macrography.You'd want, in short, capability for 4 x 5 and 35mm photog-4 x 5 and 35mm photog-raphy at continuous mag-nifications from 2.5X to the limits of light micros-copy, 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 Ultra-ohet holds three at the phot holds three at the same time so you can switch from one to the other, or combine Mer cury and Tungsten for phase-fluorescence, all by a simple flip of a lever.

4. You'd expect it to be a simple matter to ex-change stages so that you can switch from re-flected to transmitted light, or vice-versa, in a matter of seconds. You'd want the same easy ex-changeability, too, of eye-pieces and condensers.

5. You'd want a specially designed instrument table, with ample work-ing space, drawers with fittings for all accesso-ries, and a built-in power supply.

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 photo-macrography—the Ultraphot III is the supreme instrument. Write Carl Zeiss, Inc., 444 Fifth Avenue, New York, New York 10018. Nationwide Service





ATLANTA, BOSTON, CHICAGO, COLUMBUS, DENVER, HOUSTON, KANSAS CITY, LOS ANGELES, PHILADELPHIA, SAN FRANCISCO, SEATTLE, WASHINGTON, D.C. Circle No. 19 on Readers' Service Card 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.

Then they discover how easy it is to program the 700 and store the program on a tape cassette for later use. Now there's no stopping them because the 700 is theirs.

Something else they quickly learn about

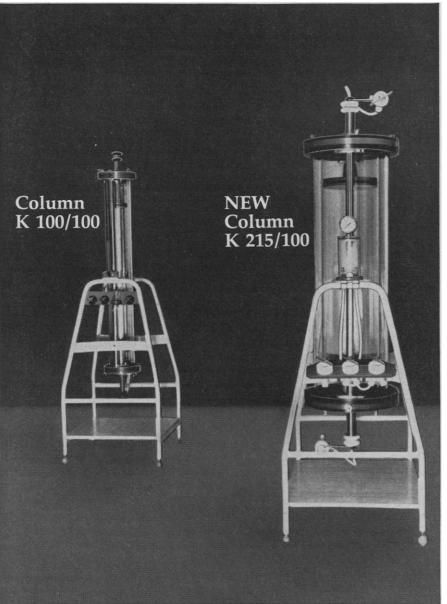
the 700 is that it is a real calculating system with a complete program library and two optional output devices.

Skeptical? For a convincing demonstration, call any one of our factory sales/service offices from coast to coast. Wang Laboratories, Inc., Dept. \$-11, 836 North Street, Tewksbury, Mass. 01876. Tel. (617) 851-7311.

Tested by skeptics.

WANG





For preparative gel filtration with analytical precision

- bed volumes from 4 to 7 litres and 20 to 32 litres, respectively.
- equipped with flow adaptors and operating panel with valves.
- $\hfill\square$ pivoted and jacketed.

Pharmacia Fine Chemicals Inc. 800 Centennial Avenue PISCATAWAY New Jersey 08854

808

A complete series of precision chromatographic columns are available. For further information, please ask for the booklets "Column K 100/100 and K 215/100" and "Sephadex Laboratory Columns".



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

BAUSCH & LOMB

ANALYTICAL SYSTEMS DIVISION

BAUSCH & LOMB

with instant concentration

linear absorbance to 2.0A, and transmittance

Now, for the first time-direct meter readings in Concentration, Linear Absorbance and Transmittance in a modestly priced spectrophotometer.

The Spectronic® 88 is easy to operate. There are no snap-in blank scales for Concentration, no verifying points, no calculations. Just read the meter. One wide set of scale markings lets you do all your samples in less time, without confusion. 0.1 × to 3.0 × scale expansion in the Concentration mode assures accurate readings of samples with low absorbance values.

SPECTRONIC BB A single knob selects the operating mode—Concentration, Transmittance or Linear Absorbance. You can read absorbance values between 0.0-2.0A over 16-inches of meter. The meter is 8-inches in length and reads from 0.0-1.0A. How-ever if your sample has an absorbance value higher than 1.0A, simply turn the selector knob to the 1.0-2.0A setting and read the value directly from the meter.

Specifications are excellent . . . an 8nm bandpass, photometric linearity better than .010A near .500A, less than 0.2% drift/day, uninterrupted wide wavelength range—no need to switch from UV to Visible to NIR because phototubes and stray light filters are automatically interchanged.

Sampling versatility is superb-interchangeable single and multiple cell compartments. There's virtually no restrictions on glassware. The 88 accepts test tubes up to 20mm path length; 1, 5, and 10mm rectangular cuvettes; cylindrical cells up to 100mm; flowthru and water jacketed 10mm cuvettes; and filter plates for special applications.

40 abutunt

The Spectronic 88 has more features and advantages than anything else within its price range. For the full story, write for catalog 33-6059 or request a demonstration. Analytical Systems Division, Bausch & Lomb, 9011-86 Linden Avenue, Rochester, N. Y. 14625.

Here's the rest of the family:

Spectronic 20®

World's most popular Spectrophotometer. Over 85,000 in use.



Circle No. 23 on Readers' Service Card

Spectronic 70®

Direct reading in Transmittance and Absorbance at low cost.

Spectronic 100®

4-place digital readout-linear Absorbanc Transmittance and Concentration.



peak performance

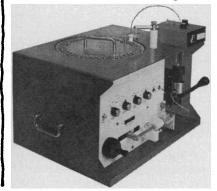


The ISCO Model 640 density gradient fractionator produces a continuous absorbance profile as the gradient is fractionated into a built in collector. All automatically. The results... perfect quantitative peaks.

It resolves zones undetectable by other methods. And it plots their exact location. Measuring the area under each peak precisely determines the mass of material in each zone.

All standard ultracentrifuge tubes fit the ISCO universal flow cell for absorbance scanning at 254 or 280 m μ . A selection of ten flow rates and twelve fraction sizes optimizes performance with different tubes and applications.

For more information on this and other ISCO equipment, write for our 1970 catalog.





4700 SUPERIOR LINCOLN, NEBRASKA 68504 PHONE (402) 434-0231 CABLE: ISCOLAB LINCOLN Circle No. 82 on Readers' Service Card 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

FREE



PROFITABLE READING...

Forty-eight different laboratories report "in-use" experience with automatic glassware washing and drying systems. This invaluable compilation presents application data in compact outline format and is available *free of charge* to all laboratory personnel.

Type of laboratory, location, number of personnel served, average number of pieces washed daily, operating procedure, and general comment, are given in these application reports.

This information passes along timesaving and money-saving ideas that can solve all kinds of laboratory glassware cleaning problems. A handy index lists usage reports alphabetically, by both type of laboratory and name of user. A special report describes successful results of the Veterans Administration's official 90-day evaluation test and lists some of the many U.S. Governmental Agencies using CRC Labwashers.

You will profit by reading this valuable new report. Send for this free booklet. We'll include full descriptive literature on our Labwasher models.



THE CHEMICAL RUBBER co. 18901 Cranwood Parkway Cleveland, Ohio

Circle No. 85 on Readers' Service Card SCIENCE, VOL. 170 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

20 NOVEMBER 1970

Fast, accurate delivery to the last µl.

The new Micromedic Automatic Pipette was designed specifically to handle fluid volumes under 20 μ l. Its two motor-driven pumps perform simple dilution or reagent dispensing operations on a 6-second cycle with better than 2% accuracy. Sample repeatability is 0.1% or better.

Five interchangeable pumps give the unit a sample capability from 1 μ l to 5000 μ l. Their sinusoidal action assures smooth, precise operation. Just dial the percentage of stroke desired, with any pump combination, for any reagent—all critical parts are corrosion resistant and, in diluting procedures, the line is flushed clean with delivery.

Model 25000 is available with hand or foot switch and all accessories. Reliability has been established by over 24 months of trouble-free operation in out-of-house laboratory testing. For complete specifications write:

Rohm and Haas Building Independence Mall West Philadelphia, Pa. 19105

Circle No. 83 on Readers' Service Card



Circle No. 84 on Readers' Service Card

Our new economy compact. Take it for a spin.

Our new PR-J general-purpose refrigerated centrifuge costs a lot less than its competition.

It takes up a lot less room: only 14 cubic feet. And it's portable.

But the PR-J does a full-size job. It offers a solid-state, non-modulating speed-control system with automatic acceleration. Plus pre-pro-

PR-J does the rest.

tubes. At speeds from 500 to 5,100 rpm, with gravities to 4,070xg. Speeds up to 21,200 rpm and 31,000xg with an optional multi-

grammed temperature, speed and speed attachment. And it takes all time control. Just push a button: the our PR-2 accessories. For full details, write to us for Bulletin PR-J at 300 The PR-J handles everything from Second Avenue, Needham Heights, 1000 ml bottles to 12x75 mm serum Mass. 02194. Or call your IEC dealer.



Calluson it.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the rescutation and discussion of important issues presentation related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material of view, rather than by publishing only material on which a consensus has been reached. Accord-ingly, all articles published in *Science*—including editorials, news and comment, and book reviews -are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Editorial Board 1970

GUSTAF O. ARRHENIUS FRED R. EGGAN HARRY F. HARLOW MILTON HARRIS

1971 NEAL MILLER BRUCE MURRAY

RICHARD C. LEWONTIN

ALFRED O. C. NIER FRANK W. PUTNAM

JOHN R. PIERCE

THOMAS EISNER Amitai Etzioni EMIL HATIRY DANIEL KOSHLAND, JR.

Publisher

Editorial Staff

Editor PHILIP H. ABELSON

Business Manager HANS NUSSBAUM WILLIAM BEVAN

Managing Editor: ROBERT V. ORMES

Assistant Editors: ELLEN E. MURPHY, JOHN E. RINGLE

Assistant to the Editor: NANCY TEIMOURIAN

Foreign Editor: JOHN WALSH

News Editor: DANIEL S. GREENBERG

News and Comment: LUTHER J. CARTER. PHILIP M. BOFFEY, CONSTAN SCHERRAINE MACK HOLDEN, ROBERT J. BAZELL, CONSTANCE

Research Topics: Allen L. HAMMOND

Book Reviews: Sylvia Eberhart, Katherine Liv-INGSTON, ANN BARKDOLL

Cover Editor: GRAYCE FINGER

Editorial Assistants: JOANNE BELK, ISABELLA BOULDIN, ELEANORE BUTZ, CORRINE HARRIS, OLIVER HEATWOLE, ANNE HOLDSWORTH, ELEANOR JOHNSON, MARSHALL KATHAN, MARGARET LLOYD, DANIEL RABOV-SKY, PATRICIA ROWE, LEAH RYAN, LOIS SCHMITT, BARBARA SHEFFER, RICHARD SOMMER, YA LI SWIGART, ALICE THEILE, MARIE WEBNER

Membership Recruitment: LEONARD WRAY; Sub-scriptions: BETT SEEMUND; Addressing: THOMAS BAZAN

Advertising Staff

Production Manager Director EARL J. SCHERAGO BONNIE SEMEL

Advertising Sales Manager: RICHARD L. CHARLES

Sales: NEW YORK, N.Y. 10036: Robert S. Bugbee, Mew Hork, N.I. 1003. Robert S. Bigbee, 11 W. 42 St. (212-PE-6-1858); SCOTCH PLAINS, NJ. 07076; C. Richard Callis, 12 Unami Lane (201-889-4873); MEDFIELD, MASS. 02052; Richard M. Ezequelle, 4 Rolling Lane (617-444-1439); CHICAGO, ILL 60611; Herbert L. Burklund, Room 2107, 919 N. Michigan Ave. (312-DE-7-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772)

EDITORIAL CORRESPONDENCE: 1515 Massa-chusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. See also page xv, *Science*, 25 September 1970. ADVERTISING CORRESPOND-ENCE: Room 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE-6-1858.

- Circle No. 11 on Readers' Service Card

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

SCIENCE

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

Nalgene labware won't shatter your lab budget.

Shattered labware means unnecessary replacement costs. You can save that money by specifying the permanent replacements-unbreakable Nalgene Labware.

Over 170 precision-designed Nalgene Labware items meet practically every lab application. Select the material you need: transparent TPX and polycarbonate, indestructible Teflon, translucent polyethylene and polypropylene. When you need calibrated ware, Nalgene Labware meets or surpasses glass accuracy requirements, and autoclavability is no problem.

> Your initial cost is comparable to the labware that breaks. But because Nalgene Labware is more durable than glass, you'll save money through longer, safer equipment life.

> > Next time you order, specify the permanent replacements—unbreakable Nalgene Labware.



NALGE

Order Nalgene Labware from your Laboratory Supply Dealer. Ask for our Catalog or write Dept. **85231**, Nalgene Labware Division, Rochester, N.Y. 14602.





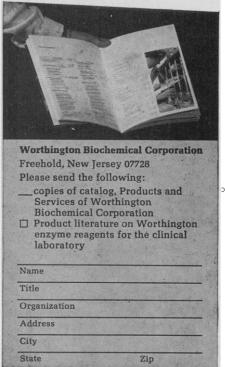
for research enzymes, enzyme reagents, nucleotides and new analytical services

Our new catalog contains what you would expect—hundreds of high-purity enzymes for research, and our complete group of enzyme reagents for the clinical laboratory.

And it contains a lot more that is completely new:

- Nucleotides, comprised of a group of 73 basic compounds frequently required in biochemical and clinical laboratories.
- **Premium enzymes,** consisting of 18 fully-characterized enzyme products of outstanding purity and activity.
- Radioactive enzymes, including seven hydrolytic enzymes and four tritiated substrates, which make highly sensitive analytical tools.
- Enzymes in quantity, comparable to Worthington research enzymes in quality, offered for use in other products or processes.
- Analytical services, including complete amino acid and ultracentrifugal analysis, available to individual researchers and institutions on a contract basis.

All told, our catalog offers the most complete range of products and services related to the multiple aspects of enzymology. Use the attached coupon to request your personal copy and another one for an associate.



Circle No. 91 on Readers' Service Card

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."

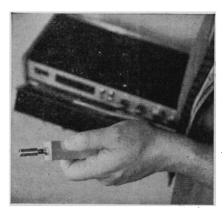
20 January. Physical chemistry of seawater (F. Millero, discussion leader): F. Millero, "The importance of ion-water and ion-ion interactions in the physical chemistry of seawater"; R. Horne, "Solute-water interactions in seawater"; J. Gieskes, "Ion-ion interactions in seawater." Organic and biological 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

Background radiation complicating your experiment?

GE's new NUCLE EYE Monitor nuclear counting system may solve your problem.

Unique high-speed solid-state circuitry lets the ultra-sensitive. General Electric NUCLE EYE Monitor detect events almost as fast as they occur. And its point probe detection head makes a mighty small target for cosmic particles. Result? Background count is virtually eliminated. No cooling ... no lead bricks. 162-58



Completely portable, the NUCLE EYE Monitor lets you get closer to your work. From \$2995.

For more information, contact Space Technology Products, P.O. Box 8439, Philadelphia, Pa. 19101. Phone: (215) 962-8300



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 electrodesmechanisms 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 de-Levie 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

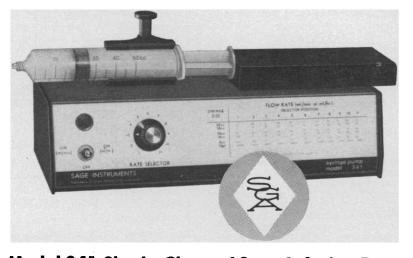
Willard R. MacDonald, chairman; Fred E. Bailey, vice chairman.

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):

20 NOVEMBER 1970

132 FLOW RATES



Model 341 Single-Channel Sage Infusion Pump

low cost - high reproducibility

Single syringes of every type and in any size from 50 cc down to microliter can be accommodated by the unique spring-loaded syringe holder on this multiplepurpose, easy-to-operate, syringe pump...designed for accurate, single-channel infusion of fluids.

Flow rates are pre-calibrated and highly reproducible... offered in two ranges—ml/min and ml/hr. All told there are 132 flow rates—66 in each range. All are clearly shown on a flow rate chart right on the pump panel. To obtain the rate you want between .0092 μ l/hr and 13 ml/min, you simply set one dial and one center-off switch. A flow range of 2350 to 1 is available with any one syringe. (Additional flow rates can be had by using microliter size syringes.)

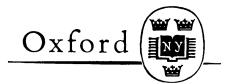
Model 341 is powered by a heavy-duty motor which enables it to pump against a maximum of 300 mm Hg with a 50 cc syringe and against larger back pressures with smaller syringes.

Ask us for more information.

P-9001X Sage Syringe Pump, Model 341, for 115 volts AC ±10%, 50/60 Hz, 125 ma. Overall size: 12¼″x5″x4½″. Each\$250.00

ALSO AVAILABLE . . . Sage Series 350 Syringe Pumps with *triple* syringe holder. Models 351 and 352 are discrete rate pumps. Model 355 is a continuously variable speed infusion type. Each has a broad range of flow rates. *Details on request.*





Dictionary of Organic Compounds

The Constitution and Physical, **Chemical and Other Properties of** the Principal Carbon Compounds and Their Derivatives, Together with Relevant Literature References; Fourth Edition, Sixth Supplement

Edited by J. B. THOMSON, The University, St. Andrews. This Sixth Supplement differs from all of its predecessors by the inclusion of an index in empirical formula sequence. The majority of new entries are derived from papers published during 1969, although entries have been added for notable omissions and errors in the main dictionary and the Cumulative Supplement. Illus. \$29.00

Jean D'Alembert

Science and the Enlightenment

By THOMAS L. HANKINS, University of Washington, Seattle. In eighteenth-century France there was a strong interaction between scientific ideas and philosophy. D'Alembert's career spanned the two worlds of the academies and society, and he played a part in many of the scien-tific controversies of his time. Professor Hankins elucidates D'Alembert's scien-tific thought and places it in the context of the intellectual world of Enlightenment \$11.25 France. 10 text figures.

The Metric System

A Critical Study of Its Principles and Practice

By M. DANLOUX-DUMESNILS, l'Ecole By M. DANLOOX-DOMESNILS, *iEcole* Nationale Supérieure de l'Aéronautique; translated by ANNE GARRETT and J. S. ROWLINSON, both of Imperial College, London. This study traces the history, form, and development and extension of the metric system. The author shows that metric system is close to perfect. though little understood and often misused. An appendix contains the language of logarithms and an index of properties and units. (The Athlone Press.) Paper, \$2.50

Ouantum Mechanics of

Molecular Rate Processes

By RAPHAEL D. LEVINE, Ohio State University. This monograph provides a survey of the quantum-mechanical theory of collisions and rate processes and its application to molecular problems. The first part of the book reviews the Dirac-von Neumann formulation of quantum mechanics, the second formulates quantum me-collision in terms of the Lippmann-Schwinger equation. The third part deals with application and further extensions of the theory. 19 text figures. \$14.50

OXFORD UNIVERSITY 👑 PRESS 🕍

200 Madison Avenue, New York, N.Y. 10016 Circle No. 81 on Readers' Service Card

J. C. Halpin, "Polymeric compositesan 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. Т. 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 nology, 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 Nat-ural History Survey, 179 Natural Resources Bldg., Urbana 61801)

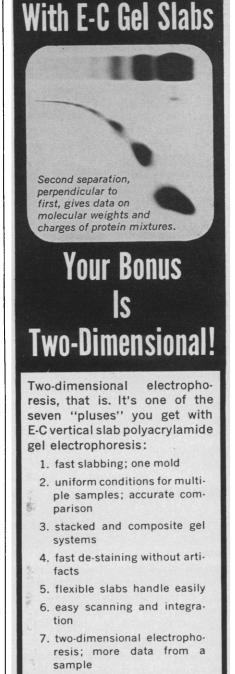
27. National Assoc. of Science Writers, Chicago, Ill. (Mrs. R. Arctander, Box H, Sea Cliff, N.Y. 11579)

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,

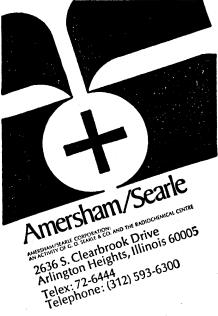


With E-C polyacrylamide gel electrophoresis, you can make your samples work twice as hard for you. Make us work, too. Call Technical Service at 215 382-9100 (collect) for details. Or write for a copy of "Vertical Gel Electrophoresis". E-C Apparatus Corporation, 755 St. Marks St., University City, Phila., Pennsylvania 19104.



A Milton Roy Company

Circle No. 92 on Readers' Service Card



TWO BETTER LABELLED INULINS NO KIDNEYING.

Labelled inulin (polyfructosan) is widely used in the determination of glomerular filtration rate and extracellular space.

Amersham/Searle's two new labelled inulins (hydroxymethyl-C14) inulin and inulin-H³ are the only labelled inulins which do not contain any reactive groups other than those in native inulin. They also have very high chemical and radiochemical purities and a known narrow range of molecular weight (~5,000).

(Hydroxymethyl-C14) Inulin

Order No.: CFA-400 Specific Activity: 5-15mCi/mmole 50uCi...\$55 0.1mCi...\$100 0.5mCi...\$375 Order No.: CFA-400P Specific Activity: 1.5-5mg/ml (5uCi/ml) 50uCi Vial...\$40 then \$30/50uCi

Inulin-H³

Order No.: TRA-324 Specific Activity: 100-300mCi/mmole 0.25mCi...\$30 1mCi...\$70 5mCi...\$210 Order No.: TRA-324P Specific Activity: 100-300mCi/mmole 0.1mCi Vial ... \$20

OUR SPECIFIC ACTIVITY IS SERVICE

Circle No. 95 on Readers' Service Card

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., Stan-

ford, 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., Lon-don, 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, Grad-uate 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.,



An Introduction to the Study of Man

By J. Z. YOUNG, University College, London. In providing the basic facts of human biology, this volume traces the agents which control human activity from their biochemical basis to the highest levels of consciousness. Discussions cover in detail such subjects as the stages of human evolution, population growth and control, individual development, war and aggres-sion, pollution, and man's increasing awareness of the workings of his brain. Spring 1971 800 pp. 256 figs.

prob. \$10.00

Geology

SECOND EDITION

By WILLIAM C. PUTNAM; Revised by ANN BRADLEY BASSETT. The Second Edition of this well known book is fully up-to-date. Detailed discussions of conti-nental drifting, plate tectonics, lunar geology, oceanography, and earth resources are brought to the limits of current understanding. The First Edition appealed to students because it expressed an identifi-able attitude toward the earth and its study. This attitude is made more explicit in the Second Edition. Environmental problems are discussed fully and man's tampering with geologic processes is made use of in explaining the processes themselves.

Spring 1971 500 pp. illus. text edition \$10.00 trade edition \$12.00 Spring 1971

Exploring the Universe

SECOND EDITION

Edited by LOUISE B. YOUNG, Science Editor, American Foundation for Con-tinuing Education. This book of readings offers an orientation for understanding the principles on which the space age has been built and suggests the methods and nature of man's exploration of the uni-verse. The reader is introduced to the attudes and motivations of scientists through the use of original writings, ranging from Newton's description of the refraction of light to the modern cosmologist's debate on theories of creation. Emphasis is placed upon the relation of science to art, philosophy, and literature. Spring 1971 650 pp. 200 illus.

650 pp. cloth \$12.00 paper \$6.50

An Introduction to Stellar **Atmospheres and Interiors**

By EVA NOVOTNY, Staff Scientist, Astronomy Branch, Manned Spacecraft Cen-ter, Houston. Written at the intermediate level, this introduction to astrophysics explores the basic theoretical concepts of stellar atmospheres and interiors. It in-cludes such topics as radiation transfer theory, model atmospheres, absorption-line formation, energy generation, degenerate matter, and stellar evolution. Fall 1971 approx. 350 pp. prob. \$9.50



Circle No. 78 on Readers' Service Card



Honolulu, Hawaii. (R. Chattopadhyay, Univ. of Hawaii, 2565 The Mall, Honolulu 96822)

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)

 $17-2\overline{1}$. 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)

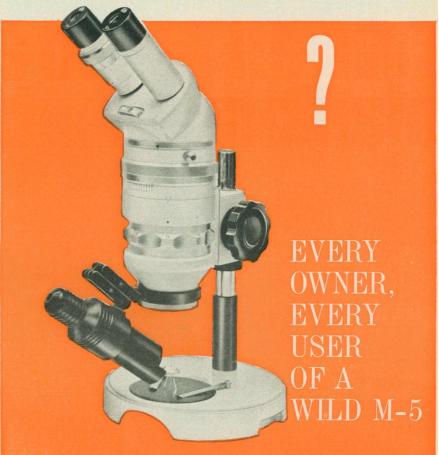
22. Bibliographical Soc. of America, New York, N.Y. (T. R. Adams, John Carter Brown Library, Brown Univ., Providence, R.I. 02912)

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)

20 NOVEMBER 1970

who ever heard of a customer designed stereomicroscope



Customer designed power? With easily interchangeable eyepieces and attachment objectives, you can choose the power range you need, from 2x to 200x.

Customer designed versatility? Specify your requirements in light sources, stages, stands, polarizing, measuring and photographic attachments.

Customer designed flexibility? Change your field of investigation, research, or observation method tomorrow. The M-5 can quickly change, and grow, with your needs. Just one example as illustrated: Your work takes you to dissection. You need adjustable depth of focus to keep specimen, scalpel or forceps in clear focus. You add the new double iris diaphragm, get greatly increased depth of focus, and retain maximum resolving power with a turn of the control ring.

Want to design your own stereomicroscope? Write for Booklet M-5, or for a demonstration.



Circle No. 28 on Readers' Service Card

You Mean I Can Get \$50,000 of TIAA Life Insurance for LESS THAN \$100?

That's what an Assistant Professor asked us when he heard about TIAA's low life insurance costs.

It's true. At his age 30 the annual premium for a 20-Year Home Protection policy providing \$50,000 initial amount of insurance is \$159.00. The first-year dividend, based on our current dividend scale, is \$61.00, making a net payment of \$98.00. Dividends, of course, are not guaranteed.

The Home Protection plan is level premium Term insurance providing its largest amount of protection initially, reducing by

schedule each year to recognize decreasing insurance needs. This is just one example of the many low-cost TIAA plans available. If you need more protection for your family, ask us to mail you a personal illustration with figures for a policy issued at your age. We'll also send the Life Insurance Guide describing other TIAA policies.

E	LI	GI	B	1L	ITY
					and the second

Eligibility to apply for this or other TIAA life insurance is limited to persons employed at the time of application by a college, university, private school, or other nonprofit educational or scientific institution that qualifies for TIAA eligibility.

TEACHERS	INSURANCE	AND	ANNUITY	ASSOCIATION	1
730 Third	Avenue, New	York,	N. Y. 1001	7	t

(TIAA)

Please mail the new Life Insurance Guide and a personal illustration.

Your Date of Birth		
Street		
	10	
State	ZIP	
iniversity, or other educational of	r scientific institution	

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

SCIENCE, VOL. 170

908

Circle No. 31 on Readers' Service Card

ISONITRILE CHEMISTRY

A Volume of Organic Chemistry Series Editor: ALFRED T. BLOMQUIST

edited by IVAR UGI, Department of Chemistry, Univ. of Southern California, University Park, Los Angeles, California November 1970, 280 pp., \$14.50

SENSORY PROCESSES AT THE **NEURONAL AND BEHAVIORAL LEVELS**

edited by G. V. GERSUNI, Pavlov Institute of Physiology, U.S.S.R. Academy of Science, Leningrad, U.S.S.R. November 1970, 348 pp., \$18.00

CONTEMPORARY SCIENTIFIC PSYCHOLOGY

edited by ALBERT R. GILGEN, Department of Psychology, Beloit College, Beloit, Wisconsin November 1970, 344 pp., \$12.00

REDISTRIBUTION REACTIONS

by J. C. LOCKHART, Department of Inorganic Chemistry, School of Chemistry, The University Newcastle upon Tyne, England

November 1970, 173 pp., \$9.50

ATLAS OF VERTEBRAET CELLS IN TISSUE CULTURE

by GEORGE G. ROSE, The University of Texas at Houston, Dental Branch, Department of Medicine, Houston, Texas November 1970, 336 pp., \$24.50

ENTROPY FOR BIOLOGISTS:

An Introduction To Thermodynamics

by HAROLD J. MOROWITZ, Department of Molecular Bio-physics and Biochemistry, Yale University, New Haven, Connecticut 1970, 210 pp., Clothbound edition \$6.95 Paperback edition, \$4.95

SOIL AND WATER

Physical Principles and Processes

A Volume of Physiological Ecology by DANIEL HILLEL, Head, Department of Soil Science, The Hebrew University Faculty of Agriculture, Rehovot, Israel Series Editor: T. T. KOZLOWSKI January 1971, about 275 pp., in preparation

MILK PROTEINS: Volume 1

Chemistry and Molecular Biology

edited by HUGH A. McKENZIE, Department of Physical Biochemistry, Institute of Advanced Studies, Australian National University, Canberra, A.C.T., Australia 1970, 519 pp., \$28.50

BIOLOGY OF BATS

edited by WILLIAM A. WIMSATT, Division of Biological Sciences, Cornell University, Ithaca, New York **VOLUME 1** October 1970, 417 pp., \$25.00 Subscription price \$21.25 VOLUME 2 December 1970, about 450 pp., \$26.00 Subscription price \$22.10 Subscription prices for individual volumes valid only on orders for the complete set received before publication of the last volume.

PRIMATE BEHAVIOR

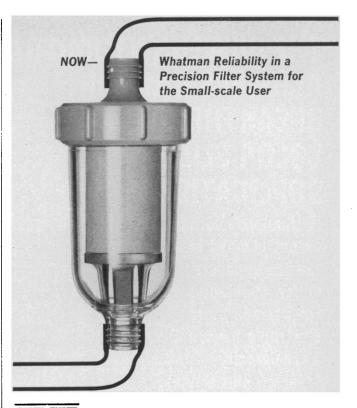
VOLUME 1

edited by LEONARD A. ROSENBLUM, Director, Primate Behavior Laboratory, Department of Psychiatry, Downstate Medical Center, Brooklyn, N.Y. November 1970, 400 pp., \$17.50

ACADEMIC PRESS

NEW YORK AND LONDON 111 FIFTH AVENUE, NEW YORK, N.Y. 10003

Circle No. 55 on Readers' Service Card



Whatman **MMA-12**

major innovation in high performance in-line filter units, the new Whatman Gamma-12 is designed specifically for high efficiency particle removal in a wide variety of environments. It uses disposable glass microfiber filter tube elements to achieve exceptionally high flow rates and remarkably high particle retention.

Whatman Gamma-12 can be used in-line or as an inlet or exhaust filter...it can be fitted with four grades of filter element covering a wide range of particle sizes, from 8 microns down to sterility levels.

The Whatman Gamma-12 unit has a transparent bowl that allows continuous inspection of the filter element ... replacement of the filter tube is simple, inexpensive, and no associated hardware is thrown away with the filter medium ... the complete unit can be autoclaved.

Gamma-12 is used for sterilization of air and maintenance of sterile environments . . . for the removal of microorganisms and particulate matter from water and other liquids . . . for virtually any filtration application in the laboratory or process plant. For the best results . . . the cleanest fluids . . . you need the finest in-line filter: Whatman Gamma-12.

For further information on this remarkable new unit, call or write for our free Gamma-12 brochure.



A reeve angel

H. Reeve Angel & Co., Inc. 9 Bridewell Place, Clifton, N.J. 07014 Sole Distributor in North America

BWhatman is a registered trademark of W. & R. Balston, Ltd., England. Circle No. 51 on Readers' Service Card

THE BOWENS ILLUMITRAN ACHIEVES A MAJOR BREAKTHROUGH IN COLOR SLIDE DUPLICATION –

continuously variable light output coupled to a direct reading exposure meter, constant color temperature electronic flash, no reciprocity failure...plus a range from half frame 35mm to 4x5. And that's not all.

WRITE for brochure and magazine articles which will give you useful ideas.

BOGEN PHOTO CORP.

232 So. Van Brunt St. Englewood, N. J. 07631



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.

SCIENCE, VOL. 170

Circle No. 88 on Readers' Service Card



CONSECUTIVE NUMBER LABELS

for test tubes, requisition forms, containers, control lots.

Easy-to-use, Time[®] Consecutive Number Labels are self-sticking — adhere to any surface in temperatures ranging from -70° F. to $+250^{\circ}$ F. Numbers can be repeated from 1 to 10 times on a choice of seven different



color stocks. Available in handy pre-cut tablet or clinically safe bacteriostatic roll form. Supplied with "No" prefix or your choice of 5 standard prefixes. Economical consecutive number labels increase lab efficiency.

FREE BROCHURE!

Write for samples, illustrated brochure, and the name of a dealer near you.

PROFESSIONAL TAPE COMPANY, INC. 365 EAST BURLINGTON ROAD, RIVERSIDE, ILLINOIS 60546 Circle No. 107 on Readers' Service Card

new stopped-flow spectrophotometric system

incorporating the Aminco-Morrow Stopped-Flow Apparatus and the New Aminco Grating Monochromator

- Permits reactions to be monitored after only 3 to 5 milliseconds' dead time
- Utilizes quantities as small as 100 μ l from each of the two reservoirs
- Allows reactants in reservoirs to be changed quickly and easily without tools

Other systems are available which incorporate the very versatile Aminco-Morrow Stopped Flow Apparatus and utilize instrumentation already in your laboratory. For further information about rapidreactions instrumentation write to



MERICAN INSTRUMENT COMPANY DIVISION OF TRAVENOL LABORATORIES, INC. Silver Spring, Maryland 20910





20 NOVEMBER 1970

Circle No. 54 on Readers' Service Card

LIGHT (18 ounces) AND SMOOTH (ball bearings)... OUR MM-33 MINIATURE MICROMANIPULATOR.

We designed the MM-33 for scientists in need of a lightweight micromanipulator with ultra-precision. Crafted of aluminum and weighing only 18 ounces, the MM-33 eliminates swaying, even on flexible stands. Ball-bearing slideways assure incredibly smooth, wear-free operation without backlash.

For ease of adjustment, all controls are aligned in a linear plane. Coaxial knobs control vertical and horizontal movements. Separate knobs control coarse and fine adjustment in the X plane, with micrometer drum and vernier readings to 0.1 mm with 10 micron accuracy. For mounting, a variety of stands are available.

For complete literature on the fantastic MM-33, write: E. Sobotka Co. Inc., 110 Finn Court, Farmingdale, N.Y. 11735.

)I(sobotka

Circle No. 90 on Readers' Service Card

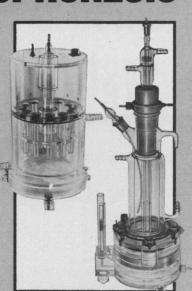
Analytical & Preparative GEL ELECTROPHORESIS

Buchler provides these important, temperature controlled instruments for separating proteins, hemoglobin, albumin, enzymes and other compounds using polyacrylamide or another supporting medium. For complete information and prices, write for appropriate bulletin.

POLYANALYST Basic analytical unit for separation and destaining. Migration takes place in 12 sample columns. Request Bulletin #3-1750.

POLY-PREP® "100" Preparative instrument for continuous fractionation and elution. Request Bulletin #3-1700.

BUCHLER



BUCHLER INSTRUMENTS DIVISION

1327 SIXTEENTH STREET, FORT LEE, NEW JERSEY, 07024

A SUBSIDIARY OF G. D. SEARLE & CO.

Rector, Cognitive Systems, 319 S. Robertson Blvd., Beverly Hills, Calif. 90211) 17–19. Solid State Circuits, intern.

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 Pa-

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 Educa**tion, 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, Mon-

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.

wood, 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 In-

stitute, 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)

Circle No. 29 on Readers' Service Card -

One-shot Macro with Bausch & Lomb's 35mm

Bausch & Lomb's 35mm Micro/Macro System for Technical Photography saves you time and money. The Canon through-the-lens spot-metering system assures convenient and accurate exposure measurements under all conditions. Most correction calculations have been eliminated. Time and film used in bracketing exposures are saved for more productive work. It surely is a "one shot" operation.

With extension tubes, rings or adjustable bellows you can get down close to your subject for 1:1 same size images on the film. Or, you can back off for an infinite number of magnifications, up to 15X without a microscope.

The right angle viewer makes for convenient observation of the specimen with the camera in the vertical position. For extreme, low-light level conditions there's a Light Meter Amplifier for exposures longer than one second. In effect, this optional attachment amplifies the available light by a factor of sixty-four.

Suggested list prices start at approximately \$500. Compare Bausch & Lomb with other less complete systems. Your checkbook will love you.

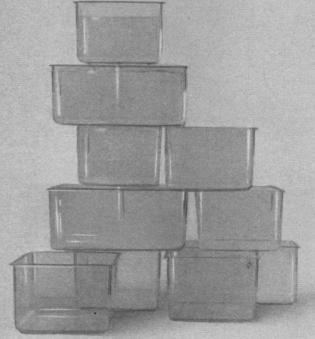
There's much more to the story and it's all in our new catalog 42-2326. Write for it and our free demonstration offer. 64235 Bausch Street, Rochester, N.Y. 14602

C

SCIENTIFIC INSTRUMENT DIVISION

BAUSCH & LOMB (

a new housing development...



engineered by research products. We started by rethinking the whole idea of small animal housing. The only 'standard' we retained is the size. A new mold - labored over long and lovingly produces cages of unusual clarity, with excellent visibility. New stacking posts increase stability and strength of the side walls. They do not stick or jam. And permit 20% more cages in transit or storage than 'standard'. New runners - with their flanged ends give the smoothest possible ride. No sticking, bumping, jiggling when you slide them into a cage rack. research products is a new company of people experienced in plastics engineering and animal cage development. Further, we manufacture our own cages. Which puts us in control of quality, inventory and shipping. And - if standard sizes don't suit your needs - our custom work is marked by the same excellence. You're dealing with the source.

research products

research products inc. 376 North Avenue Cranford, New Jersey 07016 201-276-3966 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, III. 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., Ana-

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

- Circle No. 34 on Readers' Service Card