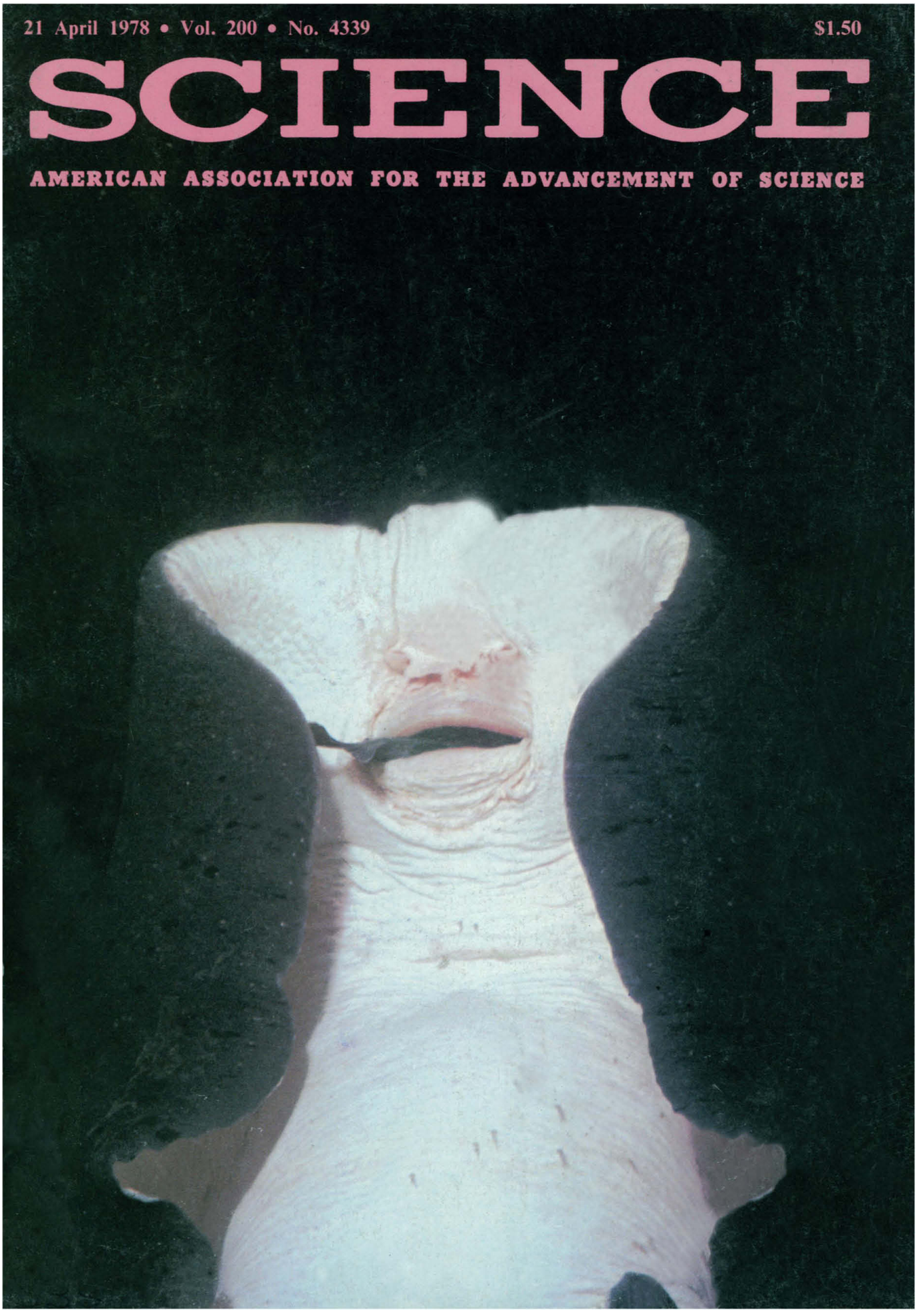
21 April 1978 • Vol. 200 • No. 4339 $1.50

SCIENCE

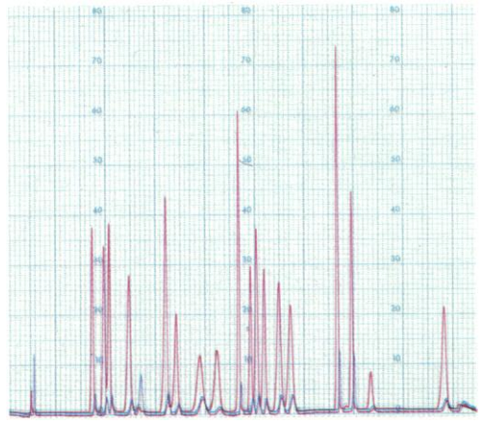
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



The sensible analyzer

The 119CL is the sensible amino acid analyzer that gives you fast, accurate results with simple programming and automatic operation—all at moderate cost. Beckman representatives install your analyzer, then thoroughly train you on your own instrument. Illustrated guides show you how to set up various runs. And the proven components of the Model 119CL assure you of reliable operation.

From a performance standpoint, the 119CL comes close to analyzers costing twice as much. For instance, its sensitivity of 0.5 nanomole means accurate analysis of very small samples. Solid-trace recordings are linear with concentration for easy quantitation. Fast run times

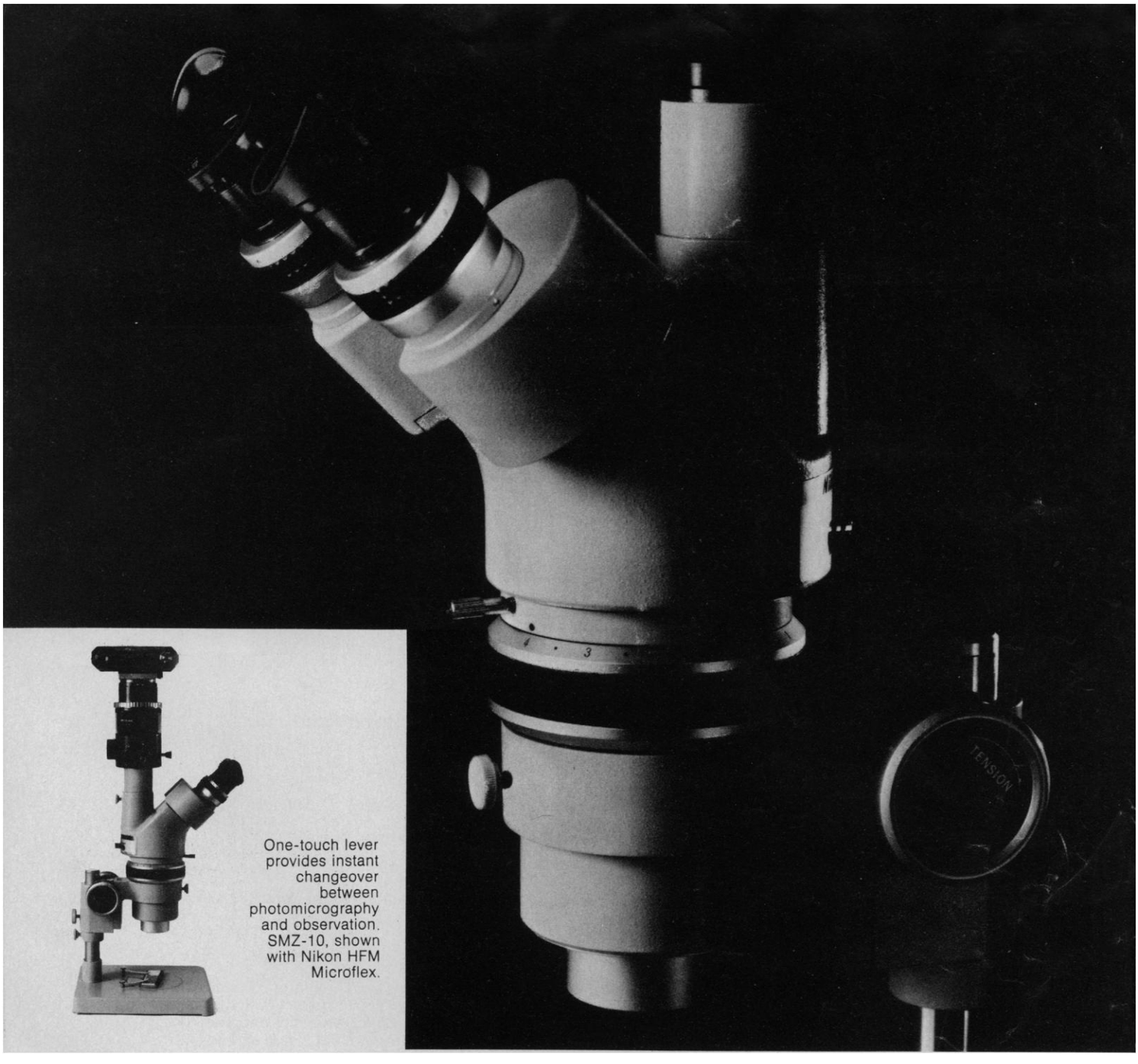


give complete single-column hydrolyzate analyses in only 1½ hours (see chromatogram) and single-column physiological separations in only 4½ hours—times which include regeneration and equilibration. And, if you want to eliminate tedious manual calculations entirely, just add the companion Model 126 Data System.

Send for literature on the sensible 119CL: the best-selling analyzer in the world. Ask for SB-428 from Spinco Division, Beckman Instruments, Inc., 1117 California Ave., Palo Alto, CA 94304.

BECKMAN®

Circle No. 286 on Readers' Service Card



One-touch lever provides instant changeover between photomicrography and observation. SMZ-10, shown with Nikon HFM Microflex.

The new Nikon SMZ-10 zoom stereo.

You won't believe your eyes.

Nikon optics deliver unbelievably sharp resolution. The SMZ-10 zoom stereo microscope's parallel optical system incorporates Nikon's new Extra-low-Dispersion (ED) glass and integrated multilayer coatings for unprecedented image quality. The eyepieces are ultra-wide-field for greater field coverage. The image can be viewed over a total magnification range of 3.3x to 160x, with the eyepieces and auxiliary objectives.

With typical Nikon attention to human engineering, the zoom control is generously proportioned for fingertip control and velvet-like smoothness of its 6x zoom ratio.

The new Nikon SMZ-10 lets you do more than view in stereo. It allows you to photograph in stereo exactly what you see. A unique feature of the SMZ-10 is its ability to photograph through the left and then the right optical paths at the touch of a lever. These paired photographs can then be viewed stereoscopically.

Accessories include a dual stereo teaching head, drawing tube, diascopic base with tungsten halogen light source, binocular head, and 0.5x and 2x auxiliary objective lenses.

The singular Nikon photographic system, Nikon optics, Nikon engineering, all at a price less than you might expect to pay. For complete details, contact Nikon Inc., Instrument Division, Ehrenreich Photo-Optical Industries, Inc., 623 Stewart Ave., Garden City, N.Y. 11530; (516) 222-0200.

Look to *Nikon*

ニコンとご用命下さい

Blicken Sie auf Nikon

Circle No. 146 on Readers' Service Card

ISSN 0036-8075

21 April 1978

Volume 200, No. 4339

SCIENCE

BOARD OF DIRECTORS

EMILIO Q. DADDARIO, Retiring President, Chairman
EDWARD E. DAVID, JR., President
KENNETH E. BOULDING, President-Elect
ELOISE E. CLARK
MARTIN M. CUMMINGS
RENÉE C. FOX
BERNARD GIFFORD

CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A): Mark Kac, Ronald Graham
PHYSICS (B): D. Allan Bromley, Rolf M. Sinclair
CHEMISTRY (C): William E. McEwen, William L. Jolly
ASTRONOMY (D): Paul W. Hodge, Donat G. Wentzel
PSYCHOLOGY (J): Brenda Milner, Meredith P. Crawford
SOCIAL AND ECONOMIC SCIENCES (K): Kurt W. Back, Gillian Lindt
HISTORY AND PHILOSOPHY OF SCIENCE (L): Robert S. Cohen, Diana L. Hall
ENGINEERING (M): Robert B. Beckmann, Donald E. Marlowe
EDUCATION (Q): Marjorie H. Gardner, James T. Robinson
DENTISTRY (R): Sholom Pearlman, John Termine
PHARMACEUTICAL SCIENCES (S): John G. Wagner, Raymond Jang
INFORMATION, COMPUTING, AND COMMUNICATION (T): Eugene Garfield, Madeline M. Henderson

DIVISIONS

ALASKA DIVISION: Donald H. Rosenberg, President; Keith B. Mather, Executive Secretary
PACIFIC DIVISION: Mildred Mathias, President; Alan E. Leviton, Secretary-Treasurer
SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION: Erik K. Bonde, President; Max P. Dunford, Executive Officer

SCIENCE is published weekly, except the last week in December, but with an extra issue on the third Tuesday in September, by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with **The Scientific Monthly**®. Second-class postage paid at Washington, D.C., and additional entry. Copyright © 1978 by the American Association for the Advancement of Science. Member rates on request. Annual subscriptions $65; foreign postage: Canada $10; other surface $13; air-surface via Amsterdam $30. Single copies $1.50; $2 by mail (back issues $3) except **Guide to Scientific Instruments** $6. School year subscriptions: 9 months $50; 10 months $55. Provide 6 weeks' notice for change of address, giving new and old addresses and postal codes. Send a recent address label, including your 7-digit account number. **Postmaster: Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.** ***Science*** is indexed in two general periodical indexes—**Readers' Guide to Periodical Literature** and **Monthly Cumulating Periodical Index**—and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORTS

MIKE MC CORMACK
FREDERICK MOSTELLER
RUSSELL W. PETERSON
CHEN NING YANG
WILLIAM T. GOLDEN
Treasurer
WILLIAM D. CAREY
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
Gerald M. Friedman
Ramon E. Bisque

BIOLOGICAL SCIENCES (G)
Ursula K. Abbott
Walter Chavin

ANTHROPOLOGY (H)
June Helm
Priscilla Reining

MEDICAL SCIENCES (N)
Leon O. Jacobson
Leah M. Lowenstein

AGRICULTURE (O)
James B. Kendrick
Coyt T. Wilson

INDUSTRIAL SCIENCE (P)
David B. Hertz
Robert L. Stern

STATISTICS (U)
Samuel W. Greenhouse
Ezra Glaser

ATMOSPHERIC AND HYDROSPHERIC SCIENCES (W)
Kenneth C. Spengler
Glenn R. Hilst

GENERAL (X)
Allen V. Astin
Joseph F. Coates

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 foster scientific freedom and responsibility, 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

Pacific electric ray (*Torpedo californica*) swallowing a small reef fish at night off Santa Barbara, California. After prey are immobilized by electric discharges, they are moved to the mouth with the ray's pectoral fins (shown folded in toward the trunk). The ray is 750 millimeters in length. See page 333. [Richard N. Bray, Marine Science Institute, University of California, Santa Barbara]

Our friendly computers help take the

With an HP desktop computer, you can concentrate on the productive aspects of problem-solving—on your own terms, at your own pace, at your own desk. Be creative, try various alternatives, experiment a little, make a few mistakes (we're all human), and come up with better solutions—still meeting those ever-present deadlines. Our System 45 is a powerful graphic and computational tool for people with no formal computer training, as well as for experienced programmers. With HP software, for example, you can construct a PERT system for a project with up to 1,800 activities, or do a Fast Fourier Transform on a set of up to 4,000 12-digit numbers. System 45 also provides the power for experienced users to write programs that will rotate three-dimensional objects, or design and analyze complex circuits, PC boards or IC chips. And much more.

drudgery out of problem solving. . .

Other friendly HP desktop computers are: the 9825, a versatile problem solver that can also handle your interfacing projects; and the low-cost 9815, ideal for repetitive calculations and data logging. HP offers a wide range of peripherals and a variety of options.

All HP desktop computers wake up smart. Simply turn them on and they're ready to help take the drudgery out of your problem solving, with no complicated start-up procedure to follow, no operating system to load, and no compiling to do.

Find out more about HP's friendly desktop computers.

Call your local HP Sales Office, or circle the reader service number.

HEWLETT hp PACKARD

408/1

P.O. Box 301-B, Loveland, Colorado 80537

For assistance call: Washington (301) 948-6370, Chicago (312) 255-9800, Atlanta (404) 955-1500, Los Angeles (213) 877-1282

Circle No. 211 on Readers' Service Card

. . .and the pain out of interfacing.

HP desktop computers extend their friendliness to interfacing with smart interface cards and a powerful I/O language. Each has a high-level interfacing language that eliminates struggling with complex, time-consuming code. Program editing is easy and direct. That's painless interfacing!

The 9825 offers interrupt, direct memory access, buffered I/O and a real-time clock. System 45 puts all these capabilities plus powerful graphics at your command. The 9815 fills the bill for most low-cost data logging.

You can order any one of them with interface cards to handle BCD, bit-parallel, bit-serial or HP-IB (our implementation of IEEE Standard 488-1975). Just plug them into the computer, connect your instruments to the cables, and you're ready to start programming.

HP desktop computers—friendly solutions for data acquisition, measurement and system control.

To learn more about HP's desktop computers and how they can solve your interfacing problems, call your local HP Sales Office, or circle the reader service number. Also, inquire about our OEM contracts and volume discount schedule.

HEWLETT hp PACKARD

P.O. Box 301-B, Loveland, Colorado 80537

For assistance call: Washington (301) 948-6370, Chicago (312) 255-9800, Atlanta (404) 955-1500, Los Angeles (213) 877-1282

Circle No. 212 on Readers' Service Card

408/1

Optics aren't the only thing to look at in a research microscope.

Of course, they are the most important. And ours are among the finest in the field.

But there are other features you should examine.

We've always tried to make our research instruments easy to use and adapt to a wide variety of techniques and applications.

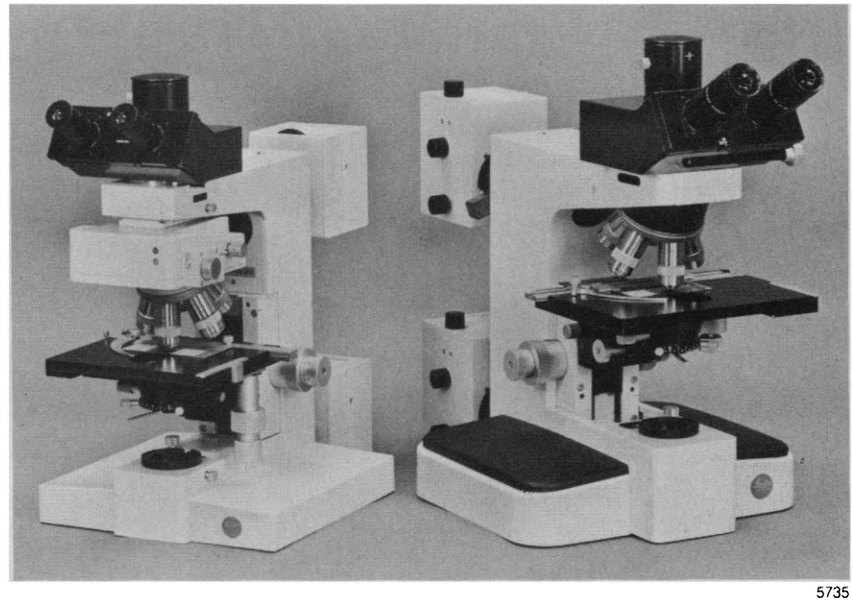
Many of these features aren't easy to see. Which is why we'd like to bring some of them to your attention.

Our fluotar objectives, for one example, offer some very distinct advantages.

They're color-coded to tell you at a glance which type you are using. And the sleeves rotate for rapid identification. That means no more craning your neck to identify the objective you're using.

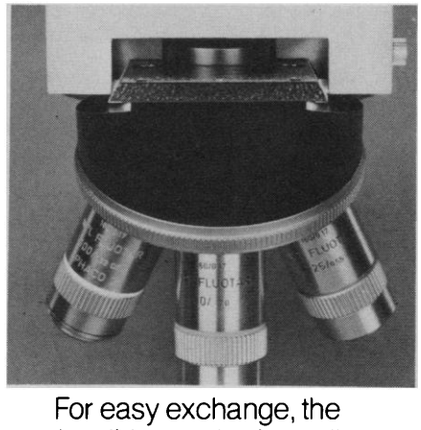
In addition, the knurled ring is placed low to make it easier to change objectives.

But don't overlook their truly superior optics. These are the result of combining the latest techniques in optical design with unique glasses developed in the Leitz Glass Research Laboratory.



5735

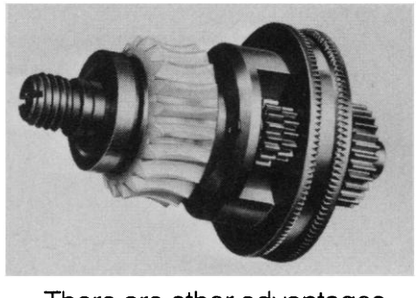
The objective carrier provides exceptional stability because of its unusually wide dovetail. This is very important for fluorescence work with the heavy incident light Ploem illuminator.



For easy exchange, the carrier slides out horizontally.

We don't expect you to look inside our microscope stand. But if you did, you'd find a complex system of planetary gears like the one shown below.

The gears move the object stage and are designed to produce razor sharp focusing.



There are other advantages to our research microscopes we hope that you will look into such as our complete range of easily interchangeable accessories and low life cycle cost.

Contact E. Leitz, Inc., Dept. SC 4, Rockleigh, New Jersey 07647.

Leitz

Circle No. 208 on Readers' Service Card

Special Announcement
To Science Readers From AAAS

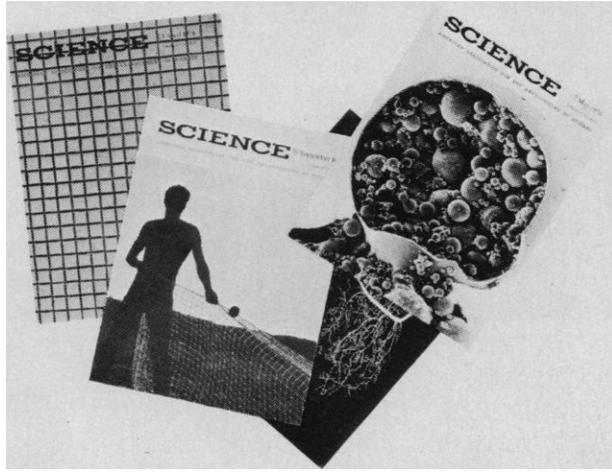
The AAAS Science Book List Supplement
Is Now Available

2842 recommended titles of reference and collateral texts and books for recreational reading in all fields of science and math for junior and senior high school students, college undergraduates, teachers, and the general reader. Fully annotated and indexed.

Your best source for those science books which make a permanent contribution to any library—personal, public, school, or college.

AAAS Science Book List Supplement
Retail Price: $16.50 AAAS Member Price: $15.00
Please allow 6-8 weeks for delivery.
Send orders with check or money order to
AAAS, Department W-2, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005

SPECIAL NOTICE TO SCIENCE READERS



AAAS announces an expanded reprint service.

All Articles, Reports, and Editorials published in SCIENCE, beginning with the 6 January 1978 (Vol. 199) issue, will be available in reprint form. Selected items from "News and Comment" and "Research News" will also be available.

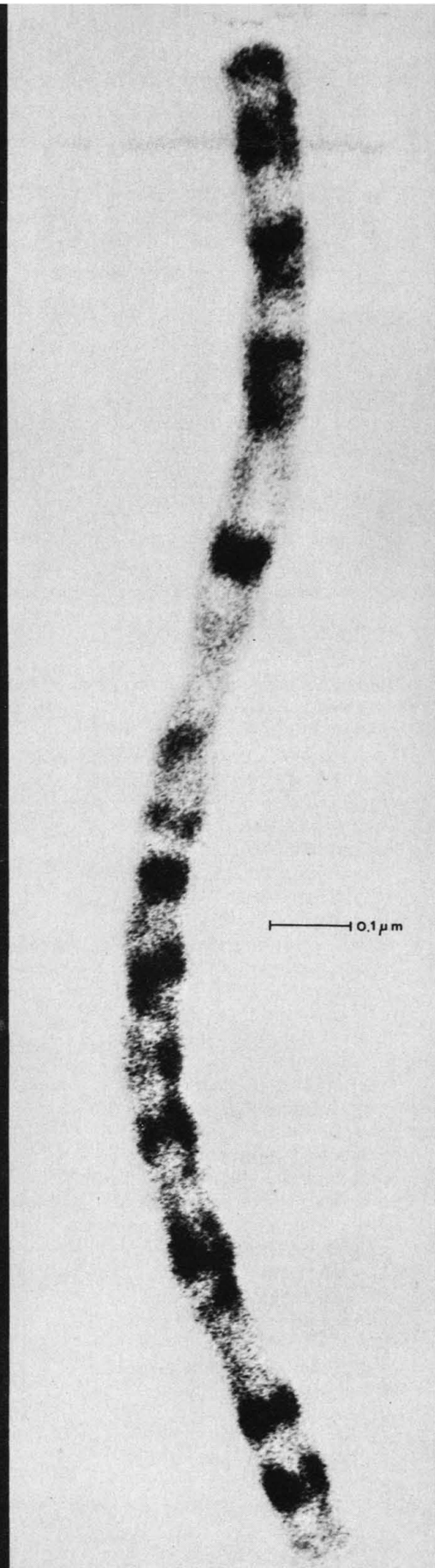
Individual reprints or reprint collections are an inexpensive yet highly effective way to present the latest developments in science to your students.

The cost is 50¢ per title (invoiced orders not less than $5.00). Checks should be made payable to AAAS. Bulk order discounts: 10% off per 10-50 copies, single item; 20%/51-250 copies; 30%/251-1000; 40%/over 1000.

Please send remittance plus specific requests (quantity/author/title) to

AAAS—REPRINTS
1515 Massachusetts Avenue, N.W.
Washington, D.C. 20005

Resolution at the limits of light microscopy.



Normal human chromosome, #2
mag.: 12,500X on print
250X in microscope
Taken with Zeiss Photomicroscope III

Circle No. 202 on Readers' Service Card

Check the point-to-point resolution in this photomicrograph taken with a Zeiss Photomicroscope III. The laws of physics are such that you'll never see any better in light microscopy.

The chromosome, supplied by Dr. Carl B. Mankinen, was taken using a 63X/1.4 N.A. oil planapochromat with bright-field illumination and a green and yellow filter combination. The chromosome spread was stained with Leishman's stain and G-banded. The film was Kodak High Contrast Copy film using a DIN setting of about 13.

If you would like more information on Photomicroscope III and Zeiss optics, fill in the coupon and mail to Zeiss.

ZEISS

THE GREAT NAME IN OPTICS

CARL ZEISS
WEST GERMANY

Carl Zeiss, Inc.
444 Fifth Avenue
New York, N.Y. 10018
Attn: Mrs. E. B. Vasco

Name

Title

Affiliation

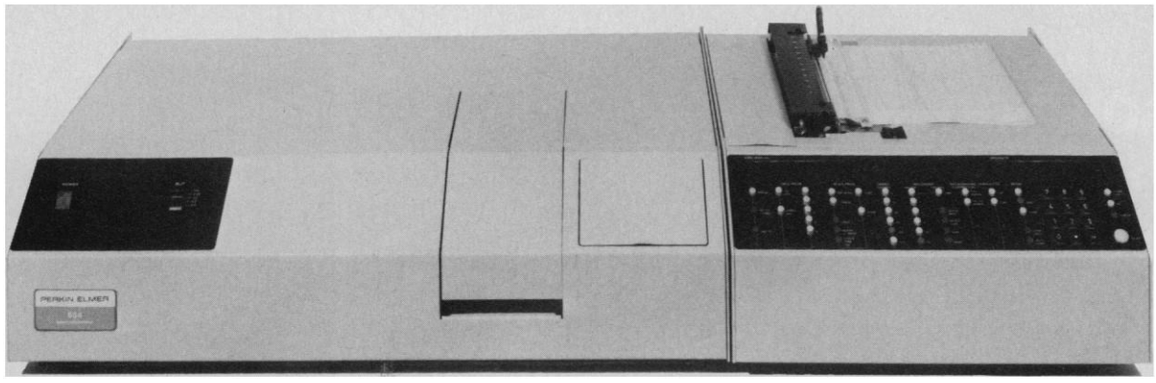
Street

City State Zip

Phone

I saw this ad in (Magazine)

THINKING UV?
THE MODEL 554 DOES.



MICROCOMPUTER CONTROL

The microcomputer at the heart of Perkin-Elmer's new Model 554 medium-priced spectrophotometer does most of your thinking in recording UV spectra. Simply enter operating parameters on the keyboard, and the instrument's own Flowchart Recorder™ displays the spectra.

HIGH AUTOMATION

The Model 554 has been designed for routine scanning without sacrifice of photometric accuracy. High automation of both instrument and sample programmer, achieved through microcomputer control, is perfect for reaction rate analysis. The microcomputer calculates and controls the abscissa and ordinate values for the built-in Flowchart Recorder, checks the OA/100%T balance, and automatically calculates concentration factors at the push of a button. It also flattens the instrument's baseline and permits recording of the first or second derivative of the spectrum. Wavelength limits for repetitive scanning, or up to seven discrete wavelengths for wavelength programming, are entered into the microcomputer's memory, and subsequent spectra may be recorded either sequentially or overlayed. The microcomputer controls the digital display of ordinate, abscissa and selected parameter values and outputs these values to data handling systems via a low cost, dedicated interface.

ADVANCED TECHNOLOGY

The keyboard provides the operational simplicity inherent in microcomputer controlled instruments. A selected value is simply entered via the keyboard and the monochromator is positioned automatically to this preselected wavelength by pushing a button. Upper and lower ordinate limits for the recorder, range limits for repetitive scanning, and wavelength values for wavelength programming are all entered via the keyboard. All stored values can be recalled on the display even while a spectrum is being scanned, without interrupting scanning.

The built-in Flowchart Recorder uses the patented * Perkin-Elmer Flowchart-lock™ system for abscissa synchronization so that the recorder pen is always in coordination with the monochromator. Manual correlation of monochromator and chart, required with conventional instruments, is not necessary.

TECHNICAL INFORMATION

For immediate answers about our full range of Perkin-Elmer UV spectrophotometers, please call (312) 887-0770, Ext. 100, or write directly to Perkin-Elmer Corporation, M/S-12, Main Avenue, Norwalk, Connecticut 06856, or Bodenseewerk Perkin-Elmer & Co., GmbH, Postfach 1120, 7770 Uberlingen, Federal Republic of Germany.

For more information on the "Thinking UV", circle Reader Service Number:
110 for information about the Model 554
111 for an immediate demonstration
112 for a schedule of demonstrations in your area

*U.S. Patents Number 4,038,664; Foreign Patents Pending

PERKIN-ELMER

Expanding the world of analytical chemistry.

Circle No. 257 on Readers' Service Card

Now it's your move. . .

Act now to order your personal copy of the current 58th edition of the *CRC Handbook of Chemistry and Physics* for just $19.95. That's a savings of $20.00 off the regular price of $39.95.

Often referred to as the "bible" of the sciences, the *CRC Handbook of Chemistry and Physics* contains more than 2300 pages of up-dated tables, graphs, data and property information vital to a wide range of scientific disciplines.

To receive this invaluable scientific reference book at the special $19.95 price, you must order by June 30, 1978. So, if you plan to take advantage of our southern hospitality . . . "better get movin' y'all."

Circle No. 264 on Readers' Service Card

ORDER FORM

Date _____

It's your move again, CRC. Please rush my copy of the 58th edition of the CRC Handbook of Chemistry and Physics for $19.95* (reg. $39.95).

To qualify for this special offer, order must:

- **Cite catalog number 458KSW,**
- **Be prepaid direct to CRC Press,**
- **Be postmarked by June 30, 1978.**

Enclosed is my check/moneyorder for $ _____
Florida residents add 4% sales tax.

Name _____

Title _____

Co./Inst. _____

Address _____

City _____ State _____ Zip _____

*Outside U.S.A., $21.95 per copy. Payable in U.S. currency by draft or check on a U.S. bank.

CRC Press, Inc.
2255 Palm Beach Lakes Blvd. West Palm Beach, FL 33409

Three major technical advances have made Neslab's constant temperature circulating baths the most advanced laboratory cooling baths available. The temperature range of +250 down to −100°C only hints at the new lows we've reached.

Multi-point sensing probes housed in a stainless steel sheath read the temperature three times per second at three different points in the bath. Unavailable in laboratory baths at any price, Neslab's 3-point sensing virtually eliminates overshoot and lag, and keeps control deviations lower than ever before possible.

The proportional IC controller provides unmatched short-term control without long-term instability or drift. Four integrated circuits provide stability of a low ±0.02°C or less. Conservatively.

The new circulating pump is adjustable from 0 to 13 liters/minute. It combines a specially designed motor, industrial grade ball bearings, a multi-bladed rotor and a massive ½" diameter shaft, reducing vibration and noise to a new low. With no sacrifice in flow or pressure.

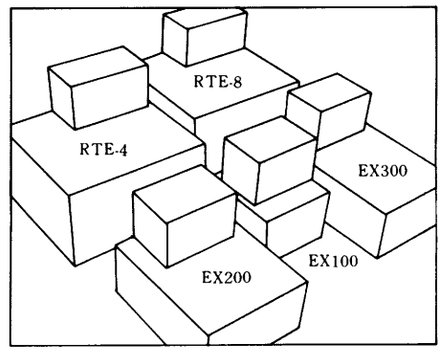
The efficient, progressive cavity pump design reduces mechanical heat input to a new low. It can operate with a wide range of temperatures, bath fluids and viscosity conditions, and is designed to run for years. Continuously.

Lowest of all is the price tag. Neslab's baths actually cost less than others not having their exclusive features. And we think that's the best low of all.

Phone right away. Or write away.

NESLAB INSTRUMENTS, INC., 871 Islington St., Portsmouth, N.H. 03801 U.S.A., (603) 436-9444.

NESLAB

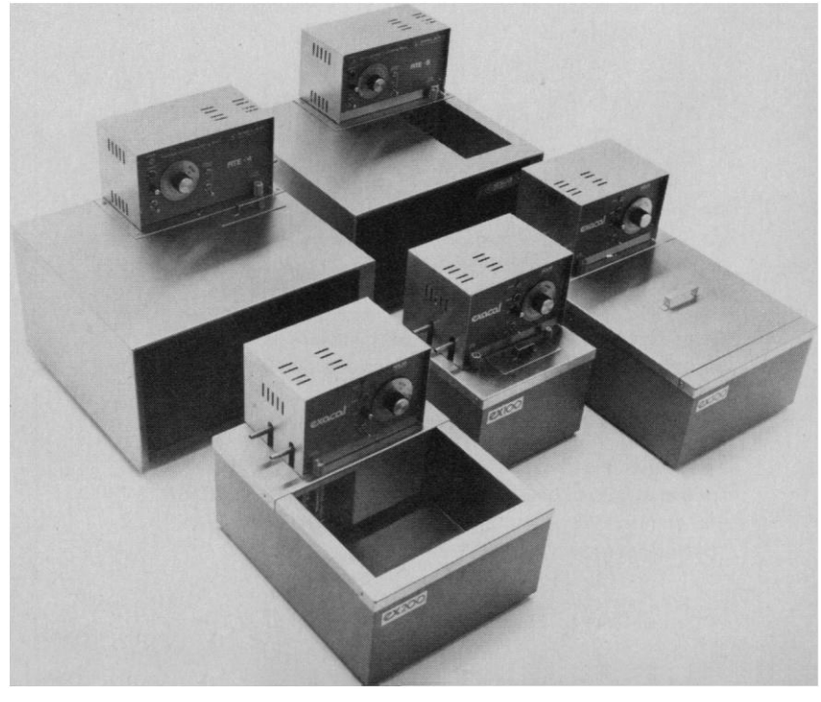


EXACAL BATH CIRCULATORS provide constant temperatures from −35 to +150°C. Stability: ±0.02°C or less. Work areas: up to 10" x 12" x 5¾" deep. Accessories: refrigeration units; electronic temperature programmer.

RTE-4 & 8 REFRIGERATED BATH CIRCULATORS have 20-30% greater cooling capacity than most baths. From −30 to +100°C. Stability: ±0.02°C. Work areas: up to 8¾" x 4¾" x 9" deep. Accessory: electronic temperature programmer.

LT-9 LOW-TEMPERATURE BATH CIRCULATOR (not illustrated) can maintain a high 300 watt heat removal capacity at −70°C. From +10°C to −80°C. Stability: ±0.05°C. Work area: 6¾" dia. x 8" deep. Accessory: electronic temperature programmer.

We've reached some new lows in temperature control.

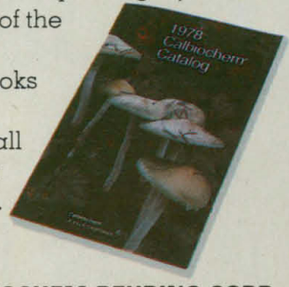


Circle No. 32 on Readers' Service Card

The 1978 Calbiochem Catalog. A complete guide to biochemicals from abrin to zwittergent.

The 1978 Calbiochem Catalog is now available. It's a complete catalog of biochemical products and related services. Over two hundred pages of product descriptions, from abrin to zwittergent. And each product, wherever possible, is referenced to the new Merck Index. So you can find background information quickly and easily.

Ask for your free copy of the 1978 Calbiochem Catalog and we'll send one out right away. It might just become one of the most used reference books in your lab. Write us or call us toll free at 800-854-2171.



CALBIOCHEM-BEHRING CORP.
10933 North Torrey Pines Rd., La Jolla, CA 92037

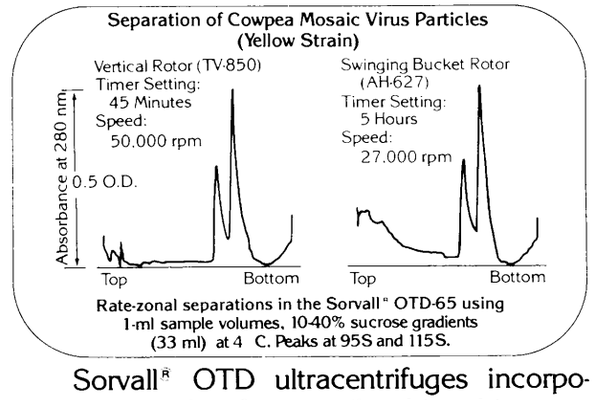
Circle No. 272 on Readers' Service Card

Density gradient spin times can Sorvall® OTD ultracentrifuges

High resolution and time savings result when the combined advantages of a Sorvall® OTD ultracentrifuge and a Sorvall® vertical rotor are used for density gradient separations.

These patented rotors* hold the tube in a fixed vertical position while tube contents are reoriented 90°. The sedimentation path length is thus reduced from the length to the width of the tube, resulting in shorter spin times. Three vertical rotors are available to suit a wide range of capacity requirements.

Typical results are shown in the rate zonal separation of cowpea mosaic virus particles using 1 ml samples. Use of a Sorvall® 8-place vertical rotor instead of a 6-place swinging bucket rotor of comparable tube volume reduced spin time more than 80% while maintaining resolution. These rotors are equally suitable for isopycnic density gradient separations.



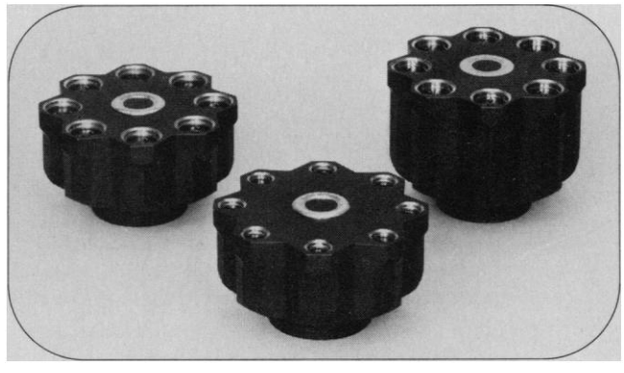
Rate-zonal separations in the Sorvall® OTD-65 using 1-ml sample volumes, 10-40% sucrose gradients (33 ml) at 4 C. Peaks at 95S and 115S.

Sorvall® OTD ultracentrifuges incorporate a unique low-friction oil turbine drive capable of providing soft starting and stopping, and smooth acceleration and deceleration. The Sorvall® Automatic Rate Controller and Reograd mode of deceleration take full advantage of this capability to avoid stirback and mixing of the gradient between 0 and 1,000 rpm.

be reduced more than 80% by with new vertical rotors.

The oil turbine drive also eliminates the maintenance and replacement of gears, belts and brushes. The many other features of OTD centrifuges include trouble-free self-contained cooling system; precise, wide-range temperature control; and automatic and manual vacuum pumping system.

For full information on Sorvall* OTD ultracentrifuges and vertical rotors, write to DuPont Instruments, Biomedical Division, Room 36005, Wilmington, DE 19898.



*U.S. Patent 3,998,383

With Sorvall® Centrifuges the spin times are changing.

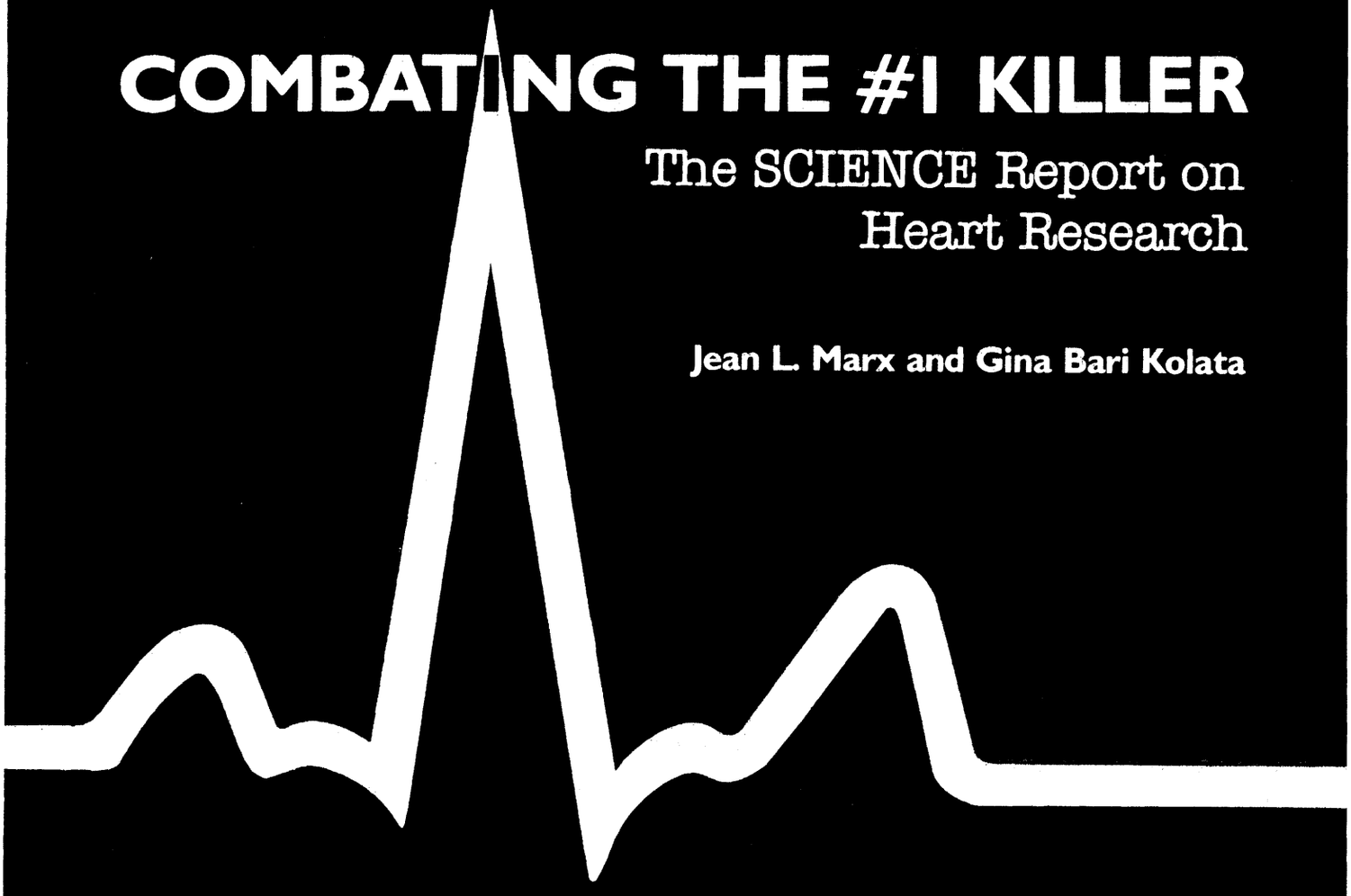
DuPont Instruments

DUPONT

COMBATING THE #1 KILLER

The SCIENCE Report on Heart Research

Jean L. Marx and Gina Bari Kolata



Cardiovascular diseases — diseases of the heart and blood vessels — are the leading cause of death in this country. They afflict more than 29 million people and are responsible for almost a million deaths per year in the United States alone. The American Heart Association estimates that the total economic costs of these diseases in 1978 will be in excess of $28 billion.

Medical scientists would like very much to know the causes of cardiovascular diseases. This knowledge would help prevent the diseases and reduce the death rate. But the causes are still eluding investigators despite vast expenditures of time and money.

COMBATING THE #1 KILLER, based on a series of award-winning articles* in SCIENCE Magazine, examines some of the recent research on cardiovascular diseases, with special emphasis on progress being made in understanding the biological mechanisms underlying the diseases.

Through interviews with the leading researchers in the health professions, Marx and Kolata investigated the current efforts now being made to deal with the epidemiology of heart disease, its diagnosis, its relationship to an individual's life-style and age, the most promising present and projected treatment strategies, the biochemical and clinical research in progress, and the ethical problems which may confound the results of any research which involves human patients.

COMBATING THE #1 KILLER — valuable precisely because its main focus is on key research currently in progress.
COMBATING THE #1 KILLER — a direct, unbiased report with information for all investigators in the field, scientists generally, makers of public policy, and the general public at large.

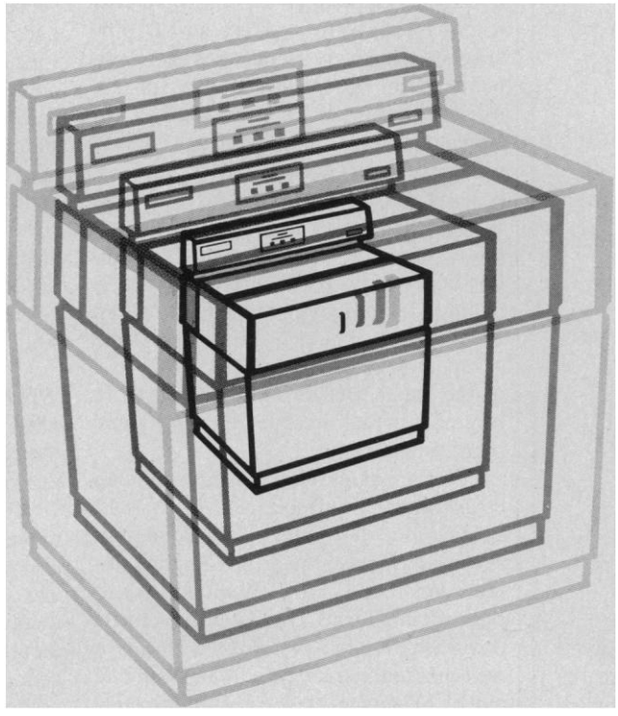
ORDER YOUR COPY NOW — and investigate the details that you ought to know about heart disease and the steps you could take to prevent it.

____ Casebound $17.00
____ Paperbound $ 7.50
AAAS Members 10% discount

Send your name and address to
American Association for the Advancement of Science
Department B-1
1515 Massachusetts Avenue, NW
Washington, DC 20005

*American Heart Association Blakeslee Award for series of nine articles in SCIENCE on cardiovascular diseases.

Packard



A
COUNTER WITHIN
A
COUNTER WITHIN
A
COUNTER WITHIN
A
COUNTER

EACH COUNTER CAN BE USED FOR A DIFFERENT GROUP
OF SAMPLES NO MATTER THE SIZE OF THE GROUP.
MODEL 2650 LIQUID SCINTILLATION COUNTING SYSTEM
IS COMPUTER CONTROLLED FOR MULTI-PROGRAMS.

Please rush me information about the 450-sample capacity system of 15 counters in one temperature-controlled cabinet (Bulletin No. 1213A).

Name _____

Institution _____

Address _____

City _____

State _____ ZIP _____

Phone _____ 4/78

Packard

PACKARD INSTRUMENT COMPANY, INC.
2200 WARRENVILLE RD. • DOWNERS GROVE, ILL. 60515
PACKARD INSTRUMENT INTERNATIONAL S.A.
RENGGERSTRASSE 3 • CH-8038 ZURICH, SWITZERLAND
SUBSIDIARIES OF AMBAC INDUSTRIES, INC.

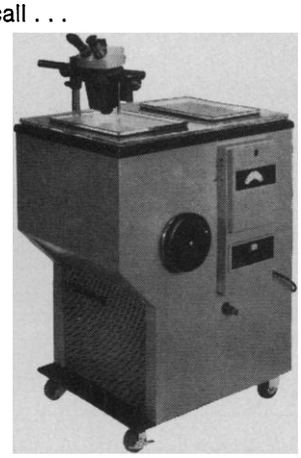
The First Wide Range Microtome-cryostat... Temperatures from −15°C to −50°C... Frozen Sections from 40 μ to 2 μ.

The Harris LoTemp model WRC is two microtome-cryostats in one. A single unit that can do both routine diagnostic procedures and such sophisticated research procedures as thin section light microscopy, autoradiography, fluorescence microscopy and other histological procedures, at a cost comparable to presently available routine cryostats.

The Harris model WRC is compact . . . can be moved anywhere it's needed. The cold chamber has extra room for tissue handling, storage or freeze drying. Full opening top with special access ports combines the features of a totally closed system with the easy accessibility of open top models.

Available equipped with International Equipment Corp. microtomes, or cryostat only prepared for installation of your present I.E.C. microtome. Installed stereo zoom microscope also available.

For a full description of the Harris WRC and its wide range of additional features write or call . . .



Harris Manufacturing Co., Inc.
14 Republic Road
Treble Cove Industrial Park
North Billerica, Mass. 01862
(617) 667-5116

Circle No. 279 on Readers' Service Card

LETTERS

Peregrine Falcon Protection

I note in the article "Bird lovers and bureaucrats at loggerheads over peregrine falcon" by Nicholas Wade (News and Comment, 10 Mar., p. 1053) that the drafter of Executive Order 11987 on exotic species has stated that the order was meant to apply to species, not to subspecies. However, if one takes the viewpoint that subspecies, even poorly marked ones, can be considered as incipient species, and therefore possess genetic diversity worth protecting, there is good reason for the U.S. Fish and Wildlife Service to interpret the Executive Order in such a way that its definition of species is consistent with the definition of species given in the Endangered Species Act of 1973, namely, "any subspecies . . . and any other group . . . of the same species or smaller taxa in common spatial arrangement that interbreed when mature."

There are at least two examples among birds where introductions of a subspecies into the range of a second subspecies has caused near or complete obliteration of the stated characteristics of the endemic form. The Seychelles turtle dove *Streptopelia picturata rostrata*, a well-marked insular race, was swamped out of existence by *S. p. picturata*, introduced to the Seychelles from Madagascar by 1867. The Italian partridge *Perdix perdix italica* is close to extinction because of genetic swamping from partridges of several other subspecies that are raised on game farms in Italy and released regularly into the dwindling area occupied by *italica*.

The possibility that peregrine *Falco peregrinus* stock from European subspecies, which has been released in the eastern United States in the recent absence of an indigenous breeding population, will mate with and dilute or swamp indigenous populations of peregrines is remote but still quite real. Furthermore, examples can easily be suggested, particularly among island populations, where the introduction of exotic subspecies would quickly spell disaster for endemic subspecies. The Executive Order would prevent such situations by also prohibiting the possibility of release in the United States of exotic species or subspecies close to extinction in their native habitat as a last-chance effort to provide a suitable habitat, a measure which, although thus far attempted only in captive or semicaptive situations, may become more appealing as various habitats around the world are increasingly disrupted and as active manipulation of species populations becomes more widely accepted and is tested.

The Fish and Wildlife Service needs a provision to waive the prohibition on release of exotics on a case-by-case basis, after it determines that the risk to indigenous populations is sufficiently remote and that conservation objectives of the species as a whole are better served by such introduction. Because the taxonomic validity of some peregrine subspecies is highly questionable, as Wade points out, determination of the status of peregrines on a geographical (state-by-state) basis would clearly serve the needs of peregrine conservation in this country better than the subspecies basis currently employed. A similar course has recently been taken by the Fish and Wildlife Service for the bald eagle *Haliaeetus leucocephalus* for the same reason.

A realistic approach the Fish and Wildlife Service might take would be to propose as threatened all populations of the peregrine worldwide, excepting populations from certain states or regions which would remain endangered. These moves would permit continuation of federal support for programs like Cade's and at the same time give a clear indication of where priorities for management and protection of this species should lie. Thus, work to produce a new peregrine population in the eastern United States would be seen to have value primarily in developing techniques applicable to managing endangered populations in the western United States.

WARREN B. KING
International Council for Bird Preservation, Smithsonian Institution, Washington, D.C. 20560

In his article concerning the peregrine falcon, Wade quotes U.S. Fish and Wildlife Service associate director Keith Schreiner as saying, "The question is whether I should be involved in establishing a new species in an area where the native species has become extinct."

Since the entire controversy over the introduction of peregrines involves *subspecies* of the peregrine falcon, and has nothing whatsoever to do with "establishing a new species," it would be most unfortunate if an administrative decision based on a misconception prevailed in this matter.

JOHN DAVIS
F. STEPHEN DOBSON
WALTER KOENIG
JULIA KJELGAARD
PAMELA WILLIAMS
Hastings Reservation, University of California, Star Route Box No. 80, Carmel Valley 93924

INSERM CONFERENCES INSERM CONFERENCES INSERM CONFERENCES INSERM CONFERENCES INSERM CONFERENCES

The French Institute of Health and Medical Research (Institut National de la Santé et de la Recherche Médicale) is organizing a series of meetings on advanced research topics in various biomedical fields. The meetings which started last year, are known as the INSERM CONFERENCES.

The aims of the conferences are:
- to foster the exchange of ideas, to evaluate new methods and new lines of investigation;
- to bring together scientists, mostly from European countries, working in universities and public or private research institutions. The meetings will be held under the direct responsibility of a chairman and a co-chairman.

The INSERM CONFERENCES have the following special features:
- only highly topical subjects are dealt with;
- if possible, the data presented should not have been the subject of any earlier complete publication, a condition which therefore excludes general reviews;
- the Conferences do not publish proceedings or any other material, even in a summarized form.

The chairman of each INSERM Conference will invite 15 to 20 scientists to give a report in line with the above conditions. The number of contributions will be limited to three or four per session and, at the discretion of the chairman, at least one third of the time will be given over to discussion and brief informal communications.

In addition to the invited speakers, at least fifty participants will attend the meeting, and efforts will be made to select young scientists. Experienced research workers from fields other than those relating to the Conference will also be welcome to attend. Participants will be chosen in such a way as to enable those engaged in all types of scientific research to establish personal contacts, exchange information and find new ways of working together.

PRACTICAL ARRANGEMENTS

The INSERM CONFERENCES 1978 will be held at the Domaine de Seillac, near Blois (180 km from Paris), during the months of October and November 1978 (full address: Domaine de Seillac, 41150 Seillac, France). Each conference will last three and a half days, from Sunday evening (departure from Paris), to Thursday afternoon. Working sessions will be held from 9 a.m. to 12.30 p.m. and from 5.30 p.m. to 8 p.m. On free afternoons, participants will have a wide choice of leisure activities at the Domaine de Seillac and in the surrounding area (Tennis, Table-tennis, bicycling, visit to the Castles of the Loire).

REGISTRATION FEE AND SPECIAL FUND

Participants whose applications are accepted but who are not invited speakers, will be asked to pay their registration fee and board (1000 FF). A special fund will be made available to the chairman of each Conference, enabling him to pay part of the expenses of some participants requesting such assistance.

PROGRAMME FOR 1978

Four INSERM CONFERENCES are scheduled for 1978.
The programmes for the first two conferences (T-CELL DIFFERENTIATION AND ITS RELATIONSHIPS TO IMMUNE REGULATION - HORMONAL CONTROL OF GENE EXPRESSION) are listed below.
The announcement for the next two conferences (DEVELOPMENTAL NEUROBIOLOGY - RECOMBINANT DNA AND EUKARYOTIC GENOME) will appear in the next issue of this journal.

IMMUNOLOGY

T-CELL DIFFERENTIATION AND ITS RELATIONSHIPS TO IMMUNE REGULATION - October 15-19

Jean-François Bach, chairman; Anthony J.S. Davies, co-chairman.

Scientists wishing to attend one of these two conferences have to submit this application form BEFORE JUNE 20th to INSERM Conferences, 101, rue de Tolbiac - 75645 PARIS CEDEX 13, France - Telephone : 584-14-41.

APPLICATION FORM:

CONFERENCE ON: .....
(Name - Date)

NAME, TITLE and POSITION: .....

.....

INSTITUTION (with address and phone number): .....

.....

See overleaf...

Monday - October 16 :

Morning session : **Ontogeny and differentiation of T cells**
Speakers : N. LE DOUARIN, F. LOOR, M. PAPIERNIK, M. RAFF, O. STUTMAN, R. ZINKERNAGEL

Evening session : **Factors of T-cell differentiation**
Speakers : A. ASTALDI, M. DARDENNE, A.J.S. DAVIES, K. PYKE, N. TRAININ

Tuesday - October 17 :

Morning session : **T-cell receptors in relation to T-cell differentiation**
Speakers : S. AVRAMEAS, H. BINZ, H. FRIDMAN, M. GREAVES, L. MORETTA, J.L. PREUD'HOMME

Evening session : **Mouse and human T-cell deficiencies. Investigation of T-cell subsets in man**
Speakers : R. BAILLEUX, A.J.S. DAVIES, C. GRISCELLI, F. LOOR, H. PLATTS-MILLS, M. SELIGMANN

Wednesday - October 18 :

Morning session : **Cellular interactions in antibody production**
Speakers : M. FELDMANN, A.L. SCHIMPL, T. TADA, J. THEZE, H. WALDMANN

Evening session : **Cellular interactions in cell mediated immunity**
Speakers : G. ASHERSHON, J.C. LECLERC, C. MAWAS, E. THORSBY, H. WAGNER

Thursday - October 19 :

Morning session : **Regulatory T cells and the control of self reactivity**
Speakers : M.A. BACH, J. CHARREIRE, T. DIAMANSTEIN, N. TALAL, H. WEKERLE, R. ZINKERNAGEL

ENDOCRINOLOGY

HORMONAL CONTROL OF GENE EXPRESSION - October 22-26

Etienne-Emile Baulieu, chairman; Anne McLaren, co-chairman.

Monday - October 23 :

Morning session : **Genes and chromatin : Structure and function (1)**
Discussion leader : A. McLAREN (London)
Speakers : P. CHAMBON (Strasbourg) - R. SCHIMKE (Stanford)

Evening session : **Genes and chromatin : Structure and function (2)**
Discussion leader : E. JENSEN (Chicago)
Speakers : E. BAUTZ (Heidelberg) - J. GOTTESFELD (Cambridge)

Tuesday - October 24 :

Morning session : **Hormonal control of specific protein accumulation**
Discussion leader : R. KING (London)
Speakers : G. SCHÜTZ (Berlin) - R. GOLDBERGER (Bethesda) - J. ROSEN (Houston)

Evening session : **Genetics**
Discussion leader : J.L. GUENET (Paris)
Speakers : M. LYON (Harvell) - M. WEISS (Gif-sur-Yvette)

Wednesday - October 25 :

Morning session : **Meiosis and Hormones**
Discussion leader : J. BRACHET (Bruxelles)
Speakers : S. SCHORDERET-SLATKINE (Genève) - Y. MASUI (Toronto) - A. BYSKOV (Copenhagen)

Evening session : **Development**
Discussion leader : J. TATA (London)
Speakers : N. RINGERTZ (Stockholm) - C. GRAHAM (Oxford)

Thursday - October 26 :

Morning session : **Cancer and Hormones**
Discussion leader : M. LIPSETT (Bethesda)
Speakers : W.L. McGUIRE (San Antonio) - H. ROCHEFORT (Montpellier) - R.L. NOBLE (Vancouver)

SCIENTIFIC INTEREST to be used for consideration of your request by the Scientific Conference Committee . . . . . .

. . . . . .

. . . . . .

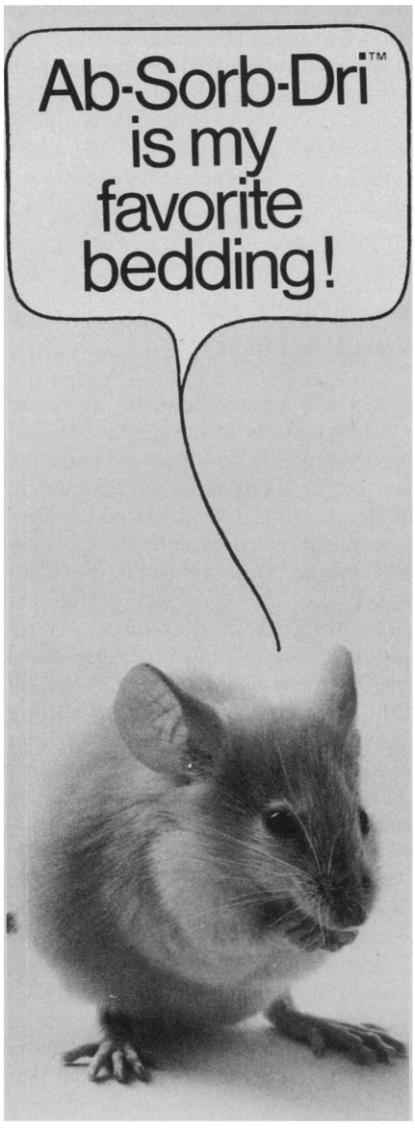
. . . . . .

. . . . . .

. . . . . .

. . . . . S1

DO NOT ENCLOSE PRE-PAYMENT WITH THIS APPLICATION FORM



Ab-Sorb-Dri consists only of hardwood chips that have been heat-treated and aspirated under the most exacting sanitary conditions. Low moisture. Minimal dust. Minimal contamination. Free of additives. Highly waste and odor absorbent. I can move it easily to expose new, dry surfaces... providing a long cage life. Doesn't mound under bottles or hide me or my associates. Easily removed from my cage without scraping. Available from distributors in 40 lb., 3-ply, autoclavable, heat-sealed bags containing 3 cu. ft. of bedding.

For more information about Ab-Sorb-dri and the name of your local distributor, write or call Lab Products Inc., 365 W. Passaic St., Rochelle Park, N.J. 07662 (phone: 201/843-4600).

lab products inc a bioMedic company

Lab Products...not just plastic cages, metal cages, custom fabrication, laminar flow systems, bedding, automatic watering systems, accessories...

Copyright © BioMedic Corporation 1976

Circle No. 275 on Readers' Service Card

World War II Nuclear Bomb Projects

The letter by F. H. Schmidt (24 Mar., p. 1286) correctly points out the importance of the electromagnetic method in the separation of uranium-235 for the World War II Manhattan Project and for the subsequent separation of stable isotopes of many elements for research purposes. A characteristic of the electromagnetic method which contributed to its wartime success, and also its adaptability to the isotopic separation of various elements, is that it intrinsically offers a high enrichment per stage. The gaseous diffusion process for uranium-235 separation was more difficult to put into production, as it required a cascade of many stages with very low enrichment per stage.

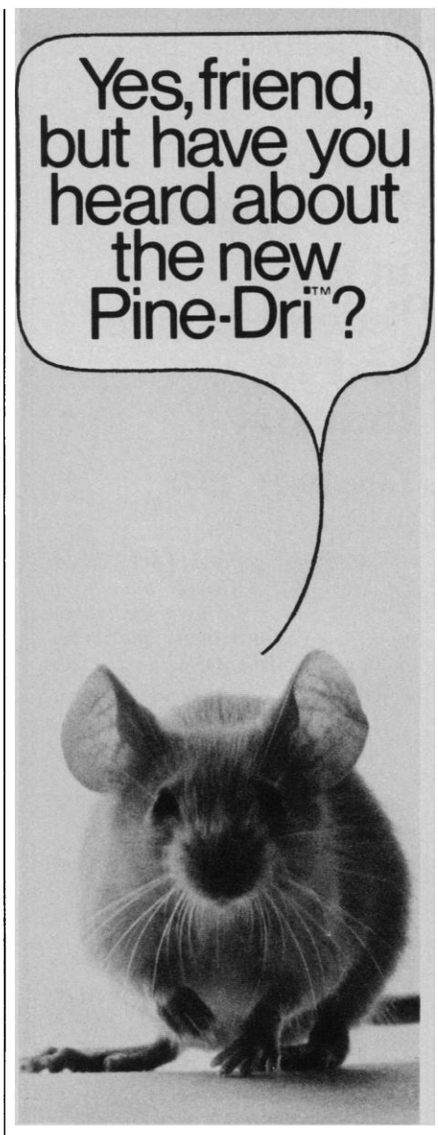
Schmidt also discusses the key issue in the success of the electromagnetic method—the requirement for adequate space-charge neutralization within the ion beams. It is interesting that both the Japanese and German physicists were discouraged from attempting the electromagnetic separation of the uranium isotopes because of the difficulty presented by this problem. The U.S. effort to produce the Hiroshima bomb could not have succeeded without overcoming the space-charge–imposed limitation in mass spectrographic resolution when intense ion beams were employed. The solution used was space-charge neutralization by automatic trapping of electrons that were produced by ionization of residual gas in the vacuum tank by the ion beams themselves.

While this solution to the space-charge problem was used by E. O. Lawrence's Radiation Laboratory in designing the Oak Ridge electromagnetic separations plant, it was discovered before the Radiation Laboratory effort. In earlier work at Cornell University with lithium ion beams, Smith *et al.* (*1*) observed and explained the trapped electron neutralization resulting from residual gas. To quote from this reference (*1*, p. 1002):

> The fact that partial space charge neutralization takes place even when no effort was made to accomplish it indicates that neutralization could be made very much more effective by introducing electrons by any of a number of special ways.
>
> It must then be concluded that there is at present no indication the space charge is limiting the current that can be collected by this method.

The article by Smith *et al.* was received by the *Physical Review* on 18 February 1942, but for reasons of secrecy was voluntarily withheld from publication until the end of the war.

The electromagnetic separation device



Much of what you've said over there (←) about Ab-Sorb-Dri applies to Pine-Dri also, except that it's made exclusively of Northern White Pine. Same heat-treating to reduce moisture content, and aspiration to remove dust. And contamination is also minimal and the additives absent. In use it's similar, too. Some differences: it's somewhat easier to handle and tends to last longer because it's more absorbent (absorbs 2.5 times its own weight in liquid). Available from those same distributors in 27 lb., 3-ply, autoclavable, heat-sealed bags containing 3 cu. ft. of bedding.

For more Pine-Dri information and your distributor's name, write or call Lab Products Inc., 365 W. Passaic St., Rochelle Park, N.J. 07662 (phone: 201/843-4600).

lab products inc a bioMedic company

Lab Products...not just plastic cages, metal cages, custom fabrication, laminar flow systems, bedding, automatic watering systems, accessories...

Copyright © BioMedic Corporation 1976

Circle No. 277 on Readers' Service Card

Announcing the 3rd AAAS Colloquium on

Research & Development in the Federal Budget and in Industry

June 20-21, 1978

The third annual AAAS report on R&D in the federal budget for FY 1979 and including a special section on R&D in industry and its impact on the economy will be the subject of an

AAAS
Science & Public Policy
Colloquium
Washington, D.C.
June 20 and 21, 1978

The AAAS R&D analysis project, sponsored by the AAAS Committee on Science and Public Policy and initiated in 1976, has resulted in two well-received books on research and development in the federal budgets for FY 1977 and FY 1978, and two highly successful colloquia in June of 1976 and 1977, attended by 200-250 AAAS members, government officials, and others. The June 20-21, 1978 colloquium will offer a forum for constructive discussion of current issues in federal and industry R&D with officials of the Executive and Legislative branches and from industry and universities.* **Research & Development: AAAS Report III** *by Willis H. Shapley and Don I. Phillips will be available in book form for the June 1978 colloquium.*

Specific topics this year will be the impact of the first complete Carter budget on R&D, trends and problems of R&D in industry, and the impact of R&D on the economy. For information and reservations, write to

Ms. Patricia S. Curlin
AAAS Office of Public Sector Programs
1776 Massachusetts Ave., N.W.
Washington, D.C. 20036

*Research and Development in the Federal Budget: FY 1977 *and* Research and Development in the Federal Budget: FY 1978 *(\$5.50 each; AAAS members, \$4.95) and the 1976 and 1977* Colloquium Proceedings *(\$5.25 each; AAAS members, \$4.75) may be purchased from AAAS.*

in which we demonstrated space-charge neutralization was basically the Dempster-type mass spectrograph. The so-called "Calutron" used in the Oak Ridge electromagnetic separations plant was also basically a Dempster-type mass spectrograph. It lends itself to electron neutralization of the ion beam space charge because the geometric separation of the ions of different isotopes takes place in a region free from applied electric fields.

A little-known aspect of the Manhattan Project was another effort to carry out quantity separation of uranium-235 by electromagnetic means. This work was performed early in the war at Princeton University with a concept referred to as the "Isotron." It was based on velocity modulation of an ion beam with time-variant electrical fields applied between drift spaces. This method did not lend itself to effective space-charge neutralization by electrons, a limitation also observed in the earlier work at Cornell and discussed in (*1*). The Isotron project was discontinued in 1943, and the wartime electromagnetic separations work was concentrated on the Dempster-type mass spectrographic approach being developed at the University of California Radiation Laboratory at Berkeley.

Those of us who were involved in that frenzied effort frequently speculated on what the counterparts of our apparatus looked like in Japan and Germany. As it turned out, there were none. Even if the scientists of those countries had solved the space-charge problem of the electromagnetic method, it is unlikely plants could have been constructed and operated to carry out the necessary quantity of uranium-235 separation. The bombing attacks during the later phase of the war would have been too disruptive.

W. E. PARKINS

Atomics International,
Canoga Park, California 91304

References

1. L. P. Smith, W. E. Parkins, A. T. Forrester, "On the separation of isotopes in quantity by electromagnetic means," *Phys. Rev.* **72**, 989 (1947).

While my own research corroborates nearly all of what Deborah Shapley reports on Japan's attempts to build an atomic bomb (News and Comment, 13 Jan., p.152), the fact is that Japan lacked adequate long-range aircraft like the B-29 and by 1943 had inadequate capabilities to even launch a second attack on Hawaii. A much more likely scenario would have been for Japan to resort to using its bomb in China, Okinawa, or even the Soviet Union.

Some Japanese newspapers have chosen to give the *Science* article front-page coverage, perhaps because it comes at a time when Japan has a near-capability of building weapons using fuel reprocessed at its pilot reprocessing plant.

ROGER W. GALE

c/o Foreign Correspondents' Club of Japan, 1-7-1 Yurakucho, Chiyoda-ku, Tokyo 100

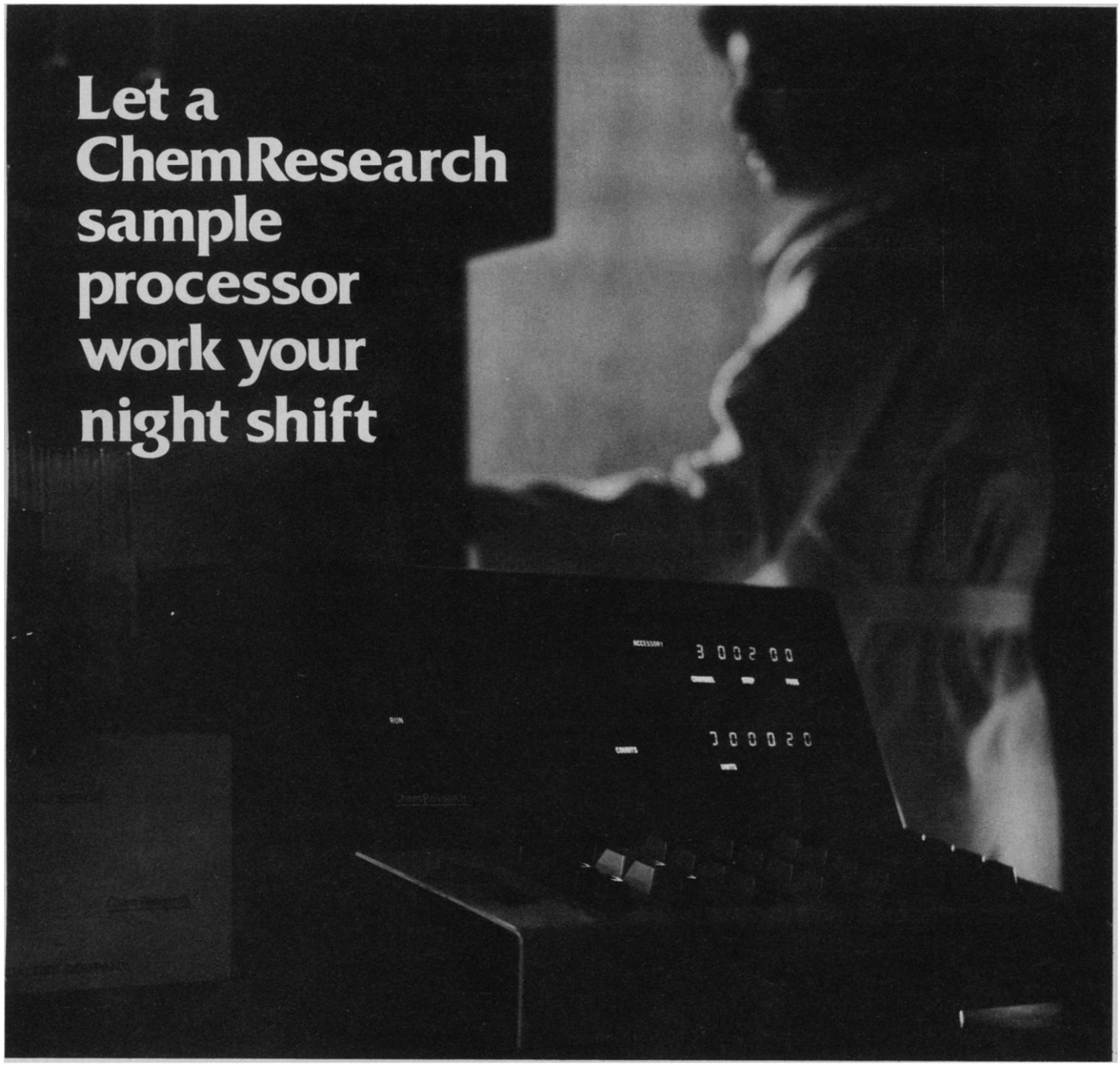
Science, Media, and Worst-Case Limits

How can one discourage misuse of worst-case limits in the public domain? One approach is to widely publicize the fact that such misuse is unprofessional, unethical, and results in slanted information. When worst-case limits are misused, the transgressors should be taken to task.

The news media often report the results of criminal trials. In those cases where a defendant is found guilty on multiple counts, before sentencing it is standard procedure to describe the limit of possible sentences by assuming that each count will result in the maximum punishment and that prison time for each count will be served sequentially. Thus, a 60-year-old man found guilty on six counts, each with a 20-year maximum penalty, is described as being subject to a possible sentence of 120 years, notwithstanding the impossibility of such a sentence being carried out. It should be noted that the 120-year sentence even has a legal connotation, namely, that parole would not be possible for 60 years (in many jurisdictions) should the maximum sentence be implemented.

Regardless of the impossibility and meaninglessness of such a sentence, there has been no apparent public confusion or concern about the use of such numbers by the media. This lack of concern may be explained by the fact that there are criteria understood by the public that allow them to evaluate the statement with proper perspective. The limited life-span of individuals and the rarity of such sentences ever being completed are self-evident, and this may prevent misinterpretations.

I call this tendency of the media, the public, scientists, and others to make an estimate of the worst-case limit in the case above and in other situations the "penal syndrome." Just as an average is a central measure of a range of possible measures, the upper (or lower) limit of the range of possible measures is also a valid, but often inferior, way of describing quantifiable conditions. However, the use of such upper limits in many situations is made without the criteria neces-



By morning, even your most complex procedure will be completed. Kinetic studies of enzymes, protein assays, peptide syntheses, tissue culturing — all can be performed automatically. A ChemResearch sample processor will do virtually everything you can do manually, but with better precision and repeatability. And it can be generating otherwise unaffordable data while you're devoting your time to other projects.

The system combines a simple, versatile sample-handling module with a controller utilizing an integral microprocessor-based computer. The control unit is quickly programmed by simple keystrokes. You don't have to know a computer language, and a display panel even tells you what to enter next. The easy entry of complex programs enables you to automate previously impractical projects, even on a one-time basis.

The basic system handles up to 210 samples — each can be processed through 960 discrete program steps, involving reagent addition from up to 40 sources, agitation, incubation, control of reaction times, withdrawal of samples for analysis, and many other events.

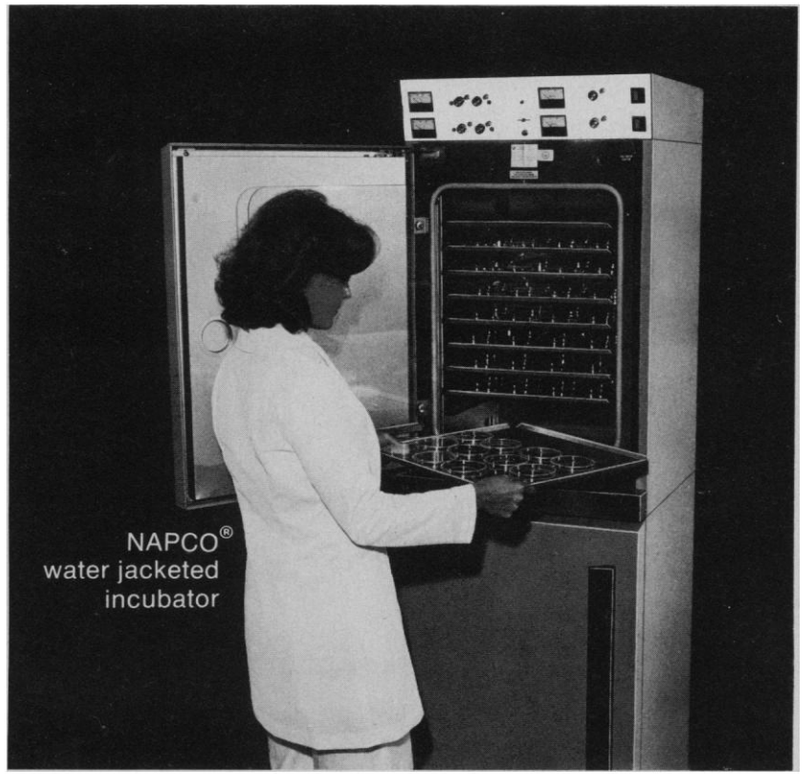
It can measure pH, optical absorbance, or other characteristics at any time, and will vary the program in response to these measurements. Looping and subroutine capabilities minimize program steps for repetitive procedures.

A built-in teletype and computer/desk calculator interface allows additional data input and output, and tape storage of the program. It also enables you to analyze data during program execution.

For more information on the ChemResearch sample processor, send for your catalog today. Or dial direct, toll free (800) 228-4250 (continental U.S.A. except Nebraska). Instrumentation Specialties Company, P.O. Box 5347, Lincoln, Nebraska 68505.

ChemResearch

Circle No. 127 on Readers' Service Card



A little known fact: U.S. Patent #3848569

Most incubator problems can be traced to unreliable CO_2 control

It's true. Most models employ a relay and filament that corrodes. This causes the CO_2 to fluctuate, but you are usually unaware of it until an experiment is endangered.

Now Heinicke announces an exclusive patented solid state system featuring a thermister detector that obsoletes the relay and filament detector. It reduces zero drift and maintains the CO_2 at precisely the level you set it.

For super-convenient maintenance, the shelf assembly snaps out, the heating element and electronic components slide out like a drawer, and the thermostat can be changed in minutes. No incubator has ever been made like this one.

Available in single or space saving vertical models. There's much more. Write for brochure.

Heinicke Instruments Company

3000 Taft Street
Hollywood, Florida 33021
Phone 1-800-327-9783
or (305) 987-6101

If you should ever have an equipment breakdown...
a Heinicke Minute Man will be on his way to you in 48 hours! You'll seldom need the Minute Man service, because Heinicke and Napco instruments are built to work. But if you do, dial toll-free 800-327-9783.

sary to put these limits in reasonable perspective. It is typical for the media and the public to focus on these upper limits, and to do so without qualifications.

As an example, consider the case of plutonium toxicity. Although there is no case on record of a fatality caused by plutonium in humans (*1*), it is often said that plutonium is one of the substances most toxic to humans and that 200 million body burdens can be held in a single teaspoon. Certainly body burdens are a useful comparative measure of the relative toxicity of substances that can be absorbed by an "average" human; but without reference to the relative ability of such doses to reach the human body, they have no meaning in any absolute way. The critical pathway to the human body for plutonium is inhalation of insoluble particles of plutonium oxide (within a limited size range). Conversely, the toxin that causes botulism, the body burden limit for which is often compared to that for plutonium, is highly soluble in water and can reach the human body more easily (*2*).

In science, extreme limits are useful measures. They may be used on either an absolute or relative basis; in the latter case systems may be compared against each other at their limits. However, for both there is now an understandable reticence by many scientists to state worst-case limits for fear of misuse by the media and others. This impedes the transfer of important information.

One cannot fault the media for wanting to use worst-case limits, as they make news more marketable. The fault lies in using them without qualification in cases where important criteria for discrimination are absent, where propagation of such limits takes place out of context, and where purposeful misuse occurs.

In any case, the professional community must preserve its right to use and publish all information for public understanding without the menace of possible misuse. A concerted effort to identify and criticize misuse as cited is an important duty that accompanies the right to free exchange of information.

W. D. ROWE

Office of Radiation Programs, Environmental Protection Agency, Washington, D.C. 20460

Notes

1. There may or may not be statistical fatalities among the total population resulting from plutonium exposure, but cause-effect relations cannot be established except when test animals have been given very large doses.
2. Further confusion may arise from the delayed effects of ^{239}Pu exposure being measured in years while those of the botulism toxin are measured in hours. Thus the comparison of body burdens alone is inferior to other measures as a way of describing relative toxicity.

The First Translation Kit

It will make your life easier and your results more reproducible

New England Nuclear offers the first reticulocyte lysate kit for use in studying protein synthesis. Not only does it save all of the trouble of preparing your own cell extract, it gives you a system free from endogenous mRNA, high in protein synthesis activity, with an optimized high-activity tracer and quality control that includes testing every lot of Methionine, L-[35S] using the kit.

The rabbit reticulocyte lysate system is reported to contain all factors required for translation of any eukaryotic mRNA.[1] But its use assumes the availability of suitable animals, preparation of the lysate extract, and inactivation of endogenous mRNA. And the meticulous tailoring of the salts, energizer, and amino acid mix. In short, it's a nuisance.

With our exclusive kit you bypass all that and concentrate on the study of protein synthesis. The kit contains:

A rabbit reticulocyte lysate—Treated with nuclease to inactivate endogenous mRNA, and tested to guarantee high protein synthesis activity.

The finest tracer available—NEG-009T, NEN's translation grade [35S]-Methionine, >500Ci/mmol, tested for incorporation into protein in cell-free translation systems. Each lot is optimized for compatibility with this system.

Translation cocktail—All the necessary components for proper translation conditions: 19 amino acids (excepting methionine) plus buffer, reducing agent, and energizer.

Control mRNA—Purified exogenous mRNA (adenovirus-infected HeLa cell mRNA) to check the biological activity of the system.

Salts and sterile deionized water—Selected and prepared to minimize potential ionic or enzymatic inhibition of the system.

And you can get rid of all those rabbits

The protocol is straightforward, and it includes suggested final assay procedures. So that's our message. Now add yours. Call us toll free for details.

NEN New England Nuclear

549 Albany Street, Boston, Mass. 02118
Call toll-free: 800-225-1572
(In Massachusetts and International: 617-482-9595)

NEN Chemicals GmbH: D-6072 Dreieich, W. Germany
Daimlerstrasse 23, Postfach 401240, Telephone: (06103) 85034, Telex: 4-17993 NEN D

NEN Canada Ltd., 2453 46th Avenue, Lachine, Que. H8T 3C9, Telephone: 514-636-4971, Telex: 05-821808

Not for use in humans or clinical diagnosis.

[1] Lodish, HF, Ann Rev Biochem, **45,** 39 (1976)

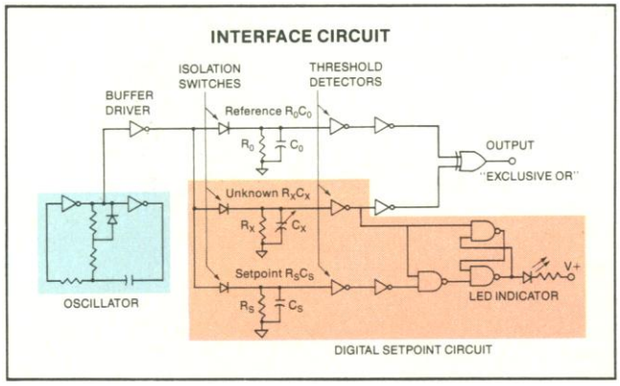
Circle No. 245 on Readers' Service Card

A chip that may someday launch a thousand interfaces.

It started simply enough. Electronics engineers here at the General Motors Research Laboratories set out to devise a highly accurate method of indicating liquid level. And they succeeded.

But then they realized that the heart of their solution, a unique circuit design, had great possibilities for use in all sorts of electrical measuring systems.

Consider the features. This patented circuit can work in conjunction with any sensor that monitors capacitance, resistance, or inductance



(the three most commonly used measurement parameters). Its outstanding asset, however, is that it converts the analog output of a sensor into a pulse-width modulated, or digital, signal.

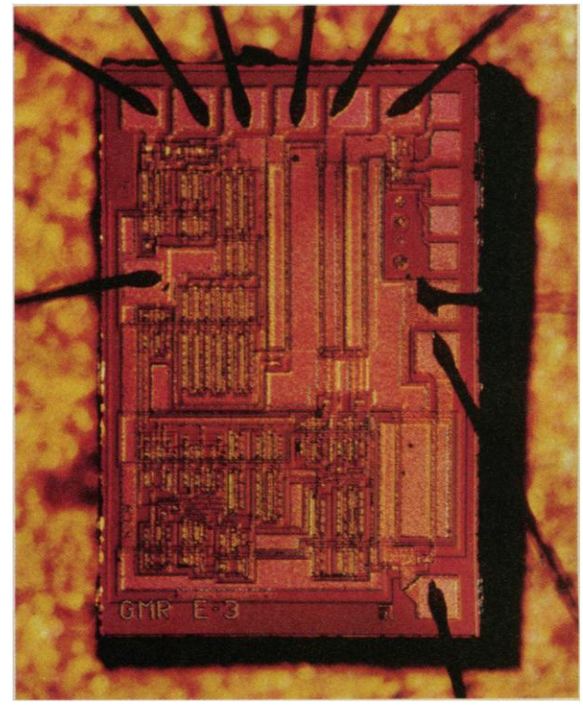
As a result, the circuit can serve as the lone interface between a sensor and a microprocessor (minicomputer) in precision control, diagnostic, and other digital systems. Moreover, it is compatible with standard indicator gages.

For added ruggedness and versatility, our engineers squeezed the circuit into solid state form. They designed and custom built a prototype complementary metal oxide semiconductor (CMOS) integrated circuit chip.

About a millimeter square, the unit contains 55 transistors and performs seven basic circuit functions — doing a job never before possible with a single IC chip.

Successfully tested in a variety of experimental uses, including a novel alcohol-in-gasoline percentage meter, the chip can be applied in almost any environment to measure position or displacement, liquid level, or pressure.

The universal interface: A promising IC chip off the block of our electronics technology.



GM

General Motors Research Laboratories
Warren, Michigan 48090

21 April 1978, Volume 200, Number 4339 **SCIENCE**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, 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

1978: RICHARD E. BALZHISER, JAMES F. CROW, HANS LANDSBERG, EDWARD NEY, FRANK W. PUTNAM, MAXINE SINGER, PAUL E. WAGGONER, F. KARL WILLENBROCK

1979: E. PETER GEIDUSCHEK, WARD GOODENOUGH, N. BRUCE HANNAY, MARTIN J. KLEIN, FRANKLIN A. LONG, NEAL E. MILLER, JEFFREY J. WINE

Publisher

WILLIAM D. CAREY

Editor

PHILIP H. ABELSON

Editorial Staff

Managing Editor
ROBERT V. ORMES

Business Manager
HANS NUSSBAUM

Assistant Managing Editor
JOHN E. RINGLE

Production Editor
ELLEN E. MURPHY

News and Comment: BARBARA J. CULLITON, *Editor;* LUTHER J. CARTER, CONSTANCE HOLDEN, DEBORAH SHAPLEY, R. JEFFREY SMITH, NICHOLAS WADE, JOHN WALSH. *Editorial Assistant,* SCHERRAINE MACK

Research News: ALLEN L. HAMMOND, *Editor;* RICHARD A. KERR, GINA BARI KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, WILLIAM D. METZ, ARTHUR L. ROBINSON. *Editorial Assistant,* FANNIE GROOM

Associate Editors: ELEANORE BUTZ, MARY DORFMAN, SYLVIA EBERHART, JUDITH GOTTLIEB

Assistant Editors: CAITILIN GORDON, RUTH KULSTAD, LOIS SCHMITT, DIANE TURKIN

Book Reviews: KATHERINE LIVINGSTON, *Editor;* LINDA HEISERMAN, JANET KEGG

Letters: CHRISTINE KARLIK

Copy Editors: ISABELLA BOULDIN, OLIVER HEATWOLE

Production: NANCY HARTNAGEL, JOHN BAKER; YA LI SWIGART, ELEANOR WARNER; JEAN ROCKWOOD, LEAH RYAN, SHARON RYAN

Covers, Reprints, and Permissions: GRAYCE FINGER, *Editor;* CORRINE HARRIS, MARGARET LLOYD

Guide to Scientific Instruments: RICHARD SOMMER

Assistant to the Editors: RICHARD SEMIKLOSE

Membership Recruitment: GWENDOLYN HUDDLE

Member and Subscription Records: ANN RAGLAND

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Area code 202. General Editorial Office, 467-4350; Book Reviews, 467-4367; Guide to Scientific Instruments, 467-4480; News and Comment, 467-4430; Reprints and Permissions, 467-4483; Research News, 467-4321; Cable: Advancesci, Washington. For "Instructions for Contributors," write the editorial office or see page xv, *Science*, 30 September 1977.

BUSINESS CORRESPONDENCE: Area Code 202. Business Office, 467-4411; Circulation, 467-4417.

Advertising Representatives

Director: EARL J. SCHERAGO
Production Manager: MARGARET STERLING
Advertising Sales Manager: RICHARD L. CHARLES
Marketing Manager: HERBERT L. BURKLUND

Sales: NEW YORK, N.Y. 10036: Steve Hamburger, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-DE-7-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581)

ADVERTISING CORRESPONDENCE: Tenth floor, 1515 Broadway, New York, N.Y. 10036. Phone: 212-730-1050.

The Annual Meeting

With 144 annual meetings under its belt, AAAS to outward appearances has mastered the job of staging the world series of science and technology. The impression is pleasant but hardly accurate. Toil and struggle go into the architecture of every meeting, and basic questions arise concerning the objectives that are sought.

When AAAS was young, the annual meeting served the purpose of assembling the scattered band of America's scientist-philosophers to read learned papers and to engage in fraternal discourse. More than a century later, the configurations of scientific research and practice are vastly changed, while the scale and sophistication of information diffusion systems put the annual meeting in another light. With close to 300 affiliated societies now in the AAAS network, some of them at or beyond the membership strength of AAAS, the burden of in-depth updating of the state of science must be shared by the disciplinary organizations.

What, then, are the purposes served by the annual meeting of AAAS? Several come to mind. The meeting helps, however briefly, to underscore the essential interdependence of scientific fields and to break down parochialism. It offers a bridging mechanism to link thoughts and experiences originating from diverse starting points and premises. It offers opportunities for challenge and cross-fertilization, both being essential counterweights to elitism and arrogance in science. It reminds scientists that there exists an implicit contract with society, and that the freedom to pursue research and apply its results carries commensurate accountability. The meeting is both a celebration of the centrality of science in our affairs and a process for disclosing its directions and meanings for the human condition. For one short week both the glory and the limits of science go on display, and for furthering public understanding of science (ergo the advancement of science) it would be hard to suggest a substitute. If there are those who come to the meeting not to share its excitement but to express dissent, they can expect a hearing within the accepted rules of civil discourse, but no license for disorder and disruption.

The 145th AAAS meeting has been rerouted to Houston. That decision by the Board of Directors, adopted out of respect for the concerns of women in science, will take AAAS for the first time to a city rich in scientific drive, creativity, and technological innovation. It will also situate the meeting close by our Latin neighbors whose needs, goals, and rising expectations for progress furnish the thrust for the AAAS project in Western Hemispheric Cooperation in Science, which has helped to shape a new and promising federation of scientific associations. The Houston meeting will be different in still another respect: it will be held during the first week of January to take advantage of the collegiate intersession.

The quality of the annual meetings of AAAS is determined chiefly by the ideas and labors of our members and affiliated societies. It is not programmed from the top down. In every sense, it is the members' meeting. The role of the headquarters staff is to negotiate for symposia, to sort out and coordinate the ideas that swarm in, to be watchful that controversial topics are presented fairly and with balance, and to make sure the final program fairly reflects the contemporary range of interactions among science, technology, and society. It is a very large order. The problem of coherence is perhaps the trickiest part of it, as the news media struggle to capture and report with accuracy the main currents of science, technology, and human values to the external audience, which furnishes the multiplier effect in explaining what science is about.

Looking back on the 1978 meeting, the directors of the Association share a variety of sentiments: much satisfaction, appreciation to those who contributed so much, and confidence that the Houston meeting will be still better.—WILLIAM D. CAREY

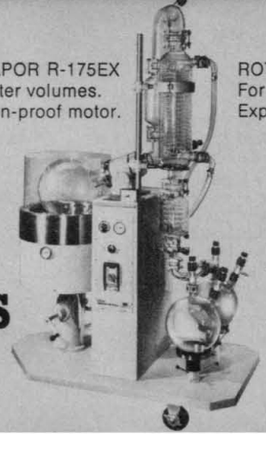
The only rotary evaporator with an air hose instead of an electrical cord.

The explosion-proof Rotavapor 115EX is Büchi/Brinkmann's innovative solution to the hazard posed by sparking electrical motors when working with highly-volatile materials.

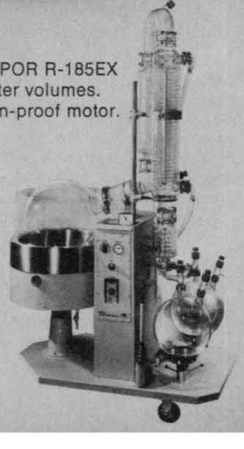
The Rotavapor 115EX has no electrical components whatsoever. Instead, its high-torque, variable speed motor is powered by compressed air. Simply connect the 115EX to any air source of 20-100psi and evaporate in safety at speeds from 15 to 270 rpm. Like the electrically-driven Büchi/Brinkmann standard models, the 115EX comes equipped with 1 liter evaporating and receiving flasks and is available with V-stand, quick-action jack, heating bath and a wide selection of other accessories.

Büchi/Brinkmann Rotary Evaporators are unsurpassed in versatility, durability, and safety of operation. In addition to the 115EX, there are eleven electrically-powered models to meet every concentrating need, from 5ml to 50 liters or more (Pilot Plant models). Our new brochure describes them all. Just write: Büchi Division, Brinkmann Instruments, Inc., Cantiague Road, Westbury, N.Y. 11590. In Canada: 50 Galaxy Blvd., Rexdale, Ont. M9W 4Y5.

ROTAVAPOR R-175EX
For 20-liter volumes.
Explosion-proof motor.



ROTAVAPOR R-185EX
For 50-liter volumes.
Explosion-proof motor.



Büchi/Brinkmann
EXPLOSION-PROOF EVAPORATORS

Circle No. 188 on Readers' Service Card

? What do Quarks, Charms and Phagocytes have in common ?

They are all readily viewed with Ilford Nuclear Emulsions.

- **Available as:**
  1. **Glass Plates:** nuclear emulsion coated on glass
  2. **Pellicles:** layers of self supporting nuclear emulsions
  3. **Shreds:** for coating your own substrate
- **Three grain sizes for .14 μ to .27 μ**
- **Various sensitivities to charged particles**
- **Applicability in nuclear physics, optical and electron microscopy, autoradiography, and astronomy**

Write for detailed information on Ilford nuclear products and other Ilford research products available from:

Polysciences, Inc.
Paul Valley Industrial Park
Warrington, PA 18976
Phone: 215-343-6484
TWX: 510-665-8542

Circle No. 122 on Readers' Service Card

The I's Have It! DNA, IUdR, IdCTP

NO DETECTABLE SINGLE STRANDS
Deoxyribonucleic acid, [iododeoxycytidine, 5-^{125}I]-
>0.1μCi/μg
NEX-082 1μCi 5μCi

CARRIER FREE
Iododeoxyuridine, 5-[^{125}I]-
>2000Ci/mmol
NEX-072 0-500μCi 1mCi add. mCi

TESTED ENZYMATICALLY
Iododeoxycytidine 5'-triphosphate tetra(triethylammonium)salt, 5-[^{125}I]-
>900Ci/mmol
NEX-074 100μCi 500μCi 1mCi

Not for use in humans or clinical diagnosis.

New England Nuclear
549 Albany Street, Boston, Massachusetts 02118
Customer Service 617-482-9595

NEN Canada Ltd., Lachine, Quebec; NEN Chemicals GmbH, Dreieich, W. Germany.

Circle No. 220 on Readers' Service Card

Melted and re-crystallized chemical in polarized light.

The Olympus BHA-P is an extraordinary microscope. While it's impossible to describe everything you can do with it, it's a pleasure to report how easily it performs its polarizing capabilities.

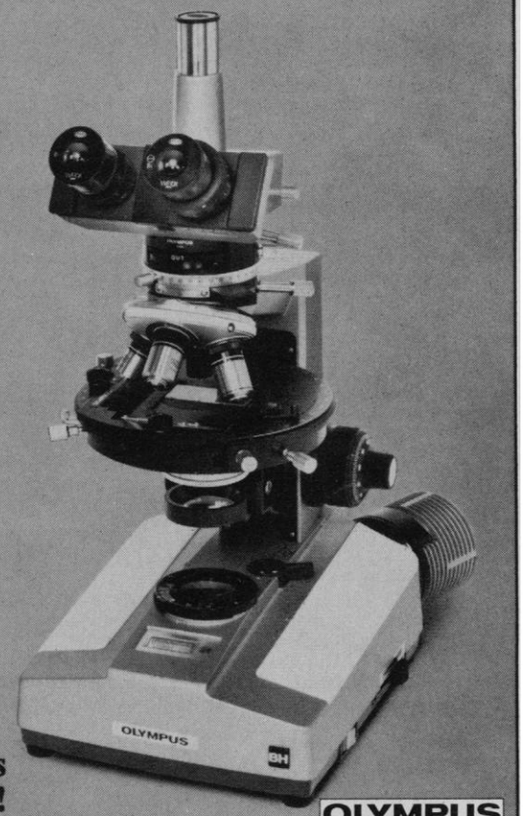
The Olympus BHA-P begins with the sturdiest of stands. All "square line." All modern. We even give you arm rests for added support. All controls are placed where your hands would like to find them.

The circular stage rotates 360°, with a 0.1° vernier scale. Two knobs make it effortless to center the stage.

A quadruple centerable nosepiece revolves with unfailing smoothness. Ball bearings and a positive click stop help to position objectives firmly in place over your specimen. Rotation is light, yet precise. Coarse adjustment spans 40mm to get you within range in seconds. Fine adjustment zeroes in with 0.002mm increments without backlash. Adjustable focusing lock prevents drift or crash landings on valuable specimens.

Olympus strain free achromatic objectives include 4x, 10x, 20x, 40x, and 100x. And you can document your discoveries with any Olympus PM-10 camera attachment.

For additional information and a demonstration just write: Olympus Corporation of America, 2 Nevada Drive, New Hyde Park, New York 11040.



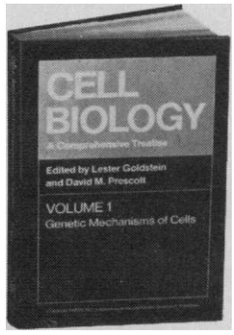
The Olympus BHA-P.

For geology, petro-chemistry and mineralogy, it's one of the finest polarizing microscopes on earth!

In Canada: W. Carsen Co., Ltd., Markham, Ontario.

OLYMPUS
SEEING BEYOND MAN'S VISION

Circle No. 101 on Readers' Service Card



CELL BIOLOGY

A Comprehensive Treatise

Edited by LESTER GOLDSTEIN and DAVID M. PRESCOTT

Volume 1: **GENETIC MECHANISMS OF CELLS**

FROM THE PREFACE:

". . . . Cell biology is now a truly mature science; research that a decade or two ago appeared to be aimless gropings into the unknown has now to a great extent been replaced by theoretically well-grounded investigations that provide useful answers to questions on cell function. Moreover, contemporary investigations can draw on a large resource of well-documented facts about cells.

Knowing all this, we agreed that this was a propitious time to compile an up-to-date, comprehensive treatise on cell biology that would serve for the next decade or two as a single source of information on many areas of this discipline. We planned this multivolume treatise as a primary source of fundamental knowledge for graduate students, investigators working in peripheral areas, and for anyone else in need of information on some particular phase of cell biology. . . ."

CONTENTS: *E. D. Garber and M. S. Esposito*, Defining the Gene by Mutation, Recombination, and Function. *M. S. Esposito and R. E. Esposito*, Gene Conversion, Paramutation, and Controlling Elements: A Treasure of Exceptions. *P. B. Moens*, The Onset on Meiosis. *S. W. Brown and H. S. Chandra*, Chromosome Imprinting and the Differential Regulation of Homologous Chromosomes. *N. R. Ringertz and T. Ege*, Use of Mutant, Hybrid, and Reconstructed Cells in Somatic Cell Genetics. *E. D. Garber*, Cytogenetics. *R. Sager*, Cytoplasmic Inheritance. *L. B. Preer and J. R. Preer, Jr.*, Inheritance of Infectious Elements. *J. Beisson*, Non-Nucleic Acid Inheritance and Epigenetic Phenomena.

1978, 448 pp., $39.50/£28.05 ISBN: 0-12-289501-0
Subscription price: $33.50

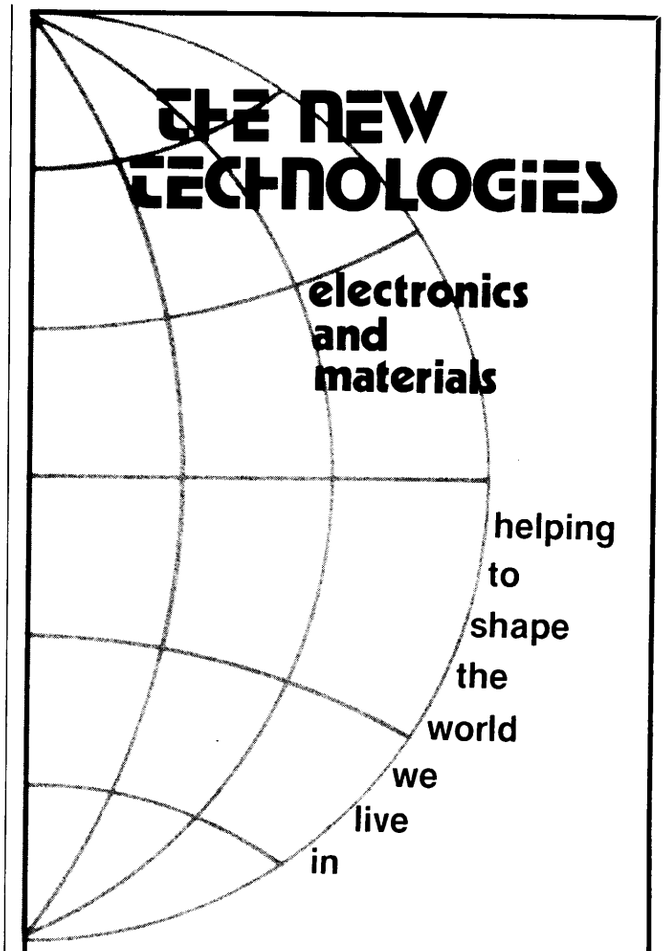
Subscription prices for individual volumes are valid only on orders for the complete set received before publication of the last volume. Subscription prices are not valid in the United Kingdom, Australia, and New Zealand.

Forthcoming Volumes of
CELL BIOLOGY/A Comprehensive Treatise

Volume 2/Structure and Replication of Genetic Material
Volume 3/Genetic Expression—The Production of RNA's
Volume 4/Genetic Expression—Translation and the Behavior of Proteins
Volume 5/Cell Growth and Reproduction (including Organellar Growth and Reproduction)
Volume 6/Cell Differentiation
Volume 7/Specialized Cells and Organelles
Volume 8/Cellular Interactions
Volume 9/The Plasma Membrane, the Cell Surface, and Exchanges between Cell and Environment
Volume 10/Energy Mobilization, Mechanical Work, and Cell Movement
Volume 11/Origin, Evolution, and Diversity of Cells

Send payment with order and save postage plus 50¢ handling charge. *Prices are subject to change without notice.*

ACADEMIC PRESS
A Subsidiary of Harcourt Brace Jovanovich, Publishers
111 FIFTH AVENUE, NEW YORK, N.Y. 10003
24-28 OVAL ROAD, LONDON NW1 7DX



Science Compendia Series

Philip H. Abelson, Series Editor

electronics: the continuing revolution

	Casebound	*Paperbound*
Retail	$ 12.95	$ 4.95
AAAS Member	11.95	4.45

materials: renewable and nonrenewable resources

	Casebound	*Paperbound*
Retail	$ 12.00	$ 4.50
AAAS Member	10.50	4.00

Send your order to

AAAS Department D2
1515 Massachusetts Ave., NW
Washington, DC 20005

Circle No. 142 on Readers' Service Card

BOOKS RECEIVED AND BOOK ORDER SERVICE

(Continued from page 308)

The Middle Woodland Population of the Lower Illinois Valley. A Study in Paleodemographic Methods. David L. Asch. Northwestern Archeological Program, Evanston, Ill., 1976. xii, 100 pp., illus. Cloth, $8.50; paper, $5.25. Northwestern University Archeological Program Scientific Papers, No. 1.

Mimbres Painted Pottery. J. J. Brody. School of American Research, Santa Fe, N.M., and University of New Mexico Press, Albuquerque, 1977. xxiv, 254 pp., illus. $22.50. School of American Research Southwest Indian Arts Series.

The Moon. Steppingstone to Outer Space. Dorothy E. Shuttlesworth and Lee Ann Williams. Doubleday, Garden City, N.Y., 1977. x, 118 pp., illus. $5.95.

Multiple Molecular Forms of Steroid Hormone Receptors. Proceedings of a workshop, Lausanne, Switzerland, June 1977. M. K. Agarwal, Ed. Elsevier/North-Holland, New York, 1977. x, 296 pp., illus. $29.95.

Nature's Economy. The Roots of Ecology. Donald Worster. Sierra Club Books, San Francisco, 1977. xii, 404 pp. $15.

Nuclear Proliferation and Safeguards. Congress of the United States Office of Technology Assessment. Praeger, New York, 1977. xiv, 274 pp., illus. $21.50. Praeger Special Studies in U.S. Economic, Social, and Political Issues.

The Once and Future Star. George Michanowsky. Hawthorn Books, New York, 1977. viii, 150 pp., illus. $7.95.

Optimal Estimation in Approximation Theory. Proceedings of a symposium, Freudenstadt, Germany, Sept. 1976. Charles A. Micchelli and Theodore J. Rivlin, Eds. Plenum, New York, 1977. x, 300 pp., illus. $29.50. The IBM Research Symposia Series.

The Ovary. Vol. 2, Physiology. Lord Zuckerman and Barbara J. Weir, Eds. Academic Press, New York, ed. 2, 1977. xx, 556 pp., illus. $39.50.

Our Changing Planet. John Gribbin. Crowell, New York, 1977. vi, 166 pp., illus. $7.95.

Parasitic Protozoa. Vol. 3, Gregarines, Haemogregarines, Coccidia, Plasmodia, and Haemoproteids. Julius P. Kreier, Ed. Academic Press, New York, 1977. xvi, 564 pp., illus. $48.

Pathogenesis of Human Muscular Dystrophies. Proceedings of a conference, Durango, Colo., June 1976. Lewis P. Rowland, Ed. Excerpta Medica, Amsterdam, 1977 (U.S. distributor, Elsevier, New York). xx, 896 pp., illus. $66.95. International Congress Series, No. 404.

The Peopling of Hawaii. Eleanor C. Nordyke. Published for the East-West Center by University Press of Hawaii, Honolulu, 1977. xx, 226 pp., illus. Cloth, $10; paper, $4.95. An East-West Center Book.

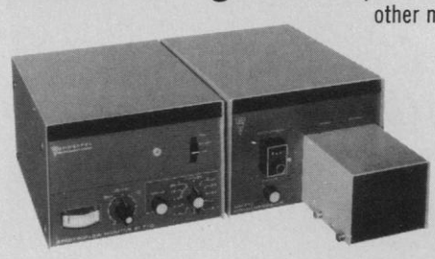
Peripheral Nerve Block. Pharmacologic—By Local Anesthesia; Electric—By Transdermal Stimulation. F. L. Jenkner. Translated from the German edition (Vienna, 1975). Springer-Verlag, New York, 1977. viii, 116 pp., illus. Paper, $10.60.

Perspectives on the Development of Memory and Cognition. Robert V. Kail, Jr., and John W. Hagen, Eds. Erlbaum, Hillsdale, N.J., 1977 (distributor, Halsted [Wiley], New York). xiv, 498 pp. $19.95.

Pesticides in Aquatic Environments. Pro-

The only thing variable about the SF 770 Spectroflow Monitor for liquid chromatography ...is the wavelength!

- It consistently offers highest sensitivity with low noise and baseline drift.
- It classically follows Beer's law in its measurements.
- It routinely includes an automatic gain control and zero suppression.
- It equally interfaces with all Liquid Chromatography systems.
- It inconspicuously takes up very little room.
- It uniquely incorporates a double-beam design.
- It invariably is an honest instrument, not relying on gimmicks to achieve unrealistic specs.
- It indubitably is preferred by more liquid chromatographers than all other models combined.



Call or write now!

24 BOOKER STREET, WESTWOOD, NEW JERSEY 07675
(201) 664-7263

SCHOEFFEL INSTRUMENT CORPORATION

Circle No. 225 on Readers' Service Card

A mere 4½"x 2". Wt: 2 oz.

Programmable History...

Sinclair Pioneers a 36-STEP, Fully Programmable Computer For An Astonishing $29.95!

The Sinclair Cambridge Programmable goes way beyond just helping you with calculations — It actually Does Them For YOU! Whether your work or personal business involves Finance, Science, Statistics, Engineering, Electronics, Mechanics, Dynamics, or Advanced Math, this incredible machine will save you hours upon hours of work *with its simple, flexible, thru-the-keyboard program entry and operation. It also features conditional and unconditional branch instructions (go to and go if negative).*

PLUS, there is a Special Stop Facility, allowing you to STEP through the program, checking that it has been entered correctly. In the event of an error, the "Learn Key" lets you correct single steps without destroying any of the remainder of the program.

Use The Vast 294-Program Library To Tailor The Machine TO YOUR OWN SPECIALTY; Unlike more expensive "specialist" calculators, the Sinclair Cambridge Programmable can be programmed to handle calculations concerned with ANY specialty, just like a full-size computer! You can devise your own programs or use the Sinclair Library which includes **77 General/Finance/Statistics programs, 93 Mathematics programs, 77 Physics/Engineering programs and 47 Electronics programs.**

Using these standard programs the machine solves problems from quadratic equations (where the program gives real and imaginary roots) to twin-T filter design, and from linear regression to bond yields. To realize the full power of this computer the Program Library is a must, however the basic unit comes complete with 12 sample programs and full instructions for easily entering your own programs, even if you are new to the concept of programmability in a calculator.

Don't Forget That It Is A Standard Calculator As Well . . . Plus A Full Scientific Computer with 8-digit floating point notation, 3-function memory, algebraic logic, brackets, etc. Sinclair, a longtime world leader in micro-electronics, pioneered the truly pocketable pocket calculator a few years ago and recently introduced the world's First Pocket T.V. They provide a comprehensive, unconditional 1-Year Guarantee with each unit. Incl. 9V. Batt.

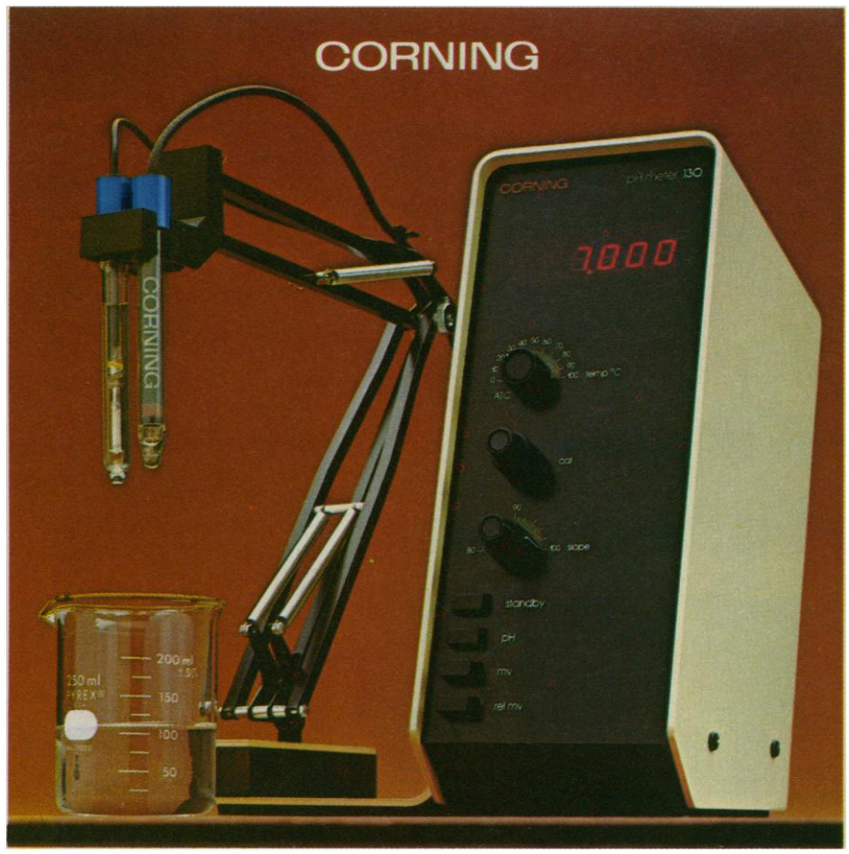
The **Stardhine** Group
Dept. 303, 1114 State Street, Suite 233, Santa Barbara, CA 93101
FOR INSTANT SERVICE, CALL TOLL-FREE: 1-800-528-6050 Ext. 1037. Ariz. Res. Call Collect 602-955-9710.

Or Send Coupon:

Please promptly send me _____ Sinclair Cambridge Programmable(s) @ $29.95 (plus $3 postage & insurance) ea. I have the option of returning it within 1 week of receipt for an immediate refund.

☐ Also include _____ AC line adapter(s) @ $4.95 ea.
☐ Also include _____ 294-Program Library Set(s) @ $10 per complete set
☐ Check or M.O. Enclosed (Calif. Res. Add 6% Sales Tax)
☐ Charge the Credit Card Checked Below
☐ American Express ☐ BankAmericard
☐ MasterCharge ☐ CarteBlanche
☐ Diner's Club

Credit Card # _____
MasterCharge Bank # _____
Exp. Date _____
Name _____
Address _____
City/State/Zip _____
Signature _____



THE TALL METERS

ORIGINATED BY CORNING

Tall to look you in the eye and save space.

A new generation of pH meters from a wedding of bioengineering and solid state of the art electronics. Digital display on top where your eyes are. Controls down the side where your hands are. Flexing sidearm to take electrodes where the work is. Mounts left side or right.

I-C chips. Single circuit board. Cool, energy-saving LED display. U/L and CSA listings.

Even the back is all up front. Everything orderly and easy to get at.

Tall and lean, including the price. Even with a general-purpose pH and a reference electrode thrown in, they cost less than comparable short meters.

At your Corning dealer.

2 and 3 decimal models.

THREE YEAR WARRANTY

THAT'S HOW RELIABLE THE TALL ONES ARE

Corning Glass Works warrants pH meters Model 125 and Model 130 to be free from defects in material and workmanship when used under normal laboratory conditions for a period of three (3) years.

Circle No. 230 on Readers' Service Card

CORNING™ pHware

ceedings of a symposium, Washington, D.C., Aug. 1976. Mohammed Abdul Quddus Khan, Ed. Plenum, New York, 1977. xiv, 258 pp., illus. $29.50. Environmental Science Research, vol. 10.

Physical Science Techniques in Obstetrics and Gynaecology. Martin Black and Michael English, Eds. University Park Press, Baltimore, 1977. viii, 184 pp., illus. $34.50.

The Piggle. An Account of the Psychoanalytic Treatment of a Little Girl. D. W. Winnicott. Ishak Ramzy, Ed. International Universities Press, New York, 1977. xvi, 202 pp. $10.

Planning for Social Welfare. Issues, Models, and Tasks. Neil Gilbert and Harry Specht. Prentice-Hall, Englewood Cliffs, N.J., 1977. xiv, 398 pp. $13.50.

Plant Pathology and Plant Pathogens. C. H. Dickinson and J. A. Lucas. Halsted (Wiley), New York, 1977. x, 162 pp., illus. Paper, $9.75. Basic Microbiology, vol. 6.

Policy Reform in Developing Countries. Bela Ballassa. Pergamon, New York, 1977. x, 176 pp. $17. Pergamon International Library. *To order this book circle No. 418 on Readers' Service Card*

Political Language. Words That Succeed and Policies That Fail. Murray Edelman. Academic Press, New York, 1977. xxii, 166 pp. $12.50. Institute for Research on Poverty Monograph Series.

Predicting Dependence Liability of Stimulant and Depressant Drugs. Proceedings of a conference, Washington, D.C., Apr. 1976. Travis Thompson and Klaus R. Unna, Eds. University Park Press, Baltimore, 1977. xvi, 328 pp., illus. $19.50.

Prehistoric Locational Behavior. A Computer Simulation. Larry J. Zimmerman. Office of the State Archaeologist, Iowa City, 1977. xiv, 176 pp., illus. Paper, $4. Report 10 of Office of the State Archaeologist.

Pressure Vessel Handbook. Eugene F. Megyesy. Pressure Vessel Handbook Publishing Inc., Tulsa, Okla., ed. 4, 1977. 416 pp., illus. $24.50.

Principles of Behavioral Pharmacology. Leslie L. Iversen, Susan D. Iversen, and Solomon H. Snyder, Eds. Plenum, New York, 1977. xvi, 454 pp., illus. $34.50. Handbook of Psychopharmacology, vol. 7.

Principles of Surgical Oncology. Ronald W. Raven, Ed. Plenum, New York, 1977. x, 510 pp., illus. $37.50.

Prison Homicide. Sawyer F. Sylvester, John H. Reed, and David O. Nelson. Spectrum, New York, 1977 (distributor, Halsted [Wiley], New York). xxiv, 126 pp. $12. Sociomedical Science Series.

Problems of Birth Defects. From Hippocrates to Thalidomide and After. Original papers with commentaries by T. V. N. Persaud. University Park Press, Baltimore, 1977. x, 400 pp., illus. $34.50.

Proceedings of the James C. Kimbrough Urological Seminar. Vol. 10. San Diego, Calif., Oct. 1976. Eaton Laboratories, Norwich, N.Y., 1977. xxviii, 344 pp. Paper.

Proceedings of the Second National Weeds Conference of South Africa. Stellenbosch, Feb. 1977. Balkema, Cape Town, South Africa, 1977 (U.S. distributor, ISBS, Forest Grove, Ore.). viii, 344 pp. Paper, $25. *To order this book circle No. 409 on Readers' Service Card*

Productivity in Service Organizations. Organizing for People. Herbert Heaton. McGraw-Hill, New York, 1977. xiv, 234 pp. $13.50. *To order this book circle No. 419 on Readers' Service Card*

Products Standards Index. Verne L. Roberts. Pergamon, New York, 1977. vi, 516 pp. $29.95. *To order this book circle No. 410 on Readers' Service Card*

Progress in Behavior Modification. Vol. 5. Michel Hersen, Richard M. Eisler, and Peter M. Miller, Eds. Academic Press, New York, 1977. xvi, 384 pp. $19.50.

Progress in the Study of Point Defects. Masao Doyama and Sho Yoshida, Eds. University of Tokyo Press, Tokyo, 1977 (U.S. distributor, ISBS, Forest Grove, Ore.). viii, 440 pp., illus. $55. *To order this book circle No. 411 on Readers' Service Card*

Prostaglandins and Thromboxanes. Papers from a NATO Advanced Study Institute, Erice, Sicily, Oct. 1976. F. Berti, B. Samuelsson, and G. P. Velo, Eds. Plenum, New York, 1977. x, 450 pp., illus. $45. NATO Advanced Study Institutes Series A, vol. 13.

Protein and Non-Protein Nitrogen for Ruminants. Proceedings of a symposium, Geneva, Jan. 1977. Published for the United Nations by Pergamon, New York, 1977. vi, 182 pp., illus. Paper, $24. *To order this book circle No. 420 on Readers' Service Card*

Psychobiological Aspects of Cognitive Growth. Reuven Kohen-Raz. Academic Press, New York, 1977. xii, 128 pp. $11.

Psychology and the Poetics of Growth. Figurative Language in Psychology, Psychotherapy, and Education. Howard R. Pollio, Jack M. Barlow, Harold J. Fine, and Marilyn R. Pollio. Erlbaum, Hillsdale, N.J., 1977 (distributor, Halsted [Wiley], New York). xii, 260 pp. $16.50.

Psychopathology and Brain Dysfunction. Papers from a meeting, Mar. 1976. Charles Shagass, Samuel Gershon, and Arnold J. Friedhoff, Eds. Raven, New York, 1977. xiv, 386 pp. illus. $22.50. American Psychopathological Association Series.

Psyclosis. The Circularity of Experience. Ralph Berger. Freeman, San Francisco, 1977. xvi, 222 pp., illus. $11.

The Rand McNally Atlas of the Oceans. Rand McNally, New York, 1977. 208 pp. $29.95.

Real-Time Computer Systems. A. L. Freedman and R. A. Lees. Crane, Russak, New York, and Arnold, London, 1977. x, 278 pp. $19.50. Computer Systems Engineering Series.

Recent Progress in Hormone Research. Vol. 33. Proceedings of a conference, 1976. Roy O. Greep, Ed. Academic Press, New York, 1977. xx, 672 pp., illus. $42.

Respiratory Adaptations, Capillary Exchange and Reflex Mechanisms. Proceedings of a symposium, Srinagar, Kashmir, India, Oct. 1974. A. S. Paintal and Pritam Gill-Kumar, Eds. Vallabhbhai Patel Chest Institute, University of Delhi, 1977. xxviii, 504 pp., illus. + plates. $30.

Roots of Caring, Sharing, and Helping. The Development of Prosocial Behavior in Children. Paul Mussen and Nancy Eisenberg-Berg. Freeman, San Francisco, 1977. xii, 212 pp. Cloth, $12; paper, $4.95. A Series of Books of Psychology.

The Samizdat Register. Roy A. Medvedev, Ed. Translated from the Russian. Norton, New York, 1977. viii, 314 pp. $10.95.

Schooling and the Acquisition of Knowledge. Papers from a conference, San Diego, Nov. 1975. Richard C. Anderson, Rand J. Spiro, and William E. Montague, Eds. Erlbaum, Hillsdale, N.J., 1977 (distributor, Halsted [Wiley], New York). xii, 448 pp., illus. $19.95.

Scientists Confront Velikovsky. Papers from

BIG TOP CREATES BIG STIR

- 100 SQUARE INCH TOP. NOW WITH STIRRER.
- Stirs 100 to 900 r.p.m. With or without heat.
- 10" x 10" surface. Holds big vessels.
- Fast, accurate heat. Fast heat-up. Fast cool-down.
- Overhang protects insides.
- PYROCERAM® glass-ceramic top. Inert. Impervious. Stays white.
- Nylon feet. Very quiet. Very smooth.
- Infinite variable control. LO to HI.
- Big, easy-to-read knobs.

NEW HOT PLATE/STIRRER, MODEL PC-101. Order from your distributor. Or call or write for the name of the distributor nearest you: 607-974-4126. Science Products Division, Corning Glass Works, Corning, New York 14830

CORNING® hotware

Circle No. 231 on Readers' Service Card

Our compact MM-33 micromanipulator drives by hand or motorized 'joy stick'.

Ideal for working at magnifications up to 250X, the MM-33 provides coarse movements in 3 planes (XYZ) plus fine movement in the thrust axis. Excursions calibrated in millimeters with vernier readings to 0.1 mm; final drive calibrated to 10 microns. Ball-bearing raceways assure smooth, backlash-free operation. All controls aligned in same vertical plane permits use of several MM-33's side by side. Mounts on Flexbar or a variety of bases.

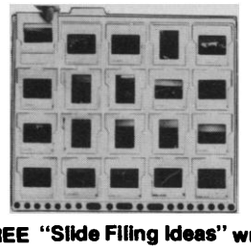
Also available in a motorized version (MM-33M), with 'Joy Stick' remote unit for vibration-free control of speed and direction. For literature, write: Brinkmann Instruments, Cantiague Rd., Westbury, N.Y. 11590.

Brinkmann Micromanipulators

Circle No. 187 on Readers' Service Card

Let me send you a free folder of Slide-filing Ideas with the versatile VPD SLIDE-SHO® SYSTEM

For protecting, fast viewing, filing and finding slides it is superior to anything around. Rigid, plastic pages each hold 20 slides, each protected in a recessed slot. No vinyl pockets to trap moisture and damage emulsion. Translucent, matte, light-diffusing backing for easy viewing, even in ordinary light. Pages nest compactly, 10 pages (200 slides) per inch, fit file drawers or ring binders. Ideal for medical, scientific, educational and other visual communication applications.



For FREE "Slide Filing Ideas" write
JOSHUA MEIER DIVISION
W.R. Grace & Co., North Bergen, N.J. 07047

Circle No. 132 on Readers' Service Card

Now Available:

the tool for selecting all your science books

Science Book List Supplement 1970-1977

Retail: $16.50
AAAS Members: $15.00

American Association for the Advancement of Science
Dept. C-6
1515 Mass. Ave., N.W.
Washington, D.C. 20005

a AAAS symposium, San Francisco, Feb. 1974. Donald Goldsmith, Ed. Cornell University Press, Ithaca, N.Y., 1977. 184 pp., illus. $8.95.

Seasonality in Human Mortality. A Medico-Geographical Study. Masako Sakamoto-Momiyama. Translated from the Japanese. University of Tokyo Press, Tokyo, 1977 (U.S. distributor, ISBS, Forest Grove, Ore.). xx, 182 pp., illus. $14.50. *To order this book circle No. 412 on Readers' Service Card*

Selecting and Ordering Populations. A New Statistical Methodology. Jean Dickinson Gibbons, Ingram Olkin, and Milton Sobel. Wiley, New York, 1977. xxii, 570 pp., illus. $24.95. Wiley Series in Probability and Mathematical Statistics.

A Sense of the Future. Essays in Natural Philosophy. J. Bronowski. Selected and edited by Piero E. Ariotti in collaboration with Rita Bronowski. MIT Press, Cambridge, Mass., 1977. xii, 286 pp. $12.50.

Sigmund Freud's Writings. A Comprehensive Bibliography. Alexander Grinstein. International Universities Press, New York, 1977. xxvi, 182 pp. $22.50.

The Social Psychology of Bargaining. Ian E. Morley and Geoffrey M. Stephenson. Allen and Unwin, Boston, 1977. 318 pp. $25.50.

The Solar Output and Its Variation. Oran R. White, Ed. Colorado Associated University Press, Boulder, 1977. x, 526 pp., illus. $8.95.

A Species of Eternity. Joseph Kastner. Knopf, New York, 1977. xiv, 354 pp., illus. $15.

The Specific Treatment of Virus Diseases. D. J. Bauer. University Park Press, Baltimore, 1977. viii, 194 pp., illus. $19.50.

Statistics. A Biomedical Introduction. Byron Wm. Brown, Jr., and Myles Hollander. Wiley, New York, 1977. xvi, 456 pp., $15.95. Wiley Series in Probability and Mathematical Statistics.

Stress and the Heart. Interactions of the Cardiovascular System, Behavioral State and Psychotropic Drugs. David Wheatley, Ed. Raven, New York, 1977. x, 262 pp., illus. $15.

Structural Theory of Organic Chemistry. N. D. Epiotis, W. R. Cherry, S. Shaik, R. Yates, and F. Bernardi. Springer-Verlag, New York, 1977. viii, 250 pp., illus. $41.40. Topics in Current Chemistry, 70. *To order this book circle No. 421 on Readers' Service Card*

The Structure, Biosynthesis, and Degradation of Wood. Proceedings of a meeting, Vancouver, British Columbia, Canada, Aug. 1976. Frank A. Loewus and V. C. Runeckles, Eds. Plenum, New York, 1977. xii, 528 pp., illus. $49.50. Recent Advances in Phytochemistry, vol. 11.

The Structure of Geology. David B. Kitts. SMU Press, Dallas, 1977. xx, 180 pp. Paper, $8.95.

A Symposium on the Use of Evaluation by Federal Agencies. McLean, Va. Nov. 1976. Eleanor Chelimsky, Ed. MITRE Corporation, McLean, Va., 1977. Two volumes. Vol. 1, Proceedings. xiv, 200 pp. Vol. 2, An Analysis of the Proceedings. viii, 52 pp. Paper.

The Synthesis of Prostaglandins. Abhijit Mitra. Wiley-Interscience, New York, 1977. xvi, 444 pp., illus. $22.50.

Teaching Thinking. Edward de Bono. Temple Smith, London, 1976 (U.S. distributor, Transatlantic Arts, Levittown, N.Y.). 238 pp., illus. $10.95.

Treatise on Materials Science and Technology. Herbert Herman, Ed. Vol. 10, Properties of Solid Polymeric Materials, Part A. J. M. Schultz, Ed. Academic Press, New York, 1977. xiv, 452 pp., illus. + index. $44.

energy:

Use, Conservation, and Supply

Interested in understanding the energy problems we face, in finding practical solutions to these problems? Then you're sure to want a personal copy of this AAAS *Science* Compendium. It presents a collection of authoritative articles that originally appeared in *Science* during 1973-4. The knowledge embodied in this collection of articles can be of considerable help in understanding the problems and in pointing the way toward practical solutions to the modes of supply and utilization of energy.

Edited and with an introduction by Philip H. Abelson.

Retail price: $10.00 casebound, $3.50 paperbound

AAAS member price, prepaid only: $8.00 casebound, $3.00 paperbound

Send orders to:

AAAS, Dept. E-4
1515 Massachusetts Ave., N.W.
Washington, D. C. 20005

(Please allow 6 to 8 weeks for delivery)

We Can't Say It Often Enough!

Thymidine, [*methyl*,1',2'-^{3}H]-	80-100Ci/mmol	NET-512*
Thymidine, [*methyl*-^{14}C]-	40-60Ci/mmol	NET-568
Thymidine, [2-^{14}C]-	>50Ci/mmol	NET-156
Thymidine, [6-^{3}H]-	>15Ci/mmol	NET-355
Thymidine, [*methyl*-^{3}H]-	2Ci/mmol	NET-027A
Thymidine, [*methyl*-^{3}H]-	6.7Ci/mmol	NET-027
Thymidine, [*methyl*-^{3}H]-	20Ci/mmol	NET-027E*
Thymidine, [*methyl*-^{3}H]-	20Ci/mmol	NET-027X
Thymidine, [*methyl*-^{3}H]-	40-60Ci/mmol	NET-027Z

*This compound supplied in ethanol:water, 7:3. All others in sterile aqueous solution.

Not for use in humans or clinical diagnosis.

Send for our new Nucleotides Brochure.

NEN New England Nuclear
549 Albany Street, Boston, Mass. 02118
Call toll-free: 800-225-1572
(In Massachusetts and International: 617-482-9595)

NEN Chemicals GmbH, Dreieich, W. Germany; NEN Canada Ltd., Lachine, Quebec

Circle No. 274 on Readers' Service Card

Computerized Scanning Densitometer System

- **Reflectance, fluorescence and transmission scans**
- All media, including cellulose acetate, agarose, paper, TLC, radiochromatograms, gel tubes
- Up to 20 cm × 20 cm sample size
- Automatic zero
- Monochromator; 190 to 740 nm
- 0.2% resolution
- Computing integrator prints four lines per second
- Automatic or manual fraction detection
- 100 slit-size combinations

TRANSIDYNE GENERAL CORPORATION

903 AIRPORT DRIVE • ANN ARBOR, MICHIGAN 48106 • 313/769-1900

Circle No. 221 on Readers' Service Card