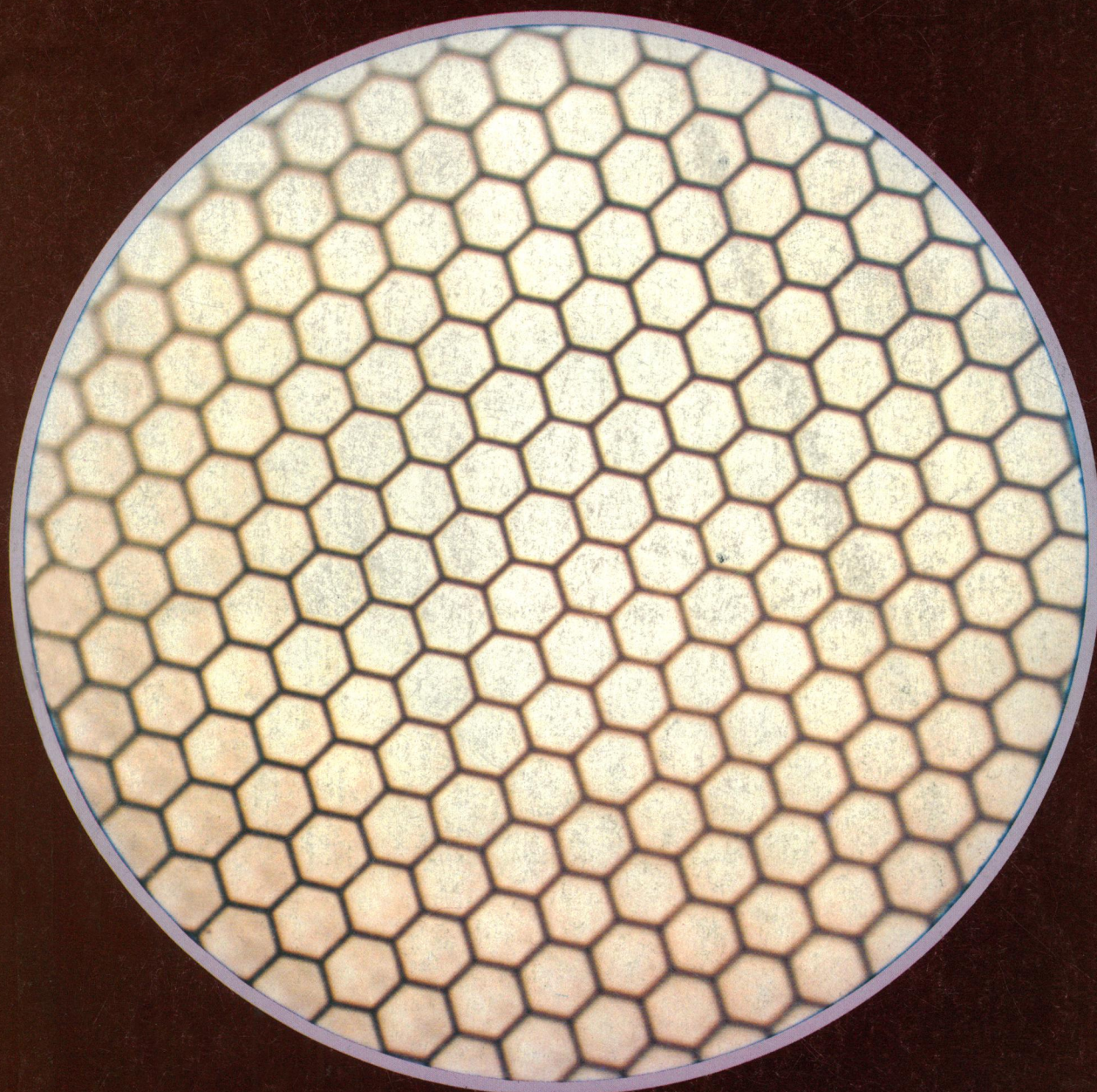


17 October 1980 • Vol. 210 • No. 4467

\$1.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Instrument Issue

You Separate Small Samples in a Hurry at 95,000 rpm with the Airfuge® Ultracentrifuge

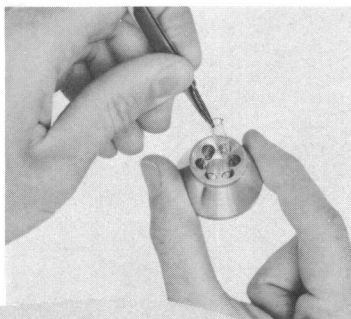
The Airfuge® miniature ultracentrifuge is one of the most useful developments in centrifugation in years. It reaches speeds of 95,000 rpm and generates forces of 178,000 g in less than a minute, so your work gets done fast.

Now there's an optional Digital Speed Readout that displays rotor speed throughout the run. This new accessory is particularly useful for molecular weight determinations, and is a convenience any time.

Five rotors are available for the Airfuge: two fixed angle rotors that

hold microliter-sized tubes; the EM-90 Rotor for preparing particles for electron microscopy; the Batch Rotor for pelleting 2 to 7-ml size samples; and the Chylomicron Rotor for clarifying lipemic sera.

So whenever your small samples need high forces, think of the efficient, quiet Airfuge ultracentrifuge. For more information about the Airfuge and its many applications, write for SB-557 to Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, CA 94304.



Circle No. 238 on Readers' Service Card

BECKMAN

Busiest cytogenetic lab banks on Photomicroscope III...

...for heavy-duty photomicrography

"An image of the best possible quality from an absolutely routine specimen preparation is what we need, and that is what we receive from our six Zeiss Photomicroscopes," says Dr. William D. Loughman. His Pre-Natal Diagnostics and Chromosome Analysis Lab at the University of California produces several thousand photomicrographs a year.

Flawless image, rugged mechanics

Great Zeiss optics give the image detail needed for accurate analysis and diagnosis. And Zeiss precision engineering gives the performance required for easy, trouble-free operation. The built-in automatic 35mm camera and data-recording system combine for speed and accuracy every step of the way.

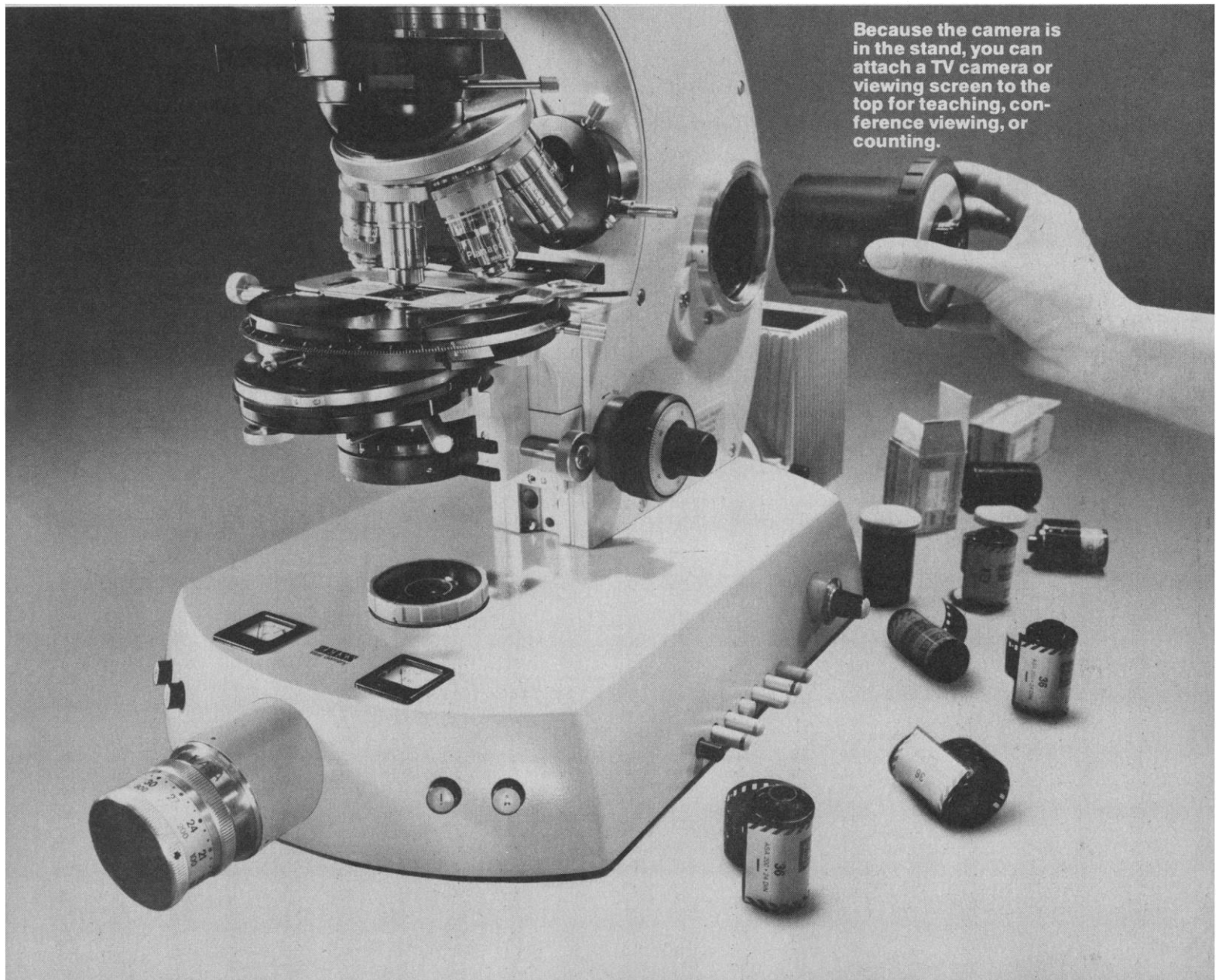
Nationwide service.

The great name in optics



Circle No. 124 on Readers' Service Card

Carl Zeiss, Inc., 444 5th Avenue, New York, N.Y. 10018. (212) 730-4400. Branches: Atlanta, Boston, Chicago, Houston, Los Angeles, San Francisco, Washington, D.C. In Canada: 45 Valleybrook Drive, Don Mills, Ontario, M3B 2S6. Or call (416) 449-4660.



Because the camera is in the stand, you can attach a TV camera or viewing screen to the top for teaching, conference viewing, or counting.

SCIENCE

LETTERS	Hybridomas Revisited: <i>H. Koprowski</i> and <i>C. Croce</i> ; Africanized Bees: <i>O. R. Taylor</i>	248
EDITORIAL	Electronics and Scientific Communication	255
ARTICLES	Computers, Health Care, and Medical Information Science: <i>T. L. Lincoln</i> and <i>R. A. Korpman</i>	257
	Biomedical Implantable Microelectrodes: <i>J. D. Meindl</i>	263
	Ultrasonic Diagnostic Instruments: <i>R. L. Popp</i> and <i>A. Macovski</i>	268
	Three-Dimensional Imaging of Heart, Lung, and Circulation: <i>E. L. Ritman</i> et al. . .	273
	Endoscopy: Developments in Optical Instrumentation: <i>M. Epstein</i>	280
	Instrumentation in Clinical Chemistry: <i>R. J. Elin</i>	286
NEWS AND COMMENT	Legislators Accept Fast-Faced Fusion Program	290
	Charges of Piracy Follow Alsabti	291
	Poland: A Visitor's Snapshot	292
	Computer Chess: Belle Sweeps the Board	293
	<i>Briefing</i> : Prizes That Predict Nobel Winners; Westinghouse Feels Impact of Declining Demand; Disease Center Will Fund Love Canal Research.	294
	Drug-Making Topples Eminent Anthropologist.	296
RESEARCH NEWS	Thalassemias: Models of Genetic Diseases	300
	NMR Opens a New Window into the Body	302
ANNUAL MEETING	Meeting Program—Part I; Advance Registration, Hotel Reservation, and Air Travel Reservation Forms	306

BOARD OF DIRECTORS

KENNETH E. BOULDING
Retiring President, Chairman

FREDERICK MOSTELLER
President

D. ALLAN BROMLEY
President-Elect

ELOISE E. CLARK
MARTIN M. CUMMINGS

RENÉE C. FOX
NANCIE L. GONZALEZ

CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
Herbert B. Keller
Ronald Graham

PHYSICS (B)
William M. Fairbank
Rolf M. Sinclair

CHEMISTRY (C)
H. S. Gutowsky
William L. Jolly

ASTRONOMY (D)
Tobias Owen
Donat G. Wentzel

PSYCHOLOGY (J)
Lloyd G. Humphreys
Meredith P. Crawford

SOCIAL AND ECONOMIC SCIENCES (K)
Kingsley Davis
Gillian Lindt

HISTORY AND PHILOSOPHY OF SCIENCE (L)
Brooke Hindle
Diana L. Hall

ENGINEERING (M)
H. Norman Abramson
Donald E. Marlowe

EDUCATION (O)
Joseph D. Novak
Roger G. Olstad

DENTISTRY (R)
Robert J. Genco
Harold M. Fuller

PHARMACEUTICAL SCIENCES (S)
David A. Knapp
Robert A. Wiley

INFORMATION, COMPUTING, AND COMMUNICATION (T)
Henry M. Kissman
Madeline M. Henderson

DIVISIONS

ALASKA DIVISION

E. Lee Gorsuch
President

T. Neil Davis
Executive Secretary

PACIFIC DIVISION

Beatrice M. Sweeney
President

Alan E. Leviton
Executive Director

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Sam Shushan
President

M. Michelle Balcomb
Executive Officer

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with *The Scientific Monthly*. Copyright © 1980 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$38. Domestic institutional subscription (51 issues): \$76. Foreign postage extra: Canada \$14, other (surface mail) \$17, air-surface via Amsterdam \$45. First class, airmail, school-year, and student rates on request. Single copies \$1.50 (\$2 by mail); back issues \$2.50 (\$3 by mail); classroom rates on request. Change of address: allow 6 weeks, giving old and new addresses and seven-digit account number. Postmaster: Send Form 3579 to Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Science is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

BOOK REVIEWS	The Languages of Native America, <i>reviewed by W. Bright</i> ; Genetic Recombination, <i>J. R. S. Fincham</i> ; The Fossil Hunters, <i>H. P. Banks</i> ; Monoclonal Antibodies, <i>M. Gefter</i> ; Books Received	315
REPORTS	Radioactive Waste: The Problem of Plutonium: <i>H. Krugmann and F. von Hippel</i>	319
	Carbon Budget of the Southeastern U.S. Biota: Analysis of Historical Change in Trend from Source to Sink: <i>H. R. Delcourt and W. F. Harris</i>	321
	Episodic Ice-Free Arctic Ocean in Pliocene and Pleistocene Time: Calcareous Nannofossil Evidence: <i>T. R. Worsley and Y. Herman</i>	323
	Late Wisconsin Climate of Northern Florida and the Origin of Species-Rich Deciduous Forest: <i>W. A. Watts and M. Stuiver</i>	325
	Direct Measurement of Microvascular Pressures in the Isolated Perfused Dog Lung: <i>J. Bhattacharya and N. C. Staub</i>	327
	Genotoxicity of the Antihypertensive Drugs Hydralazine and Dihydralazine: <i>G. M. Williams et al.</i>	329
	Genetic Mosaics of <i>Caenorhabditis elegans</i> : A Tissue-Specific Fluorescent Mutant: <i>S. S. Siddiqui and P. Babu</i>	330
	Polyamine Metabolism: A Potential Therapeutic Target in Trypanosomes: <i>C. J. Bacchi et al.</i>	332
	Folic Acid: Crystal Structure and Implications for Enzyme Binding: <i>D. Mastropaolo, A. Camerman, N. Camerman</i>	334
	JH Zero: New Naturally Occurring Insect Juvenile Hormone from Developing Embryos of the Tobacco Hornworm: <i>B. J. Bergot et al.</i>	336
	Swelling of Nerve Fibers Associated with Action Potentials: <i>K. Iwasa, I. Tasaki, R. C. Gibbons</i>	338
	Rapid Effect of Triiodothyronine on the Mitochondrial Pathway in Rat Liver in vivo: <i>K. Sterling, M. A. Brenner, T. Sakurada</i>	340
	Lithium Reduces the Number of Acetylcholine Receptors in Skeletal Muscle: <i>A. Pestronk and D. B. Drachman</i>	342
PRODUCTS AND MATERIALS	Electronic Balance; Carbon Dioxide Incubator; Slide and Photograph Service; Gas Chromatograph-Mass Spectrometer; Portable Gas Analyzer; Anaerobic Chamber; Centrifugal Thin-Layer Chromatograph; Aerosol Exposure Chamber; Literature.	344

ANNA J. HARRISON RUSSELL W. PETERSON	JOHN C. SAWHILL HARRIET ZUCKERMAN	WILLIAM T. GOLDEN Treasurer	WILLIAM D. CAREY Executive Officer
GEOLOGY AND GEOGRAPHY (E) Morris Malkin Curtis Ramon E. Bisque	BIOLOGICAL SCIENCES (G) Thomas Eisner Walter Chavin	ANTHROPOLOGY (H) Edward I. Fry Priscilla Reining	
MEDICAL SCIENCES (N) Philip K. Bondy Leah M. Lowenstein	AGRICULTURE (O) Roger L. Mitchell Coyt T. Wilson	INDUSTRIAL SCIENCE (P) John D. Caplan Robert L. Stern	
STATISTICS (U) Oscar Kempthorne Ezra Glaser	ATMOSPHERIC AND HYDROSPHERIC SCIENCES (W) Edward S. Epstein Glenn R. Hilst	GENERAL (X) Vera Kistiakowsky S. Fred Singer	

COVER

Array of aligned and fused optical fibers conveys a halftone image of an object viewed through an endoscope. The hexagonal shape of the fibers is due to the fusion of the originally round, individual optical fibers. See page 280. [C. Kot, Northwestern University, Evanston, Illinois]

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.

State-of-the-art cell sorting and analysis from Ortho

The Cytofluorograf[®] Systems 30/50 offer unequalled capabilities.

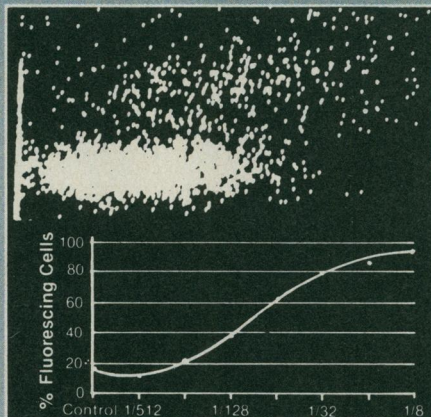
No other commercially available cell sorter and analyzer approaches the power, precision and versatility of the Ortho Systems 30/50. The instrument is offered in two basic configurations: System 30—a high resolution, 21 parameter analytical flow cytometer, and System 50—which adds cell sorting capabilities to the System 30 flow cytometer. Both feature dual lasers as standard equipment for increased analytical power.

System Components

To appreciate the far reaching capabilities of these Ortho instruments, consider that the System 50 combines: two lasers—a .8 milli-watt helium-neon for ultra high precision scatter measurements and a 5 watt argon type for fluorescence measurements (optional argon-ion, and krypton-ion lasers with U.V. capability are available); four detectors—two of the photomultiplier type for right angle scatter, and fluorescent emission detection (S-20 response, 185 nm–850 nm), and two solid state sensors for axial light loss and narrow angle forward scatter: a sophisticated optical system incorporating fiber optics: a multiplexed multichannel analyzer, with C.R.T. display: the signal processor unit: and an advanced cell sorter module (System 50). Additionally, the Model 2150 com-

puterized 8 parameter data handler/sorter controller is available as an option*. The 2150 System features simultaneous data acquisition, and realtime processing while sorting is in progress.

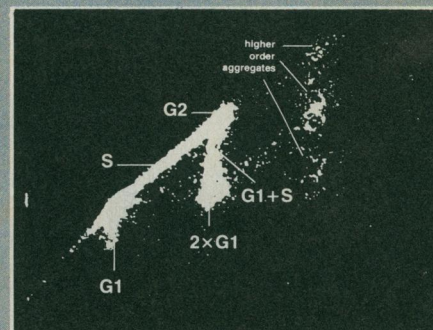
*Complete Model 2150 specifications available on request.



1. Upper: Direct immunofluorescence test (cytogram). Lymphocytes from CLL patient incubated with FITC labelled anti-human IgG. Lower: Titration of V-25 Leukemia cells from C-57 black mice different dilutions of FITC conjugated rat radiation leukemia virus antibody.

System Capabilities

These modules allow the System 50 to provide and analyze morphological information and sort on this basis, a significant first for a flow cytometric instrument. With four detectors and the ability



2. Cytogram of somewhat clumped Erlich ascites tumor cells, stained for DNA with ethidium bromide. Correlation of pulse area measurement (X) with pulse area (Y) with pulse height (Y) permits distinguishing G2 cells from 2 x G1 aggregates.

to display pulse height, pulse area or pulse width analysis for each—

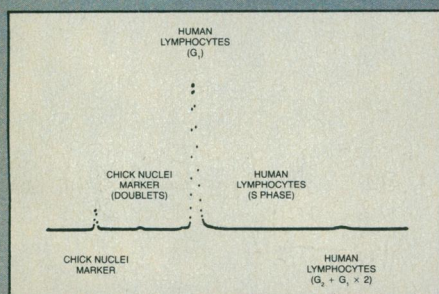


System 50H with optional argon ion and krypton ion lasers installed.

Remarkable Results

The histograms and cytograms displayed were produced by the System 50. Evaluate them. And consider the difficulty of deriving this data by any other means. The capabilities of this unique Ortho instrument will speak for themselves.

In order to provide customers with complete support, Ortho maintains an Applications Laboratory that is available for confirmation and consultation services. Additionally, an international network of service technicians is ready to aid customers should calibration or repairs ever be required.



3. Histogram of human lymphocytes utilizing a chick nuclei marker for standardization and stained for D.N.A. with Propidium Iodide. C.V. = 1.65% (Human Lymphocytes)

a total of 21 distinct measurement parameters can be studied.

The System 50 also features: two bi-dimensional regions of interest, dual histogram multi-channel analyzer with cytogram mode, super-sil quartz optics with which the cells are analyzed and easy sample entry.

Ortho Cytofluorograf Systems precisely tailored to your needs

The modular, "building block" nature of Ortho instrumentation permits you to create exactly the instrument you need. There's no need to settle for less capability than you require or pay for more. Of course, it's also easy to upgrade the Cytofluorograf System as your requirements expand. Learn more about Ortho Systems 30/50 simply by calling or writing Ortho. Naturally, there's no obligation. But you owe it to yourself to evaluate an ultimate system.

Protocols No. 28

One step Ethidium Bromide; D.N.A./cell staining procedure

Protocols No. 29

D.N.A. analysis using D.A.P.I.

To receive your complimentary copy of Protocols, write or call, Ortho Instruments, Research Instruments Division, 410 University Ave, Westwood, Ma., 02090 617-329-6100.



ORTHO INSTRUMENTS

410 UNIVERSITY AVE., WESTWOOD, MA 02090

Circle No. 239 on Readers' Service Card

The
new
Olympus.



We at Olympus are quite proud to introduce a major new generation of system microscopes.

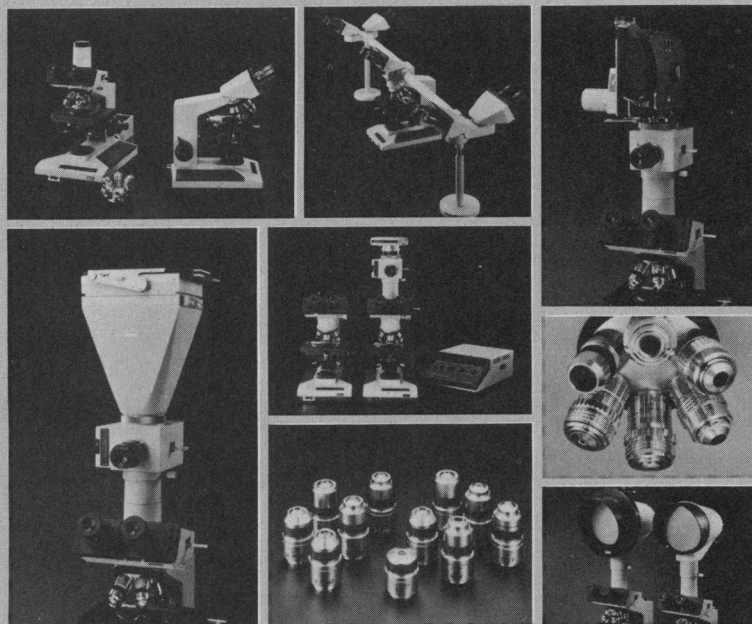
BH-2 is possibly the most significant advance in microscopic and photo-micrographic capability of the decade.

Only your own examination can adequately demonstrate the advantages of the many configurations of the BH-2.

Contact your nearest Olympus Microscope Dealer listed in your Yellow Pages.

Or write: Precision Instrument Division, Olympus Corporation of America, 4 Nevada Drive, New Hyde Park, NY 11042.

The Olympus BH-2



OLYMPUS®

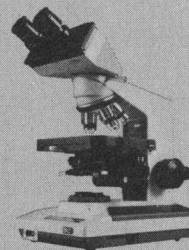
The Science Company

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

Circle No. 231 on Readers' Service Card

Attention:
Laboratory Staff!

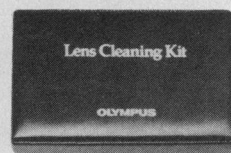
**FROM BH-2
TO YOU.**



A demonstration of the new BH-2 is valuable in itself for it shows you the added capability and ease this high-performance system offers.

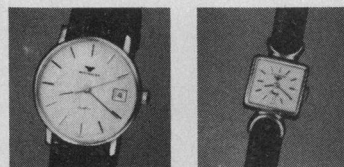
But to make it especially attractive to you, here's what you'll get at no cost:*

YOURS FREE.



This \$19.95 Olympus Lens Cleaning Kit (Fluid, magnifier, blower brush, lens tissue, Silicone cloth, dusting feather, willow stick) in a deluxe case, just for looking any time through November 30, 1980.

YOURS FREE.



A choice of either \$150-value Wittnauer Quartz Men's or Ladies' dress watch, free to anyone sending a Warranty Registration Card after purchase, through January 31, 1981.

Send this valuable coupon today.

Olympus Corporation of America, PID Div., 4 Nevada Drive, New Hyde Park, NY 11042

I want a no-obligation demonstration. Contact me promptly for an appointment.

NAME _____

INSTITUTION _____

ADDRESS _____

CITY _____ STATE _____

ZIP _____ PHONE _____

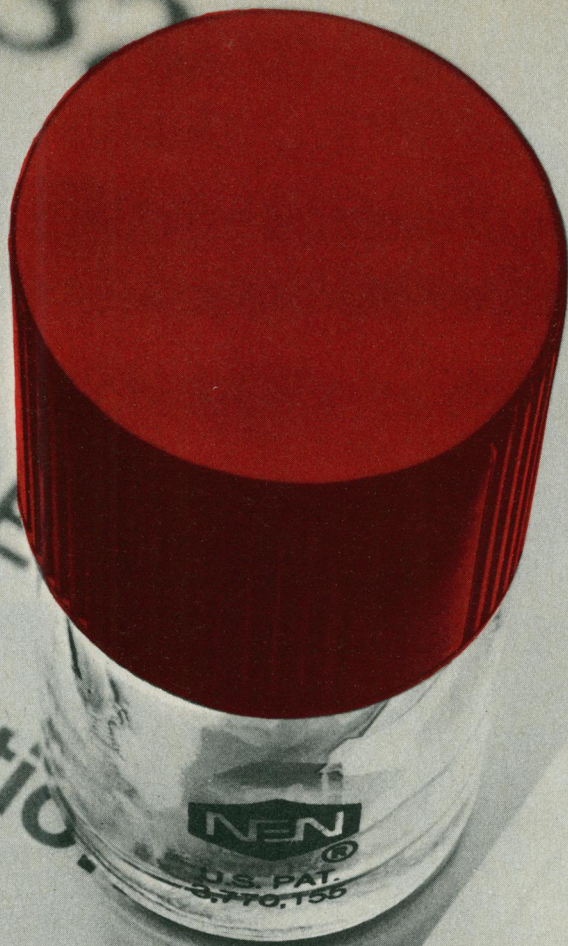
*Valid for lab personnel in the U.S. only.

OLYMPUS

The Science Company

S-10

Only from
NEN:



Not for use in humans or clinical diagnosis

Five systems to make your DNA-RNA studies faster, surer, and more reproducible

5' End Labeling

The world's first 5' End Labeling System is an accurate, efficient, time-saving means of labeling nucleic acid. Adapted from procedures described by Maxam and Gilbert,¹ it includes ATP, [γ -³²P] with our own specially prepared polynucleotide kinase and a carefully balanced complement of buffers, enzymes, and other reagents necessary for labeling the 5' termini of DNA fragments.

The components are sufficient for about 10 reactions:

- Adenosine 5'-triphosphate, [γ -³²P]-
- Alkaline Phosphatase
- Polynucleotide Kinase (purified to homogeneity)
- Phosphatase Buffer
- Direct Phosphorylation Buffer
- Exchange Phosphorylation Buffer
- Hinf I Digest of Plasmid DNA, pBR322 (control to check the system)
- Deionized Water

The system is tested the day before shipment using the same lots of components you will receive, including fresh tracer. The resulting autoradiogram is included with your system.

Order NEK-006

¹Maxam, A.M. and Gilbert, W., *Methods Enzymol.*, 65, 1980

Translation

NEN's *in vitro* protein translation systems have made cell-free translations of eukaryotic mRNAs exceptionally reliable and reproducible. These time- and trouble-saving systems are offered with either Methionine, L-[³⁵S] or Leucine, L-[³H] labeled tracers. Both utilize an extract of rabbit reticulocyte lysate that has been treated with micrococcal nuclease to inactivate endogenous mRNA. The lysate is prepared under strictly controlled conditions to ensure retention of high protein synthesis activity.

The components are sufficient for about 100 assays:

- Rabbit Reticulocyte Lysate
- Methionine, L-[³⁵S]-, or Leucine, L-[3, 4, 5-³H]-
- Translation Cocktail
- Control mRNA
- Magnesium Acetate
- Potassium Acetate
- Deionized Water

Each lot of systems is biologically tested with the exogenous control mRNA. A graph demonstrating Methionine or Leucine incorporation is provided with your shipment. Special accommodation systems will be arranged.

Order NEK-001 (Met [³⁵S])
NEK-002 (Leu [³H])

Nick Translation

We now offer two exclusive systems for making consistently high specific activity probes using nick translation: dCTP, [³²P] and dTTP, [³H]. Both systems include *E. coli* DNA Polymerase I prepared in our laboratories to ensure extremely high reproducibility. The DNase I, dNTP mixtures, stop buffer, and sterile deionized water are optimized for compatibility and stability.

The components are sufficient for about 20 assays:

- Deoxycytidine 5'-triphosphate, [α -³²P]-, or
- Deoxythymidine 5'-triphosphate, [*methyl*, 1', 2', -³H]-
- DNase I
- DNA Polymerase I
- Control Plasmid DNA (pBR322)
- Deoxynucleoside Triphosphate Mixture
- Nick Translation Buffer
- Nick Translation Stop Buffer
- Deionized Water

Each lot of systems is tested with the control supercoil pBR322 plasmid DNA to ensure efficient incorporation of dCTP or dTTP into DNA, and a copy of the curve is included with your system.

Order NEK-004 (dCTP [³²P])
NEK-005 (dTTP [³H])

Call us toll free to request detailed descriptions of any of these systems or to discuss any questions you may have for our technical staff.



New England Nuclear

549 Albany Street, Boston, Massachusetts 02118

Call toll free: 800-225-1572 (In Massachusetts and International: 617-482-9595)

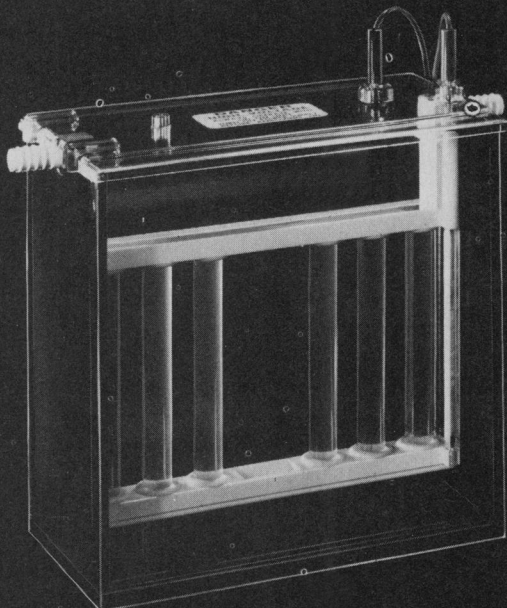
NEN Chemicals GmbH: D-6072 Dreieich, W. Germany, Postfach 401240, Tel. (06103) 85034, Telex 4-17993 NEN D
NEN Canada: 2453 46th Avenue, Lachine, Que. H8T 3C9, Tel. 514-636-4971, Telex 05-821808

**New
from**

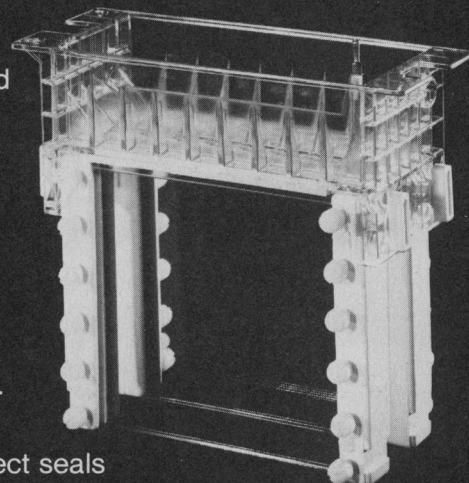
**HOEFER
SCIENTIFIC
INSTRUMENTS**

SE 600

**The Definitive Hoefer Design
for Vertical Slab Gel Electrophoresis**



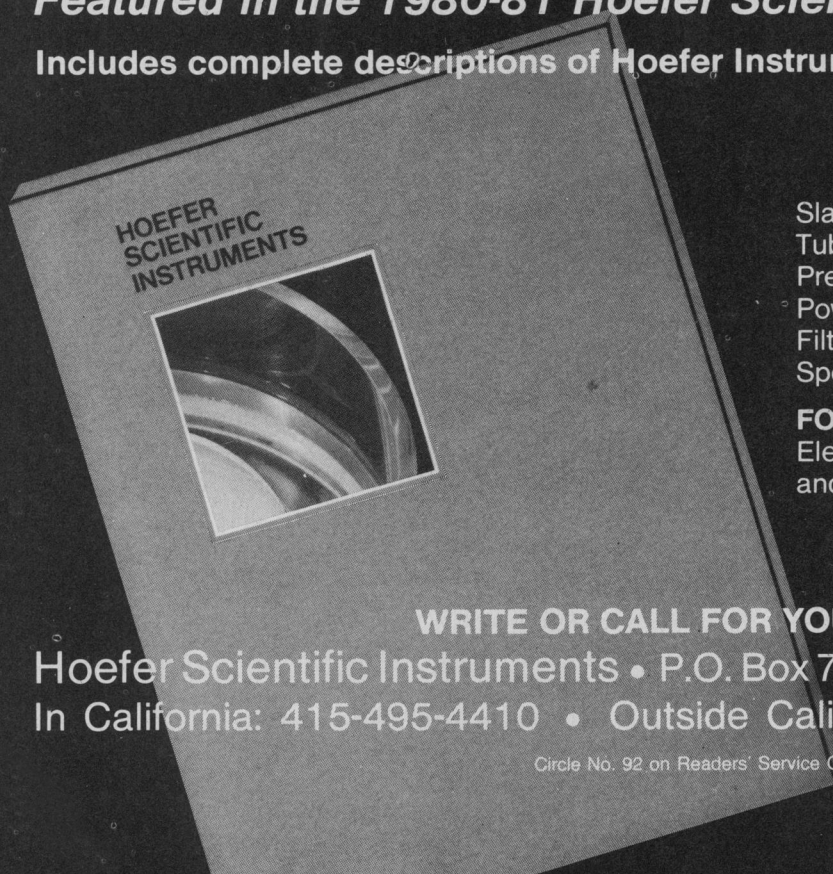
- Simple to Use. Can be Mastered in one trial run.
- Rectangular Glass Plates instead of fragile notched glass
- Improved Design for 2-D
- Excellent for Agarose
- Superb Cooling
- Made of Molded Polycarbonate. Virtually unbreakable.
- Easy-to-Use Clamps make perfect seals



One of the New Instruments

Featured in the 1980-81 Hoefer Scientific Instruments Catalog

Includes complete descriptions of Hoefer Instruments and Accessories



Slab Gel Electrophoresis
Tube Gel Electrophoresis
Preparative Electrophoresis
Power Supplies for Electrophoresis
Filtration, Centrifugation, Dialysis
Special Prices for Complete Systems

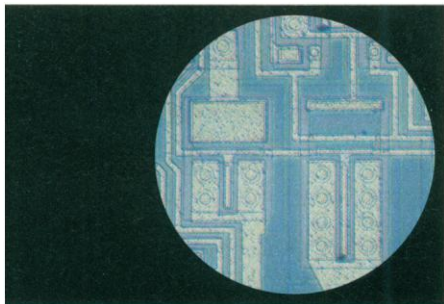
FOR NEW USERS, an entire section on
Electrophoretic Theory, Techniques,
and Exercises

WRITE OR CALL FOR YOUR COPY:

Hoefer Scientific Instruments • P.O. Box 77387 San Francisco CA 94107
In California: 415-495-4410 • Outside California toll free: 800-227-4750

Circle No. 92 on Readers' Service Card

NIKON VISIONS



**NIKON OPTIPHOT M
SPEEDS INSPECTIONS WITH
EXCEPTIONAL IMAGE QUALITY.**

INSTRUMENTATION

Nikon Optiphot M
Brightfield Microscope.

SIGNIFICANCE

Nikon has created an ideal inspection instrument that offers high performance optics and ease of operation at a very affordable price. It can reduce inspection costs by speeding the process.

SPECIFICS

The Nikon CF optical system produces images that are totally sharp edge-to-edge with no color fringing. As a result, the entire field is usable for critical quality control applications.

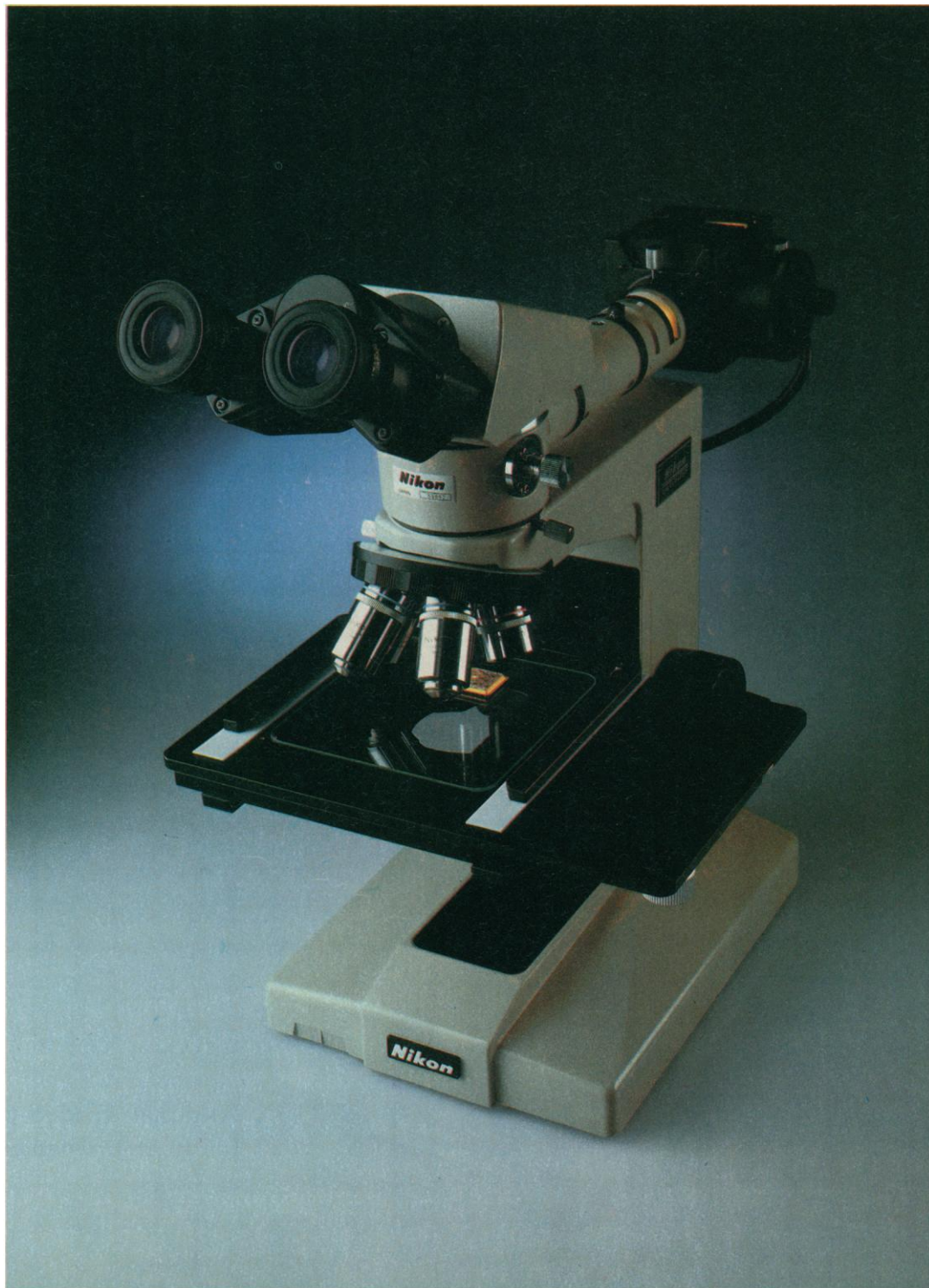
This unequalled optical system is incorporated into an extremely stable stand with a 20 watt halogen Koehler epi-illuminator that provides bright, high contrast images. The image quality and human engineered controls of the Optiphot M permit hours of continuous operation without fatigue or eyestrain.

A wide selection of Nikon accessories including darkfield, Nomarski DIC, transmitted light and photomicrographic systems allow the Optiphot M to be exactly tailored to any application.

Extend *your* vision with the Nikon Optiphot M. Write:
Nikon Visions, Nikon Inc.
Instrument Division
623 Stewart Avenue
Garden City, N.Y. 11530
(516) 222-0200

Nikon
Extending Man's Vision

Circle No. 49 on Readers' Service Card



the National Academy Press

Publishes Reports of the National Research Council

As well as those of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine.* Typical of the wide range of reports the Press publishes are the following:

IMPROVING AIRCRAFT SAFETY

A critical evaluation of the Federal Aviation Administration's certification procedures for commercial passenger airliners. Called "the most intensive (study) ever made of the system for certifying American-built airliners" by the New York Times. ISBN 0-309-03091-9; 1980, 118 pages, paperbound, \$5.75, Assembly of Engineering

HEALTH PLANNING IN THE UNITED STATES

Examines current policy and research issues related to national health planning guidelines. Recommends methods to ensure that future guidelines will benefit from the best professional or scientific advice, are open to public scrutiny, and are flexible enough to meet changing goals. ISBN 0-309-03085-4; 1980, 81 pages, paperbound, \$7.50, Institute of Medicine

EARTHQUAKE RESEARCH FOR THE SAFER SITING OF CRITICAL FACILITIES

Reviews the geologic and seismicologic data base available for siting critical facilities—nuclear power plants, dams, hospitals, chemical processing plants. Recommends a long-term research program to help guide decisions on site selection and design of critical facilities. ISBN 0-309-03082-X; 1980, 49 pages, paperbound, \$5.50, Assembly of Mathematical and Physical Sciences

DRINKING WATER AND HEALTH, Volumes II and III

These important volumes present the latest findings on methods and technologies for the disinfection of drinking water.

Vol. II provides a comprehensive assessment of both the processes and chemicals for the disinfection of drinking waters and the by-products resulting from their use. Evaluates the use of granular activated carbon for the removal of organic and other contaminants. ISBN 0-309-02931-7; 1980, 393 pages, paperbound, \$15.50, Assembly of Life Sciences

Vol. III presents an evaluation of epidemiological studies relating to drinking water and reviews the earlier study of estimation (DRINKING WATER AND HEALTH, VOL. I). Assesses the toxicity of selected drinking water contaminants and examines their contribution to mineral nutrition in humans. ISBN 0-309-02932-5; 1980, 415 pages, paperbound, \$17.00, Assembly of Life Sciences

OUTER CONTINENTAL SHELF FRONTIER TECHNOLOGY

Examines the petroleum industry's current capability to explore, develop, and produce oil and gas resources in the harsh new frontier of deep water and arctic ice. ISBN 0-309-03084-6; 1980, 224 pages, paperbound, \$8.50, Assembly of Engineering

RECOMMENDED DIETARY ALLOWANCES, Ninth Edition

Recommended dietary allowances represent recommended intakes of nutrients to provide adequate nutrition for nearly all healthy persons in the United States. ISBN 0-309-02941-4; 1980, 186 pages, paperbound, \$6.00, Assembly of Life Sciences

MEASUREMENT AND CONTROL OF RESPIRABLE DUST IN MINING

Examines the problems and hazards of airborne mine dust, particularly in coal-mining operations. Provides a comprehensive overview of the current status of research, legislative regulations, and measurement and control technologies. ISBN 0-309-03047-1; 1980, 405 pages, paperbound, \$11.00, Commission on Sociotechnical Systems

ORDER PUBLICATIONS FROM

National Academy Press, Dept. B
2101 Constitution Ave., N.W.
Washington, D.C. 20418

A check or money order must accompany all orders unless a bona fide purchase order is enclosed. Purchase orders of \$10.00 or less must be accompanied by a check or money order.

*The National Academy Press was created by the National Academy of Sciences to publish the reports issued by the Academy and by the National Academy of Engineering, the Institute of Medicine, and the National Research Council, all operating under the charter granted to the National Academy of Sciences by the Congress of the United States.



National Research Council
National Academy of Sciences
National Academy of Engineering
Institute of Medicine

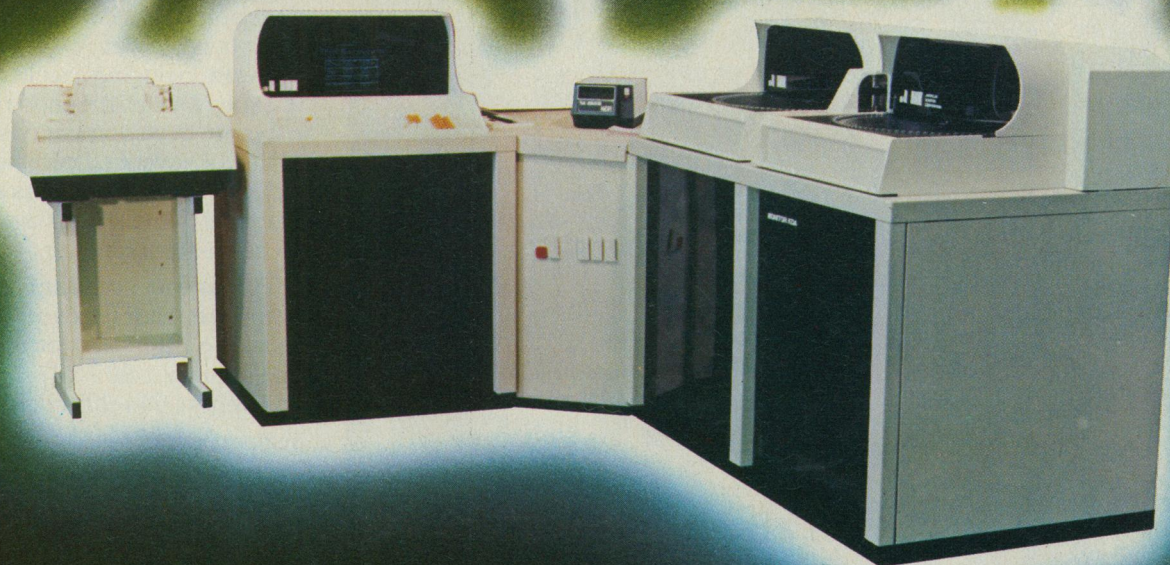
Circle No. 213 on Readers' Service Card

NEW

From American Monitor Corporation

The KDA[®] Micro Chemistry Analyzer

With the KDA[®] Micro Analyzer, your laboratory now has the ability to perform pediatric, geriatric and animal blood testing. This micro capability offers the same efficiency and precision that has made the KDA[®] one of the most successful entries into the clinical market in recent years.



If you are looking for micro-chemistry efficiency, plus versatility, and would like to know more about our unique instrument, call our KDA[®] Micro Analyzer Product Manager toll free (800) 428-3842.

The KDA[®] Micro Analyzer – Advancing Blood Chemistry into the 80's



american monitor corporation

P.O. BOX 68505, INDIANAPOLIS, INDIANA 46268

Circle No. 195 on Readers Service Card

**Solve, plot and
label a 20-pair linear
regression in the time it
takes to log-on to a host!**



**The
Tektronix
4052
Desktop
Computer**

Copyright © 1980 Tektronix, Inc. All rights reserved. OEM quotations available on request.

**THE GRAPHICS
STANDARD**

Tackle big problems with power and speed not previously available in a desktop computer. With convenience and economy you couldn't imagine with timesharing.

Take a problem in simple linear regression: In less time than it takes to dial a computer and log-on, the 4052 can fit 20 pairs of data to an equation and plot the answers, numerically and graphically, complete with residuals.

Using the optional FFT ROM Pack, it takes less than 4 seconds to transform 1024 real data points into complex spectra... with the same 14-digit accuracy found in all other 4052 computation. With fast display of text and graphics that complements the fast computation.

Our supporting products let you shape the perfect solution. Choose our data communications option to reach into central data bases and extra computing power. Applications software, including excellent volumes for statistics and math, minimize development costs, while our advanced peripherals—including copiers, plotters and file manager—maximize your problem-solving power.

This is one compact computer that lets you keep thinking big! For information call, toll-free, 1-800-547-1212 (in Oregon, 644-9051 collect).

Tektronix, Inc.
Information Display Division
P.O. Box 1700
Beaverton, Or 97075
Tektronix International, Inc.
European Marketing Centre
Post Box 827
1180 AV Amstelveen
The Netherlands

Tektronix®
COMMITTED TO EXCELLENCE

WHY DO SO MANY PEOPLE BUY THE KIND OF PROTECTION THAT'S WRONG FOR THEM?



Because they don't clearly understand the difference between Term and Whole Life insurance ... and that a Term policy can typically provide five to ten times as much immediate family protection for the same money!

As shown in the table below, a first year net outlay of only \$150 buys a \$142,000 TIAA 20-Year Decreasing Term policy or a \$97,000 5-Year Renewable Term policy, for a man aged 30 or a woman aged 35. The same outlay used to purchase a Whole

Life policy would give their family only \$13,000 of family protection.

If you're like most of your colleagues in education and research, your first priority is to give your family the most financial security for the least amount of money—and that's what TIAA Term is all about! Whatever *your* age, the difference in the level of protection available for just \$150 is dramatic, as the table illustrates.

Immediate Protection Available For \$150 First Year Net Cost *

For a Man Aged	For a Woman Aged	20-Year Decreasing Term Plan	5-Year Renewable Term Plan	Whole Life Plan
25	30	\$206,000	\$112,000	\$16,000
30	35	142,000	97,000	13,000
35	40	88,000	74,000	10,000
40	45	52,000	48,000	8,000
45	50	31,000	31,000	7,000

*Annual premium less cash dividend payable at the end of first policy year, based on 1979 dividend scales. While not guaranteed, dividends have been paid every year since TIAA's founding in 1918.

Why such big differences? With Term you pay only for protection, while a Whole Life policy combines protection with a savings (cash value) element. Remember, the protection part of life insurance is relatively inexpensive; it's when savings are included as well that a high outlay per \$1,000 of coverage is required.

If you'd like to know more, ask us to send two highly informative articles reprinted from *The New York Times* and *Business Week* that discuss the choice between Term and Whole Life. We'll gladly mail them, along with detailed personal information about TIAA policies for you.

Mail coupon or call collect

Just complete and mail the coupon at right, or call the TIAA Life Insurance Advisory Center (collect) 212-490-9000. If you wish, an Insurance Counselor will review your insurance needs with you and help you select the plan and amount that's right for you. No obligation, of course.

Eligibility to apply for a life insurance policy from Teachers Insurance and Annuity Association is limited to employees of colleges, universities, private schools and certain other nonprofit educational or research institutions. The employee's spouse is also eligible, provided more than half of the combined earned income of husband and wife is from a qualifying institution.

Life Insurance Advisory Center
Teachers Insurance and Annuity Association
730 Third Avenue, New York, NY 10017

AOIS

Please send me the reprinted articles contrasting Term and Whole Life, and personal illustrations of these TIAA policies:

☐ Decreasing Term ☐ 5-Year Renewable Term ☐ Whole Life

Please print

Name _____

Job Title _____ Birthdate _____

Home Address _____

City _____ State _____ Zip _____

Phone #s (optional) Home () _____ Office () _____

Your nonprofit employer (college, univ., private school, research institution, etc.) _____

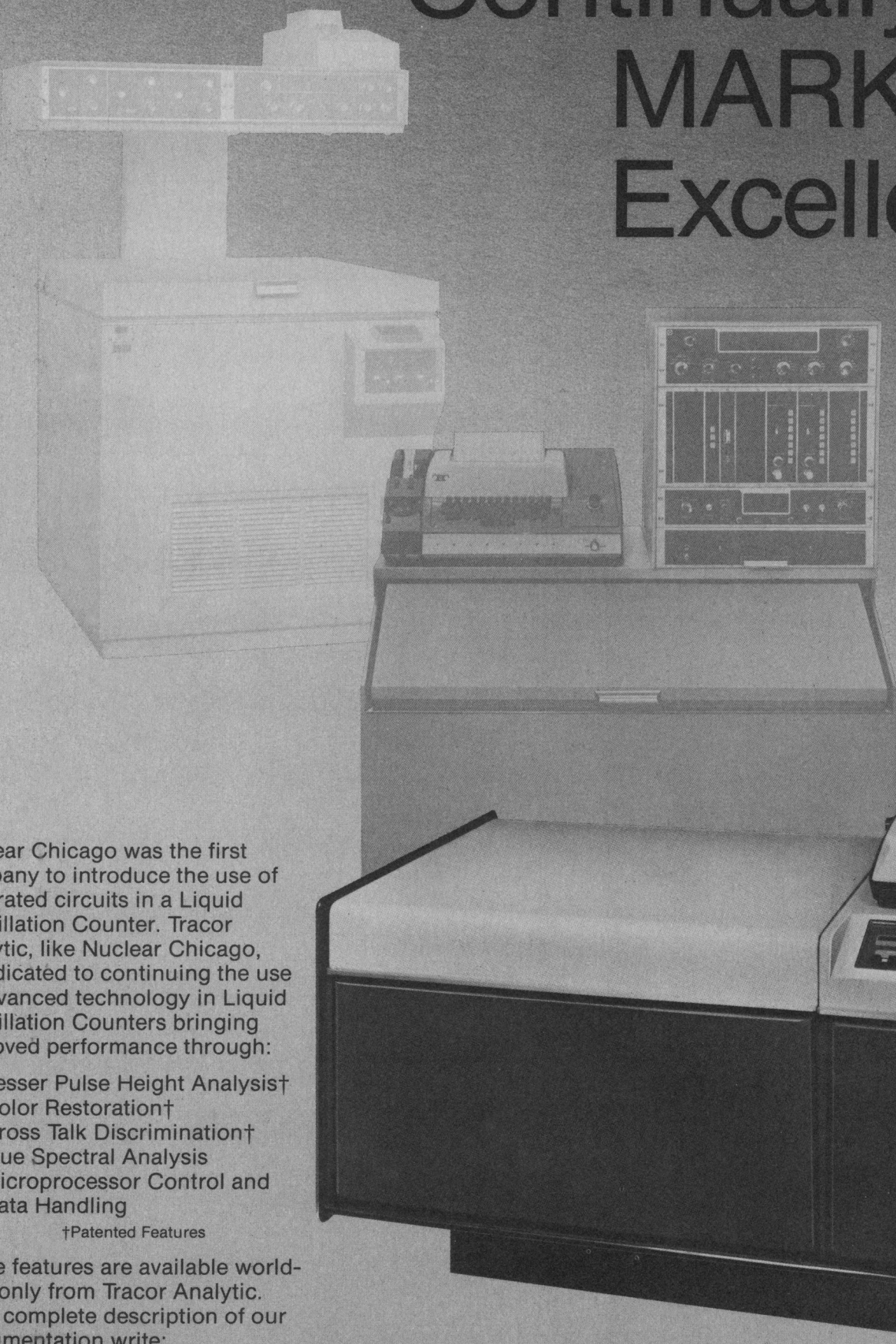
If your spouse is also eligible under the rules given at left, please provide:

Spouse's name _____ Birthdate _____



Established as a nonprofit
service organization by the
Carnegie Foundation for the
Advancement of Teaching

Continually the MARK... of Excellence



Nuclear Chicago was the first company to introduce the use of integrated circuits in a Liquid Scintillation Counter. Tracor Analytic, like Nuclear Chicago, is dedicated to continuing the use of advanced technology in Liquid Scintillation Counters bringing improved performance through:

- Lesser Pulse Height Analysis†
- Color Restoration†
- Cross Talk Discrimination†
- True Spectral Analysis
- Microprocessor Control and Data Handling

†Patented Features

These features are available world-wide only from Tracor Analytic. For a complete description of our instrumentation write:

TRACOR ANALYTIC INC.

1842 Brummel Drive, Elk Grove Village, Illinois 60007 (312) 364-9100

Tracor Analytic

Circle No. 179 on Readers' Service Card

Enlighten them!
Give them...
SCIENCE 81



**LOW
GIFT
RATES**

You know how much you and your family enjoy SCIENCE 80. So imagine how much your friends would enjoy it, too. Especially if they're like you—curious about what's going on in every field of science, eager to explore new frontiers of knowledge, absorbed by the process of scientific

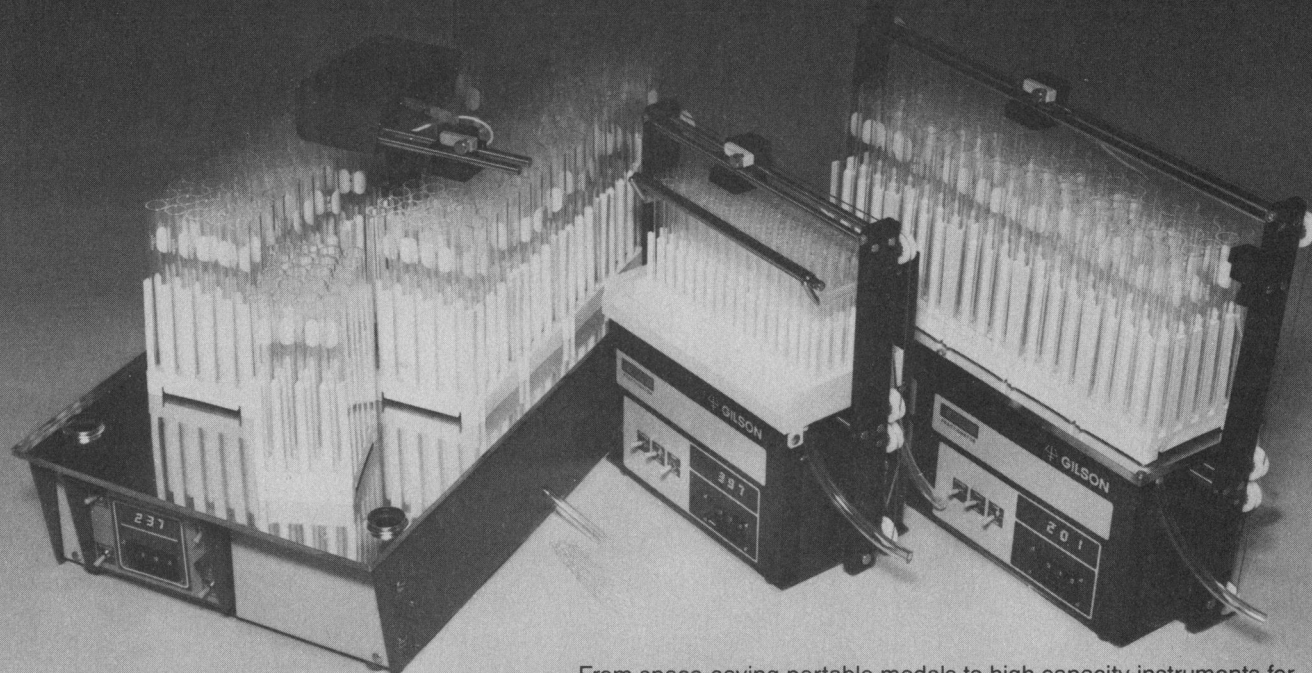
discovery, attuned to technology and how it's changing our lives.

A gift of SCIENCE 81 has special meaning. It's a gift an entire family can share—even young children, who will be enthralled by the sheer visual beauty of science. Much more than a gift, it's a compliment. And it speaks highly of your regard that you would choose a magazine published by one of the world's great scientific societies, the American Association for the Advancement of Science.

What do gift subscriptions cost? Just \$12 for the first gift—and \$11

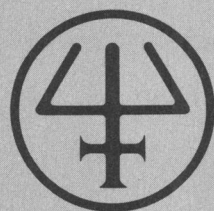
for each additional gift. And that's for a total of 10 issues! We'll bill you later and send a handsome greeting card to each recipient with your good wishes. Could anything be simpler? More appropriate? More meaningful? Do hurry, though; the Christmas season is fast approaching.

**If gift card is missing
or if you prefer,
you may phone
your gift order
toll-free:
800-247-5470.**



**No matter
what fraction
collector
you need,**

**Gilson
has one
for you.**



GILSON
INTERNATIONAL

Circle No. 196 on Readers' Service Card

From space-saving portable models to high capacity instruments for multiple column collection, Gilson has the fraction collector and accessories for your application. All of these models, which can collect by three methods, incorporate the latest technical advances for LC and other research work. All operate reliably in **cold rooms** over extended periods. And all are backed by over 25 years of experience in manufacturing quality fraction collectors. There's really no need to shop around, when you can get the best from one source—Gilson.

Model FC-80 Micro-Fractionators. The FC-80 is so compact it fits anywhere. Measuring only 29 cm x 15 cm (11½" x 6"), it accommodates up to 80 13 x 100 mm tubes. This low cost instrument, which accepts samples from small and medium size columns, is supplied as combination drop counter (1 to 999 drops/tube) and time collector (0.1 to 99.9 min.).

Large capacity FC-220. The preferred collector for liquid chromatography.

The FC-220 accommodates 220 tubes in a variety of sizes: 18 x 150 mm; 13 x 100 mm; 17 x 55 mm mini-vials. Three collection methods may be used—drop counting, time collection, or volume with a volumetric pump. Convenience features include 3-digit LED display; optional shut-off valve to stop flow during column change, and multiple collection for 2, 3, 4 or 5 columns.

Model FC-100 Micro-Fractionator. The most compact collector for use with larger size LC columns. Requires only 46 cm x 15 cm (18" x 6") of bench or cold room space. The FC-100 holds 100 18 x 150 mm tubes, as well as 17 x 55 mm mini-vials and 7 ml collection plates. Supplied as a combination drop counter and time collector.

All three Gilson fraction collectors can collect sample volumes with a volumetric pump. We've changed colors, and kept reliability. For our new brochure or to request a demonstration, call or write:

Gilson Medical Electronics

Box 27 • Middleton, WI 53562 • U.S.A. • Telephone: (608) 836-1551

Gilson Medical Electronics (France) S.A.

B.P. No. 45, 95400 • Villiers-le-Bel, France • Telephone: 990.54.41

THE HYDRAULIC DRIVE/STEPPER MOTOR ALTERNATIVE.

At last. Unprecedented micropositioning capability and low cost. And the nicest thing about Burleigh's all piezoelectric Inchworm™ Translator Systems isn't their compactness and ease of use. Or the unique optical readout accurate to $2\mu\text{m}$. Or even their interfaceability with most micro, mini, or mainframe computers. It's the fact that unlike messy hydraulic drives or vibration-prone stepper motors the Inchworm is capable of an amazing 20 nanometer resolution over 25 millimeters of travel with zero backlash.

The Inchworm can be controlled from an optional hand held unit. Command the Inchworm to go forward or backward. Choose the step size and speed. Even select the zero point. And when you're done, the meter reads position relative to the zero point you chose.

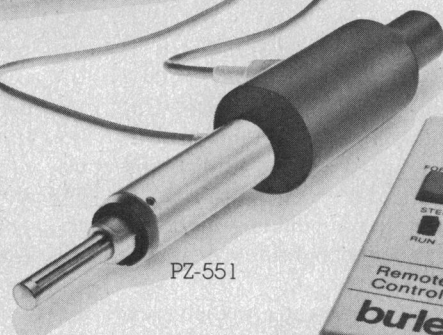
Position electrodes. Puncture cells both in vivo and in vitro. Position microelectrodes for intracellular or extracellular recording. Translate the stage in an X-Y microscope for specimen scanning.

The Inchworm is a better alternative to hydraulic drives or stepper motors. The motion is smooth and no conventional micropositioning device can match it for precision and accuracy. It's reliable too with five years of history behind us.

So call Burleigh or the nearest representative to find out why the Inchworm Translator is a better alternative.



PZ-550



PZ-551

PZ-575



Cryophysics Ltd.
Tel (0865) 722824,
England

Cryophysics SA
Tel 950 67 78, France

Cryophysics SA
Tel 329520, Switzerland

Cryophysics GmbH
Tel 06151-74081,
West Germany

Marubun Corporation
Tel (03) 622-8151, Japan

Quentron Optics Pty Ltd.
Tel (08) 466121, Australia

Banin Enterprise Co., Ltd.
Tel 361-9423, Taiwan

Isramex Company Ltd.
Tel 248213, Israel

burleigh

Burleigh Instruments, Inc.
Burleigh Park, Fishers, NY 14453
(716) 924-9355 Telex 97-8379

Circle No. 209 on Readers' Service Card

Calibration couldn't be easier...

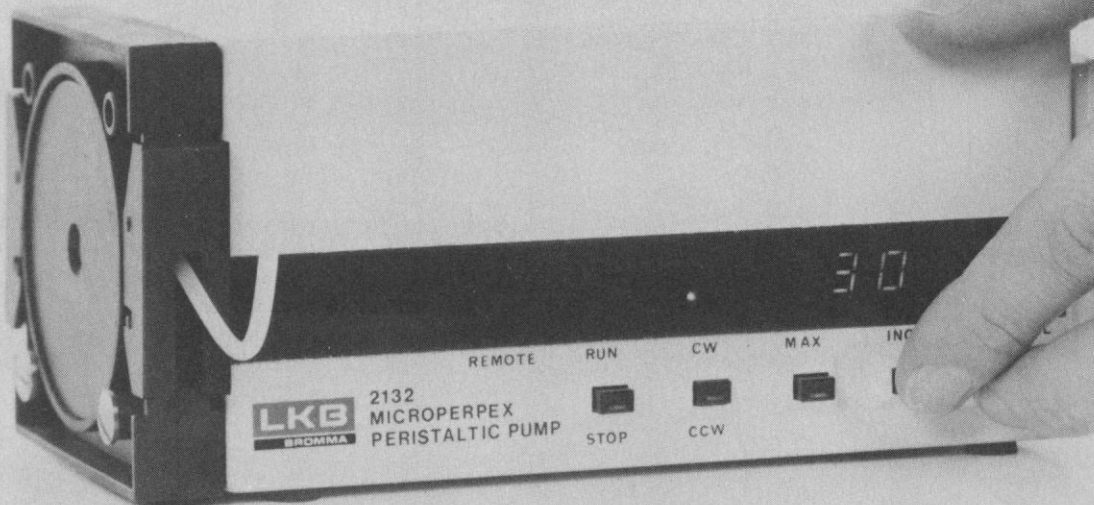
The new LKB MicroPerpex
Pump offers:

- wide range of exactly
calibrated flow rates with
one simple step
- constant, low pulsation flow
- continuous display
- choice of 1 or 2 pump heads
- microprocessor precision
- easy to mount tubing
- compact design

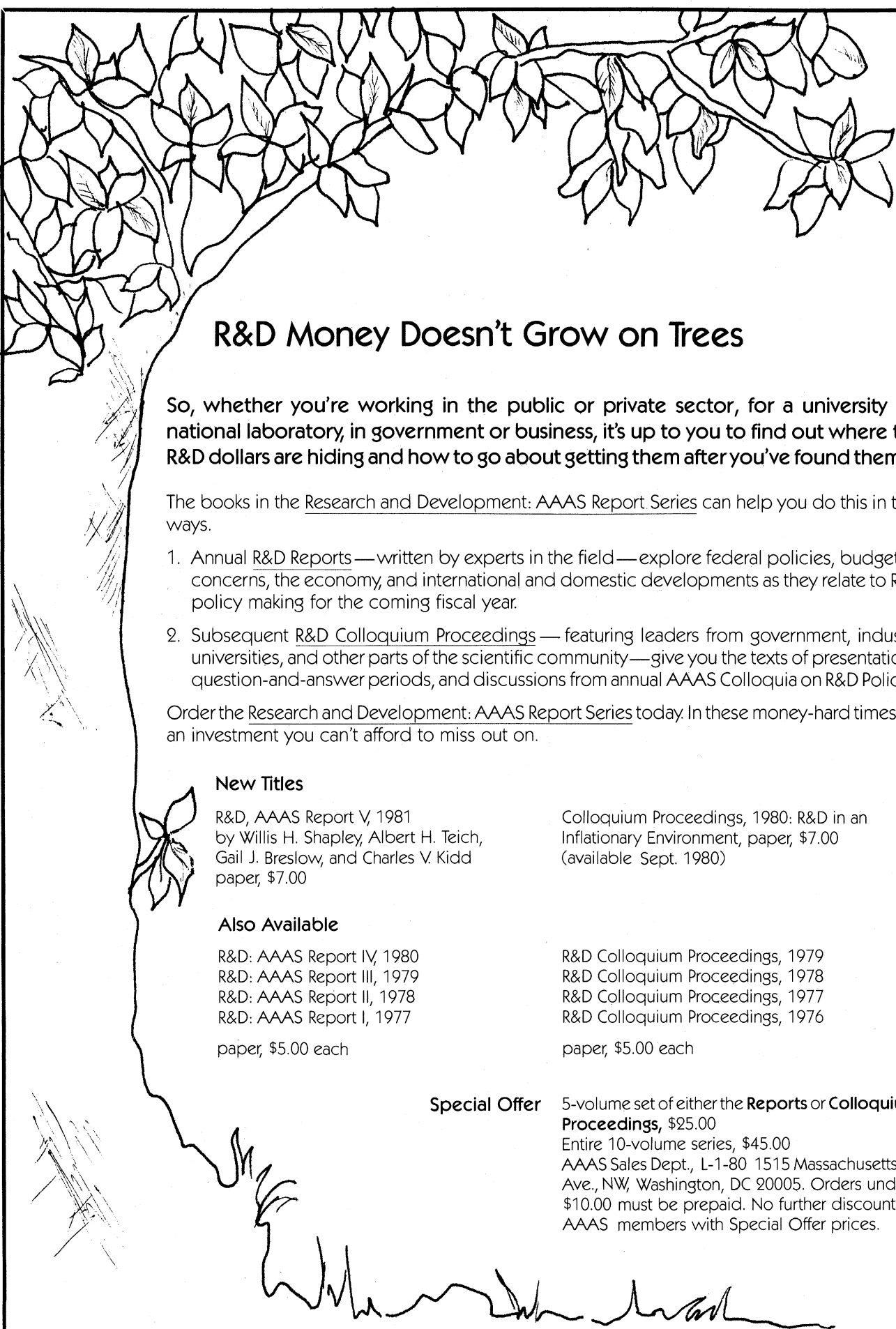
For the complete range of column
chromatography products

LKB

LKB Instruments Inc.
12221 Parklawn Drive, Rockville,
Maryland 20852 Tel: (301) 881-2510



Circle No. 202 on Readers' Service Card



R&D Money Doesn't Grow on Trees

So, whether you're working in the public or private sector, for a university or national laboratory, in government or business, it's up to you to find out where the R&D dollars are hiding and how to go about getting them after you've found them.

The books in the Research and Development: AAAS Report Series can help you do this in two ways.

1. Annual R&D Reports — written by experts in the field — explore federal policies, budgetary concerns, the economy, and international and domestic developments as they relate to R&D policy making for the coming fiscal year.
2. Subsequent R&D Colloquium Proceedings — featuring leaders from government, industry, universities, and other parts of the scientific community — give you the texts of presentations, question-and-answer periods, and discussions from annual AAAS Colloquia on R&D Policy.

Order the Research and Development: AAAS Report Series today. In these money-hard times, it's an investment you can't afford to miss out on.

New Titles

R&D, AAAS Report V, 1981
by Willis H. Shapley, Albert H. Teich,
Gail J. Breslow, and Charles V. Kidd
paper, \$7.00

Colloquium Proceedings, 1980: R&D in an
Inflationary Environment, paper, \$7.00
(available Sept. 1980)

Also Available

R&D: AAAS Report IV, 1980
R&D: AAAS Report III, 1979
R&D: AAAS Report II, 1978
R&D: AAAS Report I, 1977
paper, \$5.00 each

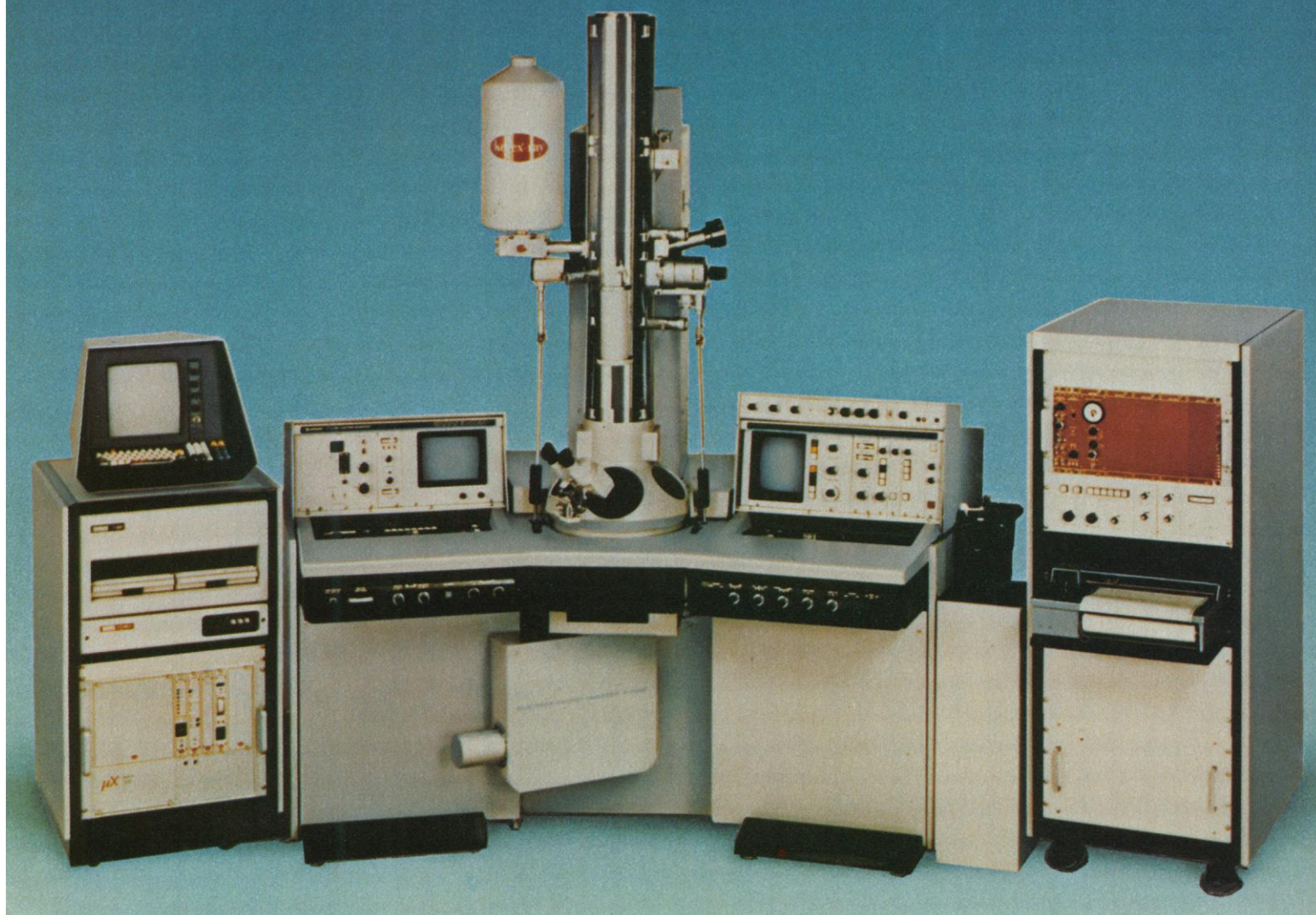
R&D Colloquium Proceedings, 1979
R&D Colloquium Proceedings, 1978
R&D Colloquium Proceedings, 1977
R&D Colloquium Proceedings, 1976
paper, \$5.00 each

Special Offer

5-volume set of either the **Reports** or **Colloquium Proceedings**, \$25.00
Entire 10-volume series, \$45.00
AAAS Sales Dept., L-1-80 1515 Massachusetts
Ave., NW, Washington, DC 20005. Orders under
\$10.00 must be prepaid. No further discount to
AAAS members with Special Offer prices.

H-600

The first analytical TEM with true microcomputer control



It's the H-600-1, an exceptionally powerful analytical tool featuring:

- LaB₆ Gun
- Pushbutton-selectable microscope modes: TEM (2.0 Å), SEM (20 Å), and STEM (10 Å)
- Triple condenser lens—all 7 lenses microcomputer controlled
- Ultra high (5×10^{-7} torr) vacuum system

The system is available with EDX, Energy Loss Spectroscopy, Diffraction, Beam Rocking, and Spot Scanning. The analytical modes require no specimen repositioning. And, probe sizes down to 15 Å are easily achieved for excep-

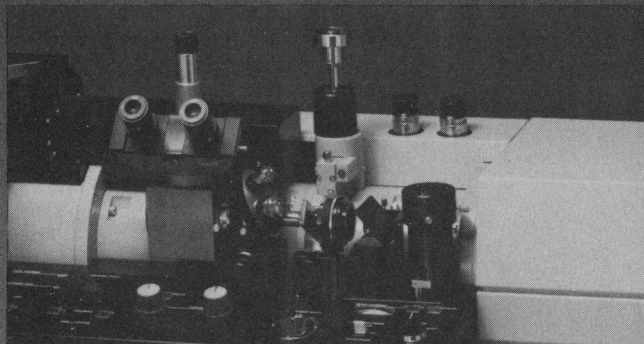
tional analytical capability. What's more, the H-600-1 is easy to operate. Routine setups and adjustments are done automatically by the built-in microcomputer. As for cost, you'll be happy to know that prices for the H-600 series start at less than \$140,000 F.O.B. San Francisco.

The H-600-1 is just part of the most complete TEM lineup in the industry. For full details about a TEM that matches your application and your budget, call or write today. Hitachi Scientific Instruments Division, 460 East Middlefield Road, Mountain View, California 94043. Phone (415) 961-0461. In Canada: Nissei Sangyo Canada Inc. Phone (416) 675-5860

 **HITACHI**
SCIENTIFIC INSTRUMENTS
NISSEI SANGYO AMERICA, LTD.

Circle No. 136 on Readers' Service Card

COMPUTERIZED EM



Up to now electron microscopy has been a painful procedure for most EM laboratories. Too much fuss and bother. The ISI-2000 puts an end to that by combining computer technology with electron optics. The result is a simple, easy-to-use electron microscope your present laboratory staff can operate without difficulty and with minimal training.

- High resolution. 8 Angstroms point to point resolution guaranteed.
- Computer control allows easy and rapid relocation of specimen sections. Remembers up to 100 different specimen positions.
- 7mm diameter grid accommodates specimens SIX TIMES larger than conventional TEMs.
- Computerized electron optics virtually eliminates all alignment and many of the operational controls associated with conventional TEM's.
- A unique high capacity, fully automated vacuum system essentially eliminates specimen contamination (no LN_2 required).
- Compact—fits into a 9'x9' room.
- Light microscope option.

Call or write for a demonstration of the user oriented ISI-2000, the computerized EM.

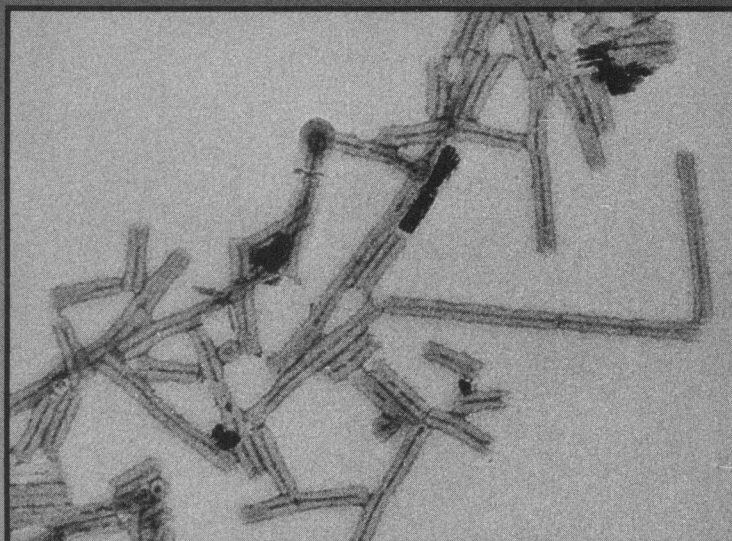
ISI

International Scientific Instruments, Inc.

3255-6C Scott Boulevard • Santa Clara, CA 95051 USA • Phone (408) 727-9840

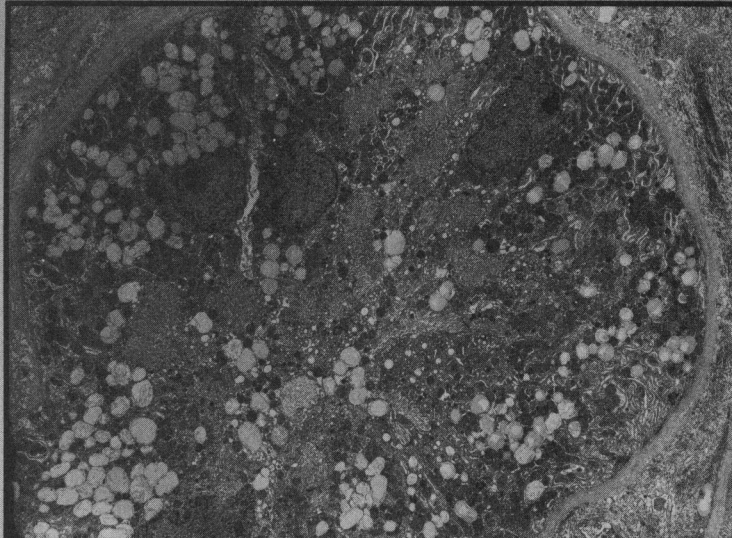
Sales and service in major cities throughout the world.

Circle No. 170 on Readers' Service Card



▲ T.M.V. 95,680X

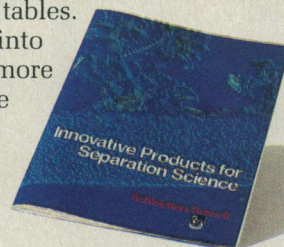
▼ Glomerulus 1,595X



A new reference guide for innovators.

"Innovative Products for Separation Science," the all-new comprehensive Schleicher & Schuell catalog and reference guide, is now available on request. Much more informative than a mere catalog, this 48-page, full-color book provides complete product descriptions... tells how to select and use separation media...and includes explanatory text, charts, illustrations, and convenient fold-out reference tables.

S&S has put a lot into it, so you can get more out of it. Next time you need filter paper...membrane filters and related apparatus...or chromatography products..have this complete selection and ordering guide on hand. Send now for your free copy.



Schleicher & Schuell

Keene
New Hampshire
03431
(603) 352-3810



Innovative Products for Separation Science

Schleicher & Schuell



Napco[®] announces: the years-ahead incubator system that won't be matched.

The new Napco water jacketed 6000 series embodies more important benefits and features than any incubator ever marketed.

Here are some of over 15 advances in incubator design.

1. More accurate control of chamber temperature.

By positioning sensors not only in the water jacket, *but also in the chamber itself*, Napco permits more precise chamber monitoring than other water jacketed incubators.

2. New electronic controls, digital display.

New solid state control system reduces chamber variances, and scanning digital displays monitor chamber parameters.



3. The first modular design.

All control elements can be unplugged from the chamber module for quick service.



4. Unique wet-jet air flow system.

The exclusive wet-jet air flow system provides maximum chamber uniformity and assures

the highest relative humidity available in any incubator.

5. More secure chamber uniformity.

Superior new Napco door closure systems ensure integrity of inner chamber.



6. The only water jacketed CO₂ incubator you can get really clean.

Shelf standards and plenums can be easily removed for cleaning in five minutes. This leaves an empty, perfectly smooth chamber that can be swabbed for easy management of spores and contaminating organisms.



7. The best service in the industry.

If you should ever have an equipment breakdown, a *Heinicke-Napco 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.

Introducing a new constant flow incubator~ the 4000 series.

The new modular Napco constant flow system embodies a unique principle that offers superior results in tissue culture and related disciplines. Each of the modular chambers has its own individual controls and separate metering system, to accommodate specific environments in each module.



National 
Appliance Company

A Heinicke Company
3000 Taft Street
Hollywood, FL 33021
800-327-9783 or
(305) 987-6101
Telex: 512610

Available at the following dealers:
Curtin-Matheson, Fisher Scientific Co.,
Preiser, Sargent-Welch, S.G.A. Scientific,
Scientific Products, Arthur H. Thomas Co.,
VWR. In Canada: Canlab, Fisher Scientific
Co. Ltd., Sargent-Welch of Canada Ltd.

All Napco water-jacket incubators are available in three space saving models.

Circle No. 8 on Readers' Service Card

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

1980: RICHARD E. BALZHISER, WALLACE S. BROECKER, CLEMENT L. MARKERT, FRANK W. PUTNAM, BRYANT W. ROSSITER, VERA C. RUBIN, MAXINE F. SINGER, PAUL E. WAGGONER, F. KARL WILLENBROCK

1981: PETER BELL, BRYCE CRAWFORD, JR., E. PETER GEIDUSCHEK, EMIL W. HAURY, SALLY GREGORY KOHLSTEDT, MANCUR OLSON, PETER H. RAVEN, WILLIAM P. SLICHTER, FREDERIC G. WORDEN

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 Editor: BARBARA J. CULLITON

News and Comment: WILLIAM J. BROAD, LUTHER J. CARTER, CONSTANCE HOLDEN, ELIOT MARSHALL, R. JEFFREY SMITH, MARJORIE SUN, NICHOLAS WADE, JOHN WALSH

Research News: RICHARD A. KERR, GINA BARI KOLATA, ROGER LEWIN, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON

Administrative Assistant, News: SCHERRAINE MACK.
Editorial Assistants, News: FANNIE GROOM, CASANDRA WATTS

Consulting Editor: ALLEN L. HAMMOND
Associate Editors: ELEANORE BUTZ, MARY DORFMAN, SYLVIA EBERHART, RUTH KULSTAD

Assistant Editors: MARTHA COLLINS, CAITILIN GORDON, STEPHEN KEPPEL, EDITH MEYERS, LOIS SCHMITT

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

Letters: CHRISTINE GILBERT
Copy Editor: ISABELLA BOULDIN

Production: NANCY HARTNAGEL, JOHN BAKER; ROSE LOWERY; HOLLY BISHOP, ELEANOR WARNER; MARY MCDANIEL, JEAN ROCKWOOD, LEAH RYAN, SHARON RYAN

Covers, Reprints, and Permissions: GRACEY FINGER, *Editor:* GERALDINE CRUMP, CORRINE HARRIS

Guide to Scientific Instruments: RICHARD G. SOMMER
Assistant to the Editors: JACK R. ALSIP

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 to the editorial office or see page xi, *Science*, 26 September 1980.

BUSINESS CORRESPONDENCE: Area Code 202. Membership and Subscriptions: 467-4417.

Advertising Representatives

Director: EARL J. SCHERAGO

Production Manager: GINA REILLY

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. (312-337-4973); 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.

Electronics and Scientific Communication

We are in the early phase of major change in scientific communication. Electronic storage and retrieval of information has become so efficient that enthusiasts are now talking of paperless communication. This possibility is raised at a time when traditional scientific publishing has lost some of its effectiveness. For about 300 years, traditional forms of journal communications among scientists remained quite satisfactory. But in every half-century since 1750 the number of scientific periodicals increased tenfold, and by 1950 there were about 100,000 journals and 300 abstract journals. Keeping abreast of the literature and retrieving earlier published information became difficult, especially in chemistry, medicine, and other large disciplines. To maintain scientific communication, changes were needed.

At this point the electronics revolution began to influence many areas of science. It provided an alternative to journals in the form of memory banks, and it has affected publication in other ways. An important early achievement was computer-controlled composition. Today *Science* is composed in this way, as are many other journals, including all of the 16 published by the American Chemical Society.

One of the pioneers in computer-controlled composition was the National Library of Medicine (NLM). It first produced *Index Medicus* by this means in 1964. The NLM now indexes about 20,000 articles a month from about 3000 journals. Since the information in *Index Medicus* is in the computer, it is available for machine searching. Beginning in 1971, on-line searching became possible nationwide, and today, with time-sharing, searches are made at the rate of about 1 million a year. Users include individuals in 40 countries.

The need for computer-assisted retrieval of information is particularly urgent in chemistry. Already 5 million chemical substances are known, and the number is increasing at the rate of about 350,000 a year. *Chemical Abstracts* covers the literature of chemistry and its applications, including biochemistry, chemical engineering, chemical substances, organic and inorganic chemistry, and physical and analytical chemistry. In addition, peripheral fields are partially covered, such as solid-state physics, metallurgy, and agriculture. Source materials include some 6500 journals, patent specifications, reviews, and monographs. The data base CA SEARCH provides information about the contents of *Chemical Abstracts*.

Two other large data bases are SCISEARCH, the machine-readable form of *Science Citation Index*, and BIOSIS Previews, which provides access to *Biological Abstracts*. But the data bases cited are only a few of the many now publicly available or being created for science and technology. The capital cost of equipment needed to access these data bases is not very great. For about \$3500 one can obtain a terminal that includes a video screen and printer. This terminal can be connected to a telecommunications net through the telephone. The net, in turn, connects to the data base through a vendor or in some cases directly.

With the use of new equipment and new techniques, data are being obtained at an unprecedented rate. It would be impractical to publish all of the data in journals. This stage is rapidly being reached in the study of nucleotide sequences in DNA. The exact sequences of thousands of nucleotides are already known, and this year the sequences of about 1 million nucleotides will be discovered. Such data, printed in dozens of different journals, would be unwieldy to compare. Stored in a computer, they would be highly amenable to manipulation and study.

Given the present state of electronic technology and the inertia of creatures of habit, major journals are not in immediate peril. Indeed, it could be argued that computer-aided searching of abstracts has increased the value of such publications. But electronics is a dynamic enterprise that will surely have additional impacts on scientific publication later in this decade.

—PHILIP H. ABELSON

NOW...TOP-LOADERS BECOME ANALYTICALS.



SARTORIUS COMBINES 0.1 mg READABILITY WITH COMPACT SIZE AND CONVENIENCE.

- Fully Electronic • Digital Readout • Instant Taring
- No Weight Dialing • Portable

These microprocessor-equipped Sartorius Electronic Balances are as compact as top-loaders, yet as accurate as analyticals.

Model 1602MP (left) weighs 160g to 0.1mg; Model 1207MP (right) weighs 80g to 0.1mg. Operation is completely automatic; there are no weights to 'dial in' and no suspended 'swinging' pan. Far smaller and lighter than comparable analytical balances, these models may easily be moved to any weighing location as needed.

Sartorius . . . those remarkable yellow balances. For literature, write: Sartorius Division, Brinkmann Instruments, Inc., Subsidiary of Sybron Corp., Cantiague Road, Westbury, NY 11590, or call 516/334-7500.

For information circle No. 103 on Readers' Service Card
For a demonstration circle No. 125 on Readers' Service Card

sartorius



Annual Meeting
Toronto
3-8 January 1981

ADVANCE REGISTRATION FORM
(C)

NAME OF REGISTRANT: _____
(Last Name) (First and Initial)

NAME OF SPOUSE REGISTRANT: _____
(Last Name) (First and Initial)

REGISTRANT'S MAILING ADDRESS: _____
[For receipt of program(s), badges(s),
and *Science* (for new applicants)]
(Street)
(City/State or Province) (Zip Code)

ADDITIONAL REGISTRANTS: _____
(With same mailing address. Use new
form if address differs.)

REGISTRANT'S
INSTITUTION OR COMPANY: _____

(City) (State or Province) (Zip Code)

CONVENTION ADDRESS: _____
(Where you can be reached) (Hotel or Street Address, and/or Phone No.)
Check days attending: Sat Sun Mon Tue Wed Thu

☐ Please check here if you need special services due to handicap. We will contact you prior to the meeting.

- Please check appropriate boxes, complete remainder of form (type or print), and enclose payment.
- Preconvention Program, badge, and voucher for full Program and Abstracts will be mailed to registrants in early December.
- Full Program and Abstract Volume can be picked up at *Advance Registrants' Desks* at the Sheraton Centre or the Royal York.
- Registrations received after 12 December will be held at the AAAS Information Booth at the Sheraton Centre.
- Refund requests for registration fees must be made by letter or telegram prior to 26 December 1980 and will be honored after the Annual Meeting. No refunds are made on cancellation notices received after this date.
- Special one-day attendance registration will be available at on-site Registration Desks only.

Registration Category	Regular				Student† or Retired			
	Single		Double		Single		Double	
☐ AAAS Member	\$US 30	\$CAN 35	\$US 45	\$CAN 52	\$US 15	\$CAN 17	\$US 23	\$CAN 26
☐ Non-Member:								
☐ Meeting registration only	38	44	53	61	19	22	27	31
☐ Register and join: Single membership*	68	95#	83	112#	42	64#	50	73#
☐ Registration and join: Double membership**			95	125#			62	86#

†Fulltime undergraduate or graduate students only.

*Specify name of new member _____

**Registrant and spouse double membership includes single subscription to *Science* (51 issues per year).

#Canadian dollar rates are for Canadian membership, including additional postage.

NOTE: 1980 Membership Dues: Regular Member \$US 38; \$CAN 60#. Student or Emeritus, \$US 27; \$CAN 47#. Spouse or Emeritus without *Science*, \$US 12; \$CAN 13#. For other countries, please inquire.

Mail to: American Association for the Advancement of Science, Dept. R,
1515 Massachusetts Ave., NW, Washington, D.C. 20005

SURVEY OF ATTENDANTS

Annual Meeting, Toronto, 3-8 January 1981

Your answers to the following questions will help us to plan future Annual Meetings. Please complete the form and either return it with your registration form or send in separately (to the same address) if you wish to respond anonymously (the two forms will be processed separately).

Principal Professional Interest	Principal Professional Activity	Institutional Affiliation Type
11 ☐ Physical, mathematical	21 ☐ Teaching, education	31 ☐ University, 4-year college
12 ☐ Biological, medical	22 ☐ Health practice	32 ☐ Other educational
13 ☐ Engineering	23 ☐ Other practice, consulting	33 ☐ Industrial, commercial
14 ☐ Social, behavioral	24 ☐ Research, development	34 ☐ Other Private
15 ☐ Science policy	25 ☐ Administration	35 ☐ Government
16 ☐ (other)	26 ☐ (other)	36 ☐ (other)
Highest Educational Level	Age	Number of Past AAAS Meetings Attended
41 ☐ Doctoral Degree	51 ☐ Under 26 years	61 ☐ None
42 ☐ Master's Degree	52 ☐ 26 to 35 years	62 ☐ One
43 ☐ Other professional	53 ☐ 36 to 45 years	63 ☐ Two
44 ☐ Bachelor's Degree	54 ☐ 46 to 55 years	64 ☐ Three
45 ☐ (other)	55 ☐ 56 to 65 years	65 ☐ Four
	56 ☐ Over 65 years	66 ☐ Five or more
		Distance Traveled to Meeting
		71 ☐ Under 51 miles
		72 ☐ 51 to 150 miles
		73 ☐ 151 to 400 miles
		74 ☐ 401 to 1000 miles
		75 ☐ 1001 to 3000 miles
		76 ☐ Over 3000 miles

HOTEL RESERVATIONS

Annual Meeting

Toronto

3-8 January 1981



Conference Air Services (CAS) has been selected as the official travel coordinator for the AAAS Annual Meeting in Toronto. CAS will handle all housing and travel arrangements. Please take note of the housing information below and the travel information on the back of this page.

- All housing reservations must be submitted to CAS in writing (use housing form below).
- Reservations must be received by *Conference Air Services* not later than **12 December 1980**; reservations received after that date are conditional upon space availability at the hotels.
- Rooms are assigned on a first come, first served basis. If room rate requested is no longer available, the next available higher rate will be assigned.
- Confirmation will come directly from *Conference Air Services (CAS)*. All changes and cancellations must be made in writing through CAS.

ROOM RATES IN CANADIAN DOLLARS*

Hotels	Single	Double & Twin	Parlor + 1 Bedrm.	Parlor + 2 Bedrms.	Parking (rates subject to change)
SHERATON CENTRE 123 Queen Street West (No. of rooms: 1000)	\$52 56 64	\$66 70 78	\$128 and up	\$192 and up	\$5.50 per 24 hours; no in-and-out privileges. Inquire for hourly rates.
ROYAL YORK HOTEL 100 Front Street West (No. of rooms: 800)	\$53 58 63	\$67 72 77	\$125 and up	\$203 and up	\$5.25 per 24 hours with in-and-out privileges.
HOTEL TORONTO 145 Richmond Street West (No. of rooms: 100)	\$58	\$68	\$150 and up	\$210 and up	\$5.00 per 24 hours with in-and-out privileges.

*\$ (Can) 1.00 = \$ (US) 0.86, with slight daily fluctuations; there is no room tax.

Charges for roll-away beds: Sheraton Centre and Hotel Toronto, \$15; Royal York Hotel, \$12.

Children are accommodated free of charge in same room with parents; age limits are as follows: Royal York, 14 and under; Sheraton Centre and Hotel Toronto, 18 and under.

Please type or print!

AAAS HOUSING FORM

Please type or print!

SEND CONFIRMATION TO:

Name _____ Street _____

City _____ State _____ Zip _____ Phone No. _____

OTHER OCCUPANTS OF ROOM:

Name _____ Name _____

Name _____ Name _____

CHOICE OF HOTEL: First _____ Second _____ Third _____

ROOM: ☐ Single ☐ Double ☐ Twin SUITE: ☐ 1 Bedroom ☐ 2 Bedrooms PREFERRED RATE: \$ _____

PLEASE INDICATE SPECIAL HOUSING NEEDS DUE TO A HANDICAP:

Wheelchair accessible room ☐ Other: _____

ARRIVAL DATE: _____ TIME: _____ ☐ a.m. ☐ p.m.

DEPARTURE DATE: _____ TIME: _____ ☐ a.m. ☐ p.m.

Be sure to list definite arrival and departure date and time. Hotel reservations will be held only until 6 p.m. unless otherwise specified.

Mail to: AAAS Housing Bureau
c/o CONFERENCE AIR SERVICES
1911 N Ft. Myer Drive
Arlington, Virginia 22209



Annual Meeting
Toronto
3-8 January 1981

AIR TRAVEL RESERVATIONS

Because of the constant increase in air fares, the AAAS is attempting to provide the attendants of its 1981 Annual Meeting in Toronto with the lowest air fares available. Thus, the Association has selected *Conference Air Services (CAS)* as the official travel coordinator for the Toronto Meeting. CAS will endeavor to arrange groups from among those traveling to Toronto from other cities on the same day, thereby offering these travelers group fare savings. CAS guarantees booking of airline space at the best rates available, consistent with travelers' requirements, using group and super saver fares whenever possible.

Please take note of the travel information below and the housing information on the preceding page. We urge you to purchase your tickets through CAS, and to do so early, since air fares are increasing constantly. Volume ticket purchases will enable CAS to form groups at key departure points, thus providing the lowest air fares possible.

SAMPLE ROUNDTRIP AIR FARES TO TORONTO*

City	Coach Fare	Special Group Fare	City	Coach Fare	Special Group Fare
Atlanta	\$299.00	\$221.00	Los Angeles	\$531.00	\$348.00
Boston	180.00	126.00	Miami	349.00	299.00
Chicago	174.00	121.00	New York	160.00	112.00
Cleveland	116.00	98.00	New Orleans	355.00	251.00
Dallas	349.00	255.00	St. Louis	241.00	168.00
Denver	345.00	243.00	San Francisco	547.00	387.00
Detroit	121.00	96.00	Seattle	517.00	358.00
Houston	387.00	274.00	Washington, D.C.	180.00	143.00

*Note: These fares were in effect in July 1980 and are most definitely **subject to change**. Only sample cities have been listed above. Please call CAS for applicable airfares and possible group departure schedules from your home area. Persons for whom group flights cannot be arranged will be booked on the best air fare available.

For assistance with travel reservations call toll-free
800-336-0227
9:00 a.m. to 6:00 p.m.—Monday through Friday
(In Virginia call collect 703/528-0114)

If you are interested in a post convention skiing weekend or vacation in the Laurentian Mountains or at Blue Mountain, Ontario call CAS at the above toll-free number.

Please type or print!

AAAS AIR TRAVEL RESERVATION FORM

Please type or print!

SEND TICKET(S) TO:

Name _____ Street _____
City _____ State _____ Zip Code _____ Phone No. _____

ADDITIONAL PASSENGERS:

Name _____ Name _____

Please make the following flight reservations to Toronto:

Departing from _____ on _____
(Airport) (Date)

Returning from Toronto on _____, based on: ☐ 1st Class ☐ Coach ☐ Group Fare*
(Date)

I prefer the following specific flights, times, stopovers: _____

I will pay for my airfare by: ☐ Check based on invoice from CAS ☐ Credit Card**

Name of Card _____ Number _____ Expiration Date _____

Authorization (Signature of Cardholder): _____

*Persons for whom group flights cannot be arranged will be booked on the best air fare available.

**Persons providing credit card information will be fare-protected at the time of booking.

Mail to: AAAS Travel Bureau
c/o CONFERENCE AIR SERVICES
1911 N Ft. Myer Drive
Arlington, Virginia 22209