

16 March 1979 • Vol. 203 • No. 4385

\$1.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



Gordon Research Conferences

Beckman Airfuge™ Ultracentrifuge.

At 160,000 g, it separates small samples in a hurry.

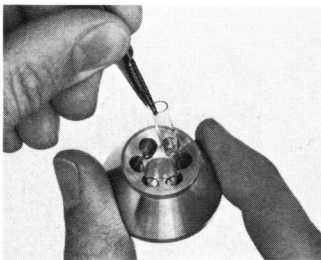
The Beckman air-driven miniature ultracentrifuge is one of the most useful developments in centrifugation in years: it is the ideal answer to the previously difficult problem of how to run small sample volumes at high forces.

Essentially, the Airfuge can pellet any material that can be sedimented in any ultracentrifuge. But the Airfuge does it in a fraction of the time. In 2½ hours, for example, the Airfuge effectively separates lipoproteins in human serum. Leukemia viruses are pelleted in 45 minutes. Most biological particles can be sedimented in the Airfuge in less than an hour.

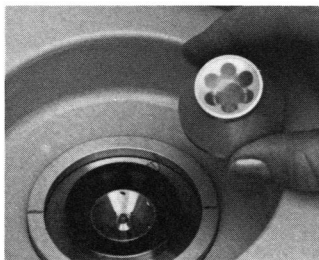
The Airfuge is efficient because sedimenting particles do not have far to travel to reach the wall or bottom of the small tube. Furthermore, since there are no tube caps to attach, samples can be spinning at 100,000 rpm at forces to 160,000 g within one minute of the time they are brought to the lab bench.

When you have small volumes of sample to centrifuge rapidly, remember: there is an ultracentrifuge that's the right size for them—the Airfuge.

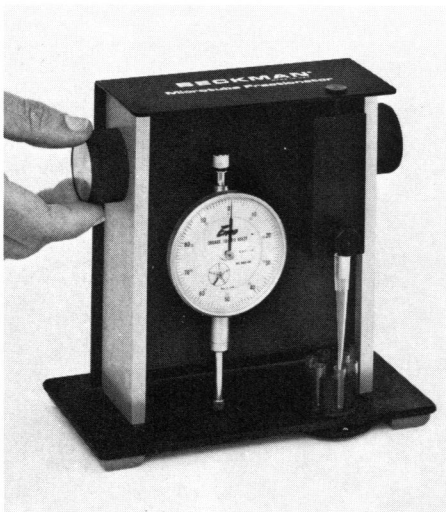
For a description of the Airfuge and a list of applications, write for DS-476/502 to Spinco Division, Beckman Instruments, Inc., 1117 California Ave., Palo Alto, CA 94304.



The fixed-angle rotor holds 6 tubes of 175 μ l each—total rotor volume approximately 1 ml. Three different tube materials are available.



The stator pad has vertical jets to levitate the rotor. Driving jets take the rotor to full speed in 30 seconds.



New Microtube Fractionator makes it easy to remove discrete fractions of the tube contents.



BECKMAN®

Circle No. 259 on Readers' Service Card



GIANT KEYHOLE LIMPET (*Megathura crenulata*) shot in environs off La Jolla, California. The Keyhole Limpet is used in the preparation of Hemocyanin. Also pictured is the brightly colored Garibaldi.

**Ask
for our new
1979 catalog...
yours
for the asking.**

Ask for the new Calbiochem-Behring Biochemical and Immunochemical catalog. Our 1979 edition contains over 2,000 product listings, including many new products. Each product, wherever possible, is referenced to the new Merck Index. So you can find background information quickly and easily.

Ask for our new catalog if you are not on the mailing list now. It's free

and it's the kind of good reference book your lab shouldn't be without. Write or call 800-854-2171 toll free.



REG. TM HOECHST AG

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

ISSN 0036-8075
16 March 1979
Volume 203, No. 4385

SCIENCE

LETTERS	Medical School Funding: <i>R. W. Berliner</i> ; Chemical Carcinogenesis: Dose-Response Extrapolation: <i>D. B. Clayson</i> ; Chimpanzee Task Force Report: <i>A. N. Rowan</i>	1066
EDITORIAL	International Cooperation in Earth Sciences	1071
ARTICLES	Submarine Thermal Springs on the Galápagos Rift: <i>J. B. Corliss et al.</i>	1073
	Mobilizing Technology for Developing Countries: <i>C. Weiss, Jr.</i>	1083
NEWS AND COMMENT	EPA Halts Most Use of Herbicide 2,4,5-T.	1090
	Another Successful Quake Forecast	1091
	Scholarly Exchanges with China	1092
	The Phenformin Ban: Is the Drug an Imminent Hazard?	1094
	Soviet Jailings Hit by 2400	1095
	<i>Briefing</i> : Yankee Know-How and the Oil of Olé; Save the Bureaucracy or the Sea Turtle?; Lab at Memphis State Hit by Xylene Killer.	1096
RESEARCH NEWS	Blood Sugar and the Complications of Diabetes	1098
BOOK REVIEWS	Black-Body Theory and the Quantum Discontinuity, <i>reviewed by R. McCormmach</i> ; The Genetics of the Jews, <i>A. G. Motulsky</i> ; The Reptile Ear, <i>M. J. Mulroy</i> ; Social Play in Primates, <i>C. Coe</i> ; Books Received	1100
REPORTS	Molybdenum Disulfide in the Poorly Crystalline "Rag" Structure: <i>R. R. Chianelli et al.</i>	1105

BOARD OF DIRECTORS

EDWARD E. DAVID, JR.
Retiring President, Chairman

KENNETH E. BOULDING
President

FREDERICK MOSTELLER
President-Elect

ELOISE E. CLARK
MARTIN M. CUMMINGS

RENÉE C. FOX
ANNA J. HARRISON

CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
Garrett Birkhoff
Ronald Graham

PHYSICS (B)
Arthur L. Schawlow
Rolf M. Sinclair

CHEMISTRY (C)
Fred Basolo
William L. Jolly

ASTRONOMY (D)
Peter S. Conti
Donat G. Wentzel

PSYCHOLOGY (J)
Frances K. Graham
Meredith P. Crawford

SOCIAL AND ECONOMIC SCIENCES (K)
David L. Sills
Gillian Lindt

HISTORY AND PHILOSOPHY OF SCIENCE (L)
Melvin Kranzberg
Diana L. Hall

ENGINEERING (M)
Daniel C. Drucker
Donald E. Marlowe

EDUCATION (Q)
Fletcher G. Watson
James T. Robinson

DENTISTRY (R)
Carl J. Witkop, Jr.
Harold M. Fullmer

PHARMACEUTICAL SCIENCES (S)
Samuel Elkin
Robert A. Wiley

INFORMATION, COMPUTING, AND COMMUNICATION (T)
Mary E. Corning
Madeline M. Henderson

DIVISIONS

ALASKA DIVISION

Daniel B. Hawkins
President

Keith B. Mather
Executive Secretary

PACIFIC DIVISION

Glenn C. Lewis
President

Alan E. Leviton
Secretary-Treasurer

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

James W. O'Leary
President

Lora M. Shields
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 © 1979 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$34. Domestic institutional subscription (51 issues): \$70. Foreign postage extra: Canada \$12, other (surface mail) \$15, air-surface via Amsterdam \$40. 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

Defects of Bile Acid Synthesis in Zellweger's Syndrome: <i>R. F. Hanson et al.</i>	1107
Cryptic Bioluminescence in a Midwater Shrimp: <i>J. A. Warner, M. I. Latz, J. F. Case</i>	1109
Phosphorylation of Isocitrate Dehydrogenase of <i>Escherichia coli</i> : <i>M. Garnak and H. C. Reeves</i>	1111
Cone Inputs to Ganglion Cells in Hereditary Retinal Degeneration: <i>C. M. Cicerone, D. G. Green, L. J. Fisher</i>	1113
DNA Repair and Longevity Assurance in <i>Paramecium tetraurelia</i> : <i>J. Smith-Sonneborn</i>	1115
Polyoma Virion and Capsid Crystal Structures: <i>K. W. Adolph et al.</i>	1117
Hybrid Myelomas Producing Antibodies Against a Human Neuroblastoma Antigen Present on Fetal Brain: <i>R. H. Kennett and F. Gilbert</i>	1120
Chemical Characterization of a Hormone That Promotes Cell Arrest in G ₂ in Complex Tissues: <i>L. S. Evans et al.</i>	1122
Multiple Sclerosis: Presence of Lymphatic Capillaries and Lymphoid Tissue in the Brain and Spinal Cord: <i>J. W. Prineas</i>	1123
Red-Absorbing Visual Pigment of Butterflies: <i>G. D. Bernard</i>	1125
Semliki Forest Virus: Cause of a Fatal Case of Human Encephalitis: <i>W. R. Willems et al.</i>	1127
Opioid Peptides Modulate Luteinizing Hormone Secretion During Sexual Maturation: <i>M. S. Blank, A. E. Panerai, H. G. Friesen</i>	1129
A Test of Some Models of Hemispheric Speech Organization in the Left- and Right-Handed: <i>P. Satz</i>	1131
Enduring Changes in Dopamine Receptor Cells of Pups from Drug Administration to Pregnant and Nursing Rats: <i>H. Rosengarten and A. J. Friedhoff</i>	1133
Technical Comments: HCN Did Not Condense to Give Heteropolypeptides on the Primitive Earth: <i>J. P. Ferris; C. N. Matthews</i> ; Infant Perception of Visually Presented Objects: <i>T. G. R. Bower, J. Dunkeld, J. G. Wishart; P. C. Dodwell, D. W. Muir, D. DiFranco</i> ; Primate Olfactory Behavior: <i>D. F. Hennessy; B. M. Slotnick; D. A. Goldfoot et al.</i>	1135

MEETING	Gordon Research Conferences: <i>A. M. Cruickshank</i>	1141
----------------	---	------

MIKE MC CORMACK
RUSSELL W. PETERSON

JOHN C. SAWHILL
CHEN NING YANG

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

GEOLOGY AND GEOGRAPHY (E)
Linn Hoover
Raon E. Bisque

MEDICAL SCIENCES (N)
Theodore Cooper
Leah M. Lowenstein

STATISTICS (U)
Richard L. Anderson
Ezra Glaser

BIOLOGICAL SCIENCES (G)
Donald S. Farner
Walter Chavin

AGRICULTURE (O)
Election in progress
Coyl T. Wilson

ATMOSPHERIC AND HYDROSPHERIC SCIENCES (W)
Eugene W. Bierly
Glenn R. Hilst

ANTHROPOLOGY (H)
James B. Watson
Priscilla Reining

INDUSTRIAL SCIENCE (P)
Herbert I. Fustfeld
Robert L. Stern

GENERAL (X)
Ruth B. Pitt
S. Fred Singer

COVER

Polyoma virus protein coat model as seen in a false color x-ray radiograph. The icosahedrally symmetric capsid structure is viewed along a twofold axis. The negative was exposed successively through a red and blue filter to produce a shamrock green combination of cyan and yellow in the print. See page 1117. [William Saunders and D. L. D. Caspar, Rosenstiel Center, Brandeis University, Waltham, Mass.]

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.

TIAA Cuts Life Insurance Costs Again!

Teachers Insurance and Annuity Association announces increased dividends for 1979, further reducing costs that were already well below what you'd pay for similar policies sold by commercial companies.

For only \$65.50 a man aged 30 or a woman aged 35 can now buy \$50,000 worth of TIAA life insurance on the 20-Year Decreasing Term plan ... and just \$111 buys \$100,000 of coverage on the same plan (if you didn't notice, that's twice the coverage at well under twice the price!). These examples, drawn from the following table, dramatize how little it costs to own substantial amounts of family protection.

See What These Lower Costs Mean to Your Family

The following table illustrates yearly costs for \$50,000 and \$100,000 Decreasing Term policies at selected ages:

20-Year Decreasing Term Insurance		\$50,000 Policy					\$100,000 Policy				
Issued to a man aged	25	30	35	40	45		25	30	35	40	45
Issued to a woman aged	30	35	40	45	50		30	35	40	45	50
Annual Premium	\$ 93.50	\$117.50	\$164.00	\$243.50	\$373.50		\$187	\$235	\$328	\$487	\$747
Yearly Cash Dividend*	42.00	52.00	70.50	100.00	148.00		104	124	161	220	316
Yearly Net Cost	\$ 51.50	\$ 65.50	\$ 93.50	\$143.50	\$225.50		\$ 83	\$111	\$167	\$267	\$431

*Dividends are payable at the end of each policy year; while not guaranteed, they have been paid every year since TIAA was established in 1918.

Isn't it time you found out more about TIAA's low cost life insurance? Just think what an additional \$50,000, \$100,000 or more of solid TIAA protection would do for your family ... and for your peace of mind.

Call Collect [212] 490-9000

The fastest, easiest way to get more information is to phone the TIAA Life Insurance Advisory Center and say "I'd like to talk with an insurance counselor."

Or Mail Coupon If you prefer, simply fill out and mail the coupon at right to receive personal illustrations for your age. There is no obligation, and no one will call upon you as the result of your inquiry.

Eligibility to apply for a life insurance policy from Teachers Insurance and Annuity Association is open solely to employees of institutions of higher education, private schools and certain other nonprofit educational or scientific organizations, and to the spouse of such an employee when more than half the combined earned income of husband and wife is from a qualifying institution.



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

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

SP7903K1

Please send me more information about TIAA's new, lower life insurance costs, including personal illustrations of TIAA policies for my age, as indicated below:

☐ Decreasing Term ☐ 5-Year Renewable Term ☐ Other _____
Please print

Name and Title _____ Date of Birth _____

Address _____

City _____ State _____ Zip _____

Nonprofit Educational or Scientific Employer (college, university, private school, etc.)

If your spouse is also eligible according to the rules set forth at left, please provide

spouse's name: _____

and date of birth: _____

FPS Expands the Scientific Universe of PDP-11 Applications



FPS MAKES GREAT COMPUTERS BETTER

The FPS AP-120B Array Processor

A great contribution to technology, the DEC PDP-11*, but it can't give you the computational power required for many scientific applications. That's why FPS developed the AP-120B Array Processor.

The AP-120B Array Processor gives economical minicomputer systems the extraordinary computational power of large scientific computers. For example, an AP-120B has been used in a PDP-11/34 system to reconstruct and analyze complex digital images. Without the AP-120B, the task would take more than two hours. With the AP-120B, it takes less than thirty seconds — that's a 240X improvement!

A PDP-11/70 and AP-120B would offer

even greater data handling capabilities.

The FPS architecture is no secret. Internally synchronous operation and seven parallel data paths provide unequalled cost/performance, reliability, and programmability. Programmable I/O units also enable exceptional features, such as direct control of disc storage and real time data flow.

Controlled by simple subroutine calls from a FORTRAN program in the PDP-11, or other host computer, FPS Array Processors can be programmed by selecting routines from the extensive FPS Math Library, by writing new routines in the relatively simple AP Assembly Language, or through use of the AP FORTRAN Compiler.

Hundreds of FPS Array Processors are in use today by people who want to retain the hands-on control and affordability of a minicomputer system, but require the exceptional throughput of a large main-frame for their application.

Find out how this new power in computing (typically under \$50K complete) can benefit your application. For more information and an FPS Array Processor brochure, use the reader response number or coupon below. For immediate consultation, contact Floating Point Systems directly.

*DEC and PDP-11 are registered trademarks of Digital Equipment Corporation.

Circle No. 378 on Readers' Service Card

The Age of Array Processing Is Here... and FPS Is The Array Processor Company.



CALL TOLL FREE 800-547-9677
P.O. Box 23489, Portland, OR 97223
TLX: 360470 FLOATPOINT PTL
In Europe & UK: Floating Point Systems, SA Ltd.
7 Rue du Marche, 1204 Geneva, Switzerland
022-280453, TLX: 28870 FPSE CH

Floating Point Systems, Inc.

FPS Sales and Service Worldwide: Boston, Chicago, Dallas, Denver, Detroit, Houston, Huntsville, Los Angeles, New York, Orlando, Ottawa, Philadelphia, Portland, San Francisco, Washington, D.C. International offices: Geneva, London, Munich, Paris, Tel Aviv (Eastronix, Ltd.), Tokyo (Hakuto Co. Ltd.)

Please send me an FPS Array Processor brochure.

Name Title
Company Phone
Address
City State Zip
My Computer System is My Application is

We appeal to your exceptional needs.

Kodak offers you hundreds of choices in films, plates, and papers for scientific applications.

Kodak meets most scientific photo-recording needs with an extensive line of commercial photographic products, many of which are designed for special applications.

These sensitized products have proven their value as problem-solving tools in astrophotography, electron microscopy, emission spectrography, holography, photomicrography, and other investigative techniques.

The wide range of sensitometric and physical properties of our standard films, plates, and papers makes them useful for the vast majority of photo-recording applications. Nevertheless, a need occasionally arises that cannot be met by a Kodak sensitized product regularly stocked by your dealer. But a catalog-listed, factory-stocked item might fill your need quite nicely.

Whatever your photographic requirements, your dealer in Kodak photographic products will help you select the material suited to your particular requirements—and place your order also. You can help by



A transmission electron micrograph of a section of the renal cortex of a rat (magnification $16,000\times$). Exposed in the microscope on KODAK Electron Image Film 4463—one of a number of Kodak products designed for specialized applications.

telling your dealer about your requirements, such as:

- Speed
- Resolution
- Granularity
- Contrast
- Illuminant
- Spectral response
- Format
- Quantity

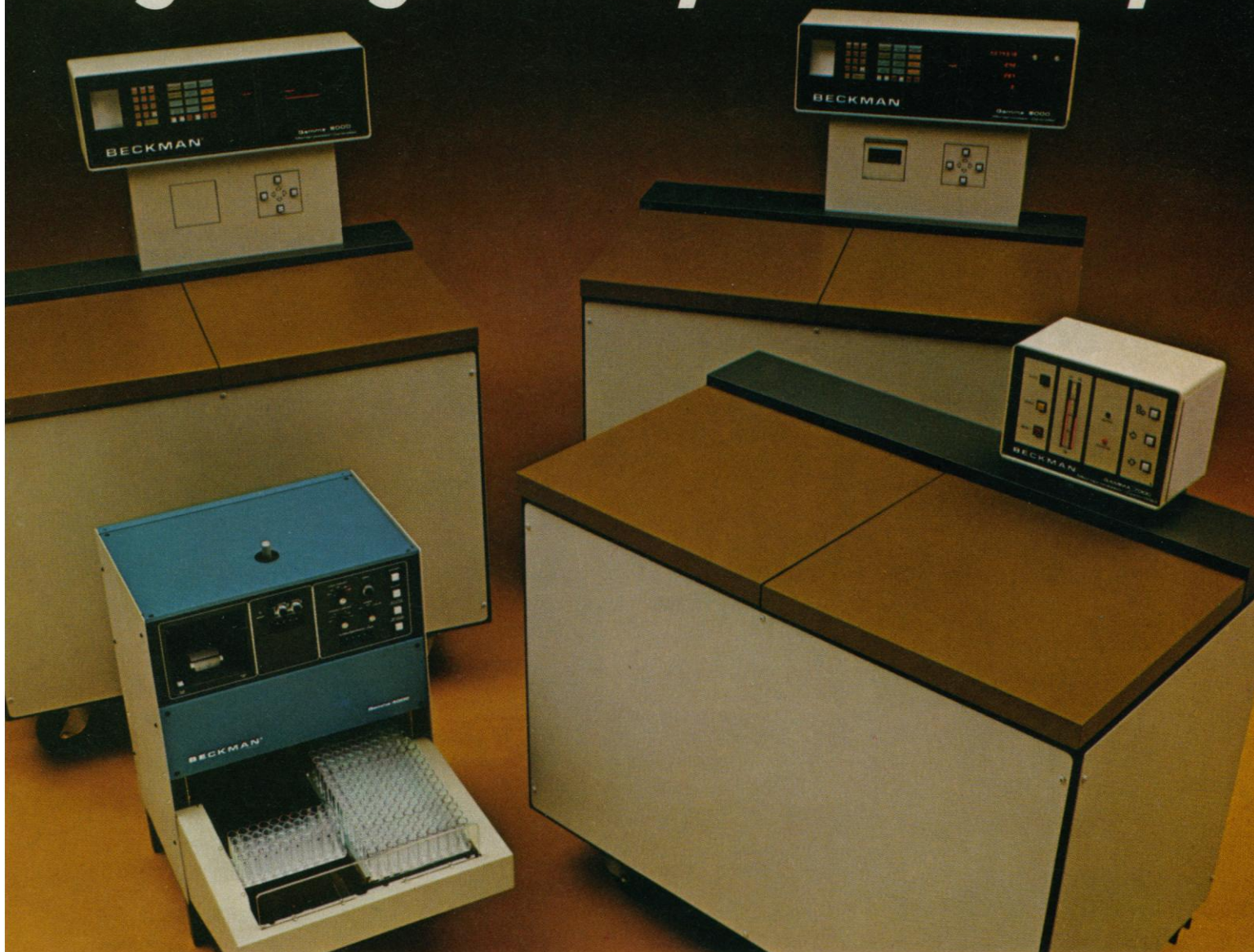
By their uncommon nature, some specialized products require different handling from regular products, may cost a little more, and take longer to deliver. But they're worth it. A few can be supplied in small quantities, but manufacturing considerations may impose a minimum order.

For successful photographic results, ask your dealer to help you choose the Kodak film, plate, or paper suited to your special need. Remember, consider on-the-shelf products first and factory-stocked items second; and if other alternatives need to be explored, your dealer can call upon a Kodak representative to assist in product selection.

**Kodak photographic products.
Capturing the images of science.**



The Beckman gamma choice. Big enough to let you be choosy.



Beckman now offers the research and clinical laboratory a complete choice of gamma-counting instruments. Check the features below to find the one instrument that can most effectively satisfy your needs.

The low cost Gamma 4000 is a high performance, bench-top unit featuring ease of operation, 200 or 400 sample capacity, preset and variable windows, and a choice of print-out devices. The optional DP-5000 computer/printer provides on-line data reduction capability—for Radio-Immunoassay final answer calculations.

The Gamma 7000 is micro-processor controlled and offers high

performance features with push-button simplicity. Permanently stored counting programs eliminate all knobs, manual controls and switches to make operation fast, easy and more reliable. Simply select the desired program, load samples and depress the AUTO pushbutton—a completely simple and thorough approach to counting.

The Gamma 8000 takes micro-processor-control one step further and allows the user to design special counting programs, while maintaining the simplicity of operation unique to Beckman Instruments.

Finally, there's the Gamma 9000 with the ultimate in data-handling

capability. Built right into the 9000 is a complete computer that both controls the operation of the instrument and takes your data through to final answer.

Of course, if you're really going to be choosy about your next gamma instrument, you'll need complete technical information. Why not get it now?

Contact Scientific Instruments Division, Beckman Instruments, Inc., P.O. Box C-19600, Irvine, CA 92713.

Innovation you can count on

Circle No. 357 on Readers' Service Card

BECKMAN®

Tape Recordings for Lab Professionals

☐ **TLC—Best for Drug Abuse Screening**

Low-cost alternative to immunoassays

☐ **Microcomputers in Biochemistry Research**

New computers make possible hitherto impossible measurements

☐ **Data Analysis in the Lab**

Today and tomorrow in chem lab data analysis methods

☐ **Use of Enzymes in Immunology**

Detection of bound and free antigen without separation

☐ **Elemental Analysis of Blood: Cancer Patients & Controls**

Detailed comparisons, plus evaluation of analytical methods used

☐ **Polarographic Analysis in Drug Development**

D.P.P. assays of drugs in biological fluids

☐ **Bioanalysis with Membrane Electrode Probes**

Recent advances in electrode development

☐ **In Vivo Electrochemistry for Monitoring Drugs**

Reveals drug's chemical fate in the brain

☐ **Detection of Lipids & Amines in Biological Samples**

Chemical ionization mass spec speeds assay of closely related chemicals

☐ **Pulse Polarography Analysis in Environmental Toxicology**

Solves tough problems in human and animal poisoning

☐ **New Developments in Measurement of Proteins**

Light scattering of immune complexes provides a specific method for proteins in body fluids

☐ **Direct Determination of Drugs in Plasma & Urine**

Non-chromatographic procedure uses chemical ionization mass spec & stable isotope labeling

☐ **DSC: New Developments in Clinical Analysis**

Differential Scanning Calorimetry—a new analytical tool

☐ **Cannabinoids by GLC and HPLC**

Very low levels can be detected in plasma

☐ **Enthalpimetric Analysis of Immunological Reactions**

Thermometric enthalpy titration may revolutionize serological analysis

☐ **Clinical Application of Titration Calorimetry**

Thermochemical methods look very promising for clinical work

☐ **GC Determination of Apomorphine in Urine**

Study of apomorphine metabolism

☐ **Metals in Liver & Kidney Tissue by AA**

AA determination of copper, zinc, magnesium, and calcium

☐ **Ultra-Trace Analysis of Metals in Biological Systems**

Review and appraisal of the most widely used methods

☐ **Drug Analysis by Direct Multiple-Ion Detection**

Unique computerized system analyses drugs without use of GC

☐ **THC in Urine by (PBM) GC-MS**

Simple, quick, positive method

☐ **Amperometric Measurement of Enzyme Reactions**

Enzyme reactions are monitored by amperometric measurement of substrate depletion, product formation

☐ **THC in Serum Using TLC and Fluorometry**

Results compare favorably with GC-MS data

☐ **Kinetic Assay of Enzyme Activity**

Centrifugal fast analyzer provides data at output rate suitable for direct input into small computer

☐ **RIA of Cannabinoid Compounds**

Many problems of RIA method solved

☐ **Automation in Clinical Medicine**

A Bureau of Standards colloquium

☐ **Analysis of Trace Elements**

Sensitive, reliable analytical methods are needed for trace elements

☐ **Electrochemical Approaches to Clinical Instrumentation**

Precise, accurate, highly specific analyses using ultramicro samples

☐ **Standardization of Protein & Enzyme Assays**

Biuret reaction as standard for measuring total serum protein

☐ **Pharmacologic Studies Using GC-MS**

Utility of GC-MS is emphasized in a report of two pharmacologic studies

☐ **Method Evaluation Studies in Clinical Analyses**

Method evaluation studies on precision and accuracy of lab methods

ORDER FROM:

American Chemical Society
1155 16th St., N.W.
Washington, D.C. 20036
ATTN: Dept. AP

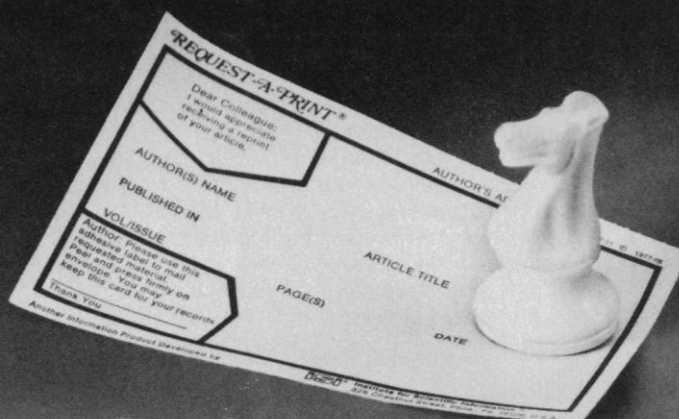
PRICE: \$11.95 per title, includes visual materials.
(California residents add 6% state use tax.)

CASSETTES ONLY CHECK TITLES DESIRED
(Allow 4 to 6 weeks for delivery)

Name _____

Address _____

Your next logical move in building your reprint collection is Request-A-Print®.



Problem.

In all likelihood, you rely largely on reprint requests to build your reprint collection. The average issue of *Science*, for instance, is shared by 2.5 readers.* Which means that 1.5 readers will have to ask for reprints of the articles they'd like to save. In fact, you are probably a pass along reader of several journals.

If you don't mind writing letters, and if you request only a few reprints every year, and if you don't mind an occasional article not being mailed to you because the author can't read your handwriting or because the postal service can't read his, then personal letters or "do-it-yourself" request cards will probably suit your needs.

But if you'd like to make more requests, and be more certain of responses, there's an answer.

A sensible solution.

Request-A-Print cards have all the advantages you need. The logical format commands the responding author's attention. Peel-off labels provide you *and* the author with a record of your request. The continuous, perforated forms save you time when typing a large number of requests.

And the *pre-printed* return address label makes it easy for the author to respond, and assures you of proper delivery of the requested reprint.

*Publisher's data, 1977, publisher's survey of individual readers.

A free sample.

We will be pleased to send you a sample card, along with a descriptive Request-A-Print brochure. With a free sample, you can find out how easy it is to request reprints by using Request-A-Print.

Your move.

Use the coupon below, or write to ISI®, Department 1428, 325 Chestnut Street, Philadelphia, PA 19106, U.S.A. Tell us you'd like your free Request-A-Print card. It's your next logical move.

**Your logic
is convincing.
Send me my free Request-A-Print®
card and descriptive brochure.**

Name _____ Title _____

Organization _____ Dept. _____

Address _____

City _____ State/Province _____ ZIP _____

Country _____ Telephone _____

**ISI® Institute for
Scientific Information®**

325 Chestnut Street, Philadelphia, Pa. 19106, U.S.A.
Tel: (215) 923-3300, Cable: SCINFO, Telex: 84-5305 29-1428

The convenient, superstable Photo-Invertoscope: IM-35

A new generation of inverted microscopes.

The IM-35 does for inverted photomicrography what the Zeiss Photomicroscope does for upright. It takes the trouble out of highest quality photomicrography.

For stability and easy access to stage and specimen, the integrated automatic 35mm camera is at the base of the instrument, not added on the top.

Notice how the lamp swings away to clear the entire stage area. This simplifies exchange of specimens and makes it easy to lift off the rigidly supported stage for ready access to the objectives. And the image is upright and side-correct to make manipulation easier.

Ideal for fluorescence

The Photo-Invertoscope IM-35 is designed to perform a maximum of tasks at minimum cost. For example, no expensive accessories are needed to do fluorescence microscopy—just a lamp, lamp mount, and reflector.

With the full line of interchangeable Zeiss optics and accessories available, the IM-35 is the ideal combination of quality, convenience, and economy in an inverted microscope.

Write or call for complete details today.

Nationwide service

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.

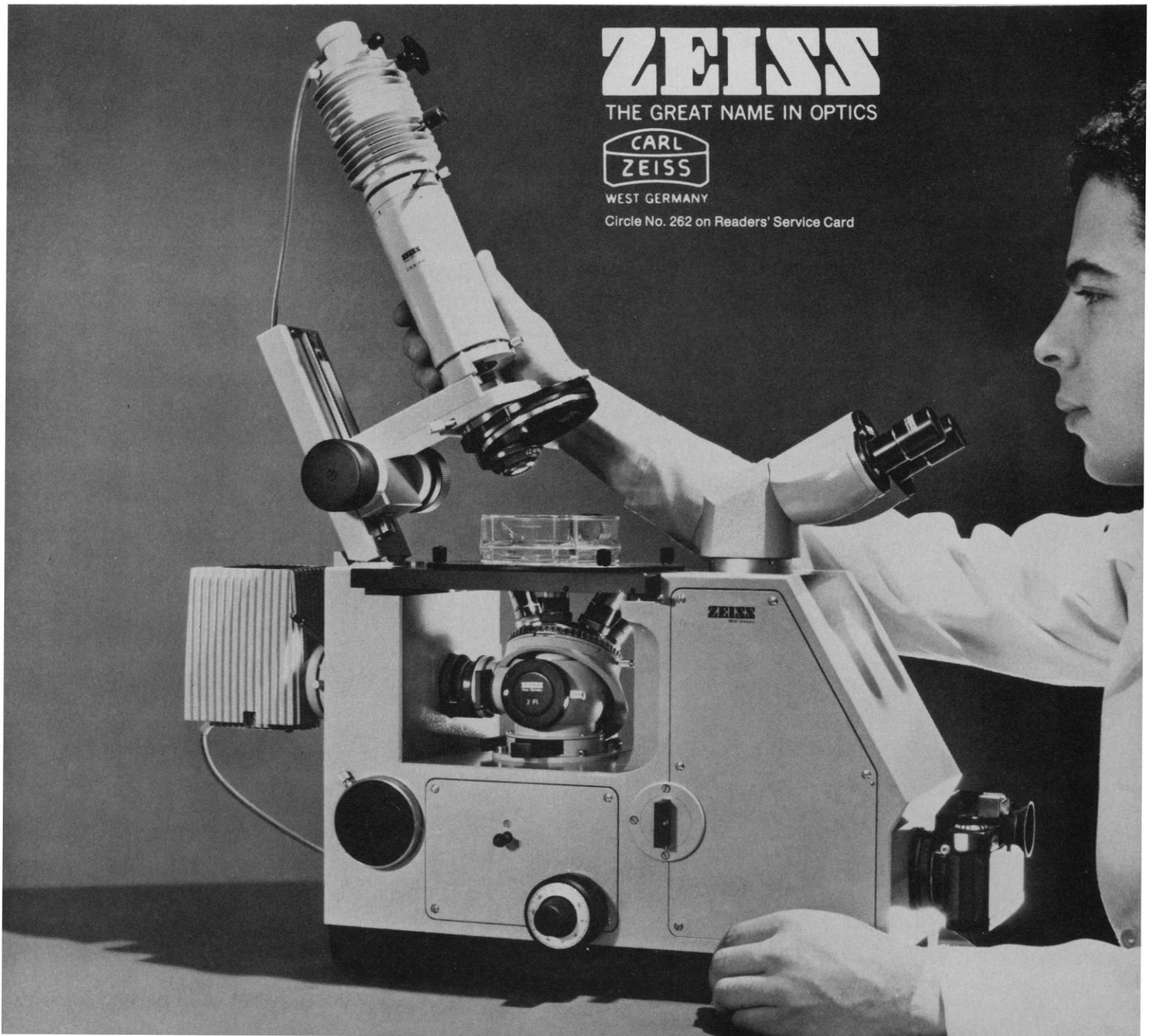
ZEISS

THE GREAT NAME IN OPTICS



WEST GERMANY

Circle No. 262 on Readers' Service Card



The Ohaus Brainweigh 1500D.

The electronic balance that thinks twice for you.

What makes our new Ohaus Dual-Range 1500D so smart?

It gives you two ways to profit from one electronic balance:

- 1) 150g x 0.01g capacity and sensitivity or
- 2) 1500g x 0.1g capacity and sensitivity

By the touch of a bar you enjoy the advantages of two different balances. In one compact unit. With one low price tag — only \$1,595 (a lot less than some electronic balances with a lot less to offer).

The brain behind it all.

The tiny genius that controls the 1500D is our sophisticated microprocessor, which stores operator commands, then responds **only** after the reading is stable.

That means human interaction without human error, in more ways than one.

Consider all the intelligent features Ohaus squeezed into each compact 1500D...

- Die-Cast Construction. Stands up to abuse. Stain resistant. Wipes clean. Protects against dust and spills.
- Microprocessor "Brain". Fewer components for greater reliability.
- Compact Size. Ideal for lab table. Sturdy enough for production line.
- Clearly Labelled Controls. Right up front for quicker and easier operation.
- Large, Stable Platform. Takes variety of objects and unexpected overloads in stride.
- Big, Easy to Read Digits. Seen when seated or standing. If overloaded, "error" shows.
- Span Calibration Adjustment.

Recessed above tare bar.

- Rock-Steady Display. "g" lights up for stable reading.
- "Rapidtouch" Tare Bar. Recessed to avoid

accidentally taring.

And you can learn to operate one in just a few minutes.

Give the new 1500D the twice over.

Send us this coupon — and we'll send you our full-color catalog about the 1500D and all the new Ohaus Brainweighs. The weigh of the future.

The Ohaus 1500D. Fully guaranteed. And backed by over 70 years of Ohaus quality engineering.

Once you have one, you won't have to think twice about it.

OHAUS

Ohaus Scale Corporation, Dept. 14-039
29 Hanover Road, Florham Park, N.J. 07932, (201) 377-9000

☐ Yes, show me the weigh of the future. Send me the full-color catalog on the Ohaus Brainweighs.

☐ I'm ready to see a demonstration. Please have a dealer sales rep call me.

NAME _____

TITLE _____

ORGANIZATION _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

PHONE NUMBER _____

Circle No. 241 on Readers' Service Card



THE OHAUS BRAINWEIGHS™

The weigh of the future.

Modular Electronics

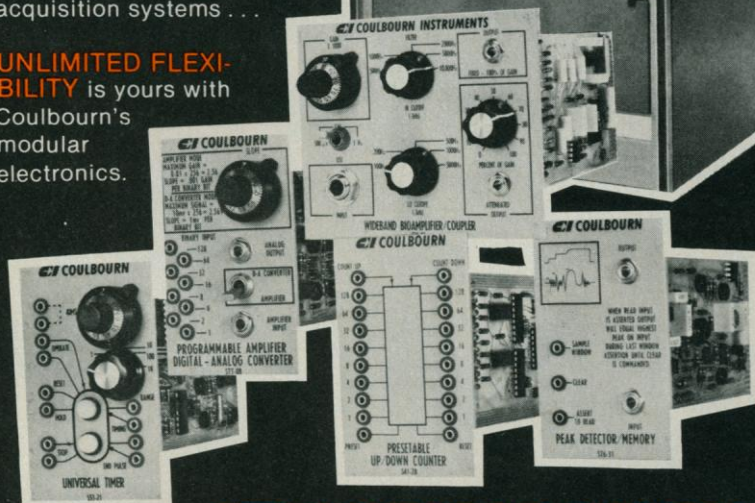
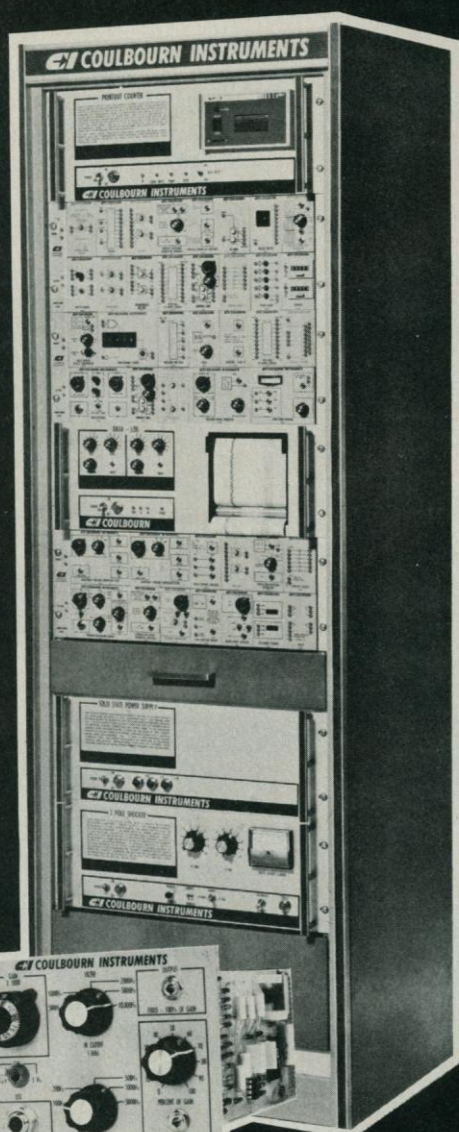
For the Scientific Laboratory

OVER 60 PLUG-IN MODULES for analog and digital programming; timing, counting, and signal conditioning. Featuring digital control of analog functions, gain attenuation, signal frequency, filter frequency.

USE THEM FOR experiment control, computer interface, data acquisition, ancillary electronics needed with polygraphs, computer systems, and electronic instruments. Applications in the life sciences, physical and earth sciences, and engineering.

BUILD YOUR OWN . . . compact portables to large laboratory cabinets . . . special purpose instruments to experiment control and data acquisition systems . . .

UNLIMITED FLEXIBILITY is yours with Coulbourn's modular electronics.



COULBOURN INSTRUMENTS

CALL OR WRITE
FOR COMPLETE CATALOG.

East: Box 2551, Lehigh Valley, PA 18001—(212) 395-3771
West: Box 194, Laramie, WY 82070—(307) 742-8246

LETTERS

Medical School Funding

In his article, "Carter attempt to limit doctor supply faces tough going in Congress" (News and Comment, 16 Feb., p. 630), R. Jeffrey Smith discusses the history of capitation grants, in particular a misconception that has been fostered by the Carter Administration. By linking the proposed elimination of capitation grants to a perceived need for reducing the output of physicians, the Administration would have us believe that the cut serves public purposes other than a reduction in government expenditures. Since, however, the link is specious, discussion of the proposed elimination of capitation support is directed to the wrong issues.

Capitation grants to schools of medicine were originally intended to defray a substantial part of medical education costs. To quote from a recent letter from Kenneth M. Endicott, formerly director of the Bureau of Health Manpower:

By 1969, when I took charge of the Bureau, nearly half of the medical schools were receiving financial distress grants. In effect, when a school encountered financial difficulties, the federal government stepped in with the "last dollar" and rescued the school. This seemed to me to be a policy which encouraged over-spending and penalized prudent management. As an alternative, I proposed a "first dollar" approach in the form of capitation grants at a level calculated to put most of the schools on a sound financial base. The idea was accepted by the Administration and was incorporated in the Administration's legislative proposal. There were to be no strings attached other than maintenance of effort. In the course of the legislative process, the House added a requirement that each school increase enrollment. . . . In conference, the House prevailed and, as a result, the 1971 Act mandated an increased enrollment as a condition for receiving capitation grants.

Thus capitation grants, although conditional upon, were not intended as a reward for or the financing of expansion. More important, the expansion that occurred as a result of this condition is not a very significant factor in the need of schools for the flexible funds that capitation grants provide. Schools of medicine with the number of students; the need for faculty, by far the largest item in educational costs, varies only slightly with moderate changes in class size. Thus the 20 students per class that most schools added as a consequence of the federal health manpower program may have required some capital investment in facilities but had little effect on faculty size and cost. Because these additional students, at least currently in privately supported schools, add more in income (in

the form of tuition) than they do in cost, the last thing these schools are likely to do in the interests of financial stability is to decrease their enrollment. Merlin DuVal is quite right in saying that if the Administration wants schools to reduce their enrollment they will have to provide funds specifically for that purpose and the amount needed would have to be significantly greater than that which would be lost in tuition. That amount would be a substantial part of the current capitation support and would largely negate the primary purpose of the Administration, which is a reduction in expenditures.

Rather than concentrating on the fancied effects on medical school enrollment that would be entailed by elimination of capitation grants, and debating the desirability of an increase or decrease in the future number of physicians, we should be examining the more readily predictable consequences. Schools of medicine would lose a substantial fraction of their flexible funds, and since most would find it difficult to make up the loss by reducing expenditures, a major increase in tuition would be necessary, at least in private schools. Since the increased need for student financial aid eats up about half of any increment in tuition, it would be necessary to raise tuition by roughly twice the lost per capita amount in order to generate an equal net income. Those low- and middle-income students not discouraged by the cost from undertaking a medical education would have to borrow the additional money, increasing further the already substantial debts with which most of our students already graduate, or apply for scholarship support through the Health Service Corps, which could accommodate few of them because it is already oversubscribed. While the earning power of physicians is such that they should be able to repay their debts from future income, many of us are concerned about the bias toward careers that lead rapidly to high incomes that is inevitably induced by such substantial debts. I am particularly concerned that talented people who might make substantial contributions to the future of medicine will be diverted from academic careers by the relatively low income that such careers promise.

These are the issues that we should be addressing when we consider the President's budget proposals, not the imponderables of the supply of physicians.

ROBERT W. BERLINER

*Office of the Dean, School
of Medicine, Yale University,
New Haven, Connecticut 06510*

16 MARCH 1979

We're not permitted to say this is today's most Versatile stereo- microscope



Wild M-5A Stereomicroscope. Because of high resolving power, ample working distance, large field coverage, powerful adjustable lamps and a complete range of accessories, we think you'll say it for us.

The M-5A is an improved M-5. Magnification range is 1.4x to 250x, producing exceptionally crisp images. New focusing and power changing mechanisms are smooth-working and jam-free. A protective steel hood makes it an ideal traveling companion.

Options

BEAMSPLITTER PHOTOTUBE: Easily inserted to convert the binocular unit into a trinocular instrument to support a camera, as shown.

DOUBLE IRIS DIAPHRAGM: Depth of field is adjustable at any given power for critical dissecting and micro-manipulation.

CAMERA LUCIDA: Attaches to make pencil tracing fast and easy.

HORIZONTAL TAKEOFF TUBE: Beamsplitter permits accurate picture taking compatibility with movie cameras and CCTV systems.

THERE'S MUCH MORE TO THE M-5A. Ask for brochure.

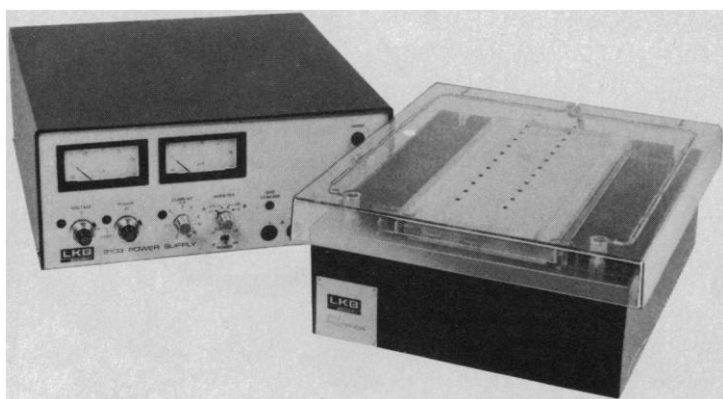
WILD WILD HEERBRUGG
HEERBRUGG INSTRUMENTS, INC.

FARMINGDALE, NEW YORK 11735 • 516-293-7400

Wild Of Canada, Ltd. 881 Lady Ellen Pl., Ottawa 3, Ont.

Wild Of Mexico, Comercial Ultramar Sa, Colima 411, Mexico 6, D.F.

In the time it takes you to read this ad you could have loaded 20 samples onto your electrofocusing gel



That's how easy it is with LKB's Multiphor® unit. And duration of the runs is also short: the precisely engineered all-glass cooling stage means that you can apply higher power for faster runs—higher field strengths for sharper resolution. With the Multiphor unit and LKB's power supply you can do up to 48 samples in less than two hours!

Besides being the system of choice for analytical and preparative electrofocusing, the Multiphor unit is excellent for electrophoresis as well. Simply add the required kit and you're ready to work with SDS-polyacrylamide gels, agarose gels — even immunoelectrophoretic methods.

For safety the Multiphor unit is also unique. There is no metal in the cooling stage to invite short circuits, the electrode design makes it almost impossible to come into contact with high voltage, and the power supply has a safety interlock so you can connect it to your own equipment without additional risk.

If you think that a system which offers so much in speed, reproducibility, versatility and safety has to be costly, think again. The Multiphor system is one of the least expensive flat bed instruments available. Send for details today. (And be sure to ask for pertinent LKB Application Notes, a free subscription to *Acta Ampholineae* and information about forthcoming electrofocusing seminars and workshops.)



LKB Instruments Inc.

12221 Parklawn Drive Rockville, MD 20852

301: 881-2510

Circle No. 363 on Readers' Service Card

19A-304

1068

Chemical Carcinogenesis:

Dose-Response Extrapolation

Marvin A. Schneiderman (Letters, 16 Feb., p. 603) implies that if you can devise an appropriate biological model for chemical carcinogenesis, you can devise a theoretical dose-response curve that will enable a meaningful extrapolation to be made to very low carcinogen doses. This may be good theory, but practically it is grossly error-prone.) My figure, used by Thomas H. Maugh II (Research News, 6 Oct. 1978, p. 37) is meant to illustrate the point that the further you extrapolate from the data base, the greater the level of uncertainty in the predictions. Significant tumor yields in animal experiments usually range from 5 to 100 percent. Vast numbers of animals have to be used to establish a 1 percent tumor yield, and much below this level adequate facilities are not available even on a worldwide basis. Therefore extrapolation to dose levels including one tumor in a population of 10^6 or 10^8 cannot be confirmed experimentally. In cancer induction the uncertainties in extrapolation are compounded by the complexity of the process and the vast number of factors, such as promoting agents, which may drastically affect tumor yield.

Schneiderman draws attention to the fact that the figure does not show the incidence of tumors occurring in a population not exposed to the carcinogen. As a logarithmic scale was, in fact, used, this incidence would not appear in the figure if the spontaneous tumor incidence was zero. More realistically, most spontaneous tumor incidences range from a fraction of 1 percent to several percent both in humans and in rodents. The uncertainty of establishing an induced tumor incidence at a level of one tumor in a population of 10^6 or 10^8 against a background incidence of, say, 1 percent is very considerable, especially if you realize that the actual human population (the real objective) is genetically heterozygous and diverse in its habits, so that spontaneous incidence will vary from one subset of the control population to another. The real or theoretical shape of the dose-response curve is quite irrelevant to my argument.

It is becoming clear that many chemical carcinogens must remain in low levels in our environment, despite the best efforts of regulatory agencies. Let us not pretend at this time that efforts at dose-response extrapolation for carcinogens is any better than pragmatic level-setting. Only a more complete understanding of the many factors involved in carcinogen-

SCIENCE, VOL. 203

esis can lead to a rational appreciation of the effects of low levels of specific chemical carcinogens.

D. B. CLAYSON

Office of the Deputy Director,
Eppley Institute for Research in
Cancer, University of Nebraska
Medical Center, Omaha 68105

Chimpanzee Task Force Report

The Interagency Primate Steering Committee (IPSC) of the National Institutes of Health has recently published a report (1) on the current and future needs for chimpanzees in biomedical programs in the United States. The report contains a number of errors, which is surprising when one considers the source of the publication and the expertise represented by the many primatologists consulted. In addition, there are apparently no detailed position papers supporting the statements and claims made in the report that are available for public scrutiny. It is therefore impossible to check the source of and justification for some of the questionable statements.

The report states that 200 chimpanzees are currently being used in toxicology and pharmacology programs and that future demands will require about 100 animals per year. However, there are few, if any, good reasons for using chimpanzees in terminal toxicological studies. It is also stated that 150 animals are currently being used in the field of hematology, immunology, and immunogenetics and that approximately 50 additional animals will be required every year. However, the World Health Organization Collaborating Center on Hematology in Primate Animals estimates that the actual figures are considerably lower than this (2). This raises the possibility that some of the other figures in the report are also inflated. Certainly the draft of the National Primate Plan published in 1977 gave a much lower estimate than the task-force report for the total number of chimpanzees currently being used in research and testing. It is estimated in the section on "Other research areas" that about 80 animals a year will be required, including ten for molecular biology projects. Presumably, the animals for this program will be passed on from other research projects involving necropsies, since it is inconceivable that these animals will be killed (or maintained) solely as a source of material for studies on the molecular biology of chimpanzee macromolecules.

The report suffers from a number of other shortcomings. First, the task force states that its evaluation has "clearly shown that [the chimpanzee] is absolutely essential for research on several important human diseases." While it is true that the chimpanzee is an important research model in some areas, the report does not substantiate the above quotation. In addition, the task force does little to demonstrate concern for conservation issues and does not emphasize the need to develop other research models that might eliminate the demand for chimpanzees in particular fields. For example, there may well be other satisfactory models in hepatitis research.

Second, the task force does not adequately consider the implications of its projected demand of 300 to 350 chimpanzees per year. Current U.S. breeding programs produce only about 40 to 50 animals a year (the major chimpanzee facilities contain about 750 animals altogether), leaving an annual import demand of 250 to 300 animals. In the 5 years up to 1977, the West African dealers were exporting between 200 and 250 animals every year to the whole world (not just the United States) (3). Because of increased restrictions on this trade as a result of the threat posed to wild chimpanzee populations, the numbers exported have fallen considerably in the last year or two, and apparently the main traders have now stopped operations altogether. Presumably, some attempt may be made to tap the Central African chimpanzee population, but this is likely to run into the same problems that have developed in the West African trade.

Third, the bibliography is most unsatisfactory. Only a few references are provided, many of which are not particularly current. Fourth, the report should have considered some of the ethical aspects of chimpanzee use and caging.

The IPSC has the prestige of the National Institutes of Health backing its publications, but that is no excuse for the production of this document. The chimpanzee, and those who are concerned about its use in biomedical laboratories, deserve detailed arguments and justifications as to why this animal in particular is required for *specific* research needs.

A. N. ROWAN

Institute for the Study of Animal
Problems, 2100 L Street, NW,
Washington, D.C. 20037

References

1. Report of the Task Force on the Use of and Need for Chimpanzees, (National Institutes of Health, Washington, D.C., 1978).
2. J. Moor-Janowski, personal communication.
3. *IPPL Newsl.* 5 (No. 3), 15 (1978).

Prepared by electrofocusing for electrofocusing



Ampholine® carrier ampholytes are prepared by electrofocusing a range of polyamino-polycarboxylic acids into nine narrow, specific pH fractions. Is there any better way to prepare materials used in a biochemical technique than by the very technique itself? We know of none.

Are you also aware that Ampholine carrier ampholytes have the sharpest and lowest MW range of any ampholytes on the market? And that *only* LKB's ampholytes have been shown to be easily separated from proteins with no artifactual binding? For the highest resolution, for the highest reliability, you can put your trust in Ampholine ampholytes.

Contact LKB today for full information on Ampholine solutions. Ask, too, about IEF workshops, seminars and a free subscription to *Acta Ampholiniae*, a bibliography of over 2000 papers on IEF using Ampholine carrier ampholytes.

New: agarose for electrofocusing!

LKB

LKB Instruments Inc.

12221 Parklawn Drive Rockville, MD 20852
301: 881-2510

Circle No. 362 on Readers' Service Card

18A-303

If you like our filter papers for paper chromatography, you'll love our chromatography papers for paper chromatography.

Whatman Chromatography Papers are made specifically for paper chromatography and electrophoresis. Manufacturing methods, materials — specially selected alpha cotton cellulose — and quality control procedures ensure characteristics essential to excellence in these applications.

Whatman Chromatography Papers are made and tested for very high purity, the best achievable uniformity and consistency, evenness of fiber distribution, freedom from "formation" and control of the microstruc-

ture of the fiber. All this results in high resolution, consistent, predictable and reproducible R_f values, high uniformity of spot or band shape and area.

In short, in excellent chromatographic results.

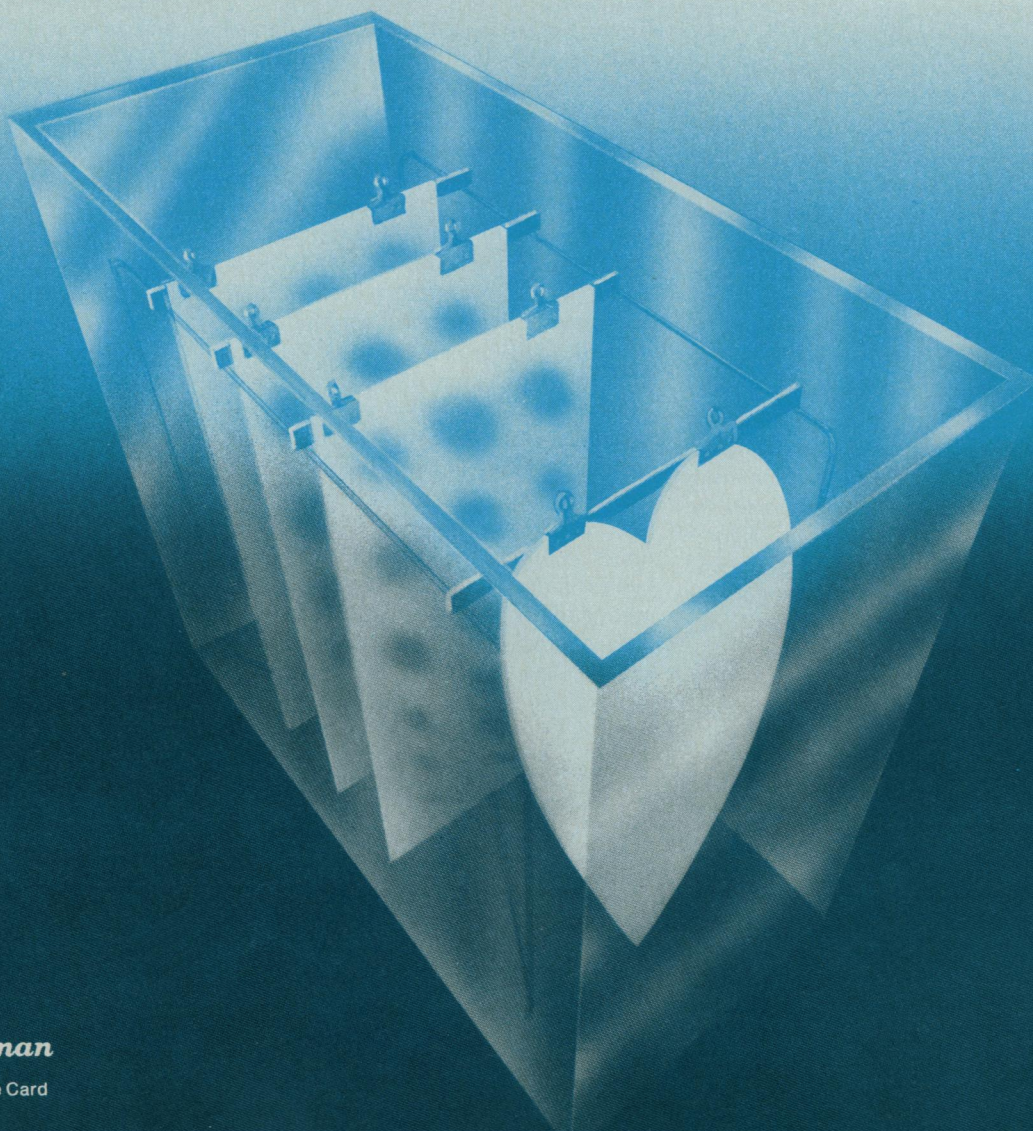
There are eight Whatman grades specifically manufactured for partition chromatography and electrophoresis. Plus ion exchange papers, and both silica gel loaded and silicone treated papers. Not to mention Glass Microfibre® grades.

Like our filter papers, Whatman Chromatography Papers are available from your local laboratory supply dealer.

® Registered trademark of Balston Ltd.

A new "Handbook of Paper Chromatography" will be available shortly. For your free copy write:

Whatman Inc. ■ 9 Bridewell Place, Clifton, New Jersey 07014 ■ Tel. (201) 777-4825.



Whatman

Circle No. 257 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

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

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

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, DEBORAH SHAPLEY, R. JEFFREY SMITH, NICHOLAS WADE, JOHN WALSH. *Editorial Assistant:* SCHERRAINE MACK

Research News: BEVERLY KARPLUS HARTLINE, FREDERICK F. HARTLINE, RICHARD A. KERR, GINA BARI KOLATA, JEAN L. MARX, THOMAS H. MAUGH II, ARTHUR L. ROBINSON. *Editorial Assistant:* FANNIE GROOM

Consulting Editor: ALLEN L. HAMMOND

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

Assistant Editors: CAITILIN GORDON, LOIS SCHMITT, DIANE TURKIN

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

Letters: CHRISTINE KARLIK

Copy Editor: ISABELLA BOULDIN

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

Covers, Reprints, and Permissions: GRACEY 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 xi, *Science*, 29 September 1978.

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.

International Cooperation in Earth Sciences

Prospects are excellent that research in the earth sciences will continue to be exciting and productive. Progress in the past two decades was fostered by the use of equipment such as the deep-sea drilling ship, by the emergence of the concept of plate tectonics, and by growing international cooperation among various branches of the earth sciences. New equipment is being developed, and the quality of older forms is being improved. The concept of plate tectonics has been stimulating and fruitful, but it does not readily explain, for example, earthquakes in supposedly stable places. Thus the extent of the applicability of plate tectonics is being questioned, and the questions create research opportunities.

International cooperation in earth sciences is being facilitated by major programs sponsored by the International Scientific Unions and United Nations agencies. The International Scientific Unions generally have fostered cooperation since their founding. However, those in the earth sciences have been particularly active. Geologists have conducted great quadrennial geological congresses at far-flung sites since 1880. Carefully prepared field trips associated with the congresses have enabled visiting scientists to examine important outcrops in many lands. This tradition will be continued when the next congress is held in Paris in July 1980 and field trips are conducted in western Europe.

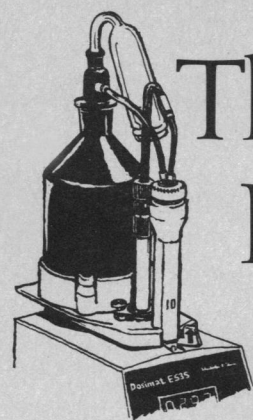
Another, more intense form of cooperation in science was initiated with the International Geophysical Year (IGY) during 1957 and 1958. Major cooperative programs dealing with many phases of the solid earth and its envelope were conducted. Participants from various nations found stimulus and satisfaction in joint efforts. The success of the IGY led to further programs in the earth sciences, including an Upper Mantle Project (1962 to 1970) initiated by the International Union of Geodesy and Geophysics (IUGG).

The International Union of Geological Sciences (IUGS) joined with Unesco to initiate in 1973 an International Geological Correlation Program, which now involves about 1000 geologists, 62 projects, and a total of 115 countries. The program is designed to encourage international research on geological problems related to the identification and assessment of natural resources and the improvement of the environment.

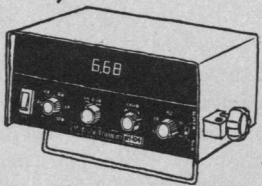

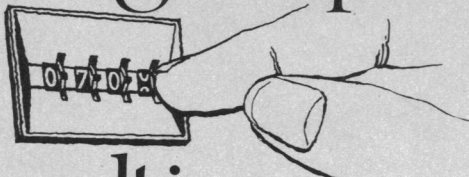
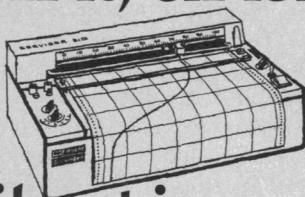
During the 1970's IUGS also collaborated with IUGG in the International Geodynamics Project. This interdisciplinary program emphasized study of tectonic plates and phenomena attending their collisions. Attention was focused on the ocean basins, island arcs, and continental margins. Since the ocean basins are comparatively young, the program dealt essentially with events of the past 200 million years. But 200 million years is only about 5 percent of the earth's age, and it is study of the continents that will reveal ancient events. At present, about 20 percent of the heat generated within the earth reaches the surface by conduction. The remainder is available for other processes such as mechanical work. During the past 200 million years sufficient energy was available in the earth to move continents thousands of miles. In an earlier day, when still more energy was present, motions probably occurred more rapidly and the energy might have been manifested in ways other than horizontal motion.

To understand the workings of the great heat engine known as the earth, observations from many places must be correlated. The present state must be examined, and evidence must be assembled about events that occurred in earlier times. The phenomena involved are complex; crucial data are difficult to obtain; potential sources of data everywhere must be tapped. Without comprehensive planning and good exchange of information and ideas, progress would be slow.

Thus the opportunities of the next decade call for further international cooperation among geologists, geochemists, geodesists, and geophysicists. Negotiations between IUGS and IUGG are proceeding. Prospects are good that a new joint program will be formulated.—PHILIP H. ABELSON



The Metrohm pH Stat Titrator.

It gives you self-refilling
burets, a removable digital
pH Meter,  quick-release
titration vessels,  finger tip
setting of stat point  or end point, and a multirange
recorder,  all in the same
pH stat titrating system.

Our catalog illustrates ten different systems incorporating Metrohm pH Stat Titrators, and a wide selection of available accessories. For your copy, please write: Metrohm Division, Brinkmann Instruments, Inc., Cantiague Road, Westbury, N.Y. 11590. In Canada: Brinkmann Instruments (Canada), Ltd.



Metrohm pH Stat Titrators

Circle No. 189 on Readers' Service Card

BOOKS RECEIVED

(Continued from page 1104)

Disabled Persons. A Conceptual Analysis and Guide. Valerie J. Bradley with the assistance of John W. Ashbaugh and Mary Ann Allard. University Park Press, Baltimore, 1978. xii, 164 pp., illus. Paper, \$9.75.

Determining Health Needs. Robin E. MacStravic. Health Administration Press, Ann Arbor, Mich., 1978. x, 268 pp. \$17.50.

Development in Mammals. Vol. 3. Martin H. Johnson, Ed. North-Holland, Amsterdam, 1978 (U.S. distributor, Elsevier, New York). viii, 472 pp., illus. \$61.

Development of Fishes of the Mid-Atlantic Bight. An Atlas of Egg, Larval and Juvenile

Stages. Fish and Wildlife Service, Washington, D.C., 1978 (available from the Superintendent of Documents, Washington, D.C.). Six volumes. viii, 366 pp.; viii, 458 pp.; viii, 394 pp.; viii, 314 pp.; viii, 340 pp.; and viii, 416 pp. \$62.25.

Development, Reform, and Malnutrition in Chile. Peter Hakim and Giorgio Solimano. MIT Press, Cambridge, Mass., 1978. xviii, 92 pp. \$10. International Nutrition Policy Series, 4.

Le Développement Psychologique de la Première Enfance. T. G. R. Bower. Translated from the English edition (San Francisco, 1977) by Anne-Marie Graulich. Mardaga, Brussels, 1978. 228 pp., illus. Paper, 320 BF. Psychologie et Sciences Humaines, 73.

Droplet Model of Atomic Nuclei. William D.

Myers. IFI/Plenum, New York, 1977. x, 150 pp. \$75.

The Ecology of North America. Victor E. Shelford. University of Illinois Press, Urbana, 1978. xxii, 610 pp., illus. Paper, \$10. Reprint of the 1963 edition.

Emission Spectrochemical Analysis. Tibor Török, József Mika, and Ernő Gegus. Adam Hilger, Bristol, England, and Crane, Russak, New York, 1978. 692 pp., illus. \$65.

Endocrine Causes of Menstrual Disorders. Papers from a symposium, Memphis, Tenn., Mar. 1977. James R. Givens, Ed. Year Book Medical Publishers, Chicago, 1978. xiv, 420 pp., illus. \$33.95.

Energie et Agriculture. Le Choix Ecologique. Jean-Roger Mercier. Editions Debard, Paris, 1978. 192 pp., illus. Paper, 45 F.

Engineering Aspects of Asbestos Dust Control. Gyan S. Rajhans and Gordon M. Bragg. Ann Arbor Science, Ann Arbor, Mich., 1978. viii, 192 pp., illus. \$28.

Environment and Services. Peter Burberry. Batsford, London, ed. 3, 1978 (U.S. distributor, Halsted [Wiley] New York). 350 pp., illus. Paper, \$9.95. Mitchell's Building Construction.

Environmental Protection in the People's Republic of China. Baruch Boxer and David Pramer, Eds. Rutgers University, New Brunswick, N.J., 1978. xii, 84 pp., illus. Paper.

Essentials of Human Physiology. Gordon Ross, Ed. Year Book Medical Publishers, Chicago, 1978. xii, 656 pp., illus. Paper, \$14.95.

Ethics in Social and Behavioral Research. Edward Diener and Rick Crandall. University of Chicago Press, Chicago, 1978. x, 266 pp. \$17.

Evolution of the Earth's Crust. D. H. Tarling, Ed. Academic Press, New York, 1978. xvi, 444 pp., illus. \$35.25.

Factors Affecting the Action of Narcotics. Proceedings of a meeting, Milan. Martin W. Adler, Luciano Manara, Rosario Samanin, Judy D. Baggott, Ellen B. Geller, and Vanna Pistotti, Eds. Raven, New York, 1978. xxii, 774 pp., illus. \$39.50. Monographs of the Mario Negri Institute for Pharmacological Research, Milan.

A Growth Chamber Manual. Environmental Control for Plants. Robert W. Langhans, Ed. Comstock (Cornell University Press), Ithaca, N.Y., 1978. 224 pp., illus. \$17.50.

Harvest the Sun. Solar Construction in the Snowbelt. Nick Nicholson. Ayer's Cliff Centre for Solar Research, Ayer's Cliff, Quebec, 1978 (distributor, Firefly Books, Thornhill, Ontario, Canada). xii, 208 pp., illus. Paper, \$9.95.

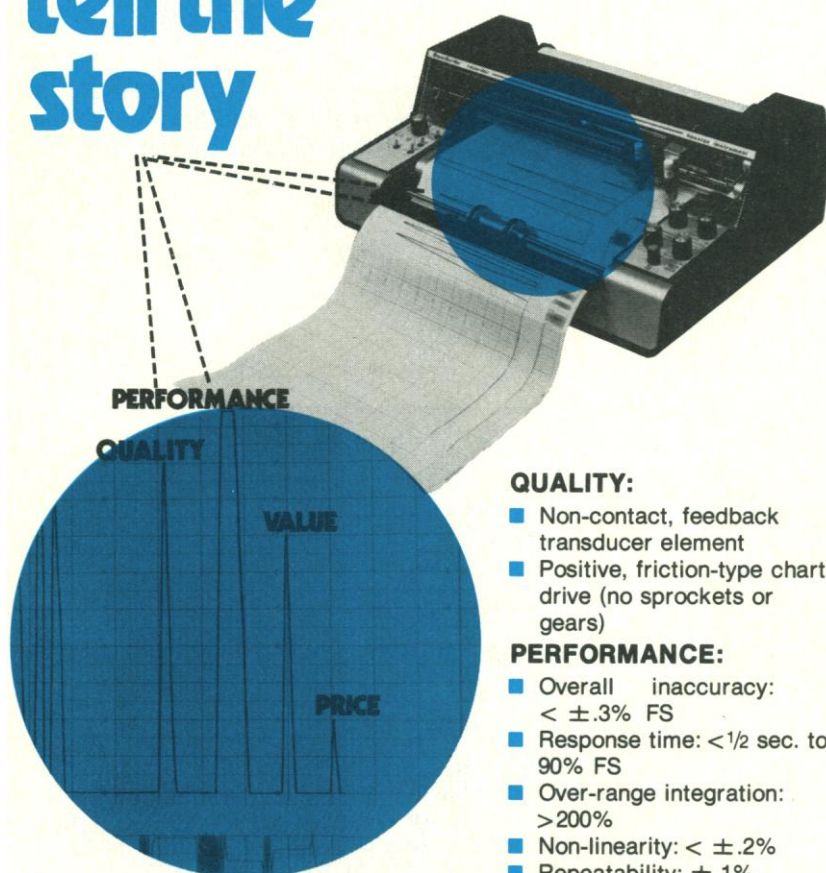
Health Implications of Nuclear Power Production. World Health Organization, Copenhagen, 1978 (U.S. distributor, WHO Publications Centre USA, Albany, N.Y.). iv, 76 pp. Paper, \$4. WHO Regional Publications, European Series No. 3.

Health Services Management. Anthony R. Kovner and Duncan Neuhauser, Eds. Health Administration Press, Ann Arbor, Mich., 1978. xii, 566 pp. \$24.

High-Power Lasers and Laser Plasmas. N. B. Basov, Ed. Translated from the Russian edition (Moscow, 1976) by J. George Adashko. Consultants Bureau (Plenum), New York, 1978. viii, 242 pp., illus. Paper, \$39.50. The Lebedev Physics Institute Series, vol. 85.

The Hodges Ruin. A Hohokam Community in the Tucson Basin. Isabel T. Kelly with the collaboration of James E. Officer and Emil W. Haury. Gayle Harrison Hartmann, Ed. University of Arizona Press, Tucson, 1978. x, 132

The "Peaks" tell the story



The OmniScribe® Strip Chart Recorder Series B-5000

*U.S. suggested retail price only
* Registered trademark of Houston Instrument

**houston
instrument**

DIVISION OF BAUSCH & LOMBE

ONE HOUSTON SQUARE (512) 837-2820 AUSTIN, TEXAS 78753
TWX 910-881-2022

"the graphics - recorder company"

EUROPEAN OFFICE Rochesterlaan 6 8240 Gistel Belgium
Phone 059/277445 Telex Bausch 81399

Circle No. 381 on Readers' Service Card



For investigations of
chemotactic receptors on the cell surface.
For cell migration studies.

Formyl-methionyl-leucyl-phenylalanine

***N*-[phenylalanine-ring-2,6-³H(N)]-**

40–60Ci/mmol

Ethanol containing 0.2% mercaptoethanol in
silanized comb-vial, shipped in dry ice.

NET-563 250μCi 1mCi

Not for use in humans or clinical diagnosis



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. 245 on Readers' Service Card

INBRED AND GENETICALLY DEFINED STRAINS OF LABORATORY ANIMALS

Part 1: Mouse and Rat

Compiled and Edited by

Philip L. Altman and Dorothy Dittmer Katz

CONTENTS

INBRED ANIMALS: History, Uses, and Classification;
Definition of Inbred Strains

I. MOUSE: Introductory Statements; Inbred and
Genetically Defined Strains; Karyology; Development;
Epidermis; Biochemical and Endocrine Mutants; Im-
munology; Neurology; Tumors; Wild Mice.

II. RAT: Introductory Statements; Inbred and Genetically
Defined Strains; Morphological Traits; Biochemical
Polymorphisms; Immunogenetics; Regulatory Systems.

ADVISORY COMMITTEE: Thomas J. Gill III, *Chairman*, Donald
W. Bailey, C. K. Chai, Carl Cohen, Alain L. deWeck, Carl T.
Hansen, Jan Klein, Raymond A. McBride, Michael Potter,
Ethan M. Shevach, Donald C. Shreffler, Otakar Stark, J.
Wayne Streilein.

1979 ISBN: 0-913822-12-4
(418 pages, 93 tables, 3450 references, 56-page index)
Price, postpaid to North and South America, \$65.00

Publisher and Distributor:

**Federation of American Societies
for Experimental Biology**

9650 Rockville Pike, Bethesda, MD 20014

A non-profit organization

Circle No. 384 on Readers' Service Card

OUR FIBRONECTIN MAKES YOUR CELLS GROW ATTACHED TO CULTURE FLASKS . . . and other growth surfaces.

If you have had disappointing results trying to grow
cells in culture, we may have the remedy . . . our
Human Fibronectin (CR-HFN). This product has re-
peatedly proven effective in getting fastidious cells to
attach to surfaces—and grow.

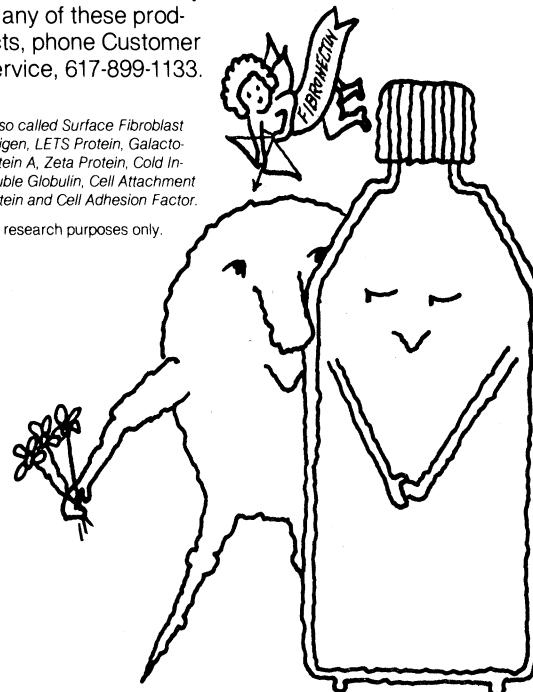
CR-HFN, — a glycoprotein cell surface antigen* —
adsorbs to surfaces to provide a hospitable environ-
ment for anchorage-dependent cells. Cells which
were previously impossible to culture, now grow.
Plating efficiency is dramatically increased. And the
variability of plating with different serum batches is
reduced or eliminated.

At Collaborative Research, we're committed to
the development of products which make tissue
culture a dependable science. CR-HFN is the latest
addition to our growing line of tissue culture prod-
ucts—including Epidermal Growth Factor, Fibroblast
Growth Factor, Nerve Growth Factor, Multiplication
Stimulating Activity, Endothelial Cell Growth Supple-
ment, and Human Thrombin.

To find out more about these products and what they
can mean for your research, write or call today. Or
for immediate delivery
of any of these prod-
ucts, phone Customer
Service, 617-899-1133.

*Also called Surface Fibroblast
Antigen, LETS Protein, Galacto-
protein A, Zeta Protein, Cold In-
soluble Globulin, Cell Attachment
Protein and Cell Adhesion Factor.

For research purposes only.



Research Products Division

Collaborative Research, Inc.

1365 Main Street, Waltham, Mass. 02154
Tel (617) 899-1133 TWX 710-324-7609

Also distributed by:

Sochibo S.A.
3, Rue Carnot
92100 Boulogne, France
Tel: 604-44-38
Telex: 270146F

Uniscience Ltd.
8 Jesus Lane
Cambridge CB5 8BA
England
Tel: (0223) 64623/4
Telex: 817698

Maruzen Oil Co., Ltd.
6, 6-Chome, Kohjimachi
Chiyoda-ku, Tokyo
Japan
Tel: 03 (230) 3311

Circle No. 393 on Readers' Service Card

HEALTH CARE



Project Hope

Regulation, economics, ethics, and practice are just a few of the topic areas discussed in this 7th compendium from SCIENCE. This highly acclaimed publication will help the professional and the lay person understand not only recent advances in medical practice but other less obvious but equally vital components of our health-care system.

HEALTH CARE: Regulation, Economics, Ethics, Practice

Edited by Philip H. Abelson

256 pp., 8½" x 11";
0-87168-302-4 (cloth), \$14.00*;
0-87168-240-0 (paper), \$6.00*
November 1978

To order your copy, send your name, address and remittance to



AAAS Department HC-3
1515 Massachusetts Avenue, NW
Washington, D. C. 20005

Please allow 6-8 weeks for delivery.

*AAAS members deduct 10%.

pp., illus. Paper, \$6.95. Anthropological Papers of the University of Arizona, No. 30.

The International Sakharov Hearing. Marta Harasowska and Orest Olhovych, Eds. Smolokyp Publishers, Baltimore, 1977. 336 pp. Cloth, \$8.95; paper, \$4.75.

International Symposium: State of Prevention and Therapy in Human Arteriosclerosis and in Animal Models. Münster, Germany, June 1977. Werner H. Hauss, Robert W. Wissler, and Rolf Lehmann, Eds. Westdeutscher Verlag, Opladen, Germany, 1978. xx, 576 pp., illus. 125 DM. Abhandlungen der Rheinisch-Westfälischen Akademie der Wissenschaften, Band 63.

An Introduction to Number Theory. Harold M. Stark. MIT Press, Cambridge, Mass., 1978. x, 348 pp. Paper, \$8.95. Reprint of the 1970 edition.

An Introduction to Optimal Estimation of Dynamical Systems. John I. Junkins. Sijthoff & Noordhoff, Alphen aan den Rijn, The Netherlands, 1978. xiv, 340 pp., illus. \$25. Mechanics, 3.

An Introduction to the History of Virology. A. P. Waterson and Lise Wilkinson. Cambridge University Press, New York, 1978. xiv, 238 pp., illus. \$27.50.

Kinship in Bali. Hildred Geertz and Clifford Geertz. University of Chicago Press, Chicago, 1978. xiv, 214 pp., illus. Paper, \$3.95. Reprint of the 1975 edition.

Language et Education. J. A. Rondal. Mardaga, Brussels, 1978. 276 pp. Paper, 390 BF. Psychologie et Sciences Humaines, 74.

The Law of Hospital and Health Care Administration. Arthur F. Southwick with contributions by George J. Siedel III. Health Administration Press, Ann Arbor, Mich., 1978. xiv, 500 pp. \$25.

Legal and Ethical Issues in Human Research and Treatment. Psychopharmacologic Considerations. Papers from a symposium, Dec. 1976. Donald M. Gallant and Robert Force, Eds. Spectrum, New York, 1978 (distributor, Halsted [Wiley], New York). xxii, 186 pp. \$15.

Limits of Medicine. The Doctor's Job in the Coming Era. Proceedings of a colloquium, Totts Gap, Pa., June 1976. Stewart G. Wolf and Beatrice Bishop Berle, Eds. Plenum, New York, 1978. xii, 156 pp. \$22.50.

Manual of the International Statistical Classification of Diseases, Injuries, Causes of Death. Vol. 2, Alphabetical Index. World Health Organization, Geneva, 1978 (U.S. distributor, WHO Publications Centre USA, Albany, N.Y.). xii, 660 pp. \$15.

Marine Biota of the NE Pacific. A Bibliography Emphasizing Systematics and Distribution. W. C. Austin and M. M. Deutsch. Khoyatan Marine Laboratory, Cowichan Station, B.C., Canada, 1978. Various pages. Paper, \$16.

Marine Geotechnology. An International Journal of Seafloor Science and Engineering. Vol. 2, 1977: Marine Slope Stability Volume. Papers from a conference, Baton Rouge, La., Oct. 1976. Adrian F. Richards, Ed. Crane, Russak, New York, 1978. viii, 392 pp., illus. \$45.

Mathematical Morsels. Ross Honsberger. Mathematical Association of America, Washington, D.C., 1978. xii, 250 pp., illus. \$14.

Matters Mathematical. I. N. Herstein and I. Kaplansky. Chelsea Publishing Company, New York, ed. 2, 1978. x, 246 pp. \$10.95.

May You Live to Be 200! Henry Gris and Milton Merlin. Barnes, New York, and Yoseloff, London, 1978. 342 pp., illus. \$12.

The Myth and Truth about Ginseng. Joseph P. Hou. Barnes, New York, and Yoseloff, London, 1978. 246 pp. \$9.95.

Nonparametric Probability Density Estimation. Richard A. Tapia and James R. Thompson. Johns Hopkins University Press, Baltimore, 1978. xiv, 176 pp. \$17.95. Johns Hopkins Series in the Mathematical Sciences, No. 1.

The Nude Mouse in Experimental and Clinical Research. Jørgen Fogh and Beppino C. Giovanella, Eds. Academic Press, New York, 1978. xvi, 502 pp., illus. \$31.

Ordinary Differential Equations. V. I. Arnold. Translated from the Russian edition and edited by Richard A. Silverman. MIT Press, Cambridge, Mass., 1978. x, 280 pp., illus. Paper, \$8.95. Reprint of the 1973 edition.

Origins in Acoustics. The Science of Sound from Antiquity to the Age of Newton. Frederick Vinton Hunt. Yale University Press, New Haven, Conn., 1978. xvi, 196 pp. + plates. \$14.

The Outlook for World Oil into the 21st Century, with Emphasis on the Period to 1990. Prepared by Petroleum Industry Research Foundation. Electric Power Research Institute, Palo Alto, Calif., 1978. Various pages. Paper, \$6.75. EPRI EA-745.

Photochemical and Photobiological Reviews. Vol. 3. Kendrick C. Smith, Ed. Plenum, New York, 1978. x, 306 pp. \$27.50.

The Psychopath in Society. Robert J. Smith. Academic Press, New York, 1978. xii, 164 pp. \$7.80. Personality and Psychopathology.

The Seven Mysteries of Life. An Exploration in Science and Philosophy. Guy Murchie. Illustrated by the author. Houghton Mifflin, Boston, 1978. xiv, 690 pp. \$17.95.

Sickness and Health in America. Readings in the History of Medicine and Public Health. Judith Walzer Leavitt and Ronald L. Numbers, Eds. University of Wisconsin Press, Madison, 1978. x, 456 pp., illus. Cloth, \$20; paper, \$8.95.

Tone. A Linguistic Survey. Victoria A. Fromkin, Ed. Academic Press, New York, 1978. xii, 292 pp., illus. \$24.

Topics in Theoretical and Experimental Gravitation Physics. Proceedings of a school, Erice, Sicily, Mar. 1975. V. De Sabbata and J. Weber, Eds. Plenum, New York, 1978. xii, 344 pp., illus. \$37.50. NATO Advanced Study Institutes Series B, vol. 27.

Toxicology. Biochemistry and Pathology of Mycotoxins. Kenji Uraguchi and Mikio Yamazaki, Eds. Kodansha, Tokyo, and Halsted (Wiley), New York, 1978. viii, 288 pp., illus. \$27.50.

The Ukrainian Herald, Issue 6: Dissent in Ukraine. An Underground Journal from Soviet Ukraine. Translated from the Ukrainian edition (1972) by Lesya Jones and Bohdan Yashen. Smolokyp Publishers, Baltimore, 1977. viii, 216 pp. Cloth, \$6.95; paper, \$3.95.

The Unity of the Senses. Interrelations among the Modalities. Lawrence E. Marks. Academic Press, New York, 1978. xii, 290 pp., illus. \$17.50.

The Use of Integrated Control and the Sterile Insect Technique for Control of the Codling Moth. Papers from a meeting, Heidelberg, Nov. 1977. Erich Dickler, Ed. Biologische Bundesanstalt für Land- und Forstwirtschaft, Berlin, 1978. 120 pp. Paper, 13.80 DM. Mitteilungen aus der Biologischen Bundesanstalt für Land- und Forstwirtschaft, Heft 180.

Water in Environmental Planning. Thomas Dunne and Luna B. Leopold. Freeman, San Francisco, 1978. xxx, 818 pp., illus. \$30.