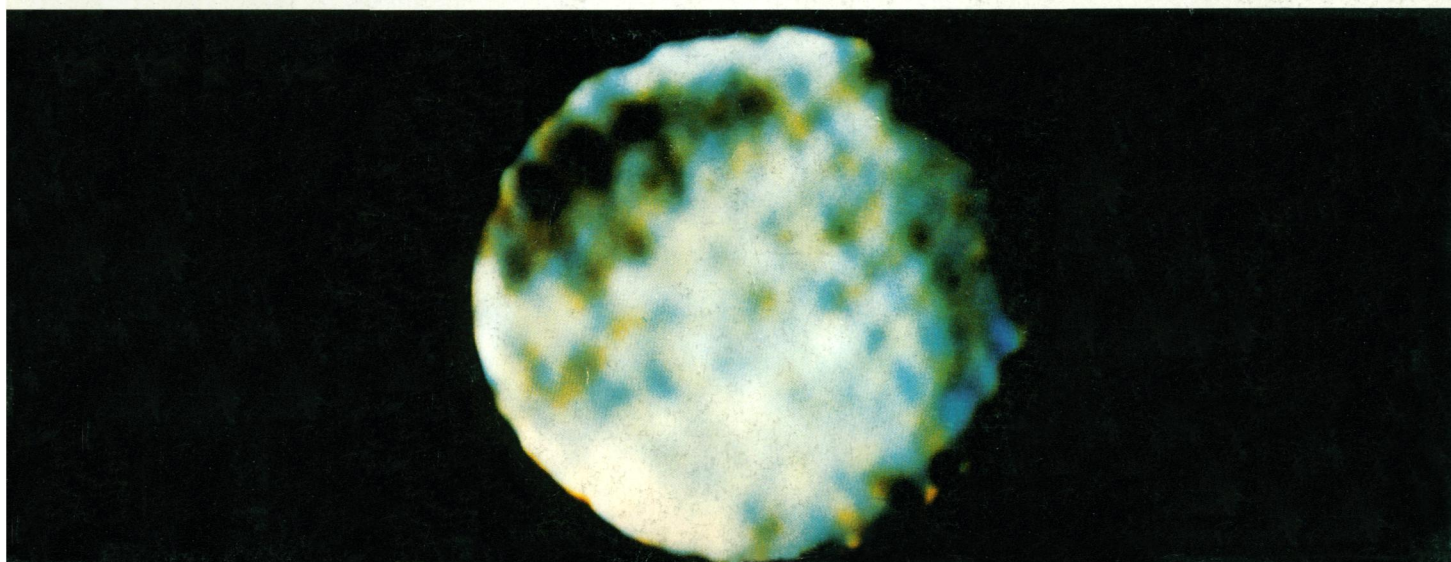
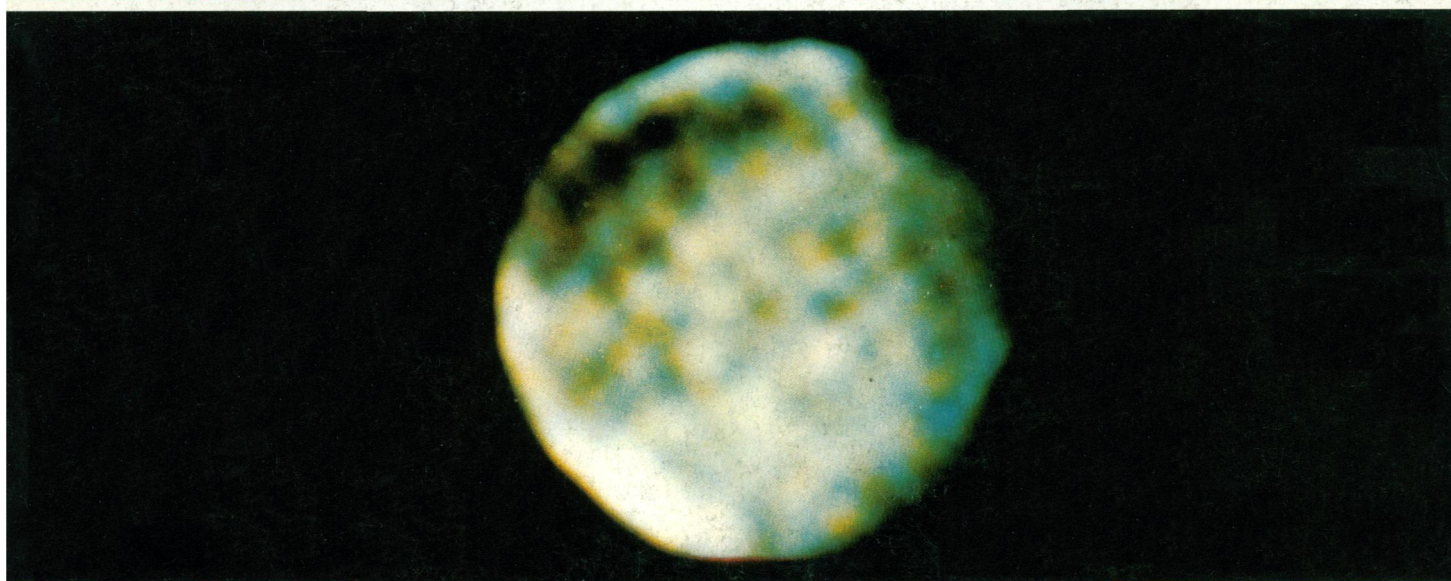
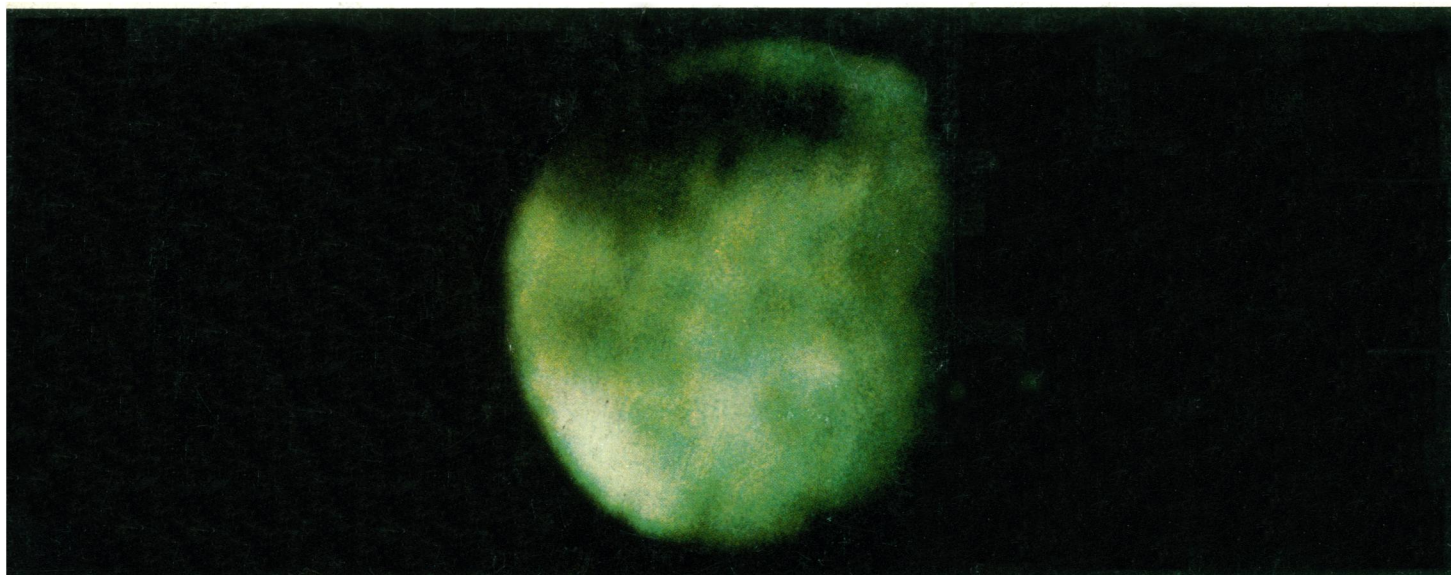


SCIENCE

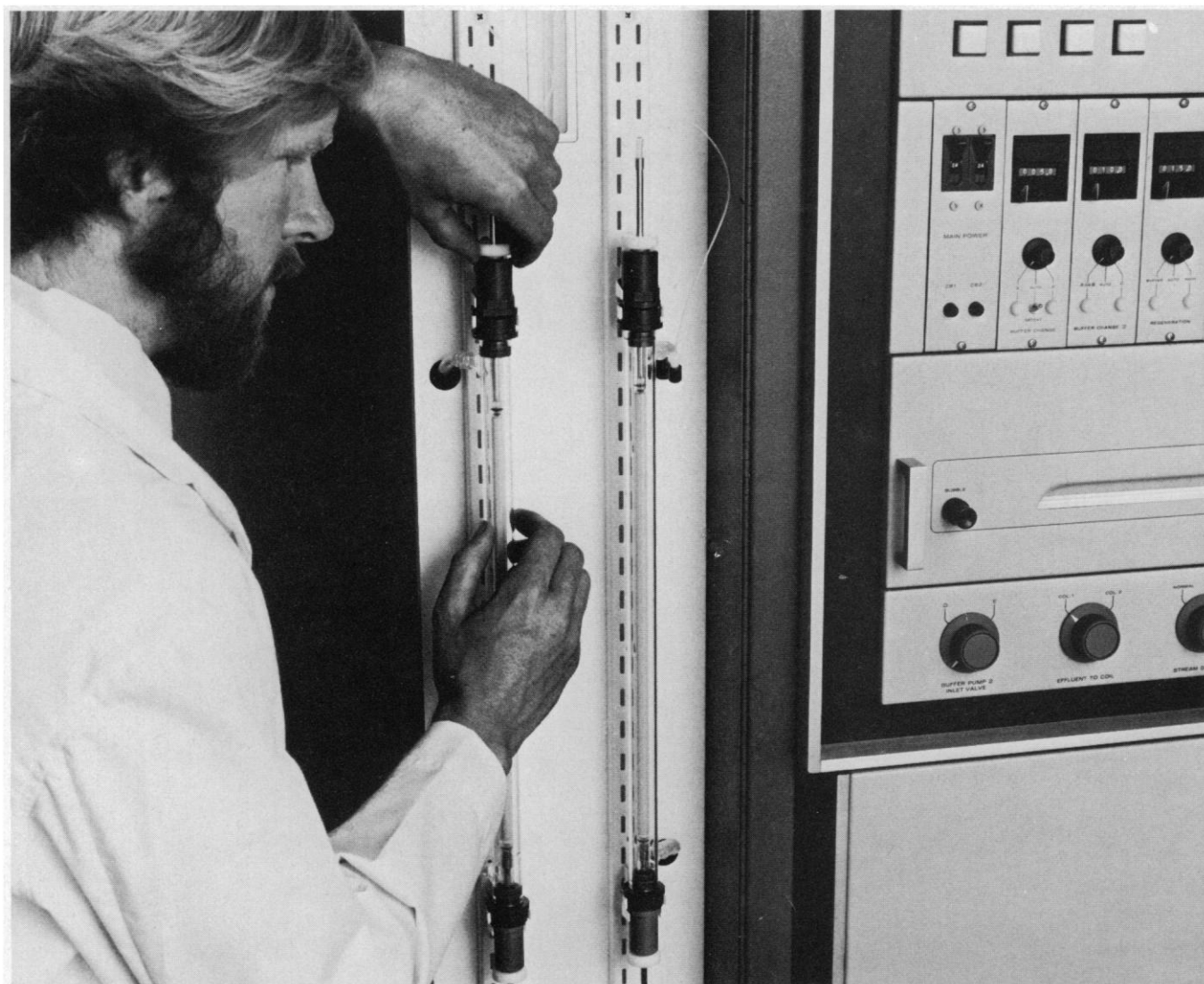
26 March 1976

Volume 191, No. 4233

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



New Beckman Model 119C: The easiest-to-use amino acid analyzer now offers the benefits of 6-mm columns



The Model 119 automatic amino acid analyzer is well known for its reliability and simplicity of operation. Now in the new Model 119C with 6-mm columns, you can also get the advantages of faster analyses, twice the sensitivity, and half the reagent consumption.

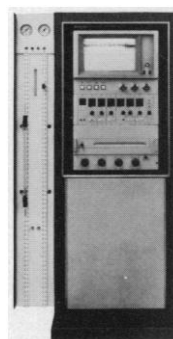
Along with this improved performance comes a new Beckman method

for the single-column analysis of physiological samples using lithium citrate buffers. It clearly separates glutamine and asparagine and lets the 119C handle these analyses completely automatically.

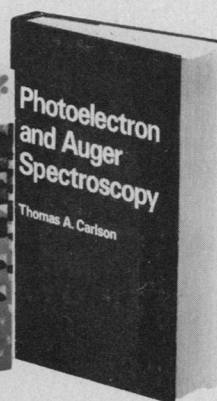
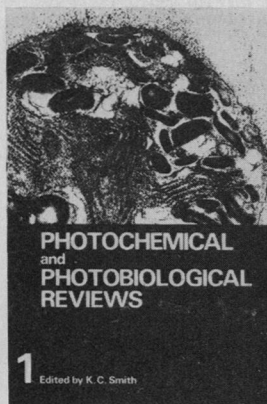
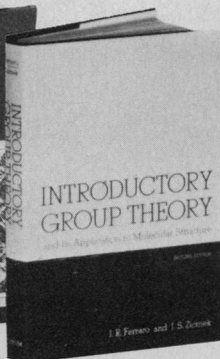
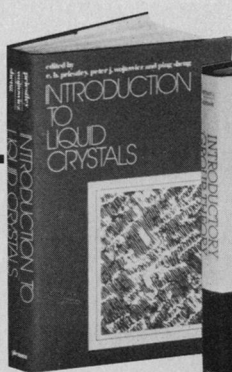
The 119C is one of a family of four Beckman amino acid analyzers covering a wide range of needs and budgets. Others include the automatic 119B which uses conventional 9-mm columns, and the semi-automatic 118B

and 118C which have manual instead of automatic sample injection.

For more information, write for Data File 428 to Spinco Division, Beckman Instruments, Inc., 1117 California Avenue, Palo Alto CA 94304.



Beckman



now in paperback!

X-Rays and Their Applications

J. G. Brown

Royal College of Advanced Technology

"... this well-written book is warmly recommended to all those concerned with learning or teaching the fundamentals of X-rays and their applications."

Isadore B. Berlman,

Quarterly Review of Biology

This text highlights generation, measurement and detection, absorption and scattering, crystallography, diffraction, spectroscopy, refraction and reflection, health hazards, and radiography. Accompanied by well-chosen examples and problems, it is one of the best and most complete guides in the field.

258 pages paperback: \$5.95

charting a dynamic
contemporary discipline

Photochemical and Photobiological Reviews

Volume 1

edited by Kendric C. Smith
Stanford University

This new series offers a critical evaluation of current research, and charts the path of future discoveries. It covers the refinement of mechanisms that control the beneficial effects of light, ways of protecting organisms from the detrimental effects of light, improvement of photochemical tools for studying life processes, and the development of photochemical therapies in medicine.

391 pages \$32.50

from fundamentals to applications

Elements of Organic Photochemistry

Dwaine O. Cowan

The Johns Hopkins University

and Ronald L. E. Drisko

Essex Community College, Baltimore

Here is the first major text in over a decade covering organic photochemistry. Its unique blend of theory, technique, and experimental results demonstrates their interrelations, clarifies the mechanisms of photochemical reactions, and everywhere addresses the needs of synthetic organic chemists. The volume will serve not only as an outstanding tutorial guide to the fundamental concepts and methodology of photochemistry for seniors and graduate students, but also as a standard reference for active chemists.

approx. 575 pages \$27.50

highlighting advanced technology

Introduction to Liquid Crystals

edited by E. B. Priestley,

Peter J. Wojtowicz,

and Ping Sheng

RCA

In response to the burgeoning interest in liquid crystal research, here is a clear and authoritative introduction that highlights both scientific principles and technology. Emphasizing areas generally ignored in other texts, this instructive work covers structural and chemical properties; microscopic statistical and macroscopic continuum theories; packaging applications; optical, electro-optic, and electro-chemical effects; addressing techniques; optical waveguides; and lyotropic liquid crystals, stressing hydrophobic effects. 356 pages \$22.50

now in an expanded 2nd edition

Introductory Group Theory and Its Application to Molecular Structure

SECOND EDITION

John R. Ferraro

and Joseph S. Zimom

Argonne National Laboratory

reviews of the first edition

"... a valuable guide for persons who wish to use spectroscopy to study molecular structure."

J. Edmund White,

Journal of Chemical Education

"The figures and tables throughout this book are very well done. ... Examples are worked out in painstaking detail."

Zentralblatt Für Mathematik

"... provide[s] a simple nonrigorous approach to group theory. ... an excellent introduction to the field."

Howard S. Kimmel,

Applied Spectroscopy

In this revised and updated second edition, the authors have expanded the coverage of point symmetry to include space symmetry and the derivation and implementation of space group selection rules for $k=0$. 292 pages \$19.95

an introductory text

Photoelectron and Auger Spectroscopy

Thomas A. Carlson

Oak Ridge National Laboratory

A comprehensive examination of the three principal areas of electron spectroscopy—x-ray photoelectron spectroscopy, uv photoelectron spectroscopy, and Auger electron spectroscopy. The author thoroughly explores the theoretical basis of the field, describes the instrumentation, and offers a critical and up-to-date survey of the literature.

417 pages \$32.50

plenum
the language of science

PLENUM PUBLISHING CORPORATION

227 West 17th Street, New York, 10011

In United Kingdom: 8 Scrubs Lane, Harlesden, London NW10 6SE, England

Prices slightly higher outside the US. Prices subject to change without notice.

Celebrating
Our 30th
Anniversary

26 March 1976

Volume 191, No. 4233

SCIENCE

LETTERS	Breeder Reactor Policy: <i>E. L. Zebroski</i> and <i>L. E. Minnick</i> ; Marihuana Effects: <i>C. N. Stefanis</i> and <i>M. R. Issidorides</i> ; "Extation": <i>R. C. Banks</i> ; PCB's in Bald Eagle Eggs: <i>J. W. Grier</i> ; Solar Models: <i>E. J. Öpik</i> ; <i>R. K. Ulrich</i>	1214
EDITORIAL	Energy from Biomass	1221
ARTICLES	The Chemical Composition of the Sun: <i>J. E. Ross</i> and <i>L. H. Aller</i>	1223
	An Experiment in Earthquake Control at Rangely, Colorado: <i>C. B. Raleigh</i> , <i>J. H. Healy</i> , <i>J. D. Bredehoeft</i>	1230
	Restored Pictures of Ganymede, Moon of Jupiter: <i>B. R. Frieden</i> and <i>W. Swindell</i>	1237
NEWS AND COMMENT	Blind Medical Student: Overcoming Preconceptions	1241
	Scientists and Bureaucrats: A Clash of Cultures on FDA Advisory Panel	1244
	NSF: Science Education is Still in the Spotlight	1246
	Nuclear Foes Fault <i>Scientific American's</i> Editorial Judgment	1248
RESEARCH NEWS	Fourier Transform: The Revolution Comes to Infrared	1250
	The Intelligent Instrument: Coming but Not Yet Here	1251
	Fluorescence Spectroscopy: Finally of Interest	1252
	Surface Analysis: Multiple Techniques for Monolayers	1253
BOOK REVIEWS	The Red Colobus Monkey, <i>reviewed by W. P. J. Dittus</i> ; Death and the Afterlife in Pre-Columbian America, <i>W. L. Rathje</i> ; Surface Physics of Materials, <i>L. M. Falicov</i> ; Ionic Polymers, <i>W. J. MacKnight</i> ; Books Received	1257

BOARD OF DIRECTORS

MARGARET MEAD
Retiring President, Chairman

WILLIAM D. MC ELROY
President

EMILIO Q. DADDARIO
President-Elect

RICHARD H. BOLT
KENNETH B. CLARK

JOEL COHEN
RUTH M. DAVIS

CHAIRMAN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
Stanislaw M. Ulam
Truman A. Botts

PHYSICS (B)
Freeman J. Dyson
Rolf M. Sinclair

CHEMISTRY (C)
Henry A. Hill
Leo Schubert

ASTRONOMY (D)
Robert B. Leighton
Arlow U. Landolt

PSYCHOLOGY (J)
Wilber J. McKeachie
Edwin P. Hollander

SOCIAL AND ECONOMIC SCIENCES (K)
William H. Sewell
Daniel Rich

HISTORY AND PHILOSOPHY OF SCIENCE (L)
Kenneth F. Schaffner
George Basalla

ENGINEERING (M)
Walter R. Hibbard, Jr.
Paul H. Robbins

EDUCATION (Q)
Mary Budd Rowe
James T. Robinson

DENTISTRY (R)
James K. Avery
Sholom Pearلمان

PHARMACEUTICAL SCIENCES (S)
Joseph P. Buckley
Raymond Jang

INFORMATION, COMPUTING, AND COMMUNICATION (T)
Burton W. Adkinson
Joseph Becker

DIVISIONS

ALASKA DIVISION

George C. West
Chairman, Executive Committee

Keith B. Mather
Executive Secretary

PACIFIC DIVISION

Richard Walker
President

Alan E. Leviton
Secretary-Treasurer

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

M. Michelle Baker
President

Max P. Dunford
Executive Officer

SCIENCE is published weekly, except the last week in December, but with an extra issue on the fourth Tuesday in November, by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with **The Scientific Monthly**. Second-class postage paid at Washington, D.C. and additional entry. Copyright © 1976 by the American Association for the Advancement of Science. Member rates on request. Annual subscription \$50; foreign postage: Canada \$10, other \$13, air lift to Europe \$30. Single copies \$2 (back issues \$3) except Materials Issue (20 Feb. 1976) is \$3 and **Guide to Scientific Instruments** is \$6. School year subscription: 9 months \$37.50; 10 months \$41.75. Provide 6 weeks' notice for change of address, giving new and old address and zip codes. Send a recent address label. **Science** is indexed in the **Reader's Guide to Periodical Literature**.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

REPORTS	Vapor Pressure of Water at Its Triple Point: Highly Accurate Value: <i>L. A. Guildner, D. P. Johnson, F. E. Jones</i>	1261
	Hemoglobin Synthesis in Somatic Cell Hybrids: Independent Segregation of the Human Alpha- and Beta-Globin Genes: <i>A. Deisseroth, R. Velez,</i> <i>A. W. Nienhuis</i>	1262
	Elimination of the Sarcoma Genome from Murine Sarcoma Virus Transformed Cat Cells: <i>A. E. Frankel et al.</i>	1264
	A Cytoplasmic Factor Promoting Oocyte Maturation: Its Extraction and Preliminary Characterization: <i>W. J. Wasserman and Y. Masui</i>	1266
	High Resolution of Human Chromosomes: <i>J. J. Yunis</i>	1268
	Stratospheric Aluminum Oxide: <i>D. E. Brownlee, G. V. Ferry, D. Tomandl</i>	1270
	Prostaglandin B ₁ : The L-Shaped Prostaglandin: <i>G. T. DeTitta</i>	1271
	Both Positive Reinforcement and Conditioned Aversion from Amphetamine and from Apomorphine in Rats: <i>R. A. Wise, R. A. Yokel, H. de Wit</i>	1273
	Cobra Venom Factor: Evidence for Its Being Altered Cobra C3 (the Third Component of Complement): <i>C. A. Alper and D. Balavitch</i>	1275
	Laboratory Plate Tectonics: A New Experiment: <i>R. F. Gans</i>	1276
	Marine <i>Oscillatoria</i> (<i>Trichodesmium</i>): Explanation for Aerobic Nitrogen Fixation Without Heterocysts: <i>E. J. Carpenter and C. C. Price, IV</i>	1278
	Pattern-Analyzing Memory: <i>P. A. Kolars</i>	1280
	REM Sleep Induction by Physostigmine Infusion During Sleep: <i>N. Sitaram et al.</i>	1281
	β -D-Galactosidase Activity in Single Yeast Cells During Cell Cycle of <i>Saccharomyces lactis</i> : <i>J. Yashphe and H. O. Halvorsen</i>	1283
	Technical Comment: Duffy Blood Group and Malaria: <i>A. P. Gelpi and M.-C. King</i>	1284

PRODUCTS AND MATERIALS

Minicomputer Series; Shatter-Proof Acid Bottles; Gas-Sensing Electrode; Packaged Computer Systems; Liquid Chromatograph; Micromolecular Still; Osmometer Standards; Peristaltic Pump; Residual Chlorine Electrode; Liquid Chromatography Columns; Line Printers; Top-Loading Balance; Literature	1286
--	------

MIKE MC CORMACK FREDERICK MOSTELLER	CHAUNCEY STARR CHEN NING YANG	WILLIAM T. GOLDEN Treasurer	WILLIAM D. CAREY Executive Officer
--	----------------------------------	--------------------------------	---------------------------------------

GEOLOGY AND GEOGRAPHY (E) Helen L. Cannon Ramon E. Bisque	BIOLOGICAL SCIENCES (G) Edwin L. Cooper Jane C. Kaltenbach	ANTHROPOLOGY (H) David G. Mandelbaum Philleo Nash
MEDICAL SCIENCES (N) Harold Wayland Richard J. Johns	AGRICULTURE (O) Orville G. Bentley J. Lawrence Apple	INDUSTRIAL SCIENCE (P) Burton V. Dean Robert L. Stern
STATISTICS (U) Emanuel Parzen Ezra Glaser	ATMOSPHERIC AND HYDROSPHERIC SCIENCES (W) Fred D. White Stanley A. Changnon, Jr.	GENERAL (X) Gordon J. F. MacDonald Joseph F. Coates

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to 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. Postmaster: Send Form 3579 to SCIENCE, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005.

COVER

Color composite pictures of Gany-mede. Each is a superposition of two monochrome images, with a third primary color artificially added. Top picture uses image data taken by the Pioneer 10 spacecraft. The remaining two pictures are from restorations of these data by linear convolution (middle) and by maximum entropy (bottom). See page 1237. [B. R. Frieden and W. Swindell, University of Arizona/NASA-Ames Research Center]

AUDIO



Selected Recordings in Psychology, Sociology, and Economics

TAPES

For the past six years, AAAS has recorded selected symposia at its annual meetings, not only as a means of enlarging our audience but also as a valuable aid to education, particularly in classroom or seminar-type settings. The following tapes in psychology, sociology, and economics are available from AAAS as 5-inch open reels or as cassettes. If you decide to purchase some for your own pleasure or for classroom use, you will find the quality of the recordings excellent and the subject matter interesting and informative, perhaps providing some new ideas quite relevant to science and a changing American society. A complete listing of AAAS audiotapes is available on request, free of charge.

Psychology

- 76-70** Mood, Behavior, and Drugs (I-IV)
- 87-71** The Role of Aggression in Human Adaptation (I)
- 97-71** Confronting the Violence of Normal Man (I)
- 109-71** Encounter Groups (I-II)
- 120-72** Cross-Cultural Perspectives on Early Development (I)
- 122-72** Facts and Fiction with Regard to Sex Differences (I)
- 133-72** Human Learning Capacity in Neurobiological Perspective (I-IV)
- 141-72** Understanding Parapsychological Phenomena (I)
- 182-74** New Developments in Brain Function for Speech Perception and Production (I)

Sociology and Economics

- 81-70** Scientific Organizations, War-Peace Issues, and the Public Policy Process (I-II)
- 85-70** Economics of Pollution (I)
- 89-71** Workers and the Environment (I)

- 96-71** Population Control in Social and Economic Perspectives (I)
- 115-71** Women in Academia: Evolving Policies Toward Equal Opportunities (I-II)
- 117-71** Can We Develop an Index for the Quality of Life (I-II)
- 123-72** Ethical, Legal, and Social Issues of Behavior Control (I-II)
- 132-72** Sex Role Learning in Childhood and Adolescence (I-II)
- 134-72** Must We Limit Economic Growth? (I-IV)
- 144-72** Prison Research (I-II)
- 161M-73** Violence and Behavior (I-II)
- 163M-73** Transfer of Technology and National Economic Development (I-VI)
- 170-74** Biological Control of Populations (I)
- 173-74** Crime and Social Control in the 1990's (I)
- 174-74** "Dismal Science" Comes of Age: Economics in America's Third Century (I)
- 175-74** Energy and Society (I-II)
- 184-74** Science and the People's Republic of China (I-II)

[The hyphenated numbers preceding the symposium titles identify each title by tape number (preceding the dash) and by year of taping (after the dash). Roman numerals following the titles designate the number of sessions in each symposium.]

Prices: Single session symposium, \$19.95

Multi-sessions, \$19.95 for first session; \$16.95 for each additional session of the same symposium.

Approximate length of a single session is 3 hours.

Please send me the following tapes: (check one) _____reel _____cassette. (Allow 3 to 4 weeks for delivery.)

Tape No. _____ Session No. _____ Tape No. _____ Session No. _____

Tape No. _____ Session No. _____ Tape No. _____ Session No. _____

☐ Check or money order enclosed (payable to AAAS—no cash) ☐ Please bill me (subject to \$1.50 handling charge)

Name _____

Address _____

City _____ State _____ Zip Code _____

☐ Please send me a complete listing of AAAS audiotapes.



Department AT-9

AMERICAN ASSOCIATION for the ADVANCEMENT OF SCIENCE

1515 Massachusetts Avenue, N.W., Washington, D. C. 20005

Worthington offers new enzymes for molecular biology

with emphasis on MAMMALIAN

In bringing out a new group of enzymes for molecular biology, Worthington has directed its efforts toward those biochemical tools which are useful in current life science research, stressing enzymes from mammalian sources.

The new products:

- ☐ **DNA polymerase α^*** from calf thymus has a molecular weight greater than 100,000 daltons. It is the main polymerase activity found in rapidly proliferating tissue. It does not utilize poly(rA) as a template. It is sensitive to sulfhydryl group inhibitors.
- ☐ **DNA polymerase γ^*** from fetal calf liver has a molecular weight greater than 100,000 daltons. Its major distinction from the alpha class DNA-directed polymerases is its utilization of poly(rA) as template.
- ☐ **Terminal transferase**, from calf thymus, is useful in the synthesis of high molecular weight poly-deoxynucleotides.
- ☐ **DNA polymerase I**, from *E. Coli*, is highly purified, corresponding to fraction 7 by the method of Jovin, *et al.*** It is available as a lyophilized material.
- ☐ **RNA polymerase II**, from wheat germ, is capable of transcribing homologous chromatin. It is sensitive to low concentrations of α -amanitin.

These five new enzymes greatly extend the scope of Worthington products for molecular biology studies. They supplement such useful products as DNase, RNase, RNase T₁, DNA, RNA, spleen and venom phosphodiesterases, *E. Coli* alkaline phosphatase, polynucleotide phosphorylase and micrococcal nuclease—products which have been available through the Worthington catalog for some time.

Worthington is appreciative of the need for high quality research materials. We insist on producing all our own enzymes, carrying each product from raw material through purification and final packaging. Thus, we can provide the user of our enzymes with important assurances of purity, quality and reliability, consistent with the Worthington philosophy of offering research products at reasonable prices.

Ask for technical data on individual enzymes and for our new Biochemical Catalog. Write, use the attached coupon, or call us on our toll-free number **800-631-2142**.

* Weissbach, A.: Vertebrate DNA Polymerases. *Cell*, 5, 101 (1975).

** Jovin, T.M. *et al.*, *J. Biol. Chem.*, 233, 2996 (1969).



Worthington Biochemical Corporation
Freehold, New Jersey 07728

Circle No. 509 on Readers' Service Card



Worthington Biochemical Corporation Freehold, New Jersey 07728

Send the following technical data sheets:

- | | |
|---|---|
| ☐ DNA polymerase I, calf thymus | ☐ DNase |
| ☐ DNA polymerase III, fetal calf liver | ☐ RNase |
| ☐ Terminal transferase, calf thymus | ☐ RNase T ₁ |
| ☐ DNA polymerase I, <i>E. Coli</i> | ☐ DNA |
| ☐ RNA polymerase II, wheat germ | ☐ RNA |
| ☐ Alkaline phosphatase, <i>E. Coli</i> | ☐ polynucleotide phosphorylase |
| ☐ phosphodiesterase, spleen | ☐ micrococcal nuclease |
| ☐ phosphodiesterase, venom | |

- ☐ The complete 1976 Worthington Biochemical Catalog

NAME _____

TITLE _____

INSTITUTION _____

ADDRESS _____

CITY _____

the resources that depend on energy, have been experienced recently and much more intensely than at any time in the history of the United States. With most Americans lacking in any personal experience with the realities of deprivation, this country luxuriates in debate, searching for near-zero hypothetical risks to man and environment from nuclear and fossil energy, while the far greater real risks of inaction grow and multiply.

The European determination and progress on the breeder highlights the importance of maintaining our momentum with this energy option so that it may be available if the great hopes for conservation and for other, more speculative, technologies are not fully realized in this century.

E. L. ZEBROSKI
L. E. MINNICK

Electric Power Research Institute,
Palo Alto, California 94303

Notes

1. This commentary represents our personal views and does not necessarily reflect the views of EPRI or of electric utilities.

Marihuana Effects

Thomas H. Maugh II, in his article "Marihuana: New support for immune and reproductive hazards" (Research News, 28 Nov. 1975, p. 865), includes an account of our work which, unfortunately, is a mixture of information from two different sets of experiments (1). He states that we "observed a variety of abnormalities in the sperm of men who have smoked cannabis for many years. These abnormalities include changes in lipid concentrations, protrusions of chromatids from the nucleus, and marked changes in the balance of acidic and basic amino acids in the histone proteins that encapsulate the sperm DNA. The significance of these changes is unclear, however, as Stefanis has found no ill effects definitely associated with them." Our only finding from the sperm study was a low, arginine-rich protein (protamine) content in sperm nuclei, indicative of deviant maturation (2). Reproductivity of these donors seemed not to be affected. As stated in our article (1), "this would be consistent with our finding that despite the low protamine content, the sperm heads of the users display the normal species-specific shape which is an indicator of normal condensation and reproductive capacity" (3).

The other findings, incorrectly described by Maugh, were actually abnormalities in peripheral blood cells of chronic cannabis users, and they include the following: low

membrane phospholipids, protrusions of heterochromatin from the nucleus, and changes in the normal complement of histones and nuclear acidic proteins. Since these findings were not associated with overt blood pathology, they may represent compensatory changes resulting from a primary effect of cannabis.

COSTAS N. STEFANIS
MARIETTA R. ISSIDORIDES

Department of Psychiatry,
Athens University Medical School,
Eginition Hospital, 74, Vasilissis Sophias
Avenue, Athens, Greece

References

1. C. N. Stefanis and M. R. Issidorides, in *Marihuana: Chemistry, Biochemistry, and Cellular Effects*, G. C. Nahas, W. D. M. Patton, J. Idänpaan-Heikkilä, Eds. (Springer-Verlag, New York, in press).
2. B. L. Gledhill, M. P. Gledhill, R. Rigler, Jr., N. R. Ringertz, *Exp. Cell Res.* **41**, 652 (1966).
3. J. MacLeod and R. Z. Gold, *Fertil. Steril.* **2**, 394 (1951).

"Extation"

There is a need for a single word to describe the status of a species whose population has been reduced to such a low level that it can no longer function as a significant part of its normal ecosystem [as in the case of the California condor (*Gymnogyps californianus*), the whooping crane (*Grus americana*), and the black-footed ferret (*Mustela nigripes*)] or to the point where there is considerable doubt whether the species remains extant [the status of the ivory-billed woodpecker (*Campephilus principalis*), the Eskimo curlew (*Numenius borealis*), and the Caribbean monk seal (*Monachus tropicalis*)]. The use of an adverb—nearly, probably, almost, perhaps—or phrase to modify the adjective "extinct" may merely mask our ignorance, implies an irreversible state, is wordier than necessary, and is probably conceptually incorrect. Extinction, like pregnancy and uniqueness, is not subject to degree. Further, such terms are basically numerical and only by inference convey any biological information.

I propose the word "extaille" (pronounced ex-tail) to fill the need expressed above. Extaille is based on the Middle English adjective "taille," meaning cut, trimmed, or limited. As a noun it can refer to what is left over after cutting and trimming. It is the root of the word "tailor" and of "tailings" (from a mine). The prefix "ex" brings the root into consonance with other words that describe the biological status of a species—"extant" and "extinct"—and further suggests a remnant "from" a formerly more abundant popu-

(Continued on page 1292)

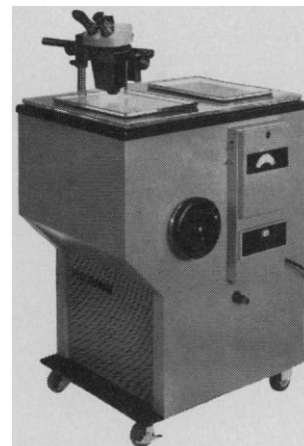
The First Wide Range Microtome-cryostat... Temperatures from —15°C to —50°C... Frozen Sections from 40 μ to 2 μ .

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

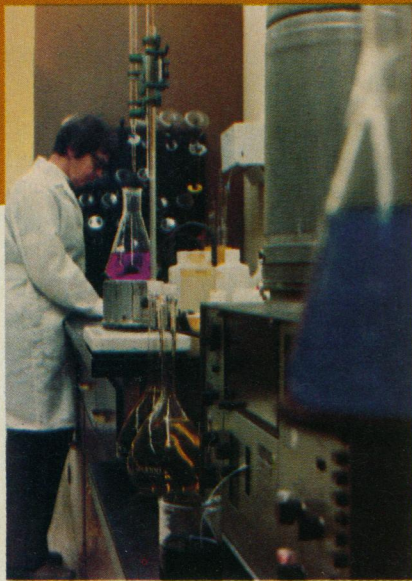
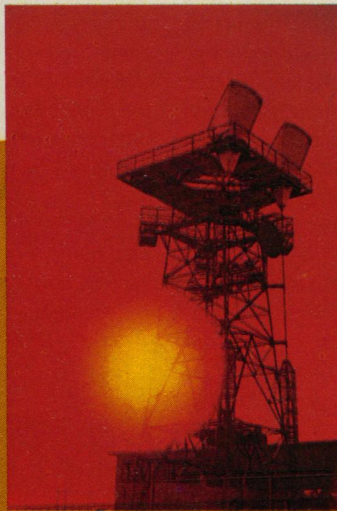
The Harris model WRC is compact . . . can be moved anywhere it's needed. The cold chamber has extra room for tissue handling, storage or freeze drying. Full opening top with special access ports combines the features of a totally closed system with the easy accessibility of open top models.

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

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



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



Automate your instruments.

Our new computing controllers make the connection friendly.

The new HP 9815 and HP 9825 computer controllers make interfacing practical and inexpensive. If you haven't automated your instruments yet, hook them up to one of these HP controllers and upgrade your system's performance. You'll get results and reports faster and easier. Increase your system's throughput. Control variables in real-time. Free yourself from manual readings, adjustments, and calculations.

No matter what your interfacing requirements are—simple data logging, dedicated instrument control, data communications or large-system integration—you'll find these controllers can save you time and money while increasing your productivity.

Interface cards and simplified programming make interfacing easy.

You can choose from the commonly used interfaces—BCD, bit-parallel/byte-serial, RS-232C, or HP-IB (the inter-

face bus that conforms to IEEE Standard 488-1975). You simply connect your instrument or black box to the cable of the appropriate HP interface card and plug the card into the controller. Then, using simple high-level commands, you program the computing controller to monitor and control your instruments and analyze the data. You don't have to hire a computer programmer to set up and use an automated instrumentation system. That's the friendly, direct approach to interfacing.

The HP 9825: unexpected power for systems control

Though the 9825 retains the friendliness and programming simplicity of a calculator, it has the power and performance of a minicomputer. Features

like vectored priority interrupt, buffered I/O, live keyboard, and direct memory access allow it to do several interfacing jobs simultaneously: transferring data and commands, accepting inputs, analyzing data and printing or plotting results. And the 9825 can run application programs and solve keyboard calculations at the same time. Using HP-IB, it can control as many as 45 instruments and peripherals at once. That's big system performance.

Let an HP 9815 supervise your instrument.

The 9815 at a base price of \$2,900* (I/O option and interface cards/cables extra), is the inexpensive alternative to manual monitoring of an instrument or small system. It can even run control appli-

cations unattended. And it can handle a variety of sophisticated computations as well. Truly, the 9815 provides a lot of performance for the price.

Improve your system and become more productive, too.

No matter what kinds of instruments you use—scanners, counters, spectrometers, meters, converters, chromatographs or your own black box—an HP computing controller can help you utilize them and their outputs more effectively. And in the process, free you for more productive, creative work.

We have a brochure that details the features and techniques of simplified interfacing using HP computing controllers. Call your local HP representative for your copy, or circle our number on this publication's reader service card.

*Domestic U.S.A. price only

406/10

HP computing calculators put the power where the problems are.



Sales and service from 172 offices in 65 countries.
P.O. Box 301, Loveland, Colorado 80537

Circle No. 376 on Readers' Service Card



Part of the solution, not the problem.

It isn't simply that Whatman AIEC's outperform other ion exchange celluloses (they do, of course) or that they are unique (they are). A key thing is that they're Whatman AIEC's.

If you are separating and/or purifying enzymes, proteins, nucleotides and the like*, and the separations are at all critical, we suggest that you can profitably ignore the lesser breeds.

With Whatman AIEC's you can confidently expect better resolution, higher capacity, particularly for macromolecules, good to excellent flow rates, among other virtues. And, far from least, Whatman product quality: uniformity, reliability, consistency of performance.

Whatman AIEC's are available in both fibrous and microgranular form (either anion or cation). They pack easily and exceptionally well. They aren't the least expensive—the best rarely is.

Interesting new technical data supporting these contentions are available on request. We appreciate your requests.

*e.g., peptides, nucleosides, hormones, viruses, polysaccharides, lipids, among others.

Whatman Inc. ■ 9 Bridewell Place, Clifton, New Jersey 07014 ■ Tel. (201) 777-4825 ■ Telex 133426.

Circle No. 418 on Readers' Service Card



Whatman

See us at FASEB Booth Numbers 016-017

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

1976

ALFRED E. BROWN	FRANK PRESS
JAMES F. CROW	FRANK W. PUTNAM
HANS LANDSBERG	MAXINE SINGER
EDWARD NEY	ARTHUR M. SQUIRES

1977

WARD GOODENOUGH	DONALD KENNEDY
CLIFFORD GROBSTEIN	NEAL E. MILLER
H. S. GUTOWSKY	RAYMOND H. THOMPSON
N. BRUCE HANNAY	

Editorial Staff

Editor

PHILIP H. ABELSON

Publisher

WILLIAM D. CAREY

Business Manager

HANS NUSSBAUM

Managing Editor: ROBERT V. ORMES

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

Assistant to the Editors: RICHARD SEMIKLOSE

News and Comment: JOHN WALSH, *Editor*; PHILIP M. BOFFEY, LUTHER J. CARTER, BARBARA J. CULLITON, ROBERT GILLETTE (on sabbatical), CONSTANCE HOLDEN, DEBORAH SHAPLEY, NICHOLAS WADE, *Editorial Assistant*, SCHERRAINE MACK

Research News: ALLEN L. HAMMOND, WILLIAM D. METZ, THOMAS H. MAUGH II, JEAN L. MARX, ARTHUR L. ROBINSON, GINA BARI KOLATA, FANNIE GROOM

Book Reviews: KATHERINE LIVINGSTON, LYNN MANFIELD, JANET KEGG

Cover Editor: GRAYCE FINGER

Editorial Assistants: JOHN BAKER, ISABELLA BULDIN, MARGARET BURESCH, ELEANORE BUTZ, MARY DORFMAN, SYLVIA EBERHART, JUDITH GIVELBER, CAITILIN GORDON, CORRINE HARRIS, NANCY HARTNAGEL, OLIVER HEATWOLE, CHRISTINE KARLIK, MARGARET LLOYD, JEAN ROCKWOOD, LEAH RYAN, LOIS SCHMITT, YA LI SWIGART, ELEANOR WARNER, ROBERTA WEDGE

Guide to Scientific Instruments: RICHARD SOMMER

Membership Recruitment: GWENDOLYN HUDDLE;

Subscription Records and Member Records: ANN RAGLAND

Advertising Staff

Director

EARL J. SCHERAGO

Production Manager

MARGARET STERLING

Advertising Sales Manager: RICHARD L. CHARLES

Sales: NEW YORK, N.Y. 10036: Herbert L. Burklund, 11 W. 42 St. (212-PE-6-1858); 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, 11 N. La Cienega Blvd. (213-657-2772); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581)

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phones: (Area code 202) Central Office: 467-4350; Book Reviews: 467-4367; Business Office: 467-4411; Circulation: 467-4417, Guide to Scientific Instruments: 467-4480; News and Comment: 467-4430; Reprints and Permissions: 467-4483; Research News: 467-4321; Reviewing: 467-4443. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. See also page xi, *Science*, 26 March 1976. ADVERTISING CORRESPONDENCE: Room 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE-6-1858.

Energy from Biomass

There has been much talk of solar energy, but most thought has been devoted to physical means of collecting sunlight. An obvious resource has had only nominal attention: energy, materials, and chemicals from plants and trees. For the coming decades in the United States, the major shift from oil and natural gas is likely to be toward coal and oil shale. In many countries, however, where there is little or no coal or oil shale, trees and plants could become important sources of energy and materials. Moreover, burning of fossil fuels yields carbon dioxide—a hazard of unknown magnitude. The use of trees and plants as sources of energy involves a closed cycle with respect to CO₂.

In comparison to the amounts of incident solar energy on earth, human utilization of energy is relatively trivial ($\sim 5 \times 10^{-5}$). The people of the United States consume an amount that is about 10^{-3} that of solar energy falling on it. Under favorable conditions, about 3 percent of solar energy can be fixed in photosynthesis. Thus, in principle, energy needs of the United States could ultimately be met by devoting only a small fraction of the land to this purpose. The same is true of the rest of the world. The present annual production of biomass on the land areas has been estimated at 100 billion tons (dry weight). This has an energy equivalent that is about a factor of 6 greater than current utilization of energy by the world's peoples. Moreover, these figures do not take into account the large additional production of biomass that might be achieved through agronomy and silviculture.

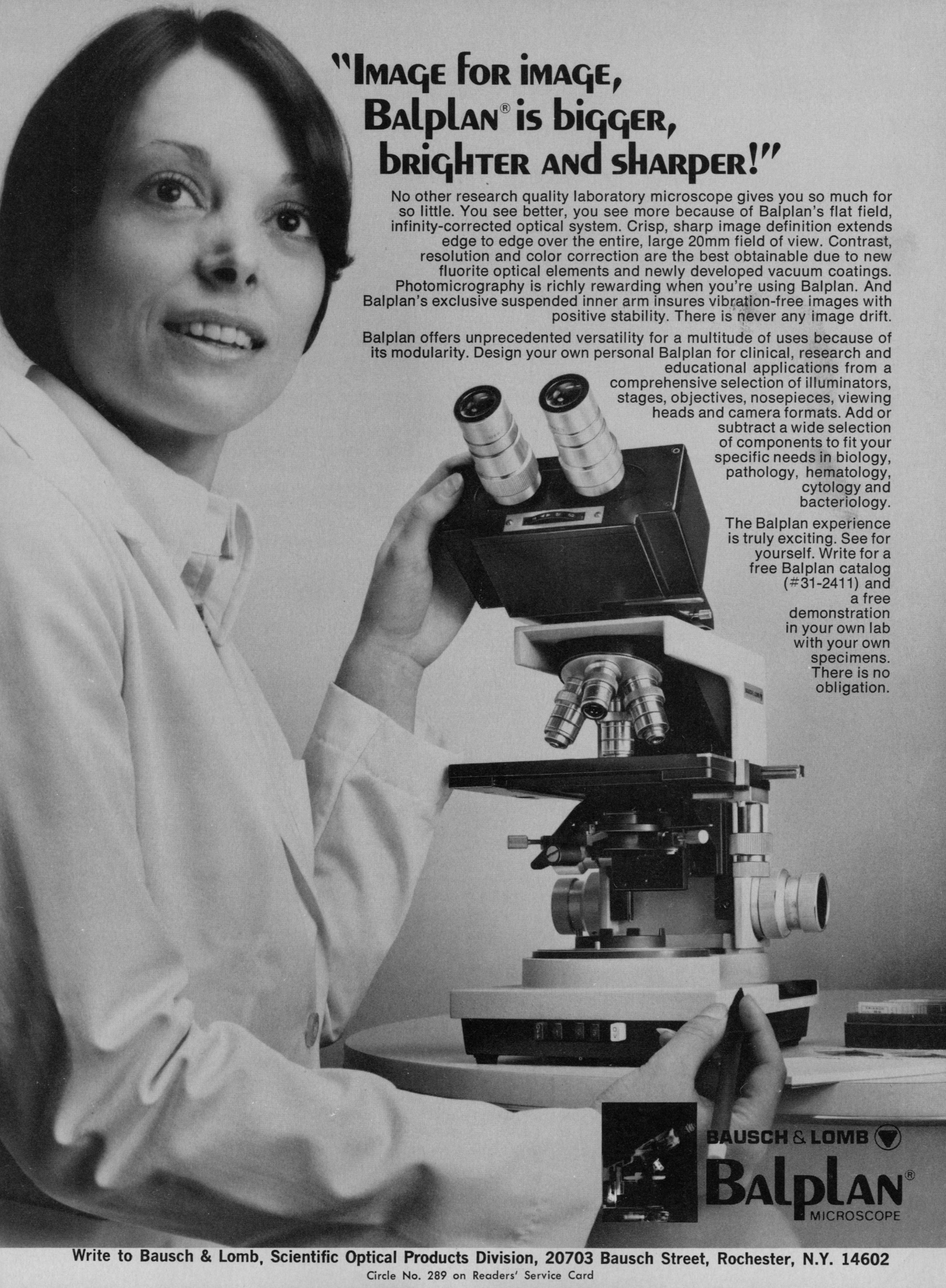
There is, of course, a long distance between potential and practice. Feeding the earth's billions of people has top priority though only a small fraction of the energy is represented by food. Perhaps a more restraining factor is the diffuse character of the biomass. Effective utilization of the potential might require many small conversion plants. This would facilitate return of nutrients to the land while cutting costs of transportation. But at present prices and with current technology, only a tiny portion of energy needs in the United States could be met today from renewable sources.

Ultimately, trees may be the preferred source of energy. However, effective use of them for other than direct burning involves complex technology. Cellulose and lignin must be separated and then processed further or the wood must be converted to carbon monoxide and hydrogen and from thence to methanol or methane. Plant materials lend themselves to anaerobic fermentation resulting in methane and CO₂ with the latter easily removed.

One potentiality that merits further study is the hydrogenation of wood which is known to yield combustible liquids.

The United States has so many possible energy sources and so much wealth that it can perhaps afford long controversies about what to do. Other nations cannot equivocate. They will adopt nuclear energy unless alternatives quickly become available. This will be true ultimately even in the tropical, less developed countries that have abundant renewable resources. Where will those countries find the billion or so dollars to buy a nuclear power plant? Where will they find the skilled technicians to operate the plants safely? Would the world not be better off and safer if such countries were obtaining their energy from biomass?

Thus, although there seems to be no great urgency in the United States to develop renewable energy sources, it would be desirable to give this matter high priority and substantial funding. The effort should include fundamental work in photosynthesis, plant genetics, artificial creation of new species, and related aspects of agronomy and silviculture. Research and development work should include imaginative approaches to better processes for utilizing plants and trees. Some of the efforts should be devoted to creating simple inexpensive devices that would enable rural peoples to obtain various types of energy including even electricity from biomass. With a moderate investment of money and scientific and technical personnel, we could perform work of immense global significance while moving toward long-term solutions to our own energy problems.—PHILIP H. ABELSON



"IMAGE FOR IMAGE, Balplan® is bigger, BRIGHTER AND SHARPER!"

No other research quality laboratory microscope gives you so much for so little. You see better, you see more because of Balplan's flat field, infinity-corrected optical system. Crisp, sharp image definition extends edge to edge over the entire, large 20mm field of view. Contrast, resolution and color correction are the best obtainable due to new fluorite optical elements and newly developed vacuum coatings. Photomicrography is richly rewarding when you're using Balplan. And Balplan's exclusive suspended inner arm insures vibration-free images with positive stability. There is never any image drift.

Balplan offers unprecedented versatility for a multitude of uses because of its modularity. Design your own personal Balplan for clinical, research and

educational applications from a comprehensive selection of illuminators, stages, objectives, nosepieces, viewing heads and camera formats. Add or subtract a wide selection of components to fit your specific needs in biology, pathology, hematology, cytology and bacteriology.

The Balplan experience is truly exciting. See for yourself. Write for a free Balplan catalog (#31-2411) and a free demonstration in your own lab with your own specimens. There is no obligation.



BAUSCH & LOMB 
Balplan®
MICROSCOPE

Write to Bausch & Lomb, Scientific Optical Products Division, 20703 Bausch Street, Rochester, N.Y. 14602

Circle No. 289 on Readers' Service Card

style manual. The University of Chicago style manual, the style manual of the American Institute of Physics, and the *Style Manual for Biological Journals*, among others, are appropriate.

Instructions for Contributors

The Editors of *Science*

Manuscripts submitted to *Science* for consideration for publication can be handled expeditiously if they are prepared in the form described in these instructions.

Submit an original and two duplicates of each manuscript. With the manuscript send a letter of transmittal giving (i) the name(s) of the author(s); (ii) the title of the paper and a one- or two-sentence statement of its main point; (iii) the name, address, and field of interest of four to six persons in North America but outside your institution who you think are qualified to act as referees for your paper; (iv) the names of colleagues who have reviewed your paper for you; (v) the field(s) of interest of readers who you anticipate will wish to read your paper.

Editorial Policies

All papers submitted are considered for publication. The author's membership or lack of membership in the AAAS is not a factor in selection. Papers are accepted with the understanding that they have not been published, submitted, or accepted for publication elsewhere. Authors will usually be notified of acceptance, rejection, or need for revision in 4 to 6 weeks (Reports) or 6 to 10 weeks (Articles).

Types of papers. Five types of signed papers are published: Articles, Reports, Letters, Technical Comments, and Book Reviews. Familiarize yourself with the general form of the type of paper you wish to submit by looking over a recent issue of the journal, and then follow the instructions for that type of paper.

Reviews. Almost all Articles, Reports, and Technical Comments, whether solicited or not, are sent to two or more outside referees for evaluation of their significance and soundness. Forms showing some of the criteria reviewers are expected to consider are available on request.

Editing. Papers are edited to improve the effectiveness of communication between the author and his readers. The most important goal is to eliminate ambiguities. In addition, improvement of sentence structure often permits readers to absorb

salient ideas quickly. When editing is extensive, with consequent danger of altered meanings, papers are returned to the author for correction and approval before type is set. Authors are free to make additional changes at this stage.

Proofs. One set of galley proofs or an equivalent is provided for each paper. Keep alterations to a minimum, and mark them only on the galley, not on the manuscript. Extensive alterations may delay publication by 2 to 4 weeks.

Reprints. An order blank for reprints accompanies proofs.

Writing Papers

Organize your material carefully, putting the news of your finding or a statement of the problem first, supporting details and arguments second. Make sure that the significance of your work will be apparent to readers outside your field, even if you feel you are explaining too much to your colleagues. Present each step in terms of the purpose it serves in supporting your finding or solving the problem. Avoid chronological steps, for the purpose of the steps may not be clear to the reader until he finishes reading the paper.

Provide enough details of method and equipment so that another worker can repeat your work, but omit minute and comprehensive details which are generally known or which can be covered by citation of another paper. Use metric units of measure. If measurements were made in English units, give metric equivalents.

Avoid specialized laboratory jargon and abbreviations, but use technical terms as necessary, defining those likely to be known only in your field. Readers will skip a paper they do not understand. They should not be expected to consult a technical dictionary.

Choose the active voice more often than you choose the passive, for the passive voice usually requires more words and often obscures the agent of action. Use first person, not third; do not use first person plural when singular is appropriate. Use a good general style manual, not a specialty

Manuscripts

Prepare your manuscript in the form used by *Science*. Use bond paper for the first copy. Submit two duplicates. Double-space title, abstracts, text, signature, address, references (including the lines of a single reference), figure legends, and tables (including titles, column headings, body, and footnotes). Do not use single spacing anywhere. Put the name of the first author and the page number in the upper right-hand corner of every page.

Paging. Use a separate page for the title; number it page 1. Begin each major section—text, references and notes, and figure legends—on a new sheet. Put each table on a separate sheet. Place figure legends and tables after the references.

Title. Begin the title with a word useful in indexing and information retrieval (not "Effect" or "New").

References and Notes. Number all references to the literature, footnotes, and acknowledgments in a single sequence in the order in which they are cited in the text. Gather all acknowledgments into a single citation, and keep them short ("I thank," not "I wish to thank"). Cite all references and notes but do not cite them in titles or abstracts. Cite several under one number when feasible. Use *Bibliographic Guide for Editors & Authors* with the few suggested revisions in *International List of Periodical Title Word Abbreviations* for abbreviations of journal names. If the journal is not listed there, provide the full name. Use the following forms:

Journal: H. Smith, *Am. J. Physiol.* **98**, 279 (1931).
Book: F. Dacheille and R. Roy, *Modern Very High Pressure Techniques* (Butterworth, London, 1961), pp. 163–180.
Chapter: F. Dacheille and R. Roy, in *Reactivity of Solids*, J. H. de Boer, Ed. (Elsevier, Amsterdam, 1960), p. 502.

Illustrations. Submit three copies of each diagram, graph, map, or photograph. Cite all illustrations in the text and provide a brief legend, to be set in type, for each. Do not combine line drawings and photographs in one illustration. Do not incorporate the legend in the figure itself. Use India ink and heavy white paper or blue-lined coordinate paper for line drawings and graphs. Use heavier lines for curves than you use for axes. Place labels parallel to the axes, using initial capital and lower-case letters; put units of measurement in parentheses after the label—for example, Length (m). Plan your figures for the

smallest possible printed size consistent with clarity.

Photographs should have a glossy finish, with sharp contrast between black and white areas. Indicate magnification with a scale line on the photograph.

Tables. Type each table on a separate sheet, number it with an Arabic numeral, give it a title, and cite it in the text. Double space throughout. Give each column a heading. Indicate units of measure in parentheses in the heading for each column. Do not change the unit of measure within a column. Do not use vertical rules. Do not use horizontal rules other than those in the heading and at the bottom. A column containing data readily calculated from data given in other columns can usually be omitted; if such a column provides essential data, the columns containing the other data can usually be omitted.

Plan your table for small size. A one-column table may be up to 42 characters wide. Count characters by counting the widest entry in each table column (whether in the body or the heading) and allow three characters for spaces between table columns. A two-column table may be 90 characters wide.

Equations and formulas. Use quadruple spacing around all equations and formulas that are to be set off from the text. Most should be set off. Start them at the left margin. Use the solidus for simple fractions, adding the necessary parentheses. But if braces and brackets are required, use built-up fractions. Identify handwritten symbols in the margin, and give the meaning of all symbols and variables in the text immediately after the equation.

Articles

Articles, both solicited and unsolicited, may range in length from 2000 to 5000 words (up to 20 manuscript pages). Write them clearly in reasonably nontechnical language. Provide a title of one or two lines of up to 26 characters per line and a subtitle consisting of a complete sentence in two lines with a character count between 95 and 105 for the sentence (spaces between words count as one character each). Do not break words at the ends of lines. Write a brief author note, giving your posi-

tion and address. Do not include acknowledgments. Place title, subtitle, and author note on page 1. Begin the text on page 2.

Insert subheads at appropriate places in the text to mark your main ideas. The set of subheads should show that your ideas are presented in a logical order. Keep subheads short—up to 35 characters and spaces.

Provide a summary at the end.

Do not submit more than one illustration (table or figure) for each four manuscript pages unless you have planned carefully for grouping. With such planning many illustrations can be accommodated in the article. Consult the editorial office for help in planning.

Reports

Short reports of new research results may vary in length from one to seven double-spaced manuscript pages of text, including the bibliography. Short papers receive preferred treatment. Limit illustrative material (both tables and figures) to two items, occupying a total area of no more than half of a published page (30 square inches). A research report should have news value for the scientific community or be of unusual interest to the specialist or of broad interest because of its interdisciplinary nature. It should contain solid research results or reliable theoretical calculations. Speculation should be limited and is permissible only when accompanied by solid work.

Title. Begin the title with an important word (preferably a noun) that identifies your subject. The title may be a conventional one (composed primarily of nouns and adjectives), a sentence (containing a verb), or a structure with a colon (Jupiter: Its Captured Satellites). Limit it to two lines of complete words of no more than 55 characters per line (spaces between words count as one character each). Do not use abbreviations. Type the title in the middle of page 1.

Abstract. Provide an abstract of 45 to 55 words on page 2. The abstract should amplify the title but should not repeat it or phrases in it. Qualifying words for terms used in the title may be used. Tell the results of the work, but not in terms such as

“_____ was found,” “is described,” or “is presented.”

Text. Begin the text on page 3. Put the news first. Do not refer to unpublished work or discuss your plans for further work. If your paper is a short report of work covered in a longer paper to be published in a specialty journal, you may refer to this paper if it has been accepted. Name the journal. If the manuscript has not been accepted, refer to it as “in preparation.” Omit references to private communications. Do not use subheads.

Signature. List the authors on the last page of the text and give a simple mailing address.

Received dates. Each report will be dated the day an acceptable version is received in the editorial office.

Letters

The Letters section provides a forum for discussion of matters of general interest to scientists. Letters are judged only on clarity of expression and interest. Keep them short and to the point; the preferred length is 250 words. The editors frequently shorten letters.

Technical Comments

Letters concerning technical papers in *Science* are published as Technical Comments at the end of the Reports section. They may add information or point out deficiencies. Reviews are obtained before acceptance.

Book Reviews

The selection of books to be reviewed is made by the editors with the help of advisers in the various specialties; arrangements are then made with reviewers. A sheet of instructions accompanies each book when it is sent to the reviewer.

Cover Photographs

Particularly good photographs that are suitable for use on the cover are desired.

Photomicroscope III—there's room at the top because of what's in the middle and the bottom.

The camera and the controls are completely integrated. The completely automatic 35mm camera of Photomicroscope III is built into the microscope stand for ease of operation and stability. All the controls are built into the base for ready accessibility and compactness. So the top is free for the addition of whatever auxiliary documentation or observation equipment you may desire—such as the unique Zeiss Glarex Projection Screen, shown below.

More light on the film. With Photomicroscope III you can direct 98% of the light onto the film and still have enough for automatic exposure detection with no change in the setting for film sensitivity. This is particularly advantageous for fluorescence and polarizing photomicrography.

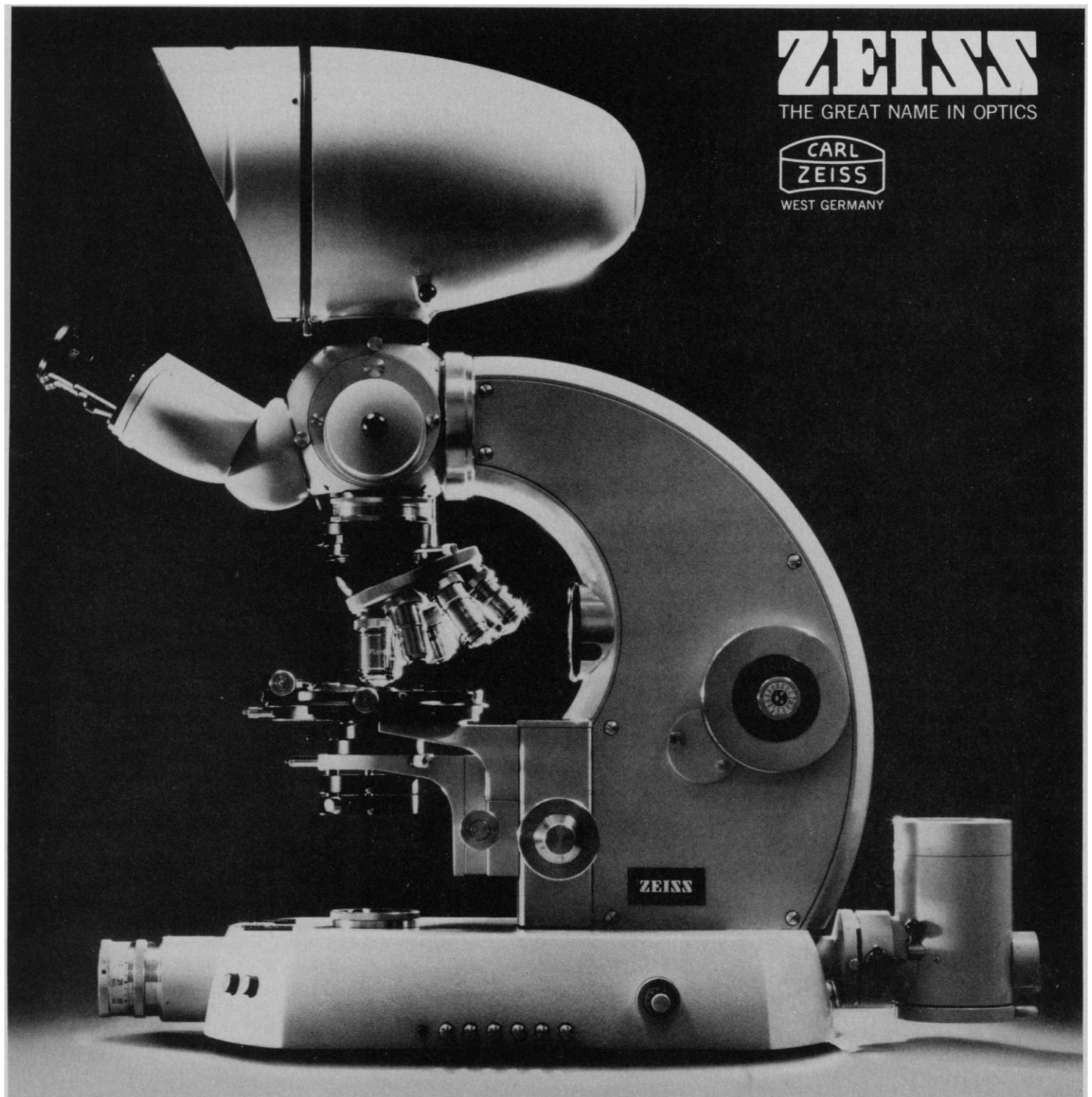
Now, an automatic electronic flash . . . a first in photomicrography. This built-in flash unit eliminates reciprocity failure and vibration problems and the need for color temperature compensation. And you still have, of course, the widest choice of illumination equipment for all microscope techniques in both transmitted and reflected light.

Much more. Get the whole story by writing Carl Zeiss, Inc., 444 Fifth Ave., New York, N. Y. 10018. Or call (212) 730-4400.

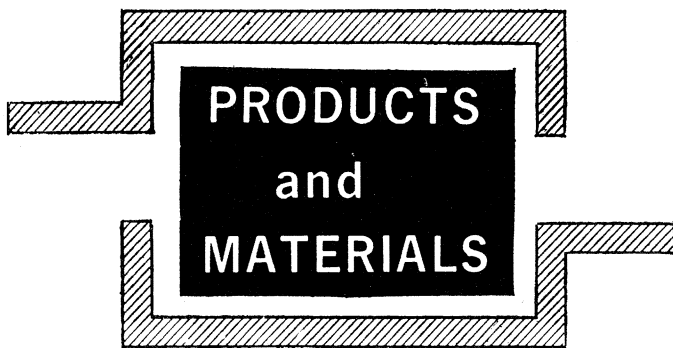
In Canada: 45 Valleybrook Drive, Don Mills 405, Ont., M3B 2S6. Or call (416) 449-4660.

Nationwide service.

BRANCH OFFICES: BOSTON, CHICAGO, COLUMBUS, HOUSTON, LOS ANGELES, SAN FRANCISCO, WASHINGTON, D. C.



Circle No. 387 on Readers' Service Card



Minicomputer Series

Series 60 Level 6 is based on a 6-million-byte-per-second Megabus data path that will allow expansion up to 16 million bytes of directly addressable memory. The system provides 64 vectored interrupts and 20 traps for identifying program error conditions. Its cycle time is 300 nanoseconds. A basic set of more than 100 instructions provides bit, byte, word, and multiple-word addressing capabilities. Packaging is modular, which enables the user to design a system to fit his needs. A basic configuration would include a choice among three processors, a controller for the interfacing of up to four peripheral subsystems, a communications processor with capacity of up to eight full duplex lines, a mass memory capable of controlling up to four disk drives, and a general interface. A variety of peripherals for mass storage devices, card readers, line printers, serial printers, a console-display unit, and teleprinter consoles. Software is also available for many applications. Honeywell. Circle 855.

Shatter-Proof Acid Bottles

Safemor bottles have a polyvinyl chloride coating. If the bottle breaks, the coating contains the cracked glass and the contents. The coating has a coefficient of friction 74 percent greater than that of dry glass; when wet, the coefficient of friction is 61 percent greater than that of wet glass. Therefore, these bottles are less likely to slip in the first place. They are available as containers of ammonium hydroxide and glacial acetic, hydrochloric, sulfuric, and nitric acids. Mallinckrodt. Circle 854.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 1226A and 1286A) and placing it in the mailbox. Postage is free.

—RICHARD G. SOMMER

Gas-Sensing Electrode

The GS-136 Universal electrode measures dissolved gases including carbon dioxide, ammonia, sulfur dioxide, nitrogen oxide, and hydrogen sulfide. Selectivity is achieved with a special internal filling solution and a hydrophobic membrane tip. The electrode body is made of Teflon for its resistance to various solvents. The electrode has an internal reference cell and is designed for existing pH-millivolt meters without need of any external reference electrode. Concentrations from less than 0.1 part per million to between 100 and 1000 parts per million are detectable. Lazaar Research Laboratories. Circle 865.

Packaged Computer Systems

The IPAC/16 and IPAC/32 include a processor, memory, peripherals and operating system, installation, and maintenance. IPAC/16 consists of a 16-bit model 6/16 with 64K bytes of memory, a 10M-byte disk, card reader, line printer, and Carousel 30 terminal in addition to the OS/16 MT2 operating system. The IPAC/32 consists of a 32-bit model 7/32 with 128K bytes of memory, the same peripherals, and the OS/32 MT operating system. Interdata. Circle 863.

Liquid Chromatograph

Model 6960 is a high-performance liquid chromatograph. It includes a fixed-wavelength detector, a constant-volume pumping system, and a sample-injection system. The dual-piston reciprocating pump is controlled by a servo loop for precise dispensing. Its minimum internal volume ensures rapid change or adjustment of carrier. The ultraviolet absorbance detector features a high signal-to-noise ratio, a wide linear absorption range, and rapid response. Accessories available include solvent programmers, columns, and other detectors. Tracor. Circle 857.

Micromolecular Still

The Microflex still performs simple distillation, molecular distillation, sublimation, or total reflux. Samples from 50 to 500 milligrams may be processed. The rotary magnetic receiver allows the collection of multiple fractions without disturbance of the vacuum in the system. The receiver accommodates all sizes of Microflex tubes. Kontes. Circle 856.

Osmometer Standards

Standard solutions are available in concentrations of 100, 220, 300, 323, 500, 900, 1100, and 1500 milliosmols. Special values are also available by request. These standard solutions do not require refrigeration and have a shelf life of 24 months. Precision Systems. Circle 858.

Peristaltic Pump

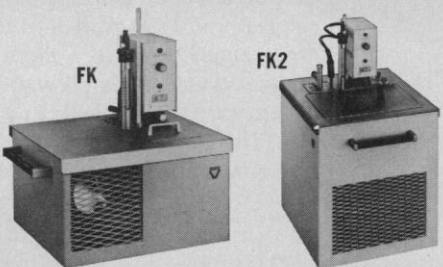
The VarioPerpex pump is a low-pulsation peristaltic pump with applications in gel filtration. Flow rates range from 0.6 to 800 milliliters per hour and a flow constancy of ± 0.5 percent per 24 hours. A roller system consisting of six peripheral rollers and one central roller operates without bearings. Tangential movement is so slight that no special arrangement is needed to hold the tubing in place. Pressure may be regulated which prolongs tube life. Silicone rubber tubing is standard and Tygon or Viton tubing is available. LKB Instruments. Circle 861.

Residual Chlorine Electrode

Model 97-70 directly measures residual chlorine in waste water, drinking water, and in other applications. All available forms are measured including chlorine bound to nitrogenous compounds. These electrodes will detect as few as 10 parts of chlorine per billion parts of sample. The principle of operation is to add iodide to the sample, which reacts with the residual chlorine to form iodine. The amount converted is measured. Orion Research. Circle 859.

Liquid Chromatography Columns

Prepacked columns feature a glass to Teflon seal with no "O" rings or other seals. Silica gel particles of 10- to 20-micrometer diameter are used to pack the columns and they may be used with dry or wet techniques and with nitrogen pres-



HAAKE BEST BUY... BIG RESULTS FROM SMALL PACKAGES

FK, the most compact REFRIGERATED BATH/CIRCULATOR with the largest specification range on the market, only 18 x 13 inches. FK and FK2 are members of the 'F' Family of HAAKE constant temperature circulators incorporating modular stainless steel design with built-in compressor cooling systems, providing you with a wide temperature range and precision control.

FK has a range of -15° to $+150^{\circ}\text{C}$; FK2 -30° to $+150^{\circ}\text{C}$. Both models have heating capacities of fully adjustable 0 - 1000 watts and have heavy duty pressure/suction pumps with pressure capacities of 15 lit./min. and 9 head (ft.), and suction capacities of 6 lit./min. and 3 head (ft.). FK and FK2 have bath sizes of 85 cu. in. and 480 cu. in., respectively.

DISTRIBUTION BY ALL PRINCIPAL LABORATORY SUPPLY HOUSES

HAAKE, INC. TEMPERATURE CONTROL EQUIPMENT DIVISION.
244 SADDLE RIVER RD., SADDLE BROOK, N.J. 07662
TELEPHONE: 201-843-7070 TELEX: 138257

Circle No. 223 on Readers' Service Card

DO YOU NEED . . .

	Cat. No.	Pkg. Size	Price
2'-O-Methylguanosine	4661	10 mg.	\$20.00
2'-O-Methylguanosine 5'-phosphate	4665	5 mg.	20.00
2'-O-Methylguanosine 5'-diphosphate	4667	5 mg.	30.00
2'-O-Methylguanosine 5'-triphosphate	4673	5 mg.	30.00
7-Methylguanosine	4296	25 mg.	\$ 5.35
7-Methylguanosine 5'-phosphate	4363	10 mg.	20.00
7-Methylguanosine 5'-diphosphate	4365	10 mg.	40.00
7-Methylguanosine 5'-triphosphate	4367	10 mg.	40.00

5'-termini of mRNA . . .

m ⁷ G(5')ppp(5')Gm	4631	5 A ₂₅₀ Units	\$40.00
m ⁷ G(5')ppp(5')Am	4633	5 A ₂₅₀ Units	40.00

We have them all in stock for immediate delivery.

Call (414) 271-0667, Telex 26881

P.L. biochemicals, inc.

1037 WEST MCKINLEY AVENUE, MILWAUKEE, WIS 53205

Circle No. 390 on Readers' Service Card

preparative gel electrophoresis with minimal dilution

Migrating sample zones from a gel into an eluting buffer is the most accepted preparative gel technique, but a high buffer flow rate has always been required to prevent zones from passing completely through the buffer toward the lower electrode. The Colora UltraPhor® now allows lowest buffer flow rates and least dilution by separating the eluting and electrode buffers with a concentrated counter-elution buffer, introducing a barrier of low field strength to effectively prevent passage of sample zones out of the elution buffer. Slab configuration provides maximum cooling, best gel adhesion, and most efficient sweeping of the elution buffer across the gel. The UltraPhor is described in ISCO's general catalog; send now for your copy.



BOX 5347

LINCOLN, NEBRASKA 68505

ISCO

PHONE (402) 464-0231

TELEX 48-6453



Circle No. 295 on Readers' Service Card

26 MARCH 1976

1287

An Exclusive System From Schwarz/Mann

¹²⁵I Radioligand* System for Labeling Proteins Polypeptides Immunoglobulins

For your convenience and safety, Schwarz/Mann has developed an exclusive system for you to store, evaporate, and use the ¹²⁵I Radioligand. The entire labeling procedure takes place within the vial.

High specific activity and immunoreactivity was observed with the glycoproteins HGH, FSH, and LH¹, and with immunoglobulins². LH labeled by the Bolton-Hunter method was significantly more stable than chloramine-T labeled LH³.

*¹²⁵I Radioligand is 3-(4-Hydroxyphenyl) Propionic Acid Hydroxysuccinimide ester [¹²⁵I], (Bolton-Hunter Reagent.)

¹Bolton, A. E. and Hunter, W. M. (1973) Biochem. J., 133, 529-539.

²Schwarz/Mann data.

³Dilts, L., Radioassay Symposium, Hartford, Conn., May 2, 1974.

Concentration: 1 mCi/0.25 ml: Benzene (containing 0.1% acetic acid)	¹²⁵ I Radioligand	cat. #333654
Specific Activity: ~ 1000 Ci/mM	\$140/1 mCi	
Radiochemical Purity: >97%	\$100/250 µCi	
Volatile Radioactivity: <2%	\$70 each add. vial	



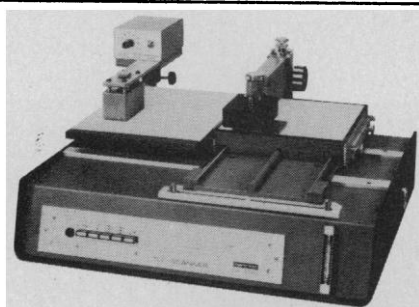
Schwarz/Mann
Mountain View Avenue
Orangeburg, NY 10962
(914) 359-2700

DIVISION OF BECTON, DICKINSON AND COMPANY



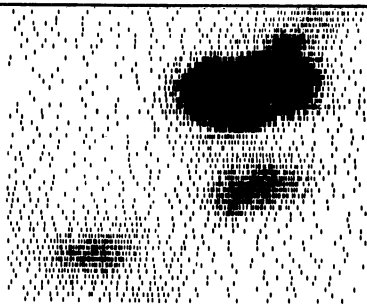
2034

Circle No. 441 on Readers' Service Card



FAST, DIRECT TLC SCANNING of radioactive isotopes... with 'fingerprints'

Tritium, Carbon 14, Phosphorus 32 and all other radioisotopes are easily detected on TLC plates with this special sensitive Berthold TLC Plate Scanner. Selected programs can scan the entire plate or just a portion, or handle 4, 6 or 8 chromatograms on one 20 x 20cm plate—all automatically. Adjustable scanning speeds are 15 to 6000mm/h; fast return at 6000mm/h. A dot-printer permits the registration of two-dimensional radioactivity distributions, providing a "fingerprint" (shown above). For more details, contact Shandon Southern Instruments, Inc., 515 Broad Street, Sewickley, Pa. 15143.



PITTSBURGH • LONDON • FRANKFURT

1288

Circle No. 274 on Readers' Service Card

sure or solvent metering pump. A different material is packed into the ends of the columns to act as a metering device for the sample. This prevents formation of internal conical bands and band mixing. The columns may be repacked. Quantum Industries. Circle 860.

Line Printers

The 8200 series operates at up to 2400 lines per minute. The output is 80 columns wide on 8.5-inch paper. Features include full print line buffer memory, automatic top-of-form advance, advance speed of 400 inches per minute, interchangeable use of roll and fan-folded paper, and sufficient speed to print a core dump from a 64K minicomputer in less than 30 seconds. These are nonimpact printers that operate quietly with a minimum of moving parts. The paper drive uses only a high-speed stepper drive. Houston Instrument. Circle 862.

Top-Loading Balance

Model 180 is an electronic balance with a capacity of 180 grams and a sensitivity of 10 milligrams. Results appear in a digital display in 1.5 seconds. A time-integrating feature assures stability even under vibration. In addition to the 180-gram capacity, the device has a 20-gram overrange. Weights are precise to within ±0.005 gram. Arbor Laboratories. Circle 864.

Literature

Vacuum Components includes 64 pages of gauges, controls, valves, fittings, pumps, traps, and accessories. Varian Associates, Vacuum Division. Circle 845.

Xenon Illuminator is a brochure devoted to a product for operation in metallographs which currently use carbon arc or tungsten lamps. Buehler. Circle 849.

Laboratory Spill Control Center describes a system to control the six most common hazardous chemical spills in the laboratory. J. T. Baker Chemical. Circle 851.

Model CRT-1000 Data Acquisition and Readout System is the subject of a 4-page brochure that includes specifications and a description of available software routines. Labtest Equipment. Circle 852.

1976 Constant Temperature Baths and Circulator Catalog lists heating and cooling circulators and their uses. Brinkmann Instruments. Circle 853.

Some Hematoxylin Substitutes in Bio-

SCIENCE, VOL. 191

logical Microtechniques describes the use of synthetic dyes in various histologic procedures. Bio/Medical Specialties. Circle 866.

Cell Staining Characteristics is a three-section chart featuring staining of casts, cells, and other bodies. Regis Chemical. Circle 867.

Radiochemicals is a comprehensive catalog of labeled compounds, radio-nuclides, reference sources, liquid scintillation fluors, and radioimmunoassay products. New England Nuclear. Circle 868.

Gas Analysis News is a bimonthly technical newsletter for workers in gas analysis. Precision Gas Products. Circle 869.

The Essential Interface describes a parallel-to-serial data converter. Science Accessories. Circle 870.

Pressure Gauges lists a line of indicating and recording instruments to measure pressure, including metric scales with measurements in kilopascals. Weksler Instruments. Circle 871.

Vapor Analyzers is devoted to portable, continuous-monitoring infrared analyzers for toxic vapors and gases. Wilks Scientific. Circle 872.

Particle Counting and Sizing Instruments features instruments for gas and liquid analyses. Royco Instruments. Circle 873.

Protein, Polypeptide and Other Reagents of Biochemical Interest provides descriptions, specifications, and literature references for organic chemicals. Eastman Kodak. Circle 874.

Korvex Heat-Shrinkable Tubing is described in a 12-page catalog. Chemplast. Circle 875.

Water Stills is devoted to features, technical data, directions for using and cleaning, and accessories. Owens Illinois, Fluid Process Systems. Circle 876.

Milling Guide is an optical alignment tool for the measurement of residual stresses by the strain-gauge hole-drilling method. Photolastic. Circle 877.

Guide to Remote Access Packaged Software lists thousands of packaged computer programs and data bases from many fields. Each copy costs \$28. Gregory Research Associates. Circle 878.

Neon Laser describes a line of gas lasers and mounting systems. Metrologic Instrument. Circle 879.

Nomarski Differential Interface-Contrast Microscopy is a reprint of four articles illustrated with graphs and four-color photomicrographs. Carl Zeiss. Circle 880.

Chromatography is a 44-page bulletin devoted to equipment for gas, thin-layer, and liquid chromatography. Circle 881.

How good are Buchler Flash Evaporators?

We take your word for it!

In a survey*, you—the user—told us how good this instrument is. Here are typical comments:

"... a well-designed, sturdy piece of apparatus that is functioning well."

"... an excellent instrument which is extremely durable."

"... fast and easy to use."

"... rarely have I seen a unit stand up to the handling it receives from graduate students."

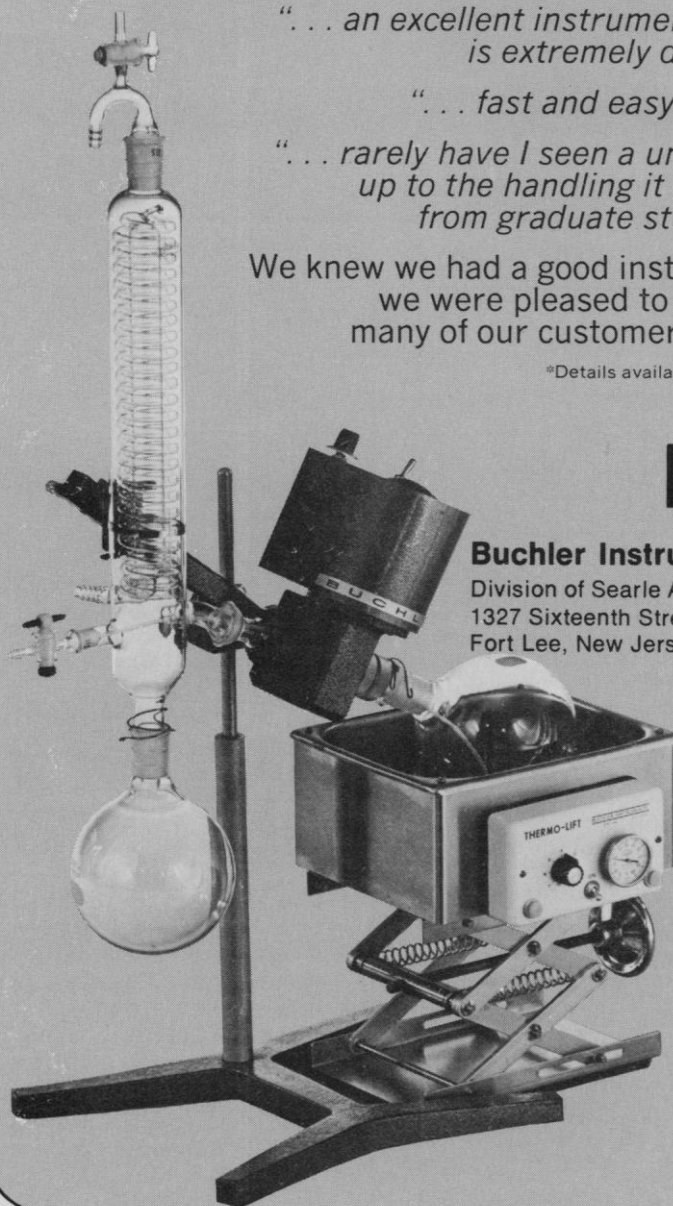
We knew we had a good instrument; we were pleased to learn so many of our customers agree.

*Details available at Buchler

SEARLE

Buchler Instruments

Division of Searle Analytic Inc.
1327 Sixteenth Street
Fort Lee, New Jersey 07024



We will send you complete information on . . .

Radiometer Quality Electrodes for Chemical Measurements

- pH • glass • combination • reference • metal
- micro • macro • autoclavable
- medical • conductivity
- ion selective



Radiometer produces one of the most extensive lines of electrodes in the industry. Almost 100 different types for analytical, medical and industrial applications are detailed in this new 36 page electrode catalog.

If you use electrodes,
you should have this book!

Your free copy is available from . . .

THE LONDON COMPANY

811 Sharon Drive, Cleveland, Ohio 44145
(216) 871-8900

Circle No. 494 on Readers' Service Card

Paleontologic- Biologic- Sociologic- BREAK-THROUGH

in understanding of life as shown
by fossils.
Integrates Snow's two cultures.
Most general significance since
Darwin.

Order Form

Vantage Press

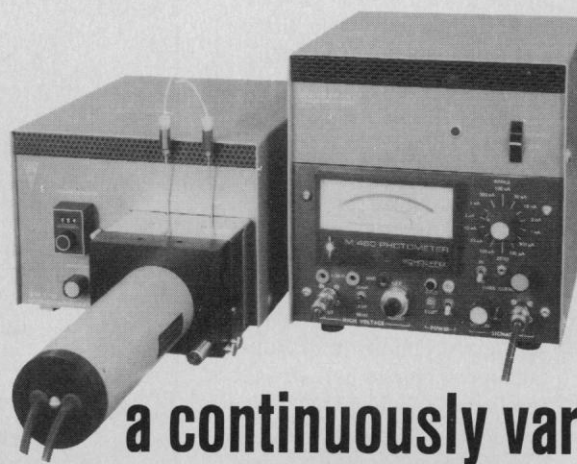
P.O. Box 483, Pasadena, Ca.
91102.

Please find enclosed \$_____ for
_____ copies of *The Natural Path
to Genuine Lasting Happiness* by
Rodney Gale @ \$6.50 each in
the U.S.A. or Canada; \$7.50 else-
where (with 20% prepublication
discount before May 15th: \$5.20
or \$6.00, respectively).

Name _____
(please print)

Address _____
street and number

city _____ state _____ code _____



Now... a continuously var- iable fluorescence detector for liquid chromatography

UV/VIS
excitation

monochromator and readily adjustable emission
wavelength in conjunction with a very accessible 5 ul flow
through cuvette makes detection at picogram levels possible.
The 970 Spectrofluorometer can be attached and operated in
conjunction with existing HPLC systems.

Write today for complete technical literature.

Schoeffel Instrument Corporation 24 Booker Street,
Westwood, N. J. 07675 • 201-664-7263

SCHOEFFEL
INSTRUMENT CORPORATION

Circle No. 370 on Readers' Service Card

SCIENCE, VOL. 191

BOOKS RECEIVED

(Continued from page 1260)

dent Association Bookstore, South Dakota State University, Brookings, ed. 3, 1975. x, 318 pp., illus. Paper, \$6.

Copyright—Information Technology—Public Policy. Part 1, Copyright—Public Policies. Nicholas Henry. Dekker, New York, 1975. x, 140 pp. \$14.50.

Crop Genetic Resources for Today and Tomorrow. O. H. Frankel and J. G. Hawkes, Eds. Cambridge University Press, New York, 1975. xx, 492 pp., illus. \$39.50. International Biological Programme 2.

Grouting in Engineering Practice. Robert Bowen. Halsted (Wiley), New York, 1975. viii, 188 pp., illus. \$19.50.

Growth and Development of the Brain. Nutritional, Genetic, and Environmental Factors. Proceedings of a symposium, New Dehli, Oct. 1974. Mary A. B. Brazier, Ed. Raven Press, New York, 1975. xiv, 400 pp., illus. \$28.50. International Brain Research Organization Monograph Series, vol. 1.

Handbook of Engineering Fundamentals. Ovid W. Eshbach and Mott Souders, Eds. Wiley, New York, ed. 3, 1975. x, 1562 pp. \$24.95. Wiley Engineering Handbook Series.

High Temperature Vapors. Science and Technology. John W. Hastie. Academic Press, New York, 1975. xvi, 480 pp., illus. \$35. Materials Science and Technology.

Isaac Newton's Theory of the Moon's Motion (1702). Introduction by I. Bernard Cohen. Dawson, Folkestone, England, 1975 (U.S. distributor, Neale Watson, New York). viii, 170 pp. \$25.

Land and the Environment. Planning in California Today. Prepared by Sedway/Cooke for the Planning and Conservation Foundation. Kaufmann, Los Altos, Calif., 1975. 154 pp. Paper, \$14.95.

Membranes. A Series of Advances. Vol. 3, Lipid Bilayers and Biological Membranes: Dynamic Properties. George Eisenman, Ed. Dekker, New York, 1975. xvi, 538 pp., illus. \$42.50.

Methods in Membrane Biology. Vol. 5, Transport. Edward D. Korn, Ed. Plenum, New York, 1975. xiv, 200 pp., illus. \$19.50.

Methods in Olfactory Research. D. G. Moulton, Amos Turk, and J. W. Johnston, Jr., Eds. Academic Press, New York, 1975. xii, 498 pp., illus. \$28.50.

Symbiosis. Papers from a symposium. Published for the Society for Experimental Biology by Cambridge University Press, New York, 1975. viii, 634 pp., illus., + plates. \$47.50. Symposia of the Society for Experimental Biology, No. 29.

Systematic Course Design for the Health Fields. Ascher J. Segall, Hannelore Vanderschmidt, Ruanne Burglass, and Thomas Frostman. Wiley, New York, 1975. Various pages. Paper, \$14.95. A Wiley Biomedical-Health Publication.

Textbook of Human Genetics. G. R. Fraser and O. Mayo, Eds. Blackwell, Oxford, England, 1975 (U.S. distributor, Lippincott, Philadelphia). iv, 524 pp., illus. Paper, \$27.

Theoretical Inorganic Chemistry. Springer-Verlag, New York, 1975. iv, 162 pp., illus. \$25. Topics in Current Chemistry, 56.

Theory of Optimal Search. Lawrence D. Stone. Academic Press, New York, 1975. xiv, 260 pp. \$29.50. Mathematics in Science and Engineering, vol. 118.

The Theory of Stochastic Processes. Vol. 2. I. I. Gihman and A. V. Skorohod. Translated from the Russian edition (Moscow, 1973) by S.

Kotz. Springer-Verlag, New York, 1975. viii, 444 pp. \$48.20. Die Grundlehren der mathematischen Wissenschaften, Band 218.

Triplet States II. Springer-Verlag, New York, 1975. iv, 138 pp., illus. \$25. Topics in Current Chemistry, 55.

Tropical Marine Pollution. E. J. Ferguson Wood and R. E. Johannes, Eds. Elsevier, New York, 1975. x, 192 pp., illus. \$26.95. Elsevier Oceanography Series, 12.

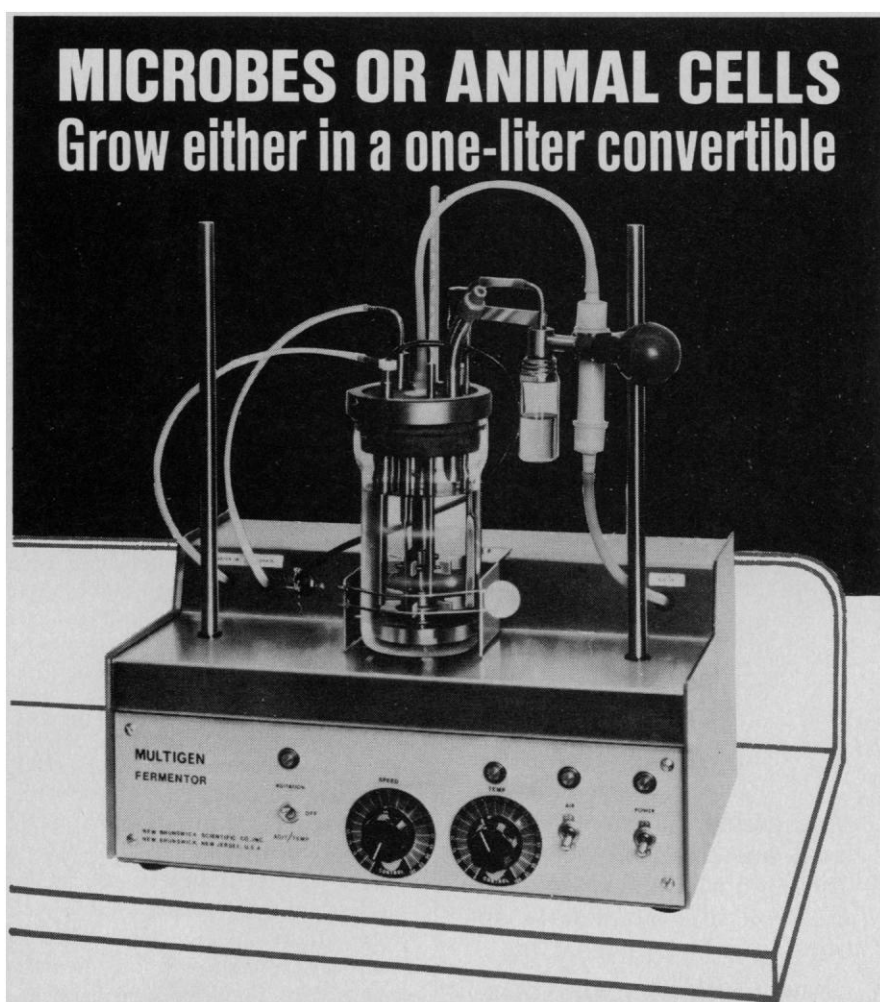
USAN and the USP Dictionary of Drug Names. 1961-1975 Cumulative List. Mary C. Griffiths, Marie J. Dickerman, and Lloyd C. Miller, Eds. United States Pharmacopeial Convention, Rockville, Md., ed. 13, 1975. 348 pp., illus. Paper, \$18.50.

Variable Structure Systems with Application to Economics and Biology. Proceedings of a seminar, May 1974. A. Ruberti and R. R. Mohler, Eds. Springer-Verlag, New York, 1975. vi, 322 pp., illus. Paper, \$12.90.

Vertebrates. A Laboratory Text. Norman K. Wessells and Elizabeth M. Center, Eds. Illustrated by Nina Shapley. Kaufmann, Los Altos, Calif., 1975. viii, 218 pp. + plates. Paper, \$8.95.

Vibration White Finger in Industry. W. Taylor and P. L. Pelmear, Eds. Academic Press, New York, 1975. xxii, 166 pp. + plates. \$13.50.

Welfare in America. Controlling the "Dangerous Classes." Betty Reid Mandell, Ed. Prentice-Hall, Englewood Cliffs, N.J., 1975. vi, 186 pp., illus. Cloth, \$8.95; paper, \$3.95.



The MultiGen is a low cost culture apparatus designed for the control of all basic environmental conditions: temperature, agitation, aeration, pH, and dissolved O₂. Whether the need is for viscous microbial cultures or animal cell suspensions, air sparging or gas overlay, the MultiGen can be adapted to specific research requirements, and can provide an ideal alternative to spinner flask procedures.

Virtually every component is supplied in one compact assembly; glassware, tubing, penetrations, air filter and sampler. It even has its own built-in air pump, heating system, and facilities for cooling, as well as a choice of agitation systems. The impellers are magnetically coupled to eliminate contamination.



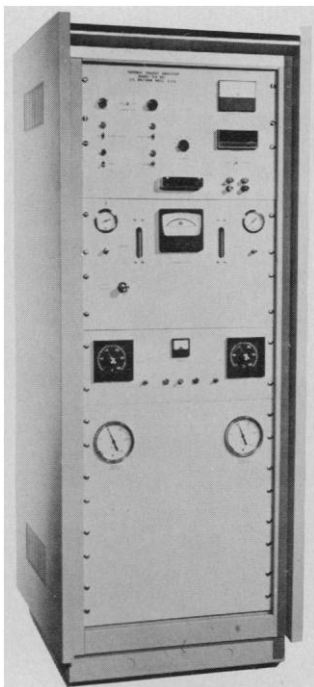
ASK FOR BULLETIN F1000/S376
NEW BRUNSWICK SCIENTIFIC CO., INC.

1130 SOMERSET ST., NEW BRUNSWICK, N. J. 08903 201-846-4600

With NBS, Advanced Technology is a Way of Life.

Circle No. 260 on Readers' Service Card

Highly Specific
and
Sensitive Measurement of
**N-NITROSAMINES
AND
N-NITROSO
COMPOUNDS**



**Model 502
Thermal
Energy
Analyzer**

*Patents Pending

Measurements at the ppb level and lower in minutes. This important new research tool will find immediate applications in analyses for

**Cancer Research Air/Water Quality
Food and Liquor Metabolic Studies
Pesticides Drug Residues**

**Thermo
Electron**
CORPORATION

Cancer Research Division

85 First Avenue
Waltham, MA 02154, U.S.A.
Telephone (617) 890-8700
Telex 92-3323
Cable TEECORP

Circle No. 495 on Readers' Service Card

LETTERS

(Continued from page 1217)

lation. As a noun to stand for the condition of being extaille, I propose "extation." In unusual instances where a transitive verb is necessary, "extaille" could serve. Thus, one might write that the Eskimo curlew is extaille, or that loss of habitat was the cause of the extation of the ivory-billed woodpecker.

Other words describe population levels or status with other connotations. "Rare" refers to frequency of observation or occurrence and may or may not imply a reduced population level or an inability to function in an ecosystem. "Endangered" and "threatened" are more sociological than biological in nature. Most species to which the word "extaille" would apply would also be considered threatened or endangered, but the converse would not necessarily be true.

Strictly speaking, one might say that whatever causes the death of the last remaining individual of a species is the cause of extinction. In general parlance, discussion of causes of extinction are really related to the causes of extation, the factors that lead to a condition whence extinction is possible. From a conservation viewpoint, the causes of extation are much more important than the cause of extinction because it is easier and more feasible to control the destiny of a population than of an individual. Further, extation may be reversible whereas extinction is not.

The verb "become" is most frequently used to indicate the course of a species to extinction, and could also be used with extation. Despite the precedence of modern usage, and particularly Will Cuppy's famous essay (1), I suggest that the verb "go" is more appropriate. Thus, a species would go extaille or extinct. "Become" usually implies a positive goal orientation, whereas "go" implies a departure. In an economic analogy, one becomes wealthy, but one goes broke.

RICHARD C. BANKS

*Division of Cooperative Research,
U.S. Fish and Wildlife Service,
Washington, D.C. 20240*

References

1. W. Cuppy, *How to Become Extinct* (Farrar and Rinehart, New York, 1941).

PCB's in Bald Eagle Eggs

The continued threat of polychlorinated biphenyls (PCB's) is reported in a Research News article by Thomas H. Maugh

II (19 Dec. 1975, p. 1189). I would like to emphasize the magnitude of the threat to natural fisheaters, such as bald eagles. Maugh notes that salmon and striped bass from the northeastern United States contain PCB's in concentrations from 5 to 20 parts per million and that 2 ppm is the upper limit adopted for edible fish. From a population of bald eagles with declining reproduction in northwestern Ontario I obtained a number of addled eggs during a period from 1967 to 1972 (1). The contents of these were analyzed for mercury and several organochlorines, including PCB's (2). The PCB concentrations in the three eggs in which that contaminant was measured were 25, 30, and 166 ppm, respectively (3). These levels are higher than those reported for bald eagle eggs in other regions of North America (4), and the last is among the highest on record for North American wildlife, amounting to nearly 0.1 percent of the entire dry weight content of that egg. I would not advise eating bald eagle eggs for breakfast.

JAMES W. GRIER

*Zoology Department,
North Dakota State University,
Fargo 58102*

References

1. J. W. Grier, *Can. Field Nat.* 33, 961 (1974).
2. PCB's were analyzed by gas chromatography, using Aroclor 1260 as reference standard, with calculations averaged from peaks 8 and 10. Analyses were performed by the Ontario Research Foundation for the Canadian Wildlife Service.
3. Concentrations are expressed as parts per million of estimated fresh wet weight to be consistent with Food and Drug Administration bases for reporting. Levels are converted from dry weight [see (1)] by assuming 83 percent moisture in freshly laid eggs.
4. S. N. Wiemeyer, B. M. Mulhern, F. J. Ligas, R. J. Hensel, J. E. Mathisen, F. C. Robards, S. Postupalsky, *Pestic. Monit. J.* 6, 50 (1972).

Solar Models

Roger K. Ulrich, in his article "Solar neutrinos and variations in the solar luminosity" (14 Nov. 1975, p. 619), seriously misrepresents my work (1) on stellar structure and variations of solar radiation. He rightly says that the described model "is physically untenable," but it is not my model, but rather, so to speak, the very opposite of mine, which he describes. With a solar core depleted of hydrogen, this element (not "heavy elements," as Ulrich says) diffuses inward, leaving the practically nondiffusing heavy elements in an outer shell, thus increasing the opacity in this shell (not "in the center of the sun"). There a superadiabatic gradient is formed, causing convection and leading to a fresh supply of hydrogen being transported to the core (not "causing the

CHARLES C THOMAS • PUBLISHER

AN INTRODUCTION TO BIO-INORGANIC CHEMISTRY edited by David R. Williams, *The Univ. of St. Andrews, St. Andrews, Scotland. (23 Contributors)* Since the realm of bio-inorganic chemistry entails the entire phenomena of human life, this volume could contain an infinite number of chapters. The selection has been limited, therefore, to sections describing the three natural divisions of the field: general principles of bio-inorganic chemistry, experimental methods used to produce the facts that gave rise to these principles, and application of these principles to medicine. '76, 416 pp. (6 3/4 x 9 3/4), 341 il., 62 tables, \$24.50

MOLECULAR AND ENVIRONMENTAL ASPECTS OF MUTAGENESIS edited by Louise Prakash, Fred Sherman, Morton W. Miller, Christopher W. Lawrence and Harry W. Taber, *all of the Univ. of Rochester, Rochester, New York. (40 Contributors)* Basic interactions of environmental mutagenesis with DNA are first considered in this book. Presentations progress in organismic complexity to mutagenesis of prokaryotic and eukaryotic cells, then to mutagenesis of multicellular test organisms, and finally to considerations of mutagenic phenomena in mammalian organisms. The discussions reflect a variety of synergistic and catalytic insights into the problems and conclusions of environmental mutagenesis. '75, 295 pp., 40 il., 66 tables, \$24.50

ENVIRONMENTAL PROBLEMS IN MEDICINE edited by William D. McKee, *Palo Alto Medical Clinic, Palo Alto, California. (36 Contributors)* Tailored to promote an understanding of increasing environmental hazards and their role in the development of disease, this book covers such topics as the population problem, changes in living patterns in modern society, health effects related to food, water and air, chemical carcinogens, agricultural chemicals and pesticides, environmental metals, and major death-causing diseases, particularly those related to arteriosclerosis. '75, 880 pp. (6 3/4 x 9 3/4), 90 il., 152 tables, \$36.50

Prepaid orders sent postpaid, on approval

301-327 EAST LAWRENCE
SPRINGFIELD • ILLINOIS • 62717

Circle No. 366 on Readers' Service Card

heavy material to be thrown out of the core"). Rightly, Ulrich says that "the diffusion time for the heavy elements . . . is quite long," but this is also my starting point. Curiously, while diffusion of hydrogen and the increased nuclear energy output are the main processes I considered, Ulrich's critique of my theory does not even contain the words "hydrogen" or "nuclear energy generation." My assumption that stellar cores are enriched by heavy elements in the prestellar process of condensation of diffuse matter during star formation may have been misunderstood by Ulrich as having been based on some process of diffusion inside the existing star.

ERNST J. ÖPIK

*Armagh Observatory,
Armagh BT61 9DG,
Northern Ireland*

References

1. E. J. Öpik, *Icarus* 4, 289 (1965).

Öpik points out that my comments about his theory for solar variability do not accurately represent his model (1). This misrepresentation was inadvertent and resulted from my efforts to find a modification of Öpik's model which was consistent with the theory of diffusion as presented by Aller and Chapman (2). Competing processes operate in the diffusion theory, and it turns out that all elements diffuse toward the center of the sun relative to hydrogen. Rather than simply abandon Öpik's model, D. Elliott and I tried to make it work by the slight modification of allowing the elements to diffuse to the solar center and there trigger the type of transient convection zone envisioned by Öpik. Such a model would proceed essentially along the lines described already by Öpik and would represent a possible solution to the solar neutrino problem. Unfortunately, diffusion models of any sort do not work for the solar core because the rates for all elements to diffuse relative to hydrogen are so low as to require 10^{11} years before any modification of chemical composition can occur. The additional models for inducing transient mixing discussed in my article are in fact efforts to find a way of modifying the thermal diffusion theory by postulating an additional physical process.

ROGER K. ULRICH

*Department of Astronomy,
University of California,
Los Angeles 90024*

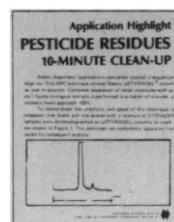
References

1. E. J. Öpik, *Icarus* 4, 289 (1965).
2. L. H. Aller and S. Chapman, *Astrophys. J.* 132, 461 (1960).

NEW required reading

on the Separation of Pesticides from Waters

Pesticide Residues 10-Minute Clean-up



Describes use of High-Speed Gel Permeation Chromatography for 10-minute "clean-up" of pesticide residue samples prior to quantitation.

Circle No. 380 on Readers' Service Card

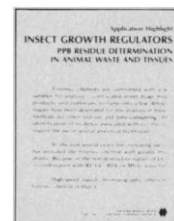
Rapidly Determine Carbaryl in Pesticide Formulations



Describes High-Performance LC as a precise, rapid, and direct method for the determination of carbaryl (1-naphthyl N-methylcarbamate) at all levels and in all formulations.

Circle No. 381 on Readers' Service Card

Insect Growth Regulators ppb Residue Determination in Animal Waste and Tissue



Reports development of an analytical method which utilizes liquid chromatography to quantitate residue levels (ppb) of insect growth regulators in animal waste and tissue.

Circle No. 382 on Readers' Service Card

free from



**WATERS
ASSOCIATES**

201 Maple Street, Milford, Ma 01757
Telephone (617) 478-2000

The Liquid Chromatography People