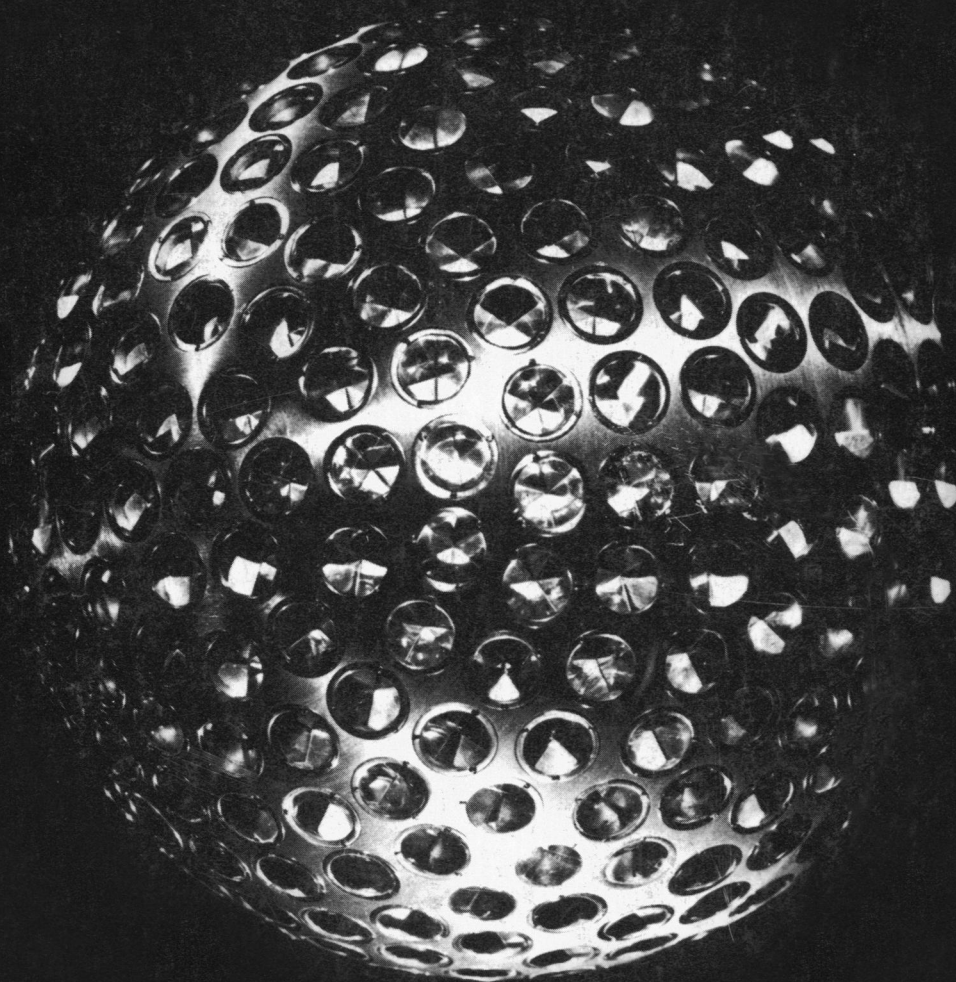


SCIENCE

25 June 1976

Volume 192, No. 4246

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



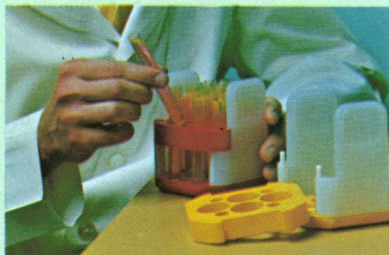
Introducing the Beckman TJ-6.



**A new large capacity
table top centrifuge
with optional refrigeration.**

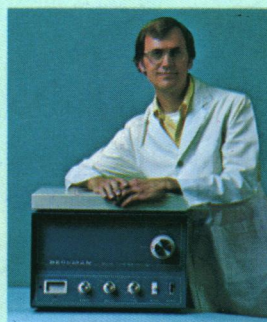
Now there's a table top centrifuge that holds up to 960 ml — and it's available with or without refrigeration.

It's the 6000-rpm Beckman TJ-6.



The TJ-6 four-place rotor and Maxi-Carrier™ tube racks hold every popular-sized tube, and more of them: 120 12 x 75-mm RIA tubes, 96 14 x 100-ml tubes, 72 16 x 100-mm tubes, or 16 50-ml tubes. With its refrigeration option and large capacity, the TJ-6 can handle many separations which formerly required the expense and size of a refrigerated floor-model.

The TJ-6 also has a rotor bowl that lifts out for easy cleaning, stain-



less steel buckets which hold the tube racks and contain spillage in case of tube breakage, and a rotor imbalance detector.

With the TJ-6, you now have two more choices from Beckman — the most respected name in centrifugation.

For a complete description of this outstanding new centrifuge, send for Data File SB-490. Write Beckman Instruments, Inc., Spinco Division, 1117 California Avenue, Palo Alto, CA 94304.

BECKMAN®

Circle No. 228 on Readers' Service Card

It steals every scene and autographs it.

Photomicroscope III . . . the fully automatic superstar.

Fully automatic built-in 35mm camera for stability, compactness, and convenience.

Fully automatic integrated computer flash to solve vibration, reciprocity and color problems.

For polarized-light and fluorescence work, 98% of the light can be directed onto the film.

Largest selection of illumination and other equipment for all techniques in both transmitted and incident light.

Acceptance of photometers, TV, projection screen, other format cameras—while keeping full 35mm camera capability.

Now another first — new film codifier.

The Photomicroscope has been making photomicrographic history for 20 years — and is now recording events even more efficiently and reliably. The new film codifier attachment leaves your mark on each exposure.

Now you can identify every frame with up to 5 symbols, letters and/or automatically successive numerals regardless of the length of time your specimens are exposed.

Contact us for the complete story or a demonstration.

Nationwide Service

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



25 June 1976

Volume 192, No. 4246

SCIENCE

LETTERS	PBB Incident: <i>F. L. Halbert</i> ; Energy Conservation and Credibility: <i>P. T. Thompson</i> and <i>J. MacTavish</i> ; Swine Flu: Quantifying the "Possibility": <i>F. Mosteller</i> ; Antiviral Agent: Abbott Tests: <i>J. H. Biel</i> ; Moral Periodic Table: <i>D. H. Douglas-Hamilton</i>	1286
EDITORIAL	More Laws, More Complexity	1291
ARTICLES	The Shape of the Earth: <i>D. King-Hele</i>	1293
	The Arctic Mirage and the Early North Atlantic: <i>H. L. Sawatzky</i> and <i>W. H. Lehn</i> . .	1300
	Energy Conservation in New Housing Design: <i>J. E. Snell</i> , <i>P. R. Achenbach</i> , <i>S. R. Petersen</i>	1305
NEWS AND COMMENT	Reactor Safety: Congress Hears Critics of Rasmussen Report	1312
	<i>Glomar Explorer</i> : CIA's Salvage Ship a Giant Leap in Ocean Engineering	1313
	Currie Inquiry Puts Pentagon Research Job Under Cloud	1316
	Nuclear Initiative: Californians Vote "No," but Legislature Acts	1317
RESEARCH NEWS	Fusion Research (I): What Is the Program Buying the Country?	1320
	Laser Spectroscopy: Illuminating the Dynamics of Collisions	1323
BOOK REVIEWS	Equity Theory, reviewed by <i>B. R. Schlenker</i> ; Proteases and Biological Control, <i>B. Kassell</i> ; Films on Solid Surfaces, <i>J. M. Blakely</i> ; Nuclear Tracks in Solids, <i>E. V. Benton</i> ; Books Received	1325
REPORTS	<i>N</i> -Nitroso Compounds: Detection in Ambient Air: <i>D. H. Fine</i> et al.	1328
	Size Variations in Planktonic Foraminifera: Implications for Quantitative Paleoclimatic Analysis: <i>A. D. Hecht</i>	1330

BOARD OF DIRECTORS	MARGARET MEAD Retiring President, Chairman	WILLIAM D. MC ELROY President	EMILIO O. 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 Arlo 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 Pearlman	PHARMACEUTICAL SCIENCES (S) Joseph P. Buckley Raymond Jang	INFORMATION, COMPUTING, AND COMMUNICATION (T) Burton W. Adkinson Joseph Becker	
DIVISIONS	ALASKA DIVISION		PACIFIC DIVISION		SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION
	George C. West Chairman, Executive Committee	Keith B. Mather Executive Secretary	Richard Walker President	Alan E. Leviton Secretary-Treasurer	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

Enhancement of Algal Growth and Productivity by Grazing Zooplankton: <i>K. G. Porter</i>	1332
Properties of the Background Global Aerosol and Their Effects on Climate: <i>G. E. Shaw</i>	1334
Metamict Mineral Alteration: An Implication for Radioactive Waste Disposal: <i>R. C. Ewing</i>	1336
Tropomyosin Binding to F-Actin Induced by Myosin Heads: <i>B. L. Eaton</i>	1337
Fertilization of Sea Urchins Needs Magnesium Ions in Seawater: <i>K. Sano</i> and <i>H. Mohri</i>	1339
Bone Cells in Culture: Morphologic Transformation by Hormones: <i>S. S. Miller,</i> <i>A. M. Wolf, C. D. Arnaud</i>	1340
Ribonucleotide Reductase in Blue-Green Algae: Dependence on Adenosylcobalamin: <i>F. K. Gleason and J. M. Wood</i>	1343
Aflatoxin Production by a Variant of <i>Aspergillus oryzae</i> (NRRL Strain 1988) on Cowpeas (<i>Vigna sinensis</i>): <i>N. El-Hag and R. E. Morse</i>	1345
Trypanosomatid Flagellate in the Phloem of Diseased Coconut Palms: <i>M. V. Parthasarathy, W. G. van Slobbe, C. Soudant</i>	1346
Leeuwenhoek's Observation of Bacteria: <i>L. E. Casida, Jr.</i>	1348
Ant-Aphid Association: Role of Aphid Alarm Pheromone: <i>L. R. Nault,</i> <i>M. E. Montgomery, W. S. Bowers</i>	1349
Lethal Interaction of Ubiquitous Insecticide Carriers with Virus: <i>J. F. S. Crocker et al.</i>	1351
Courtship Differences in Male Ring Doves: Avoidance of Cuckoldry?: <i>C. J. Erickson and P. G. Zenone</i>	1353
Stimulant-Related State-Dependent Learning in Hyperactive Children: <i>J. M. Swanson and M. Kinsbourne</i>	1354
Analgesia Mediated by a Direct Spinal Action of Narcotics: <i>T. L. Yaksh and</i> <i>T. A. Rudy</i>	1357
Evolution on the Level of Communities: <i>D. S. Wilson</i>	1358
Technical Comment: Evaluation and Publication of Scanning Electron Micrographs: <i>J. M. Clark and S. Glagov</i>	1360

PRODUCTS AND MATERIALS

Thermographic Color Display; Streak Camera; Flowmeters; Ultraviolet Laser Mirrors; Polyacrylamide Gradient Gel; Wafer Scriber; Scanning Electron Microscope; Plastic Optical Components; Literature	1362
---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------	------

MIKE MC CORMACK FREDERICK MOSTELLER	CHAUNCEY STARR CHENNING 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

COVER

Laser geodynamic satellite, Lageos. The satellite, whose actual diameter is 2 feet, has 426 retroreflectors on its exterior. Data from the satellite should aid in the development of techniques for the prediction of earthquakes. See page 1293. [Goddard Space Flight Center, National Aeronautics and Space Administration, Greenbelt, Maryland]

The American Association for the Advancement of Science was founded in 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.

Take a photomicrograph with Biophot.

"Unbelievable!" That's often the reaction to photomicrographs taken with Nikon's new research Biophot. They have startling quality... resolution... definition... contrast.

The secret is the optics.

What makes Biophot optics so phenomenal is newly developed Nikon chrome-free glass and Nikon integrated multi-coatings on all glass surfaces, coupled with an extremely stable research stand. The chrome-free glass achieves unprecedented reduction of chromatic errors. While the multilayer coatings on the lenses significantly reduce internal reflections and glare.

To go along with our breakthrough in microscopy, we designed a new photomicrographic camera system. The Nikon Microflex model HFM. It features an automatic shutter and shutter speed indicator with a range of 1/60 second to 8 minutes. Or manual operation if desired.

Formats include 2½ x 3½" sheet/ film photo plates, 3¼ x 4¼" polaroid, and 4 x 5".

Objectives include a completely new series of parfocal plan-achromats and plan apochromats.

The superb correction of the objectives achieves resolving power very close to the theoretical limit for optical microscopes.

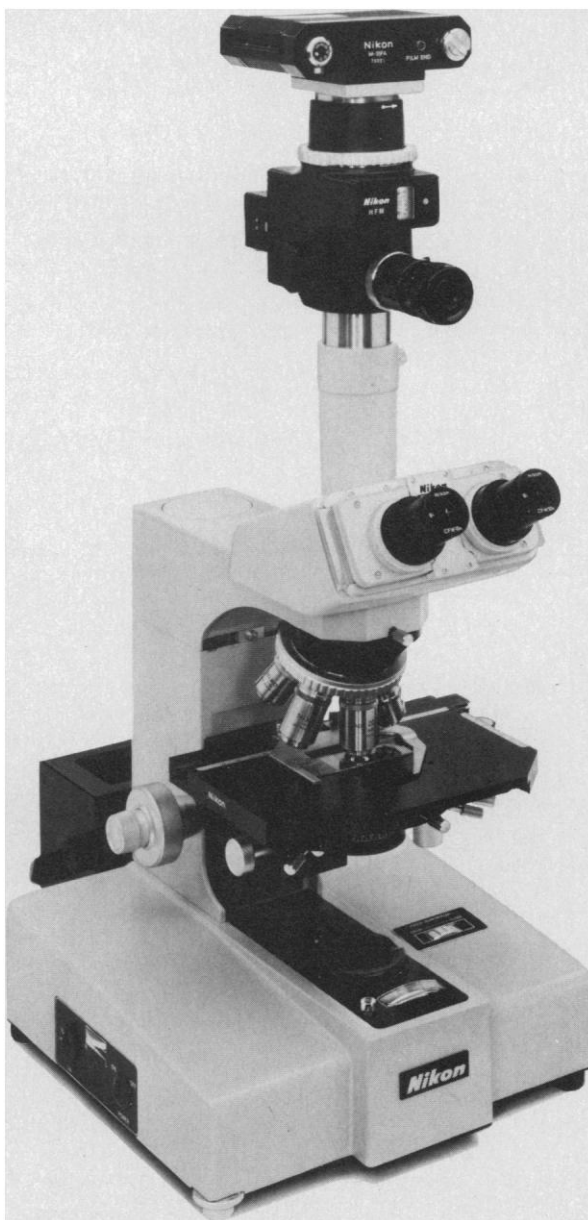
Among the techniques available are: Epi/Dia-fluorescence and Nomarski interference contrast.

But don't take our word for it. See Biophot. Believe your own eyes.

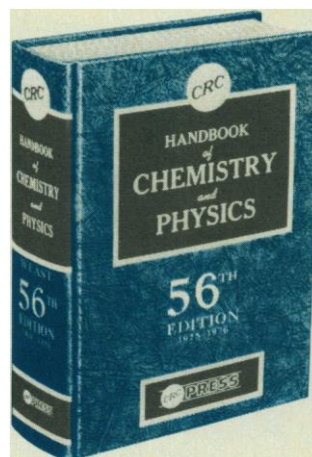
For a demonstration, write:
Saul Bernstein, Sales Manager,
Scientific Instruments,
Nikon Instrument Division,
Ehrenreich Photo-Optical Industries, Inc.,
623 Stewart Avenue,
Garden City, N.Y. 11530.
Or call (516) 248-5200.



Biophot. Seeing is believing.



A Special Celebration



The current edition of the **CRC Handbook of Chemistry and Physics** is being offered at the special price of \$17.76 until July 4, 1976.

MOST FREQUENTLY CITED SOURCE

The Handbook is regarded by professionals as the most frequently cited reference in the scientific community. This 56th Edition, in addition to containing the most reliable and complete data possible, has been up-dated and restructured by professional librarians to index subject matter by primary, secondary, and tertiary categories.

CURRENT EDITION INCLUDES

Contains over 2,300 pages of tables, graphs, data, and property information vital for chemistry, physics and a broad spectrum of related scientific disciplines. The Handbook is divided into Sections that include: Mathematical Tables; The Elements and Inorganic Compounds; Organic Compounds; General Chemical; General Physical Constants; and Miscellaneous Data.

SAVE NEARLY 40%

Thousands sold at \$28.95. And for a limited time only, this same best-seller will be sold for nearly 40% less than the regular retail price. Send your PRE-PAID order to CRC PRESS with the attached form and special catalog number before July 4 to take advantage of the special saving.

The **CRC Handbook of Chemistry and Physics** would be a useful addition to any home library, especially at this low price. BUT YOU CAN'T AFFORD TO WAIT.

DEADLINE: JULY 4, 1976

COMMENTS ON PREVIOUS EDITIONS:

"Revised each year to keep pace with and assist the growth of science, this book is the desk-top reference for chemical and physical data." — **Chemistry**

"...very possibly the most complete and up-to-date volume currently available on this subject." — **Marine Resources Digest**

"Often referred to as the 'bible' of chemistry and physics." — **Soil Science Society of America Proceedings**

"Through constant revision, **Handbook of Chemistry and Physics** continues to dominate the field of reference books used by chemists and physicists." — **Current Engineering Practice**

"This Handbook is an invaluable tool in the work of anyone involved with science in its many forms." — **Massachusetts Physician**

Date _____

ORDER FORM

Please send me the 56th Edition of the **CRC Handbook of Chemistry and Physics** for \$17.76* (reg. \$28.95). To qualify for this special offer:

- Cite Catalog No. 456JGL when ordering.
- All orders must be prepaid and placed directly with CRC Press (Postmarked before July 4, 1976). Offer valid only for individuals and/or institutions. Ohio residents add 5.5% sales tax.

Name _____

Title _____

Co./Inst. _____

Address _____

City _____

State _____

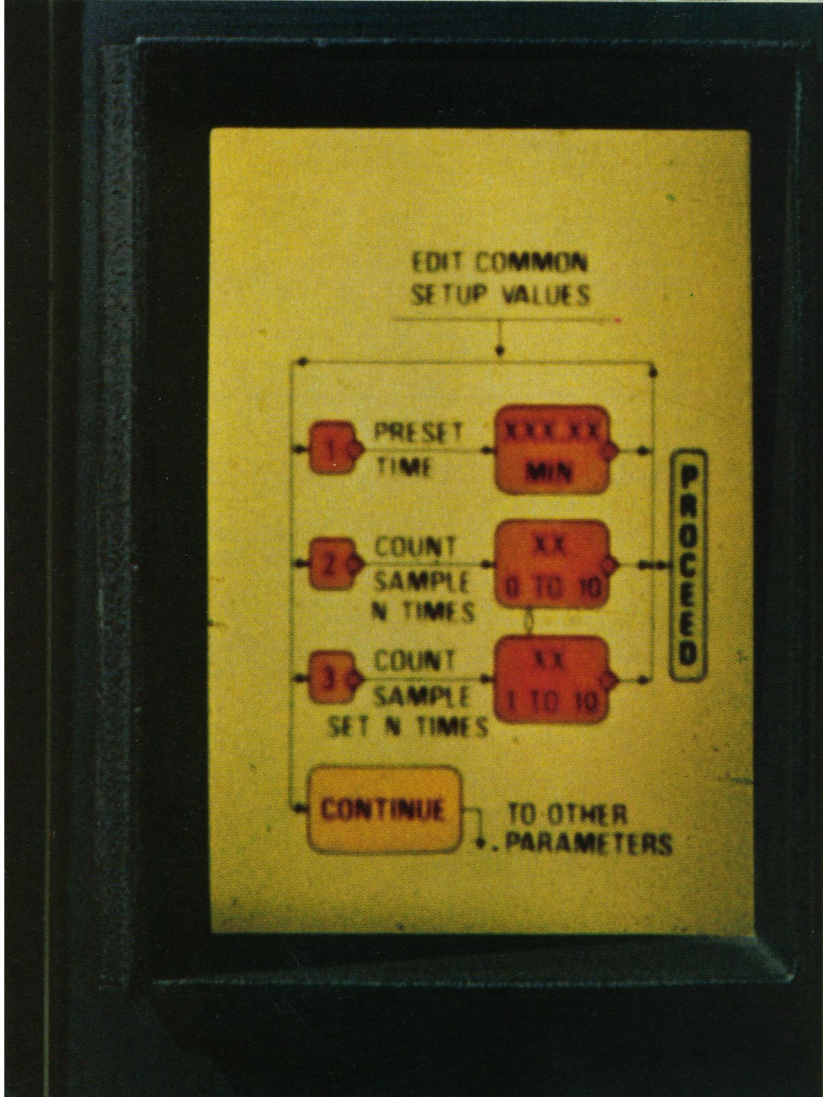
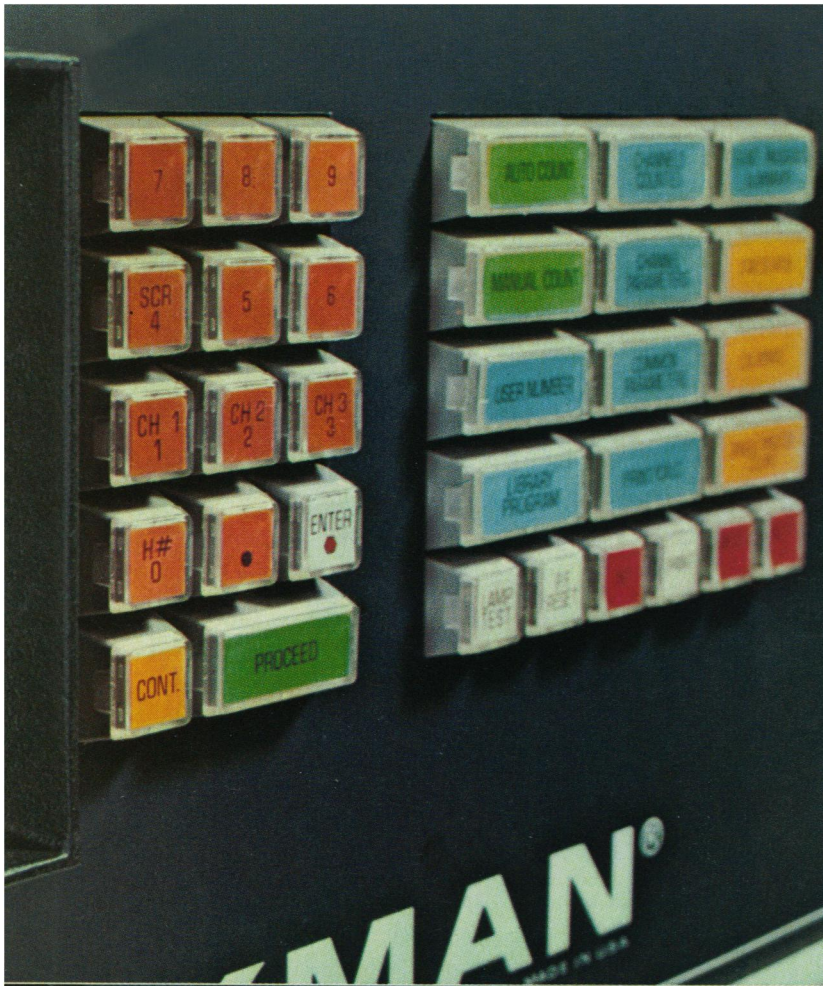
Zip _____

*(Outside U.S.A.—Add \$2.00 per copy. Payable in U.S. Currency by Draft or Check on a U.S. Bank.) In the U.S., sale price covers postage, insurance, and handling charges.

CRC PRESS, INC.

18901 Cranwood Parkway, Cleveland, O. 44128 USA

Circle No. 342 on Readers' Service Card



Announcing the world's most advanced LS counter

and four reasons why you won't need another degree to operate it.

When instruments are made vastly more powerful and flexible they usually become vastly more complicated and often require lengthy training for the user group.

That's one rule of scientific life that now has a complete exception: The new Beckman Series 8000 Liquid Scintillation Counter. Here's how you get sophisticated and versatile counting capability made simple.

1. A Program Library The exacting counting procedures of the LS-8000 are directed by a built-in computer. The computer, in turn, is guided by one of 10 user-selected library programs.

Once set in operation, each basic program can produce final answer high performance *without further user interaction*.

For maximum simplicity of operation or straightforward workhorse performance, there's only one button on the control panel that operators need know how to use. The "Autocount" button. Hit it and walk away. 300 samples run automatically. Quench is monitored automatically.

High accuracy and total flexibility have never been simpler.

2. Command Tower Programming Although the LS-8000 is a totally innovative counting instrument, liquid scintillation researchers will find its basic format totally familiar. The LS-8000 can be operated by multi-user command tower programming. Once the command tower has been set, the instrument will run automatically.

3. The Built-in Programmer The LS-8000's programming simplicity is complemented by exceptional versatility. Precision parameters for each of 10 separate users can be selected by using the built-in computer. Any one of the 10 standard library programs can be stored and edited separately for maximum specialization to your particular counting requirements. Sound complicated?

Not when the programmer is built-in, too. Shown at the lower left is the LS-8000 rear screen projector-programmer that displays every required push-button step for a given counting routine.

The user need only push a button and then follow each successive operational step directed on the screen. You can't miss and you can't go wrong.

All dials, knobs, and driftable settings have been eliminated. And the results, of course, are complete, ultra-accurate final answers, the kind of answers that can be

achieved only when you can optimize numerous individual parameters.

4. Automatic Data Reduction The LS-8000 handles the final analysis for you. Conversion of CPM to DPM — single and dual label — digital integration, and a range of biomedical calculation programs are all carried out by the on-line data reduction computer.

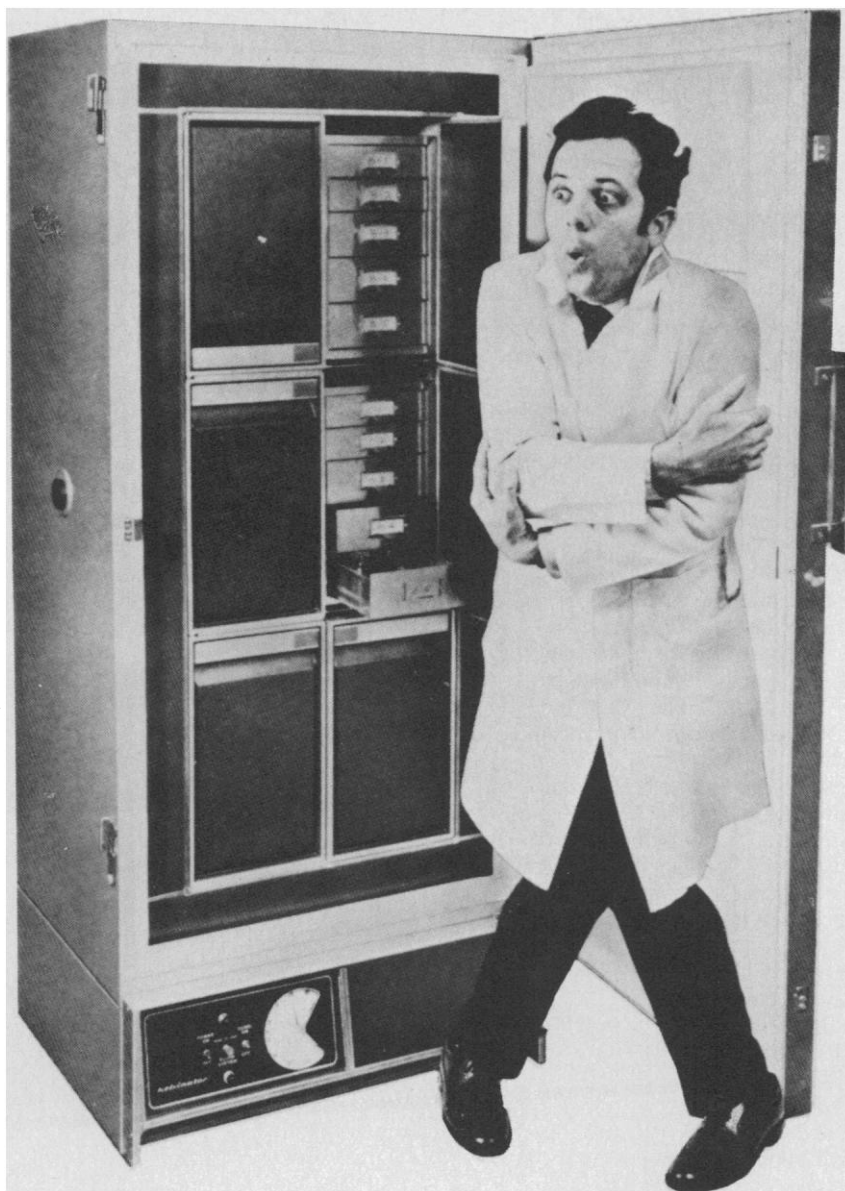
In short, when we built the world's most advanced LS counter, we went out of our way to make it simple, versatile, fully automated, and self-teaching. The computer is built-in, and so is the programmer. Why not talk to him personally.

For full information, contact Scientific Instruments Division, Beckman Instruments, Inc., P.O. Box C-19600, Irvine, CA 92713.



BECKMAN®

Circle No. 181 on Readers' Service Card



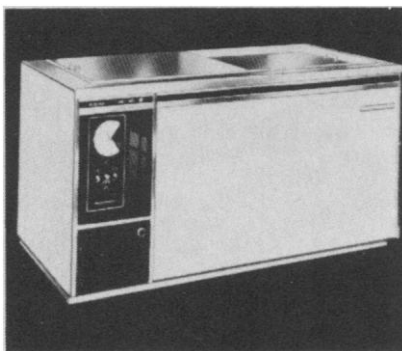
K-K-K-KEL-VI-VINATOR. -96°C !

We sell ultra-cold. Hair-cracking cold. Upright drops to -76°C . Chest model sinks to -96°C . And in over-all performance, we're the hottest cold buy around.

We know what you need in the way of cold so we've designed our units to make you happy. Take the upright. Beyond the cold you need, you'll find convenience features like six French doors. Open one without losing the cold everywhere else. You can label each door. Know what's behind it.

What's good about the chest model? It gets colder. And the top can give you some more work surface. And here too we've come up with a great way for you to identify the location of everything that's in it.

More. Both have automatic alarm systems and 2" portholes to accommodate recorders. More importantly, both carry the name Kelvinator Commercial. The company that knows how to give you the best cold you ever had.



Circle No. 29 on Readers' Service Card

Send for detailed literature.

Upright UC-105 ($-76^{\circ}\text{C}/-105^{\circ}\text{F}$)
— 12 Cubic Feet.

Chest UC-520 ($-85^{\circ}\text{C}/-120^{\circ}\text{F}$),
UC-540 ($-96^{\circ}\text{C}/-140^{\circ}\text{F}$)
— 12 Cubic Feet.

Write: J. E. Hirssig, Sales Mgr.,
Scientific and Industrial Division,
Kelvinator Commercial Products, Inc.,
621 Quay Street, Manitowoc, Wisconsin
54220. Phone (414) 682-0156.

*See Ultra Cold: Annual Meetings of
American Society for Microbiology
and Tissue Culture Association.*

Kelvinator

One of the White Consolidated Industries



Digital can make your labwork easier by making your lab work harder.

Digital can help make your job easier by making your lab more efficient. No matter whether you're doing experiment monitoring and control. Materials testing. Or spectral analysis.

We offer a complete range of lab hardware. Backed by our Laboratory Applications software. And DECnet networking software. In fact, we offer everything you need to get the most out of our systems and your lab.



For low-cost data acquisition, we offer the PDP-11/04. It's a small yet sophisticated system for data acquisition and analysis on a tight budget. You can use the 11/04 as a smart communication node. A remote data collector. An intelligent terminal. Or a completely independent data acquisition system. With the 11/04, where and how you use it depends on you.

We also offer the GT44 graphics system.

The GT44 combines the power and performance of our disk based PDP-11/40 computer system, intelligent display processor and 17" CRT. It gives you a fast, flexible system for all your interactive graphics applications. The GT44

is hardware and software compatible with the complete Digital 11 family. And that means you can simply add on to your system whenever you're ready. You can even use it as a satellite terminal in your lab network.

For really high speed FORTRAN number crunching, we offer the PDP-11T55. The 11T55 is designed to give you both fast response time and sophisticated program development. It includes two removable disks with 2.4 megabytes each for off line storage of programs and data. A fast floating point hardware processor. And 300 nanosecond cycle time. The 11T55 is ideal for applications that require fast FORTRAN or assembler execution speed.

And you can tie everything together with DECnet.

With DECnet, small systems like our 11/04 can tap the power and memory of larger systems.

Larger systems like our 11T55 or



PDP 11/70 can gather data from small computers connected to instruments. Systems can even swap information and share costly storage devices. In short, DECnet gives you the ability to easily design

your own network in any configuration you choose. So you could save money by (1) sharing resources and

(2) making a system you have work harder.

When you put our cost-effective hardware together with our application and network software, you'll find Digital has a solution to just about any lab application. Even yours.

We'd like to prove it. Just return the coupon below. Digital Equipment Corporation, Marlborough, Mass. 01752, Telephone 617-481-9511, extension 6947. European headquarters: 81 route de l'Aire, 1211 Geneva 26. Tel: 42 79 50. Digital Equipment of Canada, Ltd.

digital

50,000 Computers Saving Managers Millions.

S6256

11/04, GT44, 11T55, DECnet ad.

Digital Equipment Corporation, Marlborough, Mass. 01752

☐ I am interested. But my need is long-range. Please send me literature.

☐ I am interested. Please have a sales engineer contact me as soon as possible.

Name _____

Title _____

Company _____

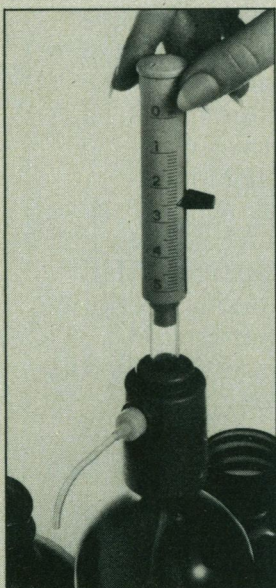
City _____

State _____

Zip _____

**NOW AVAILABLE
IN ADJUSTABLE
50, 25 & 0.5 ml MODELS!**

**The difference
between a Dispensette® and
other bottle-top dispensers:
Nothing to break off
on the outside.
Nothing to wear out
on the inside.**



One glance at its slim, compact shape tells you a lot about a Dispensette.

On the outside, there is nothing to break off, chip or crack. No fragile glass tubing, no complex springs, no awkward adjustment mechanism with magnifier. (The outer housing is made of rugged polypropylene, the flexible tip of Teflon®).

On the inside, precision engineered ball valves and spring permit fast, accurate dispensing with better than 0.1% reproducibility. Even with strong alkalis, the smooth Teflon-coated plunger and borosilicate glass cylinder will not freeze together. In fact, a Dispensette may be used with any reactive chemical (except HF) and may be autoclaved at 120°C without disassembling.

Available in a wide variety of adjustable and fixed-volume models from 0.5 to 50ml, Dispensettes mount directly on any 33mm screw-neck reagent bottle and on most other size bottles, cans or containers using optional adapters.

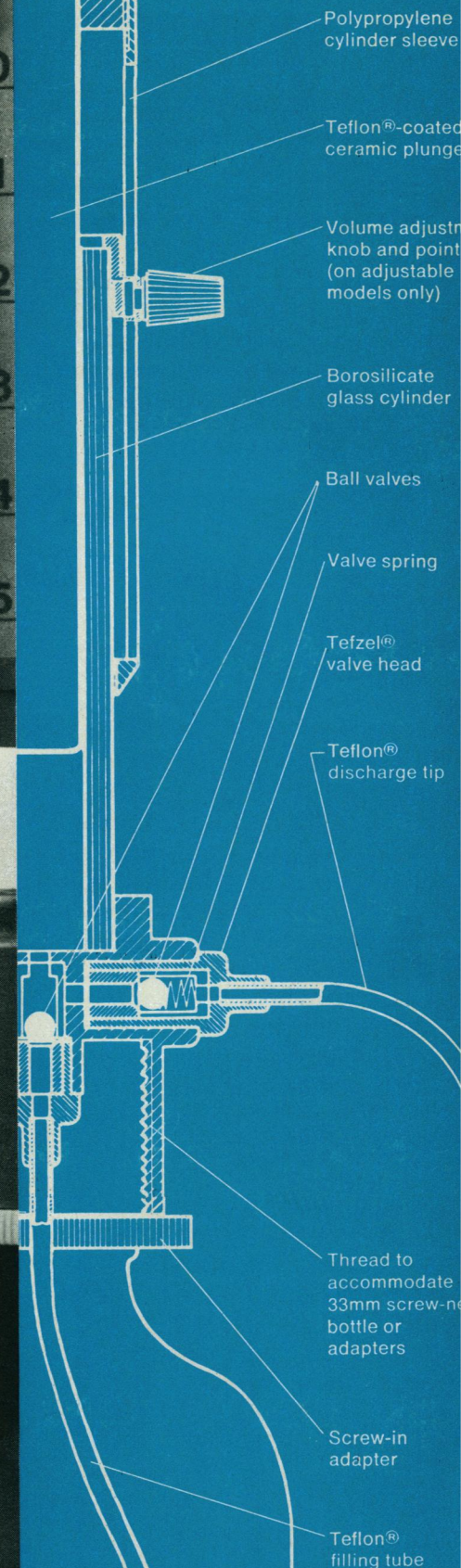
Inside and out, Dispensette is a major improvement over conventional bottle-top dispensers. For literature, write: Brinkmann Instruments, Cantiague Rd., Westbury, N.Y. 11590. In Canada: 50 Galaxy Boulevard, Rexdale (Toronto), Ont.

**iB Brinkmann
Dispensette**

Available from: Ace Scientific / Bio-Rad Laboratories / Cole-Parmer Instrument Co. / Curtin Matheson Scientific / Fisher Scientific / Preiser Scientific / Sargent Welch / Scientific Products / SGA Scientific / Arthur H. Thomas Co. / VWR Scientific.

Teflon® and Tefzel® are DuPont trademarks.
Dispensette® is a registered trademark of R. Brand Co., Wertheim, W. Germany.

Circle No. 198 on Readers' Service Card



Eastman Organic Chemicals News

New Electrophoresis Reagent Sets

We now offer four new sets of reagents for general uses in polyacrylamide gel electrophoresis. All four sets include illustrated manuals with an introduction to electrophoresis, a step-by-step guide to gel preparation, and a bibliography. The four sets are:

EASTMAN Standard Acrylamide Electrophoresis Reagent Set. Contains acrylamide, N,N'-methylenebisacrylamide, ammonium persulfate, TEMED, riboflavin, tracker dye, and stain. Whether you're a new user interested in conventional polyacrylamide gel electrophoresis, or teaching this separation technique, the set has all the reagents needed to prepare gels of various characteristics.

EASTMAN Solubilizable Gel Electrophoresis Reagent Set. Contains N,N'-diallyltartardiamide (DATDA) as the crosslinking agent for the preparation of solubilizable acrylamide gels. Also includes acrylamide, TEMED, ammonium persulfate, periodic acid, and tracker dye. Periodic acid dissolves the gels with relative ease and no viscous residue, for liquid scintillation counting.

EASTMAN SDS Electrophoresis Reagent Set. Includes sodium dodecyl sulfate (SDS), acrylamide, bis, TEMED, ammonium persulfate, mercaptoethanol, and stain for doing protein molecular weight determinations.

EASTMAN Electrophoresis Starter Reagent Set. Contains all reagents and materials in the other three sets necessary for standard electrophoresis, SDS molecular weight determinations and subunit fractionization, and DATDA solubilizable gels.

Circle No. 288 on Readers' Service Card

Scintillation-grade Chemicals

Also now available: 33 scintillation-grade EASTMAN Organic Chemicals—reagents to meet various needs and degree of flexibility.

For example, if you wish to count samples with low quench, EASTMAN Ready-to-Use I, Concentrate I, and Dry Blend I should meet your needs.



For counting highly quenched samples, consider EASTMAN Ready-to-Use II, Concentrate II, and Dry Blend II. Other reagents for LSC include fluors, solvents, tissue solubilizer, and CO₂ absorbers.

To maintain consistently high quality, our chemicals are closely monitored and include actual-use tests under a variety of conditions. We measure fluorescence quantum yield, absorbance, absolute counting efficiency, and physical constants.

Circle No. 289 on Readers' Service Card

Free guide available.

If you do not already have a copy of our latest EASTMAN Organic Chemicals Catalog No. 48, send us the coupon below. To order any EASTMAN Organic

Chemical write one of the laboratory supply distributors who carry our organic chemicals.

American Scientific and Chemical
Beckman Science Essentials
Bioclinical Laboratories Inc.
Brand-Nu Laboratories Inc.
Bryant Laboratory, Inc.
Curtin Matheson Scientific
Fisher Scientific Company
GAC Laboratories
Labproducts, Inc.
Midland Scientific, Inc.
North Strong Inc.
Preiser Scientific
Sargent-Welch Scientific
SciChemCo
Scientific & Industrial Sales and
Service, Inc.
VWR Scientific
Ward's Natural Science Establishment,
Inc.
Circle No. 290 on Readers' Service Card



• • • • •

• Eastman Kodak Company 6-65 •

• Eastman Organic Chemicals •

• Dept. 412-L •

• Rochester, N.Y. 14650 •

• I'd like to learn more about your products. Please send me •

• information on: •

• ☐ JJ-59, EASTMAN Products for Liquid Scintillation Counting •

• ☐ JJ-11, EASTMAN Reagents for Acrylamide Gel •

• Electrophoresis •

• ☐ EASTMAN Organic Chemicals Catalog No. 48 •

• _____ •

• Name •

• _____ •

• Position •

• _____ •

• Affiliation •

• _____ •

• Address •

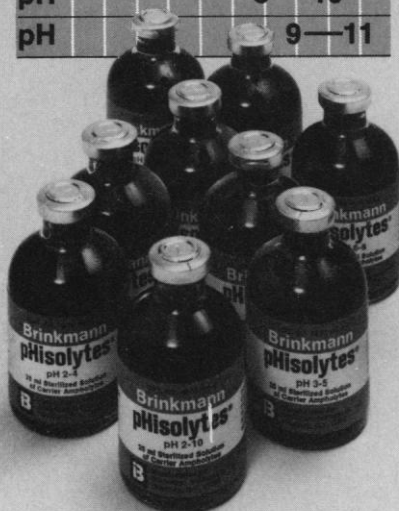
• _____ •

• City State Zip •

• • • • •

Brinkmann pHisolytes. New carrier ampholytes for isoelectric focusing.

pH 2	—	10
pH 2	—	4
pH 3	—	5
pH 4	—	6
pH 5	—	7
pH 6	—	8
pH 7	—	9
pH 8	—	10
pH 9	—	11



Because they contain more amphoteres than other ampholytes, Brinkmann pHisolytes provide a wider general pH range, from pH 2 to 10. pHisolytes are also available in eight individual pH ranges, each with a span of 2 pH units, from pH 2-4 to pH 9-11.

pHisolytes are composed of amphoteres synthesized from aliphatic polyamines with primary, secondary and tertiary amines and guanidine groups. They range in molecular weight from 400 to 700 and are easily separated from proteins by gel filtration techniques. pHisolytes come in sterile vials of 25 ml; each batch is tested for buffering capacity and adsorption.

For literature, just write: Brinkmann Instruments, Cantiague Rd, Westbury, N.Y. 11590. In Canada: 50 Galaxy Blvd., Rexdale (Toronto), Ont.

Brinkmann

LETTERS

PBB Incident

Luther J. Carter's article "Michigan's PBB incident: Chemical mix-up leads to disaster" (News and Comment, 16 Apr., p. 240) drives home the message that we can no longer be so casual with the stream of exotic chemicals flowing into commerce. In the future we must look to better living through responsible chemistry and effective control.

Carter refers to my role and that of George Fries in identifying PBB (polybrominated biphenyl) as the Michigan contaminant. I wish to acknowledge the unselfish and productive efforts of our veterinarian, the late Ted F. Jackson, who worked hand in hand with us on the problem right down to the wire, and of Al Furr, formerly with the National Animal Disease Center, Ames, Iowa, who brought new meaning to the phrase "Rocky Mountain High" by discovering the late emerging peaks characteristic of PBB in gas chromatograph analysis of our feed.

FREDERIC L. HALBERT

Route 2, Box 252,
Delton, Michigan 49046

Energy Conservation and Credibility

Philip H. Abelson's editorial "Energy diplomacy" (30 Apr., p. 429) implies some fault in the public for not being "conservation-minded." We have just completed a survey of public perceptions and attitudes concerning energy-related problems. The survey was conducted by professional interviewers using an open-ended format and involved a statistically valid sample of a metropolitan population of 350,000 persons.

Our findings indicate that the public is behaving with extraordinary internal consistency. If they believe that the United States and the world will run out of effective supplies of oil and natural gas in the next 50 years, or that there is an energy-related problem which goes beyond waste in our society or manipulated (by government or big business) shortages, they respond with a variety of conservation adjustments including plans to buy a smaller car, drive less, turn down heat, use less electricity, and so forth. Indeed, they have been acting on these beliefs for the last 2 years.

The problem is that they do not believe there is or will be a supply problem. When asked whom they trusted for energy information, 21 percent said no one,

and 20 percent said they did not know whom to trust. Only 9 percent believe the information put forth by the federal government. If we consider the contradictory statements to which they have been exposed, the public is responding in a realistic manner.

Given the internal consistency of behavior, changing the public's perception of the reality of the problem should have immediate effects on conservation behavior. The fault lies with decision-makers and leadership, not with public unwillingness to make necessary changes. Current references to the public's unwillingness to conserve energy appear to be not unlike the "blaming the victim" syndrome in the literature on poverty.

PHYLLIS T. THOMPSON

JOHN MAC TAVISH

*Urban and Environmental
Studies Institute,
Grand Valley State Colleges,
Allendale, Michigan 49401*

Swine Flu: Quantifying the "Possibility"

We need better rules for translating everyday language into quantities and vice versa, especially in the area of probability. Philip M. Boffey (News and Comment, 14 May, p. 636) reports that President Ford, in referring to the campaign against swine flu, spoke of an epidemic as a "very real possibility." Boffey consulted at least four experts and reports their responses concerning the probability of a swine flu epidemic in the 1976-77 season as being, respectively, 2 percent, 10 percent, 35 percent, and "less than even," which I translate as "less than 50 percent." The 2 percent responder regarded his number as plucked out of the air; we were not told how the others regarded theirs.

Boffey then says, "Those probability estimates, though far lower than the official rhetoric of the campaign would lead one to expect, do not necessarily mean that the vaccination campaign is a foolish endeavor." I wish to address the question of whether the estimates are far lower than the official rhetoric should have led us to expect. Since Boffey emphasizes Ford's concern about the "very real possibility" of a dangerous epidemic in the United States next fall and winter, I regard the phrase "very real possibility" as the official rhetoric needing quantification. Boffey has done the fieldwork of consulting experts for their guesses. Judith Selvidge (1) found, from responses of Harvard Business

New England Nuclear announces the labeling of fourteen suspected cancer-causing agents, available from stock. More are now in production. Your inquiry regarding other suspected carcinogens is welcomed.

Dimethylhydrazine, <i>N,N'</i> -[methyl- ¹⁴ C]-	NEC-706
Dinitrosopiperazine, <i>N,N'</i> -[¹⁴ C(U)]-	NEC-700
Ethyl- <i>N</i> -nitroso-urea, <i>N</i> -[ethyl-1- ¹⁴ C]-	NEC-694
Methyl- <i>N'</i> -nitro- <i>N</i> -nitrosoguanidine, <i>N</i> -[methyl- ¹⁴ C]-	NEC-705
Methyl- <i>N</i> -nitroso- <i>p</i> -toluenesulfonamide, <i>N</i> -[methyl- ¹⁴ C]-	NEC-282
Methyl- <i>N</i> -nitroso-urea, <i>N</i> -[methyl- ¹⁴ C]-	NEC-693
Methyl- <i>N</i> -nitroso-urea, <i>N</i> -[³ H]-	NET-408
Nitrosodiethylamine, <i>N</i> -[ethyl-1- ¹⁴ C]-	NEC-702
Nitroso- <i>N,N</i> -dimethylamine, <i>N</i> -[¹⁴ C]-	NEC-631
Nitrosoethylmethylamine, <i>N</i> -[ethyl-1- ¹⁴ C]-	NEC-703
Nitrosomonicotinic acid, [pyrrolidine-2- ¹⁴ C]-	NEC-701
Nitrosopiperidine, <i>N</i> -[2,6- ¹⁴ C]-	NEC-698
Nitrosoproline, <i>N</i> -[3,4- ³ H(N)]-	NET-525
Nitrosopyrrolidine, <i>N</i> -[2,5- ¹⁴ C]-	NEC-697



New England Nuclear

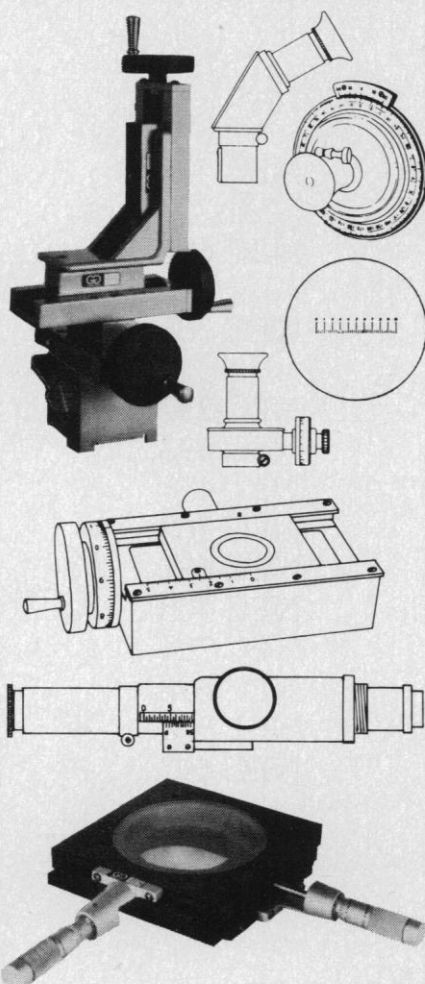
549 Albany Street, Boston, Massachusetts 02118
Customer Service 617-482-9595

Canada: NEN Canada Ltd., 2453 46th Avenue, Lachine, Quebec, H7T 3C9, Tel: 514-636-4971, Telex: 05-821808
Europe: NEN Chemicals GmbH, D-6072 Dreieichenhain, W. Germany, Daimlerstrasse 23, Postfach 1240, Tel: (06103) 85034.

Circle No. 256 on Readers' Service Card

Send for Gaertner Information Kit:
**Optical and
mechanical modules
for custom measuring
and positioning
assemblies**

A wide line of basic optical instruments, plus scores of Gaertner interchangeable components and accessories enable you to build your own precision optical system. There's an ideal combination to solve almost any lab measuring, positioning, or observing problem quickly and easily. Our Optical System Selection Chart tells you part of the story. Additional details on all the Gaertner optical instruments shown (plus many others) are contained in our Bulletin 161. Write for a copy of each, plus a General Index of literature covering all Gaertner Instruments. Just ask for an Optical Measuring Information Kit. 3-211



Manufacturers
of **metric**
instrumentation
since 1896

GAERTNER SCIENTIFIC CORPORATION
1218 Wrightwood Ave., Chicago, Ill. 60614
Phone: (312) 281-5335

School students to a questionnaire, that for the median student the word "possibility" in probability estimation had a value of 20 percent (with quartiles of 10 and 50 percent). Thus about half the students thought "possibility" meant 20 percent or less. Cliff (2), in his article "Adverbs as multipliers," found that the multiplying effect of "very" is about 1.25. I have no way of knowing the multiplicative effect of "real," but "decidedly" has a factor of 1.16, "unusually" of 1.28, and "extremely" of 1.45. I personally would consider "decidedly" as similar to "real" in multiplicative effect. This would give as a median estimate $1.16 \times 1.25 \times 20 = 29$ percent (with quartiles of 14 and 73 percent). (A more careful effort would require a transformation that would keep all percentages between 0 and 100.) Is not 29 percent one reasonable summary of the four estimates 2, 10, and 35 percent and "less than even"? If so, the official rhetoric seems to be right in line with the reported probability estimates, at least for the populations studied. I would like to see us much better able to make translations of the sort Boffey tries to make, and to encourage others to inform us of work done in this area of quantifying everyday language.

FREDERICK MOSTELLER
Department of Statistics,
Harvard University,
Cambridge, Massachusetts 02138

References

1. J. Selvidge, "Assigning probabilities to rare events," thesis, Harvard University (1972).
2. N. Cliff, *Psychol. Rev.* **66**, 27 (1959).

Antiviral Agent: Abbott Tests

The article "Chemotherapy: Antiviral agents come of age," by Thomas H. Maugh II (Research News, 9 Apr., p. 128), attributes to some anonymous investigators the suggestion that Abbott Laboratories is not pursuing the investigations of phosphonoacetic acid as actively as it might because "it is not a patented drug, but rather is in the public domain."

We wish Maugh had reviewed these suggestions with us before he reported them in *Science*, particularly in light of the evidence cited below.

The facts are that Abbott Laboratories has been actively investigating phosphonoacetic acid for some time now to establish safety evidence required both by our own scientific standards and by the Food and Drug Administration before clinical testing can be done. Sound animal studies prior to human testing

represent a responsible approach to the development of a potential new therapeutic agent and should not be interpreted as "reluctance" on Abbott's part to undertake clinical studies.

The unjustified conclusion by Maugh and his anonymous "investigators" is also based on a false premise—that phosphonoacetic acid is not a patented drug. Abbott Laboratories does have a *method* patent on this agent covering its use in herpes simplex infections—U.S. Patent No. 3,767,795 (1973). This, too, is a fact which Maugh could—and should—have checked before his article was published.

We believe that Abbott Laboratories has made many significant contributions to virus research and is deserving of more accurate representation.

JOHN H. BIEL

Abbott Laboratories,
Abbott Park,
North Chicago, Illinois 60064

Moral Periodic Table

It is very encouraging to see the interest recently directed to the moral qualities of the element plutonium (News and Comment, 23 Apr., p. 356; Letters, 21 May, p. 738). There is little doubt that the singular properties of this metal as a poison, together with its origin in the nuclear caldron and its unique explosive qualities, justify some moral questions or at least some moralization. But why limit ourselves to the baneful transuranics? We should be grateful to the National Council of Churches for originating the concept of a moral periodic table, to which some further additions suggest themselves. Gold is clearly connected with the most known immoral tendencies and has been accused of being the root of all evil. Sulfur, while good when compounded in sulfa drugs, is clearly evil as a component of pollutants and such obnoxious compounds as mercaptans, and historical tradition gives good reason for supposing elemental sulfur to be the main constituent of Hell. Oxygen, however, is more difficult to rank; it is at once the supporter of Life and the element of Fire. The difficulty is even greater when one considers its allotropic modification, ozone, which is simultaneously a main component of smog and also our sole protection from the carcinogenic effects of solar ultraviolet. Perhaps the Council will issue a ruling on this question.

D. H. DOUGLAS-HAMILTON
39 Pinckney Street,
Boston, Massachusetts 02114



HUMAN SOMATOMEDIN B

a substance which increases DNA-synthesis when added to in vitro cultures of human glial cells.

The Somatomedin B set for radioimunoassay contains :

- 1) Lyophilized powder of 20 μg human Somatomedin B (not less than 90 % purity) and buffer salts for labelling and used as a tracer.
- 2) Lyophilized powder of rabbit antiserum to human Somatomedin B.
- 3) Human reference serum (100 μg Somatomedin B per litre).
- 4) Lyophilized powder of 250 μg lactoperoxidase.
- 5) Price : 1 set 3,920 Skr

AB KABI DIAGNOSTICA



S-104 25 STOCKHOLM SWEDEN

Circle No. 315 on Readers' Service Card

I wish to order set of Somatomedin B. The price is valid fob Stockholm.

Name

Address

.....

Whatman Products.

a new complete catalog

Ninety-two pages of technical information, product descriptions, applications and ordering information on world-famous Whatman products.

Available free of charge on request to:

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



Whatman®

Contents

Section 1 — filtration

	Page
LABORATORY FILTRATION	1-4
QUALITATIVE FILTER PAPERS	1-13
QUANTITATIVE FILTER PAPERS	1-19
GLASS MICROFIBRE® FILTERS	1-23
FILTER AIDS	1-28
EXTRACTION THIMBLES	1-29
INDICATOR AND TEST PAPERS	1-30
GAMMA-12 IN-LINE FILTER UNITS	1-31
LABORATORY FILTER TUBES	1-35
ABSORBENT PAPERS	1-36

Section 2 — chemical separations

	Page
ADVANCED ION EXCHANGE CELLULOSES	2-2
ION EXCHANGE CELLULOSES	2-8
CELLULOSE POWDERS	2-10
TLC MEDIA	2-11
MEDIA FOR PLANAR CHROMATOGRAPHY AND ELECTROPHORESIS	2-12
Paper Chromatography	2-12
Electrophoresis	2-12
Specialized Media	2-13
Ion Exchange Papers	2-20
Adsorbent Paper	2-21
Silicone-Treated Paper	2-21
Glass Microfibre Chromatography Media	2-22
1PS DISPOSABLE PHASE SEPARATORS	2-23

Section 3 — liquid chromatography

	Page
APPLICATIONS	3-3
MEDIA	3-6
Microparticulate Media	3-6
Adsorbents	3-9
Bonded Phase Microparticles	3-9
Partition Media	3-9
Bonded Ion Exchangers	3-9
Pellicular (Superficially Porous) Media	3-10
Adsorbents	3-10
Partition Media	3-10
Pellicular Anion Exchangers	3-11
Pellicular Cation Exchangers	3-11
PREPACKED, PRETESTED COLUMNS	3-12
Type PXS Analytical Prepacked Columns	3-13
Adsorbents	3-13
Bonded Phases	3-13
Magnum 9 Semi-Preparative LC Columns	3-16
HPLC COLUMN KITS	3-18
ACCESSORIES AND SUPPLIES FOR HPLC	3-20
Accessories	3-20
Supplies	3-24
Fittings	3-25

® Registered trademark of Whatman Ltd.

Circle No. 252 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

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, 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 LIVINGSTONE, LYNN MANFIELD, JANET KEGG

Cover Editor: GRAYCE FINGER

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

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.

More Laws, More Complexity

In front of the Archives building in Washington, D.C., is an inscription, "What is past is prologue." This is an especially appropriate motto for a building in a city dominated by lawyers. To them precedent is compelling. Laws once enacted are rarely repealed. The inexorable tendency is to build a more complex structure on the framework already existing.

An example of long-term trends is the evolution of major federal health laws. Since 1935, more than 100 such laws have been enacted. At the beginning of the period the rate of enactment averaged between one and two a year. The laws tended to be simple and brief. With time, this changed.

During the past decade the rate of enactment has increased markedly and the laws tend to be lengthy and complex. A recent draft of a proposed National Health Insurance Act is 200 pages long. The tendency toward complexity is exacerbated by the federal administrative agencies. For the purpose of implementing legislation, the bureaucrats prepare regulations which often far exceed in complexity the legislation passed by Congress.

Individually, most of the laws have laudable goals. But in practice, the administration of the laws never measures up to the good intentions of Congress. Moreover, it is one thing to cope with a single law. It is another to cope with the cumulative effect of more than 100 laws with their often conflicting administrative regulations.

In Washington, as more bills are passed without cleaning out and reorganizing ones that came before, the complexity necessarily grows. Some examples follow.

Subsidies for hospital construction involve different legislation from that for mental health clinics or neighborhood health centers. Provisions for the organized or subsidized payment of medical bills for individuals are scattered among numerous programs geared to different population groups and different diseases.

Even before the many social programs initiated by the Kennedy and Johnson administrations, there were federal or state health programs for veterans, servicemen, servicemen's dependents, Native Americans, merchant seamen, immigrants, and recipients of public assistance or of workmen's compensation benefits; and there were temporary disability insurance, medical rehabilitation services, maternal and child care health services, and school health services.

A number of factors combine to enhance the likelihood of further federal actions. One is an organizational factor. Washington has increased its machinery for the generation of new legislation. It has become a factory for the mass production of more complicated and more numerous laws.

The relationship of Congress to the Administration has changed significantly. In the past, Congress had few staff people who were technical experts and depended on the Executive agencies to provide information. But friction between President Nixon and the Democratic Congress led to a situation in which Congress found it necessary to have more experts on its own staff. Today there are about 17,000 staff people on Capitol Hill, including 218 associated with committees engaged in medicine-related topics. Staff members acquire influence by being useful to their patrons. Any ideas they may have are placed at the disposal of the congressmen. The staff gets much of its feeling of satisfaction from its ability to manipulate behind the scenes, to make things happen, and to create change.

While every politician professes to be a man for all seasons, he is often best equipped for vote-getting. Many committees and subcommittees with special responsibilities in areas such as advanced technology or medicine have not one member with training in the field. The professional staff aides on such committees consequently are in position to do the thinking, the homework, and to a very large degree the decision-making. Today, there exists in Washington a Fifth Estate, invisible but enjoying power derived from preparation of new legislation. More laws and more complexity are in store.—PHILIP H. ABELSON

YOUR NEW BALPLAN[®] CONFERENCE MICROSCOPE...

What it means, and what it is.

It means that up to five people can see the same sharp, quality image they would see in an individual microscope. It means that they can make photomicrographs at the same time. It means faster understanding through a movable, illuminated pointer visible to each person at the same time.

It means more accurate interpretation since each viewer has its own focusing control. And it means retention of all of the details lost in diffused, projected images . . . under normal room lighting situations.

It is the logical extension of Bausch & Lomb's widely-accepted Balplan modular microscope.

You can build the Conference Microscope from your present Balplan . . . or purchase a new Balplan with from one to five viewing heads. These are available in:

- 30° and 45° inclined binocular units
- 30° inclined monocular units
- 30° inclined triocular units (for photomicrography).

All heads are interchangeable.
All may be rotated 360°.

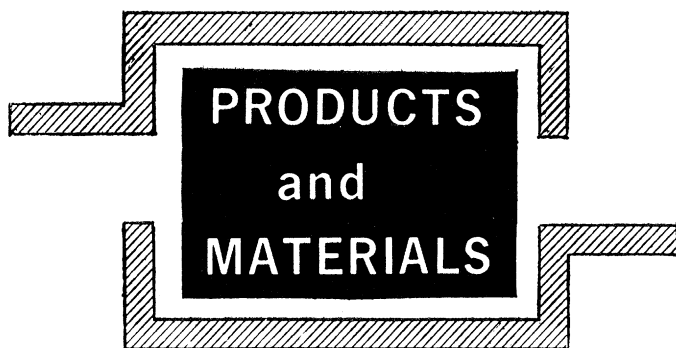
The new Balplan Conference Microscope . . . another innovative change in microscopy from Bausch & Lomb. Write for our catalog and ask for a demonstration. No obligation, of course.



BAUSCH & LOMB
Balplan
MICROSCOPE

Write to Bausch & Lomb, Scientific Optical Products Division, 20706 North Goodman St., Rochester, N. Y. 14602.

Circle No. 287 on Readers' Service Card



Thermographic Color Display

Model 14001 color Quantizer translates the gray tones of a thermogram into ten easily discernible colors. The unit accepts any standard video signal and assigns a different color to each of ten different ranges. The display appears on a 12-inch screen. An optional camera is available for permanent recording. Typically, the thermogram shows differences over a 4-degree spectrum. Thus, differences as small as 0.4 degree may be resolved into different colors. Spectrotherm. Circle 736.

Streak Camera

A new streak camera accommodates streaks to 1.5 centimeters long. Resolution is 12 picoseconds. Streak velocity is 1.5×10^9 centimeters per second. The streak tube includes a channel electron multiplier which is integral with the tube. Hamamatsu. Circle 737.

Flowmeters

Series FM 150 flowmeters have aluminum side and back panels and a heavy, clear plastic window for protection from impact. Models are available for panel mounting which will convert to bench mounting by attaching a stand which includes a spirit level and leveling screws for vertical alignment. These flowmeters have a 150-millimeter Pyrex tube which is fluted for accuracy and reproducibility. Each tube contains two spherical metering floats, one of Pyrex and one of stainless steel. Scientific Gas Products. Circle 740.

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 1282A and 1366A) and placing it in the mailbox. Postage is free.

—RICHARD G. SOMMER

Ultraviolet Laser Mirrors

Reflectors are available for the wavelengths between 1400 and 3000 angstroms. Multilayer dielectric optical coatings are each designed for 1460-angstrom krypton, 1720-angstrom xenon, 1940-angstrom argon fluoride, 2490-angstrom krypton fluoride, and 2930-angstrom ultraviolet laser wavelengths. Direct ultraviolet reflectance measurements at operating wavelength are supplied with each laser coating. Full reflectors and coatings with 2, 10, or 25 percent transmission are standard. Acton Research. Circle 741.

Polyacrylamide Gradient Gel

A preformed polyacrylamide gradient gel, PAA 2/16, has a concave monomer concentration gradient from 2 to 16 percent. It features a protein-fractionation range from 100,000 to 5,000,000 daltons and is useful in separating ribonucleic acids, serum lipoproteins, and haptoglobins. The gel is stable for up to 18 months if refrigerated. Pharmacia Fine Chemicals. Circle 738.

Wafer Scriber

The Accu-Scribe model 6000 will accommodate multiple scribe points and can handle wafers or other substrates up to 4 by 6 inches. The scribe head will hold up to 3 inches of scribes and will hold scribe depths to within ± 0.001 inch with a lockable micrometer head. The rotary stage is accurate to within ± 5 minutes through 360 degrees. The angle of attack is adjustable in either direction at 0, 10, or 20 degrees. Aremco Products. Circle 742.

Scanning Electron Microscope

Model 7 features resolution of 100 angstroms and television scanning over the complete range of magnification from 30 to 120,000 power. Accelerating poten-

tial is 15 kilovolts with a 2-kilovolt option. There is an integral photometer for automatic adjustment of contrast and brightness settings. A tilting-rotating stage allows a 32-millimeter specimen to be examined from every angle. International Scientific Instruments. Circle 735.

Plastic Optical Components

Optical quality plastic lenses, prisms, mirrors, light pipes, and specialty components from 4 to 78 inches are available. Advantages of these components include light weight (45 percent that of glass), high transmittance of visible light (up to 92 percent for 1/4-inch-thick acrylic lenses), resistance to chipping and breakage, reduced mounting cost, and price. Acrylic lenses are available in a variety of configurations. Applied Products. Circle 739.

Literature

Tools for Physiology is a catalog devoted to instruments for kymography, electrophysiology, and various other disciplines. Phipps & Bird. Circle 728.

Hematofluorometer is an instrument that will measure the amount of zinc protoporphyrin in whole blood in 10 seconds. Environmental Sciences Associates. Circle 732.

Plasticware for the Laboratory describes a complete line of laboratory apparatus and containers. Interex. Circle 733.

Deuterated Solvents lists solvents, shift reagents, and reference solvents for nuclear magnetic resonance spectroscopy. Crescent Chemical. Circle 743.

Research Chemicals includes 40,000 listings of organic and inorganic chemicals. Pfaltz & Bauer. Circle 744.

Glassware Washers and their advantages are the subject of a pamphlet. Labconco. Circle 745.

Flowmeters for Industry and the Laboratory includes whole assemblies and replacement parts. Fischer & Porter. Circle 746.

Flexi-Dry Freeze Dryer describes an instrument that is applicable to all freeze-drying techniques. FTS Systems. Circle 747.

Equipment for Reactors, Accelerators, and Laboratories is included in a 1976-77 catalog. Reactor Experiments. Circle 748.

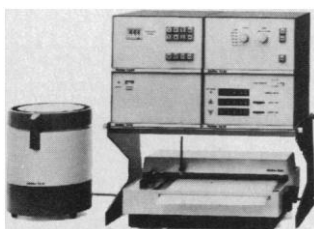
Sonifier Cell Disruptor lists design specification and applications. Branson Sonic Power. Circle 750.

Mettler is instrumental in getting accurate lab results fast.



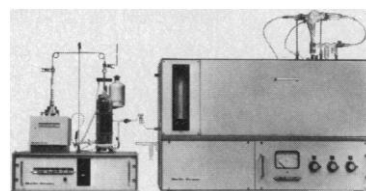
**METTLER/PAAR
DIGITAL DENSITY METERS**

Measure density or specific gravity of liquids or gases without time-consuming, tedious procedures. Mettler density meters will do it in seconds, even with unskilled technicians. No need to determine weight, volume or temperature. Therefore, you eliminate a major source of errors. Measure in range of 0 to 4 g/cm³, from -10°C to +60°C. Available in three models.



**CALORIMETRIC
THERMAL ANALYZER**

Features calorimetric reproducibility of $\pm 0.5\%$ and 0.016 millicalories per second per inch sensitivity. Covers range from -170°C to +550°C with temperature measurement precision of $\pm 0.1^\circ\text{C}$. Noise level is less than ± 1 microcalorie per second. Modular design makes expansion of system convenient.



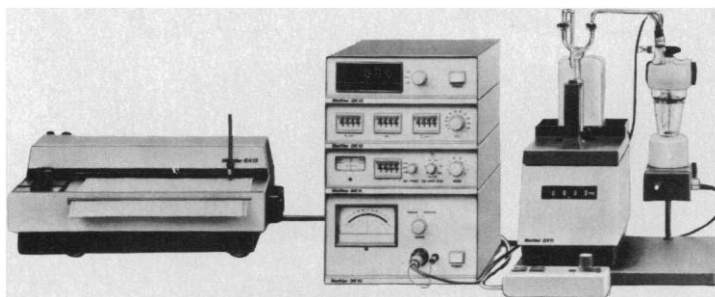
**METTLER/HERAEUS
NITROGEN ANALYZER**

Gives rapid results in determining nitrogen and protein content. Operator able to perform 50 to 60 analyses per day. No calibration or standardization needed. Avoids the lengthy Kjeldahl method. Complies with EPA and OSHA regulations. Cuts operating/sampling costs 25% to 75%. Increases plant productivity and profitability.



**MELTING/SOFTENING
POINT DETERMINATIONS**

Mettler FP series of modular instruments determines exact melting ranges using polarized light thermal microscopy. Provides extremely fast response over the -20°C to +300°C range. Thermal events are digitally displayed. Replaces old ASTM method and Wiley melting point method.



AUTOMATIC TITRATION SYSTEM

All the automatic titration capability you need is in this system. Fixed end point titration, titration curve or first derivative recording, pH stat recording, manual fixed increment titration and manual titration.

Easy to operate. Simple programming controls. Meets all potentiometric needs for aqueous and nonaqueous titrations as well as specific ion applications.

Mettler®

Mettler Instrument Corporation • Box 100 • Princeton, NJ 08540

Circle No. 292 on Readers' Service Card

BOOKS RECEIVED

(Continued from page 1327)

Advances in Bile Acid Research. Papers from a meeting, Freiburg im Breisgau, Germany, June 1974. S. Matern, J. Hackenschmidt, P. Back, and W. Gerok, Eds. Schattauer, Stuttgart, 1975. xx, 448 pp., illus. Paper, DM 58.

Advances in Human Genetics. Vol. 6. Harry Harris and Kurt Hirschhorn, Eds. Plenum, New York, 1976. xvi, 382 pp., illus. \$32.50.

Advances in Magnetic Resonance. Vol. 8. John S. Waugh, Ed. Academic Press, New York, 1976. xii, 266 pp. \$25.50.

Advances in the Study of Behavior. Vol. 6.

Jay S. Rosenblatt, Robert A. Hinde, Evelyn Shaw, and Colin Beer. Academic Press, New York, 1976. xvi, 284 pp., illus. \$19.50.

Aging, Carcinogenesis, and Radiation Biology. The Role of Nucleic Acid Addition Reactions. Proceedings of a conference, Williamsburg, Va., May 1975. Kendrick C. Smith, Ed. Plenum, New York, 1976. xii, 562 pp., illus. \$39.50.

Aldehydes—Photometric Analysis. Vol. 3. Eugene Sawicki and Carole R. Sawicki. Academic Press, New York, 1976. xiv, 342 pp., illus. \$26.75. The Analysis of Organic Materials, vol. 9.

Applied Mechanics: Statics. Charles E. Smith. Wiley, New York, 1976. xiv, 200 pp., illus. \$11.95.

Atlas of the Light Scattering Characteristics of Microparticles. Philip J. Wyatt, Ed. Science Spectrum, Santa Barbara, Calif., 1975. Various pages. \$95.

Atomic Masses and Fundamental Constants 5. Proceedings of a conference, Paris, June 1975. J. H. Sanders and A. H. Wapstra, Eds. Plenum, New York, 1976. xxxiv, 682 pp., illus. \$42.

Basic Electric Circuits. Donald P. Leach. Wiley, New York, ed. 2, 1976. xiv, 638 pp., illus. \$14.95.

BASIC for Everyone. Thomas Worth. Prentice-Hall, Englewood Cliffs, N.J., 1976. xii, 350 pp., illus. Paper, \$8.95.

The Biology of Parasitic Spirochetes. Papers from a symposium, Minneapolis, June 1975. Russell C. Johnson, Ed. Academic Press, New York, 1976. xiv, 402 pp., illus. \$18.50.

Blood Vessels. W. J. Cliff. Cambridge University Press, New York, 1976. x, 214 pp., illus. \$25. Biological Structure and Function, 6.

The Bosch Book of the Motor Car. Its Evolution and Engineering Development. John Day. Illustrated by Barry Rowe. St. Martin, New York, 1976. 256 pp. \$15.

Brain Hypoxia; Pain. Proceedings of a meeting, Heidelberg, Germany, May 1975. H. Penzholtz, M. Brock, J. Hamer, M. Klinger, and O. Spoerri, Eds. Springer-Verlag, New York, 1975. xx, 462 pp., illus. Paper, \$33.70. Advances in Neurosurgery 3.

The California Nuclear Initiative. Analysis and Discussion of the Issues. W. C. Reynolds, Ed. Stanford University Institute for Energy Studies, Stanford, Calif., 1976. xviii, 220 pp. Paper, \$3.50.

Clinical Anatomy and Physiology for Allied Health Sciences. Paul D. Anderson. Illustrated by Gayanne DeVry. Saunders, Philadelphia, 1976. vi, 486 pp. \$11.50.

Clinical Pharmacology of Anti-Epileptic Drugs. Proceedings of a symposium, Bethel, Bielefeld, Germany, May 1974. H. Schneider, D. Janz, C. Gardner-Thorpe, H. Meinardi, and A. L. Sherwin, Eds. Springer-Verlag, New York, 1975. xii, 372 pp., illus. \$49.50.

Colloid Formation and Growth. A Chemical Kinetics Approach. Julian Heicklen. Academic Press, New York, 1976. xx, 132 pp., illus. \$14.50.

Concepts of Ecology. Edward J. Kormondy. Prentice-Hall, Englewood Cliffs, N.J., ed. 2, 1976. xiv, 238 pp., illus. Cloth, \$9.95; paper, \$5.95. Prentice-Hall Biological Sciences Series.

Concrete Technology. Vol. 3. Properties and Testing of Aggregates. D. F. Orchard. Halsted (Wiley), New York, ed. 3, 1976. xiv, 282 pp., illus. \$32.50.

Contemporary Organic Chemistry. Andrew L. Ternay, Jr. Saunders, Philadelphia, 1976. xx, 994 pp., illus. + appendix + index. \$20.75. Student Guide and Solutions Manual. Robert F. Francis. vi, 442 pp., illus. Paper, \$5.95. Saunders Golden Sunburst Series.

Crystals, X-rays and Proteins. Dennis Sherwood. Halsted (Wiley), New York, 1976. xxii, 702 pp., illus. \$35.

DeFunis v. Odegaard. Race, Merit, and the Fourteenth Amendment. Ivor Kraft. Uncommon Lawyers Workshop, Sacramento, Calif., 1976 (available from the author, California State University, 6000 Jay St., Sacramento). 228 pp. Paper.

Ecological Toxicology Research. Effects of Heavy Metal and Organohalogen Compounds. Proceedings of a conference, Mont Gabriel, Quebec, Canada, May 1974. A. D.

Anyway you shake it... we make it

Gyrate, reciprocate, aerate and incubate! Just about every conceivable shaking requirement can be satisfied by NBS. Select from a full range of shaking equipment: water bath and incubator shakers, Gyrotory, reciprocating and twist-action shakers. You'll find them all in the most extensive shaker catalog ever published.

Send for Catalog CS-S/676

W8 Twist-Action Shaker

G86 Gyrotory Water Bath Shaker

G24 Bench-top Incubator Shaker

G2 Portable Gyrotory Shaker

G10 General Purpose Shaker

NEW BRUNSWICK SCIENTIFIC CO., INC.
1130 Somerset Street, New Brunswick, N.J. 08903 • 201/846-4600
With NBS, Advanced Technology is a Way of Life.

FOOD

Politics, Economics, Nutrition, and Research

For the past few years, there have been serious shortfalls in world food production and distribution. This, along with soaring agricultural prices, has posed some vital questions which demand answers.

These complex issues—and some solutions—are a major topic in this important new compendium.

Edited and with a foreword by Philip H. Abelson.

Price: \$12.95 (\$11.95 Members' Price) Casebound
\$4.95 (\$4.45 Members' Price) Paperbound

Order
From:



AAAS, DEPT. FC-4
1515 MASSACHUSETTS AVE., NW
WASHINGTON, D.C. 20005

Nothing's lost in Translation

Up To:	
L-Methionine, [³⁵S]— NEG-009H	600Ci/mmol
L-Leucine, [3,4,5-³H(N)]— NET-460	100Ci/mmol
L-Lysine, [4,5-³H(N)]— NET-376	80Ci/mmol
L-Phenylalanine, [ring-2,6-³H(N)]— NET-493	60Ci/mmol
L-Isoleucine, [4,5-³H(N)]— NET-372	105Ci/mmol
L-Proline, [2,3,4,5-³H(N)]— NET-483	80Ci/mmol
L-Tyrosine, [ring-2,6-³H(N)]— NET-444	50Ci/mmol
L-Tryptophan [side chain-2,3-³H(N)]— NET-495	20Ci/mmol

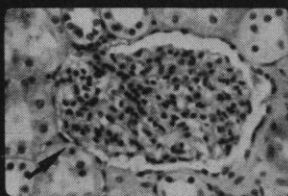


New England Nuclear

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

NEN Canada Ltd., Lachine, Quebec, NEN Chemicals GmbH, Dreierchenhain, W. Germany

Circle No. 259 on Readers' Service Card



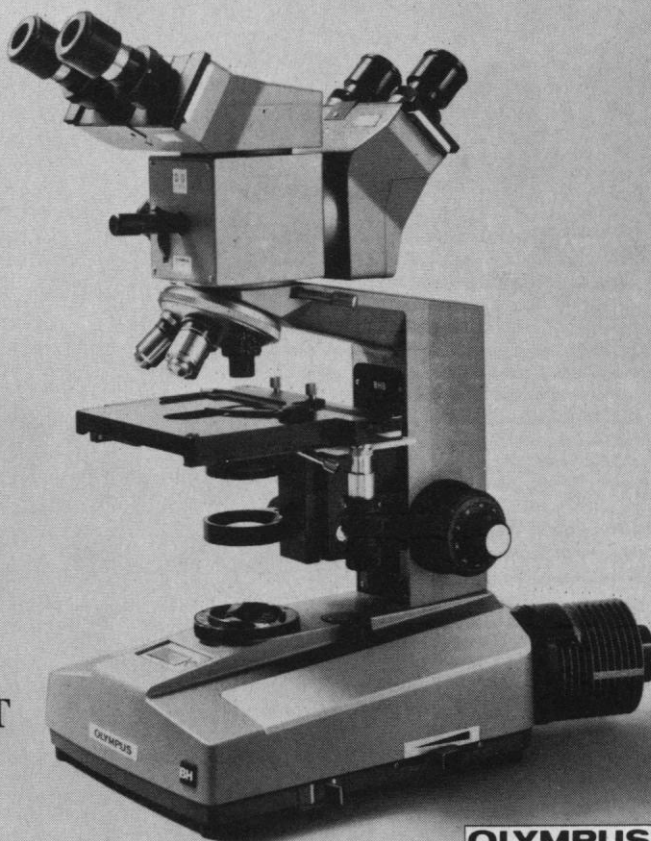
Kidney: Glomerulus.

While it may appear to the naked eye that all dual observation microscopes are alike, they're not: Olympus makes the difference.

The BH-DO proves it: all the precision and quality features you need are in an easy to use comfortable unit. A joy stick operated, illuminated arrowhead pin points specimen detail and lever-operated yellow and green filters swing in to enhance the pointer contrast. The dual observation assembly rotates through 360°. Individual focusing and interpupillary adjustments are on both tubes. Combining the BH-DO with the Olympus PM-10 camera provides a permanent photomicrographic record of your observations. So whether your needs are in the lab or in the classroom, the Olympus BH-DO microscope is made for you.

Write: Olympus Corporation of America, 2 Nevada Dr., New Hyde Park, N.Y. 11040. In Canada: W. Carson Co., Ltd., 321 Don Park Rd., Markham, Ontario, L3R, 1C2, Canada.

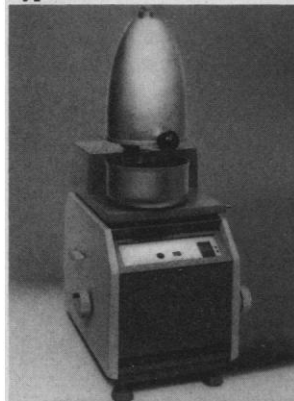
**ONE SINGLE STARTLING
OBSERVATION ON THE SUBJECT
OF DUAL OBSERVATION
MICROSCOPES: OLYMPUS.**



OLYMPUS
SEEING BEYOND MAN'S VISION

Precision balances and weighing systems by SAUTER.

**Precision Balance
Type MPR**



**Precision Balance
Type MM 160**



**Electronic Precision Balance
Type K 1200/K 12**



**Precision Balance
Type SM 1600**



**Analytical Balance
Type 404/13**



**Electronic Precision Balance
Type R 300/R 3000**

SAUTER balances have earned a reputation for ease of operation, economy and practical technology. No wonder SAUTER balances are the choice in research and development laboratories, in industry and scientific institutions just about everywhere.

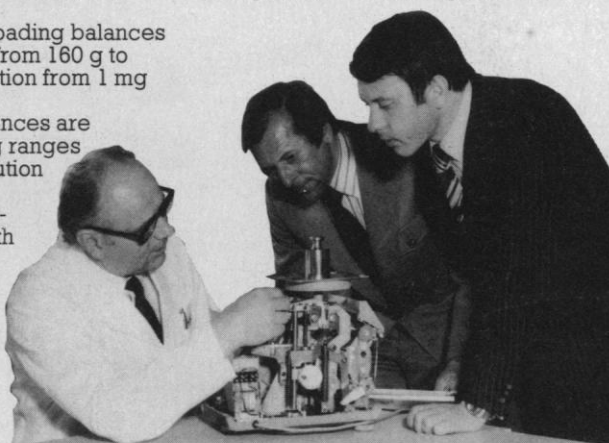
SAUTER precision toploading balances have weighing ranges from 160 g to 10 kg and more. Resolution from 1 mg to 1 g.

SAUTER-analytical balances are available with weighing ranges of 100 and 200 g. Resolution of 0.01 mg of 0.1 mg.

Electronic precision balances are available with weighing ranges of 120 g, 300 g, 1200 g, 3000 g, 12 kg and 120 kg.

Shown here is but a small sample of the complete SAUTER line affording high accuracy in weighing ranges from a few grams up a ton.

Please write and let us help solve your particular balance problems.



SAUTER

August Sauter of America,
80 Fifth Ave., New York, N. Y. 10011.

McIntyre and C. F. Mills, Eds. Plenum, New York, 1975. xii, 324 pp., illus. \$25. Environmental Science Research, vol. 7.

Econometrics. Peter Schmidt. Dekker, New York, 1976. viii, 270 pp. \$19.50. Statistics, vol. 18.

Energy Resources and Supply. J. T. McMullan, R. Morgan, and R. B. Murray. Wiley-Interscience, New York, 1976. xii, 508 pp., illus. \$29.95.

The Eruption and Occlusion of Teeth. Proceedings of a symposium, Bristol, England, Apr. 1975. D. F. G. Poole and M. V. Stack, Eds. Butterworths, Boston, 1976. xiv, 316 pp., illus. \$37.95.

Experiments in Sociology. Dwight G. Dean and Donald M. Valdes. Prentice-Hall, Englewood Cliffs, N.J., ed. 3, 1976. iv, 156 pp. Paper, \$5.75.

The Facts of Life. An Essay in Feelings, Facts, and Fantasy. R. D. Laing. Pantheon (Random), New York, 1976. xii, 156 pp. \$7.95.

Fine Particles. Aerosol Generation, Measurement, Sampling, and Analysis. Proceedings of a symposium, Minneapolis, May 1975. Benjamin Y. H. Liu, Ed. Academic Press, New York, 1976. xiv, 838 pp., illus. \$34.50.

The Force of Knowledge. The Scientific Dimension of Society. John Ziman. Cambridge University Press, New York, 1976. x, 374 pp., illus. \$15.95.

Fourier Analysis of Time Series. An Introduction. Peter Bloomfield. Wiley, New York, 1976. xiv, 258 pp., illus. \$18.95. Wiley Series in Probability and Mathematical Statistics.

Gradient Optimization and Nonlinear Control. Lawrence Hasdorff. Wiley-Interscience, New York, 1976. xvi, 264 pp., illus. \$19.50.

Health Care Delivery Systems. Evaluation Criteria. J. W. LaPatra. Thomas, Springfield, Ill., 1975. xiv, 358 pp., illus. \$21.50.

Heredity, Evolution, and Society. I. Michael Lerner and William J. Libby. Freeman, San Francisco, ed. 2, 1976. xxii, 432 pp., illus. \$13.95.

High Life Expectancy on the Island of Paros, Greece. Jeff Beaubier. Philosophical Library, New York, 1976. xvi, 144 pp. \$10.

Host Defense against Cancer and Its Potentiation. Proceedings of a symposium, Tokyo, 1975. Den'ichi Mizuno, Goro Chihara, Fumiko Fukuoka, Tadashi Yamamoto, and Yuichi Yamamura, Eds. University Park Press, Baltimore, 1975. xviii, 446 pp., illus. \$42.50.

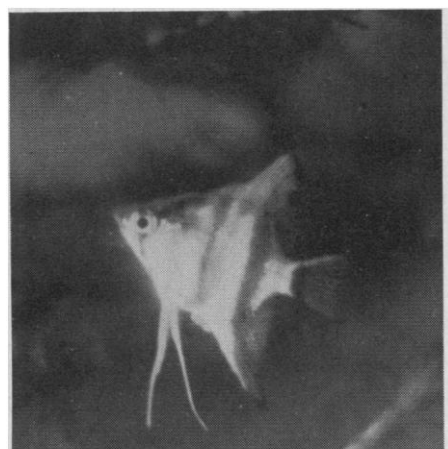
The Hot-Blooded Dinosaurs. A Revolution in Palaeontology. Adrian J. Desmond. Dial, New York, 1976. 238 pp., illus. \$12.95.

How to Save Gasoline. Public Policy Alternatives for the Automobile. Sorrel Wildhorn, Burke K. Burright, John H. Enns, and Thomas F. Kirkwood. Ballinger (Lippincott), Cambridge, Mass., 1976. xxiv, 328 pp., illus. \$17.50.

How to Troubleshoot and Repair Your Stereo System. Hershah Gardner. Reston (Prentice-Hall), Reston, Va., 1976. x, 240 pp., illus. \$14.95.

Human Development. Grace J. Craig. Prentice-Hall, Englewood Cliffs, N.J., 1976. xii, 498 pp., illus. \$12.95.

Human Origins. Louis Leakey and the East African Evidence. Glynn Ll. Isaac and Elizabeth R. McCown, Eds. Benjamin, Menlo Park, Calif., 1976. xiv, 592 pp., illus. Cloth, \$17.95; paper, \$10. Society for the Study of Human Evolution. Perspectives on Human Evolution, vol. 3. W. A. Benjamin Series in Anthropology. A Staples Press Book.



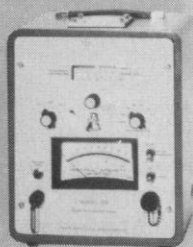
HE DEPENDS ON LIGHT

So do plants and other living things. That's why the ISCO Model SR Spectroradiometer is so important in the study of life processes. Portable, self-contained and operable from AC line or its internal batteries, the SR is practical for both field and laboratory applications.

The entire spectrum from 380 to 1350 nm is scanned continuously by simply turning a knob. Because the SR has true cosine response, there is no need for precise aiming. All incident light is measured, and the meter reads spectral intensity directly. A built-in sensor as well as a fiber optic remote probe obtain readings from otherwise inaccessible locations.

A programmed scanning recorder is available as an accessory to turn the instrument on and plot a continuous spectral intensity vs. wavelength curve at predetermined intervals.

**ISCO
Model SR**



The new ISCO catalog shows a number of instrumentation systems for the life scientist. Send for your copy today.



Box 5347

Lincoln, Nebraska
Phone (402) 464-0231

RESEARCH NEWS

(Continued from page 1324)

data. The same sort of impact on optical spectroscopy is forecast by adherents of coherent optical transients. Recently, in fact, Richard Brewer and Stephen Grossman of the IBM Research Laboratory, San Jose, California, have obtained Doppler-free spectra with the aid of an on-line computer with a fast Fourier transform algorithm to convert transient signals from the time domain to normal spectra in the frequency domain. The experimenters were able to simultaneously resolve several closely spaced spectral lines and map out coherent transients for each line.

There is a wide variety of coherent transient effects whose ability to distinguish between collisional processes derives from the fact that each decays at a different rate because each is sensitive to a different dephasing process that disrupts the perfect coherence induced in the gas by the coherent laser light.

For example, when coherent light from a laser at the frequency for resonant absorption is suddenly turned on, the quantum mechanical wave functions of each particle in a collection of atoms or molecules evolve together in time—that is, in phase. They change gradually from the wave function of the lower state to that of the upper state of the transition (absorption) and back again (stimulated emission) at a rate that increases with the intensity of the laser. In between, the wave functions are a combination of both upper and lower state waves. Thus, when all the wave functions evolve together in step, the observer sees an oscillating absorption and emission known as optical nutation.

The oscillation would persist in time if it were not for collisions. Both elastic and inelastic collisions interrupt the evolution of the wave functions with time thus forcing them out of step with each other and causing a destructive interference effect owing to their now different phases. The magnitude of the optical nutation therefore decays with time, and the nature of the decay carries information about the collisions causing it.

A special optical nutation experiment, called delayed nutation, depends only on inelastic collisions. To obtain information about elastic collisions, researchers need to measure a phenomenon called a photon echo, which depends on both types of collisions. The two experiments together, therefore, are able to separate the inelastic from the elastic collisions and give information on each separately.

In photon echoes, a very short, intense



**Cool
Counts
from
Hot
Blood**

Counting tritiated blood samples larger than 100 μ l has been a problem owing to severe color quenching by the samples and chemical quenching by the reagents. These problems can now be overcome.

In a procedure recently developed at NEN's LSC Applications Laboratory, up to 1.0ml of whole blood can be incorporated without these problems, at the same time yielding tritium counting efficiencies which are quite reasonable. PROTOSOL® is the solubilizer and BIOFLUOR™ Cocktail is the scintillator.

If this procedure would be helpful to you in your work, ask for LSC Applications Note #2: *Preparation of Whole Blood for LSC*, by Dr. Yutaka Kobayashi.

NEN New England Nuclear
549 Albany Street, Boston, Mass. 02118
Customer Service 617-482-9595

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

Circle No. 238 on Readers' Service Card

laser pulse is applied to the sample; a certain short time passes; a second pulse is applied; another short time equal to the time between pulses passes, at which point the sample spontaneously emits a pulse of light in the direction of the previously applied laser pulses—the echo.

Collisions enter the picture during the time between laser pulses. Because of the previously described dephasing effects due to collisions, the strength of the echo becomes progressively smaller the longer the waiting time between pulses. The decay in the intensity of the photon echo that occurs with different time be-

tween pulses thus contains information about the collisions involved.

Although pulsed laser light can be used to observe some coherent transient effects, many researchers feel that the experiments have been generally difficult and some effects not even observable. About 5 years ago at IBM, Brewer and Richard Shoemaker (now at the University of Arizona) introduced a technique called Stark switching that solved some of the difficulties for infrared transients. Molecules with a permanent electric dipole moment, when subjected to an electric field, experience a shift in the

energies of their quantum states (Stark shift).

Thus, instead of pulsing a laser, researchers can elicit any of the coherent transient effects by using a continuous wave (cw) laser. The proper sequence of voltage pulses, which are easier to control than laser pulses, applied to the sample shifts the energy levels into and out of resonance with the laser. Since the intensity of the laser does not change, the only transient effect present is that due to the coherent effect under study. And because light emitted by particles after a voltage pulse has a different frequency than the laser, a vastly increased sensitivity can be obtained by means of frequency mixing (heterodyning) the laser light and the frequency-shifted light produced in certain transient effects, such as the photon echo.

Not all molecules have permanent electric dipole moments, however. Recently, Brewer and Azriel Genack at IBM reported on a technique called frequency switching, which will make experiments with coherent optical transients much easier and enlarge their range of applicability. The researchers used a tunable dye laser with an electro-optic crystal in the laser cavity. An electric field applied to the crystal determines its index of refraction, which in turn controls the frequency of the laser. With a sequence of low voltage pulses applied to the electrooptic crystal, the laser can be driven into and out of resonance with the atoms or molecules in the sample.

Certain results on methyl fluoride, which has a large electric dipole moment and therefore is well suited to study by the Stark-switching technique, illustrate the usefulness of the coherent transient techniques. Brewer and Joel Levy at IBM in collaboration with Paul Berman of New York University found that elastic collisions of methyl fluoride with itself are due to velocity-changing collisions in which the characteristic velocity jump is only 85 centimeters per second, or about 0.2 percent of the average thermal velocity! They also found the total elastic cross section to be large and comparable to that for inelastic collisions. And Brewer and Grossman, with the Fourier transform technique, were able to measure the velocity dependence of the photon echo decay rate by Stark-switching different velocity groups from the Doppler profile into resonance with their carbon dioxide laser. With this information, the researchers were able to deduce the form of the intermolecular force law (such as dipole-dipole or van der Waals interaction) for each type of collision.—ARTHUR L. ROBINSON

You'll still be using this water bath shaker after others have come and gone

Originally introduced 25 years ago, the G76 is still being made to the same precision standards which have assured its continued acceptance as a dependable research tool. A triple-eccentric drive transmission imparts smooth, uniform agitation in a wide range of speeds for applications which require continuous operation, 24 hours a day, day-in and day-out. Precise controls assure reproducible conditions of temperature and agitation. The G76 is the workhorse of laboratory water bath shakers—thousands in use today and every day. If you need dependable performance rely on NBS.



Send for
New 40 Page
Catalog
G76S/676



NEW BRUNSWICK SCIENTIFIC CO., INC.
1130 Somerset Street, New Brunswick, N.J. 08903 • 201/846-4600
With NBS, Advanced Technology is a Way of Life.