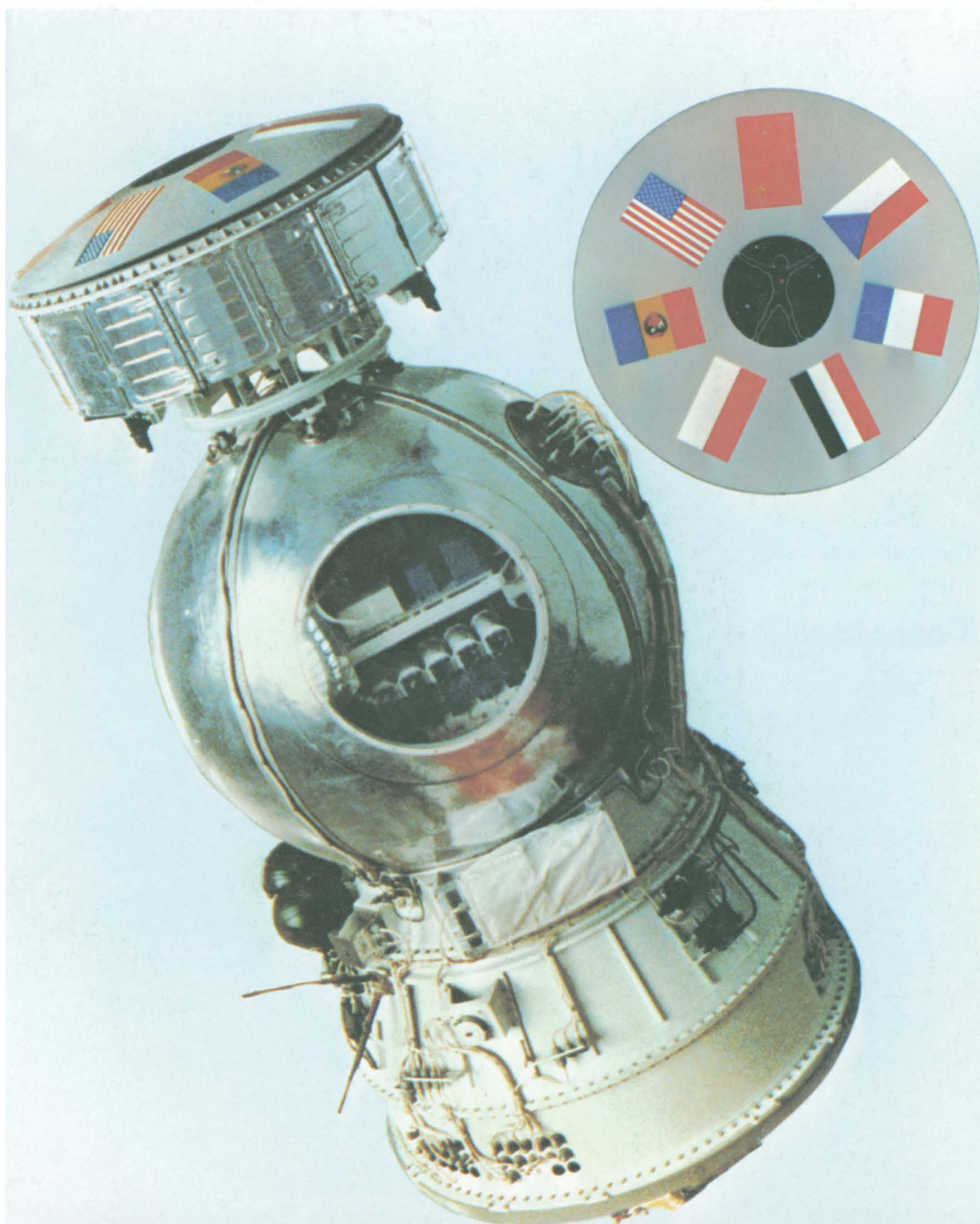


22 September 1978 • Vol. 201 • No. 4361

\$1.50

SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

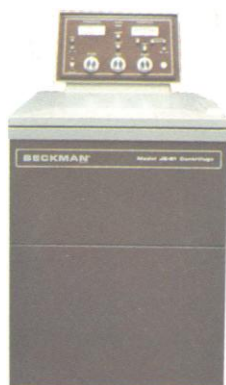




Announcing the Beckman J2-21... a centrifuge you'll love.

The J2-21 is an exciting new high-speed centrifuge. It keeps the components that made the 21,000-rpm J-21C so reliable—and adds proven features from other Beckman centrifuges. The result: by far the finest high-speed centrifuge ever built.

The J2-21 features: a fast-accelerating, high-torque drive; variable power-braking system; superior sound suppression; easy temperature setting; new, automatic vacuum system; rotor imbalance detector; easy-opening counterbalanced door; compact cabinet; built-in speed calibration; 2°



to 40°C operation; electronic door interlock; and it is UL listed and CSA approved.

There are eleven J2-21 rotors to choose from, including the new JA-17 which spins fourteen 50-ml tubes, and the new JA-20.1 which spins thirty-two 15-ml tubes.

The J2-21: it gives you reliability, quiet efficiency unmatched by any other centrifuge, and it's backed by Beckman sales and service—worldwide.

Send for brochure SB-366 to Beckman Instruments, Inc., Spinco Division, 1117 California Ave., Palo Alto, CA 94304.

BECKMAN®

Circle No. 73 on Readers' Service Card

at home in your lab

For 3500 years all the glass made by man was "soft." Then, in 1915, Corning originated the hard, borosilicate glass used in PYREX® ware for home and lab.

Corning also originated the LIFETIME RED® that enhances readability, class A precision borosilicate flasks, and PYREX low actinic flasks.

PYREX® and LIFETIME RED® are registered trademarks of Corning Glass Works.

PYREX®

ONLY FROM CORNING



SCIENCE

LETTERS	Lovins on Energy Costs: <i>A. B. Lovins</i> ; Light on the Shroud?: <i>R. A. Gorkin</i> ; Solar Energy: Ignored Predictions: <i>B. L. Welch</i> ; The Need for Materials: <i>R. C. Wingerson</i>	1077
EDITORIAL	Engineering Technology: New International Role: <i>L. L. Barrell</i> and <i>K. N. Rao</i>	1083
ARTICLES	Complex Iron Smelting and Prehistoric Culture in Tanzania: <i>P. Schmidt</i> and <i>D. H. Avery</i>	1085
	Genetic Improvement of Wild Fish Populations: <i>R. Moav</i> , <i>T. Brody</i> , <i>G. Hulata</i>	1090
	Research Involving Human Subjects: <i>B. H. Gray</i> , <i>R. A. Cooke</i> , <i>A. S. Tannenbaum</i>	1094
NEWS AND COMMENT	Technology Creep and the Arms Race: ICBM Problem a Sleeper	1102
	Defense Scientists Differ on Nuclear Stockpile Testing.	1105
	California Court Is Forum for Latest Round in IQ Debate	1106
RESEARCH NEWS	Acoustic Microscopy: A New Window to the World of the Small	1110
	Microelectronics: Defense Department Looks to the 1980's	1112
BOOK REVIEWS	Soviet Science, reviewed by <i>J. Ziman</i> ; Cooperative Equilibria in Physical Biochemistry, <i>M. T. Record, Jr.</i> ; The Hypothalamus, <i>R. E. Zigmond</i> ; Books Received	1115
REPORTS	Silicate Spherules from Deep-Sea Sediments: Confirmation of Extraterrestrial Origin: <i>R. Ganapathy</i> , <i>D. E. Brownlee</i> , <i>P. W. Hodge</i>	1119

BOARD OF DIRECTORS

EMILIO Q. DADDARIO
 Retiring President, Chairman

EDWARD E. DAVID, JR.
 President

KENNETH E. BOULDING
 President-Elect

ELOISE E. CLARK
 MARTIN M. CUMMINGS

RENÉE C. FOX
 BERNARD GIFFORD

CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)
 Mark Kac
 Ronald Graham

PHYSICS (B)
 D. Allan Bromley
 Rolf M. Sinclair

CHEMISTRY (C)
 William E. McEwen
 William L. Jolly

ASTRONOMY (D)
 Paul W. Hodge
 Donat G. Wentzel

PSYCHOLOGY (J)
 Brenda Milner
 Meredith P. Crawford

SOCIAL AND ECONOMIC SCIENCES (K)
 Kurt W. Back
 Gillian Lindt

HISTORY AND PHILOSOPHY OF SCIENCE (L)
 Robert S. Cohen
 Diana L. Hall

ENGINEERING (M)
 Robert B. Beckmann
 Donald E. Marlowe

EDUCATION (Q)
 Marjorie H. Gardner
 James T. Robinson

DENTISTRY (R)
 Sholom Pearlman
 John Termine

PHARMACEUTICAL SCIENCES (S)
 John G. Wagner
 Raymond Jang

INFORMATION, COMPUTING, AND COMMUNICATION (T)
 Eugene Garfield
 Madeline M. Henderson

DIVISIONS

ALASKA DIVISION

Donald H. Rosenberg
 President

Keith B. Mather
 Executive Secretary

PACIFIC DIVISION

Glenn C. Lewis
 President

Alan E. Leviton
 Secretary-Treasurer

SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

James W. O'Leary
 President

Lora M. Shields
 Executive Officer

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

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Crystal Chemistry of Silicon–Oxygen Bonds at High Pressure: Implications for the Earth's Mantle Mineralogy: <i>R. M. Hazen and L. W. Finger</i>	1122
Localization of Inorganic Phosphate in the Pancreatic B Cell and Its Loss on Glucose Stimulation: <i>N. Freinkel et al.</i>	1124
Mitochondrial Thyroid Hormone Receptor: Localization and Physiological Significance: <i>K. Sterling et al.</i>	1126
The Fanconi Syndrome in Basenji Dogs: A New Model for Renal Transport Defects: <i>K. C. Bovee et al.</i>	1129
Molecular Conformation of a Halogen-Free Thyroxine Analog: 4'-Methoxy-3,5,3'-trimethyl-L-thyronine <i>N</i> -Acetyl Ethyl Ester: <i>V. Cody</i>	1131
Rod-Cone Dysplasia in Irish Setters: A Defect in Cyclic GMP Metabolism in Visual Cells: <i>G. Aguirre et al.</i>	1133
Absciscic Acid Induces Formation of Floating Leaves in the Heterophyllous Aquatic Angiosperm <i>Potamogeton nodosus</i> : <i>L. W. J. Anderson</i>	1135
Inhibition of Bone Formation During Space Flight: <i>E. R. Morey and D. J. Baylink</i>	1138
Enhancement of Oncogenesis in C3H/10T1/2 Mouse Embryo Cell Cultures by Saccharin: <i>S. Mondal, D. W. Brankow, C. Heidelberger</i>	1141
Secretion in Mast Cells Induced by Calcium Entrapped Within Phospholipid Vesicles: <i>T. C. Theoharides and W. W. Douglas</i>	1143
Writing, Dictating, and Speaking Letters: <i>J. D. Gould and S. J. Boies</i>	1145
Particle Capture by a Pacific Brittle Star: Experimental Test of the Aerosol Suspension Feeding Model: <i>M. LaBarbera</i>	1147
Infantile Stimulation Induces Brain Lateralization in Rats: <i>V. H. Denenberg et al.</i>	1150
Technical Comments: Parthenogenetic Lizards: <i>P. E. Vanzolini; J. W. Wright; C. J. Cole; O. Cuellar</i>	1152
PRODUCTS AND MATERIALS	
Fiber-Optic Illumination System; Blood Analyzer; Water Analyzer; Electrocardiogram and Blood Pressure Simulator; Microprocessor-Controlled Dispenser; Electron Microscope; Anaerobic Chamber; Cabinets for Analysis of Fluorescence; Microscope Camera Attachment; Literature	1156

MIKE MC CORMACK
FREDERICK MOSTELLER

RUSSELL W. PETERSON
CHEN NING YANG

WILLIAM T. GOLDEN
Treasurer

WILLIAM D. CAREY
Executive Officer

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

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

STATISTICS (U)
Samuel W. Greenhouse
Ezra Glaser

BIOLOGICAL SCIENCES (G)
Ursula K. Abbott
Walter Chavin

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

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

ANTHROPOLOGY (H)
June Helm
Priscilla Reining

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

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

COVER

Soviet spacecraft Cosmos 782, a sphere 8 feet in diameter with service and battery modules attached, was launched 25 November 1975 and was the first Soviet spacecraft to contain U.S. experiments. Flags of the seven countries which participated in this mission (United States, U.S.S.R., Czechoslovakia, France, Hungary, Poland, and Rumania) are displayed on top of the spacecraft. The main objective of the mission was to determine effects of space flight on a variety of animals, plants, and insects. See page 1138. [R. Mah, Soviet Space Museum]

The American Association for the Advancement of Science was founded in 1848 and incorporated in 1874. Its objects are to further the work of scientists, to facilitate cooperation among them, to foster scientific freedom and responsibility, to improve the effectiveness of science in the promotion of human welfare, and to increase public understanding and appreciation of the importance and promise of the methods of science in human progress.

"Perhaps the most ingenious and effective electrophoretic method for separating proteins is electrofocusing." Lehninger, Biochemistry, 2nd. Ed., Worth, 1975.

Electrofocusing gives you fast, one-step separation of multi-protein mixtures.

Superior resolution.

More information. A

few of the reasons why electrofocusing is the fastest-growing technique in protein separation.

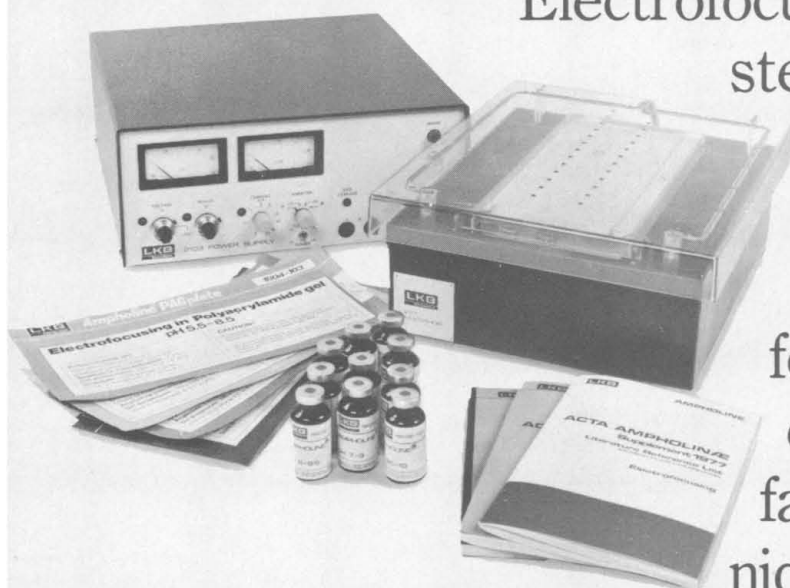
And why you should find out more about electrofocusing and what it can do for your separations.

The one to ask is the company that started it all. The company with the complete system for electrofocusing. LKB. For our special electrofocusing literature, please contact your nearest LKB office.

LKB Instruments Inc., 12221 Parklawn Drive, Rockville, Md. 20852; (301) 881-2510; Telex: 89-682.

LKB

SCIENCE, VOL. 201

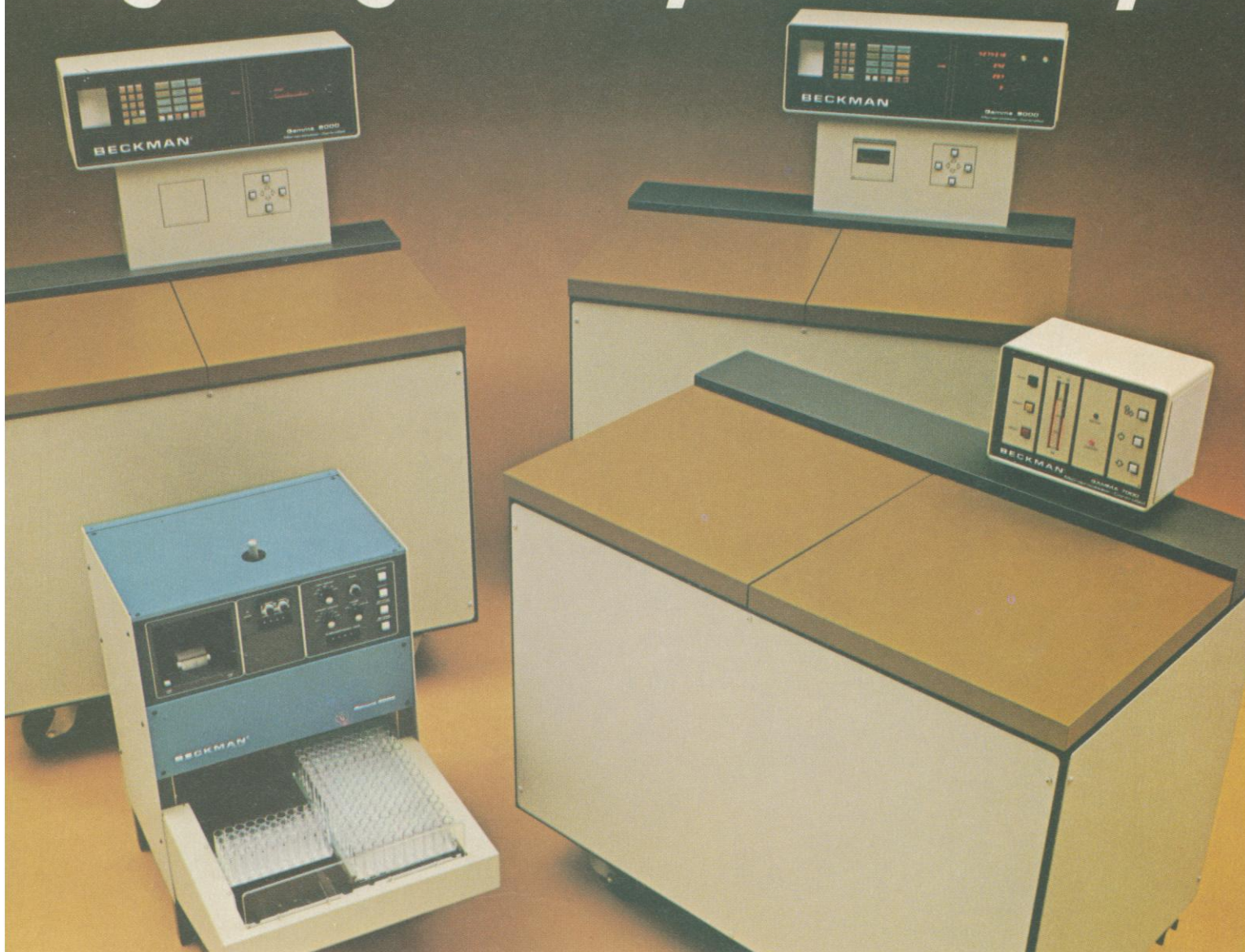


The resolving power of electrofocusing gives you more information because you can separate — in a single run — components which differ in pI by as little as 0.0025 pH units. It is thus suitable for differentiating closely related molecules and is a rigid test of homogeneity for preparation and analysis. This has spurred the rapid growth of electrofocusing as a major technique in biochemistry. To obtain all that electrofocusing promises LKB offers its complete system: Multiphor, for analytical and preparative electrofocusing; LKB Power Supply, with the constant-power output essential for electrofocusing; Ampholine® carrier ampholytes and Ampholine® PAGplates — your standards for electrofocusing. All supported by Application Notes and *Acta Ampholinae* Literature Reference List.

LKB: the only complete source of experience, knowledge, and equipment for electrofocusing.

Circle No. 23 on Readers' Service Card

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



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

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

The Gamma 7000 is micro-processor controlled and offers high

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

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

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

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

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

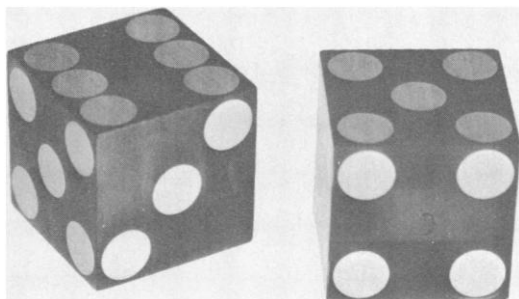
Contact Scientific Instruments Division, Beckman Instruments, Inc., P.O. Box C-19600, Irvine, CA 92713.

Innovation you can count on

Circle No. 44 on Readers' Service Card

BECKMAN®

THE ENERGY GAME!



We all have to play—
but can anyone win?

The energy game is a highly competitive, very expensive gamble. Nature supplies the basic resources, but technology determines their uses. Societies demand more and more; national economies may falter; governments may topple. Is there a technological fix?

ENERGY: Who is going to win the game?

No one can predict the outcome of the game, but two publications from AAAS can help you understand the ground rules and introduce you to the players.

Energy: Use, Conservation and Supply

(Volume II—1978)

An all-new Energy Compendium published by AAAS. ENERGY-II contains a completely new set of articles dealing with energy conservation and public policy, our remaining supply of fossil fuels, the possible transition to fission, fusion, and/or solar technologies, and an extensive analysis of the present domestic and international energy-use patterns. Available now.

***Retail price:**

\$14.00 (casebound)
6.00 (paperbound)

(Volume I—1974)

Published in 1974, ENERGY-I gives the reader a historical and general overview of our energy problem and examines ways to conserve energy and use it more efficiently, not only in industry but on an individual level. The book examines the problems we face in supplying the energy requirements for food production and reviews known energy sources in relation to current and future energy needs. Available now.

***Retail price:**

\$10.00 (casebound)
3.50 (paperbound)

**Special Combination Price for both
Energy Volume I & Volume II**

***Retail price:**

\$22.00 (casebound)
8.00 (paperbound)

.....
Since you, too, have to play . . . order your copies now and learn the rules.

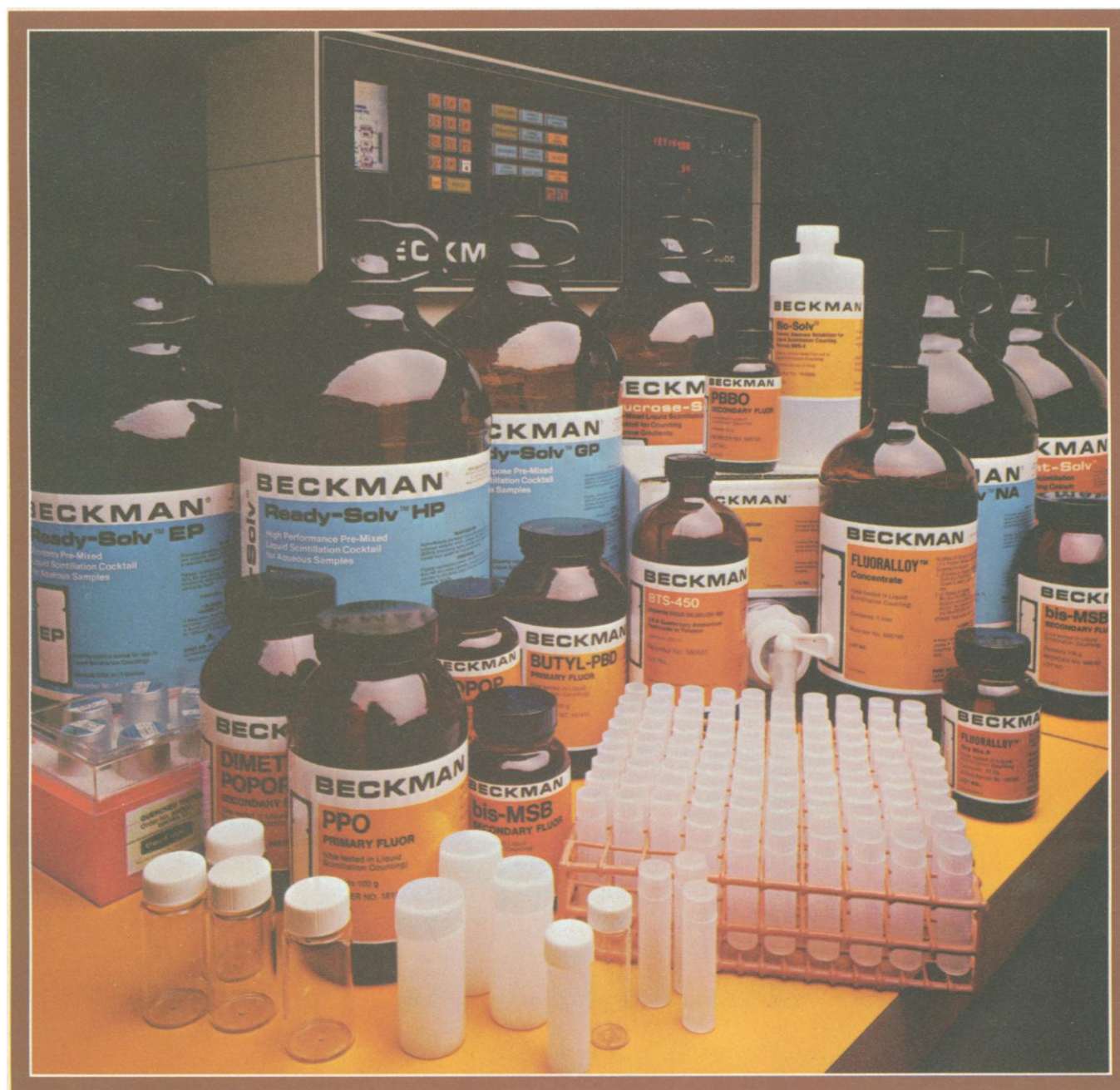
Send your name, address, and list of titles to



AAAS
Department E-1
1515 Massachusetts Avenue, NW
Washington, DC 20005

***AAAS members: Deduct 10% of retail price for each book or for set.**

Remittance must accompany all orders under \$10.00. Please allow 6-8 weeks for delivery.



Why are the world's most advanced LS instruments tested with these nuclear supplies?

The Beckman total nuclear supply capability evolved along with our LS counting instruments to give us a constant source of

fully quality-controlled cocktails, solubilizers and counting vials.

Today, the same supplies we used in our own state-of-the-art instrument R&D programs are available to LS researchers nationwide.

And whether or not you own a Beckman Instrument you'll benefit from optimized counting efficiencies, superior reliability, and the convenience of one expert source for all your nuclear needs.

Right now, orders of premixed cocktails, cocktail ingredients, and counting vials are available with 24-hour response times from a national network of

shipping depots. And major cost reduction programs have been designed to meet the individual requirements of research facilities both small and large.

So contact your local Beckman representative now and ask about our special nuclear supplies introductory programs.

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

Innovation you can count on.

BECKMAN®

Circle No. 190 on Readers' Service Card

SECOND ANNUAL BRISTOL-MYERS AWARD FOR DISTINGUISHED ACHIEVEMENT IN CANCER RESEARCH



AWARD: \$25,000

DEADLINE FOR RECEIPT OF NOMINATIONS

December 31, 1978

ANNOUNCEMENT OF AWARD RECIPIENT

May, 1979

The Bristol-Myers Company presents an annual award to a scientist making an outstanding contribution in cancer research. The candidates for the Award are to be nominated by medical schools, free-standing hospitals and cancer research centers. Only one nomination from each institution is permitted.

SELECTION COMMITTEE

John E. Ultmann, M.D., Selection Committee Chairman
Director, Cancer Research Center, University of Chicago

Harris Busch, M.D., Ph.D.
Professor and Chairman, Department of Pharmacology
Baylor College of Medicine

Albert H. Owens, Jr., M.D.
Director, Oncology Center, The Johns Hopkins University

Saul A. Rosenberg, M.D.
Professor of Medicine and Radiology, and Chief, Division of Oncology
Stanford University School of Medicine

Alan C. Sartorelli, Ph.D.
Professor and Chairman, Department of Pharmacology
Yale University School of Medicine

Rules and official nomination forms are available from:
Secretary, Award Committee, 345 Park Avenue, Room 43-30,
New York, New York 10022.

Whether you need Mid-IR, GC-IR, LC-IR, Near-IR or Far-IR measurement capabilities **NICOLET COVERS THE FT-IR SPECTRUM FROM 10 cm⁻¹ to 20,000 cm⁻¹.**

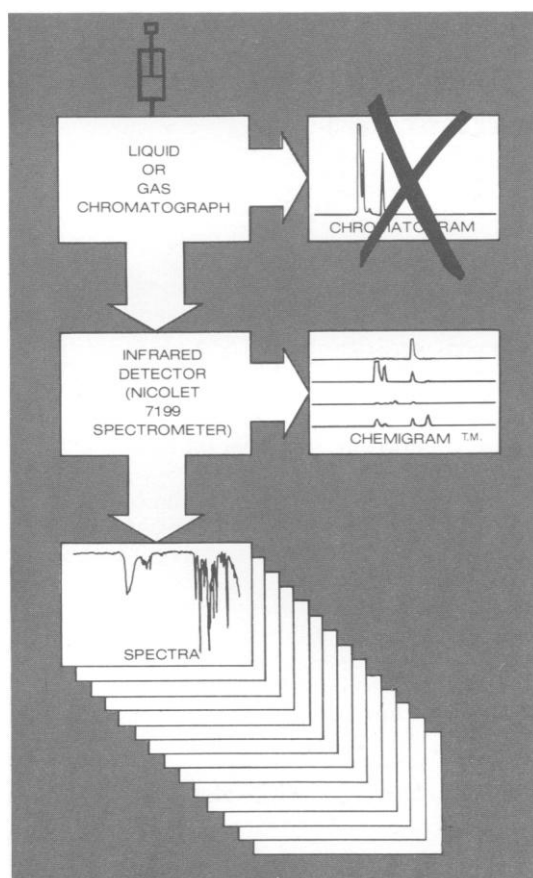
SENSITIVITY — Variable mirror scan rates from 0.05 cm/sec to 4 cm/sec optimize the system for highest signal-to-noise ratio (sensitivity) in a given measurement time.

RESOLUTION — Routinely achieves 0.06 cm⁻¹ resolution.

SUBTRACTION — Spectral stripping (subtraction) is easily used to extract solvent or aqueous background features from spectra. In many cases this allows the sample to be measured "in situ" without chemical extraction.

PREPROGRAMMED EXPERIMENTS — A macro-programming capability allows the user to easily design complicated experiments which are then implemented by pushing one button. This automates the experiment from sample insertion to automatic results plotting.

USING THE NICOLET 7199 FT-IR AS AN "INTELLIGENT DETECTOR"



The Advantages of the Nicolet CHEMIGRAM™

- True "on-the-fly" operation.
- Automatic storage of spectra.
- Real-time spectrally separated chromatograms (CHEMIGRAMS).
- Total history of elution preserved.
- High sensitivity.
- Rapid changeover from IR to GC-IR or LC-IR.
- Spectrometer and data system from one manufacturer.

For more details refer to Coffey, P., Mattson, D. & Wright, J., "A Programmable GC/FT-IR System," *American Laboratory*, May 1978 (in publication).

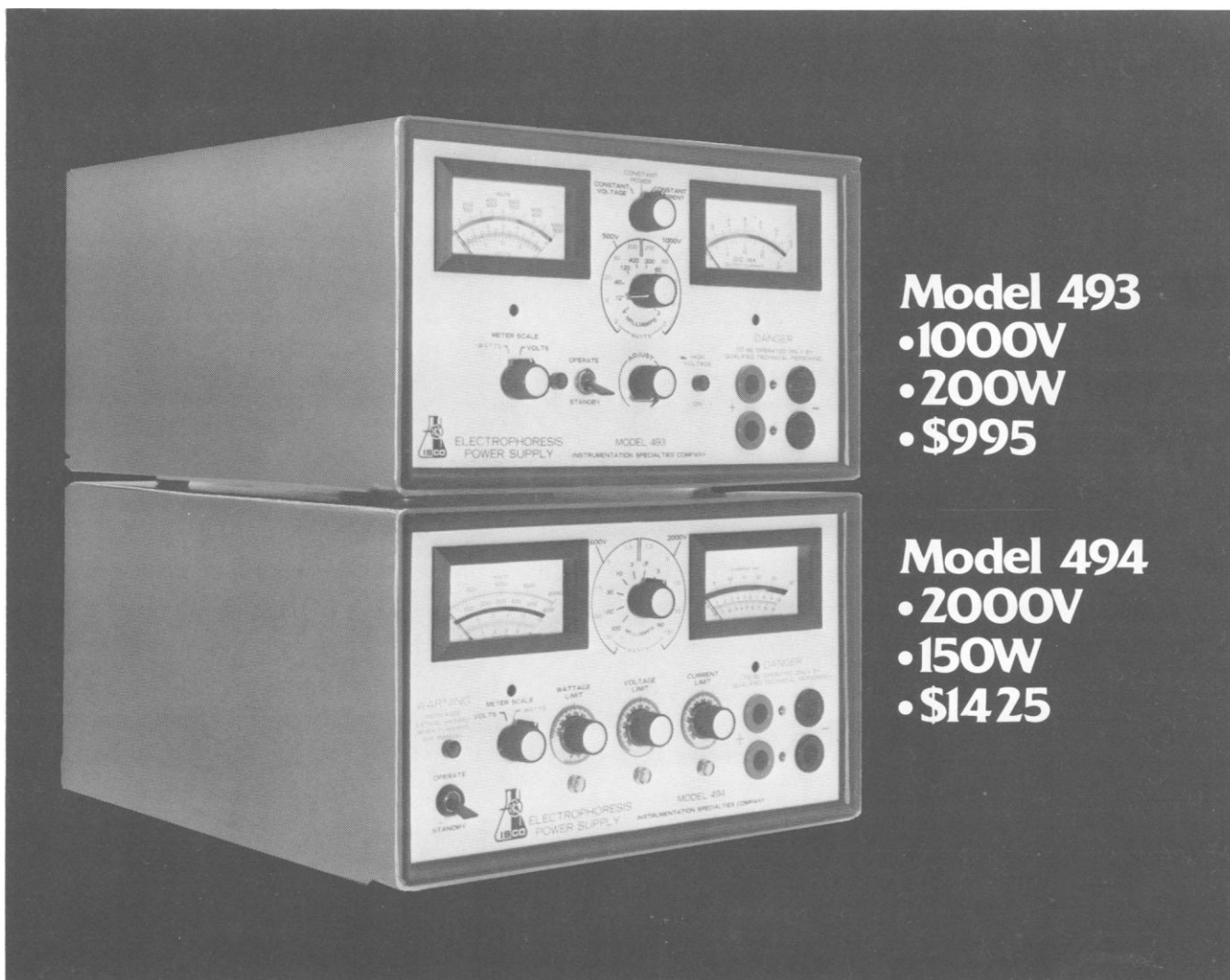
(Nicolet also offers field-proven, FT-IR data systems with complete software packages to upgrade existing spectrometers.)

For more details on the world's finest FT-IR system please phone or write Nicolet.

**NICOLET
INSTRUMENT
CORPORATION**

5225 Verona Road
Madison, Wisconsin 53711
Telephone: 608/271-3333

Circle No. 61 on Readers' Service Card



Model 493

- 1000V
- 200W
- \$995

Model 494

- 2000V
- 150W
- \$1425

Enjoy constant power and other neat things.

ISCO now has two electrophoresis power supplies offering constant power, current, or voltage. They provide you with faster separations and sharper zones than you can get from conventional equipment, especially for isoelectric focusing and high performance discontinuous buffer techniques. In a system where the resistance is continually changing, only constant power can automatically provide maximum voltage without the danger of overheating the gel or other electrophoretic medium.

ISCO power supplies have short circuit protection and operate right down to zero

voltage or current. Extremely precise regulation and metering greatly increase reproducibility. One meter always indicates current; the other may be switched to read either watts or volts, so there's no need to

compute wattage from separate voltage and current readings. The new Model 494 has an automatic crossover circuit that switches control to a different mode whenever a preset voltage, current, or power limit is reached.

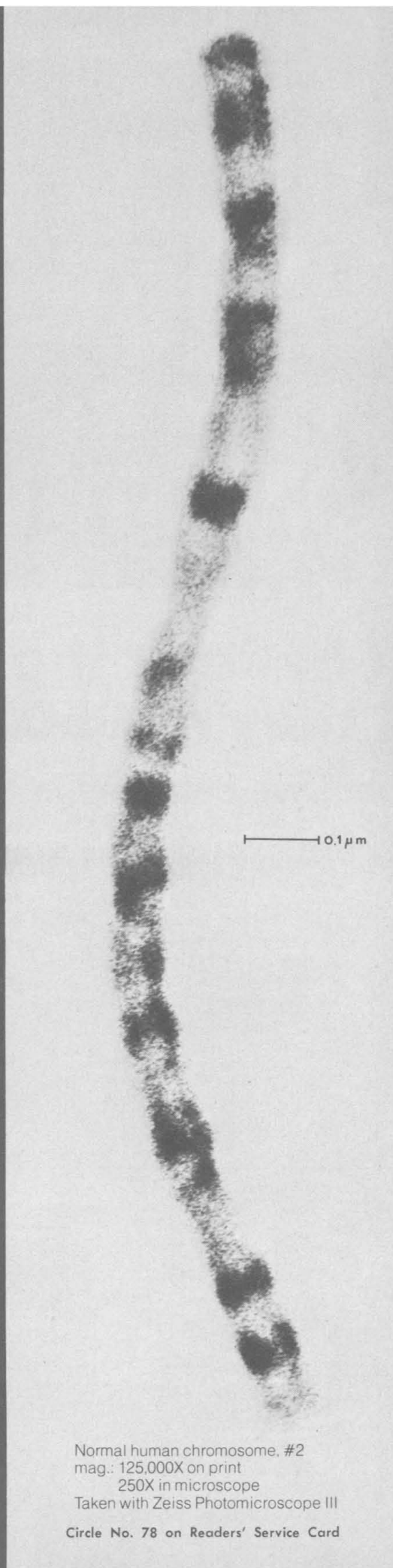
Find out how you can buy an ISCO third generation constant wattage power supply for less than someone else's first try, and get substantially better specifications too. Send for your free catalog today. Or dial direct, toll free (800) 228-4250 (continental U.S.A. except Nebraska). Instrumentation Specialties Company, P.O. Box 5347, Lincoln, Nebraska 68505.



**Instruments
with a difference**

Circle No. 48 on Readers' Service Card

Resolution at the limits of light microscopy.



Normal human chromosome, #2
mag.: 125,000X on print
250X in microscope
Taken with Zeiss Photomicroscope III

Circle No. 78 on Readers' Service Card

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

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

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

ZEISS

THE GREAT NAME IN OPTICS



WEST GERMANY

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

Name _____

Title _____

Affiliation _____

Street _____

City _____

State _____

Zip _____

Phone _____

I saw this ad in _____

(Magazine)



If you can't believe the price tag, pretend they're \$500 more.

The no-nonsense balances from Fisher.

In Spring 1976 we introduced our first **it-can't-be-a-balance** balance.

Today there are five Fisher/Ainsworth electronic toploaders, from 20g to 2000g, including a compact BCD-coupled printing balance and the lab world's first battery-pack portable. Each a remarkably rugged

lightweight instrument. With single touchbar operation (instant tare, instant sample readout on LED display). And so **modestly priced** they've made a whole generation of lab people re-think their concept of what a balance can be!

Fisher/Ainsworth toploaders. Solid

examples of American electronic technology, no-nonsense design, innovative manufacturing, stringent quality control, and sound value.

Say **No!** to inflation. Say **Yes!** to savings. Up to 40% per balance. Send for product data today.

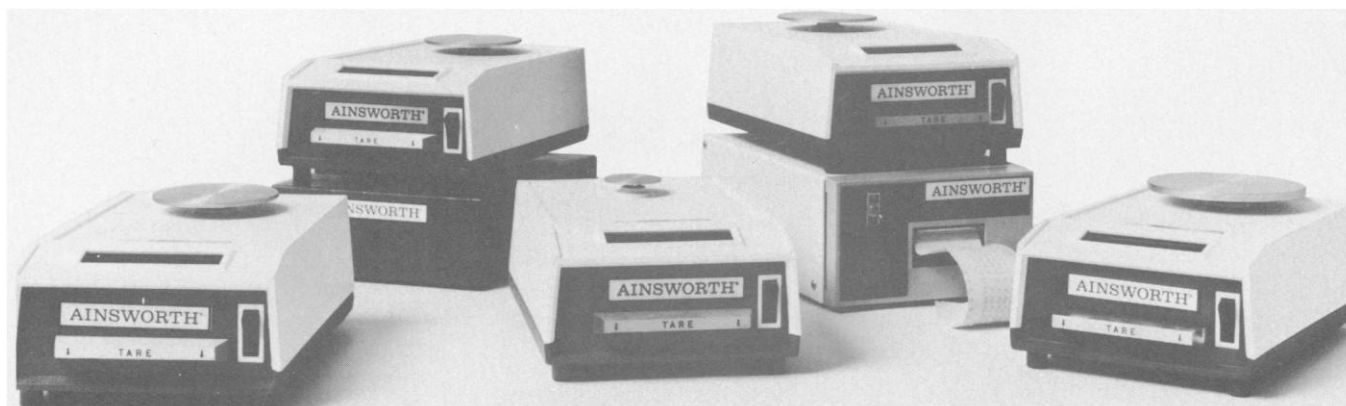
Model	A-20	A-200	A-2000	A-200BP battery-operated	A-200BCD printing balance
Range	0-20g	0-200g	0-2000g	0-200g	0-200g
Readability	0.001g	0.01g	0.1g	0.01g	0.01g
Catalog no.	1-913-265	1-913-260	1-913-267	1-913-261	1-913-262
U.S. price	\$995	\$795	\$1095	\$950	\$1795 including printer

We Know Laboratories.



Fisher Scientific Company

711 Forbes Avenue
Pittsburgh, Pennsylvania 15219
(412) 562-8543



Gilford's Sample Processing System: when you need the accuracy of a research spectrophotometer with the productivity of an automatic analyzer.

More Measurements per Hour

Whether you base it on our Model 250 Spectrophotometer or the Series 252 updates on DU® or DU2® monochromators, the Gilford Sample Processing System is a real time-saver....up to 300 manual measurements per hour, as many as 500 per hour with the available Automatic Sample Transport.

Greater Accuracy, Fewer Reruns

The precise sampling system aspirates the same amount of sample time after time. Combined with the NBS-traceable accuracy of the Gilford photometer, you get consistent high-quality results....hundreds per hour, with carryover of less than 1%.

Economy in Sample Size

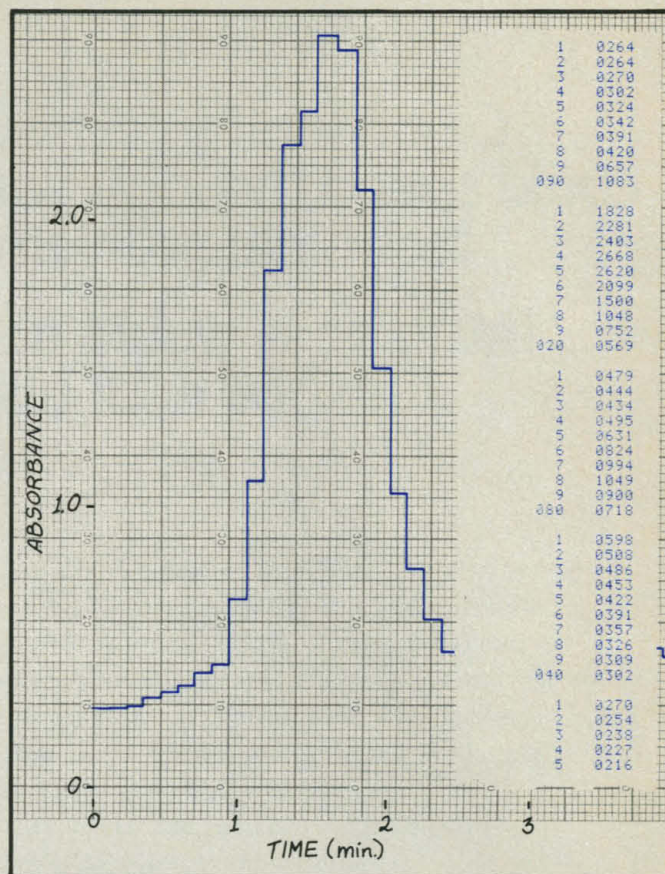
Pickup volume is adjustable, with a minimum of 700 µl for the standard aspirating cuvette; with the optional ultramicrocuvette, it's 350 µl.

® Registered trademark of Beckman Instruments, Fullerton CA



**Gilford Research Spectrophotometers:
every job easier, every result more accurate.**

The recording shows the absorbance of fractions collected by molecular gel filtration from a separation of high and low molecular weight proteins. These were collected in a cold room and read at 280nm. The tape lists the absorbance value of every fraction and identifies each sample by its position on the transport.



Retention of Sample

Sample return is standard: after samples are measured, you can discard them, return selected samples manually, or with the optional Sample Transport, return them all automatically.

Building Blocks Relieve the Budget

With the Rapid Sampler accessory alone, you read absorbance or concentration directly from the LED display. Use our Thermal Printer to provide a permanent record of results and to avoid transcription errors. Choose the Automatic Sample Transport for unattended processing of up to 100 samples, complete with sample identification printed out. Add the Thermocuvette, providing the same high-productivity sampling plus electronic control of sample temperature at 25, 30, 32, and 37°C....with automatic regulation to within $\pm 0.05^\circ\text{C}$.

gilford
INSTRUMENT

Oberlin, Ohio 44074
(216) 774-1041 Telex: 98-0456
Paris (Malakoff), France
Düsseldorf, W. Germany
Teddington, Middx., England
Toronto (Mississauga), Canada

System 45:

Our friendly computer could speed through your tough technical problems...

if the boss would just get finished with his.

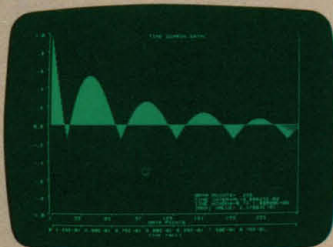
He has problems, too. The versatile System 45, along with HP-created management programs, can help him with forecasting, project management, basic statistics—even payroll and inventory control. He can also create and access departmental data bases for administrative chores. But you won't wait but a couple of minutes because the System 45 is a speedy workhorse. When

it's your turn, you, too, can take advantage of HP programs for applications as diverse and as valuable as differential equations, waveform analysis, eigenvalues and eigenvectors, regression analysis, linear equations and numerical integration to name a few.

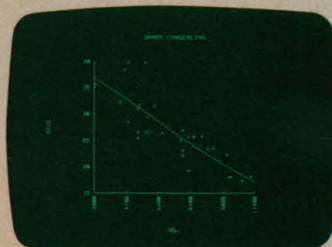
You'll get answers fast. System 45 will display a 20 variable, 20 constraint linear programming solution in under five minutes. And tackle a Fast Fourier Transform of a set of a 1,024 full precision data points in less than a minute.

Anyone in your department can easily create and run their own special programs using System 45's enhanced BASIC language.

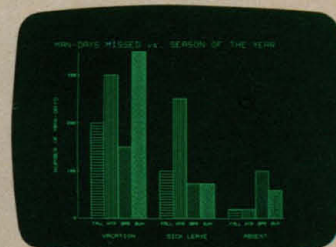
You can generate charts and graphs, interface with your instruments, add peripherals for extra storage, input and output. You can solve problems needing up to 62K bytes of



Waveform Analysis



Regression Analysis



Bar Chart

memory. Stated simply, System 45 is powerful, versatile and friendly: a productive, cost-effective tool for practically everyone in your department, even the boss. For brochures describing System 45 and the HP programs of interest to you, call the HP Literature Center toll-free day or night. The number is 1-800-821-7700, extension 302. (In Missouri, call 1-800-892-7655, extension 302.)



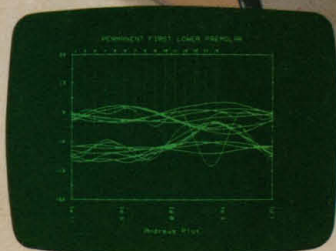
3400 E. Harmony Road, Fort Collins, Colorado 80521

For assistance call: Washington (301) 948-6370, Chicago (312) 255-9800, Atlanta (404) 955-1500, Los Angeles (213) 877-1282
Ask for Desktop Computer Sales Department.

Circle No. 22 on Readers' Service Card



408/5



Andrews Plot



Active Filter Design



RIA QC Plot

The Second Translation Kit

From the people who brought you new convenience and reproducibility with the first.

The First Translation Kit

It will make your life easier and your results more reproducible

New England Nuclear offers the first reticulocyte lysate kit for use in studying protein synthesis. Not only does it save all of the trouble of preparing your own cell extract, it gives you a system free from endogenous mRNA, high in protein synthesis activity, with an optimized high activity tracer and quality control that includes testing every lot of Methionine, L-[³⁵S] using the kit. The rabbit reticulocyte lysate system is reported to contain all factors required for translation of any eukaryotic mRNA. But its use assumes the availability of suitable animals, preparation of the lysate extract, and inactivation of endogenous mRNA. And the meticulous taking of the cells, energies, and amino acid mix. In short, it's a nuisance.

And you can get rid of all those rabbits



First, Methionine...

Our first translation kit saved you the difficulty of preparing your own lysate for cell-free translation studies, gave you a system free of endogenous mRNA and high in protein synthesis activity, and assured you of components tested for compatibility and reproducible results. All told, it was an excellent excuse to stop cultivating rabbits.

Our second kit does all of the above, too. But, instead of Methionine, L-[³⁵S], the tracer is Leucine, L-[3,4,5-³H]—specially optimized for use with this system. Here's what our Leucine Translation Kit contains:

Rabbit reticulocyte lysate Treated with micrococcal nuclease to inactivate endogenous mRNA and tested to guarantee high protein synthesis activity.

High activity ³H tracer NET-460T, Leucine, L-[3,4,5-³H], >110Ci/mmol. Special lots are prepared and tested for incorporation into protein using this cell-free translation system.

Translation cocktail All the necessary components for proper translation conditions, including buffer, biogenic polyamine, and energizer.

Control mRNA Purified mRNA to check the biological activity of the system.

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

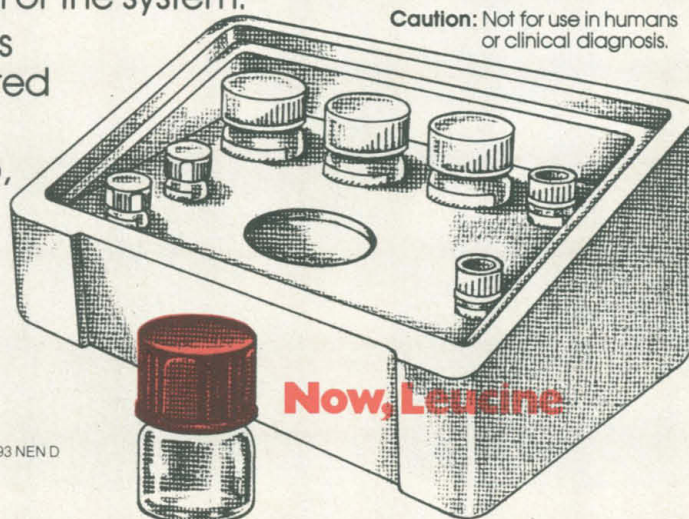
Instructions for use The protocol is straightforward and includes suggested assay procedures.

So now there are two, and only two, translation kits. Call us toll-free for details on either or both.

NEN New England Nuclear

549 Albany Street, Boston, Mass. 02118
Call toll-free: 800-225-1572
(In Massachusetts and International: 617-482-9595)
NEN Chemicals GmbH: D-6072 Dreieich, W. Germany
Daimlerstrasse 23, Postfach 401240, Telephone (06103) 85034, Telex 4-17993 NEN D
NEN Canada Ltd., 2453 46th Avenue, Lachine, Que H8T 3C9
Telephone 514-636-4971, Telex 05-821808

Circle No. 134 on Readers' Service Card



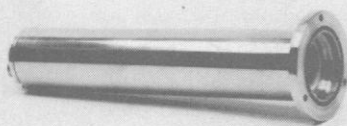
Caution: Not for use in humans or clinical diagnosis.

Now, Leucine

TWINS



New 30 mm photomultipliers from EMI mechanically and electrically interchangeable with earlier EMI types such as 9524, 9592, 9529. 9824 has a bialkali cathode giving good Q.E. with very low dark current and high gain. 9798 has a UV window which combined with its S-20 cathode gives a wide spectral range (200-850 nm). Either type can be had with spectroil window for extended UV or low background applications.



For Photon Counting, RFI/QL-30F slim-line housings complete with potted divider chain are available for all 30 mm tubes. Available from stock. Details from:



EMI GENCOM INC.

80 EXPRESS ST., PLAINVIEW, NY 11803
TEL: 516-433-5900, TLX: 510-221-1889

creased dependence on imported uranium and capital. It is thus all the more irrational to suggest that, without nuclear power, nations must war over oil.

As several thousand pages of critiques and responses on the soft-energy-path thesis show (13, 19), this is not the first time someone has decried "soft numbers" before verifying references. May I renew my earlier plea (Letters, 24 June 1977, p. 1384) that analysts get on with substantive refinement, extension, and application of soft-path concepts?

AMORY B. LOVINS
*Energy and Resources Program,
University of California,
Berkeley 94720*

References and Notes

1. A. B. Lovins, *Soft Energy Paths: Toward a Durable Peace* (Friends of the Earth and Ballinger, Cambridge, Mass., 1977), especially chaps. 3, 6, and 8.
2. —, "Re-examining the nature of the ECE energy problem" [ECE(XXXIII)/2.I.G., U.N. Economic Commission for Europe, Geneva, 1978]; "Soft Energy Technologies," *Annu. Rev. Energy* 3, 477 (1978).
3. M. Carasso et al., *The Energy Supply Planning Model* (Report to the National Science Foundation, Bechtel Corp., San Francisco, 1975), two volumes, acquisition Nos. PB-245 382 and PB-245 383 available from the National Technical Information Service, Springfield, Va.; facility data sheets and updates from M. Carasso and J. M. Gallagher, personal communications, 1976.
4. D. Sternlight (Chief Economist, Atlantic Richfield Corp., Los Angeles), personal communication (1978) of a detailed Arco estimate that the total present-valued investment (exploration, field cost, pipeline, Valdez terminal, and new tankers delivering to existing West Coast terminals), including interest, is about \$17,500/bpd (1978 dollars) for the Sadlerochit field (lifetime ~30 years). I have deflated this estimate at 7 percent per year to 1976 dollars and added \$4621/bpd for storage, refining, and distribution, all treated as marginal costs [Bechtel data (1, 3) converted to 1976 dollars with the Marshall and Stevens index (6)].
5. For illustration, if 30 percent of system investment were at the wellhead and 70 percent downstream, with respective lifetimes of 13 and 30 years, the present value of the stream of original plus replacement investments over 40 years, at a 5 percent per year real discount rate, would be only 30 percent above the total investment if all lifetimes were 40 years.
6. For a 1.1-GWe PWR, \$585 per net installed kWe (1974 dollars) is converted to \$929/kWe (1976 dollars) using the 1.26 per year index from a 35-plant multiple regression ($r^2 = 0.71$) by I. C. Bupp and R. Treitel, "The economics of nuclear power: De omnibus dubitandum" (Harvard Business School, Cambridge, Mass., 1976). For T & D—respectively \$69 and \$420 (1974 dollars) per net kWe of installed marginal generating capacity, taking into account supply diversity—the conversion to 1976 dollars is made with the 1.25 Marshall and Stevens Equipment Cost Index.
7. This is highly conservative. For example, a regression ($r^2 = 0.76$) on the 39 U.S. light water reactors (LWR's) completed through May 1977 reveals that, with each successive year of construction permit issuance (1967–1971), controlling for all other significant variables, real plant cost rose \$141/kWe. If this kept up, a 1.1-GWe PWR ordered in 1976 (25th unit built by the architect-engineer, outside the northeast region, with a cooling tower) would cost ~\$1474/kWe. Both these figures have been converted to 1976 construction dollars with the Handy-Whitman steam-plant construction cost deflator, and would be higher if they were in 1976 GNP dollars [W. E. Mooz, "Cost analysis of light water reactor power plants" (Report R-2304-DOE, Rand Corp., Santa Monica, Calif., 1978)].
8. The assumed LWR cost is also probably too low. For example, the California Energy Commission's draft report to the state legislature on Assembly Bill 1852 [R. Knecht et al., *Comparative Generation Costs* (California Energy Commission, January 1978), appendix 19] estimates \$1027/kWe for the Sundesert plant, ordered in January 1976 (neglecting dedicated transmission and deflating to 1976 dollars at 6.5 percent per year). The August 1978 final draft (in press) estimates \$1185/kWe.
9. The empirical average for all U.S. LWR's through 1977 was 60 percent (58 percent if weighted by unit size), 53 percent for units over 0.8 GWe. Exhaustive regressions on the entire U.S. data base lead to a predicted average, levelized over the first 10 years of operation of a new 1.1-GWe PWR, of 60 percent, taking account of a new vintage correlation that emerged during 1977 (55 percent without it). See C. Komanoff, *Nuclear Plant Performance Update 2* (Komanoff Energy Associates, New York, 1978). Komanoff and V. Taylor have also prepared an improved analysis of the Mooz data (7).
10. Also assumed are Bechtel's (3) \$61/kWe for marginal fuel-cycle facilities—probably ~3 to 5 times too low—updated to 1976 dollars and ordering with the Marshall and Stevens index (6), and \$100/kWe, calculated (1) in 1976 dollars, for the initial core.
11. Bechtel (3) assumes 16.4 percent at the margin.
12. The omitted terms are: real escalation after 1976 ordering; marginal investment in reserve margin, land, future services such as waste management and decommissioning, and past or present services such as federal R & D, regulation, and security services; and the ~6 1/2 to 8 percent of electric output currently needed to run the fuel cycle. Terms omitted from both the \$3495/kWe and the ~\$5000/kWe totals include costs of end-use devices, externalities, dynamic net-energy considerations, and any "miscellaneous" items.
13. U.S. House of Representatives, Committee on Government Operations, Subcommittee on Environment, Energy and Natural Resources, *Nuclear Power Costs* (Government Printing Office, Washington, D.C., 1978), part 2, pp. 1103–1115.
14. For example, if one uses Bechtel data (3), a 0.8-GWe coal-electric system with a scrubber but no fuel cycle would cost \$2200/kWe delivered (1976 dollars) at 0.62 capacity factor (1, 9). If James's oil-fired plant cost the same, an oil-system cost of \$30,000/bpd (capital charge at 0.12 per year = \$9.9/b, too much to clear the market), divided by 0.46 First Law plant efficiency, would imply a system cost of \$3172/kWe—generously assigning the whole oil-system cost to the residual rather than the light fractions (15).
15. J. Harding, in (13), part 2, pp. 1778–1802. The rationale for considering such a combined-cycle plant at the margin is that California is to have an embarrassing glut of residual oil from refining Alaskan crude oil extracted for its light fractions. Saving residual oil (nearly all of the 15 percent of California oil now burned in power stations) would probably not save crude oil; the residual oil is a by-product, not a motive. California is also considering gasifying residual oil.
16. The ratio of present electricity supply to electricity-specific needs approaches 2 in the United States today, and may exceed 3 after long-run end-use efficiency improvements.
17. J. Carter, remarks to Opening Conference, International Nuclear Fuel Cycle Evaluation, Washington, D.C., 19 October 1977.
18. V. Taylor (Pan Heuristics, Los Angeles), personal communication, May 1978. The proportional import reduction would be greatest in the United States, not in Europe or Japan.
19. U.S. Senate, Select Committee on Small Business and Committee on Interior and Insular Affairs, *Alternative Long-Range Energy Strategies* (Government Printing Office, Washington, D.C., 1977), two volumes [this contains all published critiques and responses except the exchange with Forbes in (13)].

Light on the Shroud?

Sindonologists may find the following paragraphs (1) of interest.

To make a reinforced plastic that will last for thousands of years, soak a strip of linen in oil of lavender that contains Syrian asphalt and let the fabric dry in the sun. Light will cause chemical bonds to form between adjacent molecules of the tar, converting the sticky

Unitron's zoomer

Model ZSB zoom stereo microscope

A big 6:5 to 1 ratio zoom optical system. Excellent resolution and contrast even at high powers. From 7X to 45X with 10X eyepieces. As low as 3.5X or as high as 180X with accessories. And there's a big choice of accessories . . . eyepieces, lens attachments, reticles, transmitted light base, illuminators, polarizing attachment and more.

Ask for free literature:
Unitron Instruments, Inc.,
101 Crossways Park West,
Woodbury, NY 11797, U.S.A.
Phone (516) 364-8046



UNITRON The value line

Subsidiary of Ehrenreich Photo-Optical Industries Inc.

Circle No. 45 on Readers' Service Card



A pure β -adrenergic agonist

Hydroxybenzylisoproterenol, *p*-[7- 3 H]-
5-20Ci/mmol

Ethanol, in dry ice.
NET-587 250 μ Ci 1mCi

Send for new
Radiolabeled
Ligands Pamphlet.

NEN New England Nuclear

549 Albany Street, Boston, Mass. 02118

Call toll-free: 800-225-1572

(In Massachusetts and International: 617-482-9595)

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

Circle No. 89 on Readers' Service Card

NESLAB emerges the leader in low temperature liquid systems



- temperatures as low as -80°C
- stability of $\pm 0.03^\circ\text{C}$ or better
- external circulation
- removes up to 300 watts at -70°C

Call the leader — toll free

1-800-258-0830

In N.H. call collect 603-436-9444



NESLAB the name in circulation

NESLAB INSTRUMENTS, INC. 871 ISLINGTON STREET, PORTSMOUTH, N.H. 03801 U.S.A.



Fractomettte® Alpha 200 Liquid Fraction Collector

RELIABLE: New single motor drive offers greater reliability than more complex mechanisms. Solid-state circuitry is designed for cold room use. Unit is overflow protected and includes a patented liquid detecting shutdown device.

VERSATILE: Push-button control of time, drop count or volume collection. An exclusive lift off collection platform provides unloading and cleaning convenience.

COMPACT: No other 200 tube collector is so compact. Occupies less than 1½ square feet of bench space; will fit in an ordinary household refrigerator.

COMPATIBLE: System compatible with metering pumps, column monitors, recorders and other accessories. Support rod lattice facilitates mounting. Yes, there are many reasons for you to select the Alpha 200 when your applications require a liquid fraction collector. In fact, no other fraction collector offers all the features available in the Buchler Fractomettte Alpha 200. Write for details.

Buchler Instruments

1327 Sixteenth St., Fort Lee, N.J. 07024 U.S.A. (201) 224-3333

made in U.S.A., sales and service worldwide.

mass into a durable solid. The reaction would be regarded by organic chemists as an example of photocrosslinking, but to the artisans of ancient Egypt it was merely a way to make good mummy wrappings. Syrian asphalt, which is also known as bitumen of Judea, is a naturally occurring mineral tar of high molecular weight that, according to the Bible, was used for caulking both Noah's ark and the rush basket of the infant Moses.

Other experiments can be made with the material. For example, in 1824 Joseph Nicéphore Niepce, a French physicist and amateur Egyptologist, coated a glass plate with the same mixture of oil and tar and exposed it to a brightly lighted scene with a camera obscura that he constructed according to the design of Leonardo da Vinci. When Niepce subsequently washed the plate with oil of lavender, the unexposed tar dissolved but the light-struck portions, which were photocross-linked, adhered to the glass, forming an image of the scene. The plastic film served as a lithographic surface for greasy links, thus yielding the first permanent photograph.

Such an image is three-dimensional, with a thickness proportional to the intensity and duration of the incident light; it may appear as either a photographic positive or negative depending upon the lighting and the nature of the surface material.

ROBERT A. GORKIN

*Department of Pharmacology,
Mayo Foundation,
Rochester, Minnesota 55901*

References and Notes

1. C. L. Strong, *Sci. Am.* **221**, 128 (December 1969).

Solar Energy: Ignored Predictions

In News and Comment coverage of the recent Council on Environmental Quality report, which projected that an accelerated development of solar energy technologies could result in their contributing 20 to 30 quadrillion Btu's per year by the year 2000 (12 May, p. 627), it is stated that "No federal agency has ever previously held out even the possibility of so rapid a growth of solar energy. . . ."

As a matter of fact, 4 years ago, the extensively documented but largely ignored Project Independence Task Force on Solar Energy suggested that accelerated solar technology implementation would yield almost exactly this amount of energy by the year 2000 (1).

BRUCE L. WELCH

*Welch Associates, One Investment
Place, Baltimore, Maryland 21204*

References and Notes

1. Federal Energy Administration, *Project Independence Blueprint, Final Task Force Report: Solar Energy* (Government Printing Office, Washington, D.C., 1974).

The Need for Materials

Philip H. Abelson, in his 7 July editorial "Domestic exploration for materials" (p. 7), begins with the sentence "A civilization with a high standard of living is dependent on adequate supplies of many kinds of materials." He ends with "[This country] must begin to develop a more vigorous materials policy." The entire editorial reads as if it were written by the American Mining Congress, and its assumptions and proposals only perpetuate the kind of thinking that has led to our current difficulties.

The major fallacy in Abelson's argument is the assumption that a high standard of living is closely linked to the production of virgin raw materials. This is indeed true in a once-through, throw-away economy where materials are dug from the earth, fabricated, used briefly, and then dumped in landfills. It has often been pointed out that recycling could reduce the demand for virgin materials were it not for subsidies that favor primary extraction, such as discriminatory freight rates, depletion allowances, and the free use of public lands. Abelson's proposals would further favor primary extraction by providing public funds for research and exploration, thus hastening the exhaustion of our remaining non-renewable resources.

What is really needed is a national materials management policy that would minimize the use of virgin materials. Such a policy would reduce the present inflationary pressure caused by reliance on ever lower grades of ore with their ever higher materials production costs. Elimination of subsidies for primary extraction would be only a first step. Creation of subsidies favoring recycling would be the next logical step. These measures, however, can lead to only limited materials savings because low-quality alloys tend to result from the agglomeration which occurs in present-day recycling.

In the longer term, policies are needed that will specifically encourage the design of products that are durable and can be easily repaired and recycled. These goals pose unusual scientific and engineering challenges that individual companies may find little economic incentive to meet. If public funds are to be used to solve our resource problems, this is where such monies would best be spent for the benefit of the general public.

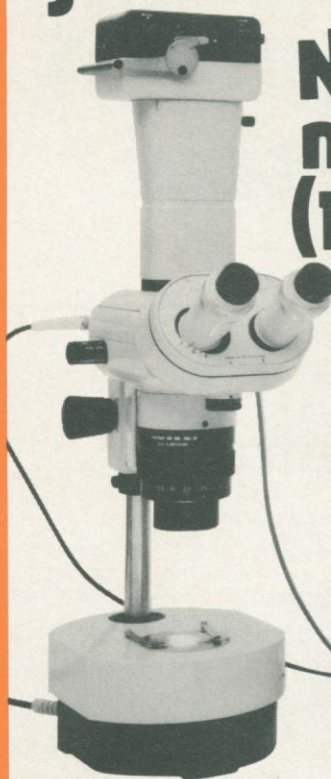
RICHARD C. WINGERSON

*Technical Committee,
High Country Citizens Alliance,
Post Office Box 1066,
Crested Butte, Colorado 81224*

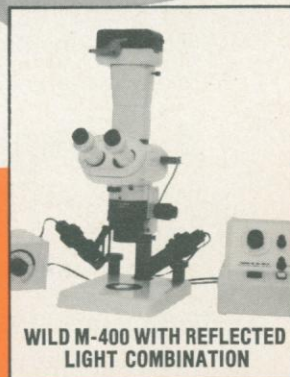
22 SEPTEMBER 1978

You're seated and you're comfortable.

Now, take macro-range (1x to 20x) photos with automatic ease.



WILD M-400 PHOTOMAKROSKOP.
The binocular automatic macro recording system, shown here with transmitted light illumination on darkfield / brightfield transillumination stand, with lens, and 35mm magazine.*



**WILD M-400 WITH REFLECTED
LIGHT COMBINATION**

With the M-400, we took the guesswork out of producing macro photographs. All adjustments, setting desired magnification, perfect composing and framing, and accurate focusing are at the tip of your finger. *Plus* automatic exposure timing with center weighted photodiode reading. *Plus* automatic 35mm film advance. *Plus* expected exposure time indicator. *Plus* elapsed exposure time, shown while taking the picture. *Plus* instrument portability.

How easy and automatic can photomacrography be? Very. Brochure M-400

*Later available with attachments for #120 roll film, Polaroid®, and extended magnification range to 60x.

**WILD WILD HEERBRUGG
HEERBRUGG INSTRUMENTS, INC.**

FARMINGDALE, NEW YORK 11735 • 516-293-7400

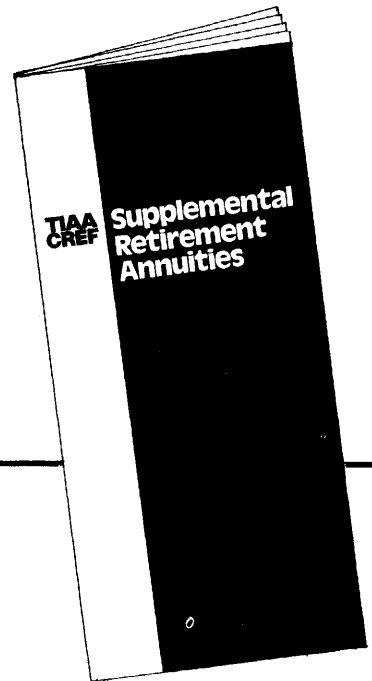
Wild Of Canada, Ltd. 881 Lady Ellen Pl., Ottawa 3, Ont.

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

Circle No. 26 on Readers' Service Card

1081

TIAA-CREF Supplemental Retirement Annuities



for tax-deferred annuity programs

Supplemental Retirement Annuities (SRA's) are new forms of TIAA and CREF contracts designed expressly for use by persons who want to set aside tax-deferred retirement funds over and above amounts being accumulated under their institution's basic retirement plan. They are available for employees of colleges, universities, private schools and certain other nonprofit educational organizations with tax-deferred annuity (salary-or-annuity option) programs. Through a properly drawn agreement with their institution, staff members may divert part of their compensation before taxes to the purchase of these new contracts.

And SRA's are cashable at any time. This means that if the money accumulated by salary reduction is needed before retirement, the SRA contracts can be surrendered for their cash value. Benefits, whether payable in cash or as income, are taxable as ordinary income when received.

For more information and answers to questions send for your copy of the booklet on Supplemental Retirement Annuities.

Send me a booklet describing
TIAA-CREF Supplemental Retirement Annuities.



Name _____ Date of Birth _____

Address _____
Street

City _____ State _____ Zip _____

Nonprofit
Employer _____

Teachers Insurance and Annuity Association
730 Third Avenue, New York, New York 10017

wi

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Science serves its readers as a forum for the presentation and discussion of important issues related to the advancement of science, including the presentation of minority or conflicting points of view, rather than by publishing only material on which a consensus has been reached. Accordingly, all articles published in *Science*—including editorials, news and comment, and book reviews—are signed and reflect the individual views of the authors and not official points of view adopted by the AAAS or the institutions with which the authors are affiliated.

Editorial Board

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

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

Publisher

WILLIAM D. CAREY

Editor

PHILIP H. ABELSON

Editorial Staff

<i>Managing Editor</i> ROBERT V. ORMES	<i>Business Manager</i> HANS NUSSBAUM
<i>Assistant Managing Editor</i> JOHN E. RINGLE	<i>Production Editor</i> ELLEN E. MURPHY

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

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

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

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

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

Letters: CHRISTINE KARLIK

Copy Editor: ISABELLA BOULDIN

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

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

Guide to Scientific Instruments: RICHARD SOMMER

Assistant to the Editors: RICHARD SEMIKLOSE

Membership Recruitment: GWENDOLYN HUDDLE

Member and Subscription Records: ANN RAGLAND
EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Area code 202. General Editorial Office, 467-4350; Book Reviews, 467-4367; Guide to Scientific Instruments, 467-4480; News and Comment, 467-4430; Reprints and Permissions, 467-4483; Research News, 467-4321; Cable: Advancesci, Washington. For "Instructions for Contributors," write the editorial office or see page xi, *Science*, 30 June 1978.

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

Advertising Representatives

Director: EARL J. SCHERAGO

Production Manager: MARGARET STERLING

Advertising Sales Manager: RICHARD L. CHARLES

Marketing Manager: HERBERT L. BURKLUND

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

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

Engineering Technology: New International Role

In three decades of assistance to education in less developed countries (LDC's), the United States has exported with varying effectiveness models of science-based engineering curricula. These efforts have created a few national centers of excellence in advanced engineering education, which are oriented by and large to solving the problems of the modern industrial sector and are sustained by disproportionately large investments by national ministries of education. The "scientist engineers" produced by these elite centers migrate to and perform well in overseas universities, but only a small percentage of them return home. At the other extreme of the technical manpower spectrum, many LDC's have an improved local capacity for training skilled and semiskilled workers for industrial employment. International development banks, foundations, and bilateral programs of the Agency for International Development have contributed to these efforts.

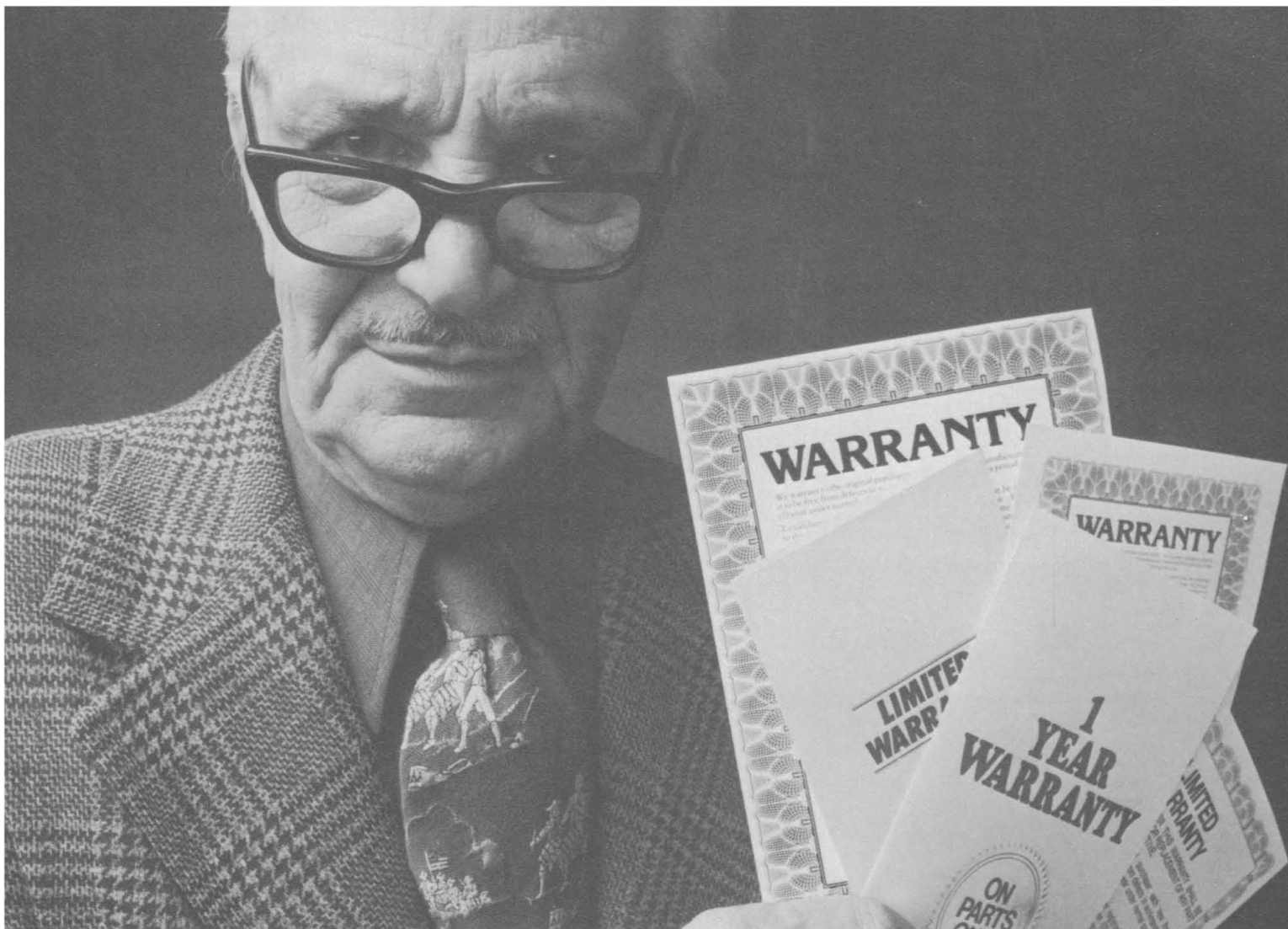
Much greater national efforts are still needed to improve the training of skilled workers for agriculture and industry in the LDC's. Manpower studies in the LDC's repeatedly point to the relative abundance—in fact, oversupply—of engineers and to the shortage of middle-level engineering and industrial technicians. They also show a pattern of distribution of these high-level human resources that is detrimental to regional and especially rural development. Urgently needed are middle-level engineering and industrial technicians who are able to implement and manage the more sophisticated technological systems now entering or being developed by countries that are rapidly becoming industrialized.

During the same 30-year period, profound changes have taken place in technological education in the developed countries, especially the United States. The technician was rediscovered in the United States in the late 1940's. Since then, programs for the training of engineering and industrial technicians with different levels of skills and knowledge have been developed in various institutional and organizational settings. When properly paired to the needs of LDC's in different stages of development, they will be able to respond to these needs. Their distinguishing characteristic is the emphasis placed on technical problem-solving and hands-on experience with the tools of modern industry.

More than 700 U.S. institutions are engaged in these programs. The outstanding ones are the 89 2-year technical colleges, accredited by the Engineers' Council for Professional Development, which offer associate degrees in engineering technology and industrial technology. Also accredited are another 30 colleges offering associate and bachelor's degrees and 35 colleges offering only a bachelor of science in technology.

Other institutions include community and junior colleges, technical institutes, and some universities and secondary-level schools offering post-secondary advanced technical programs. Until now, colleges and institutes of engineering technology have been used only sporadically in U.S. bilateral assistance activities. These institutions, especially those with experience in international work, are now considering how to pool their resources. They have the capacity and maturity to speak to LDC's that are demanding the sharing of technological resources. Such requests and demands are likely to come up at the 1979 U.N. Conference on Science and Technology for Development in Vienna.

It is essential that international policy-makers bring these resources to the attention of LDC's. High priority should be given to their development under new organizational initiatives supported by the proposed U.S. Foundation for International Technological Cooperation. This opportunity to match these appropriate resources with evident needs should not be missed.
—LAWRENCE L. BARRELL, *President, Hartford State Technical College, Hartford, Connecticut 06106*, and K. NAGARAJA RAO, *Senior Research Associate, Center for Policy Alternatives, Massachusetts Institute of Technology, Cambridge 02139*



People who've been pushing a one-year warranty won't be happy about this ad.

The fine print on many freezer warranties is enough to send cold chills up and down your spine.

Some people, for example, make a big deal out of supposedly long-term warranties in the headlines. But when you get down into the legalese, you find out they're really only guaranteeing the insulation, *limited* or something equally absurd.

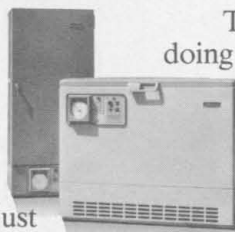
Well, those people will turn green when they see what we're putting down in black and white.

Because Revco is now offering a full one year warranty, plus an additional four year warranty

on sealed system parts and labor, from one of our 200 coast-to-coast service centers.

It's the *number one* warranty in the entire freezer industry, and it's just what you'd expect from the *number one company* in the entire scientific freezer industry. Because if we didn't build our freezers to last longer, we couldn't guarantee them to last longer.

And every Revco freezer is listed by Underwriters Laboratories, Inc. - not just the components but the entire freezer.



That's the way we've been doing business for 40 years now, and we expect to keep on doing it the same way.

For further information on our five-year limited no-nonsense warranty and a copy of our new full-color catalog, just call or write us at 1100 Memorial Drive, West Columbia, S.C. 29169. Area Code 803/796-1700. TWX: 810-666-2103. Cable: Revco.

REVCO

The world's leader in ULTra-Low® temperature equipment.

Revco Regional Offices Northeast: (215) 547-0150 Midwest: (414) 781-3639 Western: (714) 661-6588

Circle No. 94 on Readers' Service Card



Fiber-Optic Illumination System

A compact, annular light is available for use with stereo microscopes, optical comparators, image analyzers, and photographic equipment. Features include a bundle diameter of 9.5 millimeters at input and an annulus diameter of 53.3 millimeters. Working distance is between 38 and 203 millimeters and an area 51 to 254 millimeters in diameter is illuminated with no clutter of hot lamps, wires, or light pipes near the specimen, photographic object, or operator. Dolan-Jenner Industries. Circle 679.

Blood Analyzer

Ektachem analyzes human serum for glucose and blood urea nitrogen. The analyzer meters a drop of serum onto a specially prepared slide, moves the slide into an incubator, allows the reaction to occur, and then moves the slide to a final position where results are determined colorimetrically. An analysis requires only 20 microliters of serum for both determinations. Incubation requires 6.5 minutes. The device can perform up to 120 tests per hour. Eastman Kodak. Circle 680.

Water Analyzer

The OWA series of gas chromatograph-mass spectrometers performs analysis of water for organic pollutants in monitoring compliance with the Clean Water Act and in other laboratory applications. Microprocessor control and programmed parameters are two of the system's advantages. These instruments ex-

ceed the present requirements for specificity, sensitivity, and reproducibility and, additionally, they present the data in a format compatible with EPA standards for reporting. Finnigan Instruments. Circle 681.

Electrocardiogram and Blood Pressure Simulator

Model 7136 and its companion, the model 7137 sequencer, use synchronized physiological waveforms stored in read-only memory to test the performance of patient monitors and systems for the detection of arrhythmia. Normal patterns and more than a dozen abnormal conditions such as preventricular contraction, wide beats, and bradycardia may be simulated manually or automatically. Many other waveforms may be generated as well. Fogg System. Circle 682.

Microprocessor-Controlled Dispenser

Microlab P has a motorized plunger controlled by a programmable microprocessor. Volume, speed, and functions are selected by keyboard and a digital display reads out speed, function, step, volume, and plunger direction. The device is rapid, precise, and reliable for use as a repeating dispenser, transfer pipette, automatic burette for microtitration, dispenser for exponential dilution, or a repeating diluter. Gas-tight syringes, volume 50 to 5000 microliters, may be used to dispense volumes from 0.5 to 5000 microliters. Accuracy exceeds 1.0 percent and reproducibility exceeds 0.3 percent. Hamilton. Circle 683.

Electron Microscope

A patented Twin Lens objective system and a scanning transmission control unit are available for addition to the EM-400 electron microscope. This adds a feature called the "Nano Probe" for imaging at atomic resolution and the ca-

pability to analyze materials as tiny as one-billionth of a meter in diameter. The auxiliary lens is contained within the normal dimensions of the objective lens module and may be used in the TEM mode for lattice resolution down to 0.14 nanometer. Philips Electronic Instruments. Circle 684.

Anaerobic Chamber

Model XPL 855-AC is constructed of acrylic sheet to eliminate leakage of oxygen into the chamber through its walls. The chamber is a benchtop model that may be transported within the laboratory. Features include transfer chamber, canisters for indication of moisture and the primary desiccant, catalyst chamber for palladium pellets, quick-disconnect shutoff valves, and an interchangeable pump system. Plas-Labs. Circle 685.

Cabinets for Analysis of Fluorescence

Chromato-Vue cabinets feature a contrast control filter in the eyepiece. The cabinets are light-tight, portable dark-rooms for use with shortwave and long-wave ultraviolet light. The filter in the eyepiece eliminates the "blue haze" interference commonly caused by long-wave ultraviolet light. The cabinets are best used in analysis of fluorescence where competing ambient light is a problem. Ultra-Violet Products. Circle 686.

Microscope Camera Attachment

System MC 63 is for photomicrography with 35-milliliter cameras, 4 by 5 plates, or Polaroid apparatus. Corrected eyepieces in the phototube increase the field of view and maintain the quality of the photographed image from edge to edge. The cameras are focused for visual observation. Thus, the operator may see the object while it is photographed. The shutter is free of vibration for exposures from 1/6 second to 30 minutes. Carl Zeiss. Circle 687.

Literature

Balances describes devices for laboratory weighing equipment for loads from 1 milligram to 100 grams and from 100 grams to 1200 kilograms. August Sauter of America. Circle 688.

Teflon Lab Ware lists a complete line of equipment for the laboratory and classroom. Berghof/America. Circle 691.

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 or 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 Reader's Service Card (on pages 1070C and 1158A) and placing it in the mailbox. Postage is free.

—RICHARD G. SOMMER



DISCOUNT CALCULATORS

Texas Instruments

TI-25.....	24.95
SR-40.....	21.95
TI-55.....	39.95
TI-57.....	49.95
TI-58.....	94.95
TI-59.....	219.95
58/59 Mods.....	29.95
PC100A.....	149.95
PROGMR.....	47.95
BUS-ANAL.....	24.95
MBA.....	57.95
TI-5040.....	79.95
Data Chron.....	39.95

\$5.00 Rebate on TI-57
Coupon included with
calculator

HEWLETT-PACKARD		HP-37E.....	61.95
HP-19C.....	219.95	HP-38E.....	98.95
HP-29C.....	139.95	HP-67.....	359.95
HP-31E.....	49.95	HP-91.....	259.95
HP-32E.....	65.95	HP-92.....	399.95
HP-33E.....	82.95	HP-97.....	599.95

Accessories available at discount			
Sharp PC-1201.....	73.50	Sharp EL-5808.....	32.95
Sharp EL-8145.....	33.50	Canon P10-D.....	72.50
SCM 2200.....	259.95	Atari CX2600.....	149.95

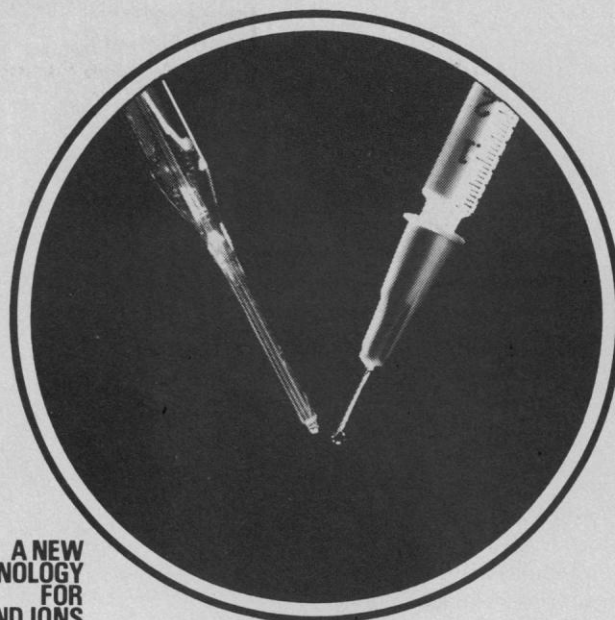
For faster delivery use cashiers check or money order.
Add shipping: 1% of your order (\$2.00 min.). East of
Mesp. Riv. add \$1.00. Calif. Res. add 6% tax. (Visa/MC
accepted, 3% surcharge on HP calcs.). Subject to
availability.

ORDER TOLL-FREE **800-421-8819** OUTSIDE
For technical information call (213) 744-1444

tam's
INCORPORATED

TAM'S Dept. S8
3303 S. Hoover St.
Los Angeles, CA 90007
(213) 744-1444

Circle No. 97 on Readers' Service Card



A NEW
TECHNOLOGY
FOR
pH AND IONS

The only combination electrode probe available
to measure pH of droplets at the source!

MICROELECTRODES, INC.

Grenier Industrial Village, Londonderry, New Hampshire 03053 USA (603)668-0692

Circle No. 108 on Readers' Service Card

Special Announcement To Science Readers From AAAS

The AAAS Science Book List Supplement Is Now Available

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

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

AAAS Science Book List Supplement

Retail Price: \$16.50

AAAS Member Price: \$15.00

Please allow 6-8 weeks for delivery.

Send orders with check or money order to

AAAS, Department W-2, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005

The Turner Spectrophotometer **NEW** with digital display.



Continuing a tradition of excellent performance at a sensible price.

The new Turner Spectrophotometer combines all of the features that have put our popular spectrophotometers in a price/performance class by themselves. The Model 380 goes a step further by offering you the convenience of a bright, easy to read digital display of linear absorbance, concentration values or transmittance. There's also a special provision for easy entry of constants for kinetic enzyme assays.

The high performance features of the Model 380 include narrow, 9 nanometer bandwidth; low (0.5%) stray light; ± 2 nanometer wavelength accuracy; wide standard operating range (320-710 nanometers); excellent linearity (up to 1.7 absorbance) even at 340 nanometers.

A wide variety of accessories that expand the versatility of our established Models 330 and 350 Spectrophotometers may also be used with the Model 380. These include the Turner **Enzyme Calculator/Printer** shown here and the Instafill® accessory for micro-flow work. At \$1725, the Model 380 is priced within the budget of every laboratory. So are the accessories. For example, the **Printer** is \$1420. The **Enzyme Calculator/Printer**, \$2150. No one else offers comparable instrumentation for so little.

Your inquiry will bring more details, a copy of our popular Spectrophotometer checkout guide, and our 1978 catalog! Contact Turner Associates, Division of American Sterilizer Co., 2524 Pulgas Avenue, Palo Alto, CA 94303. Phone (415) 324-0077.

Turn to

TURNER

... today

Turner Printer with Enzyme Calculator accessory.
Available as Printer alone.



BOOKS RECEIVED

(Continued from page 1118)

nado, Eds. Wiley-Interscience, New York, 1978. xiv, 174 pp., illus. \$19.95.

Etudes for Programmers. Charles Wetherell. Prentice-Hall, Englewood Cliffs, N.J., 1978. viii, 200 pp., illus. Paper, \$12.95.

Every Child a Wanted Child. Clarence James Gamble, M.D., and His Work in the Birth Control Movement. Doone and Greer Williams. Emily P. Flint, Ed. Francis A. Countway Library of Medicine, Boston, 1978 (distributor, Harvard University Press, Cambridge, Mass.). xviii, 446 pp., illus. \$14.95.

Exploring the Galaxies. Simon Mitton. Scribner, New York, 1978. 206 pp., illus. + plates. Paper, \$4.95. Reprint of the 1976 edition.

Faunes de Mammifères du Paléogène de l'Eurasie. Papers from a colloquium, Montpelier, France, Sept. 1976. Département de Géologie de l'Université Claude-Bernard, Lyon, France, 1977. 242 pp., illus. Paper, \$42. *Geobios*, Mémoire Spécial No. 1.

Fear. Learning to Cope. Albert G. Forgione and Richard S. Surwit with Daniel G. Page. Van Nostrand Reinhold, New York, 1978. xii, 176 pp. \$9.95.

Guide to Pre-Arranging the Sex of Offspring. Bhairab Chandra Bhattacharya. Applied Genetic Laboratories, Omaha, Neb., 1977. viii, 112 pp., illus. Paper, \$10.50.

A Guide to the Birds of Venezuela. Rodolphe Meyer de Schauensee and William H. Phelps, Jr. Plates by Guy Tudor and H. Wyne Trimm, John Gwynne, and Kathleen D. Phelps. Line drawings by Michel Kleinbaum. Princeton University Press, Princeton, N.J., 1978. xxii, 424 pp. + plates. Cloth \$50; paper, \$19.95.

Handbook of Treatment of Mental Disorders in Childhood and Adolescence. Benjamin B. Wolman, James Egan, and Alan O. Ross, Eds. Prentice-Hall, Englewood Cliffs, N.J., 1978. xvi, 476 pp. \$29.95.

Handbook of Turbulence. Vol. 1, Fundamentals and Applications. Walter Frost and Trevor H. Moulden, Eds. Plenum, New York, 1977. xviii, 498 pp., illus. \$49.50.

Health Statistics. A Manual for Teachers of Medical Students. C. R. Lowe and S. K. Lwanga, Eds. Oxford University Press, New York, 1978. xviii, 140 pp. Paper, \$8.95. Handbooks Sponsored by the IEA and WHO, No. 1.

Illustrated Glossary for Solar and Solar-Terrestrial Physics. A. Bruzek and C. J. Durrant, Eds. Reidel, Boston, 1977. xviii, 208 pp. \$26. Astrophysics and Space Science Library, vol. 69.

Imms' General Textbook of Entomology. Vol. 2, Classification and Biology. O. W. Richards and R. G. Davies. Chapman and Hall, London, and Halsted (Wiley), New York, ed. 10, 1978. viii + pp. 419-1354, illus. \$60.

Immunity to Blood Parasites of Animals and Man. Papers from a conference, Bellagio, Italy, Sept. 1975. Louis H. Miller, John A. Pino, and John J. McKelvey, Jr., Eds. Plenum, New York, 1977. x, 322 pp., illus. \$29.50. Advances in Experimental Medicine and Biology, vol. 93.

Journey through the Universe. An introduction to Astronomy. Thomas L. Swihart. Houghton Mifflin, Boston, 1978. xvi, 366 pp., illus. + plates. \$15.95.

Kidney Hormones. Vol. 2, Erythropoietin. J. W. Fisher, Ed. Academic Press, New York, 1977. xvi, 602 pp., illus. \$46.90.

Landscape Construction. M. E. Downing.

Which science books to buy?

To make your selection easier, you can depend on. . .

AAAS Science Book List Supplement

Retail price: \$16.50*

Also available. . .
AAAS Science Book List (3rd edition)

Retail price: \$10.00*

Send your order to AAAS, Department W-6, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Remittance must accompany all orders under \$10.00. Please allow 6-8 weeks for delivery.

*AAAS members deduct 10% off retail price.

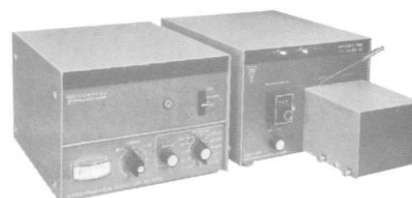
It's Axiomatic!

Many leading manufacturers of liquid chromatography systems prefer the Schoeffel SF 770 UV-VIS absorption monitor for use with their own instrumentation.

The Schoeffel SF 770 has become the industry standard for HPLC detection.

And for good reason:

- ✓ Patented optical design maximizes energy transmission.
- ✓ Continuously variable wavelength, 190-700nm.
- ✓ High sensitivity; low noise and drift.
- ✓ Double beam system for true sample absorbance measurements.
- ✓ Compact size; easy to operate.
- ✓ Interfaces easily with any liquid chromatograph.
- ✓ Wide choice of useful accessories.
- ✓ Provision for baseline and background compensated wavelength scanning.



We appreciate the confidence these manufacturers have in our products, and we'd like to gain yours. If you're looking into a variable wavelength HPLC detector, take a close look at Schoeffel. You'll be in very good company!

Call or write for our new comprehensive brochure.

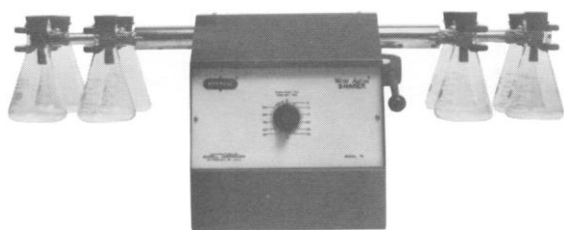
U.S.A.: 24 Booker Street, Westwood, New Jersey 07675
(201) 664-7263, Telex 134356

EUROPE: 2351 Trappenkamp, Celsiusstrasse 5, W. Germany
(04323) 2021, Telex 299660

KRATOS Inc.
SCHOEFFEL
INSTRUMENT DIVISION

Circle No. 80 on Readers' Service Card

Reliable Shakers



When it comes to reliable performance, you can count on Burrell Wrist-Action™ Shakers. They're ruggedly built for long life . . . some units have been in operation over forty years. Burrell Shakers duplicate a hand-mixing swirl with an even motion at all speeds for as long as necessary. And Burrell's unique Build-Up® System lets your Shaker grow as your lab grows . . . from a Shaker that holds 1 to 4 flasks to a Shaker that holds 24. Burrell parts and accessories are interchangeable. Burrell Wrist-Action Shakers with Build-Up design . . . the Reliable Shaker.

Write for our literature.

BURRELL

BURRELL CORPORATION
2223 Fifth Avenue, Pittsburgh, Pa. 15219
Telephone 412-471-2527

Circle No. 51 on Readers' Service Card

\$36

**STANDARD SIZE
MODEL S200C**

12 mm (1/2") Diameter,
150 mm (6") Long. Our
most rugged electrode,
for general purpose use
in classroom, laboratory,
portable and
on-line
operations.

\$55

**FLASK SIZE
MODEL S300C**

9.5 mm (3/8") Diameter, 300 mm
(12") Long. For use directly in
tall laboratory vessels.

**RECESSED BULB
SAFEGUARD TIP**

3

MODESTLY
PRICED

**'UNBREAKABLE'
COMBINATION
pH ELECTRODES**

- Recessed Bulbs, Safeguard Tips
- Sealed, No-Refill Reference
- Fast, Full Range pH Response
- Rugged, Epoxy Body

Order With Confidence
Performance is Guaranteed

\$63

**SEMI-MICRO
TEST TUBE SIZE
MODEL S900C**

6 mm (1/4") Diameter, 150 mm (6") Long.
For use in narrow tubes with samples as
small as 0.2 ml.

**Order With Confidence
Performance is Guaranteed**

SENSOR

9713 Bolsa Avenue
Westminster, California 92683
USA
Telephone: 714/554-7090

When Ordering, Specify Type
of Connector Needed or Make
and Model of pH Meter.

Circle No. 25 on Readers' Service Card

DIFFUSION COEFFICIENTS IN MINUTES

**For Association/Disassociation Equilibria,
Conformation Changes, and Reaction Rates.**



Up until now, many investigators have hesitated to include diffusion coefficients in their macromolecular studies because these important parameters were either too difficult to measure or the results were unreliable. New advances in quasi-elastic light scattering spectroscopy make it possible to conveniently measure translational diffusion coefficients in minutes with excellent accuracy.

The technique incorporates a KMX-6 Light Scattering Photometer and Model 64 Digital Correlator. Automatic data calculation and print out can also be provided by the LDS Laboratory Data System. This flexible new system contains a powerful microcomputer with specialized disc-based software for diffusion coefficients and other molecular parameters.

Besides diffusion coefficients, the KMX-6 rapidly measures absolute molecular weight, the other fundamental parameter needed for macromolecular characterizations. The accompanying table shows actual values of molecular weight and diffusion coefficients determined with the KMX-6 and appropriate accessories.

Applications include kinetic studies such as conformation changes, association and disassociation equilibria, particle size determination, and molecular weight measurement.

Call or write Chromatix today for full details. Or circle No. **151** for Application Note LS8 "Macromolecular Diffusion Coefficients by Low Angle Quasielastic Light Scattering," No. **152** for LS9 "Absolute MW of Biopolymers by Low Angle Laser Light Scattering," No. **153** for Brochure, or No. **154** for sales representative to call.

Sample	Molecular Weight	Diffusion Coefficient (Mean, 10^{-7} cm ² /sec)
T7 DNA	25.9×10^6 g/mole	—
Chymotrypsinogen	25,900 g/mole	—
Calf-thymus DNA	26.4×10^6 g/mole	0.131
BSA	—	6.45

chromatix

560 Oakmead Parkway Sunnyvale, CA 94086
 Phone: (408) 736-0300
 TWX: 910-339-9291

D6903 Neckargemünd 2
 Unterstrasse 45a
 West Germany
 Phone: (06223) 7061/62
 Telex: 461-691