

8 May 1981 • Vol. 212 • No. 4495

\$2.00

# SCIENCE

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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

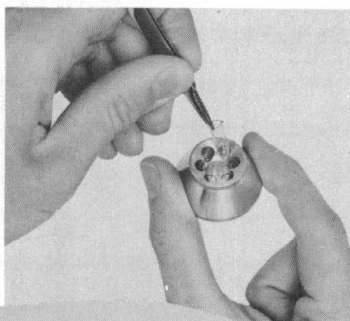
The Airfuge® miniature ultracentrifuge is one of the most useful developments in centrifugation in years. It reaches speeds of 95,000 rpm and generates forces of 178,000 g in less than a minute, so your work gets done fast.

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

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

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

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



Circle No. 227 on Readers' Service Card

## BECKMAN

ANOTHER TECHNOLOGICAL ADVANCE FROM SHARP.

# A REAL COMPUTER YOU CAN PUT IN YOUR POCKET.

It was a pipe dream only a few short years ago. A computer you could carry around in your pocket, so you could run programs at home or while traveling; a computer small enough both for your pocket *and* your pocketbook.

Herewith, the pipe dream made real: the Sharp PC-1211 Pocket Computer.

Not a fancy pocket calculator. A computer. With 1.9K RAM memory. Programmed conventionally through the keyboard. Or, using an optional cassette interface, able to load and unload programs using almost any cassette recorder around.

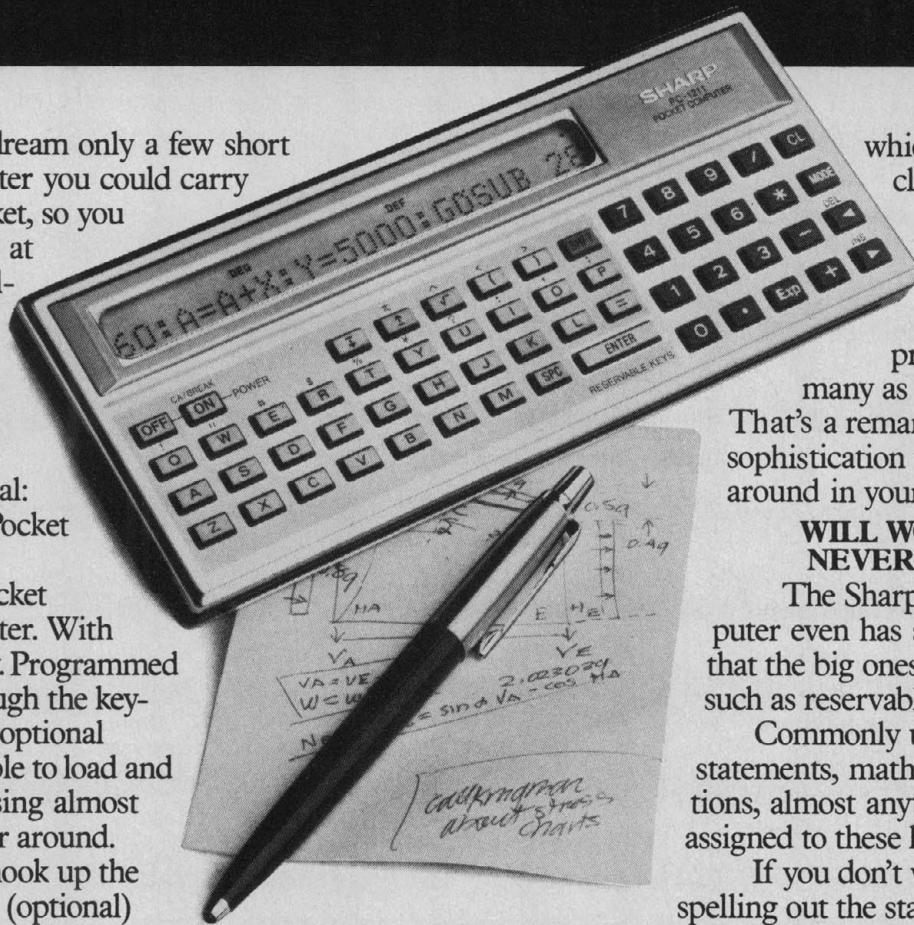
You can even hook up the PC-1211 to a printer (optional) and print out the program results or the program listing itself.

## BASIC SPOKEN HERE.

The PC-1211 Pocket Computer has a dot matrix display that scrolls right or left, handling up to 24 alphanumeric characters.

This allows the program to display instructions asking for data, as well as any other prompting the program requires. It also allows you to look at the program listing, line by line.

If you don't know Basic, the PC-1211 is a good way to learn. There are 22 statements and 12 commands at your disposal,



which comes pretty close to the flexibility of a conventional size microcomputer.

It will run programs of as many as 30 or 40 lines. That's a remarkable degree of sophistication to be carrying around in your pocket.

## WILL WONDERS NEVER CEASE?

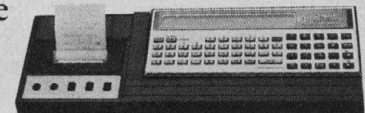
The Sharp Pocket Computer even has some features that the big ones don't have, such as reservable keys.

Commonly used commands, statements, mathematical functions, almost anything can be assigned to these keys.

If you don't want to keep spelling out the statement PRINT, for example, you simply assign it to, say, letter "A." Thereafter you press one key instead of five. Mathematical functions like COS can be assigned. Or  $A^2 + B^2$  Or RUN. And so on.

The PC-1211 has many more fascinating features. It's more than a fantastic tool. It's an intellectual adventure.

Go to your local computer store and fool around with one. You'll see that we haven't exaggerated in the least about the Sharp PC-1211 Pocket Computer.



The PC-1211 with optional printer.



# SCIENCE

|                         |                                                                                                                                                                                                                                                        |     |
|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>LETTERS</b>          | Universe Beyond the Galaxies: <i>J. Kraus</i> ; Cattle Breeding: <i>M. W. Fox</i> ; <i>G. E. Seidel, Jr.</i> ; Auto Safety: <i>B. Ancker-Johnson</i> .....                                                                                             | 610 |
| <b>EDITORIAL</b>        | Progress Toward Energy Independence .....                                                                                                                                                                                                              | 615 |
| <b>ARTICLES</b>         | Oceanic Mechanisms for Amplification of the 23,000-Year Ice-Volume Cycle: <i>W. F. Ruddiman</i> and <i>A. McIntyre</i> .....                                                                                                                           | 617 |
|                         | Regulation of Plasma Cholesterol by Lipoprotein Receptors: <i>M. S. Brown</i> , <i>P. T. Kovanen</i> , <i>J. L. Goldstein</i> .....                                                                                                                    | 628 |
|                         | Federal Funding of Basic Research: The Red Tape Mill: <i>H. S. Gutowsky</i> .....                                                                                                                                                                      | 636 |
| <b>NEWS AND COMMENT</b> | Inmos Enters the 64K RAM Race .....                                                                                                                                                                                                                    | 642 |
|                         | ELF Resurrected After Drowning by Navy .....                                                                                                                                                                                                           | 644 |
|                         | <i>Briefing</i> : Rostow Nominated to Head ACDA; Reagan Fills Top NASA Posts; R & D Spending: The Military's Growing Bite; Shuttle Astronauts Give Report; New AAAS Panel in National Security Field; Jury Exonerates Benedictin in Mekdeci Case ..... | 646 |
|                         | Senate Commences Hearings on "Human Life" .....                                                                                                                                                                                                        | 648 |
|                         | Inmates Sue to Keep Research in Prisons .....                                                                                                                                                                                                          | 650 |
|                         | Study Says Coal Cheaper than Nuclear .....                                                                                                                                                                                                             | 652 |
| <b>RESEARCH NEWS</b>    | Gene Control Puzzle Begins to Yield .....                                                                                                                                                                                                              | 653 |
| <b>BOOK REVIEWS</b>     | Probing Hadrons with Leptons, <i>reviewed by A. K. Mann</i> ; Physics of Magmatic Processes, <i>T. L. Wright</i> ; The Terrestrial Environment and the Origin of Land Vertebrates, <i>H.-P. Schultze</i> ; Books Received .....                        | 656 |

## BOARD OF DIRECTORS

FREDERICK MOSTELLER  
Retiring President, Chairman

D. ALLAN BROMLEY  
President

E. MARGARET BURBIDGE  
President-Elect

ELOISE E. CLARK  
EDWARD E. DAVID, JR.

NANCIE L. GONZALEZ  
DAVID A. HAMBURG

## CHAIRMEN AND SECRETARIES OF AAAS SECTIONS

MATHEMATICS (A)  
Ralph P. Boas  
Ronald Graham

PHYSICS (B)  
Maurice Goldhaber  
Rolf M. Sinclair

CHEMISTRY (C)  
Robert W. Parry  
William L. Jolly

ASTRONOMY (D)  
Owen Gingerich  
Donat G. Wentzel

PSYCHOLOGY (J)  
George A. Miller  
Meredith P. Crawford

SOCIAL, ECONOMIC, AND POLITICAL SCIENCES (K)  
James G. March  
Gillian Lindt

HISTORY AND PHILOSOPHY OF SCIENCE (L)  
Harry Woolf  
Diana L. Hall

ENGINEERING (M)  
Michael Michaelis  
Donald E. Marlowe

EDUCATION (Q)  
Ann C. Howe  
Roger G. Olstad

DENTISTRY (R)  
Maynard K. Hine  
Harold M. Fullmer

PHARMACEUTICAL SCIENCES (S)  
Anthony P. Simonelli  
Robert A. Wiley

INFORMATION, COMPUTING, AND COMMUNICATION (T)  
George W. Tressel  
Madeline M. Henderson

## DIVISIONS

### ALASKA DIVISION

John Bligh  
President

T. Neil Davis  
Executive Secretary

### PACIFIC DIVISION

Beatrice M. Sweeney  
President

Alan E. Leviton  
Executive Director

### SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION

Sam Shushan  
President

M. Michelle Balcomb  
Executive Officer

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 464480) paid at Washington, D.C., and at an additional entry. Now combined with *The Science Monthly*® Copyright © 1981 by the American Association for the Advancement of Science. Domestic individual membership and subscription (51 issues): \$43. Domestic institutional subscription (51 issues): \$80. Foreign postage extra: Canada \$24, other (surface mail) \$27, air-surface via Amsterdam \$55. First class, airmail, school-year, and student rates on request. Single copies \$2 (\$2.50 by mail); back issues \$3 (\$3.50 by mail); classroom rates on request. Change of address: allow 6 weeks, giving old and new addresses and seven-digit account number. Postmaster: Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.



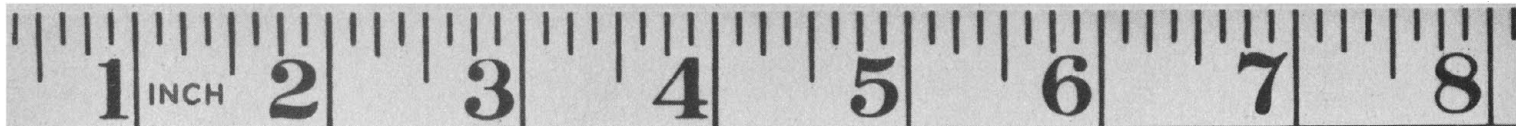
|                |                                                                                                                                                                 |     |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>REPORTS</b> | Calcite Dissolution: An in situ Study in the Panama Basin:<br><i>R. C. Thunell, R. S. Keir, S. Honjo</i> .....                                                  | 659 |
|                | Method for Estimation of Ocean Current Velocity from Satellite Images:<br><i>E. Mollo-Christensen, P. Cornillon, A. Da S. Mascarenhas, Jr.</i> .....            | 661 |
|                | Carbonyl Sulfide: Potential Agent of Atmospheric Sulfur Corrosion:<br><i>T. E. Graedel, G. W. Kammlott, J. P. Franey</i> .....                                  | 663 |
|                | Miocene Stable Isotope Record: A Detailed Deep Pacific Ocean Study and Its<br>Paleoclimatic Implications: <i>F. Woodruff, S. M. Savin, R. G. Douglas</i> .....  | 665 |
|                | Hibernation and Longevity in the Turkish Hamster <i>Mesocricetus brandti</i> :<br><i>C. P. Lyman et al.</i> .....                                               | 668 |
|                | Maternal Hyperoxia Greatly Reduces the Incidence of Phenytoin-Induced<br>Cleft Lip and Palate in A/J Mice: <i>G. Millicovsky and M. C. Johnston</i> .....       | 671 |
|                | Measles Virus Nucleotide Sequences: Detection by Hybridization in situ:<br><i>A. T. Haase et al.</i> .....                                                      | 672 |
|                | Oxalate Degradation by Microbes of the Large Bowel of Herbivores: The<br>Effect of Dietary Oxalate: <i>M. J. Allison and H. M. Cook</i> .....                   | 675 |
|                | Dolphin Vocalization Mechanisms: <i>R. S. Mackay and H. M. Liaw</i> .....                                                                                       | 676 |
|                | Metabolic Mapping of Functional Activity in Human Subjects with the<br>[ <sup>18</sup> F]Fluorodeoxyglucose Technique: <i>J. H. Greenberg et al.</i> .....      | 678 |
|                | Pregnancies in Humans by Fertilization in vitro and Embryo Transfer in the<br>Controlled Ovulatory Cycle: <i>A. O. Trounson et al.</i> .....                    | 681 |
|                | Forebrain Connections in the Goldfish Support Telencephalic Homologies<br>with Land Vertebrates: <i>S. M. Echterler and W. M. Saidel</i> .....                  | 683 |
|                | Right Handedness: A Consequence of Infant Supine Head Orientation<br>Preference?: <i>G. F. Michel</i> .....                                                     | 685 |
|                | Cholecystokinin Antibody Injected in Cerebral Ventricles Stimulates<br>Feeding in Sheep: <i>M. A. Della-Fera et al.</i> .....                                   | 687 |
|                | Stress-Induced Analgesia in Humans: Endogenous Opioids and Naloxone-<br>Reversible Depression of Pain Reflexes: <i>J. C. Willer, H. Dehen, J. Cambier</i> ..... | 689 |
|                | Visual and "Phonetic" Coding of Movement: Evidence from American Sign<br>Language: <i>H. Poizner</i> .....                                                      | 691 |
|                | Sex Differences in the Effects of Unilateral Brain Damage on Intelligence:<br><i>J. Inglis and J. S. Lawson</i> .....                                           | 693 |
|                | "Self-Awareness" in the Pigeon: <i>R. Epstein, R. P. Lanza, B. F. Skinner</i> .....                                                                             | 695 |

|                               |                                                                                                                                                                                           |     |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>PRODUCTS AND MATERIALS</b> | Centrifuge; Minicomputer for Research; Disk Drives; Minicomputer; Software for<br>Quantitative Analysis; Distributed Data Processing; Disk Cartridge;<br>Image Analysis; Literature ..... | 698 |
|-------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|

|                                                                    |                                                                                  |                                                           |                                       |
|--------------------------------------------------------------------|----------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------|
| ANNA J. HARRISON<br>WALTER E. MASSEY                               | RUSSELL W. PETERSON<br>HARRIET ZUCKERMAN                                         | WILLIAM T. GOLDEN<br>Treasurer                            | WILLIAM D. CAREY<br>Executive Officer |
| GEOLOGY AND GEOGRAPHY (E)<br>Jack A. Simon<br>J. Thomas Dufro, Jr. | BIOLOGICAL SCIENCES (G)<br>John A. Moore<br>Walter Chavin                        | ANTHROPOLOGY (H)<br>Alan R. Beals<br>Priscilla Reining    |                                       |
| MEDICAL SCIENCES (N)<br>Morton D. Bogdonoff<br>Lesh M. Lowenstein  | AGRICULTURE (O)<br>Martin A. Massengale<br>Coyt T. Wilson                        | INDUSTRIAL SCIENCE (P)<br>John Diebold<br>Robert L. Stern |                                       |
| STATISTICS (U)<br>Stephen E. Fienberg<br>Zira Glaser               | ATMOSPHERIC AND HYDROSPHERIC<br>SCIENCES (W)<br>Julius London<br>Glenn R. Hillst | GENERAL (X)<br>Herman Pollack<br>S. Fred Singer           |                                       |

#### COVER

With their general interest in dolphins, the ancient Greeks realized the animals could hear underwater and make sounds, but even Aristotle misunderstood their vocal capabilities. Greek coin from about 250 B.C. See page 676. [R. Stuart Mackay, Boston University, Boston, Massachusetts 02215]



SHOWN ACTUAL SIZE. MEASURE YOUR SPACE WITH THIS PAGE TO SEE IF A LAUDA RM-3 WILL FIT.

# Lauda's new 7 $\frac{3}{4}$ " wide refrigerated circulators need less space on your bench than the width of this page.

You wouldn't think a refrigerated constant temperature circulator could fit into bench space narrower than this page, but it's true. The new Lauda RM-3S and RM-3T are only 7 $\frac{3}{4}$  inches wide (and only 15 inches deep).

Despite their space-saving dimensions, these circulators provide all the features of full-size models. That makes them ideal for circulating liquid to jacketed glassware and other instruments (spectrophotometers, chromatography columns, electrophoresis equipment), as well as for applications requiring direct immersion.

Model RM-3S offers the convenience of digital temperature control; a flick of the finger dials in any temperature from  $-20^{\circ}$  to  $99.9^{\circ}\text{C}$ . A platinum resistance sensor insures an accuracy of  $\pm 0.01^{\circ}$  of the set temperature. A second, less accurate model, RM-3T, is equipped with a single temperature adjustment dial, and the temperature is controlled thermostatically to an accuracy of  $\pm 0.2^{\circ}$  within the operating range of  $-20^{\circ}$  to  $100^{\circ}\text{C}$ . Both models have 1,000 watt heaters, a 3-liter bath capacity, all stainless steel components contacting liquid, and are supplied with a bath cover and reading thermometer.

For literature on the compact RM-3 and the complete line of Lauda Circulators, write or call: Brinkmann Instruments, Inc.,

Subsidiary of Sybron Corporation,  
Cantiague Road, Westbury, N.Y. 11590.  
Tel. 516/334-7500. In Canada: Brinkmann  
Instruments (Canada), Ltd.



**SYBRON | Brinkmann**

For literature circle R S #183  
For demonstration circle R S #184





# WE DARE YOU TO COMPARE FUNNELS

**FIRST COMPARE PERFORMANCE.** Feel the precise control you get with a slight turn of a Corning Rotaflo® stopcock only found on PYREX® separatory funnels and burets. You control the flow even down to a fraction of a drop. Our stopcock won't leak or freeze. It's made in one piece that's easy to clean.

With the other funnel and stopcock shown, you have to line the holes up just right, to get the flow you need. When it's time to clean, you clean four pieces, not one.

Only PYREX funnels also give you the new durable PYREX stoppers. They are easy to use and clean.

**NOW COMPARE PRICES.** You'd think that all this additional control and convenience would cost more. It doesn't! The PYREX funnel with the Rotaflo stopcock costs less than the other type shown.

**COMPARE QUALITY.** Total value combined with performance is the reason why PYREX labware outsells all others, glass or plastic. Some have imitated us, but there still is really no comparison. It's been that way since we originated PYREX labware in 1915.

PYREX® and Rotaflo are registered trademarks of Corning Glass Works, Corning, NY.

**PYREX®**  
LABWARE  
**ONLY FROM CORNING**

## DARE TO COMPARE?

Discover for yourself why we've been the leader in the lab for sixty-six years. We'll send you a handy wall chart on what to watch out for with all types of labware. We'll also send you specifics about our separatory funnels. Attach this to your letterhead with your name and address. Send to: Corning Medical and Scientific, Attention: WTV, MS-21610, Corning Glass Works, Corning, N.Y. 14831.

SE-05-81-RO





# Where biological problems find answers,



Two new instruments from Varian: the VISTA Chromatography Series with the 401 Data System and the DMS 90 UV-Vis Spectrophotometer.

Life scientists have trusted Varian instruments for decades—and for good reasons.

First, Varian offers the widest range of research and analytical instrumentation available today; so you can select state-of-the-art performance to suit the needs of your laboratory. Second, Varian puts the operator first by making ease and speed of operation a design commitment; you benefit from the increased productivity. Most important of all, you can rely on the accuracy of your results; they carry the authority of long-standing leadership in scientific instrumentation.

In other words, we've earned the trust. And intend to keep earning it.

The results you see here are examples of answers found to problems in the biosciences—from instruments designed to make them all seem routine.

## ① LC: Analyze nucleic acid constituents

The separation of nucleotides, nucleosides, and bases shown was achieved in a single run in less than 90 minutes. The three-solvent capability of the *Model 5000 Liquid Chromatograph* was used to sequentially program two gradients. Flow programming was used to separate bases and nucleosides at a reduced flow during initial solvent gradient.

The *Model 5000* is fully compatible with the new *VISTA 401 Chromatography Data System*. Circle No. 63.

## ② LC: Identify and purify peptides

With the *Model 5000*, peptide species differing in only a single amino acid are sharply separated by reverse-phase chromatography. Circle No. 64.

## ③ LC: Separate proteins by molecular size

The new Varian *HPLC System* for protein and peptide chromatography gives you complete molecular-size exclusion, anion exchange, and reverse-phase capabilities. For example, you can separate proteins with a wide MW-range in minutes, with excellent recovery of protein mass and enzyme activity. Circle No. 65.

## ④ UV-Vis: Measure enzyme activity at 0.0005 A/min

The new easy-to-operate *Cary 219/210-PLUS Spectrophotometer/Computer System* offers fully computerized spectrophotometry. All experimental data are accurately collected, processed, and reduced to give you final results automatically. The superior optical performance that's part of the Cary tradition accommodates low enzyme activities just as easily as highly turbid samples. Circle No. 66.

## ⑤ UV-Vis: Do derivative spectrophotometry at the touch of a button

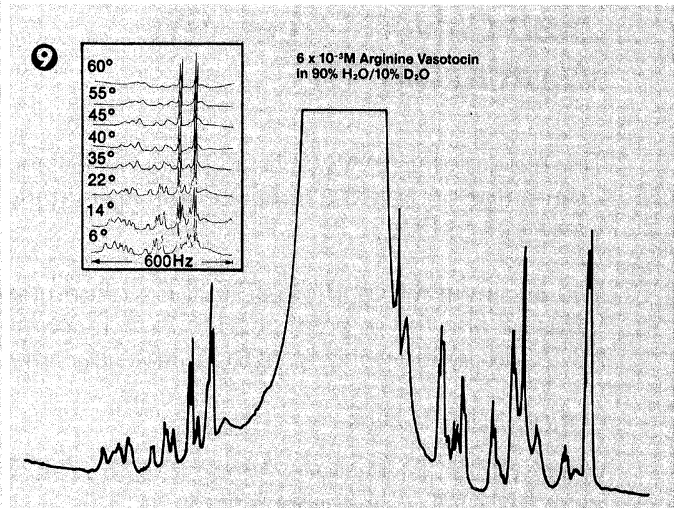
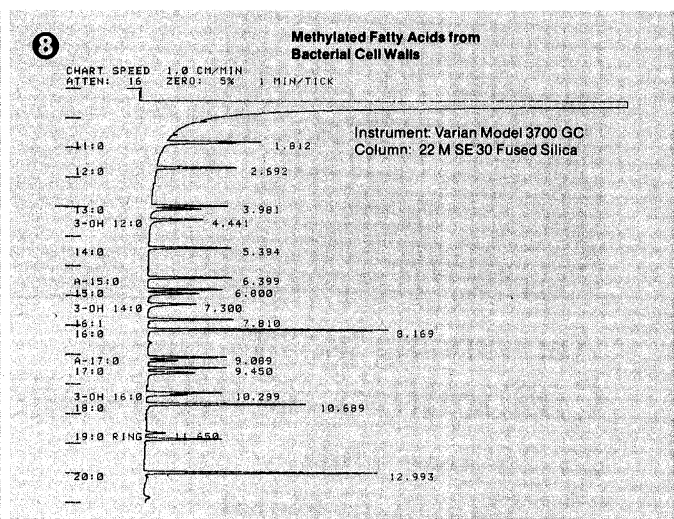
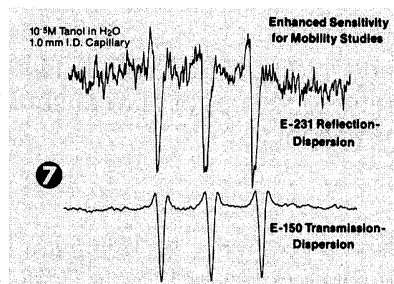
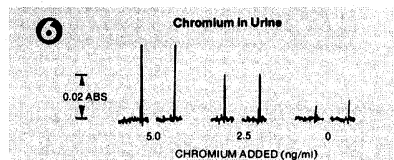
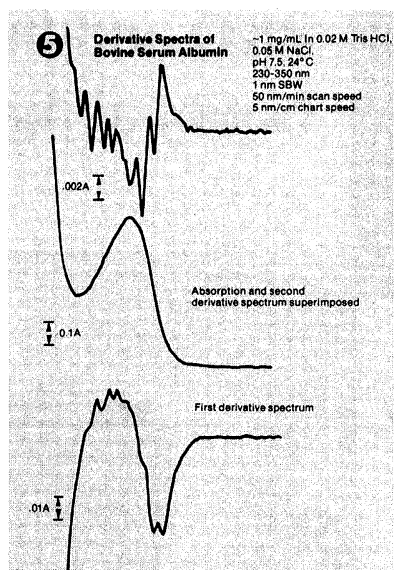
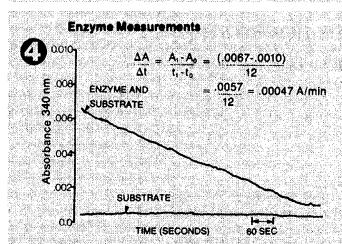
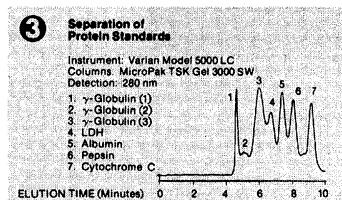
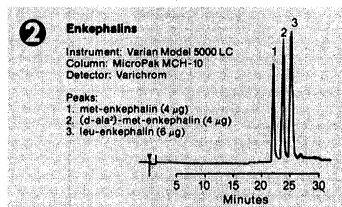
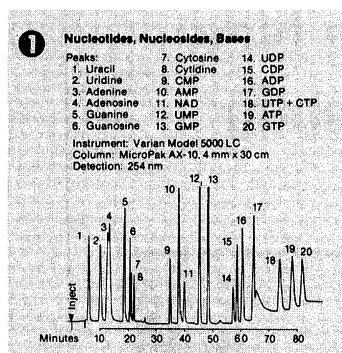
A derivative spectrum enhances spectral detail like the shoulders on this BSA spectrum, and they are easy to do with the low-cost *DMS 90 UV-Vis Spectrophotometer*! Just touch a button, and the microcomputer calculates true wavelength derivative data—both first and second derivative. Circle No. 67.

## ⑥ AA: Measure electrolytes in tissue, cells, and fluids

With the new Varian *AA-875 Atomic Absorption Spectrophotometer*, you can study toxicity, nutrient and metabolic activities, and the therapeutic effects of some 67 elements. This AA spectrum shows a typical determination of chromium in urine, using the Carbon Rod Atomizer accessory. Sample volume is 20  $\mu$ l. Sensitivity: 6 pg Cr in the urine matrix; precision: 10–20% RSD at 1  $\mu$ g/24 hr sample level. Circle No. 68.



# you'll find Varian instruments



## 7 EPR: Study RBC internal viscosity

In spin label studies of slow molecular motion, like investigations of red-blood-cell internal viscosity and the effects of chemotherapy on membrane fluidity, the saturation-transfer EPR (ST-EPR) experiment has been proven extremely useful.

The Varian *E-150 Induction EPR Accessory* now brings high sensitivity to dispersion ST-EPR, which makes it possible to use 90°-out-of-phase first-harmonic ( $\mu'$ ) detection. This technique offers easier interpretation and simulation and makes spectrometer adjustment less critical.

Using the *E-150* accessory, the full range of reflection and induction EPR experiments become available at the flick of a switch, allowing the scientist to select those parameters that optimize spectral sensitivity to slow molecular motions ( $10^{-3}$  sec  $\geq \tau_c \geq 10^{-8}$  sec). Circle No. 69.

## 8 GC: Identify bacteria by methylated fatty acids

Superb resolution achieved with the fused-silica capillary column on the *Model 3700 Capillary Gas Chromatograph* and the data presentation capabilities of the *VISTA 401 Chromatography Data System* make bacteria fingerprinting a routine procedure.

The easy-to-read printout includes peak names, run conditions, and quantitative chromatographic data. All can be stored on a floppy disk for instant retrieval and precise reproduction of the analysis. Circle No. 70.

## 9 NMR: Elucidate peptide structure

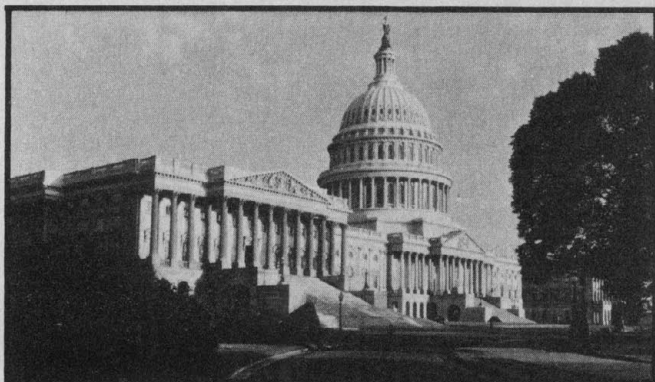
The exceptionally sophisticated software of the *XL-200 Superconducting NMR Spectrometer* gives the researcher a high dynamic range and unsurpassed data processing capabilities.

The *XL-200* proton spectrum shows  $6 \times 10^{-3}$  M arginine vasotocin in 90% H<sub>2</sub>O/10% D<sub>2</sub>O, using 32-bit double-precision acquisition and floating-point Fourier transform. Direct time averaging allows automated variable-temperature experiments to be performed without resorting to organic solvents or presaturation of H<sub>2</sub>O. You can observe temperature dependence of NH proton shifts and determine vicinal NH-CH spin couplings—information which can help you determine peptide structure in aqueous solution. Circle No. 71.

To have a representative contact you about any Varian instrument, Circle No. 312.



For immediate assistance contact: • Florham Park, NJ (201) 822-3700 • Park Ridge, IL (312) 825-7772 • Houston, TX (713) 783-1800  
Los Altos, CA (415) 968-8141 • Or write 611 Hansen Way, Palo Alto, CA 94303. In Europe: Steinhauserstrasse, CH-6300 Zug, Switzerland.



## R&D and the New National Agenda

**Announcing the 6th Annual  
Colloquium on R&D Policy**  
**25-26 June 1981**  
**The Shoreham Hotel**  
**2500 Calvert Street, NW**  
**Washington, DC**



The 6th Annual AAAS Colloquium on R&D and Public Policy, sponsored by the AAAS Committee on Science, Engineering, and Public Policy, will convene 25-26 June 1981 in Washington, D. C.

You are invited to participate in this Colloquium and in discussions with leaders in government, industry, and the scientific and technical communities on issues of current concern relating to R&D and public policy-making in the new administration.

### *Colloquium Topics*

What will be the focus of federal R&D funding? Which programs are being cut back and which increased? What philosophical tenets underlie this set of policies? How is Congress reacting to the new administration's budget recommendations for R&D? What impacts will the new budgets have on the R&D community? Speakers and panelists will provide answers and highlight problems as they address the following topics:

- *Federal R&D* • R&D issues in the FY 1982 budget • Outlook for FY 1983 and the future • R&D policies and budgets of federal agencies
- *Defense R&D* • R&D issues in the defense budget • Current policies and program content • Trends and future projections • Alternative perspectives on defense R&D
- *Agency Perspectives* • Question and answer sessions on R&D programs and policies with officials of key federal agencies
- *R&D Outlook in the Scientific and Engineering Community* • Impacts of new R&D budgets and policies on engineering; physical, social, and biomedical sciences; science and engineering education • Short- and long-range outlook for health of U. S. science and technology

*Research and Development: AAAS Report VI*, by Willis H. Shapley, Albert H. Teich, and Gail J. Breslow, will be provided in advance to colloquium registrants. The *Report* covers R&D in the federal budget for FY 1982, and other topics on R&D and public policy. Registrants will also receive the published proceedings of the conference.

For further details, write: R&D Colloquium, AAAS Office of Public Sector Programs, 1776 Massachusetts Avenue, NW, 8th Floor, Washington, DC 20036, or call (202) 467-4310





## 6th R&D Colloquium

Washington, 25-26 June 1981

The sixth AAAS R&D Policy Colloquium will be held on Thursday and Friday, 25 and 26 June 1981, at the SHOREHAM HOTEL, 2500 Calvert St., NW, Washington, DC 20008.

Registrant's Name \_\_\_\_\_  
(last name) (first and initial)

Affiliation \_\_\_\_\_

Address \_\_\_\_\_  
(street and number)

(city)

(state and zip)

(telephone number)

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

### AAAS Colloquium Advance Registration—enclosed is check or purchase order for:

- ☐ \$110 Full Registration (includes lunch on both days, dinner on Thursday, the R&D: FY 82 Report, and the Colloquium Proceedings)
- ☐ \$65 Partial Registration (includes Report and Proceedings only)
- ☐ \$30 Student Registration (includes Report and Proceedings only; available to full-time graduate or undergraduate students only)

Separate Meal Tickets (lunches at \$15 and dinner at \$22):

- ☐ Lunch on Thursday, 25th; ☐ Dinner on Thursday, 25th; ☐ Lunch on Friday, 26th

Previous Reports and Proceedings (at \$5 each):

- ☐ R&D: FY 81 ☐ R&D: FY 80 ☐ R&D: FY 79 ☐ R&D: FY 78 ☐ R&D: FY 77  
☐ Proc. 80 Col. ☐ Proc. 79 Col. ☐ Proc. 78 Col. ☐ Proc. 77 Col. ☐ Proc. 76 Col.

Program, badge, meal tickets, and R&D: FY 82 Report will be sent about 12 June. Registrations received after 12 June will be held at the AAAS Registration Desk at The Shoreham Hotel. Previous reports ordered will be sent as soon as possible. Proceedings of 81 Colloquium will be sent as soon as available.

Mail to: AAAS Meetings R&D, 1776 Massachusetts Ave., NW, Washington, DC 20036

### Shoreham Hotel Reservation—AAAS Colloquium (25-26 June)

(Reservations received after 24 May cannot be guaranteed)

#### Names and Addresses of All Occupants of Room:

Name \_\_\_\_\_ Name \_\_\_\_\_

Address \_\_\_\_\_ Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Room: ☐ Single (\$63\*) ☐ Double (\$77\*) ☐ Twin (\$77\*) (\*Plus 10% D.C. sales tax and 80¢ occupancy tax.)

Arrival: Date \_\_\_\_\_ Time \_\_\_\_\_

Be sure to list definite arrival and departure date and time. Hotel reservations will be held only until 6 p.m. unless otherwise specified. Check out time is 1:00 p.m.

Departure: Date \_\_\_\_\_ Time \_\_\_\_\_

Please indicate any special housing needs due to a handicap \_\_\_\_\_

Please enclose separate check, made out to Shoreham Hotel, for first night's room charge or indicate major credit card No.:

Card name \_\_\_\_\_ Number \_\_\_\_\_ Expires \_\_\_\_\_

Cardholder's signature \_\_\_\_\_

Mail to: AAAS Meetings R&D, 1776 Massachusetts Ave., NW, Washington, DC 20036

# No other laboratory shaker is more accurate or provides faster results than the Burrell Wrist-Action<sup>®</sup> Shaker.

If you expect fast, accurate results from your laboratory shaker, there's only one shaker that duplicates true wrist-action shaking. The Burrell Wrist-Action Shaker.

## Here's why.

The Burrell Wrist-Action Shaker duplicates a hand mixing swirl for as long as necessary, at the speed and shaking angle you select. The swirling motion is the key . . . all the contents are in continuous motion, assuring faster, more complete mixing. The swirling motion is constant at every speed, so you can replicate exact operations . . . every time.

## Flexible and versatile.

Flexibility and versatility are what make the Burrell Wrist-Action Shaker

so popular. We call it the Build-Up<sup>®</sup> System. With it you can add on or interchange side-arms and platforms so the capacity of your Burrell Shaker grows and changes with your needs. The Burrell Shaker can accommodate from four to twenty-four Erlenmeyer flasks, and with special clamps a Burrell platform can hold up to eight 250 ml flasks, as well as separatory funnels as large as 2000 ml.

## Who uses the Burrell Wrist-Action Shaker?

The Burrell Shaker is working accurately in hundreds of industrial and clinical laboratories; government research departments; universities, colleges and technical schools. For

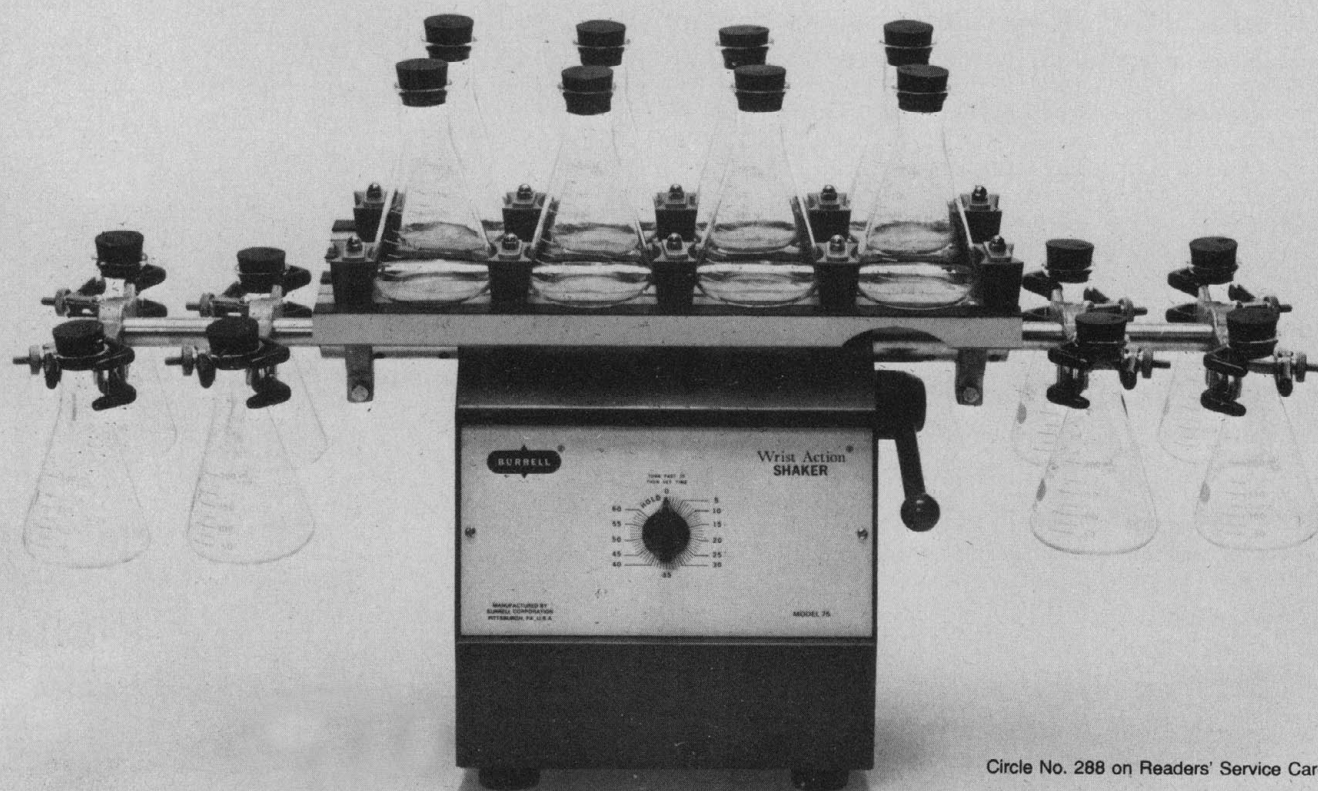
more than forty years, the Burrell Shaker has been working hard in laboratories around the world. It's a proven, quality, indispensable piece of laboratory equipment.

## Get the whole story.

We want you to know all the facts. Write or call Burrell Corporation and we'll send you our brochure describing the only true wrist-action shaker available.

**BURRELL**

**BURRELL CORPORATION**  
SCIENTIFIC INSTRUMENTS  
AND LABORATORY SUPPLIES  
2223 FIFTH AVENUE, PITTSBURGH, PA 15219  
Telephone 412/471-2527



Circle No. 288 on Readers' Service Card

ALL THE FEATURES OF THE BURRELL WRIST-ACTION SHAKER ADD UP TO THE MOST VERSATILE SHAKER AVAILABLE.





## Scientech...The Price/Performance Leader In Electronic Balances

Scientech was first to introduce the beamless electronic balance back in 1968... and the first American company to extend balance capabilities by utilizing microprocessors.

Now Scientech leads again with the introduction of the Series 3300 which sets a new standard for electronic balances in terms of value, accuracy, dependability and ease of use.

There are five models in the series, some with dual ranges. Capacities range from 30g to 5kg with resolutions as fine as 0.001g. All feature instant

electronic tare, digital and analog output, plug-in modular circuit boards for easy field servicing, and Scientech's exclusive circuitry that minimizes "digit flutter."

A universal command keyboard is available to enter and store data for complex conversions, averaging, parts counting and more.

Whatever your field, research, industry, quality control, pharmaceuticals or education, you're sure to find a Scientech balance that will help make you a leader too. Write for our brochure now.

# SCIENTECH, INC.

5649 Arapahoe Avenue, Boulder, Colorado 80302 • (303) 444-1261 • TWX 910 940 0004



---

The Bristol-Myers Company  
is pleased to announce that  
**Dr. Van Rensselaer Potter**  
of the  
McArdle Laboratory for Cancer Research  
has been awarded the fourth annual  
**Bristol-Myers Award  
for Distinguished Achievement  
in Cancer Research**  
for his fundamental discoveries  
on the biochemistry of the cancer cell  
April 14, 1981





# Give it 60 seconds and almost anything that's dry.

The Brinkmann Centrifugal Grinding Mill is designed to quickly break down to a uniform, specific particle-size range most dry materials up to 6.0 Mohs in hardness.

In just 60 seconds, the Mill will reduce 50 g plastic sheet to 100  $\mu\text{m}$ , 50 g corn to 50  $\mu\text{m}$ , or 120 g limestone to 20  $\mu\text{m}$  particles. By selecting the appropriate combination of stainless steel rotor and screen (6-tooth, 12-tooth and 24-tooth rotors, also 24-tooth tungsten carbide rotor; screens with mesh sizes from 0.08 to 6 mm), a desired particle size range down to 40 microns or smaller can be achieved with a wide variety of substances, including minerals, foods, plant fibers, animal tissue, pharmaceuticals and synthetic materials.

The Grinding Mill is equipped with a powerful dual-speed motor (20,000/10,000 rpm), a 60 min. timer, and is easy to empty and clean. It will pulverize volumes from 3 to 500 cc, even volumes as large as 5 liters using the accessory collection chamber. To facilitate rapid introduction of large amounts of sample, a vibrating feeder is available.

For literature, write: Brinkmann Instruments, Inc., Subsidiary of Sybron Corporation, Cantiague Road, Westbury, N.Y. 11590, or call 516/334-7500. In Canada: Brinkmann Instruments (Canada), Ltd.

## Brinkmann Centrifugal Grinding Mill

SYBRON | Brinkmann

# THE PULVERIZER.

For literature circle R S #185  
For demonstration circle R S #186



# AAAS Science Compendia Series

From the pages of Science comes a series of compendia designed to cover the principal issues that face science and society — now and for tomorrow. Each book presents the reader with an in-depth review of a given issue through authoritative articles written by the leading experts in the field. These compendia can serve not only as valuable reference sources for scientists and researchers, but also as supplementary reading material in courses devoted to these issues that concern all of us.

## New Titles

### The Science Centennial Review

Edited by Philip H. Abelson and Ruth Kulstad

Traces the history of Science magazine and provides an overview of the current and future status of the sciences. Includes sections on advances in molecular biology, materials science, instrumentation, earth sciences, energy, medicine, operations research and systems analysis, physics and the behavioral and social sciences, written by leading scientists.

192 pp. Illus. 1980

0-87168-305-9 (cloth) \$14.00

0-87168-250-8 (paper) \$6.00

### Advanced Technology

Edited by Philip H. Abelson and Mary Dorfman

Modern technology rests on the skillful use of energy and materials, and of the two, for many applications, advanced materials are the most important. Leading industrial research laboratories are developing many new materials that will help solve our energy problems. The twenty articles in this Compendium present research on a wide range of topics in this field.

168 pp. Illus. 1980

0-87168-303-2 (cloth) \$14.00

0-87168-249-4 (paper) \$6.00

## Additional titles in the AAAS Science Compendia are:

### Energy: Use, Conservation, and Supply

160 pp. Illus. 1974

0-87168-213-3 (cloth) \$10.00

0-87168-223-0 (paper) \$3.50

### Energy II: Use, Conservation, and Supply

208 pp. Illus. 1978

0-87168-300-8 (cloth) \$12.00

0-87168-237-0 (paper) \$5.00

### Health Care: Regulation, Economics, Ethics, and Practice

262 pp. Illus. 1978

0-87168-302-4 (cloth) \$12.00

0-87168-240-0 (paper) \$5.00

### Materials: Renewable and Nonrenewable Resources

208 pp. Illus. 1976

0-87168-216-8 (cloth) \$10.00

0-87168-277-3 (paper) \$3.50

### Population: Dynamics, Ethics, and Policy

208 pp. Illus. 1975

0-87168-214-1 (cloth) \$10.00

0-87168-225-7 (cloth) \$3.50

### Electronics: The Continuing Revolution

224 pp. Illus. 1977

0-87168-217-6 (cloth) \$10.00

0-87168-230-3 (paper) \$3.50

### Food: Politics, Economics, Nutrition, and Research

208 pp. Illus. 1975

0-87168-215-X (cloth) \$10.00

0-87168-226-5 (paper) \$3.50

## Order Form

Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

All orders under \$10.00 must be prepaid. Mail order to  
AAAS Sales Department, 1515 Massachusetts Ave., NW,  
Washington, DC 20005.

Please send me the following books in the AAAS Science  
Compendia Series:

\_\_\_\_\_ copy (ies) Science Centennial Review (hard) \_\_\_\_\_  
(pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Advanced Technology (hard) \_\_\_\_\_  
(pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Energy I (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Energy II (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Health Care (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Materials (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Population (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Electronics (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_

\_\_\_\_\_ copy (ies) Food (hard) \_\_\_\_\_ (pbk.) \_\_\_\_\_



# DON'T JUST SIT THERE WORRYING...

**PHONE TIAA (TOLL FREE) FOR HELP, RIGHT AWAY!**



Perhaps a new baby, or a big mortgage debt, or a recent salary increase, or just plain double-digit inflation has you worried that the life insurance coverage you presently maintain for your family isn't enough to take care of them the way you do. Whatever your concern, you can get help by phoning the TIAA Life Insurance Advisory Center and talking with an Insurance Counselor.

Every week hundreds of your colleagues in education call these trained TIAA professionals to discuss such questions as:

**Which kind of life insurance is best for me?**

**How much should I have besides group coverage?**

**What would it cost?**

There's no obligation of course; it's part of the service TIAA

provides to the education and research communities.

It's a fact that most educators with a family to raise and educate are seriously underinsured, and inflation isn't helping. They need as much immediate family protection as they can get for their money. That's why our counselors frequently suggest low-cost TIAA Decreasing Term policies when it's clear that a sizable chunk of new coverage is essential.

**Just \$167 a year\* buys a \$100,000 20-Year Decreasing Term policy for a man aged 35 or a woman aged 40!**

This example is drawn from the following table illustrating yearly costs for different initial amounts of protection on this plan:

**TIAA 20-YEAR DECREASING TERM INSURANCE COST EXAMPLES FOR SELECTED AGES**

|                        | <b>\$50,000 Policy</b> |          |          | <b>\$100,000 Policy</b> |       |       | <b>\$150,000 Policy</b> |          |            |
|------------------------|------------------------|----------|----------|-------------------------|-------|-------|-------------------------|----------|------------|
| Issued to a man aged   | 25                     | 35       | 45       | 25                      | 35    | 45    | 25                      | 35       | 45         |
| Issued to a woman aged | 30                     | 40       | 50       | 30                      | 40    | 50    | 30                      | 40       | 50         |
| Annual Premium         | \$93.50                | \$164.00 | \$373.50 | \$187                   | \$328 | \$747 | \$280.50                | \$492.00 | \$1,120.50 |
| Yearly Cash Dividend   | 42.00                  | 70.50    | 148.00   | 104                     | 161   | 316   | 166.00                  | 251.50   | 484.00     |
| Yearly Net Cost*       | \$51.50                | \$ 93.50 | \$225.50 | \$ 83                   | \$167 | \$431 | \$114.50                | \$240.50 | \$636.50   |

\*Annual premium, less cash dividend payable at the end of policy year on current scale. Dividends cannot be guaranteed or estimated for the future, but TIAA has paid dividends every year since its founding in 1918.

So you see, there's no reason to worry. At costs like these you can comfortably afford to give your family all the protection they need.

**For answers to your questions,** dial TOLL FREE 800-223-1200 (In New York call collect 212-490-9000). If you prefer to receive information by mail, just fill out and send the coupon at the right.

**Eligibility** for TIAA is extended only to employees of colleges, universities, private schools, and certain other nonprofit educational or scientific organizations, and to the spouse of such an employee when more than half of the combined earned income of husband and wife is from a qualifying institution.



Established as a Nonprofit Service Organization by the Carnegie Foundation for the Advancement of Teaching

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

S5881L

Please send me more information about low-cost TIAA life insurance, including personal illustrations of policies for my age as indicated below:

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

Please print

Name Title Date of Birth

Address

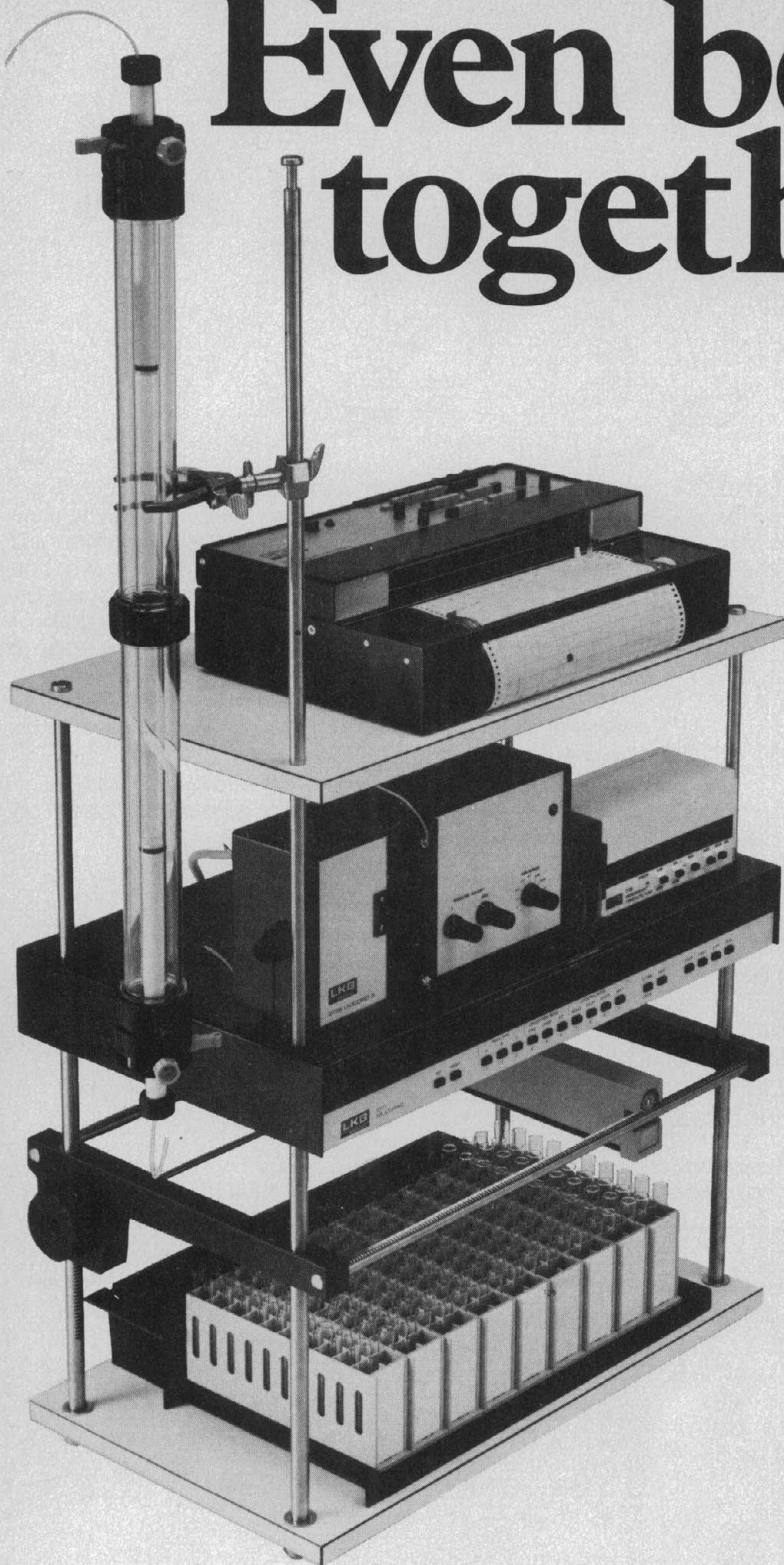
City State Zip

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

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

spouse's name and date of birth

# Even better together.



Individually, LKB chromatography instruments provide outstanding reliability and consistently accurate results.

But together, they form total, integrated systems that are unequalled in their ease of use and dependability. The LKB 2111 MultiRac® Fraction Collector is the core of just such a system.

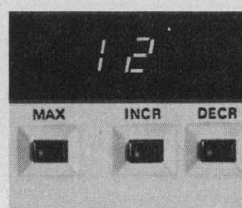
## LKB excellence in design

The LKB 2111-MultiRac® system combines the ultra-reliable 2111 Fraction Collector with the new MicroPerpex® peristaltic pump, 2210 dual channel recorder and high sensitivity 2138 Uvicord®S UV monitor in one compact package. This entire system takes up less than 2 square feet of bench or cold room space. Yet, every instrument is easy to reach and adjust.

## Integrated ease of operation

With the programmable 2111 MultiRac controlling the run, you're assured of accurate, no waste, no problem collections. And with precise pump control of fraction volumes,

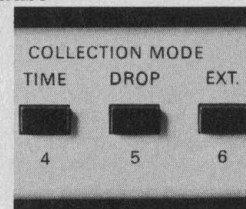
automatic flow stop function during tube changes and continuous display of flow rate on the MicroPerpex pump, the system needs minimal interaction time with laboratory personnel.



## Versatile and reliable

This new LKB collector draws on years of design experience and incorporates the most advanced circuitry. Because the MultiRac precisely shifts the drop head, it can accommodate a large variety of collection vessels.

The sophisticated microprocessor controller of the collector lets you select time, drop or precise volume modes, diverts void volumes to waste and can be programmed to save tubes by collecting valleys in large volumes, peaks in small.



## See it all together

Ask your LKB representative for more information on LKB complete chromatography systems. See how they work even better together.

**LKB**

**Head office:**  
LKB Produkter AB  
Box 305  
S-161 26 Bromma, Sweden  
Tel. 08/98 00 40, telex 10492

**Main US sales office:**  
LKB Instruments, Inc.  
12221 Parklawn Drive  
Rockville, Md 20852  
Tel. 301-881 2510  
telex 230 89 682

**Other sales offices in:**  
Athens (for the Middle East),  
Copenhagen, Ghent,  
The Hague, Hong Kong,  
London, Munich, Paris,  
Rome, Turku, Vienna

Circle No. 198 on Readers' Service Card



# THREE CHOICE ORANGES

Pick our straight neck for precise surface area work. Try the orange plug cap for a positive seal in the neck.

There are graduations alongside for quick filling.

There's a marking spot on each shoulder for easy identification.

Opt for a quick rim seal with the hard black phenolic cap. (It's really an orange at heart.) Spin it on and off with ease.

All Corning 75 cm<sup>2</sup> flasks have big mouths for easier mountings and gonging in your culturing systems.

Choose our canted neck for easier access in and out. It's a Corning original.

**CORNING**  
**CellWorQ**

You get to pick the type that suits you best with Corning 75 cm<sup>2</sup> disposable tissue culture flasks. Continuing innovations from Corning. Since 1915.

Circle No. 287 on Readers' Service Card

General Procedures  
for the  
Cell Culture  
Laboratory

**FRESH ADVICE**

Read up on some fresh ideas about good procedures for your cell culture laboratory. They're in a new brochure commissioned for you by Corning and developed at the W. Alton Jones Cell Science Center. Send for your free copy today.

Plus Free Oranges. We'll also pack you a free sampling of Corning flasks for your lab. Pick one

Send this coupon on your letterhead

Corning Medical and Scientific,  
Mail Station 18, Attention KAW, Corning  
Glass Works, Corning, New York 14830

SE-05-81-FL

**CORNING**

☐ 2511S-75 Straight neck with plug seal cap

☐ 2511S-75 Straight neck with phenolic cap

☐ 2511S-75 Canted neck with plug seal cap



# FOXY matches fractions to your chromatogram.

## Not to the clock.

FOXY, the Fraction-Optimizing X-Y fraction collector.

Microprocessor-controlled collection techniques save you time and expand your research. You can program collection by absorbance peaks, timed intervals, counted drops, controlled output of an ISCO peristaltic pump, or by Volumeter discharges.

FOXY's stainless steel racks hold practically any size test tube or 28 mm scintillation vials. For larger volumes, you can collect directly into 500 ml bottles or use a preparative adapter to obtain up to 72 fractions of unlimited size.

There's big capacity—up to 288 tubes—occupying minimal bench space: the keyboard is only 21 cm wide. FOXY collects from two columns at once and stops flow between tubes and at the end of the run.

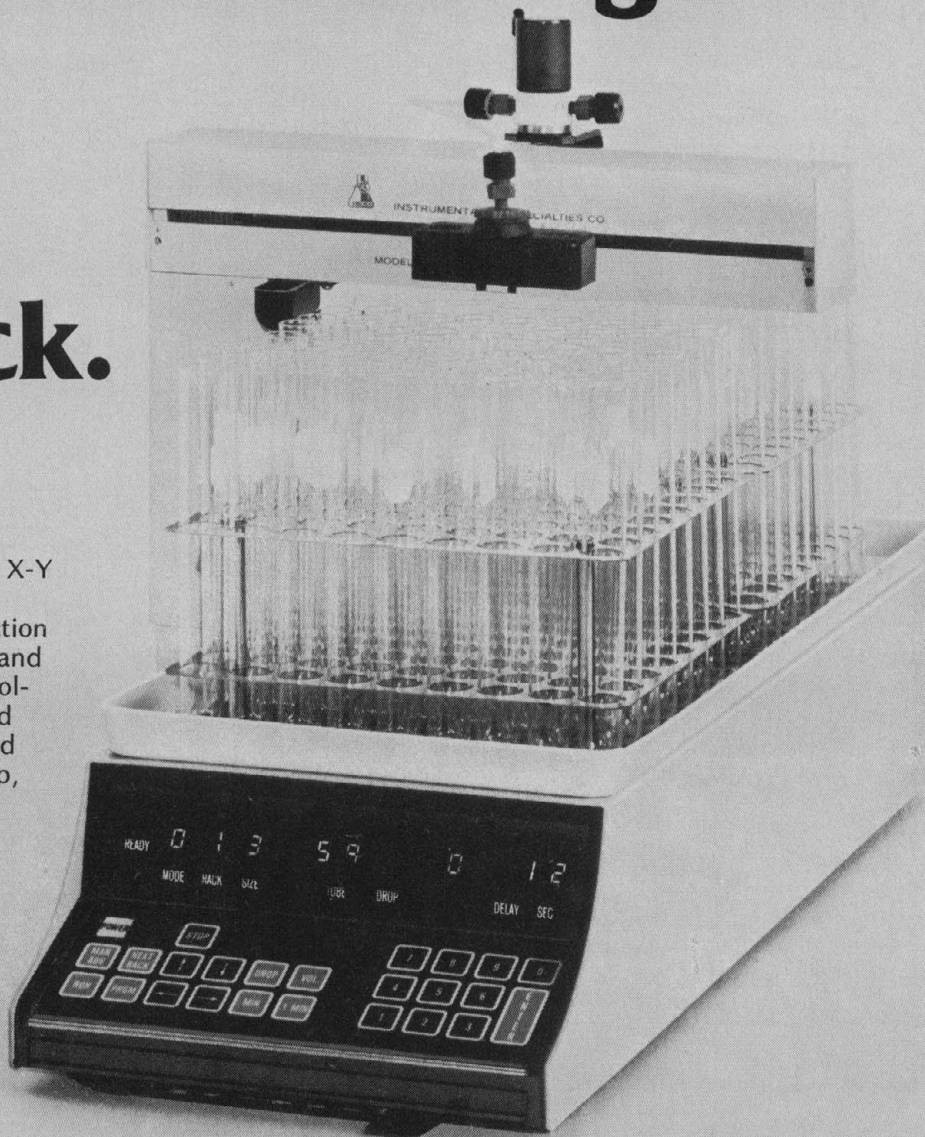
You can isolate peaks identified by elution times or detected by an ISCO UV monitor. Join peak detector and time window programming to capture only specific peaks emerging at preselected times.

Mix racks and volumes in a single run, based on peaks or time. Collect only desired peaks in one rack; put baseline effluent in another rack, in a single container, or divert it to waste. And FOXY can reject void volume before

collection begins.

FOXY's splashproof, sloped keyboard is easy to see and use. Flashing cues prompt step-by-step programming. A code directs you to a correction table to quickly put errant programming back on track. FOXY's display offers continuous program information, including current tube number and time or drop count.

It costs only \$2295 to add FOXY to your staff. Call toll-free to learn more about ISCO's smart generation fraction collector: [800] 228-4250 (continental USA except NE). ISCO, Box 5347, Lincoln, Nebraska 68505.



"See us in Booths J6-J8 at ASBC"



# America's energy future doesn't depend on miracles. Just smart choices.

By making the right choices in five critical areas, America can significantly reduce oil imports by 1990.

The choices to be made allow for more energy from federal lands, a more careful balance between the environment and domestic energy development, reasonable growth in nuclear power, increased reliance on the market system, and encouragement—rather

than preemption—of private development of a commercial synthetic fuels industry.

If America makes common sense decisions on these issues, our country will be in better control of its energy future. And the energy needed to keep America growing will be available in the year 2000 and beyond.



You expect more from a leader.



## In the Vanguard of Biotechnology . . .

### A VOTE OF THANKS TO ACADEMIA.

In less than five years, the academic world has helped provide Bethesda Research Laboratories with the technical expertise to become one of the leaders in genetic engineering.

Without the understanding and support of those in various related fields of biotechnology, BRL could not have become one of the world's leaders in the research and application of molecular and cellular biology.

In recognition of its continuing desire to support academia, BRL is taking steps to constantly encourage its scientists to publish . . . BRL works with MIT on the training of students in biotechnology . . . and BRL has formed the BRL Institute of Molecular Biology.

Our rapid growth in genetic engineering offers many career opportunities to those who want to investigate new areas of industrial applications for recombinant DNA and the "exotic" enzymes.

Our team approach can assure a scientist that their work will not be interrupted at a crucial stage . . . and professional fulfillment can be achieved.

That is our commitment to excellence.

We welcome your inquiry.

Send your C.V./Resume, in confidence, to:

Mr. Wayne E. Fowler  
Director of Personnel

#### BETHESDA RESEARCH LABORATORIES

Box 577, 8717 Grovemont Circle  
Gaithersburg, Maryland 20760  
(A suburb of Washington, D.C.)

# BRL

An equal opportunity  
employer, M/F/H

## LETTERS

### Universe Beyond the Galaxies

The statement that four giant elliptical galaxies are "the most distant celestial bodies ever studied" (Research News, 20 Mar., p. 1334) needs qualification. They are the most distant *galaxies* but not the most distant celestial bodies. Many quasars (or QSO's) are much more distant. The most distant known object, quasar OQ172, has a redshift of more than 3.5 as compared to 1.2 for the most distant of the four ellipticals. The redshift for OQ172 was established by Margaret Burbidge, President-Elect of the AAAS, and a team of Lick Observatory astronomers in 1973. In a Hubble universe with a radius of 18 billion light-years, OQ172 is at a distance of more than 16 billion light-years from Earth as compared to about 11 billion light-years for the four ellipticals.

JOHN KRAUS

*Ohio State University Radio  
Observatory, 2015 Neil Avenue,  
Columbus 43210*

### Cattle Breeding

George E. Seidel, Jr.'s review article "Superovulation and embryo transfer in cattle" (23 Jan., p. 351) raises two important issues. First is the welfare of donor cows. Codes or regulations need to be established to limit the number of surgical interventions performed annually on these animals if the surgical method of ova collection is used. Second, while this technique can certainly help improve herd utility, the possibility of narrowing the genetic base of domestic livestock should be considered, especially since there is further reduction through widespread practice of artificial insemination. There are hazards associated with rebuilding the nation's herds on the genetic material from only a few bulls and cows. It would be wise, therefore, to maintain some livestock of different lineages and phenotypic characteristics not deemed useful in order to preserve genetic diversity. A program along the lines of the Rare Breeds Trust in the United Kingdom, for example, should be seriously considered.

MICHAEL W. FOX

*Institute for the Study of Animal  
Problems, Washington, D.C. 20037*

Codes or regulations to limit the number of surgical interventions performed on a donor cow annually would serve no

useful purpose. As indicated in my article (1) and in the references I cited, embryos are recovered by entirely non-surgical methods in the commercial embryo transfer industry, except in occasional cases of infertility affecting fewer than 1 percent of donors; surgery is rarely repeated on the same donor in these cases.

Embryo transfer is unlikely to contribute significantly to narrowing the genetic base of cattle unless coupled with some form of cloning. For example, limiting donors of female gametes to 100 per generation would only decrease heterozygosity by about 2 percent per century (1, 2). To date, in fact, it appears that embryo transfer has functioned more to broaden than to narrow the genetic base of cattle in North America, primarily through the rapid proliferation of purebred animals of the so-called "exotic" breeds, such as Simmental and Limousin (1). Before the availability of embryo transfer technology, these populations were precariously small as a result of import restrictions.

Superovulation followed by cryopreservation of embryos for transfer some years hence is an ideal solution to the problem of maintaining genetic stocks of animals that are currently of marginal economic value. This is already being practiced in mice (3). The cost of frozen storage of embryos is much less than that of maintaining equivalent live animals. The freezing of semen is also an excellent method of preserving genetic material indefinitely.

Like embryo transfer, artificial insemination does not automatically lead to narrowing of genetic bases. It is clearly a more efficacious method of spreading genetic material over the population than natural mating and has contributed significantly to the recent broadening of the genetic base of beef cattle in North America.

GEORGE E. SEIDEL, JR.

*Animal Reproduction Laboratory,  
Colorado State University,  
Fort Collins 80523*

#### References

1. G. E. Seidel, Jr., *Science* **211**, 351 (1981).
2. C. C. Li, *Population Genetics* (Univ. of Chicago Press, Chicago, 1955), p. 212.
3. D. G. Whittingham, M. F. Lyon, P. H. Glenister, *Genet. Res.* **30**, 287 (1977).

### Auto Safety

The article "Auto crash tests unsettle Japan and Detroit" (News and Comment, 9 Jan., p. 150) calls attention to the



# Have it your way -

## for high-quality photomicrography. Compact, convenient—MC 63 Attachment Camera

It's the small camera with the large field. And it's perfectly human engineered for the utmost convenience. Exposure control is fully automatic. Focusing for both observation and camera is through the binocular tube. Controls are few, clearly marked, and readily accessible. The unusual compactness gives

it unequalled stability and freedom from vibration. Accepts both 35mm and 4 x 5" camera backs.

The great name in optics

# ZEISS

West Germany

### Three ways to choose from.

#### First way: MC 63A

with electronically controlled shutter for fully automatic exposure. Shown with camera back for 4 x 5" Polaroid® or 3 1/4 x 4 1/4" film.

#### Second way: MC 63C

with built-in automatic exposure control and manually released shutter. The most economical way. Shown with 35mm camera back.

#### Third way: MC 63

with electronically controlled shutter for fully automatic exposure, automatic film advance, and manual override. Shown with motor-driven 35mm camera back.

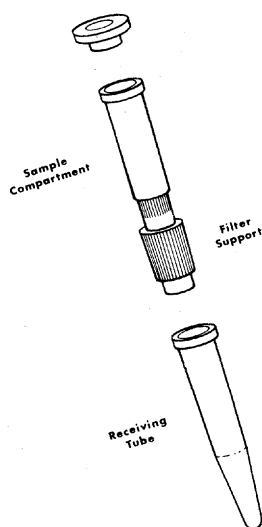
Circle No. 203 on Readers' Service Card

**Quality service—Expert dealers.**

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

## Centrifugal Microfilters

Bioanalytical Systems introduces a centrifugal micro-filter for membrane filtration of small volumes using the force of a conventional bench top centrifuge. Ideal for LC sample preparation, extraction of TLC spots, and many other applications.



- minimize loss and contamination
- no vacuum or pressure required
- solvent resistant polyalomer
- filter many samples simultaneously
- a variety of filter materials are available
- reusable

Send for details...



**BIOANALYTICAL  
SYSTEMS INC.**

1205 Kent Avenue  
West Lafayette, IN 47906  
(317) 463-2505 telex 276141

results of recent government studies comparing the crash test performances of selected new car models. The article begins and ends with reference to a Chevrolet dealer-sponsored advertisement, as an example of how the results of these tests can be used competitively by automobile manufacturers to advertise the safety performance of their products.

Although the advertisement was neither approved nor endorsed by General Motors or the Chevrolet Division, our reluctance to embrace the results of these specific government tests does not stem from any competitive shyness. Rather it evolves from our own recognition of the many technological complexities of assessing vehicle crashworthiness, which, at present, preclude a scientific correlation of the test results to real-world accident data.

For about a year, the National Highway Traffic Safety Administration (NHTSA), as part of its New Car Assessment Program, has been conducting vehicle crash tests in an effort to demonstrate that substantial differences exist in the occupant protection capabilities of today's new cars. In this test program, one each of selected new car models are crashed into a concrete barrier at 35 miles per hour. On the basis of these single, frontal tests, each vehicle is then rated as having "passed" or "failed," depending on whether the resulting impact and acceleration forces on the test dummies meet specified occupant injury criteria. Such representations are based, however, on the flawed assumption that the test results can be easily translated into injuries that would be expected to occur in actual highway crashes. This is simply not the case.

It is well recognized within the safety community that a test dummy Head Injury Criteria (HIC) value in excess of 1000 is not necessarily indicative of a serious or fatal injury. Yet, in representing their test results, the NHTSA has consistently classified HIC values in excess of 1000 as "failure"—meaning serious injury or fatality and values under 1000 as "passed"—meaning no serious injury. How high the HIC value must be and what shape or type of object must be contacted to indicate reliably a specific level of injury are not within today's science or technology.

Particularly inappropriate and misleading are "pass/fail" distinctions at or near the 1000 HIC threshold, where the test result differences are relatively small. In one of the NHTSA tests, for example, vehicle "A" with an HIC val-

ue of 997 was classified as having "passed," while another vehicle "B" with an HIC value of 1024 was classified as having "failed." The extent to which such small differences in HIC values can be considered as evidence of real performance differences and not the result of test variation cannot be demonstrated.

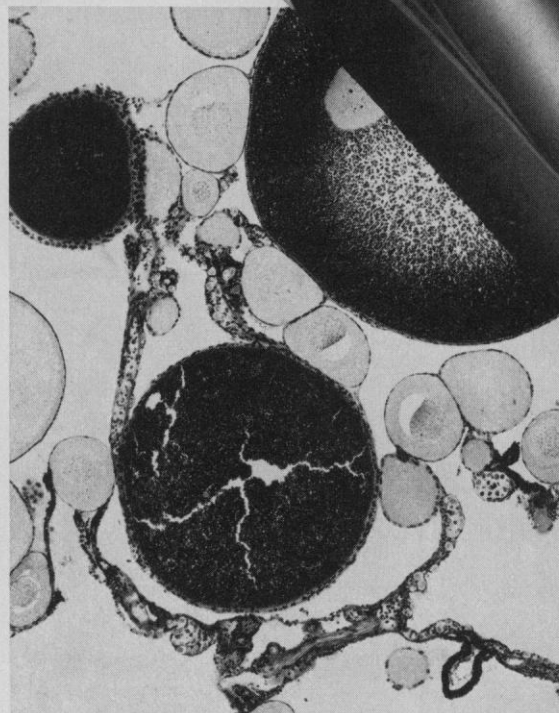
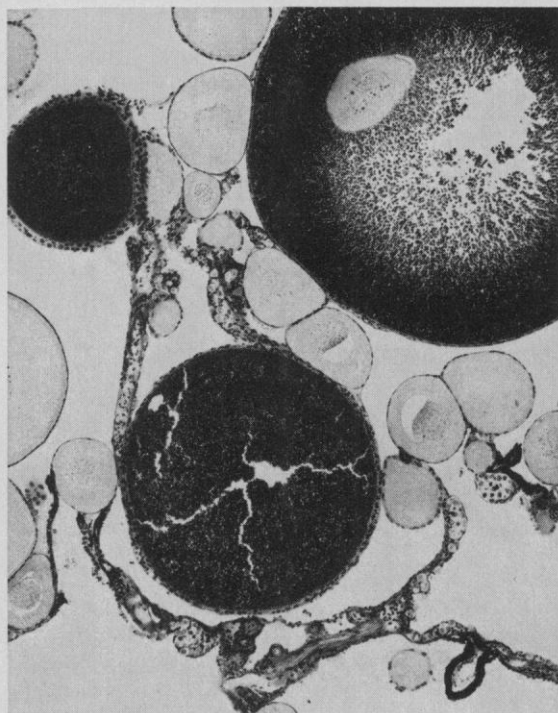
Moreover, the variety of real-world accident configurations essentially defies classification. Our analysis, for instance, of the NHTSA's own accident data file indicates that only about 5 percent of total real-world accidents are representative of the full-front barrier-type test as used by the NHTSA to justify its "pass/fail" results. This fact alone is enough to bring into question the usefulness of the NHTSA tests. Yet, regrettably, by relying on the NHTSA's simplistic "pass/fail" designations, consumers are likely to perceive car "B" as being less safe than car "A" simply because it is labeled "failed."

With increasing regularity, the tendency among industry critics is to attribute improvements in vehicle safety solely to the implementation of government safety standards. While in many instances these standards have had a beneficial effect, history documents clearly that many significant voluntary safety design improvements have evolved as a result of industry's traditional concerns for motor vehicle safety. Indeed, many of these voluntary initiatives, such as the collapsible steering column, side door beam, and so forth, were later simply translated into federal safety standards. Unfortunately, this is a fact that is generally overlooked.

As with vehicle improvements, commitment to our customers' safety also extends to consumer information. In this regard, General Motors supports the concept of providing consumers with information which can be helpful in making informed purchase decisions. However, to lead car buyers to believe that one car is more or less safe than another, when the observed differences in individual tests are so small as to be within the band of test repeatability and when "real world" cases exhibit no such "safe/unsafe" response, is categorically wrong and injects into the marketplace spurious factors which unfairly affect the competitive position of responsible manufacturers.

BETSY ANCKER-JOHNSON  
*Environmental Activities Staff,  
General Motors Corporation,  
General Motors Technical Center,  
Warren, Michigan 48090*

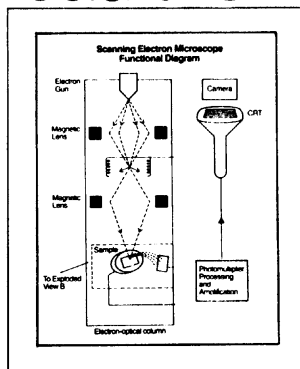




Hours.

Ours.

Next time you're waiting for your pictures to develop, read this.



**Type 51  
High Contrast**

While you're killing time, why not consider what else you're sacrificing. Polaroid instant black and white professional films tell you in seconds whether the picture you took is what you want. That could mean more than immediate gratification. It saves valuable time.

Our films help save money, too. With every shot, you'll neatly eliminate darkroom costs, expensive processors, chemicals and film waste. Not to mention re-do's or the need to save a set-up or experiment until you know whether or not your pictures turned out.

But time and money savings only partly explain why more and more technical, industrial and medical photographers are choosing to work with these films.

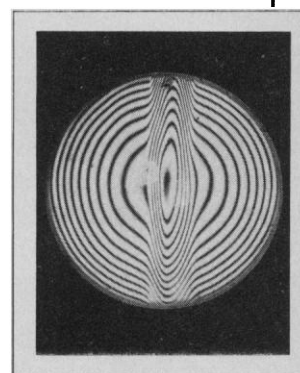
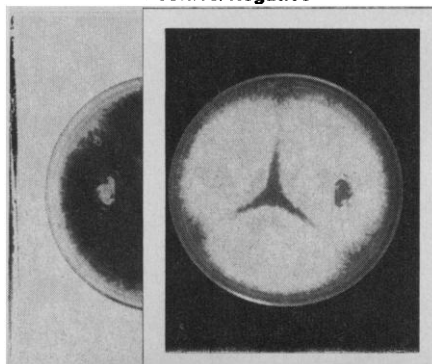
Notice the dramatic similarity between the print that took hours and ours, which was ready instantly. We used one of our

fine grain films, Type 52. Polaroid offers sixteen different instant black and white films, in a variety of sizes, formats, speeds and emulsions. With results in most cases that stand up to the quality comparison above.

And each one of them comes with a panel of photographic and technical experts who are prepared to answer further questions. Just write: Polaroid Corporation, Dept. 461, Cambridge, MA 02139. Or call us from anywhere in the continental U.S., toll free: 800-225-1618. (In Mass., call collect: 617-547-5177.) Or see a Polaroid professional film dealer.

All you have to lose are the hours of uncertainty between taking your shot and seeing whether it's what you want. And all the time you used to have to sit around and read.

**Type 665  
Positive/Negative**



**Type 667  
High Speed**

And each one of them comes with a panel of photographic and technical experts who are prepared to answer further questions. Just write: Polaroid Corporation, Dept. 461, Cambridge, MA 02139. Or call us from anywhere in the continental U.S., toll free: 800-225-1618. (In Mass., call collect: 617-547-5177.) Or see a Polaroid professional film dealer.

All you have to lose are the hours of uncertainty between taking your shot and seeing whether it's what you want. And all the time you used to have to sit around and read.

**Polaroid**  
Instant Professional Films



# BREAK THE GLASS HABIT



**Nalgene® Plastic Labware  
is as accurate as glass.  
Without the breakage.**

It's true. Nalgene labware can give you the accuracy of glass without the problems of glass.

Our PMP Volumetric Flasks, for example, are individually calibrated gravimetrically to guaranteed limits of error. And our PMP Graduated Cylinders meet the accuracy requirements of Federal Specification NNN-C-940-C.

Unlike glass, Nalgene labware is non-wetting, so total delivery of contents is assured.

Nalgene labware is safe. Shatterproof. And it's more durable than glass: you reduce replacement costs.

## **Free Nalgene Graduated Cylinder**

Put Nalgene labware to the test. Send for a free 100-mL PMP graduated cylinder. It's just as clear as glass, as accurate as glass, and safer than glass. For your free sample, simply circle the Reader Service Number. (Offer expires March 31, 1982.)

**SYBRON | Nalge**

Nalge Company, Box 365, Rochester, New York 14602

Circle No. 209 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

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

1982: WILLIAM ESTES, CLEMENT L. MARKERT, JOHN R. PIERCE, BRYANT W. ROSSITER, VERA C. RUBIN, MAXINE F. SINGER, PAUL E. WAGGONER, ALEXANDER ZUCKER

## Publisher

WILLIAM D. CAREY

## Editor

PHILIP H. ABELSON

## Editorial Staff

### Managing Editor

ROBERT V. ORMES

### Assistant Managing Editor

JOHN E. RINGLE

### News Editor: BARBARA J. CULLITON

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

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

*Administrative Assistant, News:* SCHERRAINE MACK;  
*Editorial Assistants, News:* FANNIE GROOM, CASSANDRA WATTS

*Senior Editors:* ELEANORE BUTZ, MARY DORFMAN, RUTH KULSTAD

*Associate Editors:* SYLVIA EBERHART, CAITILIN GORDON, LOIS SCHMITT

*Assistant Editors:* MARTHA COLLINS, STEPHEN KEPPEL, EDITH MEYERS

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

*Letters:* CHRISTINE GILBERT

*Copy Editor:* ISABELLA BOULDIN

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

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

*Guide to Scientific Instruments:* RICHARD G. SOMMER  
*Assistants to the Editors:* SUSAN ELLIOTT, DIANE HOLLAND

*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 "Information for Contributors," write to the editorial office or see page xi, *Science*, 27 March 1981.

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

## Advertising Representatives

*Director:* EARL J. SCHERAGO

*Production Manager:* GINA REILLY

*Advertising Sales Manager:* RICHARD L. CHARLES

*Marketing Manager:* HERBERT L. BURKLUND

*Sales:* NEW YORK, N.Y. 10036: Steve Hamburger, 1515 Broadway (212-730-1050); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); CHICAGO, ILL. 60611: Jack Ryan, Room 2107, 919 N. Michigan Ave. (312-337-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772); DORSET, VT. 05251: Fred W. Dieffenbach, Kent Hill Rd. (802-867-5581).

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

## Progress Toward Energy Independence

Recently, several oil-producing countries have announced small decreases in their prices for oil. They have done so because supply has been exceeding demand. The world, and particularly the United States, is lessening its consumption and dependence on imports of oil. Saudi Arabia could cut its production and cause higher prices, but these would provide further impetus to curtailment of the use of oil. In 1978 U.S. imports of oil and its products totaled about 8.3 million barrels a day (mbd). This year the annual rate is about 5.6 mbd. A further reduction to 3 to 4 mbd would make this country relatively secure against a disruption of supplies. Attaining such a goal in a few years is looking more and more feasible.

The three principal factors in the decline of use of oil have been conservation, enhanced energy efficiency, and substitution of other energy sources. Of these, conservation has been the most substantial contributor, but in the future the other two items will be important. In addition, a new factor is becoming significant. The refining of oil is being improved to obtain higher yields of essential products.

Conservation has had a substantial effect on the use of oil, natural gas, and electricity. Suppliers of fuel oil and natural gas have noted that, on average, individual householders have decreased their use in the home by about 15 percent. Higher prices for gasoline and mandated changes in new automobiles have resulted in a decrease in consumption of motor fuel. In 1978 demand was 7.4 mbd; currently the annual rate is 6.1 mbd. As older cars are replaced by fuel-efficient models, consumption will probably drop further.

However, the major potential for diminishing consumption of oil is in nontransportation uses, which in 1979 consumed 8.4 mbd. At least 5.5 mbd of oil is burned in applications for which coal or natural gas could suffice. This replaceable oil includes 3.0 mbd of residual and distillate oils (mainly residual) burned in utility and industrial boilers. Another 2.1 mbd of fuel oil (mainly distillate) is used for residential and commercial space heating. Natural gas, if it were available, could replace oil in some of the uses not filled by coal. At this time precise data on 1980 discoveries of natural gas are not available. However, industry sources say that the amount of gas discovered last year was the largest in a decade. In part this reflects record-breaking drilling activity. It also reflects exploration of hitherto untouched areas and depths. Favorable prospects for more discoveries enhance the desirability of further substitution of natural gas for oil. The American Gas Association has stated that if taxes on natural gas and federal regulations governing its use were relaxed, substantial substitution of gas for oil would occur quickly.

A major target for replacement is residual oil—a dirty, asphalt-like material that remains after vacuum distillation of petroleum at temperatures up to 550°C. It is made up of very large complex molecules, some of which contain sulfur and nitrogen; vanadium and nickel are also present. In electric power stations residual oil is in competition with coal and nuclear energy, both of which are cheaper energy sources. The major oil companies realize that they must find higher-value uses for residual oil, and they have been adding equipment to their refineries to enable them to convert it into gasoline and light fuel oil. As a source of gasoline, residual oil is an inferior feedstock, but it is still much better than coal. It has a hydrogen-to-carbon ratio of about 1.4 to 1.5; the corresponding value for bituminous coal is about 0.8. There are two methods for upgrading residual oil: adding hydrogen through hydrogenation at high pressures and temperatures, or subtracting carbon through a coking process. Both methods are practical, and successful plants based on them are in operation.

Substitution of coal, gas, and wood in applications where they can replace oil is the quickest practical means of further reducing dependence on imports. Technical know-how is well developed. What is needed is a continued infusion of national will.—PHILIP H. ABELSON

# AIM 65. The professional's microcomputer.



**Printer, display, full keyboard. Under \$500.00.**

For professional learning, designing and work, Rockwell's AIM 65 microcomputer gives you an easy, inexpensive head start.

- 20-column printer and display
- Dual cassette, TTY and general purpose I/Os
- R6502 NMOS microprocessor

- System expansion bus
- Read/write RAM memory
- Prom/ROM expansion sockets
- Self-prompt interactive monitor firmware
- Terminal-style keyboard
- Options include:
  - Prom Programmer module
  - RM 65 standard modules and card cages

For more on AIM 65 and how you can develop programs in assembly language, BASIC, PL/65 or FORTH, write Rockwell International, Electronic Devices Division RC55, P.O. Box 3669, Anaheim, CA 92803. For location of nearest distributor or dealer call 800-854-8099 (in California 800-422-4230).

Circle No. 264 on Readers' Service Card



**Rockwell International**  
...where science gets down to business