

# SCIENCE

5 February 1971

Vol. 171, No. 3970

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

---





NEW from LKB

# ULTROGRAD

*Makes complex  
gradients EASILY*



**3 simple steps** to produce even the most complex gradients for elution and ion-exchange chromatography.

1. Just cut out the gradient profile you want and place it in the scanning window of the ULTROGRAD.
2. Connect the solutions you want to mix; 2, or even 3 liquids.
3. Select the run-time and scanning speed you want, and switch on.

The gradient profile is followed, exactly, giving you automatic, unattended production of the gradient.

The gradient can be produced in 15 minutes or up to 16 days, at any flow rate or volume. An optional self-programmer acts on minimum external signals and automatically repeats complete cycles such as equilibration, gradient production and rinsing.

Sales and Service in USA: New York, Boston, Washington, Chicago, St. Louis, Atlanta, Houston, Los Angeles; in Europe: Stockholm, The Hague, Copenhagen, Rome, Vienna, London; and throughout the world.



IN THE SERVICE OF SCIENCE

LKB INSTRUMENTS INC. 12221 PARKLAWN DRIVE, ROCKVILLE MD. 20852 11744 WILSHIRE BLVD. LOS ANGELES CALIF. 90025  
6600 WEST IRVING PARK ROAD, CHICAGO, ILL. 60634



# A Timely, yet Tested Text



*The leading textbook of ecology  
coming soon in a completely revised new edition*

Eugene P. Odum's FUNDAMENTALS OF ECOLOGY 3rd Edition

This famous college text, by one of the leaders of the "ecological revolution" is as important to concerned citizens and scientists in government and industry as it is to ecology students. It is like three books in one. It gives a thorough and perceptive overview of the principles of ecology, of world environments, and of ecological technology. The emphasis is always on man and his environmental relationships.

Dr. Odum has always advocated the holistic view of ecology that is now generally recognized as the necessary basis for human action. But what was theory in the previous edition of this book is now practice, as is demonstrated in the rapid development of mathematical models of ecosystems. And what was once an esoteric academic study is now recognized as a matter of life or death. Consequently, this new edition has been not only rewritten and updated but also greatly enlarged. The number of illustrations has been more than doubled. Completely new chapters discuss:

The Individual and  
the Species in the Ecosystem  
Development and Evolution in the Ecosystem

Systems Ecology Estuarine Ecology  
Natural Resources  
Pollution and Environmental Health  
Remote Sensing Microbial Ecology  
Space Travel Towards a Human Ecology

Topics that have been given increased coverage include the total energy environment, crop ecology and world food production, total world productivity, global cycling of  $\text{CO}_2$  and  $\text{H}_2\text{O}$ , species diversity, community development (succession), behavior, mathematical modelling, decomposition and microbial ecology, population ecology, marine ecology, pollution, ecological technology and human ecology. This vast amount of information is superbly organized and meticulously documented. Many of the citations are to work published in 1970. Numerous cross references are provided, and almost every section concludes with a list of suggested readings.

This enlarged, updated new edition of the famous "Odum" will be welcomed not only by teachers of ecology but also by the many scientists, engineers, and laymen who urgently need an understanding of ecological concepts, methods, and data.

By Eugene P. Odum, Alumni Foundation Distinguished Professor  
and Director, Institute of Ecology, University of Georgia  
*About 688 pages with about 237 illustrations. Ready May, 1971.*



To reserve your examination copy write

**W. B. SAUNDERS COMPANY**  
**West Washington Sq., Philadelphia, Pa. 19105**



5 February 1971

Vol. 171, No. 3970

# SCIENCE

<b>LETTERS</b>	Grizzlies: To Spare or Banish: <i>H. A. Waldrop; S. F. Cook, Jr.; D. C. Lowrie; G. B. Moment</i> ; Measuring Radioactive Materials: <i>S. B. Garfinkel and W. B. Mann</i> . . .	<b>431</b>
<b>EDITORIAL</b>	Control of Agricultural Pests . . . . .	<b>437</b>
<b>ARTICLES</b>	The History and Stability of Atmospheric Oxygen: <i>L. Van Valen</i> . . . . .	<b>439</b>
	Mammalian Scent Marking: <i>K. Ralls</i> . . . . .	<b>443</b>
	Conditions Favoring Major Advances in Social Science: <i>K. W. Deutsch, J. Platt, D. Senghaas</i> . . . . .	<b>450</b>
<b>NEWS AND COMMENT</b>	'72 Budget: Nixon Proposes Modest Increases for Science . . . . .	<b>459</b>
	Star Bright, Street Light, Which Will They See Tonight? . . . . .	<b>461</b>
	Pine Bluff Saved, Detrick Critical . . . . .	<b>462</b>
	Corporate Responsibility: Group Rates Company Social Performance . . . . .	<b>463</b>
	National Medal of Science Winners . . . . .	<b>464</b>
<b>BOOK REVIEWS</b>	<i>The Emerging Japanese Superstate</i> and <i>The Japanese Challenge</i> , reviewed by <i>C. Johnson</i> ; other reviews by <i>B. S. Adams, C. E. Renn, W. W. Murdoch, J. M. Creeth, W. Bleakney, H. Feigl</i> ; Books Received . . . . .	<b>467</b>
<b>REPORTS</b>	Carbon, Carbides, and Methane in an Apollo 12 Sample: <i>S. Chang et al.</i> . . . .	<b>474</b>

<b>BOARD OF DIRECTORS</b>	ATHELSTAN SPILHAUS Retiring President, Chairman	MINA REES President	GLENN T. SEABORG President-Elect	DAVID BLACKWELL RICHARD H. BOLT	LEWIS M. BRANSCOMB BARRY COMMONER
<b>VICE PRESIDENTS AND SECTION SECRETARIES</b>	<b>MATHEMATICS (A)</b> Henry O. Pollak F. A. Ficken	<b>PHYSICS (B)</b> Gaylord P. Harnwell Albert M. Stone	<b>CHEMISTRY (C)</b> Charles C. Price Leo Schubert	<b>ASTRONOMY (D)</b> Laurence W. Fredrick Arlo U. Landolt	
	<b>PSYCHOLOGY (I)</b> James E. Deese William D. Garvey	<b>SOCIAL AND ECONOMIC SCIENCES (K)</b> Daniel P. Moynihan Harvey Sapolsky		<b>HISTORY AND PHILOSOPHY OF SCIENCE (L)</b> Cyril Smith Raymond J. Seeger	
	<b>PHARMACEUTICAL SCIENCES (Np)</b> Wallace L. Guess John Autian	<b>AGRICULTURE (O)</b> Matthias Stelly Michael A. Farrell	<b>INDUSTRIAL SCIENCE (P)</b> Burton V. Dean Jordan D. Lewis	<b>EDUCATION (Q)</b> J. David Lockard Phillip R. Fordyce	
<b>DIVISIONS</b>	<b>ALASKA DIVISION</b> Laurence Irving President Irma Duncan Executive Secretary	<b>PACIFIC DIVISION</b> George E. Lindsay President Robert C. Miller Secretary	<b>SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION</b> Loren D. Potter President Marlowe G. Anderson Executive Secretary		
SCIENCE is published weekly, except the last week in December, but with an extra issue on the fourth Tuesday in September, by the American Association for the Advancement of Science, 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Now combined with <i>The Scientific Monthly</i> . Second-class postage paid at Washington, D.C. Copyright © 1971 by the American Association for the Advancement of Science. Annual subscription \$12; foreign postage: Americas \$3; overseas \$5; single copies, \$1 (back issues, \$2) except <i>Guide to Scientific Instruments</i> which is \$4. School year subscription: 9 months, \$9; 10 months, \$10. Provide 4 weeks notice for change of address, giving new and old address and zip codes. Send a recent address label. SCIENCE is indexed in the <i>Reader's Guide to Periodical Literature</i> .					

# AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Endogenetic Craters Interpreted from Crater Counts on the Inner Wall of Copernicus: <i>R. Greeley and D. E. Gault</i> .....	477
Lunar Metallic Particle ("Mini-Moon"): An Interpretation: <i>D. S. McKay, J. L. Carter, W. R. Greenwood</i> .....	479
Solifluction: A Model Experiment: <i>A. Higashi and A. E. Corte</i> .....	480
Structure of water in Microemulsions: Electrical, Birefringence, and Nuclear Magnetic Resonance Studies: <i>D. O. Shah and R. M. Hamlin, Jr.</i> .....	483
Xenon Hexafluoride: Structural Crystallography of Tetrameric Phases: <i>R. D. Burbank and G. R. Jones</i> .....	485
Opal Precipitation by Marine Gastropods (Mollusca): <i>H. A. Lowenstam</i> .....	487
Urea-Inorganic Phosphate Mixtures as Prebiotic Phosphorylating Agents: <i>R. Lohrmann and L. E. Orgel</i> .....	490
Radioimmunoassay for Prostaglandins: <i>B. M. Jaffe et al.</i> .....	494
Adenosine 3',5'-Monophosphate Phosphodiesterase in the Growth Medium of <i>Physarum polycephalum</i> : <i>A. W. Murray, M. Spizman, D. E. Atkinson</i> .....	496
Allergic Encephalomyelitis: New Form Featuring Polymorphonuclear Leukocytes: <i>S. Levine and R. Sowinski</i> .....	498
<i>Technical Comments</i> : Promising Catalyst for Auto Exhaust: <i>W. F. Libby</i> ; X-rays from Centaurus A and the Far-Infrared Background Radiation: <i>R. Ramaty; E. T. Byram, T. A. Chubb, H. Friedman</i> .....	499
<b>MEETINGS</b> Prostaglandins: <i>G. G. Anderson and L. Speroff</i> .....	502

CARYL P. HASKINS  
PHYLLIS V. PARKINS

LEONARD M. RIESER  
KENNETH V. THIMANN

WILLIAM T. GOLDEN  
Treasurer

WILLIAM BEVAN  
Executive Officer

GEOLOGY AND GEOGRAPHY (E)  
Ellis L. Yochelson  
William E. Benson

BIOLOGICAL SCIENCES (FG)  
George Sprugel, Jr.  
Richard J. Goss

ANTHROPOLOGY (H)  
Ward Goodenough  
Anthony Leeds

ENGINEERING (M)  
Newman A. Hall  
Raynor L. Duncombe

MEDICAL SCIENCES (N)  
George B. Koelle  
F. Douglas Lawrason

DENTISTRY (Nd)  
Henry W. Scherp  
Sholom Pearlman

INFORMATION AND  
COMMUNICATION (T)  
Edward L. Brady  
Scott Adams

STATISTICS (U)  
Elizabeth Scott  
Ezra Glaser

ATMOSPHERIC AND HYDROSPHERIC  
SCIENCES (W)  
Thomas F. Malone  
Louis J. Battan

## COVER

Maxwell's duiker (*Cephalophus maxwelli*), a small antelope of the West African forests. Duikers rub the secretion of the large scent gland in front of the eye, which exudes through a row of pores, on vegetation and each other's glands. See page 443. [Bill Meng, New York Zoological Society]

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

# This is the end.



The end of leakage. The beginning of convenience.

*At Last – a leak-proof, screw cap vial  
for radioactive chemicals.*

It's the best of both worlds – the security of a  
multidose closure and the convenience of a screw cap.  
Contents may be removed by syringe or pipette.  
After the multidose closure is removed, the vial can be  
reclosed with the screw cap.

Another plus from the world's leading manufacturer  
of radioactive chemicals for research.



**New England Nuclear**

575 Albany Street, Boston, Mass. 02118  
Customer Service: (617) 482-9595

## METABOLIC CONJUGATION AND METABOLIC HYDROLYSIS Volume 2

edited by **WILLIAM H. FISHMAN**, Tufts University School of Medicine, New England Medical Center Hospitals, Boston, Massachusetts

January 1971, 700 pp., \$35.00

Subscription price: \$29.75\*

\*Subscription prices for individual volumes valid only on orders for the complete set received before publication of the last volume.

## INVERTEBRATE PHOTORECEPTORS:

### A Comparative Analysis

by **JEROME J. WOLKEN**, Biophysical Research Laboratory, Carnegie Institute of Technology, Carnegie-Mellon University, Pittsburgh, Pennsylvania

January 1971, 188 pp., \$9.50

## METHODS IN IMMUNOLOGY AND IMMUNOCHEMISTRY

Volume 3: REACTIONS OF ANTIBODIES WITH SOLUBLE ANTIGENS

edited by **CURTIS A. WILLIAMS** and **MERRILL W. CHASE**, both at the Rockefeller University, New York

January 1971, 528 pp., \$23.50

Subscription price: \$19.97\*

\*Subscription prices for individual volumes valid only on orders for the complete set received before publication of the last volume.

## PHYSICAL PRINCIPLES AND TECHNIQUES OF PROTEIN CHEMISTRY

### Part B

edited by **SYDNEY J. LEACH**, Russell Grimwade School of Biochemistry, University of Melbourne, Parkville, Victoria, Australia

January 1971, 510 pp., \$24.00

## MOLECULAR ORBITAL THEORY IN DRUG RESEARCH

A Volume in **MEDICINAL CHEMISTRY**  
Series Editor: **GEORGE DeSTEVENS**

by **LEMONT B. KIER**, Battelle Memorial Institute, Columbus, Ohio

January 1971, 279 pp., \$15.00

## MICROBIAL TOXINS

Volume 2: BACTERIAL PROTEIN TOXINS

edited by **SOLOMON KADIS**, Research Laboratories, Albert Einstein Medical Center, Philadelphia, Pennsylvania, **THOMAS C. MONTIE**, Department of Microbiology, University of Tennessee, Knoxville, Tennessee, and **SAMUEL J. AJL**, Research Laboratories, Albert Einstein Medical Center, Philadelphia, Pennsylvania

Part A: February 1971, 434 pp., \$22.00

Subscription Price: \$18.70\*

Part B: April 1971, about 425 pp., in preparation

\*Subscription prices for individual volumes valid only on orders for the complete set received before publication of the last volume.

## TRACE ELEMENTS IN HUMAN AND ANIMAL NUTRITION

### Third Edition

by **E. J. UNDERWOOD**, Institute of Agriculture, University of Western Australia, Nedlands, Western Australia

March 1971, about 480 pp., in preparation

## REVERSE OSMOSIS

by **S. SOURIRAJAN**, Division of Chemistry, National Research Council of Canada, Ottawa, Canada

1970, 580 pp., \$25.00



**ACADEMIC PRESS**

NEW YORK AND LONDON  
111 FIFTH AVENUE, NEW YORK, N. Y. 10003

pened not to turn out as a source of injury to them. Some were even quite humorous and I recommend reading the accounts if one is interested in bears.

Herrero's recommendations are excellent. I hope we never try to deliberately eliminate even mosquitoes from the national parks. Those afraid of injury should observe their bears in zoos and those who would like to observe them close at hand should know how to do it. They will not be injured either, even if they are able to find a grizzly. . . .

DONALD C. LOWRIE

Zoology Department, California  
State College, Los Angeles 90032

### References

1. P. R. Cutright, *Lewis and Clark: Pioneering Naturalists* (Univ. of Illinois Press, Urbana, 1969).
2. R. D. Burroughs, Ed., *Natural History of the Lewis and Clark Expedition* (Michigan State Univ. Press, East Lansing, 1961).

Herrero correctly named me as a supporter of the proposal to remove grizzly bears from parks such as Yellowstone and Glacier and then labeled the proposal both undesirable and "clearly contrary to the obligation stated in the statutes" under which our national parks were established.

Herrero himself recently pointed out (1) that "few people would suggest reintroducing the grizzly into the back country of the Sierra Nevada National Park areas. Back country use by people in the Sierra is simply too great to permit such sharing." Thus the main difference between our positions reduces to whether or not people should be permitted, indeed encouraged, to get out from behind their windshields and hike as they are doing in the Sierra park. It is worth noting that in the new German national park in the Bavarian Forest grizzlies will not be reintroduced.

The extensive statistics cited by Herrero on the miles hiked, grizzlies studied, and man-hours devoted by the Craigheads in Yellowstone without serious injury are no doubt accurate although the Craigheads reported (2) that their "information was not gleaned without risk. Time and again we have been treed by bears." It is difficult to see how the experience of a group of professionals, usually armed at that, applies to the average hiker or camper.

An Act of Congress established Yellowstone in 1872 both as a "pleasuring-ground for the people" and for "the preservation of all the timber, mineral deposits, natural curiosities, and won-

Just



one



drop



## at a time:

Squeeze as hard as you can! Nalgene Dropping Bottles deliver only one drop at a time—never a stream. Drops are precise—about 0.04 ml. The Drop-Dispenser Bottle is available in 5 sizes from 15 to 250 ml. For those who prefer to hold the bottle in an upright position, there is the Unitary design in 125 and 250 ml. All are unbreakable polyethylene with polypropylene screw closures. Order from your Laboratory Supply Dealer. Ask for our Catalog or write Dept. 4102, Nalgene Labware Division, Rochester, N. Y. 14602.

Nalgene® Labware...the permanent replacements.





ders within said park." As soon as roads through the park and Old Faithful Inn were built, the inherent conflict of purposes became apparent. Clearly, if the first part of the 1872 obligation is to be fulfilled, some compromise is inevitable in the second. Furthermore, no one generation can in fact forever bind future generations. . . . Even though laws remain the same, as decades pass and new circumstances arise, the laws tend to be reinterpreted.

We can all agree that feeding garbage to grizzlies in national parks should stop. But will the Park Service, which does such a superb job in so many ways, continue to enforce no-feeding rules after the present excitement has subsided? I have seen garbage fed to grizzlies every night under the eyes of unprotesting park rangers even though it was in flagrant violation of regulations.

Last, some caution is in order before accepting Herrero's theme that "the highest function our parks can serve" is to give man a sense of being "part of nature." This is a complex and slippery idea. Does he imply that the man studying biochemistry or atomic physics is not as fully and deeply immersed in the study of nature as the man hiking the back trails and thinking about grizzly bears? Most of us believe we find mountain scenery ennobling, something which uplifts the mind and heart. Yet Hitler found his inspiration in the Berchtesgaden Alps. There simply is no assurance that a sense of union with an alpine ecosystem including large and savage carnivores will automatically be a civilizing experience.

GAIRDNER B. MOMENT  
Department of Biological Sciences,  
Goucher College,  
Baltimore, Maryland 21204

#### References

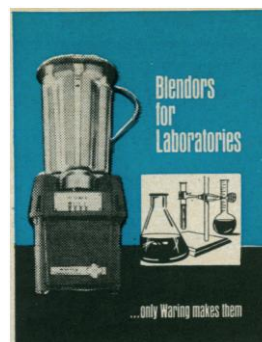
1. S. Herrero, *BioScience* 20, 1148 (1970).
2. F. Craighead and J. Craighead, *Nat. Geogr. Mag.* 130, 252 (1966).

#### Measuring Radioactive Materials

We have noted with interest the correspondence on the subject of the mislabeling of radioactively tagged chemicals, culminating with the letter (4 Dec.) from A. Broido entitled "More mislabeling—more frustration." Broido rightly points out the hazards of using, to say nothing of supplying, solid "standard" sources of such low specific activity, low-energy beta-particle emit-

This one-gallon laboratory "workhorse" has all the power you will ever need for high-speed reduction of solids. You can grind, emulsify, disintegrate, homogenize, shred, blend, or mix in seconds! The container, cover, and blending assembly are stainless steel, easy to clean, and trouble free. An ingenious adapter lets you use smaller containers on the one-gallon base.

Waring also makes one-quart models (some with timers, some with 7-speed controls), explosion-proof models, and accessories from 12 ml Mini Containers to ice crusher attachments. All are ruggedly constructed and warranted for one year of commercial use.



Write for our new catalog.

## Reduce research problems faster with this Waring Laboratory Blendor®

Waring Blendors®  
are unique . . .


no wonder  
we registered the name!



# waring

Waring Products Division/Dynamics Corporation of America  
New Hartford, Conn. 06057





**HOW TO COOL**  
*Martinis*

... or anything else. The Neslab PBC-4 portable cooler will chill a quart of Martinis from 75°F to 40°F in 10 minutes ... without dilution from melting ice.

It will also fit into Dewar flasks to hold methanol at -40°C ... and into a variety of laboratory vessels to chill reagents.

In fact, the specially designed 1 inch diameter cooling probe gets into more places and does more cooling than any other.

Of course it is at its best in a well insulated Tamson Circulating Thermostatic Bath where the 1700 BTU/hr capacity of the PCB-4 extends the bath control range to -20°C

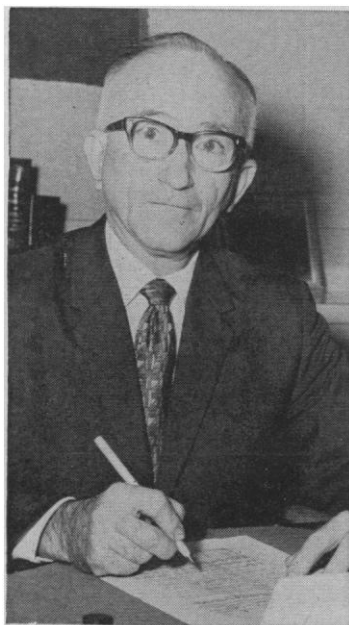
**NESLAB**  
Instruments, Inc.

Temperature Controlled  
*Liquid* Systems

871 Islington St., Portsmouth, N.H. 03801

## Samford University's, Dr. J. H. Langston:

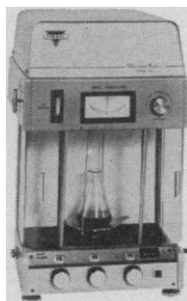
**"I evaluated analytical balances for a year...but it was a 15 minute TORBAL demonstration that sold me."**



Dr. J. H. Langston, Chairman of the Chemistry Department at Samford University, needed some new analytical balances that could stand up under use by as many as twenty chemistry students per day. It took the Torsion representative just 15 minutes to point out that the no-knife-edge torsion design principle provides this kind of ruggedness—plus high accuracy and precision.

As a result of this demonstration, Samford University equipped their analytical lab with TORBAL EA-1 electronic analytical balances. The EA-1, with a capacity of 160 g and precision of 0.03 mg, features an electronic null indicator, which eliminates inaccuracies due to sensitivity variations, and complete digital readout to 0.1 mg for faster, easier reading.

We'd welcome the chance to demonstrate the EA-1 to you. Just call your nearest Torsion sales representative.



**THE TORSION BALANCE CO.** Dept. J. Clifton, New Jersey. Sales offices in Chicago, Ill.; San Mateo, Cal.; Pittsburgh, Pa.; Montreal, Quebec; and Windsor, England. Balances manufactured in Waterford, Ireland and Clifton, New Jersey.

ters as  $^{14}\text{C}$ . The difficulties inherent in the measurement of solid  $^{14}\text{C}$  sources as a result of absorption and scattering have recently been discussed by Wood (1).

Because of such problems arising from absorption and scattering, the emission rates per curie from solid sources of the same low-energy beta-particle emitter can vary quite considerably, depending on their chemical composition and geometrical configuration. Since it is impossible to calibrate such solid sources nondestructively, the National Bureau of Standards has never offered calibration services for this type of source.

Where the assay of a  $^{14}\text{C}$  sample cannot conveniently be carried out by liquid-scintillation or gas counting we have, in the past, recommended the preparation of a working standard custom-made for the particular experiment. It is inadvisable that such a working standard be made by anyone but the user himself. Thus we have suggested that our  $\text{Na}_2\text{CO}_3$  solution standards containing  $^{14}\text{C}$  can be satisfactorily used for the assay of  $^{14}\text{C}$  samples by preparing a working laboratory standard, into which a quantitative "spike" of our standard has been introduced at some appropriate stage in the preparation of a sample, with the analysis carried out in *exactly* the same manner as for the samples that are to be assayed.

Price lists of our standards for use in the assay of  $^{14}\text{C}$ , including [ $^{14}\text{C}$ ]-*n*-hexadecane and [ $^{14}\text{C}$ ]benzoic acid in toluene for liquid-scintillation counting, and of other low-energy beta-particle solution standards, such as  $^3\text{H}$ ,  $^{63}\text{Ni}$ , and  $^{147}\text{Pm}$ , can be obtained from the Radioactivity Section of the National Bureau of Standards. Lists of our radioactivity calibration services are also available. Information and guidance on problems arising in radioactivity measurements can be found in a number of texts such as, for example, NBS Handbook 80, *A Manual of Radioactivity Procedures*, available from the Government Printing Office or the Radioactivity Section. Personnel of this section are also available for consultation on such problems.

S. B. GARFINKEL  
W. B. MANN

Radioactivity Section,  
Center for Radiation Research,  
National Bureau of Standards,  
Washington, D.C. 20234

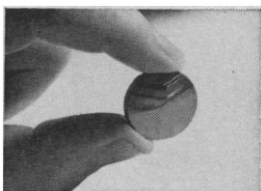
### Reference

1. K. G. Wood, *Int. J. Appl. Radiat. Isot.* **21**, 581 (1970).

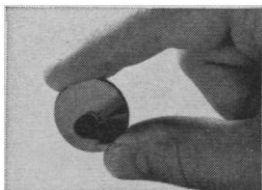
# We want to be useful ...and even interesting

**Kodak**

## Magneto-optics



**CdTe**—sold by Kodak Apparatus Division, Rochester, N.Y. 14650 as polycrystalline KODAK IRTAN 6 Optical Material, or at \$50/lb in chunks for evaporation applications. About as hard as anthracite, insoluble. Transmits from 0.9 to 31  $\mu\text{m}$  at room temperature. Outstanding window material for far infrared.



**CdCr<sub>2</sub>S<sub>4</sub>**—too costly yet to sell. Similarly polycrystalline but more interesting optically. Transmits from 0.8 to 15  $\mu\text{m}$  when cooled with liquid nitrogen. In addition, its Curie temperature is 85 K, 8 K above liquid nitrogen. Consider the consequences.

Not too many years ago all magnets were metals. Now there are several dozen materials that are both ferromagnetic and semiconducting. Metals absorb at all frequencies; nonmetals are transparent at some wavelengths even when thicker than thin films. Ferromagnetism makes possible a substantial field strength within an optical material, very much more field

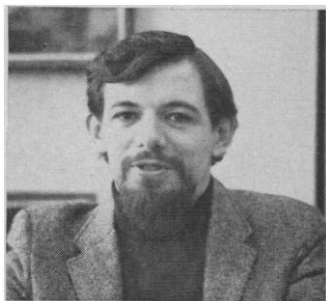
strength than Faraday could bring to bear when he demonstrated long ago that as polarized light passes through a solid in the direction of a magnetic field the polarization plane rotates.\*

A Curie temperature of 85 K permits ferromagnetism without the cumbersome helium cryostats that earlier ferromagnetic semiconductors like EuO and EuS have required. In return for the lesser trouble of cooling CdCr<sub>2</sub>S<sub>4</sub> with liquid nitrogen, one gets a ratio of Faraday rotation to absorption that is several thousand times more favorable than in, say, a thin film of iron. Insert a crossed polarizer and you have plenty of rotation for modulating a CW laser beam when you modulate magnetic field.

We did not invent CdCr<sub>2</sub>S<sub>4</sub>. What we did was to find out how to put it into the form of a high-grade optical material, just as workable by standard grinding and polishing techniques as the six famous KODAK IRTAN Optical Materials. Inspired by its obvious promise, we have been rather thoroughly exploring its magneto-optical properties.

You may be hearing more about this.

\*In 1970 a professor at the University of Grenoble was honored with a Nobel Prize in physics for deeper insights into what Faraday uncovered.



**"My book came out today."**



**"My third should be out in another two years."**

It feels great. Whether the book is about a little known genus of Antarctic ostracods, or tells what every homemaker should know about houseplants, or merely entertains the under-worked secretary between coffee breaks, it's wonderful to have one's work and thought perpetuated between hard covers. A paperback may be just as good. Books will not disappear, though they are getting costly to publish and to buy. Ditto for journals. Something can be done about this, and we are doing it.

**Micropublication.** For the publisher or would-be publisher who wants to publish in the form of microfiche (or other microforms), we are prepared to manufacture his product. He deals with authors, illustrators, editors, manuscript typists, copyright offices. He arranges for contact with an interested audience and for payment of the bills, including ours, which can cover much or little. It can even cover airmailing out the micropublication from our production centers. Postage would be a very small item indeed. Equipment for reading the product would be a problem that nobody is in a better position to help solve than Kodak.

*The sooner conversation is begun with us, the sooner the problems can be overcome. Make first contact by a note to Eastman Kodak Company, Dept. 55W, Rochester, N.Y. 14650.*

**Realism** is in order. We expect precious little business supplying secretaries with microfiche readers for their novels. While color microfiche would do a grand and highly economical job of showing houseplants, homemakers will be encountering it in catalog-shopping stores before microfiche readers enter the average home. But for ostracods and other subjects that cannot attract large paying audiences, micropublication is far, far better than no publication at all.


**... and here we offer a \$2.50 paperback that gratifies no egos, fails to entertain, is printed on 8 1/2 x 11" paper pages, and may make your microscope work better.**

Kodak doesn't even make microscopes, but we do make film for them. Many microscope users tend to be overly tolerant until there is a photograph to look at and show. Then they blame the film. If it's Kodak film, they shouldn't. Nor should they blame the microscope. They should first make sure that in their preoccupation with the subject under study, they have not neglected some fundamentals of microscopy. This is a subject in itself but one that most microscope users find

less than fascinating. The latest edition of the Kodak publication "Photography Through the Microscope" treats the subject in more detail than did previous editions but no more than you need. Unless your photography through the microscope is already as good as you want it to be, order a copy from your photographic dealer. It will make the film work better.

*Prices subject to change without notice.*





## Just wait till you see through it!

Once again Leitz sets the standard for innovation in microscope engineering others will try to follow. The all new SM-LUX Medical/Laboratory Microscope offers you an instrument so extraordinarily functional, it dares to challenge medical microscopes of the future.

From its radically new design, inspired by those who spend countless hours at the microscope, to its matchless optical and mechanical refinements, the SM-LUX meets the sophisticated demands of today's medical scene. But, as always, your best test is to place a slide on the stage and let performance speak for itself. You'll immediately see *and* feel why the SM-LUX is the scope to fol-

low you through school and later assist you during years of professional practice.

A few special features:

- *built-in*, Koehler illumination via a high-intensity, low voltage light source and regulating transformer for adjustable brightness—no extras to carry.
- needle bearing coarse and fine adjustment that maintains its smoothness and precision over years of hard use.

- new design achromatic objectives that provide crisp, sharp images at all magnifications.

- quick transfer from bright-field to darkfield or phase contrast.

But there's much more to the SM-LUX: Write today for our portfolio containing complete specifications and details on SM-LUX technical features and innovations.

# 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

1971

THOMAS EISNER	NEAL MILLER
AMITAI ETZIONI	BRUCE MURRAY
EMIL HAURY	JOHN R. PIERCE
DANIEL KOSHLAND, JR.	MAXINE SINGER

1972

ALFRED BROWN	FRANK PRESS
JAMES F. CROW	FRANK W. PUTNAM
THOMAS KUHN	WALTER O. ROBERTS
ELLIOTT W. MONTROLL	

## Editorial Staff

### Editor

PHILIP H. ABELSON

### Publisher

WILLIAM BEVAN

### Business Manager

HANS NUSSBAUM

Managing Editor: ROBERT V. ORMES

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

Assistant to the Editor: NANCY TEIMOURIAN

News and Comment: JOHN WALSH, PHILIP M. BOFFEY, ROBERT J. BAZELL, CONSTANCE HOLDEN, SCHERRAINE MACK

Research Topics: ALLEN L. HAMMOND

Book Reviews: SYLVIA EBERHART, KATHERINE LIVINGSTON, ANN BARKDOLL

Cover Editor: GRAYCE FINGER

Editorial Assistants: MARGARET ALLEN, JOANNE BELK, ISABELLA BOULDIN, BLAIR BURNS, ELEANORE BUTZ, BARBARA GUARIN, CORRINE HARRIS, OLIVER HEATWOLE, ANNE HOLDSWORTH, ELEANOR JOHNSON, MARSHALL KATHAN, MARGARET LLOYD, DANIEL RABOVSKY, PATRICIA ROWE, LEAH RYAN, LOIS SCHMITT, BARBARA SHEFFER, RICHARD SOMMER, YA LI SWIGART, ALICE THEILE, MARIE WEBNER

Membership Recruitment: LEONARD WRAY

Subscriptions: BETT SEEMUND

Addressing: THOMAS BAZAN

## Advertising Staff

### Director

EARL J. SCHERAGO

### Production Manager

BONNIE SEMEL

Advertising Sales Manager: RICHARD L. CHARLES

Sales: NEW YORK, N.Y. 10036: Herbert L. Burkland, 11 W. 42 St. (212-PE-6-1858); SCOTCH PLAINS, N.J. 07076: C. Richard Callis, 12 Unami Lane (201-889-4873); MEDFIELD, MASS. 02052: Richard M. Ezequelle, 4 Rolling Lane (617-444-1439); CHICAGO, ILL. 60611: John P. Cahill, Room 2107, 919 N. Michigan Ave. (312-DE-7-4973); BEVERLY HILLS, CALIF. 90211: Winn Nance, 111 N. La Cienega Blvd. (213-657-2772)

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., NW, Washington, D.C. 20005. Phone: 202-387-7171. Cable: Advancesci, Washington. Copies of "Instructions for Contributors" can be obtained from the editorial office. See also page xv, *Science*, 25 December 1970. ADVERTISING CORRESPONDENCE: Room 1740, 11 W. 42 St., New York, N.Y. 10036. Phone: 212-PE-6-1858.

## Control of Agricultural Pests

Our nation has been blessed with high-quality, dependable supplies of low-cost food and fiber. But few people are aware of the never-ending battle that makes this possible. Among the insects, about 10,000 species are known to damage crops, forests, or livestock. If left undisturbed, some of these pests would take more of the crop than would the farmer. Agriculture must cope not only with native enemies but also with invaders from abroad. Increasing air travel has expanded the probability of bringing in pests from all over the world. For these, natural controls such as parasites are often absent.

During more than two decades, agriculture has depended heavily on chemical pesticides such as DDT. But even in the 1950's it was apparent that DDT was not the final answer; resistant insect forms were emerging. The use of degradable chemicals such as the organic phosphates and carbamates has been expanding. However, these are acutely toxic to warm-blooded animals, including man, and to useful insects such as bees, parasites, and predators. For the long term it is desirable to develop methods of control that minimize the use of broadly toxic chemicals.

Some of these methods antedate the use of the chemical pesticides—for instance, the use of insect-resistant varieties of plants and the fostering of natural enemies. Promising methods of control that have recently been developed include the use of sex attractants and the release of competitive radiation-sterilized males. About 20 of the sex attractants have now been identified. Of particular importance is that of the gypsy moth, an insect that has been ravaging a rapidly increasing fraction of the hardwood trees of northeastern United States. The synthesis of the attractant and its use in conjunction with localized applications of insecticides give promise of timely intervention in what otherwise might be a dreadful destruction of vast stands of trees.

At the AAAS meeting in Chicago, E. F. Knipling described proposals to exploit techniques that he had previously used successfully to eradicate the screwworm in Florida. These same techniques have been employed to minimize the population of screwworms in Texas and adjoining states. In that area, eradication is impossible because of reinvasion from Mexico. However, the pest is more than 99 percent controlled at an annual cost of about \$6 million and with annual benefits estimated at \$100 million. Knipling pointed out that a limited number of pests account for a very major fraction of all crop damage. Under especially close study are the boll weevil, the codling moth, and the corn borer. The boll weevil alone causes losses of about \$200 million a year, and about \$70 million is spent by growers for chemical control. About one-third of all insecticides used for agricultural purposes are employed to control this single insect. Knipling discussed plans for a large-scale demonstration experiment to suppress populations of this insect in an area 250 kilometers in diameter. The plans involve a combination of treatments to diminish the overwintering population and an intensive program in the spring to trap insects by use of sex attractants. The survivors would be subjected to repeated release of 100 times their number of sterilized males.

The suppression or elimination of the use of DDT and related pesticides will constitute a hardship to many farmers. Prospects are reasonably bright, however, that satisfactory methods of specific pest management will be devised, and these methods will be more in keeping with our desire to minimize man's destructive impact on the environment.

—PHILIP H. ABELSON



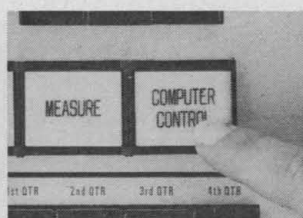
# FABRI-TEK 1070

... more than just a signal averager



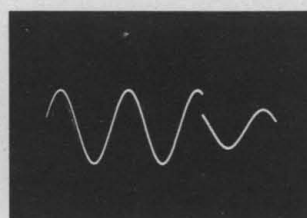
## NUMERICAL DISPLAY

Both the address number and data value are displayed on the CRT for any selected coordinate point. The selected coordinate point is clearly intensified on the analog CRT display so that the numerical values of ordinate and abscissa can be associated with a particular position on the analog plot. Changes in the position of this intensified point are made with three pushbuttons for fast, slow and single step allowing movement to the left or right.



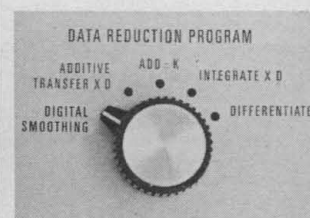
## COMPUTER INTERFACE

The 1070 Signal Averager may be interfaced to a general purpose (GP) computer to exploit the best features of both units. The hard-wire programmed 1070 is easy to operate since it needs no programming except switch selection, uses memory storage more efficiently, and provides rapid data collection and display. The GP computer provides additional memory and flexibility, especially in arithmetic processing. A software package for taking the fast Fourier transform of stored data is available from Fabri-Tek.



## CONTINUOUS DISPLAY

Slow sweep speeds or infrequently occurring fast sweeps make it difficult to view the memory contents in order to monitor an experiment's progress. With the SW-71 Continuous Display Sweep Control plug-in, the memory contents are always displayed on the CRT regardless of sweep speed or sweep repetition rate. Any small segment of the display may be expanded as much as desired even while acquiring data.

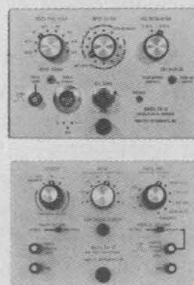


## BUILT-IN DATA REDUCTION

The 1070 permits integration of memory contents, addition or subtraction of stored data between memory subgroups, and baseline correction through addition or subtraction of a constant to (or from) any selected memory subgroup. Baseline correction aids in integration since the integral curve might otherwise be distorted by input signal baseline drift. Digital smoothing by three-point running averages and differentiation are useful options that can be added at any time.

## PLUG-IN CONCEPT

Fabri-Tek's 1070 combines a main frame with plug-in modules for specific input interfaces and data acquisition requirements. Plug-ins are available for spectrometer sweep stabilization control, pulse height analysis, auto- and cross-correlation, high speed (1 microsecond per sample) digitizing, time and frequency histograms and a new X-Y sweep control plug-in for parametric sweeping of the independent variable.



## OTHER FEATURES...

All digitizers have input filters, attenuators and d.c. level adjustments, and all sweep control units have adjustable trigger level discrimination, trigger delay and a wide range of sweep speeds. The input signal may be monitored for ease of set-up. Call or write to discuss your specific application.

**FABRI-TEK Instruments, Inc.**



5225 VERONA ROAD • MADISON, WIS. 53711 • PHONE: 608/271-3333

**Sales and Service:** In Canada by Ahearn & Soper, Limited, 844 Caledonia Road, Toronto 19, Ont. Tel. (416) 789-4325 — Telex 02-2757. Branches in Montreal, Vancouver, and Ottawa ... In Europe by Fabri-Tek Instruments, Inc., 6000 Frankfurt 1, Eschersheimer Landstr. 34, West Germany

