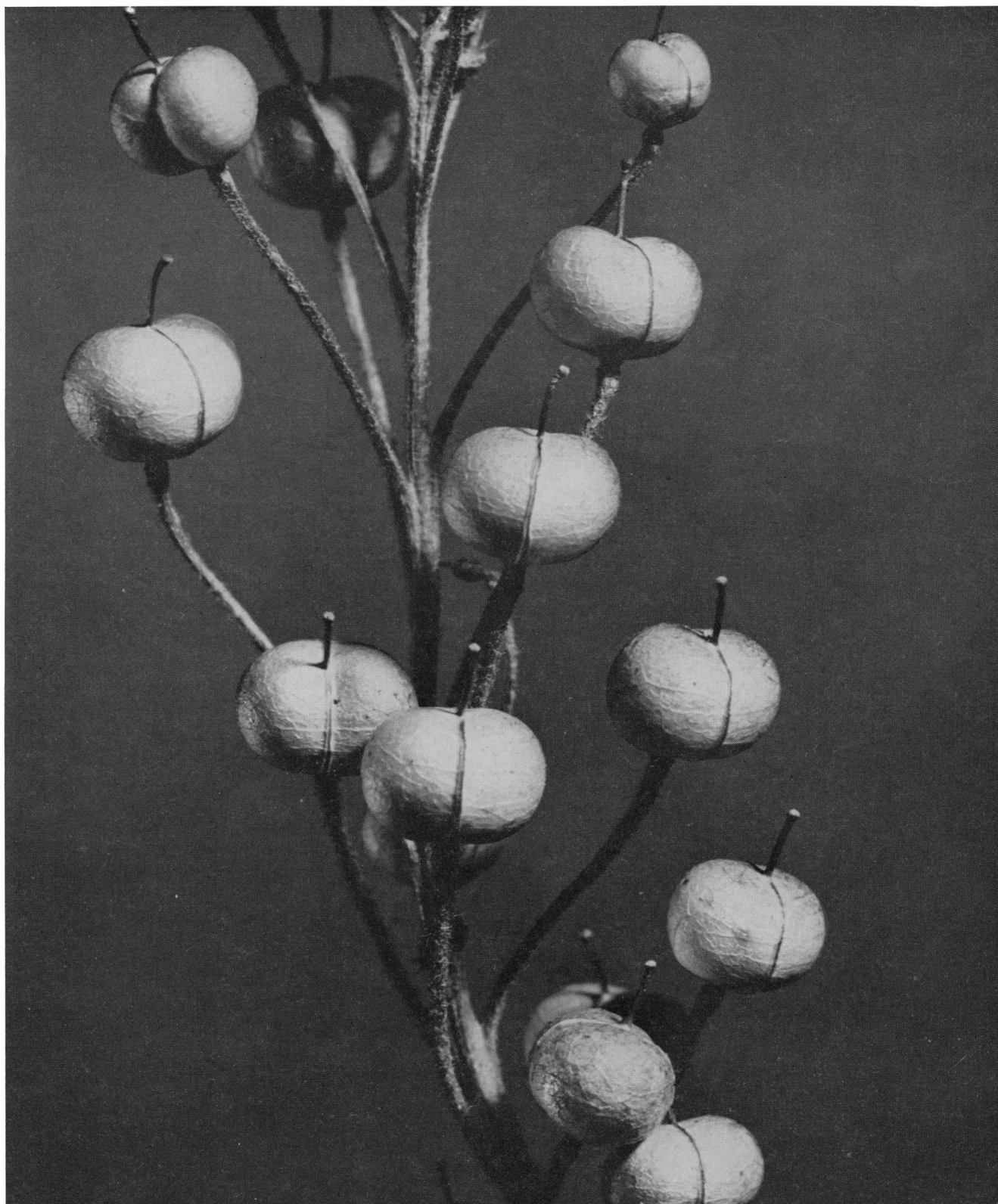


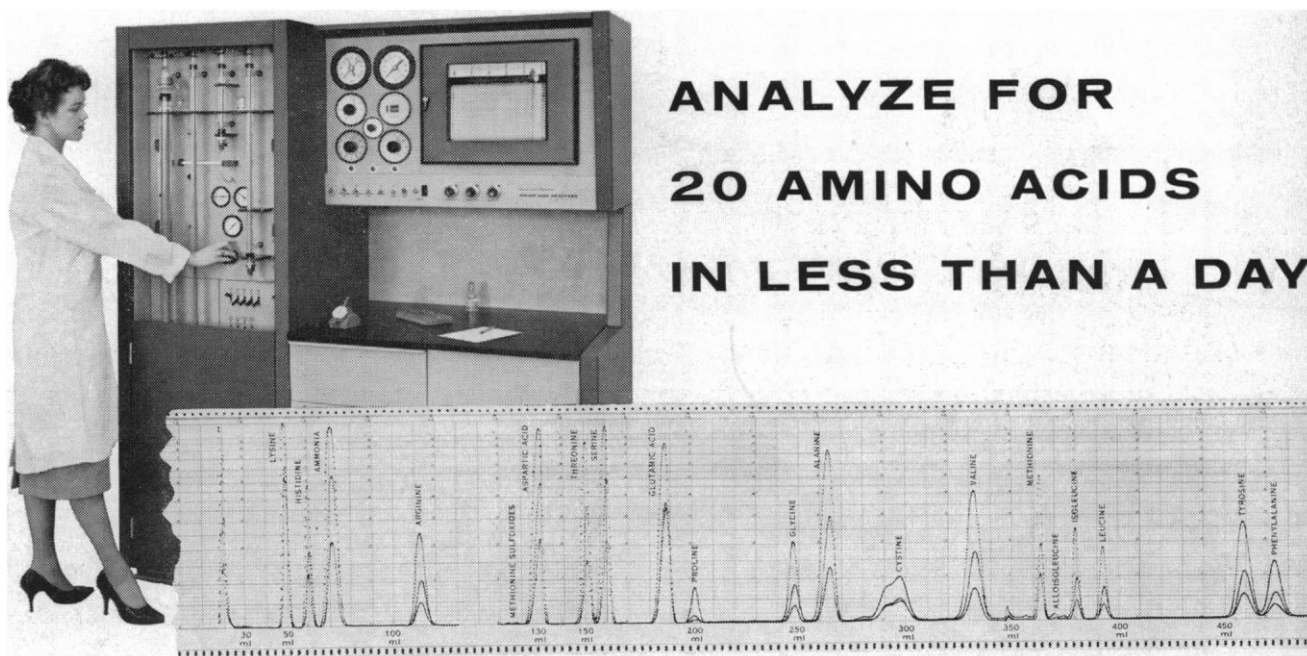
# SCIENCE

14 October 1960

Vol. 132, No. 3433

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





## ANALYZE FOR 20 AMINO ACIDS IN LESS THAN A DAY

**RIBONUCLEASE:** Chart of analysis allows precise quantitation of amino acids and related compounds in 3 mg acid hydrolyzate sample of bovine Ribonuclease A. In addition to protein and peptide hydrolyzates, other materials which can be automatically analyzed include physiological fluids, foods, pharmaceuticals and components of plant and microbiological systems.

*... do it routinely  
with the Beckman/Spinco Model 120  
Amino Acid Analyzer*

### *New features include preparative column*

A new Spinco Preparative Column and Stream Divider Accessory is now available for use with the Model 120 Analyzer. In addition, the versatility of the instrument itself has been greatly increased by a new valving system which also allows use of external columns and accessories, including fraction collector and scintillation counter.

Amino acid analyses can be done for you quickly, accurately, *automatically*, by the Beckman/Spinco Analyzer. Simpler runs are finished in less than a day, the most complex within two days.

The instrument employs the Spackman-Stein-Moore technique of automatic recording ion-exchange chromatography. With it a typical analysis takes only half a day of operator time. Five to ten times as many operator hours would be required for analysis by older bio-assay or manual chromatographic techniques.

Compared with earlier analytic methods, operation of the Beckman/Spinco Analyzer is simplicity itself. A small sample is placed on a chromatograph column in the instrument and the analysis is begun. As the sample goes through the Analyzer, a permanent picture is recorded of the amino acids present and their precise amounts.

More than 100 Spinco Amino Acid Analyzers are now in use around the world. If your research involves—or could involve—amino acids, write now for information on this remarkable research tool. Address Beckman Instruments, Inc., Spinco Division, Stanford Industrial Park, Palo Alto 5, California.



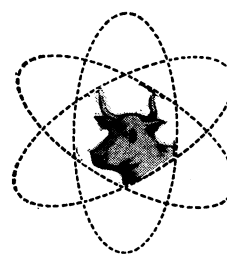
**Beckman/Spinco Division**  
Beckman Instruments, Inc.

# The barn door is "Wide Open"



The Barn Door is literally "wide open" at NBCo and out of it have come more than 100 items we jokingly refer to as "Barnyard Biochemicals". These are the various chemicals of direct animal origin—Cephalin, Lecithin, Enzymes, Blood derivatives, etc. These are of tremendous importance as sources of active principles. It is from materials of direct animal source that many new approaches may still be evolved. These "Barnyard Biochemicals" are among the more than 2,600 products offered by NBCo, the largest Research Biochemicals House on the globe featuring complete inventories of highest quality Biochemicals at economical prices and instant service.

**NUTRITIONAL BIOCHEMICALS CORPORATION**  
21010 MILES AVENUE • CLEVELAND 28, OHIO



**SEND FOR OUR FREE  
JULY, 1960 CATALOG**  
CONTAINING MORE THAN 2600  
ITEMS. FILL OUT COUPON AND  
MAIL TODAY FOR YOUR COPY.

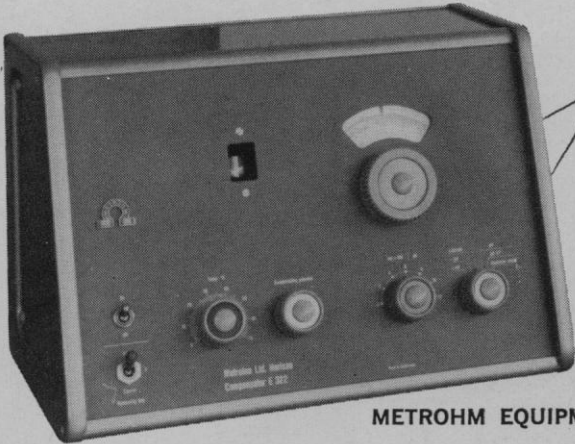
NAME \_\_\_\_\_  
ORGANIZATION \_\_\_\_\_  
ADDRESS \_\_\_\_\_  
CITY \_\_\_\_\_  
STATE \_\_\_\_\_ ZONE \_\_\_\_\_

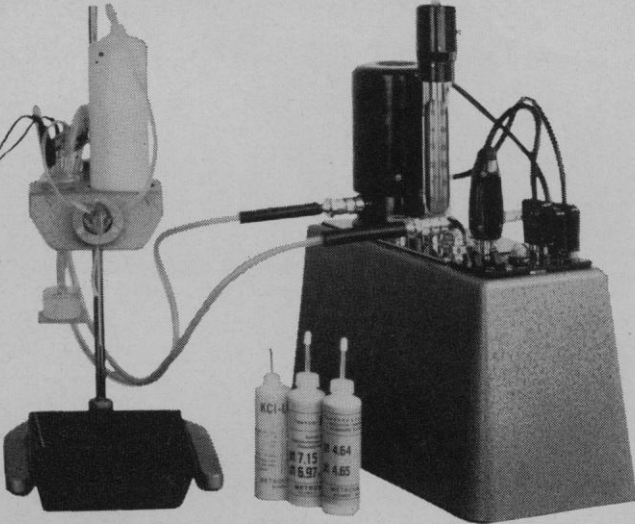
SCIENCE is published weekly by the AAAS, 1515 Massachusetts Ave., NW, Washington 5, D.C. Second-class postage paid at Washington, D.C., and additional mailing office. Annual subscriptions: \$8.50; foreign postage, \$1.50; Canadian postage, 75¢.

# METROHM pH METERS FOR EVERY NEED AND BUDGET



Model E-322





**METROHM EQUIPMENT FOR BLOOD pH ILLUSTRATED**

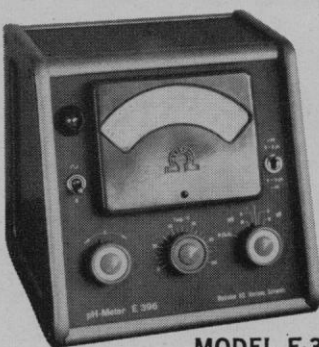
A Precision Compensator is the most accurate type of pH measuring system. It eliminates even the minor errors present in all direct reading instruments, i.e. calibrating deviations, non-linearity of the indicating instrument, bearing friction in galvanometers etc. For this reason we can guarantee that in the E-322 you will have a pH meter with a sensitivity of 0.002 pH and an absolute accuracy of 0.005 pH. Whether for Blood pH measurements, advanced control or research projects we believe that the E-322 has many features which will appeal to you.

- fully line-operated
- electronic indication
- high precision slide wire provides absolute accuracy over the full pH scale
- minimum number of controls achieved through unique interlocking electronic system provides utmost simplicity of operation
- all controls and components are custom built for the specific job
- absolute zero point stability obtained with specially designed chopper-amplifier
- complete selection of electrodes and accessories including the most widely used micro capillary measuring chains
- Modern design and a conveniently located control panel



**MODEL E-300**

The model E-300 is a high quality direct reading instrument. It features an exceptionally long (8 3/4") scale from 0-14 pH. Each main scale division equals 0.1 pH. In addition there is an expanded scale covering a range of 2.8 pH which may be used anywhere along the pH range. On the high sensitivity scale direct readings of 0.02 pH are obtained. The instrument is line-operated and contains an AC amplifier. Temperature compensation from 0 to 100°C is provided.



**MODEL E-396**

The E-396 is a pH meter of advanced design intended primarily for routine laboratory use. The unit has a dual scale to cover the ranges 0-8 pH (-140 to + 1000 mV) and 6-14 pH (+ 140 to -1000 mV). Each main scale division equals 0.05 pH and it can easily be read to 0.02 pH. Temperature compensation from 0-100°C is provided.



**MODEL E-350**

A modern pH meter for general laboratory work which features simplicity and a minimum number of operating controls. One scale covers the range from 0-14 pH (-500 to + 500 mV). Each division represents 0.1 pH. Readability is 0.05 pH.

Write for descriptive catalog 993

# BRINKMANN

BRINKMANN INSTRUMENTS, INC., 115 CUTTER MILL ROAD, GREAT NECK, N.Y.

Philadelphia • Cleveland • Houston • Miami • Menlo Park, Cal.

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                              |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| <b>Editorial</b>           | Research with Human Subjects .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 989                                          |
| <b>Articles</b>            | Sterilization of Interplanetary Vehicles: <i>C. R. Phillips</i> and <i>R. K. Hoffman</i> .....<br>Earthly organisms can be kept from contaminating the moon and planets,<br>but careful planning will be required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 991                                          |
|                            | Two Aspects of Science: <i>G. Thomson</i> .....<br>Control over nature and understanding of nature must both be held in<br>equal honor.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 996                                          |
| <b>Science in the News</b> | Disarmament: America Is Finding That Its Proposals Have Less Appeal Than Those<br>of the Soviet Union .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1000                                         |
| <b>Book Reviews</b>        | <i>The Making of the Broads</i> , reviewed by <i>M. G. Wolman</i> ; other reviews .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1007                                         |
| <b>Reports</b>             | Isolation, Identification, and Synthesis of the Sex Attractant of Gypsy<br>Moth: <i>M. Jacobson</i> , <i>M. Beroza</i> , <i>W. A. Jones</i> .....<br>Expanding Shoals in Areas of Wave Refraction: <i>W. F. Tanner</i> .....<br>Delayed Visual Feedback and Behavior: <i>W. M. Smith</i> , <i>J. W. McCrary</i> , <i>K. U. Smith</i> .....<br>Effect of Galactose-1-Phosphate on Glucose Oxidation by Normal and<br>Galactosemic Leukocytes: <i>A. N. Weinberg</i> and <i>S. Segal</i> .....<br>Molybdenum as a Factor Limiting Primary Productivity in Castle Lake,<br>California: <i>C. R. Goldman</i> .....<br>Simple Technique for Study of Cortical Arousal Response:<br><i>Z. P. Horovitz</i> and <i>D. Papandrianos</i> ..... | 1011<br>1012<br>1013<br>1015<br>1016<br>1017 |
| <b>Departments</b>         | Letters from <i>B. de Leon</i> ; <i>F. N. Kerlinger</i> ; <i>F. L. Gager, Jr.</i> , <i>V. Johnson</i> ,<br><i>J. C. Holmes</i> .....<br>British Association for the Advancement of Science; Forthcoming Events .....                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1018<br>1023                                 |
| <b>Cover</b>               | Storied fruits, each about 3 millimeters across, of <i>Lesquerella lyrata</i> , which grows<br>on thin soil overlying horizontally bedded limestone in the cedar glades of north-<br>western Alabama. In some parts of its range, <i>Lesquerella</i> is known as "bladder-pod."<br>[Reed C. Rollins, Gray Herbarium, Harvard University]                                                                                                                                                                                                                                                                                                                                                                                             |                                              |

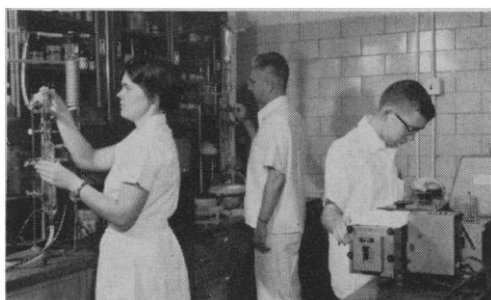
# When sterility is a packaging factor...



... that's when you can count on help from CES, the Castle Engineered Sterilization program. At your disposal are the results of a three-year study of the many packaging films, papers and laminations suitable for use with the Castle Sterox-O-Matic ethylene oxide process. Our analyses of factors such as gas and water absorption, ability to

withstand pressure fluctuation, color retention and clarity in packaging may be a real help to you.

Right now we're doing research for some of the country's biggest producers of sterile-packaged products. By many we're recognized as the leading authority on sterile packaging. Be that as it may, we'd like to put our resources to work for you, too.



*CES research leads the ever-widening search for better sterilizable packaging materials.*

**WRITE** today for literature. There's no obligation for initial CES research and planning.

## Castle

**LIGHTS AND STERILIZERS**

WILMOT CASTLE CO., 1713-10 E. HENRIETTA RD., ROCHESTER 18, N.Y.





ANOTHER EXAMPLE OF THE EXPANDING KIMBLE LINE

## Combine Kimble hard and soft glass for maximum discounts

Now . . . it's easier to qualify for maximum discounts offered by laboratory supply dealers and realize substantial savings.

Because, now you may combine your hard (Kimax) and soft (standard flint) glass tubing and rod orders.

Ask your Laboratory Supply Dealer about the many new sizes available from Kimble

which give you a complete selection of hard and soft glass tubing and rod. It's all part of the Kimble expansion program.

The complete Kimble line of tubing and rod is listed in Catalog Supplement SP-57.

For your copy, write to Kimble Glass Co., subsidiary of Owens-Illinois, Toledo 1, Ohio.

KIMBLE LABORATORY GLASSWARE  
AN **(I)** PRODUCT

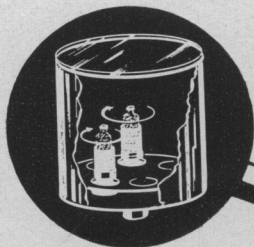
**OWENS-ILLINOIS**  
GENERAL OFFICES • TOLEDO 1, OHIO

# ALL PURPOSE

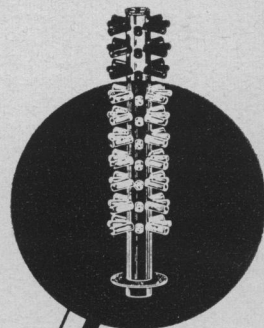
## automated

# FREEZE-DRYING

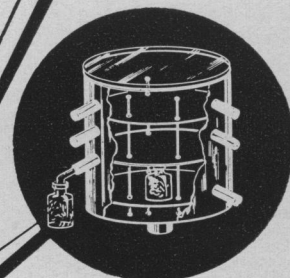
Increased convenience and versatility are built in features of the new, redesigned VIRTIS MECHANICALLY REFRIGERATED FREEZE-MOBILE. This complete freeze-drying system accomplishes virtually all laboratory and pilot plant freeze-drying procedures efficiently and automatically. The entire equipment is housed in an attractive, rugged, epoxy coated, carbon steel cabinet with stainless steel table top. Controls are front panel mounted for maximum operating ease.



CENTRIFUGAL DRYING



CULTURE DRYING

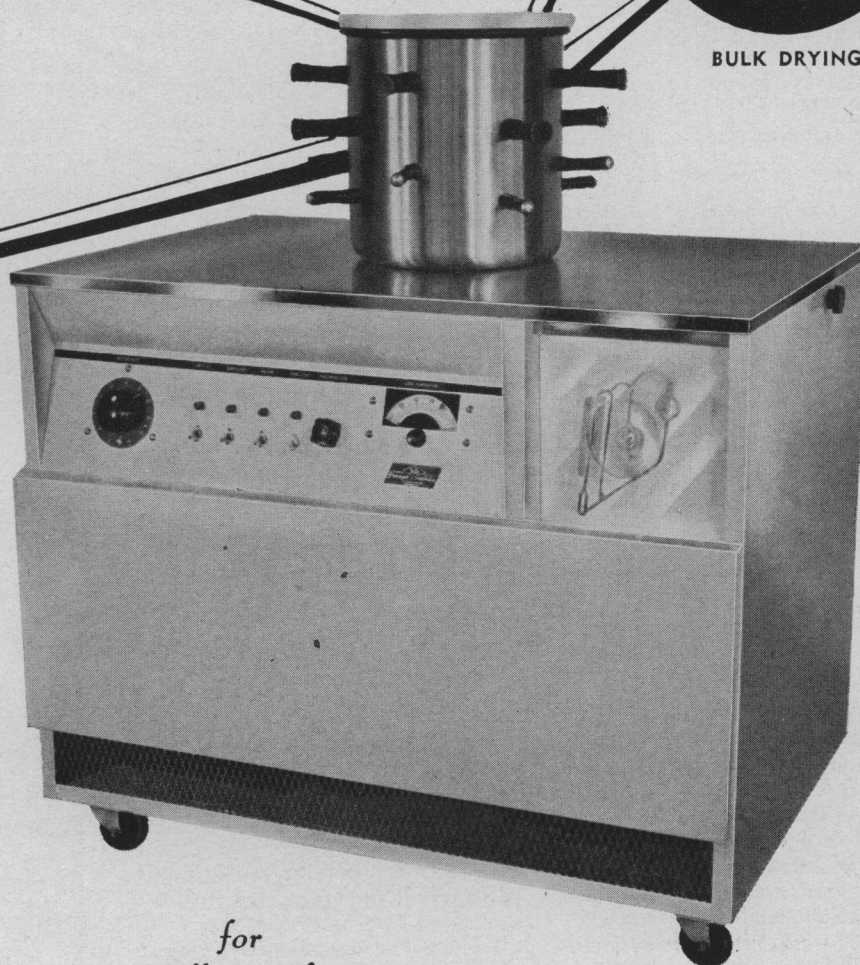


BULK DRYING



TRAY DRYING

Four types of vacuum drum can now be used with the MECHANICALLY REFRIGERATED FREEZE-MOBILE — the standard dual purpose manifold and bulk drying chamber; an eighty port manifold for bacterial and virus culture drying; a front loading electrically heated tray drying chamber; and the revolutionary new centrifugal freeze-drying vacuum drum which permits freezing of samples by evaporative freezing without danger of loss of sample due to foaming.

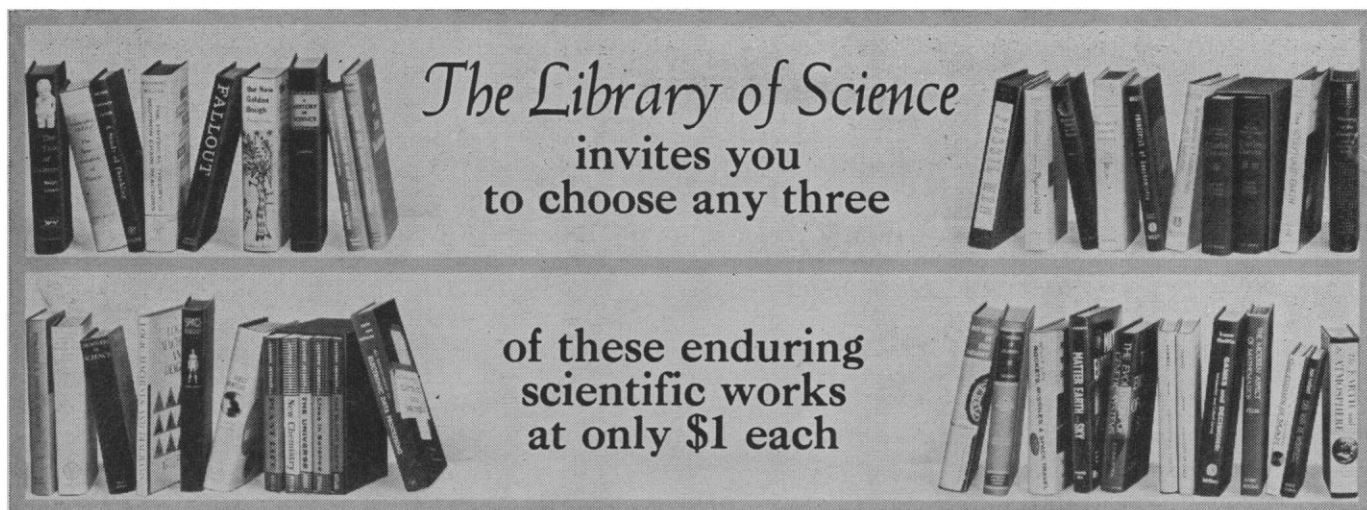


*for  
Full Details  
write . . .*

**VIRTIS**

**THE VirTis COMPANY INC.**

**GARDINER, N.Y.**



## The Library of Science invites you to choose any three

of these enduring  
scientific works  
at only \$1 each

An expanding world of knowledge, presented by leading scientific discoverers and thinkers  
— 37 fine volumes currently available to members

**SPACE BIOLOGY**, by Hanrahan and Bushnell. The human factors in space flight, incorporating findings of the latest research. List Price \$6.00

**PROBABILITY THEORY AND ITS APPLICATIONS**, by William Feller. List Price \$10.75

**LOGIC MACHINES AND DIAGRAMS**, by Martin Gardner. List Price \$5.00

**MATHEMATICS AND THE PHYSICAL WORLD**, by Morris Kline. List Price \$6.00

**FALLOUT**: a study of superbombs, strontium 90 and survival, ed. by J. M. Fowler. List Price \$5.50

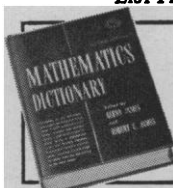
**ELECTRONIC DATA PROCESSING**, by Roger Nett and Stanley A. Hetzler. List Price \$6.75

**THE LOGIC OF SCIENTIFIC DISCOVERY**, by Karl R. Popper. List Price \$7.50

**ELECTRONS, WAVES AND MESSAGES**, by John R. Pierce. List Price \$5.00

**PRINCIPLES OF GEO-CHEMISTRY**, by Brian Mason. Second edition, newly revised and enlarged. List Price \$8.50

**FOSSIL MEN**, by Marcellin Boule and Henri V. Vallou. List Price \$9.50



**MATHEMATICS DICTIONARY**, by Glenn and Robert C. James. Definitions of over 7,000 mathematical terms, concepts and relationships, with 423 integral tables, over 400 mathematical symbols, differentiation formulas, and a 72-page four-language index of basic terms. List Price \$15.00

**EVOLUTION OF GENETIC SYSTEMS**, by C. D. Darlington. List Price \$5.50

**VIRUS HUNTERS**, by Greer Williams. From Jenner to Sabin and Salk. List Price \$5.95

**GEORGE SARTON'S** second volume of *A History of Science*. List Price \$11.00

**SIR JAMES G. FRAZER'S NEW GOLDEN BOUGH**. One-volume abridgment, ed. by Theodor H. Gaster. List Price \$8.50

**STRANGE WORLD OF THE MOON**, by V. A. Firsoff. List Price \$6.00

**MATTER, EARTH AND SKY**, by George Gamow. List Price \$10.00

**THIS SCULPTURED EARTH**, by John A. Shimer. Geological forces and landscape, 105 illustrations. List Price \$7.50

**A STUDY OF THINKING**, by Jerome S. Bruner. List Price \$6.00

**RIVERS IN THE DESERT**, by Nelson Glueck. Archaeological explorations in the Negev. List Price \$6.50

**GAMES AND DECISIONS: An Introduction to Game Theory**, by R. Duncan Luce and Howard Raiffa. List Price \$8.75

**THEORIES OF LEARNING**, by Ernest A. Hilgard. List Price \$5.50

**THE TREE OF CULTURE**, by Ralph Linton. List Price \$7.50

**PHYSICAL THEORY OF NEUTRON CHAIN REACTORS**, by Alvin M. Weinberg and E. P. Wigner. "First authoritative and unified account of modern reactor theory." Robert A. Charpie. List Price \$15.00

**TOWARDS A UNIFIED COSMOLOGY**, by Reginald O. Kapp. List Price \$6.50

**FRONTIERS IN SCIENCE**, ed. by Edw. Hutchings, Jr. Contributions by Pauling, Oppenheimer, Hoyle, Beadle. List Price \$6.00

**SIGMUND FREUD: The Interpretation of Dreams**. The only complete English translation. List Price \$7.50

**CHARLES DARWIN: Life and Letters**. Two volumes, boxed, edited by his son, Francis Darwin. List Price \$10.00

**SPEECH AND BRAIN-MECHANISMS**, by Wilder Penfield and Lamar Roberts. List Price \$6.00

**CONCEPTS OF SPACE and CONCEPTS OF FORCE**. Two volumes by Max Jammer. List Price \$9.25

**THE FUTURE OF MAN and CAN MAN BE MODIFIED?** by Peter B. Medawar and Jean Rostand, respectively. Two volume set. List Price \$6.00

**MODERN ASPECT OF MATHEMATICS**, by Lucienne Felix. The Bourbaki revolution in mathematics and its consequences. List Price \$5.00

**SCIENTIFIC AMERICAN BOOKS, Second Series**. Five paperbound volumes, boxed, by the editors of the *Scientific American*. List Price \$7.25

**WILLY LEY: Rockets, Missiles and Space Travel**. 3rd revised edition. List Price \$6.75

**THEORIES OF THE UNIVERSE**, by Milton K. Munitz. From primitive myth to modern astronomy, physics and mathematics. List Price \$6.50

**A SHORT HISTORY OF SCIENTIFIC IDEAS**, by Chas. Singer. List Price \$8.00

**THE EARTH AND ITS ATMOSPHERE**, ed. by D. R. Bates. List Price \$6.00

FOR THE SERIOUS, the important and the enduring in scientific literature, readers interested in keeping up with contemporary developments have turned in increasing numbers to The Library of Science. Now in its fifth year, The Library of Science counts as members over 50,000 scientists, educators and related professionals.

The 37 works listed here exemplify the depth, scope and quality of the volumes offered each month at substantial savings to members of The Library of Science. From archeology to zoology, from the behavior of the electron to the functioning of

the living cell, from the inner structure of the earth to the limitless reaches of space—Library of Science Selections range over the entire universe of scientific knowledge.

To start your membership, choose any three of these fine books at only \$1.00 each. Thereafter, as a member, you need take as few as four more Selections during the next 12 months from the more than 75 available to you at reduced Member's Prices. These, together with the free Bonus Books which you yourself choose after every fourth Selection, insure you savings that total over 40%.

Up to \$41.00 worth of books for only \$3.00

The Library of Science, Dept. L-17  
59 FOURTH AVENUE, NEW YORK 3, N. Y.

Please enroll me as a member and send me at once the three Selections indicated below, for which you will bill me only \$3.00 (plus postage). As a member, I need take as few as four more Selections during the next 12 months, from the more than 75 works available to me at reduced Member's Prices. I understand that I will receive a free bonus book of my own choosing after every four Selections.

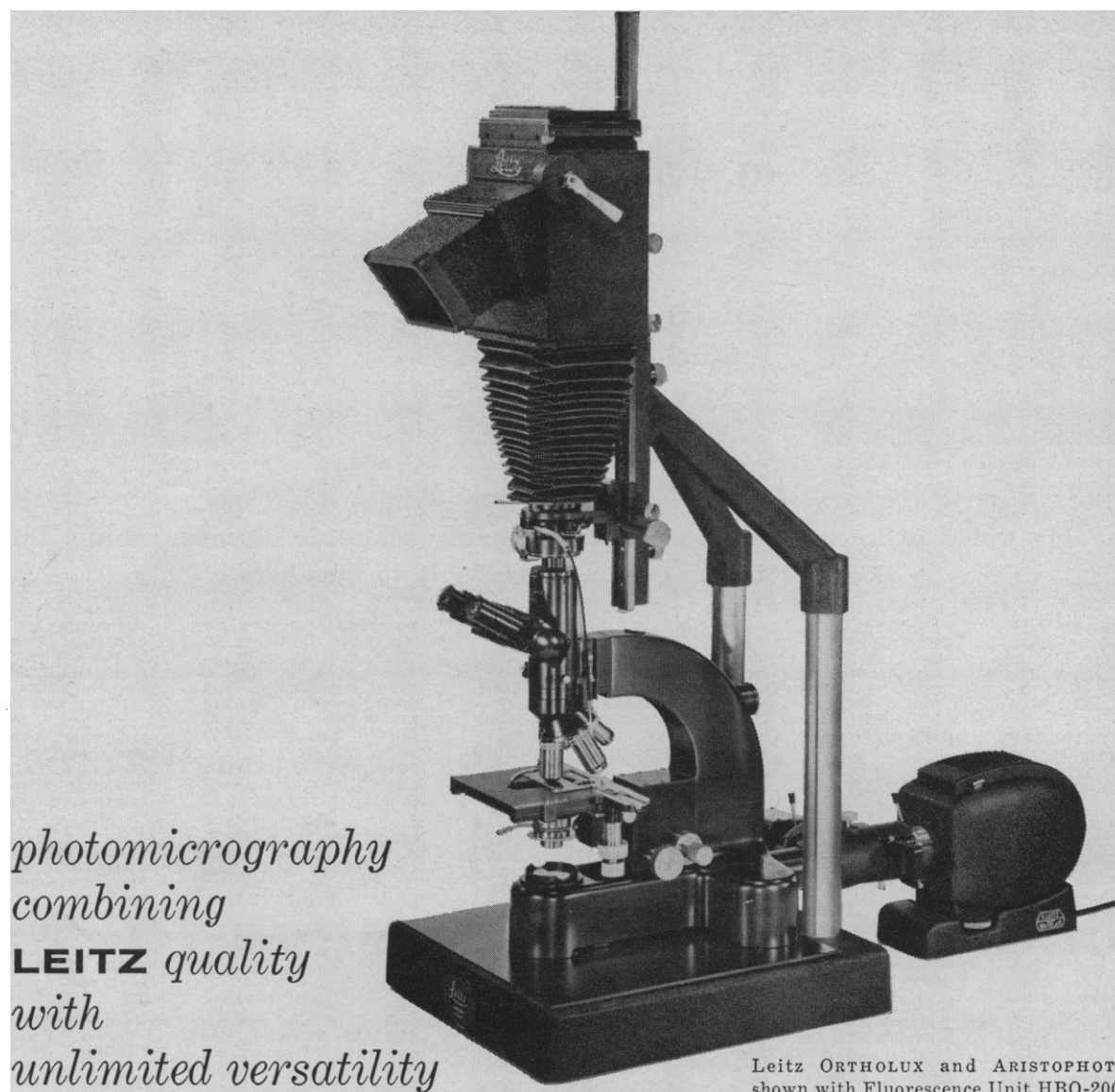
SELECTIONS \_\_\_\_\_

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

The Library of Science, 59 FOURTH AVENUE, NEW YORK 3, N. Y.



Leitz ORTHOLUX and ARISTOPHOT,  
shown with Fluorescence Unit HBO-200

## ORTHOLUX *Microscope* with **ARISTOPHOT II**

Here are precision Leitz instruments perfectly matched for exacting photomicrography. They are simple to operate, yet capable of infinite variations to fit all your photomicrographic requirements.

With the Leitz ORTHOLUX with ARISTOPHOT, image sharpness is limited only by the resolution of the film you are using. Only air separates the optical system from the film. There is no loss of image sharpness because of mirrors or other devices.

Film size is not restricted: 35mm Leica,  $3\frac{1}{4} \times 4\frac{1}{4}$ ,  $4 \times 5$ , or Polaroid. Your choice of illumination, too, is virtually unlimited: transmitted or incident light, dark field, polarized or phase contrast.

With the ARISTOPHOT detached, the Leitz ORTHOLUX fulfills the most critical requirements for a research microscope. The ARISTOPHOT II may be used separately for gross photography or macrophotography.

Write for illustrated brochure, Dept. SC-1014.



E. LEITZ, INC., 468 PARK AVENUE SOUTH, NEW YORK 16, N. Y.  
Distributors of the world-famous products of  
Ernst Leitz G.m.b.H., Wetzlar, Germany—Ernst Leitz Canada Ltd.  
LEICA CAMERAS · LENSES · PROJECTORS · MICROSCOPES · BINOCULARS

29459

The total capacity of the #7001 is on the needle tip . . . you may be able to see it with a magnifying glass.

## ACCURATE LIQUID DISCHARGE TO .01 ul

*Announcing—The #7001 Hamilton Microliter Syringe!* Here is a revolutionary new syringe with a 1 ul capacity and a scale subdivided into 100 parts. It has an accuracy of  $\pm .03\%$  . . . permitting accurate discharge of liquids to 1/100 ul. The bore of the needle serves as the syringe barrel. The plunger is 0.006" tungsten wire which bottoms at the point of the 7 cm needle. As a result, there is only microscopic loss of liquid, and no hold-up or dead volume.

The #7001 is the ideal syringe for discharging the minute liquid volumes required for extreme accuracy in chromatography and similar research and analysis.

#7001-N 1 ul (1/1000 ml) Microliter Syringe with 7 cm length needle, pat. pend., \$35.00

#7001-NCH (Above syringe, with Chaney Adaption) . . . . . \$41.00

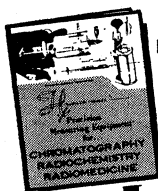
**Order direct . . . also available through your supply house.**



**HAMILTON COMPANY, INC.**

PRECISION MEASURING EQUIPMENT  
FOR CLINICAL AND CHEMICAL RESEARCH

Write today for a brochure describing Hamilton's complete line of precision measuring equipment. Price list is included.



**Hamilton Company, Inc.**

**P. O. Box 307-K, Whittier, California**

Send me a copy of your equipment brochure.

Name \_\_\_\_\_

Attach to company letterhead and mail

One of a series

## New Light on a Compound Semiconductor

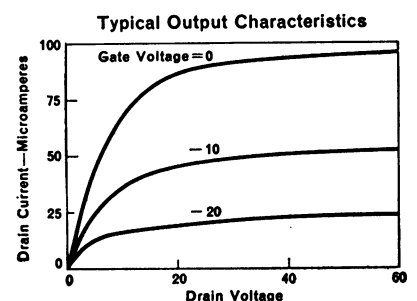
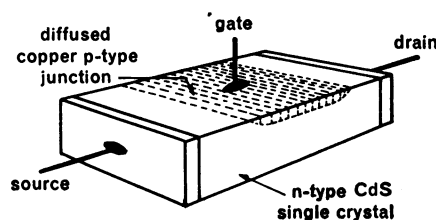
Pictured is a new and unusual transistor . . . made from a *compound* semiconductor. Its electronic properties are greatly affected by *light*. It is a *field-effect* transistor having input impedances up to 100 megohms (versus 1,000 ohms for junction transistors). Its unique combination of properties has enabled it to perform some novel circuit functions not possible with other transistors.

Still in the early experimental stage, this phototransistor is a tangible result of the General Motors Research Laboratories' program of semiconductors — particularly the group II-VI compound, cadmium sulfide. Behind its development lies the steady accumulation of (1) know-how in crystal growing, doping, and contact preparation and (2) information about CdS's intriguing solid state properties (red or green luminescence, high photoconductivity, short relaxation times, etc.).

For the researcher, this three-terminal device is adding a new dimension to the fundamental understanding of semiconductors. For instance: GM Research scientists have uncovered the important role of photo-generated holes in modulating the conductance of this intrinsic semiconductor and have determined the hole drift mobility through a new theoretical analysis.

These semiconductor investigations illustrate the dual aim of GM Research: contributions to the science, advances in the technology of important new subject areas. Such research is the initial step in General Motors' continuing quest for "more and better things for more people."

## General Motors Research Laboratories Warren, Michigan



AMERICAN ASSOCIATION  
FOR THE  
ADVANCEMENT OF SCIENCE

**Board of Directors**

CHAUNCEY D. LEAKE, *President*  
THOMAS PARK, *President Elect*  
PAUL E. KLOPSTEG, *Retiring President*  
HARRISON BROWN  
H. BENTLEY GLASS  
MARGARET MEAD  
DON K. PRICE  
MINA REES  
ALFRED S. ROMER  
WILLIAM W. RUBEN  
ALAN T. WATERMAN  
PAUL A. SCHERER, *Treasurer*  
DAEL WOLFLE, *Executive Officer*

**Editorial Board**

KONRAD B. KRAUSKOPF    H. BURR STEINBACH  
EDWIN M. LERNER        WILLIAM L. STRAUS, JR.  
PHILIP M. MORSE        EDWARD L. TATUM

**Editorial Staff**

DAEL WOLFLE, *Executive Officer*  
GRAHAM DUSHANE, *Editor*  
JOSEPH TURNER, *Assistant Editor*  
ROBERT V. ORMES, *Assistant Editor*

BETHSABE ASENJO, CHARLOTTE F. CHAMBERS, SARAH  
S. DEES, NANCY S. HAMILTON, OLIVER W. HEAT-  
WOLE, HOWARD MARGOLIS, ELLEN E. MURPHY,  
BARBARA SUTHERLAND, NANCY TEIMOURIAN, LOIS  
W. WOODWORTH, CONRAD YUNG-KWAI

EARL J. SCHERAGO, *Advertising Representative*



SCIENCE, which is now combined with THE SCIENTIFIC MONTHLY, is published each Friday by the American Association for the Advancement of Science at National Publishing Company, Washington, D.C. The joint journal is published in the SCIENCE format. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

**Editorial and personnel-placement correspondence** should be addressed to SCIENCE, 1515 Massachusetts Ave., NW, Washington 5, D.C. Manuscripts should be typed with double spacing and submitted in duplicate. The AAAS assumes no responsibility for the safety of manuscripts or for the opinions expressed by contributors. For detailed suggestions on the preparation of manuscripts and illustrations, see *Science* 125, 16 (4 Jan. 1957).

**Display-advertising correspondence** should be addressed to SCIENCE, Room 740, 11 West 42 St., New York 36, N.Y.

**Change of address notification** should be sent to 1515 Massachusetts Ave., NW, Washington 5, D.C., 4 weeks in advance. If possible, furnish an address label from a recent issue. Give both old and new addresses, including zone numbers, if any.

**Annual subscriptions:** \$8.50; foreign postage, \$1.50; Canadian postage, 75¢. Single copies, 35¢. Cable address: Advancesci, Washington.

Copyright 1960 by the American Association for the Advancement of Science.

## Research with Human Subjects

It is the nature of scientific inquiry to push towards the limits of the phenomena being studied, and the limits of research on human behavior will surely entail some danger to the subjects. As a current example, what kinds of performance can be expected of an astronaut in the super-solitary confinement of space? Under what circumstances will integrated, rational behavior break down? Such questions can be answered only by putting experimental subjects under real stress, and the subjects who volunteer to help find the answers, even under simulated and earth-bound conditions, are running some risk of personal damage. So are subjects in studies of other types of stress, fatigue, or the factors that induce abnormal mental states.

Most discussions of the legal and moral problems of the use of human subjects have been written from the medical point of view. Medicine has the most experience with human subjects, but in several respects the medical experience provides a quite inadequate guide. In testing a new medical or surgical technique on human patients it is customary to explain the nature of the technique, its possible dangers, and its possible beneficial results, and to secure the patient's consent before the new technique is tried. In psychological research, neither explanation nor consent can be so easily handled. Explanation of the nature or prospective results of a psychological experiment may vitiate the results. And if the experiment cannot be fully and honestly explained, to what has the subject consented? Or has he in fact consented at all?

There is another difference. A new medicine or operative technique is ordinarily tried out on ill patients who may themselves be directly benefited. In contrast, research of the type being considered must frequently be carried out on normal and healthy subjects who may never directly benefit from the experiment. Clearly the differences are too great to allow using the precedents of the physician-patient relationship as a total guide in handling the problems of the experimenter-subject relationship.

In a thoughtful analysis of this issue, the *Duke Law Journal* (No. 2, 1960) recently offered a partial solution with the concept of "liability without fault." Under this concept, if a subject is damaged as a result of participation in a psychological experiment he would be entitled to be made whole, through treatment or rehabilitation, or to receive compensatory damages. Thus the subject would be protected. The experimenter would also be protected. He would not be considered to be at fault, but rather to have been acting in the interest of society. Thus society, through appropriate government channels, would assume the costs of rehabilitation or compensation just as society, also through government channels, supports most of the experimentation for which the concept of liability without fault would be appropriate.

Some practical problems remain, such as which experimenters would be protected and how psychological damage would be assessed. But the fact that such details and the underlying legal and moral issues are being seriously considered constitutes somber evidence that scientific inquiry will prove increasingly powerful in gaining knowledge of man himself.—D.W.

# Fully Automatic, Transistorized **AUTO-GAMMA<sup>®</sup>** Spectrometer System

for counting samples of:

IODINE<sup>131</sup>

IRON<sup>59</sup>

GOLD<sup>198</sup>

RADIUM  
DAUGHTERS

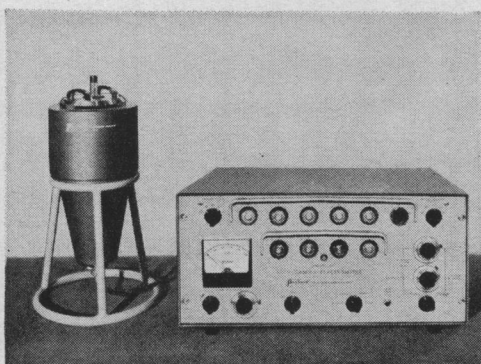
POTASSIUM<sup>42</sup>

CHROMIUM<sup>51</sup>

COBALT<sup>60</sup>

... and other gamma emitters—

- up to 100 samples counted automatically
- repeats individual samples or entire loading
- symmetrical geometry provides constant background
- sample number, time and count printed out on paper tape
- integral, differential and wide-window counting modes
- manual model can be automated at any time



For complete information write for Bulletin 400.



The Auto-Gamma Spectrometer System counts and records data from as many as 100 test tube samples. Operation can be maintained on an around-the-clock basis.

The energy spectrum of an isotope can be plotted with the Auto-Gamma Spectrometer by means of the precise Narrow Window setting. Ordinarily, the photopeak is then counted within the Wide Window of the pulse height analyzer to minimize background. This use of the spectrometer optimizes the count-to-background ratio and permits shorter counting periods or lower tracer levels.

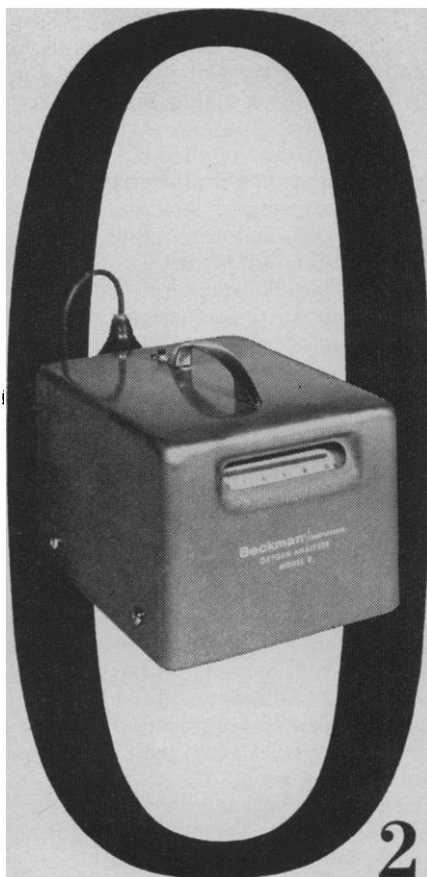
Obviously, automatic sample counting is desirable when large numbers of samples are to be counted. It is just as useful, however, for counting small numbers of low activity samples. Blanks and standards can be arranged among the samples for background checks and calibration. The complete series of tubes can then be counted automatically as many times as required to give desired statistical accuracy.

The detector and spectrometer components of the system are available separately for manual operation.

**Packard** Instrument Company, Inc.

P. O. BOX 428-A, LAGRANGE, ILLINOIS

ATLANTA • BOSTON • LOS ANGELES • NEW YORK • PHILADELPHIA  
PITTSBURGH • SAN FRANCISCO • WASHINGTON, D. C. • ZURICH, SWITZ.



## wherever oxygen is vital...

the world's standard instruments for precision measurement are Beckman Oxygen Analyzers... in biochemical research, food processing control, industrial applications, medical analyses and military applications. Choice of three basic models to fit any requirements for accuracy, types of samples to be analyzed and range of concentrations. Model E2 is designed for the most exacting work, with flowing or static samples, in five ranges, uses 110V AC power. Model C2, semiportable, also operates on 110V AC, for flowing or static samples in a wide variety of ranges. Model D2 is portable, battery operated, for static samples in two ranges. For complete specifications on these three laboratory instruments contact your Beckman dealer. Or write direct for Data File 38-42-05.

**Beckman**  
Scientific and Process Instruments Division  
Beckman Instruments, Inc.  
2500 Fullerton Road,  
Fullerton, California



## Letters

### Science and Human Welfare

The statement of the AAAS Committee on Science in the Promotion of Human Welfare [*Science* 132, 68 (8 July 1960)] is an admirable delineation of the crisis facing the scientific community in its relation with the general public. Mutual misunderstanding and lack of trust detrimental to both science and the people has evidently reached a level which makes remedial action rather urgent. Undoubtedly, both parties were at fault in creating this situation. Yet, subjected to severe pressure from the immense power generated by the scientist's discoveries, the public could hardly be blamed for considering irresponsible his disclaimer of any special competence for making decisions on the use of this power. Nor could the scientist help judging the public immature when its decisions on complex scientific matters were often based on partial or unproved information.

To remedy this schism the AAAS committee urges scientists and scientific organizations, as producers and custodians of scientific knowledge, to assume the obligation of imparting such knowledge to the public. Unquestionably, the committee understands that such a policy may involve these organizations in rather violent controversy, when some powerful political leaders with vested interests in particular governmental agencies are especially desirous of keeping certain facts from the public. Such politicians do not always conduct these controversies in accordance with the scientific principles of intellectual honesty, scrupulous integrity, objective and free speculation, and open communication. On the contrary, the usual process involves manipulation of public opinion by innuendo, half-truth and outright distortion of fact. Confronted by these conditions, the large scientific societies, in the past, found it safer to avoid entering public discussion on controversial matters. Fortunately, it is now recognized that this avoidance reaction was an abdication of social responsibility.

The AAAS could advance the objectives of its own committee by taking a vigorous position on such a scientific issue now before the public: Senator Dodd's demand, under threat of a contempt citation, that Linus Pauling hand over the names of all scientists who helped gather petitions against atom-bomb tests. The senator may be acting on behalf of men in the United States Congress who were annoyed by Pauling's success in disseminating widely the dangers of con-

tinued testing and by his effectiveness in raising the question of banning such tests to a public issue of widespread concern. Furthermore, these legislators seem determined to make any future action of this type as difficult as possible by generating the fear, particularly among young scientists, that participation on the wrong side of these controversial issues may place one's career and livelihood in jeopardy.

Since unhampered speculation and open communication are at the very foundation of the scientific tradition, the AAAS—as spokesman for the scientific community—should protest vigorously against the harassment of Linus Pauling by the committee of the Senate and the hunting down of dissident opinion by committees from both houses of Congress. For it is becoming more and more apparent that the atmosphere generated in this country by the activities of these committees has not only hampered the nation's scientific advances but has also sapped its democratic vitality.

BENJAMIN DE LEON  
192 Keer Avenue, Newark, New Jersey

### Small High Schools

In a letter to the editor [*Science* 131, 1560 (1960)] Barker makes the point that small high schools "produced their full quota of scientists in 1957 and 1958." If all other variables are controlled, which is unlikely, the implied argument is that since it turns out its quota of scientists, the small high school is an adequate educational institution. This argument defends the small high school on the basis of the record of a small proportion of its graduates, potential scientists. It is quite possible that it does not make too much difference whether a high school is small or large as far as disciplines heavily dependent on the traditional academic curriculum and on high intellectual ability are concerned. Bright youngsters may learn mathematics, science, English, and the like in a high school of any size, provided instruction and facilities are fairly adequate.

But Barker's implied argument ignores the large mass of children who are of average and less than average intelligence. It is these children (as well as, perhaps, the more gifted children) that the small high school may not be serving adequately. The modern high school needs a variety of courses and activities—courses in languages, typing, home economics, citizenship, and elementary probability and statistics, extracurricular activities, and the like—which a small high school usually cannot offer. To a relatively gifted youth who is going to



### Principles of Plant Breeding

By R. W. ALLARD, *University of California, Davis*. Based on the idea that there is a basic unity to the methods of breeding self-pollinated species and cross-pollinated species, and that this unity is more important than the differences in methods. 1960. 485 pages. \$9.00.

### Mechanics and Properties of Matter

#### Second Edition

By REGINALD J. STEPHENSON, *The College of Wooster*. Provides a good introduction to types of analysis in physics—and an idea of the unity of this subject and its various branches of heat, light, sound, electricity, and atomic physics. 1960. 367 pages. \$7.50.

### Principles of Genetics

By ELDON J. GARDNER, *Utah State University*. Develops a full account of modern genetics, concentrating on the basic fundamentals of the science, instead of particular materials or techniques. Examples are cited in the cases of human beings as well as animals and plants. 1960. 366 pages. \$7.50.

### Behavior Genetics

By JOHN L. FULLER, *Roscoe B. Jackson Memorial Laboratory*; and W. ROBERT THOMPSON, *Wesleyan University*. This work is essentially a survey of the methods and main findings relating to the inheritance of behavior. Equal emphasis is given to genetics and psychology. 1960. 396 pages. \$8.95.

### Lipide Metabolism

Edited by KONRAD BLOCH, *Harvard University*. With Hanahan's *Lipide Chemistry*, this book completes a two volume set on the principles and concepts of lipides. It summarizes current knowledge of the intermediary metabolism of lipides. 1960. Approx. 432 pages. Prob. \$10.50.

### Elementary Introduction to Nuclear Reactor Physics

By S. E. LIVERHANT, *Maritime College, State University of New York*. Gives a coherent account of that branch of physics involved in the study and design of nuclear reactors at a level of presentation suitable for advanced undergraduate students. 1960. 447 pages. \$9.75.

### Forest and Shade Tree Entomology

By ROBERT F. ANDERSON, *Duke University*. Offers a fundamental understanding of insect life, and the means of dealing with actual forest insect problems. 1960, 409 pages, \$8.50.

### Biochemistry of Plants and Animals

#### An Introduction

By M. FRANK MALLETTE, PAUL M. ALTHOUSE, and CARL O. CLAGETT, all of *The Pennsylvania State University*. Covers a wide variety of topics in the biological, physical, and agricultural sciences. 1960. 552 pages. \$8.50.

### Modern Insecticides and World Food Production

By FRANCIS A. GUNTHER and LEE R. JEPSON, *University of California Citrus Experiment Station, Riverside*. Designed to provide a general and comprehensive insight into modern insecticides and acaricides. 1960. *In Press*.

### Comparative Effects of Radiation

Proceedings of the Symposium on the Comparative Effects of Infrared, Visible, Ultraviolet, and High-Energy Radiations in Biology, Chemistry, and Physics

Edited by MILTON BURTON and J. L. MAGEE, both of the *University of Notre Dame*; and J. S. KIRBY-SMITH, *Oak Ridge National Laboratory*. 1960. *In Press*.

### Heterocyclic Compounds

#### Volume VII

Polycyclic Compounds Containing Two Hetero Atoms in Different Rings. Compounds with Three Hetero Atoms.

Edited by ROBERT C. ELDERFIELD, *University of Michigan*; and *National Academy of Sciences, National Research Council*. 1960. *In Press*.

### Guide to the Study of the Anatomy of the Shark, Necturus, and the Cat

#### Third Edition

By SAMUEL EDDY, *University of Minnesota*; CLARENCE P. OLIVER, *University of Texas*; and the late JOHN P. TURNER, 1960. Approx. 136 pages. Prob. \$3.50.

### Selective Toxicity

#### Second Edition

By ADRIEN ALBERT, *Australian National University*. Covers drugs, weed-killers, and insecticides. A Methuen Monograph in Biological Subjects. 1960. 233 pages. \$5.50.

### Proceedings of the Second Conference on Reactions Between Complex Nuclei

Edited by ALEXANDER ZUCKER, EDITH C. HALBERT and FREDERICK T. HOWARD, all of *Oak Ridge National Laboratory*. A compendium of recent advances in the new and rapidly growing field of heavy-ion nuclear physics. 1960. 319 pages. \$7.00.

Send for your examination copies.

JOHN WILEY & SONS, Inc.

440 Park Avenue South, New York 16, N.Y.

# GET YOUR ADVANCE COPY

## of the General Program of the AAAS New York Meeting

### by first class mail – early in December

The General Program of the 127th Meeting of the AAAS in New York, 26–31 December 1960, will be available to you, at cost, within the first week in December—whether you can attend the Meeting or not.

#### Program Content

1. The two-session AAAS General Symposium, "Moving Frontiers of Science V"—Speakers: Edward Anders, H. W. Magoun, George Wald, and H. H. Goldstine; Thomas Park, presiding.
2. The "Challenge to Science" evening with Sir Charles P. Snow, Theodore M. Hesburgh, and W. O. Baker; Warren Weaver, presiding.
3. On "AAAS Day," the three broad, interdisciplinary symposia—Plasma: Fourth State of Matter; Life under Extreme Conditions; and Urban Renewal and Development, arranged by AAAS Sections jointly.
4. The Special Sessions: AAAS Presidential Address and Reception; Joint Address of Sigma Xi and Phi Beta Kappa by Polykarp Kusch; the Tau Beta Pi Address; National Geographic Society Illustrated Lecture; and the first George Sarton Memorial Address by René Dubos.
5. The programs of all 18 AAAS Sections (specialized symposia and contributed papers).
6. The programs of the national meetings of the American Astronomical Society, American Nature Study Society, American Society of Zoologists, History of Science Society, National Association of Biology Teachers, Scientific Research Society of America, Sigma Delta Epsilon, Society for General Systems Research, Society for the Study of Evolution, Society for the History of Technology, Society of Systematic Zoology, and the Society of the Sigma Xi.
7. The multi-sessioned special programs of the American Association of Clinical Chemists, American Astronautical Society, American Geophysical Union, American Physiological Society, American Psychiatric Association, American Society of Criminology, Association of American Geographers, Ecological Society of America, Mycological Society of America, National Science Teachers Association, New York Academy of Sciences—and still others, a total of some 90 participating organizations.
8. The four-session program of the Conference on Scientific Communication: The Sciences in Communist China, cosponsored by the AAAS, NSF, and ten societies.
9. The sessions of the Academy Conference, the Conference on Scientific Manpower, and the conference of the American Council on Women in Science.
10. The sessions of the AAAS Cooperative Committee on the Teaching of Science and Mathematics, and of the AAAS Committee on Science in the Promotion of Human Welfare.
11. Titles of the latest foreign and domestic scientific films to be shown in the AAAS Science Theatre.
12. Exhibitors in the 1960 Annual Exposition of Science and Industry—103 booths—and descriptions of their exhibits.

#### Advance Registration

Advance registration has these decided advantages: (1) You avoid delay at the Registration Center upon arrival; (2) You receive the General Program in ample time to decide, unhurriedly, which events and sessions you particularly wish to attend; (3) Your name is posted in the Visible Directory as the Meeting opens.

The following coupon may be used both by advance registrants and by those who wish only the advance copy of the General Program.

-----THIS IS YOUR COUPON FOR AN ADVANCE COPY OF THE GENERAL PROGRAM-----

- 1a. ☐ Enclosed is \$3.50 for my advance Registration Fee which brings me the General Program, Convention Badge, and all privileges of the Meeting (50¢ is for first-class postage and handling).
  - 1b. ☐ Enclosed is \$2.50 for only the General Program. (It is understood that, if I should attend the Meeting later, the Badge—necessary for the privileges of the Meeting—will be secured for \$1.00 more.) (check 1a or 1b)
2. FULL NAME (Dr., Miss, etc.) .....  
(Please print or typewrite) (Last) (First) (Initial)
  3. ACADEMIC, PROFESSIONAL, OR BUSINESS CONNECTION .....
  4. OFFICE OR HOME ADDRESS .....  
(For receipt of General Program)  
CITY ..... ZONE ..... STATE .....
  5. FIELD OF INTEREST .....
  6. CONVENTION ADDRESS .....  
(May be added later, after arrival)

Please mail this Coupon and your check or money order for the total amount to the  
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE  
1515 Massachusetts Avenue, NW, Washington 5, D.C.

specialize in science, the lack of such educational and social experiences, while regrettable, may not be very serious. But to a less gifted youth, and especially to a youth for whom high school is the limit of his formal education, the poverty of curriculum of the small high school is probably serious.

Like Barker, I would like data on how students from small and large high schools turn out. But I suspect that adequate data will be very hard to come by, due to the great difficulty of controlling independent variables in educational research of this kind. (An example of one of the most serious difficulties is the factor of individual selection: the bright child may be selecting the small high school, the private school, and the small college.) At any rate, of all citizens, scientists should be circumspect in their judgments and pronouncements on the relative merits of different types of education and educational institutions.

FRED N. KERLINGER  
School of Education,  
New York University, New York

#### Ancient Tobacco Smokers

The persistence of alkaloids in plant tissue 1300 years old has been reported by Raffauf and Morris [*Science* **131**, 1047 (1960)]. They reported a test for alkaloids but did not identify the substance present in tobacco samples. These samples were obtained from Indian caves in northern Arizona.

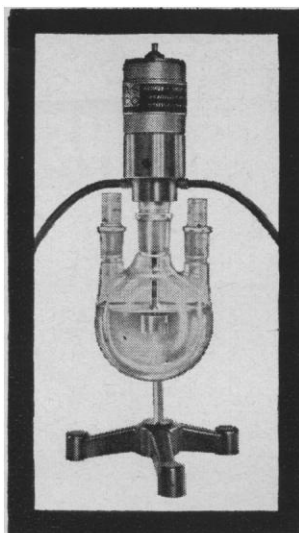
We have examined samples from the same archeological excavations (1). Microscopic and chemical investigations have shown that tobacco, presumably *Nicotiana attenuata*, was smoked by the Indians in pipes. Chromatographic and spectrophotometric analyses have established that nicotine was present in both loose tobacco and pipe dottel. The persistence of an alkaloid over such a period of time is remarkable, as Raffauf and Morris stated.

We believe our data are the oldest documented evidence for the smoking of tobacco (approximately A.D. 650) (2).

FORREST L. GAGER, JR.  
VIRGINIA JOHNSON  
JOSEPH C. HOLMES  
McComas Research Center,  
Philip Morris, Incorporated,  
Richmond, Virginia

#### References and Notes

1. The samples were kindly submitted by Dr. Morris.
2. V. Johnson, J. C. Holmes, F. L. Gager, Jr., "A study of the history of the use of tobacco," paper presented at the 13th Tobacco Chemists' Research Conference, Lexington, Ky., 30 Oct. 1959.



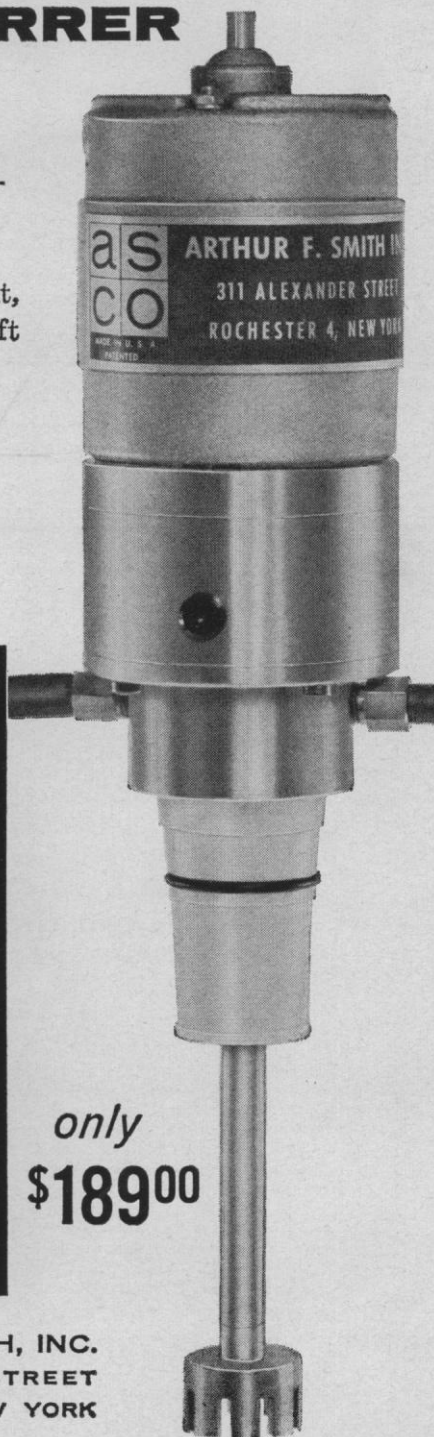
**now . . . for the first time . . .  
an inexpensive stirrer  
featuring electronic speed  
control and rotary seal for  
normal and high vacuum  
operation!**

## ASCO ALL-PURPOSE STIRRER

Here is a quiet operating, modern Hiltch-type agitator, robustly constructed, that emulsifies, homogenizes, or stirs simply by adjusting speed. Positioned by the flask and joint, it fits all flasks by means of 5 shaft extensions. Water cooling may be applied to operate at high flask temperatures. A Teflon® covered 34/45 joint with an O-Ring ASCO Seal assures vacuum tight operation to 10<sup>-8</sup> mm Hg.

#### FEATURES:

- Fits all flasks, 500-12000 m.l.
- Universal application—high or low viscosity fluids
- Electronic speed control—smooth speed regulator, 0-2500 r.p.m.
- Operates at temperatures above 100° C
- O-Ring seal eliminates use of greases thereby avoiding contamination
- Oil sealed shaft and seal
- Stirrers available type 316 S.S.
- Adapters available for larger joint sizes



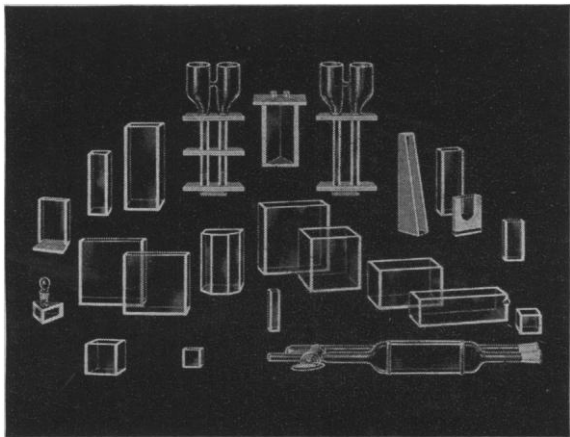
*only*  
**\$189<sup>00</sup>**

a | s  
c | o

ARTHUR F. SMITH, INC.  
311 ALEXANDER STREET  
ROCHESTER 4, NEW YORK

# GLASS ABSORPTION CELLS

made by **KLETT**



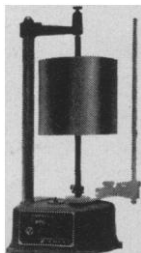
## SCIENTIFIC APPARATUS

Klett-Summerson Photoelectric Colorimeters—  
Colorimeters—Nephelometers—Fluorimeters—  
Bio-Colorimeters—Comparators—Glass Stand-  
ards—Klett Reagents.

**Klett Manufacturing Co.**  
179 East 87 Street, New York, New York

# BIRD KYMOGRAPH

Model



Very suitable  
for student  
and general  
work

**P**resenting a motor driven recording drum that is very suitable for student experiments and general experimental work.

The driving mechanism, consisting of an induction motor and gear box, is housed in the aluminum base. Five speeds are provided—0.44, 2.2, 11, 54 and 270 centimeters per minute. Care has been exercised to provide speeds that will be suitable for all student experiments. Any one of the five speeds may be selected at will. Simply rotate the speed control knob to the desired position while the motor is running. The chart drum (aluminum) is 15 cm. high and 50 cm. in circumference.

A special feature of this kymograph is the convenient drilled and tapped base for attaching the long paper extension (No. 70-128). Extension is attached by removing the two acorn nuts and attaching the drilled end plate to the base. Paper records 225 cm. in length may be made.

**No. 70-060—Kymograph-Bird, complete as illustrated.**

**PHIPPS & BIRD, INC.**

Manufacturers & Distributors of Scientific Equipment  
6th & Byrd Streets - Richmond, Va.



# NEW! FAST

MICROSCOPIC  
SLIDE LABELING



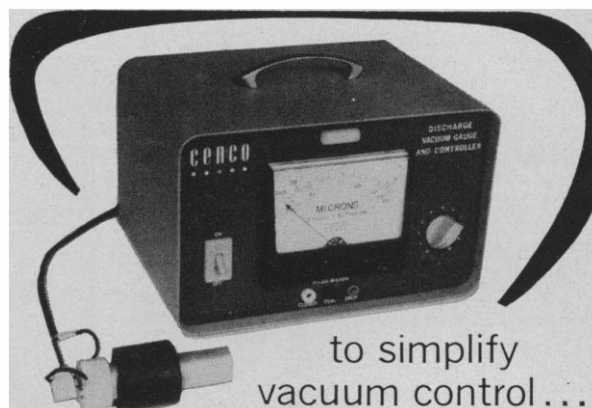
Fast—convenient and accurate! Simply pull tab and label "pops" out. The pressure-sensitive labels are dispensed one at a time and are available in two sizes; standard and

"tissue-high" thickness. They accept pen, pencil, ball point or typewriter marking. 1000 labels per carton in  $\frac{3}{8}$ " x  $\frac{7}{8}$ " or  $\frac{7}{8}$ " x  $\frac{7}{8}$ " plain or pre-printed.



Write for detailed information and the name of your nearest TIME distributor. Dept. RM

**PROFESSIONAL TAPE CO., INC.**  
355 Burlington Ave. • Riverside, Ill.



to simplify  
vacuum control...

# NEW CENCO DISCHARGE GAGE AND CONTROLLER

A gage and automatic controller that continuously reads from 0.001 to 20 microns total pressure of all condensable vapors and gases in your system. Starts instantly at any pressure. Controller provides automatic on-off switching at pre-set pressures—transistorized amplifier opens or closes contacts of relay to control up to 1 amp.

No. 94183

\$249.50



**CENTRAL SCIENTIFIC CO.**

A Subsidiary of Cenco Instruments Corporation  
1718-M Irving Park Road • Chicago 13, Ill.  
Branches and Warehouses—Mountainside, N. J.  
Boston • Birmingham • Santa Clara • Los Angeles • Tulsa  
Houston • Toronto • Montreal • Vancouver • Ottawa

# Meetings

## British Association for the Advancement of Science

The British Association was founded in 1831 "to convince an indifferent public and government that science is important and worth backing." Currently its main task is "the promotion of a better understanding of the significance for industry of scientific research and its impact, through its applications, of science as a whole." The annual meeting of the British Association is arranged accordingly in such a way as to present summary reviews and discussions of recent scientific advances for the benefit of a general public audience, with special sessions for young people. The annual meetings are held early in the fall, at cities around Great Britain, so as to bring scientists directly to local communities. The Cardiff meeting was a huge success in these respects.

Cardiff is a bustling city of nearly 300,000 and is now the capital of the principality of Wales. It has changed from a major coal exporting port to a general industrial center with many large parks and handsome public buildings. The great castle goes back to Roman times, but is chiefly a Norman structure, and the city has developed around it. Nearby is a large park containing the major public buildings, including the fine Welsh National Museum, the great City Hall, and the main university buildings.

### Addresses

Some 4000 attended the 1960 meeting, under the presidency of Sir George Thomson, whose presidential address dealt with "Two aspects of science" (see page 996). This address was given at a formal occasion with full academic regalia. Sir George discussed the relations of pure and applied science. Honorary degrees were conferred by the University of Wales on Sir George Thomson, Sir James Gray (immediate past president), Dame Cathleen Lonsdale of the University of London, and on Principal W. Arthur Lewis of the University College of the West Indies.

Special evening discourses were given on "The structure of the universe" by Professor H. Bondi of the University of London, and on "Microbiological methods in the development of drugs" by Dr. E. V. Chain, professor of biochemistry of the Istituto Superiore di Sanita, Rome.

Outstanding were the addresses by presidents of sections: Dr. James Taylor on "Chemistry in industry"; G. S. Carter, "Tropical climates and biology"; Sir Alfred Pugsley, "Statics and the engineer"; Professor E. E. Evans, "The

Peasant and the past"; Professor T. M. Harris, "The origin of angiosperms"; Dr. William Davies, "Pastoral systems in relation to world food supplies"; T. R. Peace, "The dangerous concept of the natural forest"; A. B. Oldfield-Davies, "Science broadcasting"; Dr. R. Woolley, "Stellar motions"; Professor E. B. Bowen, "Welsh emigration overseas"; Professor R. S. Sayers, "Monetary policy in Great Britain"; Professor William Burns, "The physiology of hearing"; Professor H. C. Dent, "Sixty years of progress in English education"; Professor R. C. Oldfield, "Experiment in psychology—a centenary"; G. F. Mitchell, "Pleistocene history of the Irish Sea"; and Professor D. V. Glass, "Population growth, fertility, and problems of policy."

Individual reports were arranged under the headings of the physical sciences; the biological sciences; forestry and agriculture; geography, anthropology and archeology; and economics, education, psychology and sociology.

Major interest at the meeting centered in the special symposium on world food and population. There were seven speakers in the symposium, and the general consensus was that technological improvements in the use of arable land can maintain adequate food supplies if population growth can be reasonably controlled.

Dr. Michael P. Reece of the Electrical Research Association gave the Kelvin lecture on "Physical principles of switches and circuit breakers." The Lister lecture was given by W. M. Williams of the University College of North Staffordshire on the "Social study of family farming." Interesting was the Darwin lecture by Martin J. Wells of Cambridge University on "What the octopus makes of it: Our world from another point of view."

For the young people there were special panel discussions on questions submitted by students, and there was an excellent exhibit on science teaching in schools. The York lecture for young people was given by Sir James Gray on "The flight of birds." Professor A. Charlesby talked on "Atomic radiation and materials." B. B. Lloyd discussed "Ends and means in human respiration," and Professor C. E. H. Bawn lectured on "Plastics and fibers." Scientific films were also shown, and special exhibits were arranged in the National Museum of Wales. Sectional excursions were provided for geologists and other groups.

Outstanding at the meetings of the British Association for the Advancement of Science are the social functions. The city of Cardiff and the University College were lavish in their entertainment. There were receptions, luncheons, and dinners, arranged with

**Order now before  
publication - -**

**SAVE \$7 50**

*A complete library  
of psychology in  
one volume—*

# Classics in Psychology

*Edited by*

**THORNE SHIPLEY**

To own this book is to own one of the most comprehensive collections of psychological writings ever gathered in one volume. In a text of over 1400 pages are the works of the leading psychologists of Europe, the United States and Russia, spanning a period of one-hundred and fifty years. The selections cover every major school in the field—faculty, behaviorist, Gestalt, Jungian—as well as every major branch including individual, clinical, psychoanalytical, child, animal, educational, social and genetic psychology. Beginning with the tremendous achievements of Pinel and Charcot, right down to the works of Freud and Adler, the 35 chapters represent essential contributions to science by world-renowned psychologists. Authors include: Wundt, von Helmholtz, James, Titchener, Rush, Sakel, Bleuler, Jung, Pavlov, Watson, Rorschach and many others.

CLASSICS IN PSYCHOLOGY is much more than a lifetime reference. It is a significant historical record of the complex growth of ideas that are now of lasting benefit to mankind. You will find yourself returning to this magnificent volume again and again in the years to come. **Take advantage of this pre-publication offer and SAVE \$7.50 (Regular published price \$20.00). Mail this coupon today.**

**PHILOSOPHICAL LIBRARY, Publishers**

**Dept. SM-10**

**15 East 40th Street, New York 16, N.Y.**

Please send me a copy of CLASSICS IN PSYCHOLOGY at the special pre-publication price of \$12.50. I enclose

( ) Check ( ) Money Order

Name .....

Address .....

City ..... Zone ... State ...

## GRASSLANDS

Editor: Howard B. Sprague 1959

6" x 9", 424 pp., 37 illus., index, cloth. Price \$9.00, AAAS members' cash orders \$8.00. AAAS Symposium Volume No. 53.

This volume is intended as a review of knowledge on many aspects of grasslands resources. The 44 authors were selected by their own professional colleagues as being particularly competent to present the respective subjects. Thirty-seven papers are arranged under these chapter headings:

1. Sciences in Support of Grassland Research
2. Forage Production in Temperate Humid Regions
3. Engineering Aspects of Grassland Agriculture
4. Forage Utilization and Related Animal Nutrition Problems
5. Evaluation of the Nutritive Significance of Forages
6. Grassland Climatology
7. Ecology of Grasslands
8. Range Management

British Agents: Bailey Bros. & Swinfen, Ltd.,  
Hyde House, W. Central Street,  
London, W.C.1

AAAS, 1515 Mass. Ave., NW,  
Washington 5, D.C.

delightful formality and with a minimum of speaking. The Lord Mayor (Mrs. Dorothy Lewis) and the corporation of Cardiff gave a civic luncheon, as well as a general reception.

Sir Wilfred Le Gros Clark, professor of anatomy at Oxford University, succeeds Sir George Thomson, professor of physical chemistry at Cambridge University, as president of the British Association. Sir Wilfred is widely known for his studies on nerve regeneration and on paleontology. In thanking Sir George Thomson for his presidential address on the undersanding and control of nature, Sir James Gray, past president, referred to the unique situation of son following father in the presidency of the British Association. Sir George's father was the famed J. J. Thomson, whose concept of electrons opened the atomic age. Both father and son were Nobel laureates.

With full and detailed press coverage, the Cardiff meeting of the British Association was especially successful with respect to its prime function of promoting a better understanding of the significance of scientific research. The program was well arranged. The various papers and symposia will be published in *The Advancement of Science*, the well-designed periodical maintained by the BAAS.

The AAAS was represented officially by Dr. Alfred S. Romer of the Board of Directors and by the President. Dr. Carl F. Kayan of the Council was a guest of the Engineering Section. Several other Americans attended the meetings. All were impressed by the pleasant character of the occasion, the delightful hospitality, and the high quality of the scientific discussion.

CHAUNCEY D. LEAKE

President, AAAS

### Forthcoming Events

#### November

2-4. Plasma Physics, 2nd annual, Gatlinburg, Tenn. (A. H. Snell, Oak Ridge Natl. Lab., Oak Ridge, Tenn.)

2-4. Society for Experimental Stress Analysis, Berkeley, Calif. (W. W. Murray, Massachusetts Inst. of Technology, Cambridge)

2-5. American Soc. of Parasitologists, Los Angeles, Calif. (F. J. Kruidenier, Zoology Dept., Univ. of Illinois, Urbana)

2-5. American Soc. of Tropical Medicine and Hygiene, Los Angeles, Calif. (R. B. Hill, 3573 St. Gaudens Rd., Miami 33, Fla.)

2-5. American Speech and Hearing Assoc., Los Angeles, Calif. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington 6)

3-4. Electrostatic Propulsion, conf., Monterey, Calif. (J. M. Sellen, Thompson Ramo-Wooldridge, Inc., 8433 Fallbrook Ave., Canoga Park, Calif.)

3-4. Muscle as a Tissue, conf., Philadel-

phia, Pa. (Division of Research, Lankenau Hospital, Philadelphia 31)

4-5. West-Central States Biochemical Conf., Lincoln, Neb. (J. H. Pazur, Dept. of Biochemistry and Nutrition, Univ. of Nebraska, Lincoln)

4-6. Assoc. of Clinical Scientists, Washington, D.C. (R. P. MacFate, 54 W. Hubbard St., Chicago 10, Ill.)

5. Society for Industrial and Applied Mathematics, Philadelphia, Pa. (G. Kaskey, Remington Rand Univac, 1900 W. Allegheny Ave., Philadelphia)

7-10. Society of Exploration Geophysicists, 30th annual intern., Galveston, Tex. (C. C. Campbell, Box 1536, Tulsa, Okla.)

8-10. Forensic Sciences, 2nd symp., Washington, D.C. (Director, Armed Forces Inst. of Pathology, Washington 25)

9-10. Use of Secondary Surfaces for Heat Transfer with Clean Gases, symp., London, England. (Secretary, Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1)

9-11. Clinical Chemistry Methods, symp., Cleveland, Ohio. (A. Hainline, Cleveland Clinic, 2020 E. 93 St., Cleveland 6)

10-12. Geological Soc. of America, 73rd conv., Denver, Colo. (H. R. Aldrich, GSA, 419 W. 117 St., New York 27)

10-12. National Assoc. of Geology Teachers, Denver, Colo. (F. Foote, Dept. of Geology, Williams College, Williamstown, Mass.)

10-13. Pacific Coast Fertility Soc., Las Vegas, Nev. (A. C. Wineberg, 3120 Webster St., Oakland, Calif.)

11-12. Paleontological Soc., Denver, Colo. (H. B. Whittington, Harvard Univ., Cambridge 38, Mass.)

13-16. Society of American Foresters, 60th annual, Washington, D.C. (H. Clapper, SAF, 825 Mills Bldg., Washington 6)

14-17. Magnetism and Magnetic Materials, 6th annual conf., New York, N.Y. (L. R. Bickford, Jr., I.B.M. Research Center, Yorktown Heights, N.Y.)

14-18. American Soc. of Agronomy, Chicago, Ill. (L. G. Monthey, 2702 Monroe St., Madison 5, Wis.)

14-18. Nuclear Ship Propulsion, symp., Taormina, Sicily. (International Atomic Energy Agency, 11 Kärntner Ring, Vienna 1, Austria)

15-16. Engineering Application of Probability and Random Function Theory, symp., Lafayette, Ind. (J. L. Bogdanoff, School of Aeronautical and Engineering Sciences, Purdue Univ., Lafayette)

16-19. Society of Naval Architects and Marine Engineers, annual, New York, N.Y. (W. N. Landers, SNAME, 74 Trinity Pl., New York 6)

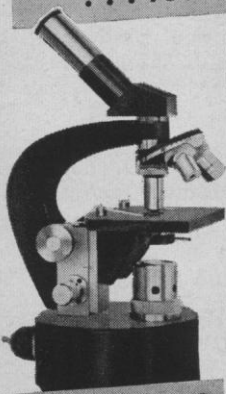
17-19. Extrapyramidal System and Neuroleptics, intern. symp., Montreal, Canada. (J.-M. Bordeleau, Dept. of Psychiatry, Univ. of Montreal, Montreal)

17-19. Surgery of Endocrine Organs, symp., New York, N.Y. (Office of the Associate Dean, New York Univ. Post-Graduate Medical School, 550 First Ave., New York 16)

17-20. American Anthropological Assoc., Minneapolis, Minn. (B. J. Meggers, 1530 P St., NW, Washington 5)

17-20. Southern Thoracic Surgical Assoc., Nassau, Bahamas. (H. H. Seiler, 517 Bayshore Blvd., Tampa 6, Fla.)

(See issue of 16 September for comprehensive list.)



**UNITRON'S Model MSA**  
makes teaching easier  
... learning faster!

Here is a teaching microscope with built-in features to aid the instructor and student, yet priced for school budgets.

- Inclined prismatic eyepiece rotates 360° permitting two students or teacher and student to share the instrument
- Built-in low-voltage illuminating system, fixed condensing lens ... transformer conveniently housed in base ... accessory mirror included ... cabinet
- Substage condenser with aperture iris diaphragm assures correct and brilliant illumination at all powers ... filter on swing-out mount
- All metal construction with durable black and chrome finish
- Low positioned coarse and fine focusing controls with protective stops to prevent damage to objectives or slides
- Three parafocal achromatic objectives 4X, 10X, 40X: professional quality with full numerical aperture ... triple nosepiece ... three eyepieces 5X, 10X, 15X ... available magnifications — 20X, 40X, 50X, 60X, 100X, 150X, 200X, 400X, 600X

**\$96<sup>30</sup>**  
5 — 10 UNITS  
F. O. B. Destination

11-24 units — only \$94.16 FREE 10-DAY TRIAL

**UNITRON**  
INSTRUMENT COMPANY • MICROSCOPE SALES DIV.  
66 NEEDHAM ST., NEWTON HIGHLANDS 61, MASS.

Please rush UNITRON's Microscope Catalog 4-H-3

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_