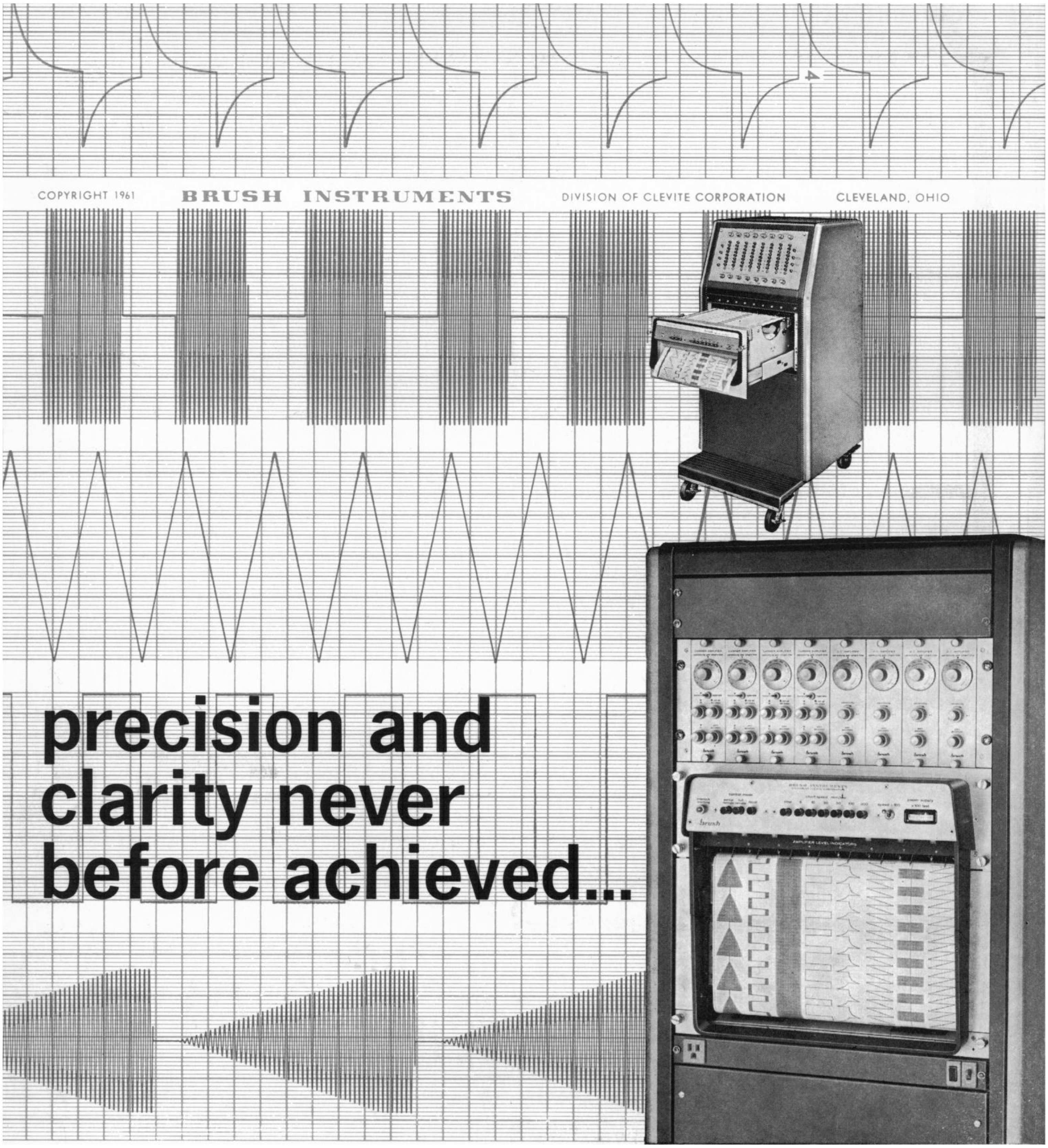
SCIENCE

10 May 1963

Vol. 140, No. 3567

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



The new Brush Recorder Mark 200 made these incredibly crisp tracings. No other recorder in existence can match them. Note the line width. It never varies... regardless of writing velocity, regardless of chart speed. The writing mechanism is electrically signaled by the position-seeking "Metrisite" transducer . . . no parts to wear, infinite resolution, verifiable dynamic ½% accuracy. Traces are permanent, high-contrast, reproducible . . . on low cost chart paper. The Mark 200 has but three standard controls . . . attenuator, pen position, chart speed. Such fidelity, simplicity and economy are possible with no other direct writing recorder. *Available in both vertical and horizontal models* with interchangeable plug-in preamplifiers or signal conditioning push-button controls. Write for details . . . they'll speak for themselves.

brush INSTRUMENTS

DIVISION OF CLEVITE 37TH AND PERKINS, CLEVELAND 14, OHIO

10 May 1963
Vol. 140, No. 3567

SCIENCE

SCIENCE is published weekly by the American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington 5, D.C. Now combined with **The Scientific Monthly** ®. Second-class postage paid at Washington, D.C. Annual subscriptions $8.50; foreign postage, $1.50; Canadian postage, 75¢; single copies, 35¢. School year subscriptions: 9 months, $7; 10 months, $7.50. Provide 4 weeks' notice for change of address, giving new and old address and zone numbers. Send a recent address label. Opinions expressed by authors are their own and do not necessarily reflect the opinions of the AAAS or the institutions with which the authors are affiliated. Indexed in the **Reader's Guide to Periodical Literature.**

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

EDITORIAL CORRESPONDENCE: 1515 Massachusetts Ave., N.W., Washington 5, D.C. Phone: 202-DU 7-7171. Cable: Advancesci, Washington. Manuscripts should be submitted in triplicate, double-spaced throughout. The AAAS assumes no responsibility for the safety of manuscripts. Copies of "Instructions for Contributors" can be obtained from the editorial office.
ADVERTISING CORRESPONDENCE: Room 1740, 11 West 42 St., New York 36, N.Y. Phone 212-PE 6-1858.

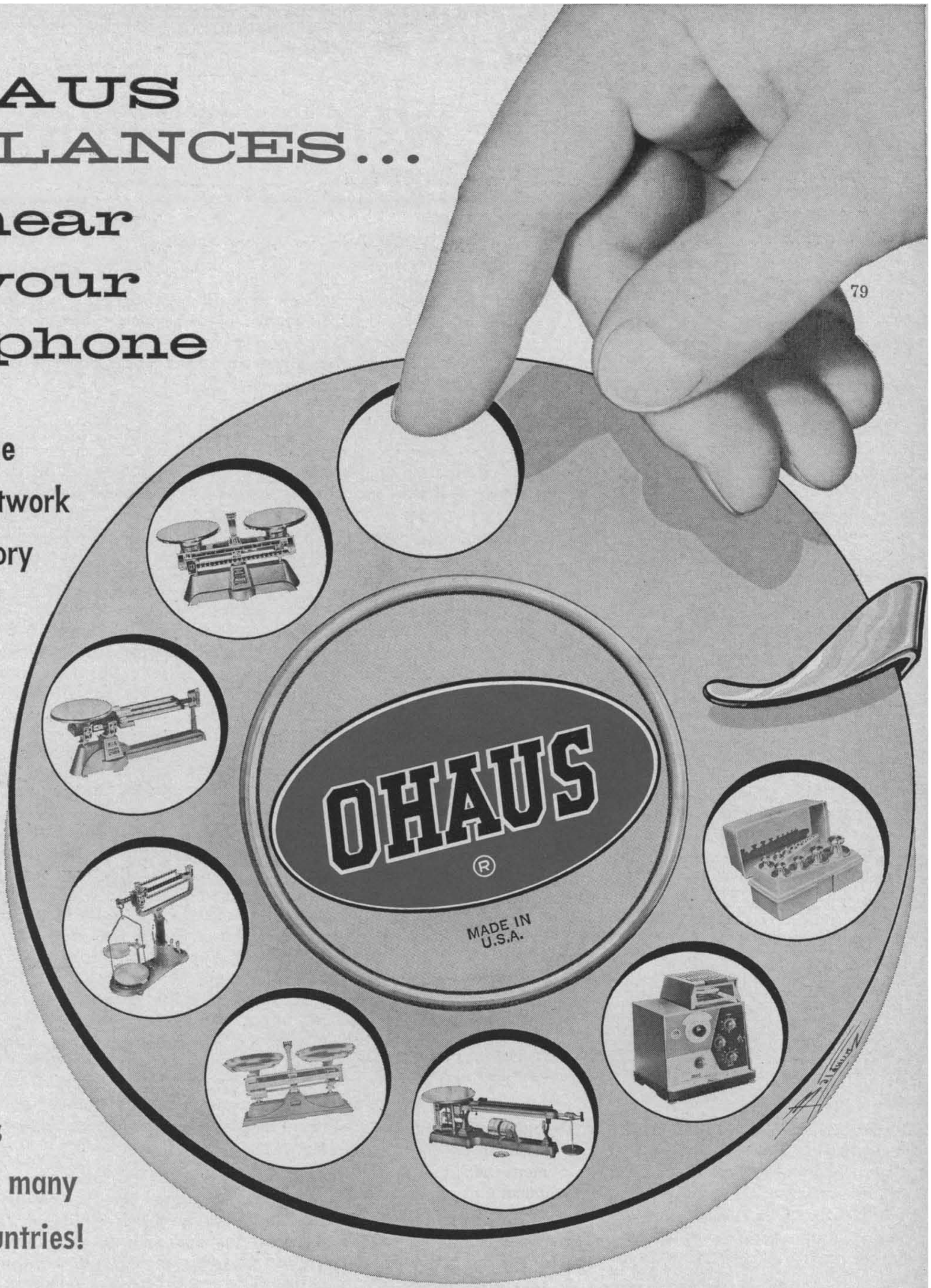
COVER

Spiral nebula in Ursa Major. Many late spiral galaxies are of this type. Among their characteristic features are a small nucleus from which the spiral pattern emerges in dust lanes, at first, and farther out in luminous filaments; and multiple spiral arms, thin and highly branched in their outer regions. See review of *The Distribution and Motion of Interstellar Matter in Galaxies*, page 657. [From *The Hubble Atlas of Galaxies*, Mount Wilson and Palomar Observatories, Carnegie Institution of Washington, California Institute of Technology]

OHAUS BALANCES...

as near as your telephone

79



through the OHAUS network of laboratory and school supply dealers OHAUS QUALITY PRODUCTS are available from stock in all the fifty states as well as many foreign countries!

OHAUS ®

for complete information write;

OHAUS SCALE CORPORATION

1050 COMMERCE AVENUE UNION, N. J.

Dept. EF

Kodak reports on:

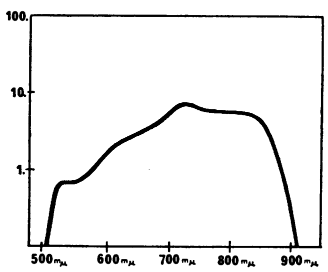
a nice way to look down ... a possible alternative to ninhydrin ... confidence in one's position

Under false colors

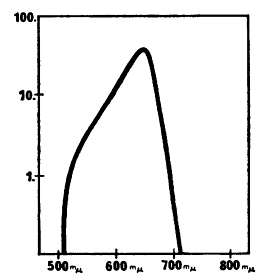
Ecologists have more important things to think about than the technicalities of color film, and we have other things to think about than ecology.* Let us, nevertheless, make beautiful music together. To any geologists or others who wish to join in, welcome.

A little while ago we announced a new color film for aerial photography and set up a howl about how much more informative is photography to which have been added the dimensions of color. We now go the next step and suggest that man's color vision can be exploited for scientific purposes in a way quite unrelated to the color sensation that nature presents to the naked eye.

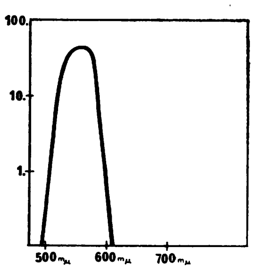
The brain's response to the spectral distribution of energy falling directly on the cones of the retina is measurable but not truly describable and certainly immutable. Color film lacks such mystical character. If we want to make it see well at 850mμ, we do so without waiting for eons of evolution. We can then use it to adapt the mystical processes of the central nervous system to man's needs in 1963 A.D., as distinguished from his needs in 200,000 B.C. We have freedom. We can arbitrarily decide that it might be useful to see



as red (when it's mostly infrared),



as green (when it's actually red), and



as blue (when it's actually green). This might give the world a crazy aspect but heighten sensitivity to the way various carotenoids and xanthophylls mark the members of the association of a rain forest.

We can't go on, for fear of betraying our ignorance. Far better merely to say that the above-indicated spectral sensitivities are indeed available in the three layers of a new film called KODAK EKTACHROME *Infrared Aero Film, when exposed through a* KODAK WRATTEN *No. 12 Filter. We supply it only in aerial-film widths and lengths. If you don't know any aerial photographers, ask Eastman Kodak Company, Professional Photographic Division, Rochester 4, N. Y.*

The contributions of Dr. Kazuo Satake and Dr. Tsuneo Okuyama and of Mrs. Sasakawa

At the request of the department of agriculture of a neighboring country, we prepared some *2,4,6-Trinitrobenzenesulfonic Acid.* We announced we had a little left over, and that was quickly snatched up. Now we think we know why and have decided to stock the compound as EASTMAN 8746.

Investigation discloses that in one of those thick annual reviews of progress in analytical chemistry that everybody appreciates and some actually get to leaf through at the end of a slow day when it's too near quitting time to start anything new, there was buried a top-of-the-head suggestion that this reagent might be a good alternative to ninhydrin for keeping track spectrophotometrically of amino acids and peptides coming off ion exchange columns. The one paragraph devoted to this subject gave a reference, which, on an impulse, we decided to chase down. This led to p. 654 of Volume 47 of the *Journal of Biochemistry* (*Tokyo*).

There we learned that *2,4,6-Trinitrobenzenesulfonic Acid* has been found to react specifically with primary amines, amino acids, and peptides. Extinction coefficients of the products run from 1.14 to 1.46 x 10^4 for amino groups of amines and amino acids and 0.98 to 1.12 x 10^4 for those of peptides at a final concentration of *N*, respectively. Similarity of the relative color intensity among various peptides from simple dipeptide to oxidized insulin was pointed out as an advantage in assay of peptide.

It seemed to us that a nice contribution had been made. We thought it would be a mark of respect to have our man in the world's largest city drop in at the source of this information, the Department of Chemistry of Tokyo Metropolitan University, where he found two of the authors, Dr. Tsuneo Okuyama (*left*) and Dr. Kazuo Satake.

The lady is Mrs. Shigeru Sasakawa, who finds that after assay of chromatographic effluent, the corresponding peptide can be regenerated from trinitrophenyl-peptide so readily with concentrated ammonia that there isn't even any appreciable splitting of peptide bonds.

The gentlemen freely grant that the precise mechanism of desulfonative condensation of aromatic sulfonic acid with amino compounds is still unclear. They mix 1.0 ml of amino acid, peptide, or primary amine sample solution (0.01 to 0.8 μmol), 1.0 ml of 4% $NaHCO_3$, and 1.0 ml of 0.1% *2,4,6-Trinitrobenzenesulfonic Acid.* They keep the mixture in the dark at 40°C for 2 hours, then acidify with 1*N* hydrochloric acid and measure optical density at 340mμ.

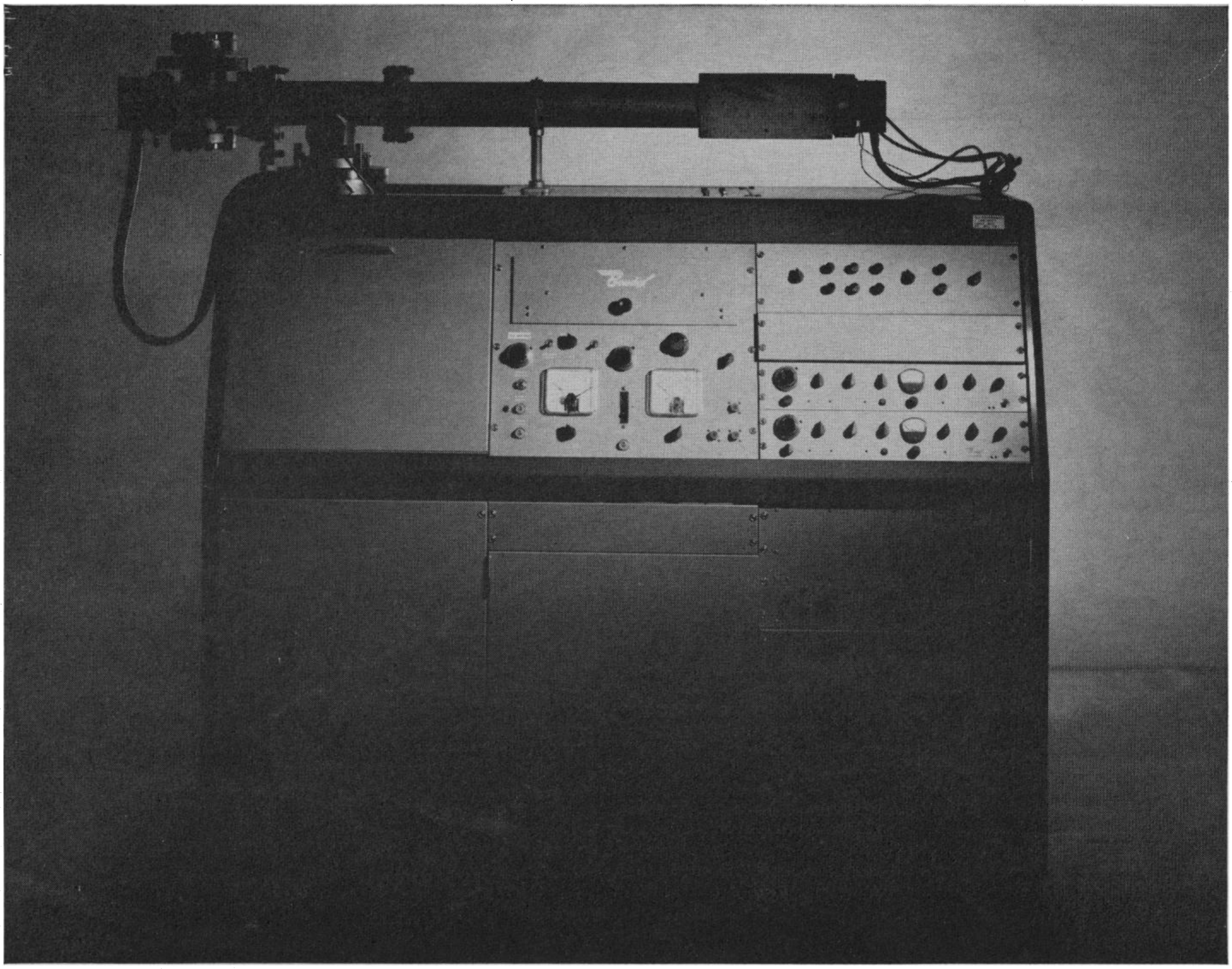
That's what they do. To do what you do, get some EASTMAN *8746 and go to work. It's one more of some 4100* EASTMAN *Organic Chemicals sold by Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company).*

Sticking glass together

So sure are we of the total optical quality of Kodak lenses for photography and projection that we don't mind selling the many and various optical cements we have developed for them. Twelve cements, along with detailed directions for use. Some are for glass-to-glass, some for glass-to-metal, some thermosetting, some thermoplastic, some with solvents, some without, some tried and true, some new and better, some cheap, some dear, some fast-setting, some slow. No Canada balsam. Nothing suitable for household use. Request yellow folder entitled "KODAK Optical Cements" from Eastman Kodak Company, Apparatus and Optical Division, Rochester 4, N. Y.

*But none more important.

This is another advertisement where Eastman Kodak Company probes at random for mutual interests and occasionally a little revenue from those whose work has something to do with science




The HITACHI HS-7
features push-button operation!
The medium cost HS-7 electron microscope is a virtually automatic push-button instrument, featuring all the conveniences of modern motorized vacuum valving, along with simplified operation. With its guaranteed resolution of 15 AU, magnification up to 50,000x, electronically, with condenser, and with potentiometric focusing, the Hitachi HS-7 provides a real advancement in electron microscopy. Many of the HS-7's features, such as interchangeable objective apertures and binocular for fine focusing have heretofore been found only in the most expensive instruments.
Microphotograph is of Molybdenite, taken at 55,000x
Please write or call for further information
ERB & GRAY SCIENTIFIC
A Division of The Perkin-Elmer Corporation
LOS ANGELES • HOUSTON • CHICAGO • NEW YORK

New Books from PERGAMON PRESS

COLOR CENTERS IN SOLIDS
J. H. Schulman and W. D. Compton
An introduction to the field of color centers which reviews the rather bewildering variety of color centers in alkali halides, and shows their interrelationships.
375 pages $12.50

FERROELECTRIC CRYSTALS
F. Jona and G. Shirane
An introduction to ferroelectricity, with an extensive bibliography and references to unpublished research.
412 pages $15.00

ELECTROLUMINESCENCE
H. K. Henisch
Intended primarily for those who are making the phenomena of electroluminescence a subject of special study. Contains a detailed discussion of theoretical models.
368 pages $12.50

SEMICONDUCTOR STATISTICS
J. Blakemore
Provides a comprehensive discussion of the factors which govern the concentration of free charge carriers in semiconductors and of the electrical properties of these materials.
381 pages $12.50

ELECTROMAGNETIC WAVES IN STRATIFIED MEDIA
J. R. Wait
This monograph is concerned with electromagnetic waves in media whose properties vary in one particular direction. Applications to the real world are used as illustrations of the theoretical principles.
372 pages $15.00

IONOSPHERIC SPORADIC E
E. K. Smith and S. Matsushita, *Editors*
A survey of all current knowledge of Sporadic E, and a presentation of new work, most of which has not been treated elsewhere.
391 pages $15.50

PHOTOELASTICITY, Proceedings of the International Symposium
M. M. Frocht, *Editor*
A collection of papers reflecting new techniques and improvements in known methods, and showing the latest fundamental developments in new directions.
320 pages $14.00

EXPERIMENTAL MECHANICS, Proceedings of the First International Congress
B. E. Rossi, *Editor*
General categories covered include: survey lectures; dynamics and impact; plates, shells and stress analysis; creep, plastic flow, fracture and residual stresses.
406 pages $21.00

BIO-TELEMETRY, Proceedings of the Interdisciplinary Conference held in New York, March, 1962
L. E. Slater, *Editor*
The first comprehensive and authoritative collection of papers on the use of telemetry in animal behavior and physiology in relation to ecological problems, with detailed discussion material.
369 pages $18.50

INTRODUCTION TO ELECTRON MICROSCOPY
S. Wischnitzer
This book bridges the gap between the simple presentation of electron optics for laymen and the complex explanation for the physicist.
132 pages $6.50

THE CONTROL OF CHROMATOPHORES
M. Fingerman
This monograph covers chromatophores and color changes wherever they occur in the animal kingdom.
192 pages $7.50

THE PLANT CELL WALL
S. M. Siegel
A topical study of architecture, dynamics, comparative chemistry and technology in a biological system, this monograph contains the most recent and significant advances in the field of cell wall science.
136 pages $6.50

BIOGENESIS OF NATURAL COMPOUNDS
P. Bernfeld, *Editor*
A general review dealing with compounds occurring both in the animal and vegetable kingdoms and the substances synthesized only by plants or micro-organisms.
approx. 1,200 pages **To be published July, 1963.** $28.00

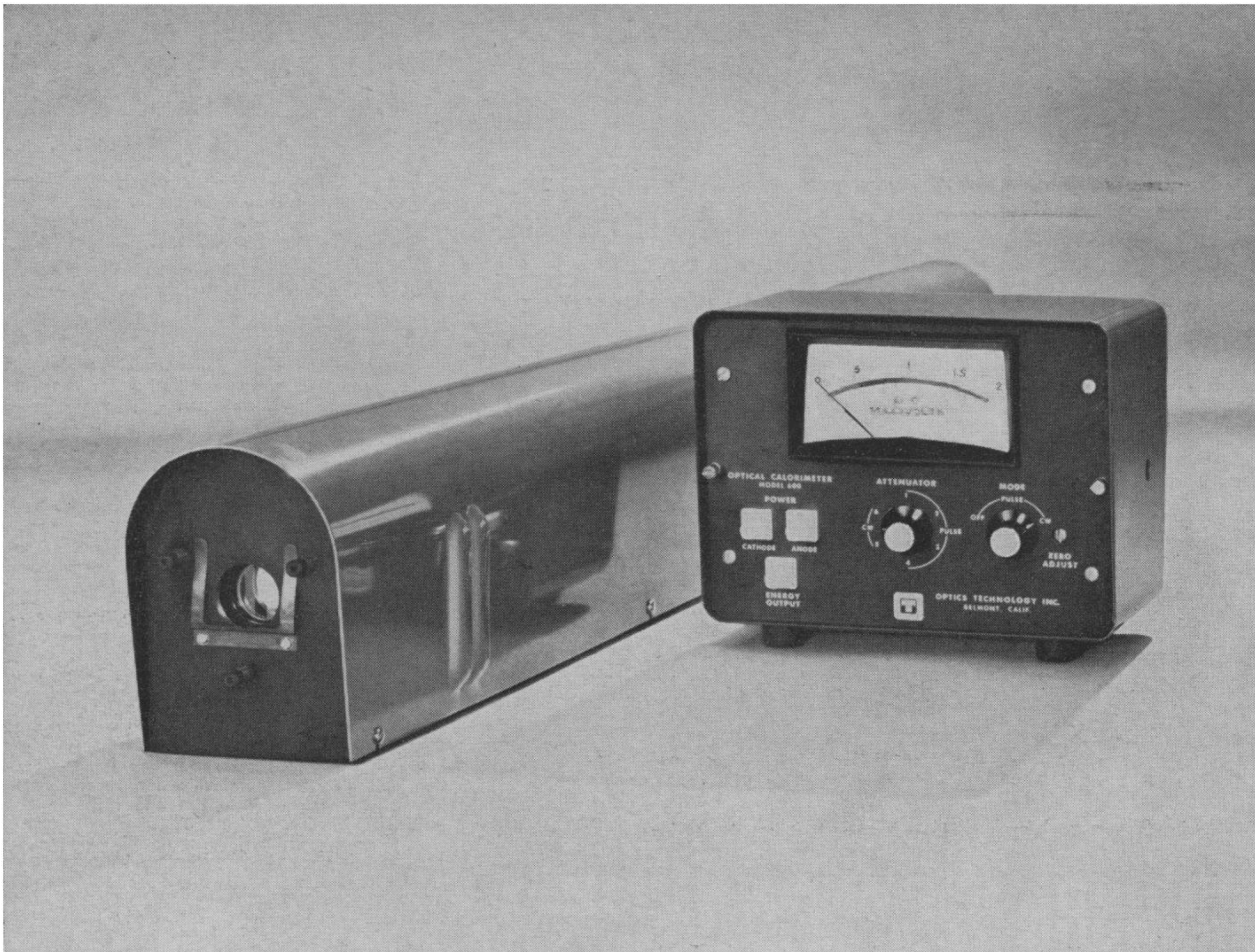
NATURAL ORGANIC MACROMOLECULES
B. Jirgensons
An introduction to the chemistry of natural organic high polymers. Includes the vast domains of proteins, polysaccharides, and nucleic acids.
464 pages $15.00

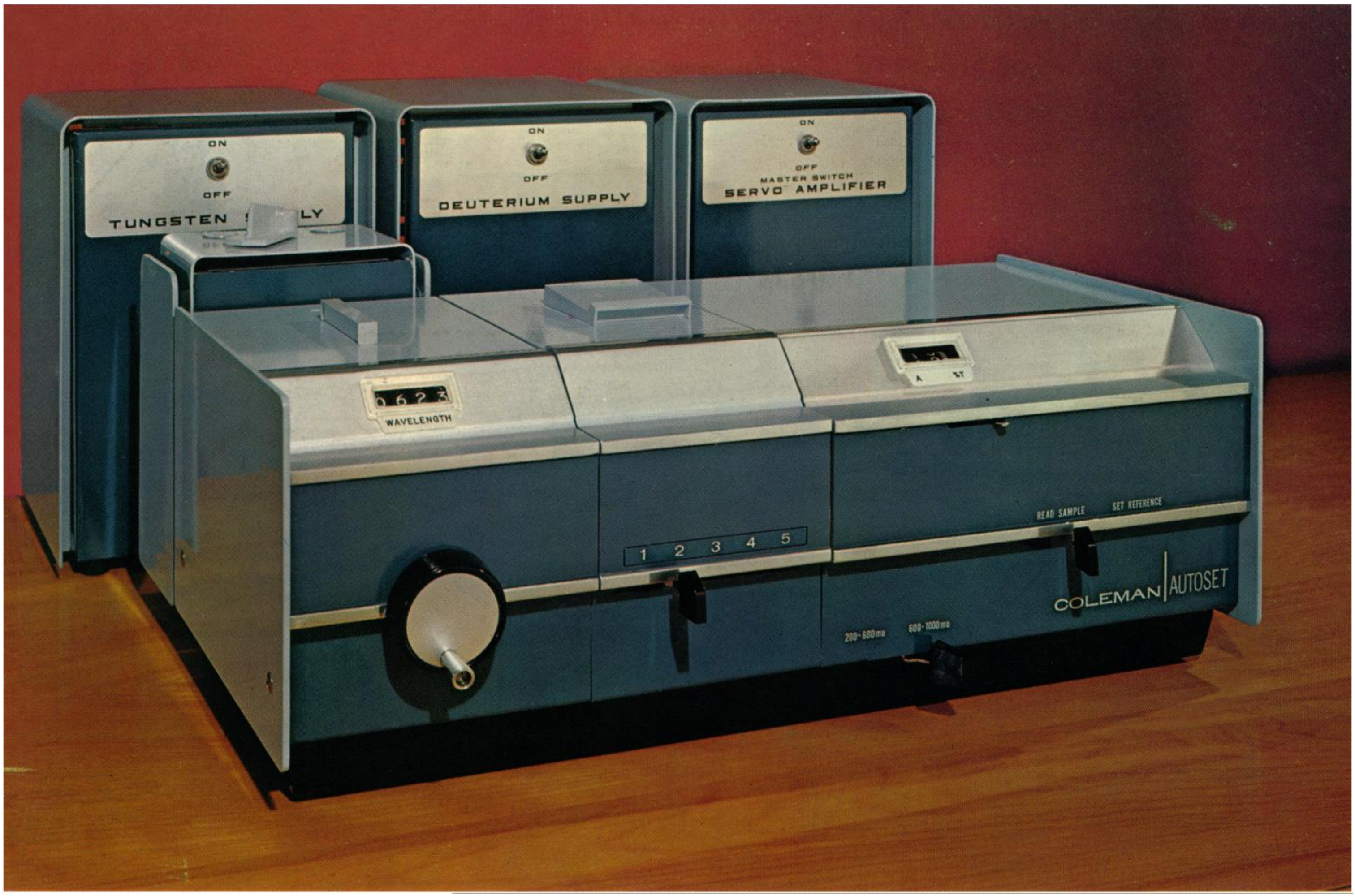
PROGRESS IN THE CHEMISTRY OF FATS AND OTHER LIPIDS, Volume 6
R. T. Holman, W. O. Lundberg and T. Malkin, *Editors*
Papers and contributors include: The synthesis of phospholipids—Erich Baer; Fatty acid oxidation—D. E. Green; Fatty acid biosynthesis—D. M. Gibson; Recent developments in the glyceride structure of vegetable oils—H. J. Dutton and C. R. Scholfield.
378 pages $15.00

THERAPIST-PATIENT EXPECTANCIES IN PSYCHOTHERAPY
A. P. Goldstein
A comprehensive and well-organized review of all the pertinent research on expectancy in human behavior.
141 pages $4.50

PERGAMON PRESS
Oxford *New York* *Paris*
Distributors in the Western Hemisphere and The Philippines: THE MACMILLAN COMPANY

These books and all books advertised in this issue available from
MAXWELL SCIENTIFIC INTERNATIONAL, INC.
Scientific and scholarly books and periodicals in all languages.
13-05 44th Avenue, Long Island City 1, New York


OPTICAL CALORIMETER
ATTENUATOR
MODE
POWER
CATHODE
ANODE
ENERGY OUTPUT
PULSE
CW
OFF
ZERO ADJUST
OPTICS TECHNOLOGY INC.
BELMONT, CALIF.



INTRODUCING THE

COLEMAN

AUTOSET

SPECTROPHOTOMETER

★ *the working spectrophotometer for the ultraviolet-visible range*

★ *automated reference setting*

★ *direct reading, numerical data display*

★ *bipartite diffraction grating optics*

C O L E M A N

AUTOSET

SPECTROPHOTOMETER

the working spectrophotometer for the ultraviolet-visible range

Unequalled speed and convenience

Automated reference setting, the AUTOSET provision, ends the need for multiple manipulations ordinarily required for making a spectrophotometer reference setting. With AUTOSET, the value is achieved in seconds—*automatically*—by positioning a single control.

For sample analysis, the operator merely repositions the control and selects the sample . . . the sample value is quickly and clearly displayed in the instrument's readout window. The entire operation takes but a few seconds.

Simplified controls and AUTOSET eliminate critical, time-consuming adjustments and the need for nulling meters.

Error elimination

Reading information in numerical form is twice as fast and three times as accurate as reading the same information from dials. In the AUTOSET Spectrophotometer, all data is presented in unmistakable numerical form.

Wavelength data is presented directly in millimicrons—there are no non-linear scales to interpolate or micrometer screws to adjust.

Terms of readout—either in transmittance or absorbance—are selectable. This ends confusion of simultaneous presentations.

Sample identification is quick, positive and accurate.

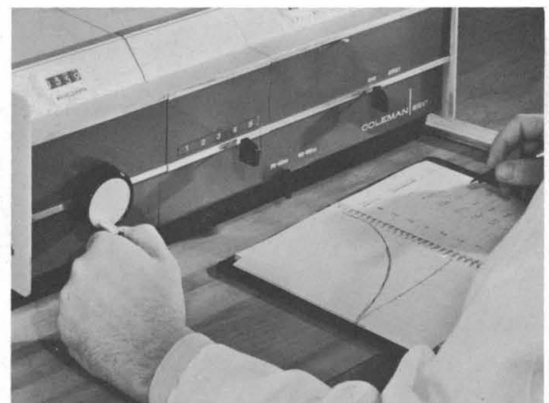
Sample versatility

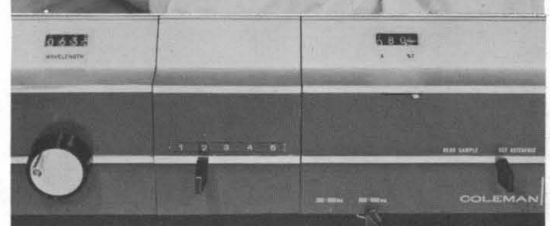
General purpose and special cuvettes extend the scope of the instrument to meet widely-varying sample requirements. The instrument's sample compartment is designed for efficient use of a full range of cuvettes—ultramicro, long light path, and round test tube types as well as the highly-accurate standard square cuvettes with parallel optical faces.

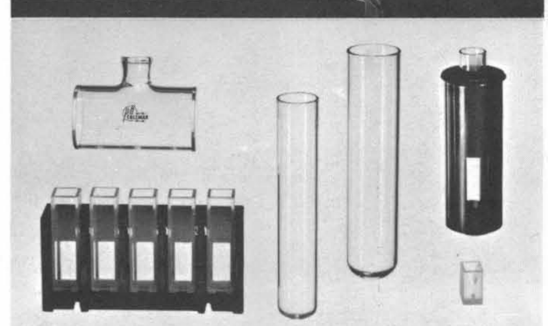
The sample compartment provides adequate room for such special equipment as magnetic mixers, thermostatted components, and special cells with 100 mm light path.

Bipartite diffraction grating optics

The Coleman AUTOSET Spectrophotometer provides the laboratory with the practical advantages of a working instrument with the analytical range of specialized research equipment. A bipartite diffraction grating, dual light source, and dual phototubes provide high levels of energy throughout the 200-1000$m\mu$ spectrum. The bipartite grating produces a straight and linear spectrum which provides constant band width at all wavelengths, with fixed optical slits. Constant band width insures maximum reproducibility.







CONDENSED SPECIFICATIONS

Monochromator
Bipartite reflection diffraction grating.
2 millimicron standard bandwidth; 1 and 5 millimicron bandwidths also available for special work.
Wavelength range 200-1000 millimicrons.

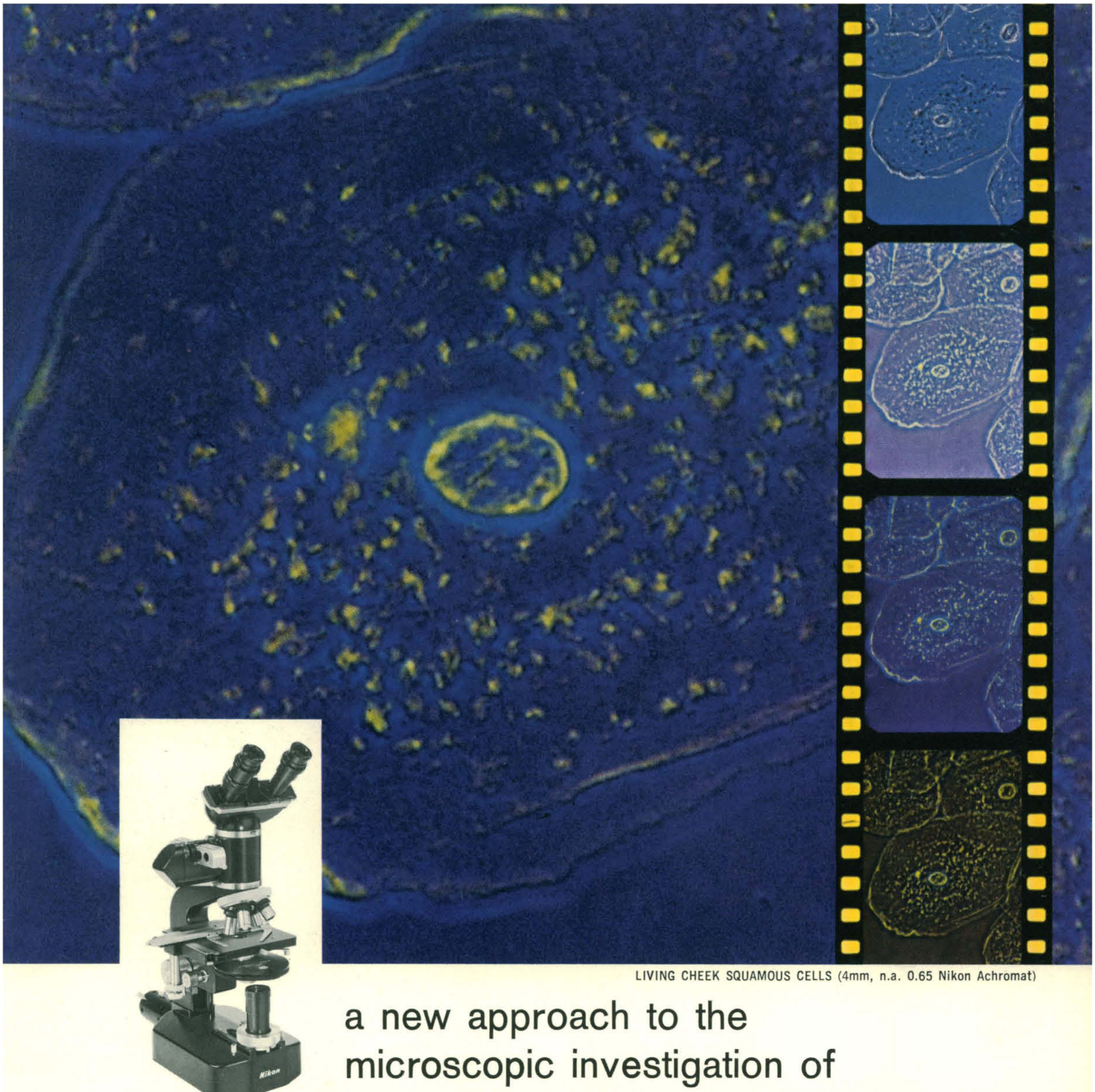
Photometer
Self-balancing null system.
Photometric accuracy: ±0.5%T, ±0.005A at 0.4A.

Sample range
120 microliters to 25 milliliters.
1 to 100 millimeter light path.

COLEMAN

Ask for descriptive literature and a demonstration

COLEMAN INSTRUMENTS, INC., MAYWOOD, ILLINOIS



LIVING CHEEK SQUAMOUS CELLS (4mm, n.a. 0.65 Nikon Achromat)

Aminco Rounds Out Important System for Materials Evaluation with Addition of New ADSORPTOMAT

A systemized approach to the evaluation of materials allows the researcher to better interpret and correlate the various data needed in the rapid development of new and improved materials. Toward this end, Aminco's six-instrument materials evaluation system investigates density, particle size distribution, specific surface area, pore size distribution and pore structure investigations; as well as relating the effects of these factors on other physical and chemical properties, such as thermal analysis and chromatographic characterization of effluent therefrom.

Adsorptomat . . . Automatically determines complete nitrogen adsorption and desorption isotherms for pore structure and surface area analysis. Surface area is determined by the B.E.T. method, which involves determination of the quantity of gas which will form a monomolecular layer on the pore surface. Pore size distribution is derived from the Kelvin vapor pressure lowering in the capillary pores and corrected for the adsorbed volume. Sample data is printed out in digital form for computer calculation while a recorder plots the uncorrected adsorption-desorption isotherm. No operator attention is required after set-up. *Photo A*

Aminco-Roller Particle-Size Analyzer . . . Physically separates subsieve powdered materials according to micron sizes for detailed microscopic examination and successive determinations of distribution vs. particle size range. Any number of size fractions may be obtained within the 5-75 micron range and within size limits as close as desired. Percentage weight of separated fractions is reproducible to ± 0.5%. *Photo B*

Aminco-Winslow Porosimeter . . . Graphically presents pore size, volume and distribution of solid or powdered materials. Samples are immersed in mercury and subjected to varying degrees of air pressure. The amount of mercury forced into the sample's pores is measured at specific pressure intervals. Pressure and volumetric readings are plotted on semilog graph paper. Two models available: one with pressures to 5,000 psi for analysis of pores from .035 to 100 microns, and a second for pressures to 15,000 psi for pores from .012 to 100 microns. *Photo C*

Thermo-Grav (Thermogravimetric Analyzer-TGA) . . . Measures and automatically records changes in sample weight as a function of time or temperature. Unit incorporates: (1) a weighing system which converts weight changes to electrical signals; (2) a vacuum system which permits operation in vacuum or controlled pressures in air or gas; (3) a heating system which heats sample at programmed rates to 1000° C, or maintains constant temperature; (4) a recording system which records weight changes as a function of programmed temperature, or time at a constant temperature. *Photo D*

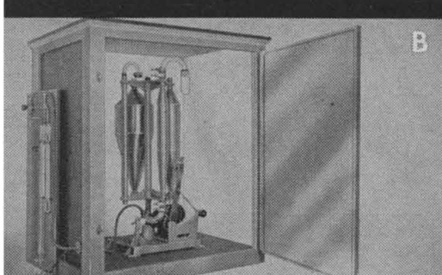
Differential Thermoanalyzer . . . Measures enthalpic effects attending chemical or physical changes that occur as sample temperature increases at a selected rate. DTA curves are plotted showing the temperature difference between a thermally inert reference material and the sample as a function of sample block temperature. Among the physical reactions that may be compared and investigated are crystalline transition, solidification, adsorption, absorption, hydration, corrosion, direct reaction of solids or liquids with gaseous oxidants, and many others. *Photo E*

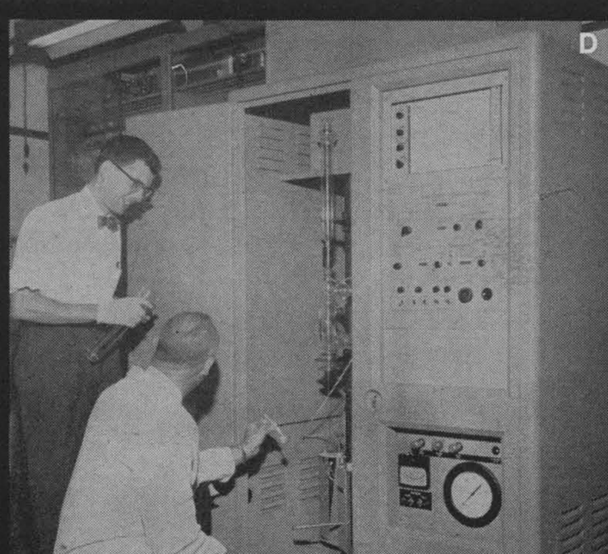
Analytical Gas Chromatograph . . . For the identification and quantitative assay of effluents of DTA and TGA operations. Unit is available with three interchangeable detector systems: a Thermistor Detector, a Filament Detector and a recently developed R.F. Detector. The Chromatograph removes and analyzes the products of thermal degradation from the DTA or TGA units, resulting chromatographic peaks are then correlated with the valleys and peaks of the thermograms. *Photo F*

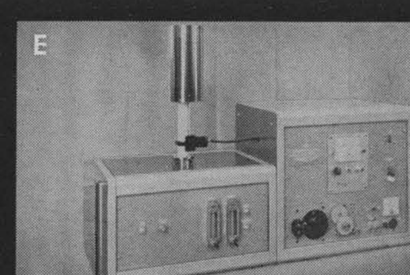
Bulletin Package on Request . . . Complete information on all 6 instruments described above available. Request Literature File ME J-51

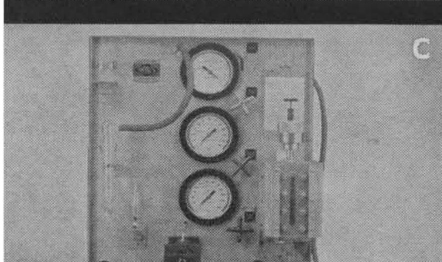
AMERICAN INSTRUMENT CO., INC. • 8030 Georgia Avenue, Silver Spring, Md.

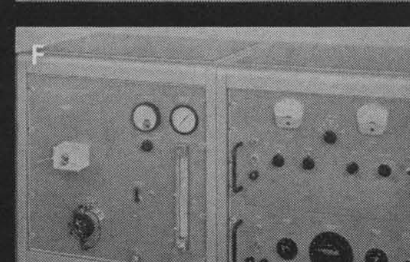
AMINCO











These New Saunders Books Bring You Up-to-date on Three Scientific Frontiers

This Brilliantly Illustrated Work Helps You Interpret Fine Structure

A New Book—AN ATLAS OF ULTRASTRUCTURE—Rhodin

In this fascinating *New Atlas,* Dr. Rhodin brings you a vivid look at tissue and cellular details that could only be guessed at a relatively few years ago. As a supplement to the standard histology textbook, it supplies the student and investigator with a tool to help bridge the gap between light and electron microscopy.

You'll find magnificent views of tissues taken from mouse and man, as the author, in accompanying legends, sums up the wealth of information revealed by the electron miscroscope. You'll find nerve sheath, liver cells, taste buds, cornea, smooth muscle, and many more cells and tissues not previously explored so extensively. In many cases, sets of serially increased magnifications are presented on the same specimen. These effectively help you relate the view given by the electron microscope to that you see through the light microscope. Succinct descriptions explain each perfectly reproduced view; labels point out every pertinent feature.

The reader will find this atlas offers a superb introduction to fine structure—an area of great portent for the future of medicine.

By JOHANNES A. G. RHODIN, M.D., Professor of Anatomy, New York University School of Medicine, New York City; Docent of Anatomy, Karolinska Institutet, Stockholm, Sweden. 222 pages, 9" x 11½", with 213 illustrations on 78 plates. $10.00. *New—Published March, 1963.*

Shows You Blood Vessels Reaction to Nervous, Locals, & Humoral Factors

A New Book—PHYSIOLOGY of the CIRCULATION in Human Limbs in Health and Disease—Shepherd

Here is lucid discussion of virtually everything currently known about the circulation of blood in the arms, hands, legs, and feet . . . and its relation to the cardiovascular system as a whole. Description of normal vascular activity is followed by discussion of modifications of activity in the presence of specific diseases.

The first part of this book covers nervous, local, and humoral control of blood vessels in muscle and skin. Here you will find such topics as: effects of heat and cold—vascular reactions to changes in transmural pressure—the effect of CO_2 tension and pH—the effects of epinephrine, norepinephrine, and isopropylnorepinephrine on skin and muscle vessels. The last section presents changes in limb circulation caused by: Raynaud's disease—arterial gas embolism—essential hypertension—diabetes mellitus—beriberi—arteriovenous fistulas—and many others. New concepts include the role of vasoconstrictor and vasodilator nerves—factors affecting capacity and distensibility—mechanisms of fainting, reactive hyperemia, and muscle vasodilation with exercise.

By JOHN T. SHEPHERD, M.D., M.Ch., D.Sc., Consultant, Section of Physiology, Mayo Clinic; Professor of Physiology, Mayo Foundation Graduate School, University of Minnesota. 415 pages, 6⅛" x 9¼", with 179 illustrations. $12.00. *New—Published January, 1963.*

A Concise Summary of Present Knowledge on Neural Mechanisms

A New Book—SYNAPTIC TRANSMISSION—McLennan

This *New Book* offers a clear account of current advances in knowledge of transmission of neural impulses across the synapse—primarily in the mammalian central nervous system. The author reviews the three main areas of investigation: morphology of synaptic regions; electrical consequences of synaptic activities; possible chemical substances involved. In order to show qualitative similarities and the flexibility of synaptic interaction inherent in all nervous systems, Dr. McLennan discusses synapses in other sites and organisms.

Drawings and micrographs amplify the author's review of the literature and reports on his own findings. Characteristics common to all synapses are summarized, as well as those exclusive to electrical and to chemical synapses. Electrical factors examined include resting potential, presynaptic inhibition, and excitatory postsynaptic potential. Among the possible chemical transmitters discussed are found acetylcholine, gamma-aminobutyric acid, and catecholamines.

By HUGH D. MCLENNAN, Ph.D., Associate Professor of Physiology, Faculty of Medicine, The University of British Columbia, Vancouver, Canada. 134 pages, 7¼" x 10¼", illustrated. $7.00. *New—Published April, 1963.*

PUBLISHED BY W. B. SAUNDERS COMPANY

West Washington Square, Philadelphia 5, Penna.

Please send and bill me:

- ☐ Rhodin—ATLAS of ULTRASTRUCTURE $10.00
- ☐ Shepherd—PHYSIOLOGY of the CIRCULATION $12.00
- ☐ McLennan—SYNAPTIC TRANSMISSION .... $ 7.00

Name: ....

Address ....

SC 5-10-63

Use This Coupon To Order!

For the New Era in Electron Microscopy

New EMU-3G
RCA Electron Microscope

New Universal Specimen Chamber

Hot and cold stages, and additional access ports widen the range of specimen control

Ten times the working volume is provided with this new RCA electron microscope accessory as compared with conventional chambers. Hot and cold stages provide a specimen temperature range of −140°C to 1000°C, as well as any steady-state intermediate temperature. Two extra ports give ready access for other types of specimen manipulation. Eight electrical feed-throughs provide means for accurate measurements of temperature and other parameters. Since no airlocks are involved, stages and samples can be changed easily and quickly. Though designed specifically for the new EMU-3G, the Universal Chamber can be used with all EMU-3 series electron microscopes—an excellent example of RCA's design philosophy of protecting customers against instrument obsolescence.

The new EMU-3G electron microscope incorporates many improvements in design as well as all the features which have made RCA instruments world famous—ease of operation, rapid specimen scanning by means of a new inertial-drive mechanism, step focussing in known increments (up to 200,000 X), simplicity of alignment, very fast automatic valving, and many others.

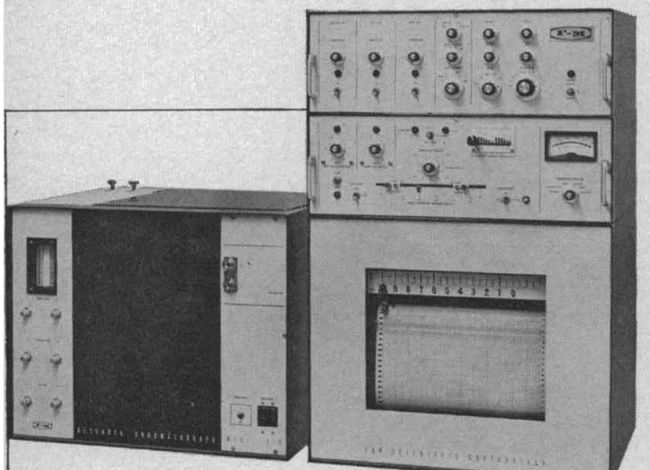
For full information, write to RCA Scientific Instruments, Dept.UB-362, Building 15-5, Camden, N. J. In Canada, write RCA VICTOR Company, Ltd., Montreal.

RCA The Most Trusted Name in Electronics

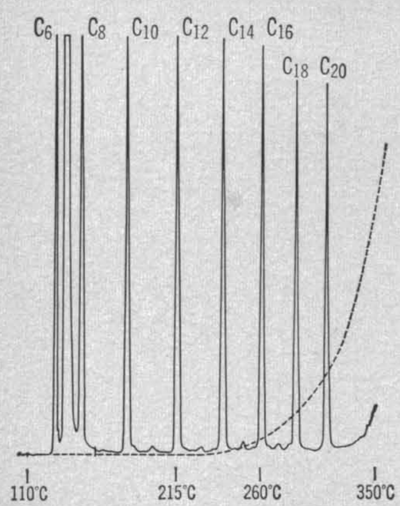
NEW F & M MODEL 810 SETS NEW LEVELS OF

versatility, accuracy and reproducibility in gas chromatography

An advanced research gas chromatograph, the F & M Model 810 incorporates the latest developments in the science of gas chromatography. Multiple detection systems, precise column compensation, automatic programmed temperature cycle and a versatile injection port design offer the analyst new levels of versatility, accuracy and reproducibility.



1. Versatility and Accuracy for All Types of Analyses—The Model 810 has dual flame ionization detectors that can be interchanged with optional electron capture and micro cross-section detectors. The flame detector is accurately sensitive to a long list of compounds including most organic and biological materials. Halogenated compounds (such as pesticides) and certain organo-metallics and polycyclic hydrocarbons are readily analyzed quantitatively by the F & M pulsed-voltage type electron capture detector. The micro cross-section device will detect any material in the carrier gas and will give a completely calculable quantitative response for precise analytical results.



■ Note the stable baseline of this dual-column-compensated chromatogram of a mixture of equal parts of normal C_6 to C_{20} paraffins produced on a Model 810 equipped with dual flame ionization detectors; dashed line represents the drifting baseline obtained during single column operation. Sensitivity of the instrument is indicated by the fact that each peak represents about 2.0 micrograms and the instrument was operated at 1/640 of full sensitivity.

2. Accuracy in High-Temperature Detection—The 810 is particularly suited to high-sensitivity high-temperature analyses, even of trace constituents in the face of column substrate bleeding (see chromatogram). With dual column compensation, accuracy is enhanced by an extremely precise flow control system and virtually perfect temperature uniformity within the oven.

3. Reproducibility in Repeated Runs—Equipped with a completely automatic programmed temperature cycle, the Model 810 permits precisely reproducible runs that combine adjustable isothermal and linear programmed periods with automatic operation from sample injection to re-equilibration at original conditions. This high degree of automation removes human errors and provides exceptional qualitative and quantitative repeatability since no manual resetting of conditions is required.

4. Versatility in Sample Injection—Because of its versatile injection port design, the Model 810 can handle a wide variety of samples. Temperature sensitive or unstable samples can be injected directly onto the column; reactive materials and those that tend to be adsorbed or catalyzed can be injected into a replaceable liner in the port; and hard-to-vaporize materials can be injected directly into the heated zone of the port.

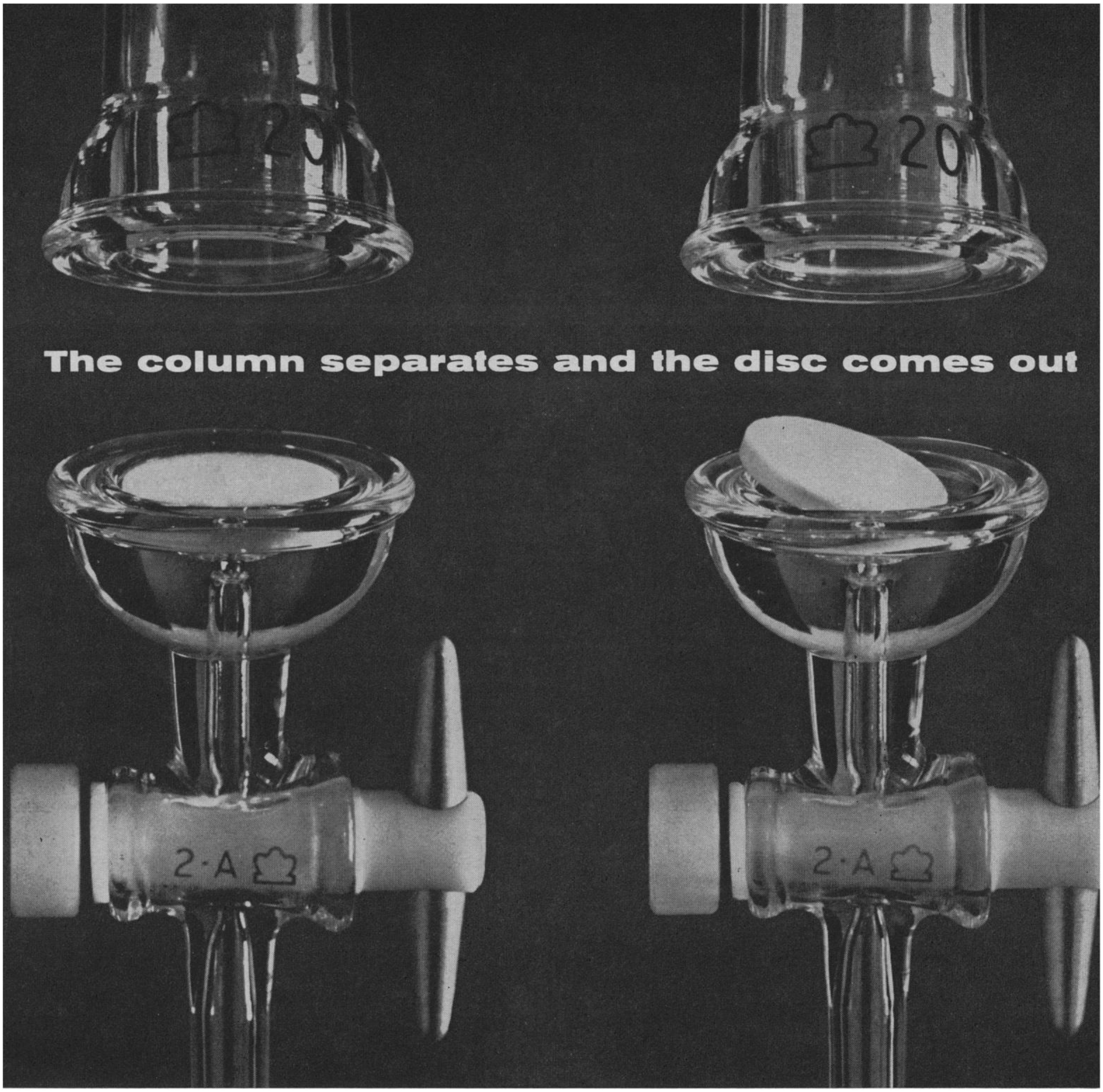
The new Model 810 incorporates many other technological improvements recently made in the fast moving field of gas chromatography. For complete details, write F & M Scientific Corporation, Route 41 and Starr Road, Avondale, Pennsylvania, 215 COlony 8-2281. *European subsidiary: F & M Scientific Europa N.V., Leidsestraat 67, Amsterdam, The Netherlands.*

F&M

F & M SCIENTIFIC CORPORATION

AVONDALE / PENNSYLVANIA

SALES OFFICES: Atlanta • Boston • Chicago • Dallas • Cleveland • Houston • Los Angeles • New York • Pittsburgh • St. Louis • Toronto • Washington



With Chromaflex, it's that simple!

So, to meet tomorrow's chromatographic needs, just add a column extender, select a new disc porosity, change the reservoir style, or the adapter type. "Tailor" basic columns to meet new needs without glass blowing.

We've tried to think of everything. Reservoir solvents run down column walls without disturbing adsorbent beds. Wetted connections are greaseless and of constant inside diameter. Below fritted discs, mixing volumes are minimal.

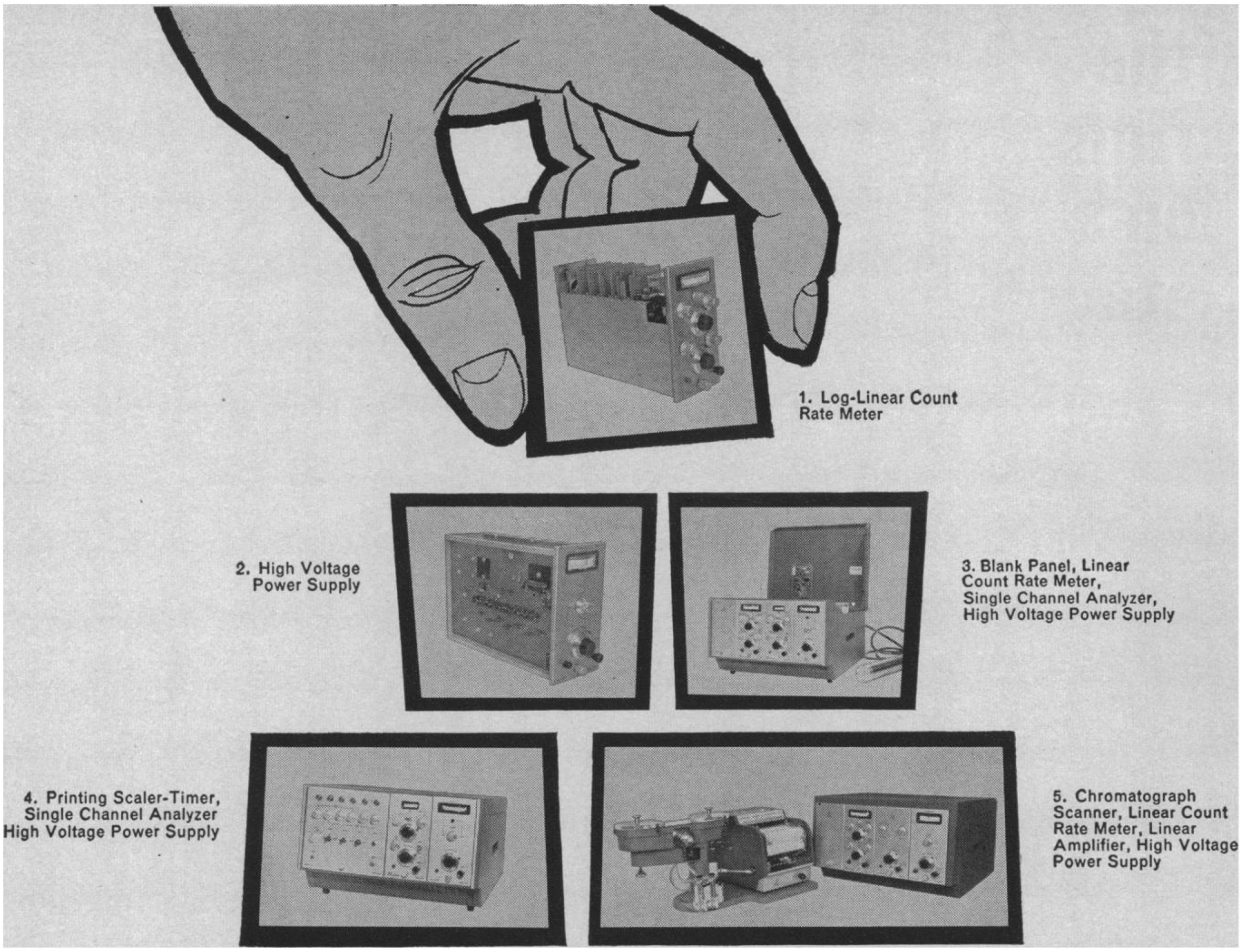
Dualap stopcocks are an extra bonus; barrels are smooth enough to use with TEFLON* plugs, yet have sufficient texture to retain lubricants for glass plugs. Varibor plugs are still another option to provide semi-needle valve control and remember settings from run to run.

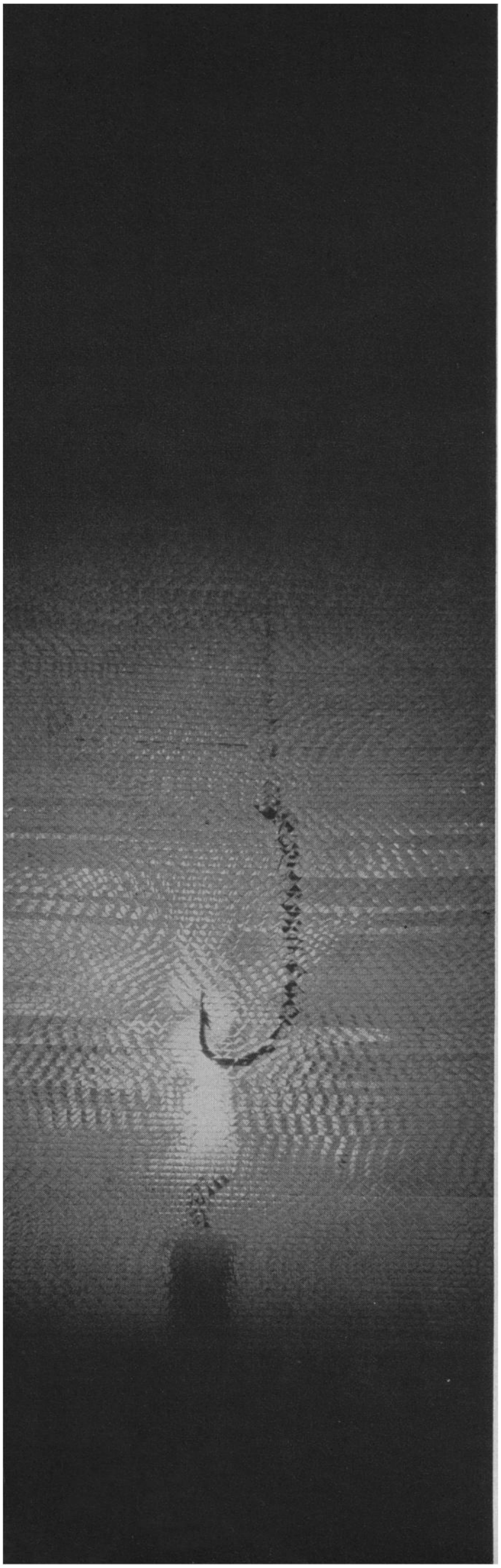
From top to bottom Chromaflex Columns are functional . . . flexible. They are now an important part of more than 11,000 standard items that make up the Kontes line of fine technical glassware.

The complete Chromaflex story is told in Bulletin CA-1. Write today for your copy.

KONTES
GLASS COMPANY
Vineland, New Jersey

*Trademark of E. I. Du Pont


1. Log-Linear Count Rate Meter
2. High Voltage Power Supply
3. Blank Panel, Linear Count Rate Meter, Single Channel Analyzer, High Voltage Power Supply
4. Printing Scaler-Timer, Single Channel Analyzer High Voltage Power Supply
5. Chromatograph Scanner, Linear Count Rate Meter, Linear Amplifier, High Voltage Power Supply



One of a series briefly describing GM's research in depth

Fishing Btu's from fluid streams

A heat exchanger can catch escaping thermal energy. For example, it more than doubles the efficiency of gas turbines by recovering exhaust heat. But predicting its performance is a subtle and often perplexing art.

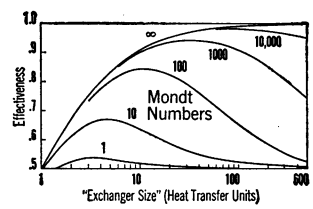
To put heat exchanger design on a more scientific basis, our thermally inclined colleagues at the Laboratories have been developing—and experimentally verifying — better ways of analyzing its behavior. One result is a new conduction parameter for the thermodynamicist's kit of tools. Dubbed the Mondt number by fellow staff members, it neatly explains why increasing the size of a heat exchanger does not necessarily improve effectiveness (see graph). The reason: longitudinal conduction losses may more than offset the expected gain in performance.

Or say you're interested in thermal distortions and stresses of metals, or in sealing the leakage of counterflowing gases. We are. Another analytical advance has enabled us to compute the transient and steady-state temperature distribution in the solid and in both fluid streams. With it most any heat exchanger can be simulated on a digital computer.

These fundamental studies are aiding the understanding of heat transfer—in theory and in engineering practice. They illustrate General Motors' constant search for a better way—through research in depth.

General Motors Research Laboratories

Warren, Michigan



The Mondt number is the ratio of convective heat transfer rate to conductive rate.

View through an experimental heat exchanger matrix.

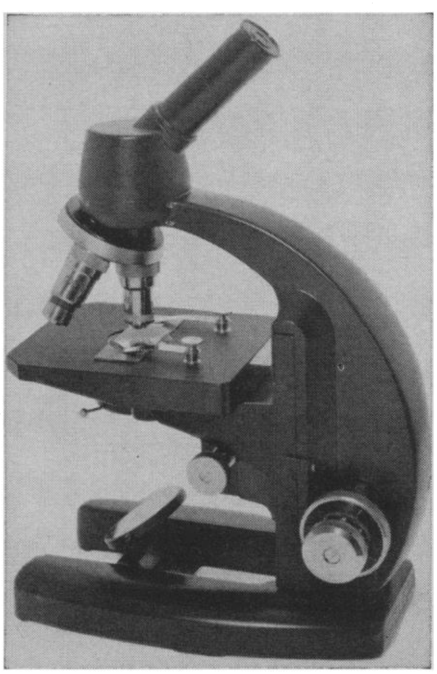
VICKERS BRIEFS

Teaching and Routine Microscopes

The New Cooke M15A Microscope

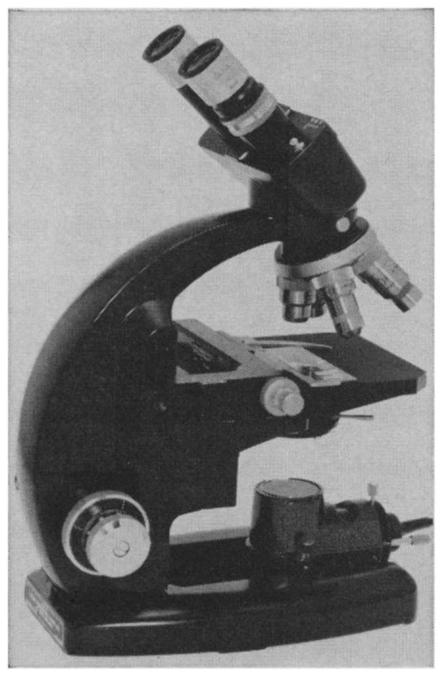
The M15 Microscope has proven itself as a robust, stable stand, fitted to meet modern standards of convenience and to stand up under many years of continuous routine use. The same stand is used for "student" models as for routine and semi-research binocular instruments. A wide selection of body tubes, stages, substages, objectives and eyepieces is available so that, commencing with a simple microscope, almost any degree of elaboration of optical capability can be achieved.

In redesign our first concern has been to produce an instrument of outstandingly superior stability. This has been achieved by fitting extra-long (5½") ball bearing focusing slides, set far apart so that they subtend an unusually wide angle at the optical axis. Thirty-two 3/16" dia. balls are used in the bearing tracks to assure smoothness of focusing, combined with a rigidity that is not approached in most so-called "research" microscope stands.



M15AR (Magnifications 100X — 400X) $266.

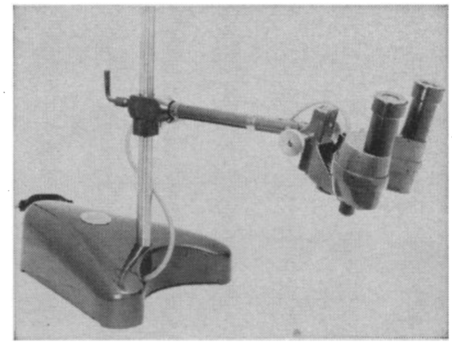
For those considering the M15 for teaching purposes we call attention to its hard wearing qualities and the built-in safeguards against accidental damage to focusing mechanism, specimen or optics. A friction clutch is fitted to the focusing motion; high power objectives are spring-mounted; it is impossible for an operator to damage the focusing mechanism, break a slide, push out an objective front lens or chip a condenser. The stand is finished in an exceedingly hard and durable epoxy black.



M15AM (Magnifications 50X — 1000X) $608.
(Including Microplan 40x objective and 10X Complan eyepieces)

An important reason for the M15's widening acceptance as a laboratory and hospital microscope is the MICROPLAN 40x flat-field objective and the COMPLAN 10X wide-and-flat-field eyepieces (with true compensating correction). The MICROPLAN gives an amazingly flat field — without any sacrifice of resolution or contrast. Moreover its design is such that it can be made comparatively inexpensively. It costs only seventeen dollars more than the standard 40X high-dry achromat — in contrast to the very high prices of the other flat-field designs available.

The Sterimag (Stereoscopic Microscope)



Sterimag (10X or 20X models) $175.

This instrument is widely used in industrial inspection work, but has also an important application as a student tool in teaching laboratories. Image quality is excellent, working distances are unusually large. Field of view diameters equal or exceed those obtained with more elaborate and more expensive stereoscopic microscopes.

Either a 10X or 20X model can be supplied; magnifications are fixed and cannot be changed. For routine observations and dissection, these magnifications are usually sufficient.

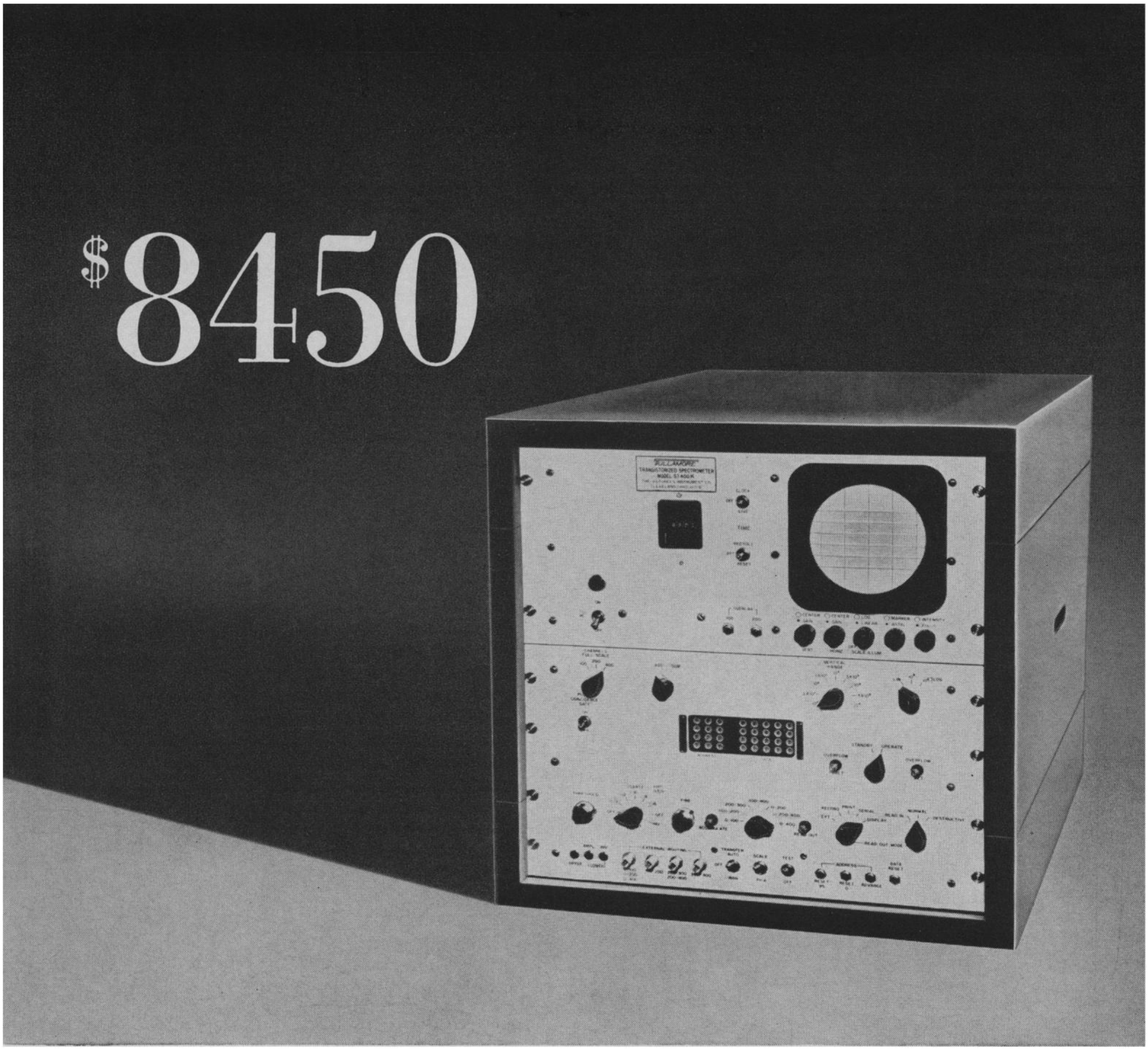
The eyepieces and objectives are locked in place and the instrument is virtually student-proof. A ruggedly constructed, universally adjustable pillar stand with heavy base increases its capabilities, as well as its suitability for student use.

A built-in light source, with focusable condensing system and adjustable mounting, gives high quality illumination conveniently and without the complications which come from use of an exterior lamp. Transformer for the lamp is mounted inside the base.

Low-priced, the Sterimag has many positive advantages for student and routine use.

Chicago Office

In order better to serve our customers in the Illinois-Indiana-Wisconsin area we have opened a sales office, located at 460 Central Avenue, Highland Park, Illinois. Telephone number is 432-3800 (Area Code 312).


$8450

of publication. I have known a professor who was not granted tenure because of lack of publication despite the fact that he was a gifted educator. I have also listened to professors speak disdainfully of educating undergraduates and profess their primary goal of attaining scientific stature through writing. It appears that too much sophistication is overpowering the virtue of humility which apparently was held in higher esteem by bygone academic generations.

The plethora of scientific material is only beginning to plague us and the present educational system has, as noted by Hubbert, constrained most of us to select some limited domain. We are succeeding in producing a large population that is able to read but unable to distinguish worthwhile reading. The end results are confusion, stifling of creative thought, and ironically, suppression of education. From the utilitarian viewpoint, we have succeeded in concocting a truly wondrous paper mill.

KEITH WESTHUSING
Texas Instruments Incorporated,
P. O. Box 35084, Dallas, Texas

Anyone familiar with the government support of scientific education and research in American colleges and universities can only be astonished at the gross errors and misinterpretations of this situation contained in the article by M. King Hubbert. The errors and the misinterpretations are especially surprising in view of Hubbert's own admonition in the early part of his article that "the acceptance of any conclusion, valid or otherwise, by an individual who is not familiar with the observational data on which it is based and the logic by which it is derived is a negation of science . . ."

The source of most of Hubbert's errors is contained in his Table 1 entitled "Federal contract support of representative endowed universities, 1958–59". The figures in every line of that table, except one, are wrong—many of them grossly wrong—and the entire table is misinterpreted within the body of the article.

The figures given in his table for the "Total income" and the "Income from contracts" of a selected group of private universities are obtained from the volume *American Universities and Colleges* (American Council on Education, Washington, D.C., ed. 8, 1960). This is an excellent volume for general information about the organization, admission requirements, curricular offerings, enrollments, and fees of the colleges and universities of America. It is not, however, a suitable source for financial data from which important conclusions are to be drawn. The figures reproduced are sketchy at best; they follow no uniform pattern and do not pretend to be a complete statement of the institution's financial situation. The financial statement is normally contained in a short paragraph of five to six lines, giving only such figures as the college itself deems pertinent to this particular volume. The least that could have been done by an author pretending to be "familiar with the observational data" and wishing to draw sweeping conclusions therefrom would be to consult the official annual financial reports of the universities concerned. Figures drawn from these reports are shown in Table 1.

The important point is to note the contrast between the figures given in the last two columns of this table. For example, Hubbert concludes that Caltech receives 88 percent of its "operating income" from government sources. The true figure is 38 percent.

The differences between the two sets of figures for the first three institutions result from the fact that Hubbert's table includes in "Total income" and "Income from contracts" the costs of oper-

Table 1. Financial data for selected private universities, 1958–59. Figures for Rice University are omitted since its report was not in our files. Hubbert's figures are given in parentheses for comparison.

University	Total income for campus operations ($)		U.S. Government grants and contracts ($)		(%)	
Caltech	11,564,530	(60,675,342)	4,343,605	(53,600,442)	38	(88)
M.I.T.	49,378,129	(101,386,000)	28,444,832	(67,276,000)	58	(66)
Chicago	51,073,083	(103,771,777)	10,787,065	(61,531,262)	21	(59)
Princeton	31,563,460	(31,563,000)	17,511,579	(17,723,000)	55	(56)
Harvard	67,292,489	(67,292,489)	13,053,342	(16,307,946)	19	(24)
Stanford	33,521,000	(34,663,961)	11,180,158	(8,312,208)	33	(24)
Yale	32,978,787	(36,985,998)	5,207,431*	(0)	16	(0)

* Includes "grants" only.

ating large off-campus facilities (the Jet Propulsion Laboratory, the Lincoln Laboratory, and the Argonne National Laboratory, respectively) which have only a remote relation to the campus programs and do not constitute "support" for such programs. The funds received and expended for these large national laboratories are removed from the amounts I have set down.

As an example of another error, the M.I.T. entry in *American Universities and Colleges* includes under "contract research and services" a figure which encompasses both government and nongovernment research support. The nongovernment, mostly industrial, support amounts to $3,144,000.

Finally, the astonishing entry in Hubbert's table indicating that Yale receives no government support is a conclusion he draws from the fact that the Yale entry in *AUC* simply fails to mention the university's government contract and grant figure. Yale's annual report, however, for 1958–59 shows $5,207,431 in "gifts" (that is, grants) from federal agencies. The report does not mention "contracts," though it is known that such contracts do exist in addition. Anyone familiar with the scope and high distinction of the Yale program of research and graduate education knows perfectly well that a substantial portion of it is of high enough quality to command support from government sources—as are such programs at every major university, both public and private, in the country. A university would be doing its faculty a gross injustice if it declined to accept government funds to support their research.

Hubbert comments at some length on his incorrect figures. He says, in the first place, that "universities have entered the field of big business by becoming the operators, under government contracts, of several very large industrial-research laboratories." Many individuals join with Hubbert in their doubts as to whether the management of such national laboratories is a proper university function. Universities engaged in such operations are doing it because they have been persuaded it is in the national interest to do so. Whatever the merits of this argument, however, it is incorrect to say that the universities are in the field of "big business" or that these are "industrial-research laboratories." These are all scientific research and development laboratories doing both basic and applied research in some fields of important national interest—for example, electronic systems for national defense, nuclear energy, space research. For a variety of reasons (too lengthy to discuss here) such laboratories cannot be well operated either by commercial corporations or by the government itself. The universities have filled an important gap.

In any case, these laboratories are off-campus establishments; no faculty member is required to be involved in them and very few, often none, are so involved. They exert no necessary influence on the academic program of the institution unless members of the academic staff find it useful to employ in the teaching program some of the exceptional talents which these laboratories often attract. To state that "the effect upon the universities of this type of diversion has been devastating" is to make an assertion quite contrary to the truth, even though certain "headaches" have often been involved.

As one proceeds from the off-campus establishments to the on-campus support of research and education by the government, one finds Hubbert still drawing unjustified conclusions. The universities which he mentions can, by no stretch of the imagination, come under his description of "essentially war-research laboratories employing large staffs of nonacademic personnel" or even as "large centers of applied research." The funds provided to these institutions by such agencies as the U.S. Public Health Service, the National Science Foundation, the Office of Naval Research, and the Atomic Energy Commission, are almost entirely devoted to basic research. Caltech, for example, has not a single classified military research project in progress on the campus, and most of the other institutions have adopted essentially the same policy. On the contrary, vastly important and exciting basic research projects are being supported in fundamental nuclear physics, in seismology, geophysics, and astronomy, in genetics, biochemistry, and plant physiology, in the various areas of chemistry—programs of the "pure research" type which universities have long cherished and which thrive primarily and to best advantage in the university atmosphere. That government agencies have seen fit to support such basic research is a tribute to the wisdom and farsightedness of these agencies. It is surely obvious that the extensive and high-quality programs of

(Continued on page 716)

10 May 1963, Volume 140, Number 3567

SCIENCE

Some Needed Reforms

The scientific community has been curiously flabby in reacting to evolutionary trends which challenge the vitality of science. Modes of communication which were adequate 50 years ago have not been altered, in spite of the vast increase in numbers of scientists. The annual round of spring meetings reminds us that these great national gatherings are losing their effectiveness as media for scientific communication. At the recent Atlantic City meeting of the Federation of American Societies for Experimental Biology there were 3138 papers presented and as many as 34 simultaneous sessions. There are comparable situations in other areas of science. Planning one's program of attendance on such occasions can be frustrating, for one notes numerous papers of interest but discovers that many of the attractive presentations are being given concurrently. All too often the harassed scientist cannot make up his mind and foregoes all of the choices.

The proliferation of scientific literature has comparable negative aspects. Faced with a flood of material, no man can do more than sample the publications appearing in his immediate field and in the relevant neighboring disciplines. Here, too, each scientist has a breaking point at which he gives up on the effort to follow new developments.

Instead of tackling these communication problems we have ignored them, and we have retrogressed, for we have allowed our standards to deteriorate. We permit and even encourage scientists to deliver virtually the same lecture at meeting after meeting. It is annoying and wasteful to make a special effort to hear a paper only to find that the speaker is repeating, almost verbatim, material he has presented earlier.

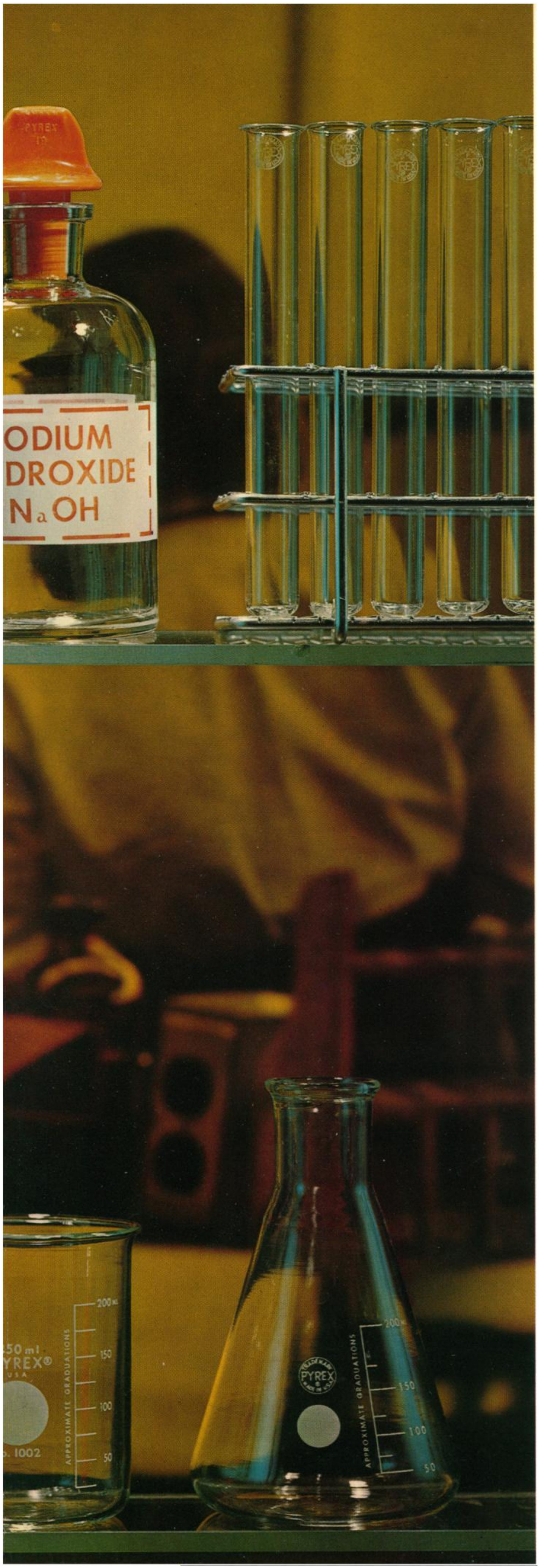
This tendency toward repeated presentation has also affected the literature. I have noted instances in which basically the same article has appeared more than five times. This repetition is compounded in the structure of the usual scientific paper. A scientist will obtain one new result, the essence of which can be stated in a paragraph and a table. In the standard minuet, he expands the paragraph to ten pages as he describes his new fact in the abstract and presents it again in introduction, discussion, conclusion, and summary. When such a paper is published repeatedly, the author can easily succeed in restating his basic paragraph several dozen times.

The present communication problems could be greatly ameliorated if the scientific community would adopt a tougher standard of what is acceptable. If editorial policies were tightened, the amount of material appearing could be cut to a quarter of the present volume with no essential loss. This tougher approach might well take the form of a stern attitude toward repeated publication of the same material. It would require some reforms in the conventional structure of papers, so that key ideas would not be repeated so many times. It might be necessary to suppress the tendency toward premature publication of fragmentary results.

A parallel toughening in our approach to scientific meetings also would be useful, and the number of sessions could be cut drastically without much loss.

Such needed reforms would have obvious beneficial consequences. To implement them requires courage on the part of editors and officers of societies and generous cooperation and understanding on the part of scientists-at-large.—P.H.A.


NITRIC
ACID CON.
HNO_3
AMMONIUM
HYDROXIDE
NH_4OH
PYREX



Remember when chemistry was new to you?

Look over this PYREX® brand labware and you'll see there have been some changes since you were in high school.

The students haven't changed, though. They're always our toughest customers. Remember that glassware-testing combination of enthusiasm and awkwardness?

The trademark hasn't changed, either. Today's teachers know, as yours did, that PYREX brand labware gives that extra margin of durability and safety.

Doesn't it follow that the ware that stands up to student use will give longer service and greater value in *your* lab? You might even find some real bargains for your lab among the items shown here.

You'll also discover real bargains when you standardize on PYREX brand labware. It lasts longer, and quantity discounts can save you up to 28 cents on every dollar you spend. Laboratory Glassware Dept., Corning Glass Works, 7105 Crystal St., Corning, N.Y.

COLOR-CODED REAGENT BOTTLES—with non-sticking polyethylene stoppers, these cost less than conventional bottles with glass stoppers. They're attractive, and M.C.A. colors make them more functional, too. No. 1552.

WEST CONDENSER—the same old war horse you probably used in your high school lab. Sturdy. Fast condensing action. No. 2700.

PINCHCOCK BURET—real economy where absolute precision isn't required. This costs 40% less than a ground stopcock model. No. 2118 buret and tip.

TEST TUBES—a great change here. Machine-made uniformity, stronger rims—much stronger than before. No. 9800.

BOILING FLASK—a new heavy rim, neck and shoulder on our standard heavy-wall flask gives you the strength, the stability and heat resistance you need, all at a school-economy price. No. 4060.

GRADUATED CYLINDER—here's one to consider. Detachable plastic hex base. Replacement cylinders are available. Both cost considerably less than you would pay for conventional one-piece units. No. 3075.

HEAVY-RIMMED GRADUATED BEAKERS AND ERLENMEYERS—we've put approximate graduations in white enamel on these sturdy items to make them more versatile in any lab. Beaker No. 1002. Erlenmeyer No. 4982.

CORNING

THE MAKERS OF PYREX® BRAND WARE

Index of Books Reviewed in Science

6 April 1962 through 29 March 1963

Archeology and Anthropology

Astronomy

Biochemistry and Microbiology

Biological Sciences

ment, C. H. Waddington (Columbia Univ. Press), 15 Feb. 1963, 580

On Growth and Form, Sir D. W. Thompson (Cambridge Univ. Press), 6 Apr. 1962, 38

Physical Techniques in Biological Research, W. L. Nastuck, Ed. (Academic Press), 11 May 1962, 521

Principles of Biology, N. D. Buffaloe (Prentice-Hall), 5 Oct. 1962, 25

Problemy Radiacionnoi Genetiki, N. P. Dubinin (Gosatomizdat, Moscow), 27 July 1962, 276

Radiobiology, P. L. T. Ilbery, Ed. (Butterworth), 20 July 1962, 219

Regeneration, D. Rudnick, Ed. (Ronald), 18 Jan. 1963, 206

Spores, O. Halvorson, Ed. (Burgess), 11 May 1962, 527

A Synthesis of Evolutionary Theory, H. H. Ross (Prentice-Hall), 11 May 1962, 528

This Is Life, W. H. Johnson and W. C. Steere, Eds. (Holt, Rinehart and Winston), 23 Nov. 1962, 885

Tritium in the Physical and Biological Sciences, (International Atomic Energy Agency, Vienna), 21 Sept. 1962, 971

Ultrastructure in Biological Systems, A. J. Dalton and F. Haguenau, Eds. (Academic Press), 14 Sept. 1962, 849

Wildlife's Ten-Year Cycle, L. B. Keith (Univ. of Wisconsin Press), 22 Mar. 1963, 1196

A World Monograph of the Genus Pleospora and Its Segregates, L. E. Wehmeyer (Univ. of Michigan Press), 11 May 1962, 524

Botanical Sciences

Atlas of Plant Morphology, E. L. Fish and W. F. Millington (Burgess), 11 May 1962, 527

Atlas of the British Flora, F. H. Perring and S. M. Walters, Eds. (Nelson), 26 Oct. 1962, 506

Contemporary Botanical Thought, A. M. MacLeod and L. S. Cobley, Eds. (Quadrangle Books), 11 May 1962, 525

A Flora of the Alaskan Arctic Slope, I. L. Wiggins and J. H. Thomas (Univ. of Toronto Press), 11 May 1962, 529

Flora of the British Isles, A. R. Clapham, T. G. Tutin, and E. F. Warburg (Cambridge Univ. Press), 26 Oct. 1962, 506

Fungi in Oceans and Estuaries, T. W. Johnson, Jr., and F. K. Sparrow, Jr. (Cramer, Weinheim, Germany), 31 Aug. 1962, 662

Gnetum, P. Maheshwari and V. Vasil (Council of Scientific and Industrial Research, New Delhi), 8 Feb. 1963, 481

A Handbook to Plants in Victoria, J. H. Willis (Melbourne Univ. Press; Cambridge Univ. Press), 8 Mar. 1963, 897

Mineral Salts Absorption in Plants, J. F. Sutcliffe (Pergamon), 24 Aug. 1962, 596

A Monograph of the World Species of Hypoxylon, J. H. Miller (Univ. of Georgia Press), 11 May 1962, 523

Morphology and Evolution of Fossil Plants, T. Delevoryas (Holt, Rinehart, and Winston), 14 Dec. 1962, 1254

The Morphology of Pteridophytes, K.

R. Sporne (Hutchinson; Hillary House), 8 Mar. 1963, 899
Nitrogen Metabolism in Plants, H. S. McKee (Oxford Univ. Press), 29 Mar. 1963, 1280
Physiology and Biochemistry of Algae, R. A. Lewin, Ed. (Academic Press), 22 Mar. 1963, 1193
The Physiology of Flowering, W. S. Hillman (Holt, Rinehart, and Winston), 5 Oct. 1962, 24
Plant Life of Palestine, Israel, and Jordan, M. Zohary (Ronald), 11 May 1962, 523
Plant Taxonomy, L. Benson (Ronald), 9 Nov. 1962, 672
Proceedings of the Symposium on Algology, P. Kachroo, Ed. (Indian Council of Agricultural Research, New Delhi), 13 July 1962, 122
Summer School of Botany, 1960 (Darjeeling), P. Maheshwari, B. M. Johri, and I. K. Vasil, Eds. (Ministry of Scientific Research and Cultural Affairs, New Delhi), 18 Jan. 1963, 207
The Wild Species of Gossypium and Their Evolutionary History, J. H. Saunders (Oxford Univ. Press), 25 May 1962, 708

Chemistry

Absorption Spectra and Chemical Bonding in Complexes, C. K. Jørgensen (Pergamon), 1 Feb. 1963, 401
Absorption Spectra in the Ultraviolet and Visible Region, L. Lang, Ed. (Academic Press), 11 May 1962, 519
Absorption Spectroscopy, R. P. Bauman (Wiley), 12 Oct. 1962, 129
Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson (Interscience), 23 Nov. 1962, 887
Atomic-Absorption Spectrophotometry, W. T. Elwell and J. A. F. Gidley (Macmillan), 14 Sept. 1962, 847
Calculations in Physical Chemistry, B. W. V. Hawes and N. H. Davies (Wiley), 22 Feb. 1963, 749
Catalysis by Metals, G. C. Bond (Academic Press), 12 Oct. 1962, 129
Chemistry for the Modern World, G. Porter (Barnes and Noble), 18 Jan. 1963, 205
The Chemistry of Flavonoid Compounds, T. A. Geissman, Ed. (Pergamon), 1 Feb. 1963, 400
Collection of Problems in Physical Chemistry, J. Bares, C. Cerny, V. Fried, and J. Pick (Pergamon; Addison-Wesley), 18 Jan. 1963, 203
Comprehensive Analytical Chemistry, C. L. Wilson and D. W. Wilson, Eds. (Elsevier), 11 May 1962, 517
Crystallization, Theory and Practice, A. van Hook (Reinhold), 11 May 1962, 518
The Determination of Stability Constants and Other Equilibrium Constants in Solution, F. J. C. Rossotti and H. Rossotti (McGraw-Hill), 18 May 1962, 643
Diffuse X-Ray Reflections from Crystals, W. A. Wooster (Oxford Univ. Press), 15 Mar. 1963, 1043
Direct Methods in Crystallography, M. M. Woolfson (Oxford Univ. Press), 20 Apr. 1962, 252
Direct Observation of Imperfections in

Crystals, J. B. Newkirk and J. H. Wernick, Eds. [Interscience (Wiley)], 21 Sept. 1962, 927

Dynamic Physical Chemistry, J. Rose (Wiley), 14 Dec. 1962, 1255

Electrochemistry of Fused Salts, I. K. Delimarskii and B. F. Markov (Sigma Press), 11 May 1962, 518

Elementary Introduction to Molecular Spectra, B. Bak [North-Holland; Interscience (Wiley)], 12 Oct. 1962, 128

Elementary Organic Chemistry, E. Campaigne (Prentice-Hall), 25 May 1962, 707

Elements of Chemistry, R. B. Brownlee, R. W. Fuller, W. J. Hancock, M. D. Sohon, and J. E. Whitsit (Allyn and Bacon), 6 July 1962, 32

Fundamental Chemistry, D. H. Andrews and R. J. Kokes (Wiley), 26 Oct. 1962, 506

Gas Chromatography, N. Brenner, J. E. Callen, and M. D. Weiss, Eds. (Academic Press), 15 Feb. 1963, 579

Gas Chromatography, J. H. Knox (Methuen; Wiley), 15 Feb. 1963, 579

Gas Chromatography, A. B. Littlewood (Academic Press), 15 Feb. 1963, 579

Gas Chromatography, H. Purnell (Wiley), 15 Feb. 1963, 579

Gas Chromatography Abstracts, 1961, C. E. H. Knapman and C. G. Scott, Eds. (Butterworth), 15 Feb. 1963, 579

Gas-Liquid Chromatography, S. Dal Nogare and R. S. Juvet, Jr. [Interscience (Wiley)], 15 Feb. 1963, 579

Heavy Water Exponential Experiments Using ThO_2 and UO_2, J. A. Thie (Pergamon), 11 May 1962, 517

Inorganic Reactions and Structure, E. S. Gould (Holt, Rinehart, and Winston), 10 Aug. 1962, 417

Introduction to Advanced Inorganic Chemistry, P. J. Durrant and B. Durrant (Wiley), 9 Nov. 1962, 675

Introduction to Chemical Instrumentation, E. J. Bair (McGraw-Hill), 11 May 1962, 517

An Introduction to Infrared Spectroscopy, W. Brügel (Methuen; Wiley), 29 Mar. 1963, 1280

Introduction to Ligand Field Theory, C. J. Ballhausen (McGraw-Hill), 25 Jan. 1963, 326

Introduction to Molecular Spectroscopy, G. M. Barrow (McGraw-Hill), 12 Oct. 1962, 128

An Introduction to the Chemistry of Complex Compounds, A. A. Grinberg (Pergamon), 8 Feb. 1963, 480

Introduction to Theoretical Physical Chemistry, S. Golden (Addison-Wesley), 14 Dec. 1962, 1255

Ion Exchange, F. G. Helfferich (McGraw-Hill), 12 Oct. 1962, 133

Ions in Hydrocarbons, A. Gemant (Interscience), 15 Mar. 1963, 1044

Mellor's Comprehensive Treatise on Inorganic and Theoretical Chemistry, Supplement (Wiley), 11 May 1962, 518

Minerals in the Infrared: A Critical Bibliography, R. J. P. Lyon (Stanford Research Institute), 8 Mar. 1963, 900

Molecular Orbital Theory for Organic Chemists, A. Streitwieser, Jr. (Wiley), 13 Apr. 1962, 143

Molecular Structure and Properties of Liquid Crystals, G. W. Gray (Academic Press), 18 Jan. 1963, 206

The Nature of Atoms and Molecules, E. C. Scott and F. A. Kanda (Harper), 26 Oct. 1962, 506

Orbitals in Atoms and Molecules, C. K. Jørgensen (Academic Press), 22 Feb. 1963, 747

Organic Chemistry Today, F. W. Gibbs (Penguin Books), 25 May 1962, 707

Physical Chemistry, E. Hutchinson (Saunders), 24 Aug. 1962, 596

Physical Organic Chemistry, J. Hine (McGraw-Hill), 30 Nov. 1962, 967

Plasticity of Crystals, K. V. Klassen-Neklyudova, Ed. (Consultants Bureau), 28 Dec. 1962, 1390

Progress in Infrared Spectroscopy, H. A. Szymanski, Ed. (Plenum Press), 29 Mar. 1963, 1280

The Pyrimidines, D. J. Brown [Interscience (Wiley)], 4 Jan. 1963, 29

Rare Earth Research, J. F. Nachman and C. E. Lundin, Eds. (Gordon and Breach), 11 Jan. 1963, 102

Retardation of Evaporation by Monolayers: Transport Processes, V. K. La Mer, Ed. (Academic Press), 11 May 1962, 514

Standard Methods of Chemical Analysis, N. Howell Furman, Ed. (Van Nostrand), 13 July 1962, 121

Stereochemistry of Carbon Compounds, E. L. Eliel (McGraw-Hill), 28 Sept. 1962, 1046

Structural Principles in Inorganic Compounds, W. E. Addison (Wiley), 31 Aug. 1962, 663

Structure and Properties of Organic Compounds, C. R. Noller (Saunders), 3 Aug. 1962, 334

Teaching Chemistry with Models, R. T. Sanderson (Van Nostrand), 11 Jan. 1963, 100

Theoretical Inorganic Chemistry, M. C. Day and J. Selbin (Reinhold), 9 Nov. 1962, 675

Theory and Applications of Ultraviolet Spectroscopy, H. H. Jaffe and M. Orchin (Wiley), 29 Mar. 1963, 1276

The Third Law of Thermodynamics, J. Wilks (Oxford Univ. Press), 20 Apr. 1962, 251

Dictionaries

Chemical Dictionary, J. Fouchier and F. Billet (Netherlands Univ. Press), 11 May 1962, 520

The Condensed Chemical Dictionary, A. Rose and E. Rose (Reinhold), 17 Aug. 1962, 523

Dictionary of Commercial Chemicals, F. Snell and C. Snell (Van Nostrand), 17 Aug. 1962, 523

Dictionary of Ecology, H. Hanson (Philosophical Library), 21 Dec. 1962, 1326

Dictionary of Geological Terms (Doubleday), 17 Aug. 1962, 522

A Dictionary of Geology, J. Challinor (Univ. of Wales Press and Oxford Univ. Press), 17 Aug. 1962, 522

The Encyclopaedic Dictionary of Physics. vols. 1–3, J. Thewlis, Ed. (Pergamon), 8 June 1962, 867

Encyclopedia of Electronics, C. Susskind, Ed. (Reinhold), 21 Dec. 1962, 1323.

International Dictionary of Drugs Used in Neurology and Psychiatry, C. M. Poser and V. Osbourn (Thomas), 15 Feb. 1963, 583

McGraw-Hill Encyclopedia of Russia and the Soviet Union, M. T. Florinsky, Ed. (McGraw-Hill), 11 May 1962, 507

A New Dictionary of Chemistry, L. M. Miall, Ed. (Interscience), 17 Aug. 1962, 523

Russian-English Chemical Dictionary, E. A. Carpovich and V. A. Carpovich (Technical Dictionaries), 11 May 1962, 515

Slownik Lekarski: Angielsko-Polski i Polsko-Angielski, S. Jedraszko (Polish State Medical Publishers), 19 Oct. 1962, 424

Earth Sciences

Applied Geophysics, USSR, N. Rast, Ed. (Pergamon), 16 Nov. 1962, 804

Atoll Environment and Ecology, H. J. Wiens (Yale Univ. Press), 12 Oct. 1962, 133

Basic Concepts of Physical Geology, E. W. Spencer (Crowell), 22 Mar. 1963, 1194

Beryllium, A. A. Beus (Freeman), 4 Jan. 1963, 30

British Mesozoic Fossils, C. P. Costell, L. R. Cox, and H. M. Murwood [British Museum (Natural History)], 11 Jan. 1963, 104

Continental Drift, S. K. Runcorn, Ed. (Academic Press), 25 Jan. 1963, 323

L'Evolution de la Lithosphère, vol. 3, H. Termier and G. Termier (Masson), 11 May 1962, 520

Fundamentals of Mid-Tertiary Stratigraphical Correlation, F. E. Eames, F. T. Banner, W. H. Blow, and W. J. Clarke (Cambridge Univ. Press), 6 July 1962, 31

Geographical Conversion Tables, D. H. K. Amiran and A. P. Schick, Eds. (Aschmann and Scheller), 11 May 1962, 516

A Geography of Manufacturing, E. W. Miller, Ed. (Prentice-Hall), 19 Oct. 1962, 422

Geologie des Gites Minéraux, E. Raguin (Masson), 2 Nov. 1962, 588

Geology and Earth Sciences Sourcebook for Elementary and Secondary Schools, R. L. Heller, Ed. (Holt, Rinehart and Winston), 8 Mar. 1963, 900

The Geology of Queensland, D. Hill and A. K. Denmead, Eds. (Melbourne Univ. Press), 30 Nov. 1962, 965

Great Britain: Geographical Essays, J. B. Mitchell (Cambridge Univ. Press), 21 Dec. 1962, 1322

Groundwater and Seepage, M. E. Harr (McGraw-Hill), 18 Jan. 1963, 205

Introduction to College Geology, C. D. Holmes (Macmillan), 11 May 1962, 516

Introduction to Physical Geology, C. R. Longwell and R. F. Flint (Wiley), 26 Oct. 1962, 505

An Introduction to Physical Oceanography, W. S. Von Arx (Addison-Wesley), 11 May 1962, 515

Limestone-Building Algae and Algal Limestones, J. H. Johnson (Colorado School of Mines), 22 Feb. 1963, 747

The Morphology of the Earth, L. C. King (Hafner), 16 Nov. 1962, 806

Norway North of 65, O. Vorren, Ed. (Oslo Univ. Press; Allen and Unwin), 11 May 1962, 512

On the Morphology and Classification of the Brachiopod Suborder Chonetoidea, H. M. Muir-Wood [British Museum (Natural History)], 7 Sept. 1962, 744

Petrology, W. T. Huang (McGraw-Hill), 14 Dec. 1962, 1253

Problèmes Actuels de Paléontologie (Éditions du Centre National de la Recherche Scientifique, Paris), 15 Mar. 1963, 1044

The Rock-hunter's Range Guide, J. E. Ransom (Harper), 8 June 1962, 869

Sedimentary Petrography, H. B. Milner (Allen and Unwin; Macmillan), 18 Jan. 1963, 204

Soviet Potentials, G. B. Cressey (Syracuse Univ. Press), 21 Dec. 1962, 1322

Statistical Geography, O. D. Duncan, R. P. Cuzzort, and B. Duncan (Free Press), 11 May 1962, 510

Structural Geology of North America, A. J. Eardley (Harper and Row), 29 Mar. 1963, 1277

Study of the Earth: Readings in Geological Science, J. F. White (Prentice-Hall), 8 Mar. 1963, 900

The System of Mineralogy of James Dwight Dana and Edward Salisbury Dana, C. Frondel (Wiley), 1 Mar. 1963, 821

Theory of Ground Water Movement, P. Ya. Polubarinova-Kochina (Princeton Univ. Press), 1 Mar. 1963, 820

The Value of Water in Alternative Uses, N. Wollman, R. L. Edgel, M. E. Farris, H. R. Stucky, and A. J. Thompson (Univ. of New Mexico Press), 14 Dec. 1962, 1253

Volcanoes, F. M. Bullard (Univ. of Texas Press), 21 Sept. 1962, 970

Volcanoes and Their Activity, A. Rittmann (Wiley), 21 Sept. 1962, 970

X-Ray Powder Data for Ore Minerals, L. G. Berry and R. M. Thompson (Geological Society of America), 27 Apr. 1962, 310

Economics and Political Science

An Alternative to War or Surrender, C. Osgood (Univ. of Illinois), 15 Mar. 1963, 1040

American Scientists and Nuclear Weapons Policy, R. Gilpin (Princeton Univ. Press), 15 June 1962, 974

Conflict and Defense, General Theory, K. Boulding (Harper), 28 Dec. 1962, 1385

Economic Development and Social Changes in South India, T. S. Epstein (Univ. of Manchester Press), 23 Nov. 1962, 885

Kill and Overkill: The Strategy of Annihilation, R. Lapp (Basic Books), 15 Mar. 1963, 1040

Megalopolis, J. Gottmann (Twentieth Century Fund), 7 Dec. 1962, 1089

Modern Technology and Civilization, C. R. Walker (McGraw-Hill), 12 Oct. 1962, 132

The New American Political Economy, M. E. Dimock (Harper), 11 May 1962, 509

Of Time, Work, and Leisure, S. de Grazia (Twentieth Century Fund), 5 Oct. 1962, 23

On the Theory of Social Change: How Economic Growth Begins, E. E. Hagen (Dorsey Press), 26 Oct. 1962, 502

Politics, Personality, and Nation Building, L. W. Pye (Yale Univ. Press), 22 June 1962, 1045

Preventing World War III, Q. Wright,

W. M. Evans, and M. Deutsch, Eds. (Simon and Schuster), 14 Dec. 1962, 1256

The Sino-Soviet Conflict, 1956–1961, D. S. Zagoria (Princeton Univ. Press), 18 May 1962, 642

Southeast Asia Today and Tomorrow, R. Butwell (Praeger), 11 May 1962, 511

Toward a Reasonable Society, C. E. Ayres (Univ. of Texas Press), 11 May 1962, 509

Trends in Natural Resource Commodities, N. Potter and F. T. Christy, Jr. (Johns Hopkins Press), 2 Nov. 1962, 587

The Underprivileged Nations, P. Moussa (Sidgwick and Jackson), 26 Oct. 1962, 504

General

The Academic President—Educator or Caretaker?, H. W. Dodds (McGraw-Hill), 10 Aug. 1962, 416

After the Seventh Day, R. Calder (Simon and Schuster), 20 Apr. 1962, 250

Barth's Travels in Nigeria, A. H. M. Kirk-Greene (Oxford Univ. Press), 6 July 1962, 31

The Biology of Art, D. Morris (Methuen), 22 June 1962, 1047

The Economics of Education, J. Vaizey (Free Press), 21 Dec. 1962, 1324

The Effects of Federal Programs on Higher Education, H. Orlans (Brookings Institution), 2 Nov. 1962, 581

The Federal Interest in Higher Education, H. D. Babbidge, Jr., and R. M. Rosenzweig (McGraw-Hill), 2 Nov. 1962, 581

A Field Guide to Western Bird Songs (Houghton-Mifflin), 11 Jan. 1963, 104

A Field Guide to Western Birds, R. T. Peterson (Houghton-Mifflin), 11 Jan. 1963, 104

A General Pattern for American Public Higher Education, T. R. McConnell (McGraw-Hill), 7 Sept. 1962, 743

Human Values and Science, Art, and Mathematics, L. R. Lieber (Norton), 11 May 1962, 503

Jean-Bernard Bossu's Travels in the Interior of North America, 1751–1762, S. Feiler, Ed. (Univ. of Oklahoma Press), 8 Feb. 1963, 478

The Journals of Captain James Cook on His Voyages of Discovery, J. C. Beaglehole, Ed. (Cambridge Univ. Press), 11 May 1962, 507

Journey Through the Rocky Mountains and the Humboldt Mountains to the Pacific Ocean, J. H. Schiel (Univ. of Oklahoma Press), 8 Feb. 1963, 478

Letters of the Lewis and Clark Expedition, D. Jackson, Ed. (Univ. of Illinois Press), 8 Feb. 1963, 478

Meeresprodukte, F. Pax (Borntraeger), 18 Jan. 1963, 204

Music from Mathematics (record), J. R. Pierce, M. V. Mathews, D. Lewin, J. Tenny, S. D. Speeth, and N. Guttman (Decca Records), 4 Jan. 1963, 28

Oceanographic Vessels of the World, L. Capurro, A. Bargeski, and W. Myers (U.S. Hydrographic Office), 1 Mar. 1963, 823

On Knowing, J. S. Bruner (Harvard Univ. Press), 25 Jan. 1963, 323

Physical Sciences: Some Recent Advances in France and the United States, H. P. Kallmann, S. A. Korff, and S. G.

Roth, Eds. (New York Univ. Press), 29 Mar. 1963, 1279
Scientific Books, Libraries, and Collectors, J. L. Thornton and R. I. J. Tully (Library Assoc.), 8 Mar. 1963, 897
The Search for a Common Learning, R. Thomas (McGraw-Hill), 11 May 1962, 505
Silent Spring, R. Carson (Houghton Mifflin), 28 Sept. 1962, 1042
Socialized Medicine in England and Wales, A. Lindsey (Univ. of North Carolina Press), 26 Oct. 1962, 504
The Teaching of Science, J. Schwab and P. Brandwein (Harvard Univ. Press), 11 May 1962, 501
Undergraduate Education in Foreign Affairs, P. W. Bidwell (King's Crown Press), 1 Feb. 1963, 397
The World Role of Universities, E. W. Weidner (McGraw-Hill), 17 Aug. 1962, 519
World Technology and Human Destiny, R. Aron, G. Kennan, R. Oppenheimer, and others (Univ. of Michigan Press), 29 Mar. 1963, 1276

History and Philosophy of Science

Analyses of Ancient Glasses, 1790–1957, E. R. Caley (Corning Museum of Glass), 8 June 1962, 868
Roger Joseph Boscovich, 1711–1787, L. L. Whyte, Ed. (Allen and Unwin), 29 June 1962, 1114
Theodor Boveri, F. Baltzer (Wissenschaftlicher, Stuttgart, Germany), 25 May 1962, 709
The Cholera Years, C. E. Rosenberg (Univ. of Chicago Press), 15 Mar. 1963, 1045
The Collected Papers of Lord Rutherford of Nelson, J. Chadwick [Interscience (Wiley)] 28 Sept. 1962, 1044
The Concept of the Positron, N. Russell Hanson (Cambridge Univ. Press), 22 Feb. 1963, 745
The Correspondence of Isaac Newton, H. W. Turnbull, Ed. (Cambridge Univ. Press), 7 Sept. 1962, 743
Count Rumford, Physicist Extraordinary, S. C. Brown (Doubleday), 11 Jan. 1963, 100
Darwin and the Modern World View, J. C. Greene (Louisiana State Univ. Press), 11 May 1962, 502
The Dreams of Reason: Science and Utopias, R. Dubos (Columbia Univ. Press), 20 July 1962, 216
David Edwardes' Introduction to Anatomy, 1532, C. D. O'Malley and K. F. Russell (Stanford Univ. Press), 15 June 1962, 977
Fifty Years of X-ray Diffraction, P. P. Ewald, Ed. (Oosthoek's), 14 Dec. 1962, 1254
From Miasmas to Molecules, W. B. Wood (Columbia Univ. Press), 1 June 1962, 770
Galen on Anatomical Procedures, M. C. Lyons and B. Towers, Ed. (Cambridge Univ. Press), 15 June 1962, 977
Great Chemists, E. Färber, Ed. (Interscience), 11 May 1962, 501
Histoire Générale des Sciences, vol. 3, R. Taton, Ed. (Presses Universitaires de France), 10 Aug. 1962, 418
Historical Studies in the Language of

Chemistry, M. P. Crosland (Harvard Univ. Press), 8 Feb. 1963, 479

A History of American Pathology, E. R. Long (Thomas), 28 Dec. 1962, 1390

A History of Astronomy, A. Pannekoek (Interscience), 4 Jan. 1963, 31

A History of Chemistry, J. R. Partington, vol. 2 (St. Martin's Press), 24 Aug. 1962, 594; vol. 3 (Macmillan; St. Martin's Press), 22 Mar. 1963, 1192

History of Science, A. C. Crombie and M. A. Hoskin, Eds. (Heffer), 16 Nov. 1962, 803

Charles Lyell, E. Bailey (Doubleday), 1 Mar. 1963, 821

Medical Teaching in Western Civilization, W. B. Wartman (Year Book), 20 Apr. 1962, 251

On the External Characters of Minerals, A. G. Werner (Univ. of Illinois Press), 10 Aug. 1962, 419

Joseph Priestley, I. V. Brown, Ed. (Pennsylvania State Univ. Press), 9 Nov. 1962, 674

Sarton on the History of Science, D. Stimson, Ed. (Harvard Univ. Press), 15 Mar. 1963, 1043

The Sciences and the Arts, H. G. Casidy (Harper), 12 Oct. 1962, 130

Selected Papers, K. Linderstrom-Lang (Danish Science Press; Academic Press), 8 Feb. 1963, 481

A Short History of Clinical Pathology, W. D. Foster (Williams and Wilkins), 1 June 1962, 772

The Structure of Scientific Revolutions, T. S. Kuhn (Univ. of Chicago Press), 14 Dec. 1962, 1251

Unpublished Papers of Isaac Newton, A. R. Hall and M. B. Hall, Eds. (Cambridge Univ. Press), 16 Nov. 1962, 803

Alexander Wilson, Naturalist and Pioneer, R. Cantwell (Lippincott), 6 Apr. 1962, 37

Mathematics

Advanced Calculus for Applications, F. B. Hildebrand (Prentice-Hall), 28 Dec. 1962, 1391

Advanced Engineering Mathematics, E. Kreyszig (Wiley), 22 Mar. 1963, 1196

Algebraic Logic, P. R. Halmos (Chelsea), 23 Nov. 1962, 886

Analytic Geometry: A Vector Approach, C. Wexler (Addison-Wesley), 14 Sept. 1962, 846

A Course of Advanced Mathematics for Technical Schools, N. P. Tarasov (Pergamon), 18 Jan. 1963, 208

A Course of Mathematics for Engineers and Scientists, C. Plumpton and B. H. Chirgwin (Pergamon), 18 Jan. 1963, 208

Discrete Variable Methods in Ordinary Differential Equations, P. Henrici (Wiley), 13 Apr. 1962, 143

Elementary and Advanced Trigonometry, K. S. Miller and J. B. Walsh (Harper), 14 Sept. 1962, 846

Elements of Linear Spaces, A. R. Amir-Moez and A. L. Fass (Pergamon), 22 Feb. 1963, 745

Elements of Mathematical Statistics, H. W. Alexander (Wiley), 29 June 1962, 1114

Elements of Mathematical Statistics, J. F. Ratcliffe (Oxford Univ. Press), 8 Feb. 1963, 482

Elements of Probability and Statistics,

F. L. Wolf (McGraw-Hill), 30 Nov. 1962, 968

Elements of Queuing Theory, T. L. Saaty (McGraw-Hill), 7 Sept. 1962, 742

Foundations of Geometry and Trigonometry, H. Levi (Prentice-Hall), 14 Sept. 1962, 846

Fourier Series, G. P. Tolstov (Prentice-Hall), 12 Oct. 1962, 134

Geometric Transformations, I. M. Yaglom (Random House), 22 Feb. 1963, 749

Guide to Tables in Mathematical Statistics, J. A. Greenwood and H. O. Hartley (Princeton Univ. Press), 3 Aug. 1962, 332

Handbook of Statistical Tables, D. B. Owen (Addison-Wesley), 14 Sept. 1962, 849

Handbook of Vector and Polyadic Analysis, T. B. Drew (Reinhold), 27 Apr. 1962, 310

An Index of Mathematical Tables, vols. 1 and 2, A. Fletcher, J. C. P. Miller, L. Rosenhead, and L. J. Comrie (Addison-Wesley), 3 Aug. 1962, 332

Integrals of Bessel Functions, Y. L. Luke (McGraw-Hill), 15 Feb. 1963, 583

An Introduction to Fourier Analysis, R. D. Stuart (Wiley), 12 Oct. 1962, 134

Introduction to Probability and Mathematical Statistics, Z. W. Birnbaum (Harper), 29 June 1962, 1114

Introduction to Set Theory and Topology, K. Kuratowski (Pergamon), 9 Nov. 1962, 674

Introduction to the Theory of Queues, L. Takacs (Oxford Univ. Press), 7 Sept. 1962, 742

Introductory College Mathematics, C. G. Jaeger and H. M. Bacon (Harper), 14 Sept. 1962, 846

Mathematical Programming, S. Vajda (Addison-Wesley), 8 Mar. 1963, 898

Mathematical Statistics, J. E. Freund (Prentice-Hall), 29 June 1962, 1114

Mathematical Statistics, S. S. Wilks (Wiley), 29 June 1962, 1114

The Mathematical Theory of Linear Systems, B. M. Brown (Wiley), 22 Mar. 1963, 1195

Mathematics: A Cultural Approach, M. Kline (Addison-Wesley), 6 July 1962, 28

Mathematics for Physicists and Engineers, Organisation for Economic Co-operation and Development (O.E.C.D. Regional Office, Washington, D.C.), 21 Dec. 1962, 1324

Mathematics in Your World, K. W. Menninger (Viking Press), 1 Feb. 1963, 399

Mathematics Manual, F. S. Merritt (McGraw-Hill), 17 Aug. 1962, 522

Methods of Mathematical Physics, R. Courant and D. Hilbert (Interscience), 3 Aug. 1962, 334

Numerical Methods for Scientists and Engineers, R. W. Hamming (McGraw-Hill), 7 Dec. 1962, 1091

Popular Lectures in Mathematics, vol. 1, I. S. Sominskii; vol. 2, N. N. Vorob'ev; vol. 3, V. A. Uspenskii; vol. 4, A. N. Kostovskii; vol. 5, A. S. Smogorzhevskii; vol. 6, P. P. Korovkin (Blaisdell), 6 July 1962, 28

Programming for Digital Computers, J. F. Davison (Gordon and Breach), 8 June 1962, 869

Queues, D. R. Cox and W. L. Smith (Methuen), 7 Sept. 1962, 742

Random Processes, M. Rosenblatt (Oxford Univ. Press), 27 Apr. 1962, 311

Recent Developments in the Theory of Connections and Holonomy Groups, H. Busemann, Ed. (Academic Press), 11 May 1962, 513

Statistics, G. H. Weinberg and J. A. Schumaker (Wadsworth), 22 Feb. 1963, 746

Stochastic Service Systems, J. Riordan (Wiley), 7 Sept. 1962, 742

Studies in Modern Analysis, R. C. Buck, Ed. (Prentice-Hall), 6 July 1962, 28

The Theory of Probability, B. V. Gnedenko (Chelsea), 19 Oct. 1962, 422

Topology, J. C. Hocking and G. S. Young (Addison-Wesley), 21 Dec. 1962. 1323

Use and Abuse of Statistics, W. J. Reichmann (Oxford Univ. Press), 10 Aug. 1962, 417

USSR Olympiad Problem Book, D. O. Shklarsky, N. N. Chentzov, and I. M. Yaglom (Freeman), 24 Aug. 1962, 595

Medicine

Advances in Comparative Physiology and Biochemistry, O. Lowenstein, Ed. (Academic Press), 26 Oct. 1962, 503

Advances in Pharmacology, S. Garattini and P. A. Shore, Eds. (Academic Press), 7 Dec. 1962, 1092

Annual Review of Pharmacology, W. C. Cutting, Ed. (Annual Reviews), 31 Aug. 1962, 663

Basic Endocrinology, J. H. U. Brown and S. B. Barker (Davis), 7 Sept. 1962, 744

Calciphylaxis, H. Selye (Univ. of Chicago Press), 13 July 1962, 120

Carbohydrates of Living Tissues, M. Stacey and S. A. Barker (Van Nostrand), 28 Sept. 1962, 1044

Design and Function at the Threshold of Life: The Viruses, H. Fraenkel-Conrat (Academic Press), 18 Jan. 1963, 207

Diagnosis and Treatment of Acute Radiation Injury (Columbia Univ. Press), 13 July 1962, 123

Eccrine Sweat Glands and Eccrine Sweating, W. Montagna, R. A. Ellis, and A. F. Silver (Pergamon), 22 Feb. 1963, 748

Electron Microscopy, G. Causey (Williams and Wilkins), 2 Nov. 1962, 586

Experimental Embryology, R. Rugh (Burgess), 17 Aug. 1962, 521

Fluorescence Assay in Biology and Medicine, S. Udenfriend (Academic Press), 12 Oct. 1962, 130

International Review of Experimental Pathology, G. W. Richter and M. A. Epstein, Eds. (Academic Press), 15 Mar. 1963, 1044

An Introduction to Comparative Pathology, G. A. Gresham and A. R. Jennings (Academic Press), 18 Jan. 1963, 208

Introduction to Electron Microscopy, S. Wischnitzer (Pergamon), 7 Dec. 1962, 1093

Lectures on the Whole of Anatomy, W. Harvey (Univ. of California Press), 15 June 1962, 977

Manuale di Micologia Medica, R. Ciferri (Renzo Cortina, Pavia, Italy), 11 May 1962, 526

A New System of Anatomy, Sir S.

Zuckerman (Oxford Univ. Press), 11 May 1962, 524

Physiological and Behavioral Aspects of Taste, M. R. Kare and B. P. Halpern, Eds. (Univ. of Chicago Press), 31 Aug. 1962, 662

Progress in Medicinal Chemistry, G. P. Ellis and G. B. West (Butterworth), 7 Dec. 1962, 1092

Psychophysiological Aspects of Space Flight, B. E. Flaherty, Ed. (Columbia Univ. Press), 28 Sept. 1962, 1045

Radioisotopes and Bone, F. C. McLean, P. LaCroix, and A. M. Budy, Eds. (Davis), 25 Jan. 1963, 325

Rapid Microchemical Identification Methods in Pharmacy and Toxicology, F. Amelink [Netherlands Univ. Press, Amsterdam; Interscience (Wiley)], 9 Nov. 1962, 676

Readings in Pharmacy, P. A. Doyle (Interscience), 28 Sept. 1962, 1044

Science and the Safe Period, C. G. Hartman (Williams and Wilkins), 15 Feb. 1963, 581

A Stereoscopic Atlas of Human Anatomy, D. L. Bassett (Sawyer's), 11 May 1962, 526

Steroid Drugs, N. Applezweig (McGraw-Hill), 5 Oct. 1962, 26

Strahlenschutz in Forschung und Praxis, H.-J. Melching *et al.*, Eds. (Rombach, Freiburg, Germany), 27 Apr. 1962, 309

Structural Aspects of Ageing, G. H. Bourne, Ed. (Pitman), 21 Sept. 1962, 973

A Survey of Cardiac Glycosides and Genins, J. Hampton Hoch (Univ. of South Carolina Press), 11 May 1962, 528

A Textbook of Comparative Endocrinology, A. Gorbman and H. A. Bern (Wiley), 7 Sept. 1962, 744

Ticks and Disease, D. R. Arthur (Pergamon), 18 Jan. 1963, 205

Time, Cells, and Aging, V. L. Strehler (Academic), 1 Feb. 1963, 400

Transplantation of Tissues and Cells, R. E. Billingham and W. K. Silvers, Eds. (Wistar Institute Press), 21 Dec. 1962, 1325

Physics

Advances in Quantum Electronics, J. R. Singer, Ed. (Columbia Univ. Press), 6 Apr. 1962, 37

Atomic Spectra, H. G. Kuhn (Academic Press), 2 Nov. 1962, 586

Classical Electrodynamics, J. David Jackson (Wiley), 22 June 1962, 1046

The Collected Papers of Enrico Fermi, E. Segre, Ed. (Univ. of Chicago Press), 22 Feb. 1963, 746

The Collected Works of Irving Langmuir, vols. 1–12, C. G. Suits, Ed. (Pergamon), 12 Oct. 1962, 126

Elementary Solid State Physics, C. Kittel (Wiley), 8 Mar. 1963, 897

Experimental Cryophysics, F. E. Hoare, L. C. Jackson, and N. Kurti, Eds. (Butterworth), 12 Oct. 1962, 131

Frontiers in Physics, David Pines, Ed. (Benjamin), 14 Sept. 1962, 846

Fundamental Problems in Statistical Mechanics, E. G. D. Cohen (Wiley), 7 Dec. 1962, 1093

The Green Function Method in Statistical Mechanics, V. L. Bonch-Bruevich and

S. V. Tyablikov [North-Holland; Interscience (Wiley)], 1 Feb. 1963, 399
Neutron Physics, M. L. Yeater, Ed. (Academic Press), 4 Jan. 1963, 29
Particle Accelerators, M. S. Livingston and J. Blewett (McGraw-Hill), 8 June 1962, 870
Physics of Fully Ionized Gases, L. Spitzer, Jr. (Interscience), 15 Mar. 1963, 1045
Physics of the Nucleus, M. A. Preston (Addison-Wesley), 14 Sept. 1962, 848
Polyelectrolyte Solutions, S. A. Rice and M. Nagasawa (Academic Press), 1 June 1962, 771
Quantum Mechanics, A. Messiah (North-Holland; Interscience), 11 May 1962, 514
Quantum Mechanics for Mathematicians and Physicists, E. Ikenberry (Oxford Univ. Press), 8 June 1962, 868
Quantum Statistical Mechanics, L. P. Kadanoff and G. Baym (Benjamin), 1 Feb. 1963, 399
Quantum Theory, D. R. Bates, Ed. (Academic Press), 20 July 1962, 219
Radiation and Waves in Plasmas, M. Mitchner, Ed. (Stanford Univ. Press), 11 Jan. 1963, 101
Recent Developments in General Relativity (Państwowe Wydawnictwo Naukowe, Warsaw; Pergamon), 12 Oct. 1962, 134
Rutherford Jubilee International Conference, J. B. Birks, Ed. (Academic Press), 9 Nov. 1962, 674
Spectral Theory, E. R. Lorch (Oxford Univ. Press), 12 Oct. 1962, 132
Studies in Statistical Mechanics, J. De Boer and G. E. Uhlenbeck, Eds. (Wiley), 30 Nov. 1962, 965
Theory of Elementary Particles, P. Roman (North-Holland; Interscience), 11 Jan. 1963, 103

Psychology

Affect, Imagery, Consciousness, S. S. Tomkins (Springer), 1 Feb. 1963, 400
Clinical Research Design and Analysis in the Behavioral Sciences, E. E. Levitt (Thomas), 25 May 1962, 708
Communication in Africa, a Search for Boundaries, L. W. Doob (Yale Univ. Press), 11 May 1962, 508
Creativity and Intelligence, J. W. Getzels and P. W. Jackson (Wiley), 9 Nov. 1962, 673
Deterrents and Reinforcement, D. H. Lawrence and L. Festinger (Stanford Univ. Press), 16 Nov. 1962, 807
Experiments in Personality, H. J. Eysenck, Ed. (Humanities Press), 28 Dec. 1962, 1388
The Human Factor in Changing Africa, M. J. Herskovits (Knopf), 25 Jan. 1963, 324
Intelligence and Experience, J. McV. Hunt (Ronald), 5 Oct. 1962, 24
Psychological Differentiation, H. A. Witkin *et al.* (Wiley), 7 Dec. 1962, 1092
The Psychology of Jung, A. M. Dry (Wiley), 3 Aug. 1962, 333
Psychotherapy in the Soviet Union, R. B. Winn, Ed. (Philosophical Library), 20 July 1962, 217
Roots of Behavior, E. L. Bliss, Ed. (Harper), 11 May 1962, 512

Social Research to Test Ideas, S. A. Stouffer [Free Press (Macmillan)], 8 June 1962, 869

Thought and Language, L. S. Vygotskii (M.I.T. Press and Wiley), 6 Apr. 1962, 36

Science for the Layman

The ABC's of Astronomy, R. A. Gallant (Doubleday), 4 Jan. 1963, 31

Abominable Snowmen: Legend Come to Life, I. T. Sanderson (Chilton), 20 Apr. 1962, 252

About Biology, K. von Frisch (Oliver and Boyd), 4 Jan. 1963, 31

Artificial Satellites, M. W. Ovenden (Penguin Books), 11 May 1962, 499

Astronomical Dictionary, J. Kleczek (Academic Press), 11 May 1962, 519

Astronomy of the 20th Century, O. Struve and V. Zebergs (Macmillan), 21 Dec. 1962, 1321

Atlas of the Universe, B. Ernst and T. E. de Vries (Nelson), 27 Apr. 1962, 310

Aus Jahrmillionen: Tiere der Vorzeit, A. H. Müller (Fischer), 8 Mar. 1963, 900

Biological Order, André Lwoff (Massachusetts Institute of Technology Press), 15 Feb. 1963, 582

Challenge of the Universe, J. A. Hynek and N. D. Anderson (Scholastic Book Services), 21 Sept. 1962, 971

Cloud Physics and Cloud Seeding and *Radar Observes the Weather*, L. J. Battan (Doubleday), 25 Jan. 1963, 327

Clouds, Rain and Rainmaking, B. J. Mason (Cambridge Univ. Press), 4 Jan. 1963, 30

The Computer Revolution, E. C. Berkeley (Doubleday), 16 Nov. 1962, 806

Discovery: Great Moments in the Lives of Outstanding Naturalists, J. K. Terres, Ed. (Lippincott), 11 May 1962, 504

Earth, Sea, and Air, J. Spar (Addison-Wesley), 8 Feb. 1963, 480

Evolution, R. Moore (Time), 8 Mar. 1963, 899

The Evolution of Life, F. H. T. Rhodes (Penguin Books), 21 Sept. 1962, 972

The Exploration of Outer Space, B. Lovell (Harper and Row), 1 Mar. 1963, 820

Exploring the Secrets of the Sea, W. J. Cromie (Prentice-Hall), 1 Mar. 1963, 823

Exploring the Universe, L. B. Young, Ed. (McGraw-Hill), 22 Mar. 1963, 1194

Fossils, W. H. Matthews III (Barnes and Noble), 11 May 1962, 505

Gravity, G. Gamow (Doubleday), 11 May 1962, 499

The Human Species, A. Barnett (Penguin Books), 11 May 1962, 508

The Inspiration of Science, Sir G. Thomson (Oxford Univ. Press), 30 Nov. 1962, 966

Life and Energy, I. Asimov (Doubleday), 11 May 1962, 503

Life in the Universe, F. Jackson and P. Moore (Norton), 1 Feb. 1963, 398

Life: Origin and Development, G. Ehrensvärd (Univ. of Chicago Press), 1 Feb. 1963, 398

The Orion Book of Volcanoes, H. Tazieff (Orion Press), 21 Sept. 1962, 970

Pain, Its Modes and Functions, F. J. J. Buytendijk (Univ. of Chicago Press), 11 May 1962, 504

Penguin Science Survey, 1961, S. A. Barnett and A. McLaren, Eds. (Penguin Books), 4 Jan. 1963, 32
Prehistoric Life on Earth, K. Petersen, Ed. (Dutton), 11 May 1962, 506
The Scientific Life, T. Berland (Coward-McCann), 15 Feb. 1963, 582
The Seeing Eye, H. Asher (Duckworth), 11 May 1962, 504
The Senses of Animals and Men, L. Milne and M. Milne (Atheneum), 19 Oct. 1962, 423
Space, the Architecture of the Universe, G. Honegger and P. van de Kamp (Dell), 28 Sept. 1962, 1046
Spacecraft, J. L. Haggerty, Jr. (Scholastic Book Services), 11 May 1962, 499
The Stars, H. A. Rey (Houghton Mifflin), 13 July 1962, 122
The Story of Pollination, B. J. D. Meeuse (Ronald), 11 May 1962, 528
The Thinking Machine, J. Pfeiffer (Lippincott), 16 Nov. 1962, 806
The Universe, O. Struve (Massachusetts Institute of Technology Press), 9 Nov. 1962, 675
The Unseen World, R. Dubos (Rockefeller Institute Press), 18 Jan. 1963, 203
Volcanoes in Action, L. Poole and G. Poole (McGraw-Hill), 21 Sept. 1962, 970
The World of Animals, J. W. Krutch, Ed. (Simon and Schuster), 11 May 1962, 504
The World of Ice, J. L. Dyson (Knopf), 10 Aug. 1962, 416

Technology

Advances in Electrochemistry and Electrochemical Engineering, P. Delahay, Ed. (Interscience), 22 Feb. 1963, 747
The Analysis of Titanium, Zirconium, and Their Alloys, W. T. Elwell and D. F. Wood (Wiley), 12 Oct. 1962, 134
Applied Clay Mineralogy, R. E. Grim (McGraw-Hill), 8 June 1962, 870
Chemical Reaction Engineering, O. Levenspiel (Wiley), 29 Mar. 1963, 1278
Computer Control Systems Technology, C. T. Leondes, Ed. (McGraw-Hill), 24 Aug. 1962, 595
Design of Water-Resource Systems, A. Maass, M. M. Hufschmidt, R. Dorfman, H. A. Thomas, Jr., S. A. Marglin, and G. M. Fair (Harvard Univ. Press), 20 Apr. 1962, 250
Elements of Infrared Technology, P. W. Kruse, L. D. McGlauchi, and R. B. McQuistan (Wiley), 13 July 1962, 123
Engineering Alloys, N. E. Woldman (Reinhold), 11 Jan. 1963, 103
Instrumentation for Engineering Measurement, R. H. Cerni and L. E. Foster (Wiley), 12 Oct. 1962, 128
Instruments for Measurement and Control, W. Holzbuck (Reinhold), 12 Oct. 1962, 135
International Symposium on Mining Research, G. B. Clark, Ed. (Pergamon), 11 May 1962, 515
Introduction to Chemical Engineering, L. B. Andersen and L. A. Wenzel (McGraw-Hill), 25 Jan. 1963, 325
An Introduction to the Physical Chemistry of Iron and Steel Making, R. G. Ward (Arnold; St. Martin's Press), 8 Mar. 1963, 898

Laboratory Organization and Administration, K. Guy (Macmillan), 22 Feb. 1963, 748

Laboratory Planning, H. F. Lewis, Ed. (Reinhold), 22 Feb. 1963, 748

Minerals for the Chemical and Allied Industries, S. J. Johnstone and M. J. Johnstone (Wiley), 13 Apr. 1962, 145

Nuclear Instruments and Their Uses, A. H. Snell, Ed. (Wiley), 8 Mar. 1963, 899

Progress in Materials Science, B. Chalmers, Ed. (Pergamon), 3 Aug. 1962, 331

Uranium Metallurgy, W. D. Wilkinson (Interscience), 29 Mar. 1963, 1277

Zoological Sciences

Abyssal Crustacea, J. Laurens Barnard, R. J. Menzies, and M. G. Bacescu (Columbia Univ. Press), 19 Oct. 1962, 424

The Beetles of the Pacific Northwest, M. Hatch (Univ. of Washington Press), 9 Nov. 1962, 676

Behavioral Aspects of Ecology, P. H. Klopfer (Prentice-Hall), 25 Jan. 1963, 324

Birds of the Caribbean, R. P. Allen (Viking), 7 Dec. 1962, 1094

British Prosobranch Molluscs, V. Fretter and A. Fraham (Quaritch, London), 11 Jan. 1963, 102

Chordate Morphology, M. Jollie (Reinhold; Chapman and Hall), 29 Mar. 1963, 1278

The Exploitation of Natural Animal Populations, E. D. Le Cren and M. W. Holdgate, Eds. (Wiley), 28 Dec. 1962, 1389

Fortschritte de Zoologie, H. Bauer, Ed. (Fischer), vol. 14, 20 July 1962, 217; vol. 15, 11 Jan. 1963, 103

Handbook of North American Birds, R. S. Palmer, Ed. (Yale Univ. Press), 17 Aug. 1962, 520

Insect Sounds, P. T. Haskell (Quadrangle Books), 11 May 1962, 523

Introductory Zoology, L. Coles Pettit (Mosby), 28 Sept. 1962, 1045

The Life of Birds, J. C. Welty (Saunders), 30 Nov. 1962, 967

The Life of Vertebrates, J. Z. Young (Oxford Univ. Press), 1 Mar. 1963, 822

Monogenetic Trematodes, B. E. Bychowsky, W. J. Hargis, Ed. (American Institute of Biological Sciences), 21 Dec. 1962, 1325

Morphogenesis of the Vertebrates, T. W. Torrey (Wiley), 11 May 1962, 522

The Orientation of Animals, D. L. Gunn and G. F. Fraenkel (Dover), 25 May 1962, 707

Papers on Animal Population Genetics, E. Spiess (Little, Brown), 19 Oct. 1962, 424

Soil Animals, D. K. McE. Kevan (Philosophical Library), 10 Aug. 1962, 418

A Synopsis of the Birds of India and Pakistan, Together with Those of Nepal, Sikkim, Bhutan, and Ceylon, S. D. Ripley II (Bombay Natural History Society), 22 Feb. 1963, 748

The Taxonomy and Speciation of Pseudophonus, G. E. Ball and J. N. Anderson (Catholic Univ. of America Press), 22 Mar. 1963, 1193

The Vertebrate Body, A. S. Romer (Saunders), 23 Nov. 1962, 888

intern. congr., Washington, D.C. (R. MacDonald, Natl. Library of Medicine, Bethesda 14, Md.)

17–18. Learning, Adaptation, and Control in **Information Systems**, symp., Evanston, Ill. (J. T. Tou, Computer Sciences Laboratory, Technological Inst., Northwestern Univ., Evanston, Ill.)

17–19. American **Dairy Science** Assoc., Lafayette, Ind. (H. F. Judkins, 32 Ridgeway Circle, White Plains, N.Y.)

17–19. American **Nuclear** Soc., Salt Lake City, Utah. (R. E. Lightle, P.O. Box 521, Idaho Falls, Idaho)

17–19. Canadian Federation of **Biological Societies**, London, Ont. (A. H. Neufeld, CFBS, Faculty of Medicine, Univ. of Western Ontario, London, Ont., Canada)

17–19. Hanford Symp. on Biology of **Radioiodine**, Richland, Wash. (L. K. Bustad, Biology Laboratory. General Electric Co., Richland)

17–19. Society for the Study of **Development and Growth**, Storrs, Conn. (W. A. Jensen, Dept. of Botany, Univ. of California, Berkeley 4)

17–21. American Soc. for **Engineering Education**, Philadelphia, Pa. (W. L. Collins, American Soc. for Engineering Education, Univ. of Illinois, Urbana)

17–21. **Gas Chromatography**, 4th intern. symp., Ann Arbor, Mich. (Instrument Soc. of America, 530 William Penn Pl., Pittsburgh 19, Pa.)

17–22. **Pacific Division, AAAS**, San Francisco, Calif. (R. C. Miller, California Acad. of Sciences, Golden Gate Park, San Francisco)

17–22. International Congr. of **Engineers**, 4th, Munich, Germany. (Deutscher Verband Technisch-Wirtschaftlicher Vereine, Prinz-Georg-Str. 79, Düsseldorf, Germany)

17–23. Nuclear Energy, 8th intern. congr., Rome, Italy. (Ufficio Congressi e Mostre CNEN, Via Belisario 15, Rome, Italy)

18–20. Chemistry and Biochemistry of **Fungi and Yeasts**, symp., Dublin, Ireland. (T. S. Wheeler, Dept. of Chemistry, University College, Science Bldgs., Upper Merrion St., Dublin)

18–22. American Soc. of **Ichthyologists** and **Herpetologists**, Vancouver, B.C., Canada. (J. A. Peters, Biology Dept., San Fernando Valley State College, Northridge, Calif.)

19–21. Joint **Automatic Control** conf., Minneapolis, Minn. (T. J. Williams, Monsanto Chemical Co., St. Louis, Mo.)

19–21. Metal Chelates in **Chemical Analysis**, natl. symp., Tucson, Ariz. (H. Freiser, Dept. of Chemistry, Univ. of Arizona, Tucson)

19–26. **World Petroleum** Congr., 6th, Frankfurt-am-Main, Germany. (U.S. Natl. Committee, 15 W. 51 St., New York, N.Y.)

20–21. Institute of **Mathematical Statistics**, 96th, Eugene, Ore. (D. G. Chapman, Dept. of Mathematics, Univ. of Washington, Seattle 5)

20–21. **Nutrition** Soc. of Canada, 6th annual, London, Ont. (E. V. Evans, Dept. of Nutrition, Ontario Agricultural College, Guelph, Ont., Canada)

22–23. **Ukrainian Medical** Assoc. of North America, Kerhonkson, N.Y. (R. W. Sochynsky, UMA, 2 E. 79 St., New York 21)

23–26. American Soc. of **Agricultural Engineers**, Miami Beach, Fla. (J. L. Butt, P.O. Box 229, St. Joseph, Mich.)

23–29. American Soc. for **Horticultural Science**, Caribbean region, 11th annual, Mexico City, Mexico (E. H. Cásseres, Calle Londres 40, Mexico 6, D.F.)

23–26. American Soc. of **Mechanical Engineers**, Ithaca, N.Y. (A. B. Conlin, Jr., 345 E. 47 St., New York, N.Y.)

23–28. American Soc. for **Testing and Materials**, 66th annual, Atlantic City, N.J. (ASTM, 1916 Race St., Philadelphia 3, Pa.)

24–26. International **Astrophysical** Symp., 12th, Liège, Belgium. (M. Migeotte, Institut d'Astrophysique, Cointe-Sclessin, Belgium)

24–26. American Soc. of **Heating, Refrigerating and Air Conditioning** Engineers, Milwaukee, Wis. (R. C. Cross, 345 E. 47 St., New York 17)

25–28. American **Home Economics** Assoc., Kansas City, Mo. (D. S. Miller, 3705 Van Buren Ave., Corvallis, Ore.)

26–27. **Computers and Data Processing**, Estes Park, Colo. (W. H. Eichelberger, Denver Research Inst., Univ. of Denver, Denver 10, Colo.)

26–28. **Wind Effects** on Buildings and Structures, Teddington, Middlesex, England. (Mrs. S. M. Russell, Aerodynamics Div., Natl. Physical Laboratory, Teddington)

26–29. American Assoc. of **Bioanalysts**, annual, Chicago, Ill. (R. Thornburg, 720 N. Michigan Ave., Chicago 11)

(See 26 April issue for comprehensive list)

New Products

Low background beta counting system, using wholly solid-state circuits, enables automatic assay of solid samples with counting rates lower than 1 count per minute by canceling cosmic ray counts. Before triggering the flow counter's inner detector, cosmic rays must penetrate a surrounding, dome-shaped, guard detector; beta radiation from the sample can only trigger the inner detector. A transistorized anti-coincidence circuit, by rejecting any pulse simultaneously received from both detectors, prevents counting of virtually all of the 35 percent of cosmic rays normally present in background radiation. The guard detector also protects the inner detector from beta radiation not emitted from the sample. Materials used in both detectors eliminate background contributed by natural sources, while terrestrial gamma radiation is minimized by extensive lead shielding. The unique design of the flow counter, plus the use of an ultra-thin Mono/Mol window, enables absolute efficiencies greater than 45 percent for strontium-90 or yttrium-90, for example. Absolute efficiency for carbon-14 is better than 35 percent. The Omni/Guard BLB-550T automatic sample-changing system accommodates up to 50 1- or 2-inch samples per load. A single switch controls sample changes in any of four modes: all samples counted once for a single cycle; continuous counting of all samples for any desired number of cycles; selection of a particular sample for counting; repetitive counting of a single sample. In operation, samples are automatically elevated into test position and fixed at a minimum distance of 0.0312 inch from the window of the flow counter. Precise spacing guarantees maximum reproducibility and enhances efficiency by maintaining a minimum air column between sample and counter. Data can be read out on the automatic printer in one of two forms: sample number, time, and count; or, sample number, time, count, and counts per minute. Electronic components of the BLB-550T include: six-decade, solid-state scaler; preset count circuits with 16 positions between five and 500,000; a 500- to 3000-volt power supply adjustable with ten-turn lockable controls (1000-division dials); a preset time with 11 positions between 0.2 and 500 min. Specifications include: background, less than 0.5 count/min for 1-inch samples and less than 1.0 count/min for 2-inch samples; window diameter, 1.25 or 2 inches, depending on sample size; window weight, approximately 150 $\mu g/cm^2$ with 900-μg windows available as an option; weight, 1415 lb, with shielding; overall dimensions, 33 inches wide by 51 inches high by 26 inches deep.—R.L.B. (Tracerlab, 1601 Trapelo Rd., Waltham 54, Mass.)

Circle 1 on Readers' Service card

The material in this section is prepared by the following contributing writers:

Robert L. Bowman (R.L.B.), with the assistance of Denis J. Prager, Laboratory of Technical Development, National Heart Institute, Bethesda 14, Md. (medical electronics and biomedical laboratory equipment).

Joshua Stern (J.S.), Basic Instrumentation Section, National Bureau of Standards, Washington 25, D.C. (physics, computing, electronics, and nuclear equipment).

The information reported here is obtained from manufacturers and from other sources considered to be reliable. Neither *Science* nor the writers assume responsibility for the accuracy of the information. A Readers' Service card for use in mailing inquiries concerning the items listed is included on page 549. Circle the department number of the items in which you are interested on this card.

Electronic timer is a solid-state device designed to operate at cryogenic temperatures and over a range of −196° to +55°C. The timer provides time intervals from 0.05 to 1 sec, adjustable by means of an external timing resistor. Operating voltage range is 20 to 31, d-c. The output switch is capable of delivering up to 500 ma to an external load. The components of the timer are supported by rigid polyurethane foam for shock and vibration resistance. Dimensions are 1 by 1 by 1-19/32 inches, and weight is 0.13 lb. Other cryogenic timers in the series can be designed to provide time intervals up to 100 sec, output current up to 2 amp, single pulse output, delay or drop-out logic, and repetitive square-wave output.—J.S. (Tempo Instrument, Inc., Plainview, N.Y.)

Circle 2 on Readers' Service card

Rapid electrophoresis system utilizes sepraphore, a microporous cellulose acetate of high uniformity, instead of filter paper, to achieve rapid separation, highly reproducible results, and ease of washing and staining, as well as to obtain a clear film for photometric scanning. In operation, strips of the material are placed across a microscope slide with the ends dipping into the electrode chambers. The sample is applied with the strip in place and voltage turned on. When the separation is complete (less than 3 hours) the strips are stained, washed, and cleared with oil. The clear strips are then scanned with a photoelectric scanner and the recorded density peaks are analyzed with a planimeter. The planimeter analysis is said to take only a few minutes longer than the more automatic methods, but there is a considerable saving in equipment cost.—R.L.B. (Gelman Instrument Co., 106 N. Main, Chelsea, Mich.)

Circle 3 on Readers' Service card

Ionization gage (type CIC-110A) is a cabinet-mounted, hot-filament, single-station ionization gage for the measurement of pressure from 2×10^{-9} to 10^{-3} mm-Hg. The numerical value indicated on a linear decade meter scale, multiplied by the power of 10, selected by a range switch, gives the pressure in mm-Hg. Emission current of the ion tube is regulated to minimize fluctuations caused by changes of line voltage or system pressure. A protection and alarm circuit cuts off filament current when the meter reaches 25 percent beyond full scale. An alarm trip circuit is adjustable for any meter deflection from 50 to 200 percent of full scale. A reset button unlocks the alarm circuit and also serves as a check on amplifier zero. Output is provided for operation of a 10-mw high-impedance recorder.—J.S. (Consolidated Vacuum Corp., 1775 Mt. Read Blvd., Rochester 3, N.Y.

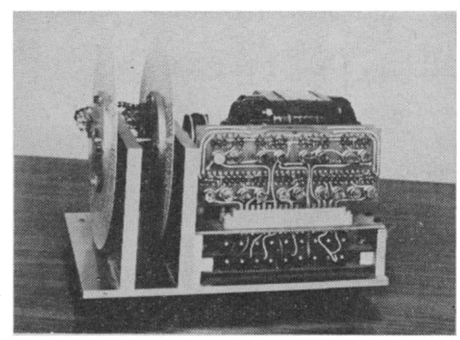
Circle 4 on Readers' Service card

Bragg diffraction apparatus uses 3-cm microwaves to simulate x-ray diffraction investigation of crystal structure for educational demonstration. The "crystal" is a cubic lattice of 10-mm aluminum spheres about 4 cm apart in an 18- by 18- by 18-cm foam-plastic matrix that is transparent to 3-cm radiation. The (100), (110), and (210) families of planes may be investigated and the separation of the planes computed. The foam plastic is in separable layers held in place by a plastic cover. The

cover may be removed to allow the student to measure the separation of crystal planes directly at the end of the experiment. Accuracy better than ± 5 percent is said to be attainable. The microwave spectrometer is provided with a boom system that permits independent adjustment and measurement of the relative angular positions of the transmitter horn, receiver horn, and lattice. The transmitter horn supports a klystron microwave generator tube. The receiver horn, with a silicon-diode detector, is supported by the other boom. Both horns may be removed from the spectrometers for application to other experiments.—J.S. (Welch Scientific Co., 1515 Sedgwick St., Chicago 10, Ill.)

Circle 5 on Readers' Service card

Photoelectric code converter (model 190) is said to be capable of converting any 5- to 8-bit code into any other 5- to 8-bit code at a rate of 20 characters per second. Selection of codes to be interconverted is made by interchanging code disks. Conversion is parallel by bit and serial by character;



code disks accommodate up to 128 characters. The device is said to be suitable for input/output typewriters converting to various codes for computer and communications compatibility, paper-tape to paper-tape converters, automatic message handling, and similar devices. The converter is 7.5 by 7.5 by 9 inches and weighs 9 lb. It operates on 117 volts a-c and requires +6, −12, and −24 volts d-c supply.—J.S. (Invac Corp., 26 Fox Rd., Waltham 54, Mass.)

Circle 6 on Readers' Service card

"How to apply statistics to nuclear measurements" describes the variations which are encountered by the experimenter when making radioactivity measurements. It explains why these variations occur, how they can be predicted, and how to determine statistical accuracy. The following discussions are included: Poisson distribution, chi-square test, propagation of errors, dead time losses, nomogram for counting errors, errors of count rate meter readings, and other related subjects. Illustrations include tables and graphs showing statistical variation and computations. The bulletin (Tech. Bull. No. 15) is free of charge.—R.L.B. (Nuclear-Chicago Corp., 359 E. Howard Ave., Des Plaines, Ill.)

Circle 7 on Readers' Service card

Electronic thermometers using thermistor probes are available for indicating, recording, or controlling temperature for industrial, laboratory, or agricultural applications. Ranges available are from −102° to +302°C and −153° to +577°F. Standard units are accurate to 0.5°C and .05°C in modified units. The thermistor probes provide rapid response and relative freedom from interference, and the high output from the measuring package is sufficient to operate standard recorders and control devices. Read-out package features a rugged, taut band suspension meter and self-contained power. Custom and multipoint arrangements are available.—R.L.B. (Atkins Technical Inc., P.O. Box 3617, University Station, Gainesville, Fla.)

Circle 8 on Readers' Service card

Particle analyzer provides a method of electronically analyzing the distribution of droplet sizes and is capable of scanning, sorting, and counting up to 18,000 particles in less than one minute. It classifies droplets ranging in diameter from as small as 20 μ to as large as 16,250 μ. The analyzer consists of a modified vidicon camera, an adjustable lens system for microscopic pickup, a strobe flash unit designed for high-intensity, short-duration flashes, a video monitor, and a mobile console that houses the video controls, programming circuitry, a single-purpose digital computer, and a single-channel strip-chart recorder. The strobe flash illuminates the spray of droplets, thus freezing the motion of the particles. Through an intricate system of pre-set programming, the individual video pulses are referred through the console for processing and data readout. The computer, operating on the video signal, measures the diameter of the particles, groups them according to size, and counts the number in each group. The output is a distribution graph of quantity versus size and is registered on a meter tally and/or the strip-chart

recorder. It is possible to identify particle features such as dimensions in one or more directions, location, orientation, form (solid, hollow, re-entrant, dumbbell), proximity to others, and so forth.—J.S. (Thompson Ramo Wooldridge, Inc., Dage Div., 455 Sheridan Ave., Michigan City, Ind.)

Circle 9 on Readers' Service card

Microscopes of high quality manufactured in West Germany are available with two basic stands and several options in stages, illuminators, tubes, and optics, including phase. Quadruple nose pieces, centerable substage, and retracting objectives are supplied as standard equipment. Standard stock combinations are easily selected by a convenient numerical system from a well-illustrated catalog.—R.L.B. (Brinkmann Instruments, Inc., 115 Cutter Mill Rd., Great Neck, L.I., N.Y.)

Circle 10 on Readers' Service card

Inverse pinch plasma generator (model Q) is designed for the study of certain interactions arising when an ionized plasma sheath expands into a vacuum-magnetic field environment. The equipment is capable of producing a plasma sheath that will expand at rates up to 10^7 cm/sec in magnetic fields up to 2 kgauss. The basic instrumentation for the inverse pinch plasma generator consists of a large vacuum chamber surrounded by a Helmholtz coil for production of a uniform magnetic field within the vacuum region. After a small amount of gas is injected at the center of the chamber by means of a quick-acting magnetic valve, a fast electric discharge occurs, forming and accelerating an expanding shell of plasma. The shell or sheath may be observed optically and by means of a magnetic sheath-velocity probe, a Langmuir ion and electron temperature probe, a hollow-cathode density probe, and a ballistic pendulum sheath-momentum probe. The sheath is formed by discharging a 1-μf, 50-kv capacitor through the initially injected gas with a ringing frequency of 380 kcy/sec.—J.S. (Allied Research Associates, Inc., Concord, Mass.)

Circle 11 on Readers' Service card

Digital printout recorder uses a Polaroid camera back to photograph a series of digital registers. The unit includes four to nine 5-digit registers, lighting and optical system, timer, and the camera back. Models are available for battery or power-line operation.

The standard timer provides 54 successive photographs of the register bank at intervals of 15 or 60 minutes on a single 3.24-by-4.24-inch print. Timers are available for other program intervals; exposures at intermediate intervals can be made by push-button control. An exposure counter and reset button are located near the camera back and an automatic cutoff operates after 54 exposures have been made. The register images are said to be readable without magnification. Timing is established by a d-c motor that incorporates a chronometer-type jeweled escapement with temperature-compensated rustproof hairspring.—J.S. (C. W. Thornthwaite Associates, Route 1, Centerton, Elmer, N.J.)

Circle 12 on Readers' Service card

Membrane osmometer operates with a sample of 1 ml placed on top of a membrane that is in contact with solvent. Tendency for solvent to pass out into the unknown is detected optically and a servo system applies suction to counteract the flow. The suction side of the membrane is supported on a flat, rigid surface, assuring minimum distortion by the control pressure. The pressure is continuously indicated directly in centimeters of solvent, either on the numerical readout or via the recorder output. Organic solvents or aqueous solutions can be determined in minutes, depending on the membranes and solutions used. Schleichter and Schuell membranes available provide a range down to molecular weights of 20,000, and reproducible readings can be made up to 1,000,000. Pressure range is up to 25 cm of solvent.—R.L.B. (Mechrolab, Inc., 1062 Linda Vista Ave., Mountain View 3, Calif.)

Circle 13 on Readers' Service card

Center-of-gravity determination system measures unbalance directly in both the *x-x* and *y-y* axes and allows location of the center of gravity within ± 0.001 inch, according to the manufacturer. The test object may be placed on or hung beneath a detecting head that is provided with bolting holes to accommodate a variety of holding fixtures. Detecting heads have load-carrying capacities of 250, 1000, 2500, and 10,000 lb with corresponding unbalance ranges of ± 25, ± 100, ± 250, and ± 1000 in.-lb. In operation, the test fixtures are bolted to the detecting head and brought to approximate balance by the addition of weights. The zero balance of the electrical indicating instrument is used to achieve final balance. The test object is then placed on the fixture and the indicating instrument reads unbalance directly. Calibration is accomplished by placing a known weight at a known distance from the center. The detecting heads are mechanically protected against overload.—J.S. (Bytrex Corp., 50 Hunt St., Newton 58, Mass.)

Circle 14 on Readers' Service card

Fatty acids analysis report on recent developments in gas chromatographic analysis of fatty acids has been published by the Perkin-Elmer Corporation. Included in the report is a review of the significance of polyester liquid phases for column preparation and examples of current accomplishments of a new quantitative system which combines dual columns with a flame ionization detector. Other areas discussed in the publication include open tubular columns, advances and limitation of nonselective liquid phases, and refinements in Golay column design. The report (Application Report GC-AP-001) is available from the Technical Publications Dept., Instrument Div.—R.L.B. (Perkin-Elmer Corp., 1001 Main Ave., Norwalk, Conn.)

Circle 15 on Readers' Service card

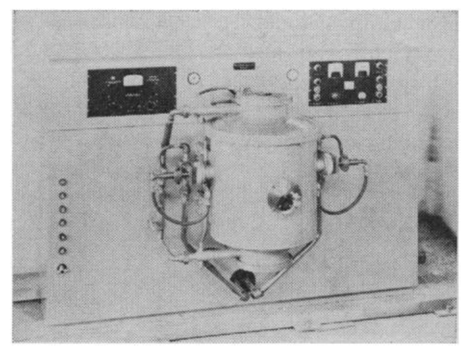
Microvoltmeter (model A-61) is a fully transistorized potentiometric instrument providing five full-scale ranges from 3 μv to 1 kv. Accuracy is said to be $\pm$5 percent and stability $\pm$0.01 percent per hour. Input impedance is 100 kohms to 10 megohms, according to range. With an external probe, measurements can be made from 1 volt to 1 kv at a constant input impedance of 10 megohms. Input is floated and output is isolated. Operation may be from power line at 50 to 400 cy/sec or from batteries. Line voltage changes of 10 percent cause less than 0.1 μv shift, according to the manufacturer.—J.S. (Medistor Instrument Co., 1443 N. Northlake Way, Seattle 3, Wash.)

Circle 16 on Readers' Service card

Voltage-standing-wave ratio is measured and displayed directly on an oscilloscope by this detector. It utilizes a bridge circuit to produce a d-c voltage which is directly proportional to the magnitude of the reflection coefficient of an unknown compared with a standard. The detector covers the frequency range of 1 Mcy to 2500 Mcy/sec. Output of the detector can be used with a null-balance meter or to provide vertical deflection of an oscilloscope using frequency as the horizontal axis. The device measures 1 by 1 by 2⅜ inches and is fitted with three type N connectors and one BNC connector for making input and output connections. —J.S. (Telonic Engineering Corp., 480 Mermaid St., Laguna Beach, Calif.)

Circle 17 on Readers' Service card

Vacuum resistance furnace (model 48) provides temperatures as high as 3000°C in vacuum or controlled atmosphere. The furnace will pump down to operating pressure and attain its maximum temperature in 45 min. The heating element is heavy-wall graphite. Both the heating element and its insulation are said to be easily removed and replaced. The complete furnace includes a hot zone 4 inches in diameter by 8 inches high, a fully jacketed vacuum chamber, saturable-core reactor-controlled power supply, vacuum



pumping equipment, and pressure and power instrumentation. Shuttered sight ports permit temperature measurement by means of an optical pyrometer. —J.S. (Vacuum Specialties, Inc., 34 Linden St., Somerville 43, Mass.)

Circle 18 on Readers' Service card

Thickness monitor (model DTM-2) for vacuum deposition measurements, determines deposit thickness by monitoring the change in resonance frequency of a quartz crystal held in the evaporation path. Range of measurement is 1 to 300 $\mu g/cm^2$, equivalent to 30 to 10,000 Å of aluminum. Accuracy is said to be ± $\mu g/cm^2$. Output is provided in the form of meter indication, audible signal, and external recorder signal. A built-in meter has a set-point relay for automatic source control. The transistorized instrument occupies less than 1 ft^3. A detection unit occupying 2 $in.^3$ is installed near the substrate.—J.S. (Sloan Instruments Corp., 323 State St., Santa Barbara, Calif.)

Circle 19 on Readers' Service card

Inertness tester for estimating the purity of helium or argon used in controlled-atmosphere enclosures utilizes a calibrated titanium wire as the sensor. Each tester is wired to operate in either atmosphere, with the proper one being selected by a manually operated switch. The equipment includes enough wire for 2000 tests, an audio-visual timer, and calibration charts that read directly the parts per million of oxygen in either an argon or a helium atmosphere.—J.S. (United Nuclear Corp., 660 Madison Ave., New York 21)

Circle 20 on Readers' Service card

Lasers and accessories include the following models. Model 3020 is a 20-joule, liquid-nitrogen-cooled unit laser that can be fired several times a minute; input is variable up to 3000 joules. Model 3100N is an ambient-cooled unit with a 50-joule output; it utilizes a single 10,000-joule xenon flash lamp. Model 3100 is cooled by liquid nitrogen and has a guaranteed output of 100 joules at a one-per-minute firing rate. The series 3300 multicavity laser head provides outputs ranging 200 to 300 joules. Power supplies are available for all models.—J.S. (Maser Optics, 89 Brighton Ave., Boston, Mass.)

Circle 21 on Readers' Service card

Light emitting diode (model GAE-402) is a diffused-junction GaAs diode that, when forward biased, emits monochromatic radiation near 9000 Å. The intensity of the emitted radiation can be varied by suitable variation of the bias current, making it possible to modulate the output at frequencies extending into the microwave region. Modulation requires power of a few tenths of a watt and radiated power output of more than 1 mw is obtainable when the device is operated at room temperature, and more than 25 mw when the diode is cooled to 77°K. Operating bias power requirement is 1.2 volts and 100 ma when the diode is at room temperature. Efficiency is said to be 5 percent at room temperature and to approach 100 percent at 77°K. The device emits through a 60-deg cone in its mount, so that emitted radiation is about 10 percent of generated radiation. The mount is a UG-88/U type BNC connector with a window at its end through which radiation is emitted. —J.S. (Philco Corp., Tioga and C Streets, Philadelphia 34, Pa.)

Circle 22 on Readers' Service card

(Continued from page 574)

university research could not possibly be carried on these days with private funds alone.

That this government support of research on university campuses has raised some problems goes without saying. There are difficulties in fiscal and contractual management. There are difficulties arising from the fact that some scientific fields are adequately supported while others are not. Some institutions have, no doubt, overreached themselves and have taken on larger projects than the quality of their staffs warranted.

However, these difficulties and headaches should not lead one to assume that the entire picture is as black as Hubbert claims. A vast amount of fine research is being properly carried on and adequately supported under suitable conditions. A very large number of graduate students and postdoctoral fellows have been enabled to carry on their studies under these research grants and contracts, and many more have been enabled to pursue their studies by virtue of government fellowships of various types. Most universities have greatly improved both their undergraduate and graduate instructional programs in pure and applied science by virtue of these government funds.

Hubbert also regrets that universities have become "dependent" on federal support. It is obvious that if the Congress of the United States suddenly refused to appropriate any money for university scientific research, many universities would face catastrophic disruptions of their programs. Many universities faced such disruption during the great depression of the 1930's when private funds were so drastically reduced and when state appropriations to public institutions were heavily curtailed. There is risk and a danger of "dependency" in any form of financial support of university education and research. Actually, the government programs have, since the war, shown a remarkable stability and a healthy growth rate. The benefits to the nation and to science have been so spectacular that it seems unlikely that any Congress would suddenly drastically reduce the research budgets of all government agencies. And government agencies have not sought to direct either the academic or research programs of the institutions whose self-initiated proposals they help to support.

I need not comment on Hubbert's gratuitous remark that there has been "a reversion to pure authoritarianism . . ." There is no evidence for this assertion, and Hubbert himself warns us of the dangers "whereby statements, if made by proper 'authorities,' are to be accepted as valid, independently of any supporting evidence."

Scientists, educators, and government officials do face problems in properly carrying on the great programs of education and research in the sciences in our colleges and universities. Much open and frank discussion and debate on the essential issues is necessary. Such debate, however, is not assisted by the misinterpretation of incorrect data from improper sources.

LEE A. DUBRIDGE
California Institute of Technology, Pasadena, California

In my presidential address before the Geological Society of America, "Are we retrogressing in science?", a condensed version of which was published in Science, I expressed concern over the direction in which science in the United States has been evolving during the last few decades. As evidence of retrogression, a few examples were cited on pages 884–886 from recent major treatises and textbooks of physics which indicate either an indefensible carelessness on the part of authors, referees, and editors with regard to some of the fundamental principles of physics, or else the emergence of a generation of physicists who are inadequately acquainted with those principles. In either case misinformation of the kinds cited is being extended to another generation of physicists who are now, or recently have been, students in American universities.

In seeking for a reason for this abandonment of intellectual standards, I directed attention to a number of probable contributory factors. One of these, with which I have been associated (on the giving end) for some 20 years, is the contract-grant system of supporting scientific research in universities. I have seen this system grow, since about 1935, from small grants of a few hundred dollars from private funds, each made to individuals, to grants in the range of tens-to-hundreds of thousands of dollars from government funds, still made to individuals.

Over the years, I have served on several committees or advisory groups concerned with the distribution of such funds, principally to academic personnel: the Projects Committee of the Geological Society of America, the Advisory Committee for the Earth Sciences to the Office of Naval Research, and the Advisory Panel for the Earth Sciences of the National Science Foundation. In addition, I have had a continuing load of related projects which have been sent to me for refereeing.

On the academic side, I have served as a member of the Visiting Committee of the Department of Geology and Geophysics of Massachusetts Institute of Technology, the Visiting Committee of the Department of Physics, University of Houston, and the Advisory Council of the Institute of Geophysics and Planetary Physics of the University of California.

It was largely on these firsthand personal observations that my analysis of the objectionable effect of the contract-grant system was based. From such information it was clear that most of our universities, especially the privately endowed ones, are becoming increasingly dependent upon this contract-grant system for their essential financial support. In order to obtain approximate information on the extent of this support I referred to a standard secondary reference, *American Colleges and Universities* (8th edition, 1960), from which I obtained the data I gave in Table 1. A recheck of this source confirms that all the items in my Table 1 are correctly quoted except those for Rice and Yale. The Rice figure for "Income from Contracts" was quoted as $633,500; it should have been $633,300.

The Yale figure is more interesting. No information on "Income from Contracts" was given, and this was erroneously interpreted as being zero. Several previous correspondents have pointed out this error, and it has already been corrected in the full version of the address which is shortly to appear in the *Geological Society of America Bulletin.*

In an effort to obtain a valid figure for Yale the "Report of the Treasurer of Yale University for the Fiscal Year 1958–1959" (Series 55, Aug. 1959, No. 15) was studied in detail. The figure on "Income" for 1958–59 agreed exactly with that cited in Table 1. The sources of income were also listed, but the United States Government was not included. Finally, on the back pages of the report the donors of gifts were listed. Of these "gifts" five, totaling $2,075,745, were from the National Science Foundation; five others, totaling $3,075,788, were from the U.S. Public Health Service; and one, of $2900, was from the U.S. Forest Service. Unofficial information from government sources indicates that Yale also receives grants from other government agencies.

DuBridge has seized upon this error of interpretation and has magnified it out of all proportion to its importance. He has also implied that all the data in my Table 1 are misleading and has substituted a table of his own, whereby, by excluding the large-scale operations such as the Jet Propulsion Laboratory, the Lawrence Radiation Laboratory, the Argonne National Laboratory, and other such essentially industrial laboratories which I had criticized as having no legitimate place in universities, he has drastically scaled down the amount of apparent federal support.

I have not had an opportunity to examine the financial reports of all the universities cited in Table 1, but I have seen that for California Institute of

Technology (*1*). On page 58 of this report, the following data are given for the year ending 30 June 1959:

Total Income	$60,675,342
Income from research under agreements with the U.S. Government	50,731,179

The first of these figures agrees exactly with that of my Table 1. The second is lower by $2,869,263, which represents income from "wind tunnel tests and other special research." Apparently the latter amount was erroneously ascribed to the U.S. Government by the editors of *American Colleges and Universities.*

The correct figure in my Table 1 for the percentage of total income represented by federal funds for California Institute of Technology should, therefore, be 83.6 percent instead of my original figure of 88 percent, or DuBridge's figure of 38 percent.

However, all of this is largely irrelevant with respect to the main problem which I was discussing. Regrettably, in the *Science* condensation, my own position with respect to the government-support problem was not made sufficiently clear. In the full version it was pointed out that public support of education at all levels in a modern industrial society is a social necessity, and that in the United States this is coming increasingly to mean support by the federal government. That this is not an onerous burden to the government or to our society is indicated by the fact that the entire cost of operating all the colleges and universities in the country amounts to but about $3.5 billion per year, as compared with President Kennedy's recent statement that the space program budget for this year would be $5.4 billion.

My real point was not to criticize the government for supporting the universities, or the universities for accepting such support, but rather to criticize the chaotic way in which such support is now being administered, and to point out its bad effects upon the universities. It is my opinion that, when the funds to be dealt with are small, the making of modest individual grants upon recommendation by the people who are acquainted with the subject concerned, and preferably with the applicant also, is the best procedure. When the sums to be dealt with reach the magnitudes of tens-to-hundreds of millions of dollars per year, as is now the case for the National Science Foundation, the Public Health Service, the Atomic Energy

Commission, the National Aeronautics and Space Administration, and other fund-granting federal agencies, the effect upon the universities is to produce much of the chaotic state which I tried briefly to describe.

The solution to this kind of haphazard administration appears to me to be obvious: Grant to each of the universities directly, by means of a well-monitored system of dispensation, enough money to meet adequately all of its legitimate needs, and hold the university officials responsible for a proper internal administration of these funds.

In case DuBridge and other readers of *Science* may suspect that the views expressed in the paper under discussion are merely the "half-baked" and ill-considered views of a single individual, and are not representative of the scientific community at large, it is worthy of note that this paper has evoked an avalanche of mail consisting overwhelmingly of expressions of enthusiastic approval. Already 166 such communications have been received from a cross section of scientists ranging from nuclear physicists to psychologists—both in the United States and abroad. To the members of Congress, the administrators of agencies disbursing government funds for scientific and educational uses, and others who should be mindful of such matters, this unintentional poll of scientific opinion should be of more than passing interest.

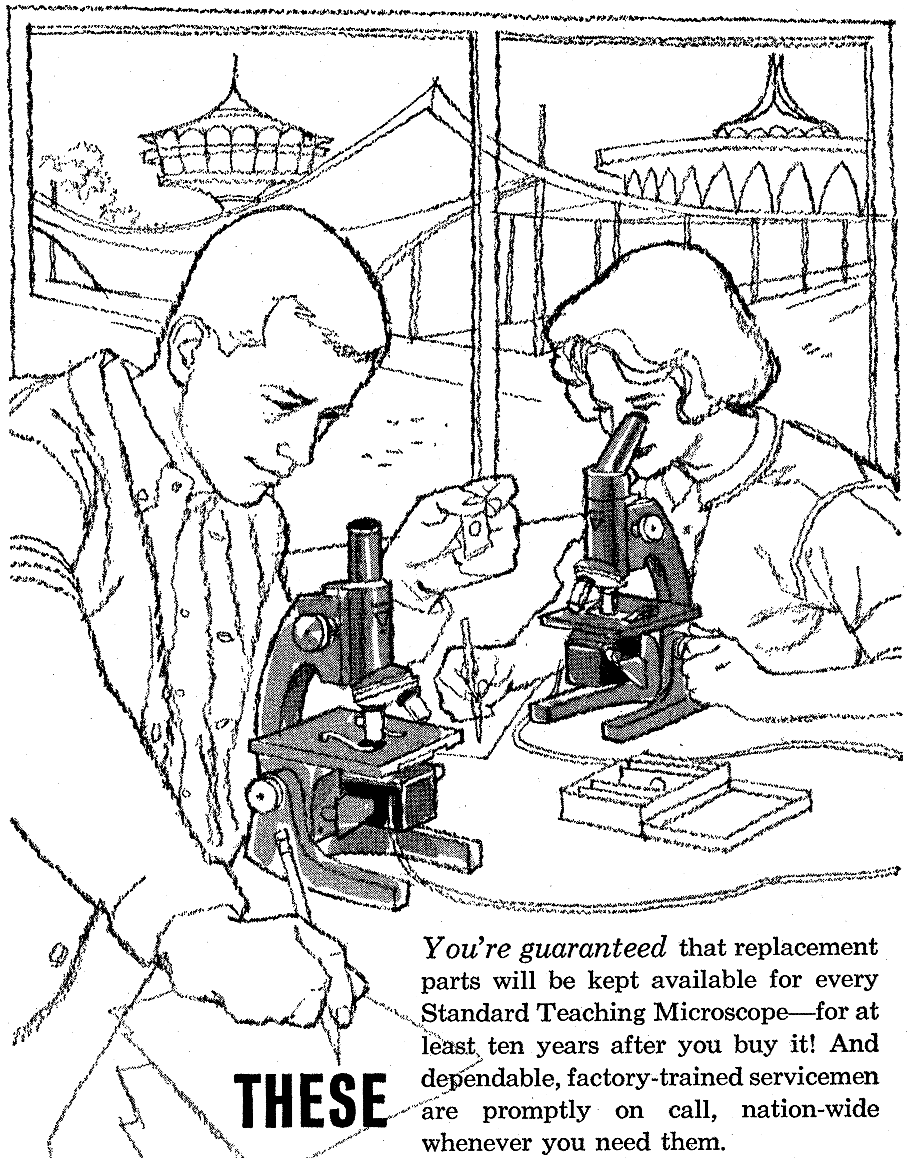
M. KING HUBBERT
Box 481, Houston 1, Texas

Reference

1. *Bulletin of California Institute of Technology*, vol. 69, No. 4 (Pasadena, Calif., Nov. 1960).

More on Paper Work

The editorial "More paper work, less research" [*Science* **139**, 725 (22 Feb. 1963)] is much to the point. However, it does not mention what seems to me the most disturbing feature in the new regulations of the grant program of the National Institutes of Health. This is the requirement that the investigator must notify the granting agency if he has altered the objectives of his research, as he stated them in his application. How this rule is to operate in practice I do not know. No criteria are given to indicate just what constitutes a change of objective, but in any case the requirement appears to impair the fundamental distinction



between a research grant and a contract. A contract is given to a man who agrees in advance to do a specified job in applied research or development; the fundamental scientific evidence is already available to show that the job can be done, and general specifications can be laid out in advance. A research grant, on the other hand, is given to permit the investigator to explore unknown territory; he may state in his application some of the things that he thinks he may find and will indicate how he may start to go about finding them. However, in any fundamental research new and unexpected leads will turn up, and the whole point of the research is to find out things that could not be foreseen at the time when the application was written. The research grant program of NIH, as hitherto administered, has shown profound appreciation of these fundamental facts. It is regrettable that pressure from congressional committees is leading to a more rigid attitude, and to diminished freedom of research.

Of course, investigators who have already achieved high distinction can generally write their research applications in such broad terms as to include almost any new development that may occur in the course of the research. Relatively unknown young investigators are generally under pressure, in writing research grant applications, to specify in considerable detail what they intend to do and how they plan to do it. If they are conscientious they may feel considerably worried by the requirement that they must report to the granting agency any new turn that their research takes. Moreover there may be a future tendency, if present trends continue, to require *all* investigators, when they apply for grants, to write out a description of the intended research in great detail and to stick to that prearranged line unless they get specific permission to change it. This would be contrary to sound policy.

When, for instance, Roentgen made the initial observation that led to the discovery of x-rays he changed the objective of his research immediately. Would the progress of science have been promoted by requiring him to get permission from a government agency to do so?

Very likely permission would have been granted after some delay, but any delay would have retarded the pursuit of a great discovery. No administrator, and no advisory scientific panel, is in a position to tell the investigator what he ought to do under such circumstances. It is easy enough to miss the opportunity for major new discoveries; the inertia of the human mind is great. Several investigators before Roentgen had observed fogging of photographic plates near cathode ray machines, but had failed to see the great discovery implicit in this simple observation. If we set up rules that make it harder for investigators to change the objective of their research we shall make such discoveries less likely in the future.

To grant government money with such freedom in its use may appear to place the scientist in a position of special privilege. In fact, scientific research is probably the most profitable form of investment known, but it yields its best returns only when competent investigators, recognized as such by qualified experts in a panel or study section, are given adequate research grants and plenty of discretion in following the lines of research that look most promising to them. This is a justifiable way to spend the taxpayer's money, because experience has shown that, in the long run, it yields the best results. The dividends to the public are far greater if the scientist has a good deal of latitude in trying out his ideas, within the limits of his approved budget, than if he is held more tightly on the leash. To ask this is not to ask for special privilege, but for the opportunity to carry on the work so as to secure the best results.

It seems likely that the new regulations will not save money for the government. Rather they will increase the costs of research by requiring a new army of accountants and administrative officials to handle the elaborate bookkeeping and paper work. The cost of all this is likely to be much more than the amount saved by imposing stricter regulations on the scientists, quite apart from the serious loss to science, which your editorial mentions, because the scientists themselves will be spending more time on paperwork and less on research.

Nevertheless, scientists cannot dismiss lightly the problem of fiscal responsibility. If even one grant in a thousand is handled wastefully or dishonestly, such irresponsibility endangers the whole scientific community and the community at large. It is harmful to the national interest to cripple the development of fundamental science, as the new NIH regulations probably will; but it is also harmful to allow irresponsible people to waste or misappropriate government money. The wastefulness of a few demoralizes many and must be held in check. This is the serious problem that justly concerns those members of Congress who are critical of the administration of research grant programs. It is a genuine problem, and we cannot ignore it, while at the same time we must urge the maintenance of liberal policies in administering research grants, for the advancement of science and of our society.

Some of the great private foundations set a pattern of free and flexible support for research in the earlier decades of this century. Their example profoundly influenced government agencies, such as NIH and NSF, when they began to support research on a very large scale, and in a manner that has nourished such a magnificent growth of science in the United States during the last 15 years. Government support has been so great, and its administration so well designed to permit the scientist to proceed freely with his work that the private foundations have largely withdrawn from this field and have devoted themselves to other problems and needs. In view of these new developments it is perhaps in the public interest that more money from private sources should again flow into the support of research in the natural sciences. Private foundations can choose carefully among the people they wish to support and grant them funds with a maximum of freedom and a minimum of administrative regulation. Such funds, even though limited, will be worth far more to the people who receive them than the same amount of money from NIH, with its present encumbrances.

It is one of the most effective features of our social system that the sources of power and influence are widely distributed. Large-scale government support is essential today for the development of scientific research, but the maintenance of some support from sources outside of government is vital to preserve the balance and to minimize the potential danger that science might be stifled by bureaucratic regulation.

JOHN T. EDSALL
Biological Laboratories, Harvard University, Cambridge, Massachusetts

Your editorial properly calls attention to an abuse of confidence which may lead to inconveniences for those who contribute to the progress of science.

Calling the attention of the scientific fraternity as a whole to this situation serves notice that scientists, as a group, must adhere to ethical as well as legal standards in their dealings with government.

The professions have found that the best way of dealing with the "small minority who betray their trust" is to subject them to pitiless publicity, rather than to anonymity in referring to their act, which, without revealing their identity, casts a reflection on the entire group. Congressional demand for better policing of situations such as you have described merely reflects the public demand for such action and there is no greater deterrent of unethical conduct than the knowledge that the discovery of such conduct will be made public.

ROBERT P. FISCHELIS
4000 Cathedral Avenue, NW,
Washington 16, D.C.

In view of inaccuracies contained in your 22 February editorial and at the urging of scientists who feel that your statements should not go unanswered, I feel obliged to make further comment on this matter.

I believe the editor has greatly exaggerated the increase in paper work required for yearly grant continuations under the new NIH policies and the additional reporting requirements in general. In this connection, our studies revealed that NIH has not made the most effective use for grant management purposes of report data already in its possession. In any event, the Committee on Government Operations has performed its proper function in demonstrating the inadequacy of policies for the guidance of grantees and the need for more effective procedures to prevent the misuse and the inefficient use of public funds. The specific manner by which NIH chooses to implement the recommendations of the Committee with which it has expressed agreement is the agency's responsibility.

I cannot avoid the conclusion that the editor of *Science* has not studied the Committee's reports and hearing record when he speaks of an "unfortunate slip" and "one instance of mismanagement." The fact is that the Committee has demonstrated a pattern of administrative weakness in the NIH grant programs. The case referred to was illustrative of the kinds of undesirable spending practices that have resulted in the absence of clear-cut grant policies and under the agency's management procedures. Moreover, one should not ignore the fact that NIH officials testified that management improvements were desirable and overdue in these programs.

Perhaps the editor is too close to NIH to be a disinterested observer. It is noteworthy that he has been a consultant to the agency for many years.

L. H. FOUNTAIN

Chairman, Intergovernmental Relations Subcommittee, Committee on Government Operations, U.S. House of Representatives

As one who has participated in the flourishing growth of American science during the last two decades, I wish to endorse the editorials in *Science* of 1 and 22 February. I consider that the thoughtful dispensation of public funds has moved American science into world leadership.

The National Institutes of Health and the National Science Foundation, led by their scientific administrators, developed a granting policy that guaranteed a fair but stern judgment. This resulted in a distribution of funds which benefited the gifted and promising young men and women as well as those who had already shown ability. In particular, the availability of funds and decent salaries for young people not only attracted gifted people to scientific fields at home but also drew scientific talent from all over the world to this country. In contrast to most other countries, here there was an opportunity to get a place in the scientific community and obtain the means to do independent research work which, because of the structure of many scientific communities outside this country, was obtainable by only a very few.

It is difficult to understand that this almost miraculously successful government expenditure should be challenged as an imprudent distribution of public funds. Although such slips as there have been should not be brushed off lightly, the magnitude of the success shows how small the waste has been. It is witnessed by the increase in the flow of Nobel prizes in chemistry, physics and medicine to this country in recent years. We find that 40 went to United States scientists in the years 1946–1962 as against 16 in the period 1927–1945.

FRITZ LIPMANN

Rockefeller Institute, New York

Your excellent editorial pointed out some of the inevitable consequences of the new budgetary rules propounded by the NIH in the wake of congressional inquiry. Perhaps these are indeed the sorts of rules that congressmen deem necessary, perhaps not. Certainly some congressmen, like Fogarty of Rhode Island, who have specialized in matters concerning health research, should be able to understand how wasteful of precious research and teaching time these procedures are; the cure for cancer or even the common cold will not be found in double-entry accounting books.

Needless to say, no one is condoning the few examples of actual misuse of funds, which have received an undue amount of publicity. But apparently this phrase, "misuse of funds," has a different meaning for the accountant and the investigator—and we cannot agree with the implication of your news writer D. S. Greenberg (1 March, pp. 814–15) that this connotes a lack of moral fiber among scientists. To cite one possible example, is it truly a misuse of funds to transfer monies from the category for technical help to the purchase of a \$4000 photomicrographic apparatus that came on the market after the grant was made? Previously such shifts were encouraged, on the assumption that the investigator might know best what use of funds would yield the most in the long run. Now, apparently, one must wait months for an uncertain permission from Washington.

It is in this light that the recent furor over the American Institute of Biological Sciences augurs badly for the future. The scant information on the alleged "misuse" of funds that has reached us in newspaperless New York City as part of appeals for financial support has failed to clarify the nature of the actual crime. What does appear is that the NSF saw fit suddenly to require the return of funds. Certainly to use money to make a series of teaching films, even if not covered in the original grant, should not be termed "misusing public money," as one sees in many summaries, including those in *Science*. Is it not possible that AIBS gave the public a great deal for its money? Certainly the spasticity of the NSF in this matter gives one cause for apprehension. Does this action imply that each of us who has transferred funds might now be summarily required to return them? Can we look forward to receiving appeals from individual scientists for the same kind of financial support the AIBS has required in the last month or so? Is it in fact true that science and scientists have been shown to be "guilty" and must clear themselves in the public eye?

If it becomes necessary that, to do investigative work, one must spend weeks each year fussing over the assignment of funds and worrying about foreseeing future needs, many may consider the excitement of the actual research not worth the trouble. One problem that worries many of us in academic medicine, for example, is that the pool of talented people interested in pursuing these lines is steadily shrinking because other exciting areas are opening up. A major factor that has helped our particular group in maintaining its competitive position has been the availability of funds for doing exploratory (basic) rather than applied research. If the chore of seeking and administering such funds becomes increasingly unpleasant and if the threat of being held personally accountable for alleged "misuse of funds" becomes routine, the attraction of this field will dim rapidly. Will this turn of events aid the opening of still more medical schools to produce the needed physicians?

In this connection, it seems pertinent to quote the Nobel laureate Otto Loewi on the conditions before World War I in the German universities [*Perspectives Biol. Med.* **4**, 3 (1960)]:

"The conditions in Germany at that time were most favorable to the development of scientists. . . . The universities were government owned, but the government hardly ever interfered with their far-reaching autonomy. As a rule, it contented itself with accepting the debts of the departments. If the debts were excessive, the department got a warning—and a little later the payment. Because of these enlightened policies, there was no need to rush work and publication."

We are deeply disturbed and wish to benefit from wide discussion of the problems facing our particular community. These problems must be considered within the larger framework of the adjustment of the United States to the problem of recruiting personnel for all of the current needs. But we doubt that the direction recently taken by the NIH and NSF is going to aid in the ultimate solution of our dilemma, or even to improve the ethics of the scientific community, if such improvement is indeed required.

ERNST A. SCHARRER
HELEN WENDLER DEANE
*Department of Anatomy,
Albert Einstein College of Medicine,
Yeshiva University, New York 61*

The development of a broad program of research related to health under the auspices of the National Institutes of Health during the past two decades represents one of the highlights of scientific achievement in the United States. Moreover the administration of this program until now has been conducted with commendable attention to the dual objectives of freedom of scientific inquiry and proper accountability for the use of public funds.

Recently, administrative procedures of the National Institutes of Health have been revised and distributed to universities and research institutes.

While recognizing the continuing need for scrupulous stewardship, we are deeply concerned about the introduction of measures that are fundamentally in conflict with the fact that research, which in its very essence is a creative process, must be evaluated in terms of its productivity, not in terms of its pro-

cedural components. Research productivity is principally determined by the incisiveness and originality of the ideas on which it is based. The generation of good research ideas is an unpredictable process which is at least as dependent on the stimulation provided by the study of disease processes and by contacts with fellow scientists and students as it is related to time spent in the mechanics of experimentation in the laboratory. Therefore it is manifestly inappropriate and unrealistic to measure a scientist's effort and contribution in terms implicit in one of the new procedures, which draws an artificial distinction between these components.

Furthermore, scientific progress is impeded when competent scientists are denied sufficient latitude to alter their direction of inquiry as indicated by the course of their observations or by the unfolding of their ideas. Progress is also impeded when scientists are unable to exploit new leads promptly for lack of essential equipment. The requirement that scientists stipulate equipment needs as much as one year in advance is clearly impractical, as is the requirement that unforeseeable changes in research direction or in equipment must have the prior written approval of nonscientific personnel.

The threat to future progress of the research programs related to health in the United States is so grave that the procedures should be altered, if necessary by revision of the law, to meet the special needs of the scientific community.

WALTER J. BURDETTE
R. LEE CLARK, JR.
GEORGE B. COOPER, SIDNEY FARBER
PAUL M. GROSS, A. MCGEHEE HARVEY
HENRY S. KAPLAN, JOHN G. KIDD
MARY W. LASKER, LYNDON E. LEE, JR.
PHILLIPPE SHUBIK
FRANK M. TOWNSEND
J. WALTER WILSON

The recent "scandal" involving the use of federal funds by the American Institute of Biological Sciences has reinforced an impression that has developed through the years: first, that much grant money is indeed being used improperly as a federal aid to education, and second, that the grant recipient or principal investigator may be the victim of embezzlement of his research funds by his chief or even by the institution which employs him.

Much of this situation can be remedied by rescinding permission for research grant funds to be used as salary

or salary supplement for the principal investigator. This would take the granting agencies away from the business of providing federal aid to education. There is certainly nothing wrong with the assignment of federal monies to supplement education, but it should come from a source so designated.

Rescinding this freedom would return the grant systems to rules under which they operated 12 years ago, would remove any conflicts of interest that had developed, and, in institutions, would avoid placing in the hands of department heads the temptation to expand their departments by the use of grant-in-aid funds.

The second remedial step would be to insure that the grantee alone had the privilege of directing the expenditure of his own funds. This would prevent intradepartmental pooling of misappropriated funds, which is so often used to keep some institutes alive. The third step would be to dispense with the $100,000 grants or "megagrants," for scientists may then hire other scientists, and we are back to some type of institutional aid program. After all, $100,000, when properly invested in research, can produce more data than any single man can digest in a year. Why not break big grants down into subgrants for those professionals working on different aspects of a major problem?

Proper administration of funds of this magnitude is almost a full-time job in itself. When large research plants are heavily endowed with scientific equipment bought on grant monies, and then heavily stocked with scientists, the granting agency finds itself burdened with the obligation to keep the place endowed or watch it fold up. Add to this porridge the fact that the grant award committees are heavily staffed by the most important scientists in their respective fields, who are aware that those coming up for review this year may be passing on committee members' requests next year, we find that we have a pyramiding system which might run out of funds before it reaches its apogee.

I would be inclined also to trust the small investigator a little more. One gets the impression that monies have been given recently to institutions rather than to individuals, and institutions of themselves have never produced research.

In short, all forces in the grant system as it exists today supplement one another, and the crusty, cynical system of checks and balances that seems to be the glue of our society, and which guards it against man's natural cupidity, is missing.

Somehow, either the government or the scientists themselves will have to provide the feedbacks or opposing forces that will make the grant systems fair, functional, and operational.

There will be much talk during this ferment about "getting the most out of our dollar," and rules will be offered that may well destroy the freedom that is the heart of productive research. This must be prevented.

Research by its very nature is inefficient and its value cannot be measured in dollars. If measurement could be made it might take a generation or so to appraise its true worth. Investing in research is an act of faith. Thus the issue is not how to get the most out of the research dollar, but how to keep the research dollar honest, and toward this end the scientific community must now address itself.

CHARLES HARRIS

534 Elkins Avenue,
Elkins Park 17, Pennsylvania

I cannot resist commenting on your editorial "More paper work, less research". This is another of a series of commentaries that seems to say that "scientists" are or should be a race apart when handling money other than their own. Present evidence is against this view and I, among many, am disappointed in your failure to appreciate that reasonable and generally accepted accounting procedures are desirable whether applied to expending taxpayers', a company's, or an individual's money.

I assume you are exaggerating for emphasis when you state that the 1 to 7 days required to fill out the "new" form would cost millions of dollars in time. A single million dollars is quite a lot of money. It would pay a scientist $24,000 per year for more than 40 years, or 3650 scientists at the same salary for the average of 4 days required to fill out the form. Yet you think it would cost not 1 million, but millions.

I will also have to take exception to your downgrading of administrators, "who will not be able to handle scientific problems with confidence. They can only run scared, go by the book. . . ." I can't believe you mean what you have written. Scientific administrators aren't really that bad and I am sure you know it.

Don't you believe that our "public image,"which seems to be of such concern these days, will be improved if we follow the same rules as nonscientists who spend someone else's money?

JOHN R. WARREN

Department of Biology, Tennessee Polytechnic Institute, Cookeville

I did not overestimate the cost of the recent changes in NIH procedure. There are about 15,000 NIH grants presently in effect, each involving from one to many scientists—amounting to a total of perhaps as many as 50,000 persons.

When scientists are highly irritated by extraneous annoyances, they stop functioning creatively. Some days usually elapse before the normal rate of progress is resumed following a bout of paper work.—P.H.A.

Reporting Oceanographic Data

In a story about pirates and treasures, it is fascinating and quaint to hear about knots and fathoms. In a journal, however, whose readership overwhelmingly does not belong to the class of old tars and salts, one might expect the use of kilometers, meters, and where necessary, centimeters.

In the 15 February issue of *Science*, I read with interest three articles on oceanographic topics. One dealt with oceanographic experience and expressed the depth of water in meters and distances in kilometers; the second on uplifted islands, described distances in kilometers, and thickness of sediments in meters; the third, however, in a discussion of ripple marks in the Florida Straits, recorded the flow of water in knots, distances in miles, depth in fathoms, and heights and lengths in feet and inches.

I am a chemist. Those who plied my trade before me used the impressive units of stones, grains, and other quaint weights. Some time ago a switch was made to the cgs system. Why do not others, writing in *Science*, make the same switch? If great hardship should be involved, knots and fathoms could still be added in parentheses.

WILLY LANGE

2832 Robers Avenue, Cincinnati 39, Ohio

The Ninth Eastern Pacific Oceanic Conference adopted a resolution urging authors and editors to use metric units and the Celsius scale in reports on oceanographic research. We shall follow this suggestion—EDS.

(Continued from page 621)

for outer space. So far, "space law" consists of the two points expressed in a General Assembly resolution of December 1961: that international law, including the U.N. Charter, applies to outer space and to celestial bodies, and that these are free for exploration by all states, and are not subject to national appropriation.

Attempts to elaborate these principles into practical rules were hampered between 1958 and 1961 by a Soviet boycott of the U.N. Space Committee because of dissatisfaction with its composition. Subsequently, they have been hampered in more fundamental ways by serious differences in the American and Soviet concepts of what a suitable law for outer space might be. These differences stalemated the legal subcommittee, both at its first meeting in Geneva last spring and at its recent session as well.

Different Approaches

What the Soviets want, essentially, is a binding law that would qualify general pieties about free exploration and use of outer space with specific limits and prohibitions on permissible space activities. Once these principles are established, they say, then more detailed legal provisions can be worked out, but without them there can be no progress.

The United States envisions a more pragmatic evolution of space law, beginning with agreements on liability for space accidents, and for the rescue and return of disabled astronauts and spacecraft. The Americans go along with many of the general pieties the Soviets have proposed, but find certain of the specific qualifications repugnant. In addition, the U.S. wants the general principles, if at all, only in the form of a U.N. resolution, while the Soviets want them in a formal international treaty.

If they reflected nothing more than the differing legal traditions of their sponsors—American pragmatism versus a Soviet predilection for theory—the different approaches might be reconcilable. In fact, however, they become the source of additional mistrust. The American delegation thinks the Soviets are hammering at points clearly unacceptable to the U.S. precisely to prevent agreement, and cannot bring itself to believe that the Soviets may be serious about them. The Soviets, in turn, think the American focus on smaller legal issues grows out of fear that general principles would compromise what they regard as the more nefarious aspects of our space program. Problems that to the Americans appear separable, seem to the Soviets interwoven, and the result is deadlock, even on issues where agreement seemed within reach.

Four principles proposed by the Soviet Union as qualifications on the "absolute" freedom of outer space caused most of the trouble. These called for (i) prohibiting the use of outer space for "propagating war, national or racial hatred, or enmity between nations"; (ii) international consultation and agreement prior to any experiment in space "that might hinder its exploitation or use for peaceful purposes"; (iii) limiting space activities to states and international organizations; and (iv) prohibiting the collection of intelligence data by satellites.

The cynicism with which Western delegates greeted the proposal to ban war propaganda in outer space was based on experience at the Geneva disarmament talks last year. A similar proposal had been debated, on Soviet initiative, and agreement had been reached. A draft had already been prepared for signing, when the Soviets suddenly changed their minds, and in the end they refused to sign. Speculation abounds, but a good many Western delegates attributed the switch to Chinese objections based, they think, on a particular provision which prohibited propagandizing for "wars of national liberation." Even aside from its political history, however, most Western delegates thought the proposal too broad and ambiguous to be useful.

Military Complications

The Soviet proposal for international consultation on potentially harmful experiments was a bit delicate for the U.S., since Project Starfish (our high altitude nuclear test series) and Project Westford (orbiting communications needles) have aroused widespread scientific controversy around the world. The U.S. moved a considerable way toward the Soviet position during the course of the meeting, agreeing to use the consultative facilities of the international Committee on Space Research (COSPAR). The Soviet position is still open, but they would apparently like to go beyond simple consultation to real international scientific agreement on potentially dangerous experiments.

As long as the space programs of

both the U.S. and the U.S.S.R. continue to have military implications, however, anything approaching an international scientific veto on space projects is unlikely to be accepted—by either side. Coexistence of military and civilian space programs in both countries was affirmed by the committee's explicit recognition of "aggressive" rather than the "military" as the antonym of the "peaceful" in its title. Neutral delegations, led by the United Arab Republic, supported nonetheless a binding prohibition on all military activity in outer space.

The proposal to exclude private companies from space activities—an obvious attack on the American Communications Satellite Corporation—also was a bit embarrassing to the U.S. Our official response was that the Soviets had taken an ideological position, were attempting to impose a single economic system (their own) on outer space, and that our system was none of their business. We were publicly supported by other Western states on the committee, but in private, both Western and neutral delegates appeared to share some of the Soviet's uneasiness about commercial exploitation—uneasiness shared by many in Congress as well.

The genesis of the Soviet position may be ideological, but many of their arguments and fears are practical. Private ownership, in their view, compromises the principle of the liability of the launching state for space vehicles. This was one reason why they refused to consider a separate treaty on liability, despite very close agreement with the U.S. on the specific contents of such a treaty. The U.S. sought to alleviate this worry by explicitly recognizing that private corporations active in outer space were to be chartered and regulated by the government, and by accepting liability for them. But the Soviets fear, nonetheless, a sort of "United Fruit Company" in outer space, and imagine a time when the U.S. would shrug, deliver a lecture on free enterprise, and claim it had no control over the activities of its citizens in outer space.

On this question the deadlock seems permanent unless the Soviet position changes, for the Communications Satellite Corporation is a going concern, and there is little chance that it will be dismantled.

The final point of disagreement came on the use of reconnaissance satellites (such as the Air Force's Samos) for intelligence gathering. The Soviets call this espionage, and want to prohibit it altogether. The U.S. calls it "observation to promote national security," and regards it as a legitimate and "peaceful" use of space that promotes international stability by closing the "information gap" between Communist and non-Communist countries. Since what we call the "information gap" amounts, in fact, to the overall Soviet security system, it is hardly surprising that they failed to welcome our arguments.

The Soviets also related reconnaissance satellites to a treaty on rescue and return of disabled astronauts and spacecraft, pointing out that no country would return an enemy intelligence satellite that fell by chance on its territory. The U.S., basically, agrees that this is a problem, but it would rather smudge over the issue, make de facto exceptions for the spy satellites, and proceed with the rescue and return treaty nonetheless. The Soviets, insisting on stark clarity, say the two are incompatible, and they won't take one without the other.

The failure to reach any agreement on legal principles does not augur well for international cooperation on scientific projects in outer space. The technical counterpart of the U.N. legal subcommittee opens meetings in Geneva next week, and the U.S.-U.S.S.R. bilateral agreements on weather and communications satellites are scheduled to go into effect on 20 May. These do not seem directly threatened by the legal stalemate, but the work of the scientists would be a good deal easier, and their positions less tenuous, had the politicians been able to record some progress.—ELINOR LANGER

Announcements

The National Cancer Institute and the U.S. Atomic Energy Commission have begun a joint project to investigate the roles of radiation, viruses, and chemicals as **causes of cancer**. The research is being conducted at Oak Ridge National Laboratories, Tennessee.

Films and other educational materials on **dermatology** may be bought or rented from the new Institute for Dermatologic Communication and Education. The institute was established in response to recommendations made last September at a meeting of the International Committee of Dermatology and the house of delegates of the

International League of Dermatological Societies. The institute's president is **Marion B. Sulzberger**, technical director of research for the U.S. Army Research and Development Command.

Detailed descriptions and price lists of the films are available from the institute's headquarters, 630 Ninth Ave., New York 36.

Massachusetts Institute of Technology will establish an advanced study center for practicing engineers and **engineering** professors under a \$5 million grant from the Alfred P. Sloan Foundation. The first classes are scheduled to begin next year. Plans call for formal study courses on recent advances in science and engineering concepts, designed to provide advanced education beyond formal degree programs. The center will be part of the M.I.T. school of engineering.

A standard method for evaluating **radiological health specialists** is being developed by the U.S. Public Health Service's radiological health division. A contract to set up a complete set of examinations has been assigned to the Professional Examination Service of the American Public Health Association. The project is expected to take 2 years to complete; it will provide basic standards by which federal, state, and local agencies may evaluate workers in radiological health. Further information is available from the Professional Examination Service, 1790 Broadway, New York 19.

Courses

The School of Mines and Metallurgy at the University of Missouri, Rolla, plans two consecutive programs in polymer chemistry:

A **polymer orientation** course is scheduled for 3–14 June and will cover basic organic and physical polymer chemistry. Laboratory and classroom sessions are planned. Applicants must have college-level knowledge of organic chemistry, and at least 1 year's experience in a chemical laboratory. Registration fee is \$100.

A conference on the **chemistry and physics of polymers** will take place 17–21 June at the university. Topics covered will include physical, chemical, and mechanical structure and properties of polymers; chemistry and physics of polyesters and polyamides; and addition polymers. Practical knowledge of polymers is required for this program. Registration fee is $40.

Campus housing and dining facilities are available for both programs. (W. Bosch, Missouri School of Mines and Metallurgy, Rolla)

A 12-month course in **reactor operations supervision** will begin 23 September at Oak Ridge National Laboratory, Oak Ridge, Tenn. The program is sponsored by the U.S. Atomic Energy Commission, and is designed for international participation. It provides basic instruction in nuclear engineering, with emphasis on reactor operation.

The course is open to U.S. and foreign graduate students. Applicants must have at least a bachelor's degree in chemistry, physics, metallurgy, mathematics, engineering physics, or engineering. Tuition is $2000.

U.S. citizens must be sponsored by the AEC, its contractors, or other appropriate government agencies. Applications may be sent to the Director, Education Division, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tenn.

Applicants from other countries must have their government's approval. Financial assistance, if needed, may be obtained through the Agency for International Development, the International Atomic Energy Agency, the Organization of American States, or the World Health Organization. Application must be made through the candidate's embassy or legation in Washington, to the AEC. Deadline for receipt of applications: *15 June.*

A laboratory course in **histochemistry** will be presented 10–22 June at the University of Kansas Medical Center. It will include principles, techniques and applications of histochemistry. Tuition is $75 per week; fellowships are available. (Department of Postgraduate Medical Education, University of Kansas School of Medicine, Kansas City 3)

Applications are being accepted for participation in the University of Oklahoma's conferences on advanced **computer science and related mathematics** or on **biostatistics and computer science.** The courses are scheduled for 27 June to 23 July, and are open to college professors who have a knowledge of computer programming. Forty-six stipends of $405, plus partial travel allowances will be provided. The courses will include work on advanced program techniques, numerical analysis, Monte Carlo methods, logical programming, compiler construction, linear programming, mathematical models, and computability. (R. V. Andree, Department of Mathematics, University of Oklahoma, Norman)

The chemical division of the American Society for Quality Control will present a course 20–22 June, at the University of Rochester, N.Y. It will review **control techniques** now in use, and will introduce new techniques that use cumulative sum charts, exponentially weighted means, and methods of adaptive quality control. The fee for the course is $120. (R. J. Malach, Color Technology Div., Kodak Park, Bldg. 65, Eastman Kodak Co., Rochester 4, N.Y.)

A graduate course in **marine science** will be held 4 June to 17 August at the University of Texas Institute of Marine Sciences. The program will include general marine science, microbiology, geology, icthyology, and research problems. The course will conclude with an 8-day trip to the coral reefs at Veracruz, Mexico, to study tropical marine life. Ten NSF stipends of $300 will be awarded, plus dependent and travel allowances. Part-time research assistantships are also available. (H. T. Odum, Director, University of Texas Marine Institute, Port Aransas)

Meeting Notes

Papers are invited in all branches of **applied spectroscopy** for a symposium scheduled 16–18 September, in Ottawa, Ontario, Canada. The meeting is sponsored by the Canadian Association for Applied Spectroscopy. Deadline for receipt of titles and abstracts: *3 June*. (J. Kelly, The Steel Company of Canada, Metallurgical and Chemical Laboratory, Wilcox St., Hamilton, Ont.)

The date of the 1964 annual meeting of the **Electron Microscope Society of America**, to be held in Detroit, has been changed to 13–17 October to avoid conflict with the Third European Regional Conference on Electron Microscopy, which will be held in Prague, in August 1964.

Papers are being solicited by the Institute of Electrical and Electronic Engineers for the 1963 Northeast **Electronics Research and Engineering**

Meeting (NEREM), 4–6 November, in Boston, Mass. The papers should describe significant original advances in engineering research and development. Speakers are requested to submit a 35- to 50-word abstract and a summary of 600 to 1000 words. Deadline: *7 June*. (A. O. McCoubrey, 313 Washington St., Newton 58, Mass.)

Scientists in the News

Charles C. Sprague has been appointed dean of the Tulane University School of Medicine. Sprague, professor of medicine and director of the hematology laboratory at Tulane, succeeds **M. E. Lapham**, who was named provost of the university.

At the University of Michigan:

Margaret J. Hunter, research biophysicist at the Institute of Science and Technology, has been appointed associate professor of biological chemistry.

Kenneth E. Jochim, head of the biodynamics section, defense research laboratories at General Motors Corp., has been named professor of physiology.

John P. Dawson, of the Harvard University law school, will be visiting professor of law for the fall semester.

Kenneth S. Pitzer, president of Rice University, has been awarded the 12th Priestly Memorial award of Dickinson College for "contributions to the welfare of mankind through chemistry."

Frederick Coulston has been appointed professor of experimental pathology and toxicology at the Albany Medical College of Union University. He previously served at the Sterling-Winthrop Research Institute as director of experimental pathology and toxicology and as assistant director of the biology division.

Rachmiel Levine, chairman of the department of medicine at New York Medical College has been elected 1963 president of the Association for Research of Nervous and Mental Diseases.

Frederick B. Llewellyn has been appointed science adviser to and deputy for the director of the University of Michigan Institute of Science and Technology. Llewellyn, who joined the institute in 1961, previously served as executive secretary to the President's Science Advisory Committee.

New president of the National Society of Professional Engineers is **John H. Stufflebean**, chief engineer at Blanton and Cole, Tucson, Ariz.

Franz Sondheimer, head of the organic chemistry department at the Weizmann Institute of Science, New York, has been named recipient of the Corday-Morgan medal for his "contributions to the chemistry of natural products." The Chemical Society of London's award includes a silver medal and an honorarium of 400 guineas ($1176).

New director of the Dounreay Experimental Reactor Establishment, United Kingdom Atomic Energy Authority, is **Roy R. Matthews**, formerly a deputy director in the Authority's reactor group. He succeeds **R. Hurst**, who will become director of research of the British Ship Research Association.

Recent Deaths

Wilfred H. Crook, 75; retired chairman of the department of economics, Colgate University; 16 April.

James A. Doull, 73; director of the Leonard Wood Memorial for the Eradication of Leprosy, Washington; 6 April.

Scott V. Eaton, 77; associate professor emeritus of botany at the University of Chicago; 16 February.

Frank G. Helyar, 80; retired director of resident instruction and professor of animal husbandry, Rutgers University; 15 April.

Helen Stephens Noble, 70; retired associate professor of higher mathematics, Fairleigh Dickinson University; 29 April.

Louis A. Pardue, 62; former vice president and director of graduate studies at Virginia Polytechnic Institute; 27 April.

William H. R. Shaw, 38; chemistry professor at Arizona State University; 24 April.

Abraham Segal, 63; former director of urology, Jewish Hospital of Brooklyn; 19 April.

Gilbert L. Stout, 64; chief of the bureau of plant pathology, California Department of Agriculture; 19 April.

Theodore Von Karman, 81; space and aeronautical engineer, Aachen, Germany, 6 May.

Carl J. Wiggers, 79; professor emeritus at Western Reserve University's department of physiology; 28 April.