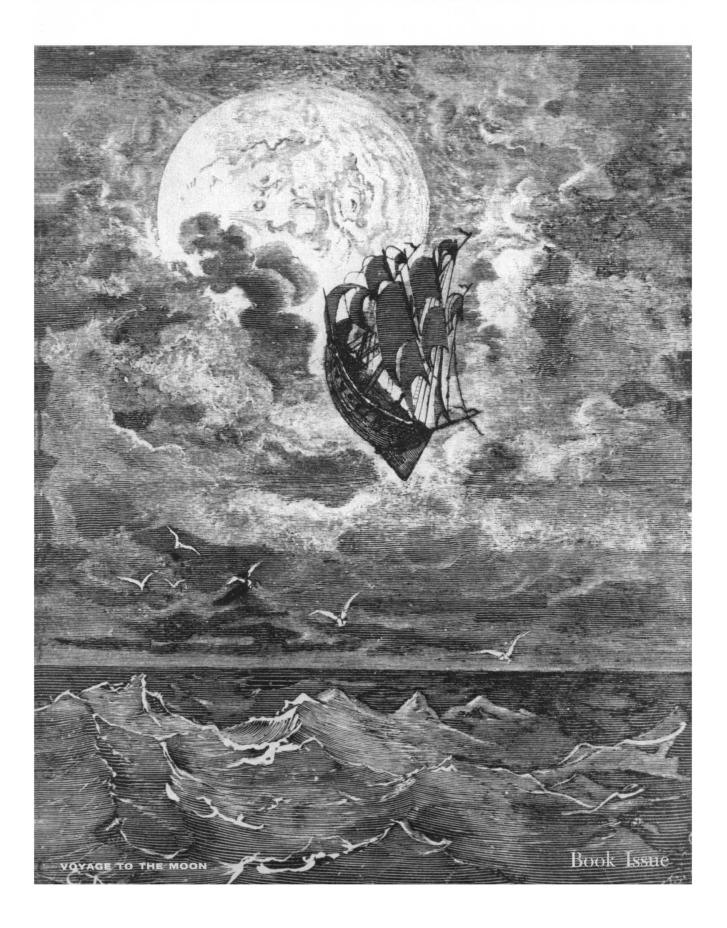


AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





We have more than 3000 reasons why you should order a NBCo Catalog.

NBCo.'s catalog contains more than 3000 items. Many of the biochemicals are standard items you use every day. Many more of them are brand new ones that could shed new light on your research projects. Maybe even speed things up. Of course, the biochemicals you order from NBCo. are always the purest, finest ones you can buy. The prices are the lowest possible. The delivery is the fastest: 24 hours anywhere in the continental U.S.A.; 80 hours anywhere in the world. Order your NBCo. catalog today. It's free, and besides there are more than 3000 reasons why you should.

Please send me NBCo.'s latest catalog containing more than 3000 items:

Name

Orc	janiz	atio	n

Address___

City

State

Zip



12 May 1967 Vol. 156, No. 3776

LETTERS	 Removal of Oil Slicks on Oceans: K. Hickman; Are Better Schools Better?: A. M. Mood et al.; I. Katz; R. C. Nichols; Christian Impact on Ecology: E. S. Feenstra; L. White, Jr.; R. Baserga; C. Emiliani and S. Niskin; Economics of Reprints: M. Mota; The Imperturbable Feline: H. W. Pittenger 	731
EDITORIAL	Excessive Educational Pressures	741
ARTICLES	Sounder Thinking through Clearer Writing: F. P. Woodford	743
	Librarians against Machines: J. H. Shera	746
	International Cooperation: The New ICSU Program on Critical Data: H. Brown	75 1
	The National Standard Reference Data System: E. L. Brady and M. B. Wallenstein	754
	Proposal for an Institution for Scientific Judgment: A. Kantrowitz	763
NEWS AND COMMENT	Birth Control: U.S. Programs Slow To Start	765
	France: Plan To Strengthen Computer Industry	767
	Dædalus: A Decade of Journeys from the Labyrinth	770
BOOK REVIEWS	On Writing the History of Our Monumental Enterprises: T. P. Hughes, O. E. Anderson, Jr.; other reviews by M. J. Klein, A. J. Ihde, E. Hutchisson, E. P. Gross, A. O. Barut, J. A. O'Keefe, F. Q. Orral, L. H. Aller, L. M. Gould, E. M. Baldwin	7 74
	A Study in European Prehistory: L. G. Freeman; other reviews by M. W. Stirling, W. L. Straus, Jr., I. Kopytoff, L. Nader	787
	Life in Wytham Woods: L C. Cole; other reviews by P. I. Yakovlev, D. Chitty, C. L. Camp, M. L. Jones et al., L. Constance, I. M. Lamb, F. Rosenblatt	792
	Mankind by Design: G. Hardin; other reviews by E. P. Wigner	797

SCIENCE

BOARD OF DIRECTORS	ALFRED S. ROMER Retiring President, Chairr	nan President		WALTER ORR ROBERTS President-Elect	BARRY COMMONER DAVID R. GODDARD	HUDSON HOAGLAND GERALD HOLTON
VICE PRESIDENTS AND SECTION SECRETARIES	MATHEMATICS (A) A. M. Gleason Wallace Givens		(B) avens, Jr S. Ballard	CHEMISTRY (Herman F. M Milton Orchin	ark	ASTRONOMY (D) John S. Hall Frank Bradshaw Wood
	ANTHROPOLOGY (H) Cora Du Bois Anthony Leeds	PSYCHOLOGY (1) Leo J. Postman Frank W. Finger	David 1	AND ECONOMIC SCIENCE ruman B. Skolnikoff	S (K) HISTORY AND PH Peter J. Caws	HILOSOPHY OF SCIENCE (L
	PHARMACEUTICAL SCIENC Curtis Waldon Joseph P. Buckley	ES (Np) AGRICUL Richard Ned D.		INDUSTRIAL Allen V. Asti Burton V. De	1	EDUCATION (Q) Herbert A. Smith Frederic B. Dutton
DIVISIONS		SION eanor Viereck ecutive Secretary	PACIFIC Adolph Hecht President	Robert C. Miller		CKY MOUNTAIN DIVISION Marlowe G. Anderson Executive Secretary

	Tissue, Psyche, and Motive: V. E. Bixenstine; other reviews by I. P. Howard, R. L. Gregory	799
	Ontological Debate in Logic: A. E. Blumberg; other reviews by A. Newell, R. K. Lindsay, R. Zwanzig, I. Kelson	802
	Analyzing an Industrial Economy: G. Fromm; other reviews by M. Kranzberg, G. Basalla, H. E. Thomas	806
	Concerning an Important Invention: A. Court; other reviews by G. E. Allen, H. Woolf, D. Wolfle, A. G. Drachmann, R. E. Schofield	812
	Books Received	817
	Index of Books Reviewed in Science	851
REPORTS	Cliftonite in Meteorites: A Proposed Origin: R. Brett and G. T. Higgins	819
	DDT Residues in an East Coast Estuary: A Case of Biological Concentration of a Persistent Insecticide: G. M. Woodwell, C. F. Wurster, Jr., P. A. Isaacson	821
	Bacteriophage S13: A Seventh Gene: I. Tessman et al.	824
	Optical Differentiation of Amoebic Ectoplasm and Endoplasmic Flow: W. R. Baker, Jr., and J. A. Johnston, Jr.	825
	Humoral Agent from Calf Lung Producing Pulmonary Arterial Vasoconstriction: E. D. Robin et al.	827
	Geochemical Evidence of Present-Day Serpentinization: I. Barnes, V. C. LaMarche, Jr., G. Himmelberg	830
	Virus-Induced Erythropoiesis in Hypertransfused-Polycythemic Mice: E. A. Mirand	832
	Attention Shift and Errorless Reversal Learning by the California Sea Lion: R. J. Schusterman	833
	Maternal Behavior in the Domestic Cock under the Influence of Alcohol: J. K. Kovach	835
	Technical Comment: Tektites are Terrestrial?: C. M. Botley and A. Dauvillier	837
MEETINGS	Transplutonium Elements: O. L. Keller, Jr.; Calendar of Events	838

PAUL E. KLOPSTEG Treasurer MINA S. REES ATHELSTAN F. SPILHAUS JOHN A. WHEELER

GEOLOGY AND GEOGRAPHY (E) Louis Quam Richard H. Mahard ENGINEERING (M) Paul Rosenberg Newman A. Hall INFORMATION AND COMMUNICATION (T) Phyllis V. Parkins Heen H. Stewart

ZOOLOGICAL SCIENCES (F) Colin S. Pittendrigh David E. Davis MEDICAL SCIENCES (N) Julius H. Comroe Robert E. Dison

BOTANICAL SCIENCES (G) William C. Steere Warren H. Wagner DENTISTRY (Nd) Lester R. Cahn Richard S. Manly STATISTICS (U) George E. P. Box Rosedith Sitgreaves

DAEL WOLFLE Executive Officer

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

COVER

A mid-19th century illustration, "A Voyage to the Moon," depicted man's dream of lifting himself off the earth and venturing out toward the moon, the sun, the planets, and even the stars. See review of *The New Ocean*: A History of Project Mercury, page 774. [Paul Gustave Dore (Bella Landauer Collection, Library of Congress)]



New and recent

METHODS OF WOOD CHEMISTRY

Volumes I & II

By B. L. BROWNING, The Institute of Paper Chemistry. Here in readily available form are all of the important experimental methods that are used in studying the composition and chemistry of wood, wood components, and certain derived products. Volume I is divided into three parts: Introduction and Preparation of Materials; Extraneous Components; and General Procedures. Volume II is divided into three parts: Cellulose; Noncellulose Carbohydrates; and Lignin. Vol. I: 1967. 384 pages. \$15.00. Vol. II: 1967. 498 pages. \$18.75.

TOPICS IN THE BIOLOGY OF AGING

Edited by P. L. KROHN, Professor of Endocrinology, University of Birmingham. The first of a scries of monographs from the Salk Institute for Biological Studies. Here are given the papers and discussions presented at a symposium held at the Institute in November 1965, at which specialists examined and evaluated some of the most recent work on the biology of aging. 1966. 177 pages. \$9.75.

EXPERIMENTAL METHODS OF MATERIALS RESEARCH

Advances in Materials Research-Vol. I

Edited by HERBERT HERMAN, Department of Metallurgy, University of Pennsylvania. The first volume of a new series that provides a forum in which reviewers present up-to-date accounts of the activities, the barriers, and the victories in materials science. This volume includes articles on the following topics: X-Ray Diffraction; Neutron Diffraction; Electron Microscopy; Field-Emission Microscopy; Electron-Probe Microanalysis; Applications of the Mössbauer Effect to Problems in Materials Science; Anclastic Techniques: Iron, A Case History; Low Temperature Deformation Techniques; Determination of the Stored Energy of Deformation of Metals and Alloys; Some Experimental Aspects of Diffusion in Metals. 1967. 316 pages. \$14.95.

PHYSICAL CHEMISTRY OF SURFACES Second Edition

By ARTHUR W. ADAMSON, University of Southern California, Los Angeles. A thoroughly readable revision of this text and reference that takes into account the major developments in the field since the first edition was published. The topics include: Capillarity; The Nature and Thermodynamics of Liquid Interfaces; Surface Films on Liquid Substrates; Electrical Aspects of Surface Chemistry; Surfaces of Solids; Long Range Forces; The Solid-Liquid Interface-Contact Angle-Nucleation; The Solid-Liquid Interface. Adsorption from Solution; Friction and Lubrication; Adhesion. 1967. 748 pages. \$15.00.

THE X-RAY DETERMINATION OF ELECTRON CHARGE DENSITY AND MOMENTUM DISTRIBUTION (Selected Topics in Solid State Physics, Volume 6)

By RICHARD J. WEISS, *Physicist, U. S. Army Materials Research Agency.* Provides the experimentalist with all the essential theoretical details necessary to make accurate and absolute X-ray scattering factor measurements. A North-Holland (Interscience) book. 1966. 196 pages. \$10.50.

INVERTEBRATE ZOOLOGY, Volume I

Sponges to Mollusks and Annelids; Arthropods; Lophophorates and Deuterostomes

By ALFRED KAESTNER, University of Munich and Natural History Collections of Bavaria. Translated and Adapted by HERBERT W. LEVI, Museum of Comparative Zoology, Harvard University, and LORNA R. LEVI. More than a survey of anatomy and systematics, this book recognizes the function of the structures, habits, and adaptations of species, and reflects the diversity of each group. Contents: Introduction. Reference Works for the Study of Invertebrate Animals. Phylum Mesozoa. Phylum Porifera, Sponges. The Coelenterates: Phylum Cnidaria, Class Hydrozoa. Cnidaria: The Scyphozoa and Anthozoa. Phylum Ctenophora, Comb Jellies. Bilateria. Phylum Platyhelminthes, Flatworms. Entroproota (or Kamptozoa). 1967. Approx. 576 pages. \$27.50.

INTERSCIENCE PUBLISHERS a division of JOHN WILEY & SONS, Inc.

Interscience books



TOPICS IN MEDICINAL CHEMISTRY

Volume 1

Edited by J. L. RABINOWITZ and R. M. MYERSON, both of Veterans Administration Hospital, Philadelphia, Pennsylvania. The first of a series of volumes on all the important categories of medicinals, including discussion of the biomedical aspects of each subject. The book is divided into three parts: Theoretical Concepts; Applied Medicinal Chemistry; and Clinical Medicinal Chemistry. 1967. 464 pages. \$17.75.

PROGRESS IN PHYSICAL ORGANIC CHEMISTRY Volume IV

Editors: ANDREW STREITWIESER, Jr., University of California, Berkeley; and ROBERT W. TAFT, University of California, Irvine. This new volume includes the following topics: Mechanism and Catalysis for the Hydrolysis of Acetals, Ketals, and Ortho Esters; Ionic Reactions in Acetonitrile; Nucleophilic Displacements on Peroxide Oxygen and Related Reactions; Conformation and Structure as Studied by Electron Spin Resonance Spectroscopy; and Solvolysis in Water. 1967. 303 pages. \$15.50.

TRANSMISSION OF VIRUSES BY THE WATER ROUTE

By GERALD BERG, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. Comprises the papers presented at a symposium sponsored by the Research Branch of the Division of Water Supply and Pollution Control of the Public Health Service, U.S. Department of Health, Education, and Welfare (now the Federal Water Pollution Control Administration, U.S. Dept. of the Interior). The volume gives a thorough, well-rounded picture of current knowledge and thinking in important areas relating to the problem of virus transmission by water. Each of the volume's five parts corresponds to a session of the symposium, with each chapter devoted to a specific aspect of a particular area. However, the book *in toto* contains more material than was included at the symposium. 1967. 484 pages. \$15.00.

NIELS BOHR

His Life and Work as Seen by His Friends and Colleagues

Edited by STEFAN ROZENTAL.

Presents a many-sided picture of Niels Bohr's development and activities through reports by a number of people close to him-family, school and university friends, and scientific collaborators. The reader gets an idea of the kind of man he was and the significance that his work had for physics and for other sciences. **A North-Holland (Interscience) book.** 1967. 355 pages. \$9.00.

SPECTROSCOPIC CALCULATIONS FOR A MULTIELECTRON ION

By H. H. THEISSING and P. J. CAPLAN, both at the U.S. Army Electronics Command, Fort Monmouth, N. J. With the advent of quantum electronics, many scientists have felt the need to enlarge their knowledge of spectroscopic calculations—including calculation of energies, wave functions and transition probabilities in multielectron ions, and spin orbit and crystal-field interactions. Here is a book designed to guide the scientist in these new subject areas. 1967. 209 pages. \$10.00.

CELL DIFFERENTIATION AND MORPHOGENESIS

By W. BEERMANN, C. W. WARDLAW, R. J. GAUTH-ERET, V. B. WIGGLESWORTH, P. D. NIEUWKOOP, E. WOLFF, and J. A. D. ZEEVAART. A selection of writings taken from the International Lecture Course, held at Wageningen, The Netherlands in April, 1965. A North-Holland (Interscience) book. 1966. 209 pages. \$9.75.

VIRUSES OF PLANTS

Edited by A. B. R. BEEMSTER, Institute of Phytopathological Research, Wageningen, The Netherlands; and JEANNE DIJKSTRA, Laboratory of Virology, Wageningen, The Netherlands. Gives the proceedings of the Conference on Plant Viruses held at Wageningen, The Netherlands, in July, 1965. A North-Holland (Interscience) book. 1966. 342 pages. \$12.75.

605 Third Avenue, New York, N.Y. 10016



New and recent

THE MATHEMATICAL APPROACH TO BIOLOGY AND MEDICINE

By NORMAN T. J. BAILEY, Cornell University and Sloan-Kettering Institute for Cancer Research. Describes many of the potentialities of the mathematical approach to biology and medicine that are of great importance. Mathematical, statistical and computing methods are treated. Contents: PART I: GENERAL PRINCIPLES AND TECHNIQUES. The Necessity of Mathematics. The Role of Probability and Statistics. The Process of Scientific Research. The Scope of Operational Research. The Influence of Automatic Computers. Teams, Projects and Organizations. PART II: SPECIAL APPLI-CATIONS. (One of the Dixon Series in Quantitative Methods for Biologists and Medical Scientists). 1967. 296 pages. \$8.75.

PHYSICS AND TECHNOLOGY OF SEMICONDUCTOR DEVICES

By A. S. GROVE, Fairchild Semiconductor Research and Development Laboratory and University of California, Berkeley. A thorough treatment of semiconductor devices with particular emphasis on modern silicon devices which form the basis of integrated circuits. 1967. 366 pages. \$12.95.

GROWTH OF KNOWLEDGE

Readings on Organization and Retrieval of Information

Edited by M. KOCHEN, Mental Health Research Institute, The University of Michigan. A selection of essays of current activities in information retrieval. Stresses the importance of evaluating and synthesizing newly generated knowledge into a coherent overall image. (In the Library of Behavior Science Series.) 1967. Approx. 500 pages. Prob. \$12.95.

INTRODUCTION TO NUMERICAL METHODS AND FORTRAN PROGRAMMING

By THOMAS RICHARD McCALLA, Naval Research Laboratory. Offers a unified presentation of numerical methods and FORTRAN programming, using simple standardized notation throughout. 1967. 359 pages. \$7.95.

DESIGN OF ACTIVE-SITE-DIRECTED IRREVERSIBLE ENZYME INHIBITORS The Organic Chemistry of the Enzymic Active-Site

By B. R. BAKER, University of California, Santa Barbara. The first book on design of enzyme inhibitors that considers the species and tissue specificity problem, and the design of "labels" for enzyme active sites. 1967. Approx. 352 pages. \$13.50.

MECHANISMS OF INORGANIC REACTIONS A Study of Metal Complexes in Solution Second Edition

By FRED BASOLO and RALPH G. PEARSON, both of Northwestern University. Treats modern inorganic chemistry with emphasis on chemical reactions rather than structure. 1967. 701 pages. \$17.95.

ULTRAMAFIC AND RELATED ROCKS

Edited by PETER J. WYLLIE, The University of Chicago. 33 contributors to 41 articles incorporated into the book in "sequential" format.

Describes the variety of rock types and of field and petrographic association, the variety of approaches used to study them, and the processes involved in their origin and formation. 1967. Approx. 440 pages. Prob. \$19.95.

REGULATION AND CONTROL IN LIVING SYSTEMS

Edited by H. KALMUS, The University of London. Presents, in contemporary form, life from an Aristotelian (holistic) point of view, which complements and—up to a point—is opposed by the now prevalent Democritian (atomistic) approach. It employs the engineering approach to the study of life and attempts to restore communication between engineers and biologists. 1967. 465 pages. \$13.75.

QUANTUM ELECTRONICS

By AMNON YARIV, California Institute of Technology. A comprehensive account of the quantum mechanical treatment of the interaction of radiation and atomic systems and the theory of devices that utilize these phenomena. 1967. Approx. 489 pages. \$14.95.

TAXONOMY: A Text and Reference Book

By RICHARD E. BLACKWELDER, Southern Illinois University. Thoroughly covers the field from the simple practical aspects to the most complex and theoretical. Treats philosophy, methods problems, limitations, reference materials, and nomenclature. 1967. Approx. 720 pages. \$19.95.

APPLIED STATISTICS a handbook for practical work Volumes I & II

By I. M. CHAKRAVARTI, University of North Carolina; R. G. LAHA, The Catholic University of America; and J. ROY, The Pennsylvania State University. A clear exposition of basic statistical methods, illustrated by workedout examples and many exercises drawn from various fields of application. The four parts cover: Techniques of Computation; Descriptive Methods; Statistical Inference; and Planning of Surveys and Experiments. (Wiley Series in Probability and Mathematical Statistics). Vol. 1: 1967. Approx. 480 pages. \$12.95. Vol. 2: 1967. Approx. 200 pages. \$9.00.

EXPERIMENTS IN MODERN GENETICS

By GEORGE A. HUDOCK, Indiana University. 20 selected laboratory exercises in genetics using organisms ranging from viruses through bacteria to algae and fruit flies. Emphasis is strongly quantitative with each problem to be solved experimentally. May be used at almost any level of training in genetics. 1967. 100 pages. \$4.50.

JOHN WILEY & SONS, Inc., 605 Third Avenue, New York, N. Y.

(Wiley books

PLANETS, STARS, AND GALAXIES

An Introduction to Astronomy

Second Edition

By STUART J. INGLIS, Chabot College. A revised edition of an elementary book for students with little background in science and mathematics. Stresses methods of observing astronomical objects, interpretation of these observations, and material on the evolutionary processes in stars and galaxies. 1967. 480 pages. \$7.95.

GENERAL VIROLOGY

Second Edition

By S. E. LURIA, Massachusetts Institute of Technology; and JAMES E. DARNELL, Jr., Albert Einstein College of Medicine, New York, N.Y. A description of virology as an independent experimental biological science. Integrates work in bacterial, animal, and plant viruses into a composite picture of the operation of viruses as genetic and biochemical entities. 1967. 512 pages. \$12.50.

FUNDAMENTAL PHYSICS

Second Edition

By JAY OREAR, Cornell University. This new edition of "Orear" gives special emphasis to quantum mechanics and relativity. It has been thoroughly updated incorporating new advances, especially in elementary particles, quasars, and lasers. 1967. 472 pages. \$8.95.

THE CHEMISTRY OF BORON AND ITS COMPOUNDS

Edited by EARL L. MUETTERTIES, E. I. duPont de Nemours & Co., Inc., Wilmington, Delaware. Here is the first book that presents an authoritative and systematic introduction to the chemistry of boron. The book covers the major areas of current research in a critical fashion encompassing structure, dynamic reactivity, and theoretical considerations. 1967. 699 pages. \$27.50.



A TEXTBOOK OF PHYSIOLOGICAL PSYCHOLOGY

By SEBASTIAN P. GROSSMAN, The University of Chicago. A thorough review and analysis of research and theoretical notions concerned with the physiological, anatomical, and pharmacological basis of behavior. It shows how information from these diverse fields can be used to study the human brain and to gain a more thorough understanding of behavior under normal as well as abnormal circumstances. 1967. 932 pages. \$14.95.

EARLY BEHAVIOR

Comparative and Developmental Approach

Edited by HAROLD W. STEVENSON, University of Minnesota; ECKHARD H. HESS, University of Chicago; and HARRIET L. RHEINGOLD, University of North Carolina. A collection of research papers on the early development of behavior in different species of animals, including man. Each chapter presents the research findings of a competent and recognized investigator and illustrates the many different approaches to this subject. 1967. 303 pages. \$9.75.

BIOLOGICAL FOUNDATIONS OF LANGUAGE By ERIC H. LENNEBERG, University of Michigan. With Appendices by NOAM CHOMSKY and OTTO MARX. Looks at language from a point of view that is both very new and very old. It seeks to reinstate the thesis, challenged in recent years, that man's language capacity is based on specific, biologically determined propensities, including anatomy, physiology, and species-specific ontogeny. 1967. 489 pages. \$14.95.

TABLES OF PHYSICAL AND CHEMICAL CONSTANTS And Some Mathematical Functions Thirteenth Edition

Originally compiled by G. W. C. KAYE and T. H. LABY; Now prepared under the direction of an editorial committee. A modernized new edition of this handy collection of the more reliable and recent determinations of some of the important physical and chemical constants. 1967. 249 pages. \$5.75.

Order from your bookseller or use this handy coupon for direct service

Mr. I. Rosen JOHN WILEY & SONS, INC. 605 Third Avenue, New York, N. Y. 10016

Please send me the following books on ten-day approval. I agree to pay for the books within ten days or return them in good condition. (Wiley pays postage on orders accompanied by remittance.)

<u>.</u>		
		· · · · · · · · · · · · · · · · · · ·
NAME		
ADDRESS	、 	·
CITY	STATE	ZIP
12 MAY 1967		689

When you order a LINC-8 Computer for 60 day delivery, you get all of it.

That says a lot.

For LINC-8 is more than just a computer. LINC-8 is a complete, integrated, $1.5 \mu sec$, 4096 12-bit word laboratory data handling system with paper tape punch and reader, page printer, built-in A to D converter, oscilloscope display, dual magnetic DECtape unit, relay buffer, buffered input-output lines, an ASR-33 tele-typewriter, and two complete software systems (one for the LINC, one for the PDP-8 which, together, make up LINC-8).

Delivered. In 60 days. And that means, if you want a

full, working, data processing system installed and on-line by the first day of your Fall semester, you've got it.

For physics. Physiology. Psychology. Research in hearing, or surgery. Research in pharmacology. Linguistics.

The original LINC was conceived at MIT to be an easy to use, powerful, general purpose laboratory system. LINC-8 retains the features of the original LINC, except it is five times faster, has twice as much memory, and costs less money. \$38,500. Complete. In 60 days.



DIGITAL EQUIPMENT CORPORATION, Maynard, Massachusetts 01754. Telephone: (617) 897-8821 • Cambridge, Mass. • New Haven • Washington, D.C. • Parsippany, N.J. • Rochester, N.Y. • Philadelphia • Huntsville • Pittsburgh • Chicago • Denver • Ann Arbor • Houston • Los Angeles • Palo Alto • Seattle • Carleton Place and Toronto, Ont. • Reading, England • Paris, France • Munich and Cologne, Germany • Sydney and West Perth, Australia • Modules distributed also through Allied Radio



STATISTICS IN BIOLOGY, Volume I. By Chester 1. I. Bliss. 576 pages, \$15.50.

First of a three-volume series describing the statistical methods useful in biology and natural science. This volume covers material from the Binomial Distribution through the Analysis of Fourfold Tables, Normal Distributions and Linear Regression. No prior knowledge of statistics necessary.

2. NERVE, MUSCLE, AND SYNAPSE. By Bernard Katz. McGraw-Hill Series in the New Biology. 208 pages, \$4.95.

Introduces the structural and physico-chemical properties of nerves, muscles, and synapses, as well as their functional relationships. Discusses the development of modern theoretical concepts and the experimental evidence behind them.

3. VECTORS, MATRICES AND GROUP THEORY FOR SCIENTISTS AND ENGINEERS. By Charles Hollingsworth. 384 pags, \$10.50.

Introduces to scientists and engineers some of the major areas of mathematics beyond the calculus. Examples included cover both chemistry and physics.

4. BASIC TABLES IN PHYSICS. By John Robson. 384 pages, \$3.95 (soft-cover).

Offers the undergraduate a compact collection of tables combining basic mathematical data and many of the physical properties of materials.

5. REFLECTIONS ON RESEARCH AND THE FU-TURE OF MEDICINE. Merck, Sharp & Dohme Research Laboratories. Edited by Charles E. Lyght, M.D. 210 pp., 45 illus., \$9.95.

A collection of significant papers which consider the impact of research on the future of medicine. Included are talks by some of the world's most distinguished scientists, among them several Nobel Prize winners, who discuss advances in such topics as Molecular Biology, Degenerative Diseases, and Autoimmune Disease. This volume will be welcomed by many physicians who have already read excerpts from the book in "Medical World News," as well as by all persons interested in the future of scientific medicine.

6. THE METABOLIC BASIS OF INHERITED DIS-EASE, Second Edition. Edited by John B. Stanbury, M.D., James B. Wyngaarden, M.D., and Donald S. Fredrickson, M.D. 1434 pp., 556 illus. plus 12 figs. on 2 color plates, \$35.00.

Long recognized as the most valuable single source in its field, Stanbury is now available in a thoroughly updated second edition. Outstanding chapters include new findings in information transfer, coding, and protein synthesis; a completely new, systematic approach to the understanding of familial increases in plasma lipoproteins; and three new diseases of the urea cycle.

7. PATHOLOGY OF THE NERVOUS SYSTEM. Editor: Jeff Minckler, M.D. Coeditors: Orville T. Bailey, M.D.; Irwin Feigin, M.D.; George Jervis, M.D.; Richard Lindenberg, M.D.; Karl Neubuerger, M.D. Volume I-Approx. 1200 pages, 1117 illus. In press.

An encyclopedic two-volume reference work, written by one-hundred fifty-two internationally prominent contribu-

tors in cooperation with Dr. Jeff Minckler, Editor, and five Coeditors, this book represents a bold step in making the world's present store of information in this area available to neuropathologists, neurologists, and pathologists everywhere.

COMMUNICATION SYSTEMS AND 8. TECH-NIOUES. By Mischa Schwartz, William R. Bennett, and Seymour Stein. McGraw-Hill Inter-University Electronics Series. 640 pages, \$16.50.

Covers a wide range of topics in modern communication theory and systems, stressing practical realizations of the theories developed and containing many useful summaries of significant results.

9. AMPLIFIER HANDBOOK. Edited by R. F. Shea. 1496 pages, 1423 illus., \$37.50.

This definitive, encyclopedic work covers all types of amplifiers operating along the entire range of the frequency and power spectrums. The approach is practical throughout, and reference data useful to practicing engineers, scientists, technicians, and students have been collected from many sources. All topics related to amplifiers are included.

10. INORGANIC SYNTHESIS, Volume X. Edited by Earl L. Muetterties. 224 pages, \$12.50 (tent.).

Latest addition to the Inorganic Synthesis Series, Volume X contains well over fifty syntheses prepared by a truly international group of contributors. Synthetic procedures cover three areas: the chemistry of metal compounds, particularly transition metals; aspects of boron chemistry; and the chemistry of nitrogen, phosphorous, and arsenic. Syntheses selected on the basis of potential value to the scientific community.

11. Other volumes in the Inorganic Synthesis Series include:

I by Harold S. Booth. 197 pages, \$7.95. II by W. C. Fernelius. 293 pages, \$7.95. III by L. F. Audrieth. 230 pages, \$7.95. IV by John C. Bailar. 218 pages, \$7.95. V by Therald Moeller. 265 pages, \$7.95. VI by Eugene G. Rochow. 272 pages, \$7.95. VII by Jacob Kleinberg. 352 pages, \$9.50. VIII by Henry F. Holtzclaw, Jr. 320 pages, \$12.50. IX by S. Y. Tyree, Jr. In Press. ---- 10 DAYS FREE EXAMINATION -----

BOX 402 HIGHTST		OOK CO					
proval. In for deliver	10 days y costs, sts if yo	I will re and return ou remit w	emit fo m unw vith thi	r book(anted b	s) I kee ook(s) r	amination o p, plus few oostpaid. (W return priv	cents
1 2	3	4 5	6	7	8	9 10	11
I II	ш	IV	v	VI	VП	VIII	IX
NAME (pr ADDRESS CITY	S					······	
					ZIP		
		ms outsid			34-0		31374



Observation of molecular vibrations in tunneling

Physicists from the Scientific Research Staff at Ford Motor Company recently developed a device to demonstrate a new phenomenon in solid state physics.

The device, called a Solid State Spectrometer, represents a significant development in our ability to detect microscopic amounts of chemical materials.

The phenomenon, known as inelastic electron tunneling, is capable of seeing minute amounts of molecular material which are in the adsorbed state, having attached themselves to the surface of a thin, insulating film. Experiments have shown that less than a single layer of these impurities can be detected.

In the experiment, an electron current is passed through the thin film on which the impurities have been adsorbed. The ability of the film to pass current was measurably affected by the presence of the impurity molecules.

Tunneling electrons were found to interact with vibrational states of molecules included at a metaloxide interface. There were increases in the conductance G of the junction occurring at various characteristic voltages V. These voltages correspond to vibrational frequencies v of molecules contained in the junction, i.e., eV = hv.

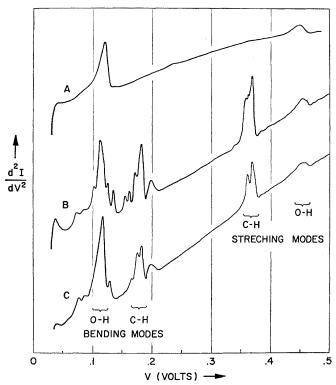
These increases represent changes in G of about 1% and correspond to the onset of new tunneling channels paralleling the bulk of the tunneling current. The characteristic voltages occur when molecular impurities are introduced in the junction, usually after formation of the oxide insulating barrier and before deposition of the top metal film. Coverage is estimated to be of the order of one monolayer.

A spectrum was obtained that was characteristic of the particular molecular species. The spectra reflect the internal molecular vibrations.

Traditional methods of obtaining this information have used infrared light of varying wave length to probe the sample. In this new method, electrons take the place of light waves and the voltage applied to drive current through the insulating film takes the place of wave length.

Compared to infrared absorption, electrons are effected more than a thousand times more efficiently in this method, which accounts for its high sensitivity.

Besides providing a new analytical tool, the Solid State Spectrometer permits experimentation on molecules in the adsorbed state, which will be of importance to the field of surface chemistry. It also represents an advance in understanding the basic processes related to electron tunneling in the solid state.



Recorder traces of d^{21}/dV^{2} versus applied voltage for three AI-AI oxide-Pb junctions taken at 4.2°K. The zero of the vertical scale is shifted for each curve and all three are normalized to the same arbitrary units. The largest peaks represent increases of 1% of G. Also indicated are intervals associated with the energy of IR active molecular vibrational modes. Curve A is obtained from a "cleam" junction. Curves B and C are obtained from junctions exposed to propionic acid (CH₃(COH) respectively. The spectra are independent of voltage polarity.

PROBING DEEPER FOR BETTER IDEAS



BOOKS FROM BLAISDELL

The Life Sciences

THE LICHEN SYMBIOSIS

Vernon Ahmadjian, Clark University

A guide for biology students and scientists to the literature, methodology, and the present status of experimental lichenology, this book gives a critical evaluation of the field sufficient to serve as a point of departure for further research and experimental studies.

1967. 152 pages. Illustrated. \$5.75.

DRUG AND TRACER KINETICS

Aldo Rescigno, The Australian National University Giorgio Segre, Università di Camerino, Italy

This book presents formulations and analyses of the models most frequently used in the mathematical study of the kinetics of drugs and radioactive tracers in biological systems.

1966. 209 pages. \$7.50.

MOLECULAR PHYSICS IN PHOTOSYNTHESIS

Roderick K. Clayton, Cornell University

Physical aspects of photosynthesis are emphasized in this book, but integrated in are the chemical and biological aspects. Teachers of biophysics, plant physiology, microbiology and other advanced biology courses will find the book particularly appropriate for graduate course use.

19 6 5.	205 pages.	Illustrated.	\$7.50.
----------------	------------	--------------	---------

The Engineering Sciences

INTRODUCTORY SIGNALS AND CIRCUITS

Jose B. Cruz, University of Illinois M. E. Van Valkenburg, Princeton University

Intended as a first course in circuit theory, this text presents the highlights of the subject, provides an accurate picture of its objectives and methods, and gives students effective preparation for subsequent studies and applications of circuit theory to topics within the discipline of electrical engineering. Simple solutions to problems and fundamental principles expressed in their most general form precede the more difficult concepts. Answers to exercises are included. A Solutions Manual will be available.

1967. 468 pages. In press.

INTRODUCTION TO THE SCIENCE OF METALS

Marc Herbert Richman, Brown University

Designed for an introductory course in the science of metals and as a review for metallurgists, this text builds on the various levels of structure from the atomic to the crystal structure to the microstructure. The relation of microstructure to properties is developed and from the microstructure the reader is taught how to interpret atomic level phenomena as well as to predict bulk engineering properties.

1967.	330 pages.	In press.



The Physical Sciences

THE SOLAR ATMOSPHERE

Harold Zirin, California Institute of Technology

This introductory text describes the recent findings in solar research through new observational techniques that have made the study of the sun more understandable. A collection of more than 150 photographs, many never before published, is included.

1966. 501 pages. Illustrated. \$15.00.

Numerical Analysis and Computer Science

These books are of a series on numerical analysis and computer science presenting individual topics useful in the classroom and computation laboratory. Since curricula vary widely, it is felt that a series of brief texts can better serve the needs of advanced undergraduate and graduate courses in numerical analysis and computer science than a single volume.

STATISTICAL COMPUTATIONS ON A DIGITAL COMPUTER

William J. Hemmerle, University of Rhode Island

Useful both to statisticians and numerical analysts with some knowledge of computer programming, advanced calculus, and matrix algebra, this text briefly presents statistical theory for various applications which are selected because of their importance in applied statistics and numerical analysis.

1967. 230 pages. \$7.50.

NUMERICAL INTEGRATION

Philip J. Davis, Brown University Philip Rabinowitz, Weizmann Institute, Israel

Providing a balance between practical computer applications and theoretical topics which underlie numerical integration, this text contains carefully selected material including multiple and automatic integration.

1966. 255 pages. \$7.50.

BLAISDELL PUBLISHING COMPANY

A Division of Ginn and Company

275 Wyman Street

Waltham, Massachusetts 02154

the Melabs membrane osmometer

No other instrument offers as many advantages for measuring molecular weights of macromolecules: from proteins to polymers.

The new Melabs membrane osmometer is the most versatile, simple and convenient instrument ever designed for measuring osmotic pressures of solutions of large molecules (20,000 to 1,000,000 number average).No other membrane osmometer offers these advantages for biomedical and polymer applications:

□ Simplified design for easy operation and maintenance. Melabs uses a direct-reading strain gauge detection system-eliminates servo systems and air bubbles. More compact, less complex and less trouble. □ Wide temperature ranges. 5° C to well over 100° C in Model CSM-2, 30° C to well over 100° C in Model CSM-1.Built-in variable temperature control over entire range in both instruments.

□ Wide pressure ranges. Four selectable ranges, 0-5 cm water, 0-10 cm water, 0-50 cm water, 0-100 cm water. □ Performs equally well using *water* or *organic* solvents. Only stainless steel, Teflon[®], and the membrane contact sample.

Competitively priced. In most instances, Melabs osmometers will be lower-priced than comparable instrumentation.

Additional details: sample size, 0.5 ml.Response speed, 5-30 minutes. Accuracy, $\pm 0.5\%$ full scale, any range. Recorder output, 0-1 mv dc.

For complete information, please write to Melabs, Scientific Instruments Department, 3300 Hillview Road, Palo Alto, California.

In Europe, write Melabs, S.A., 43 Rue De Namur, Brussels, Belgium.



SCIENCE, VOL. 156



Whatman ADVANCED ION-EXCHANGE CELLULOSES specifically designed for the separation and purification of

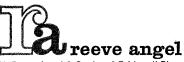


... if you work with enzymes, you'll find Whatman Advanced Ion-Exchange Celluloses unlike any other ion-exchange cellulose product you have ever used.

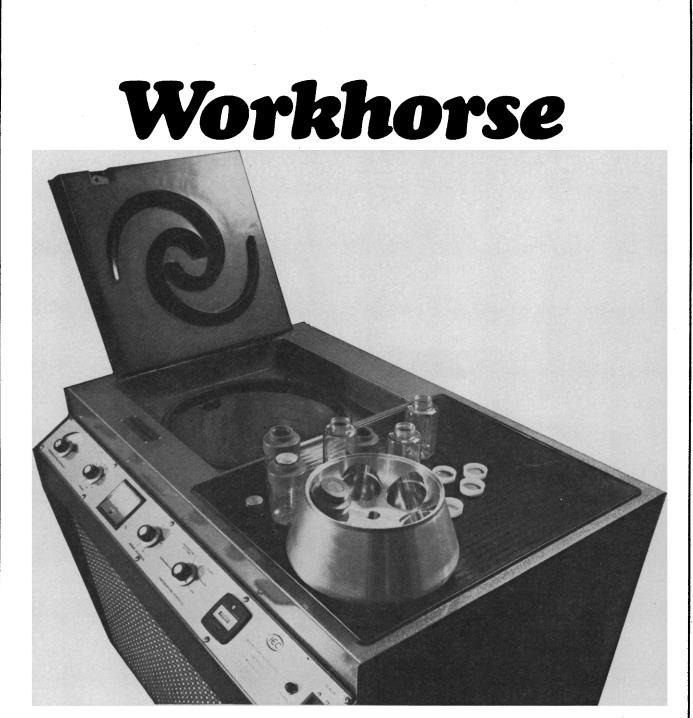
Manufactured by a special process, under rigid quality control standards, Whatman AIEC's offer carefully controlled molecular structure, resulting in controlled particle size and shape—which lead to higher capacity...faster kinetics...improved resolution—important advantages when you are working with enzymes.

The enzymes shown are just a few of the many that have been successfully separated on Whatman AIEC's. In addition, equally successful separations have been made with proteins and nucleotides.

For further information on the properties, applications, and techniques for these products, send for our FREE DATA MANUAL and CATALOG 2000.

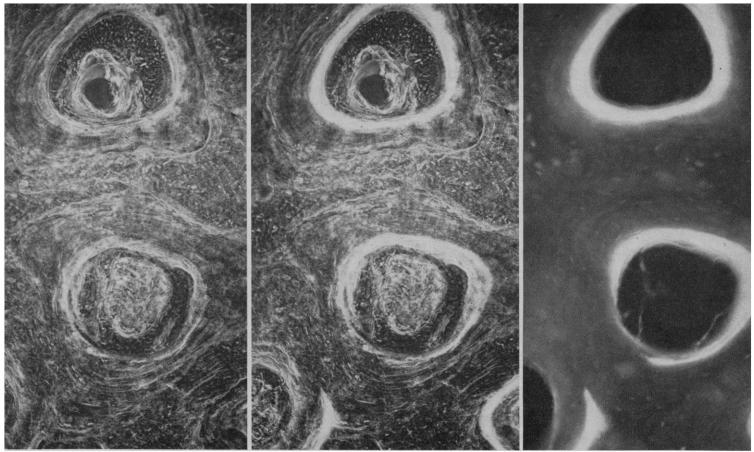


H. Reeve Angel & Co. Inc. 9 Bridewell Place, Clifton, N.J. 07014 H. Reeve Angel & Co. Ltd., 14 New Bridge Street, London, E.C.4, U.K. ØWHATMAN IS THE REGISTERED TRADEMARK OF W. & R. BALSTON LTD., MAIDSTONE, ENGLAND.



Meet the toughest of high-speed refrigerated centrifuges. Our B-20. Durable. Dependable. The strong, silent type. With its flexible belt-drive it will deliver 46,300 g with hardly a murmur. Or swing 4x250 ml in a bucket head. You won't find a comparable centrifuge that'll do all that for you. What's more the B-20 has a unique Turbo-Cover (patent pending) that stabilizes the load and provides remarkable temperature control. And it offers programmed, one-knob automation. In short, the B-20 is in a class by itself. So if you're in the market for a workhorse that can shoulder more than its share of the workload, drop us a line. We'd like to tell you more about ours. Your IEC dealer has the B-20 in stock. Send for Bulletin B-20.





Human bone, tetracyclin stain, magnification 65x. Left to right: phase contrast; phase-contrast fluorescence; fluorescence illumination.

You get versatility like this with Zeiss Fluorescence Microscopes.

The complete new line of Carl Zeiss Fluorescence Microscopes permits you to continuously vary the ratio of mercury to tungsten light—or select either one—at the touch of a lever. They can be used for any type of conventional fluorescence microscopy and for phase-fluorescence studies, too. The fluorescence is produced either by transmitted or reflected light excitation.

Zeiss Fluorescence Microscopes have the widest range of filters. Five excitation and six barrier filters, in various combinations, create maximum fluorescence definition against a dark background. You can select any excitation-barrier filter combination simply by moving a lever.

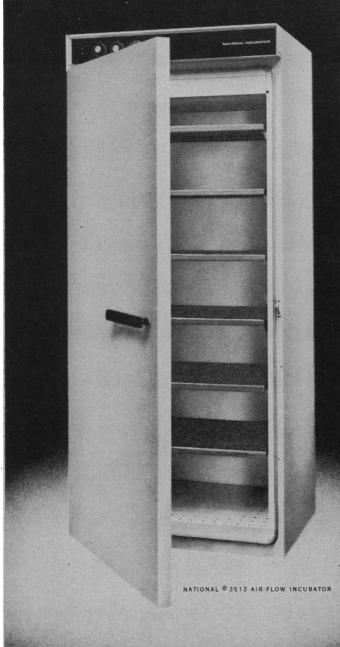
Special front-surface mirrors throughout the system assure maximum intensity of the excitation wavelength. The light path is completely enclosed.

Any Carl Zeiss Fluorescence Microscope can easily be adapted for all known methods of microscopy because of the convenient interchangeability of components.

For complete information, write Carl Zeiss, Inc., 444 Fifth Avenue, New York, N. Y. 10018. Complete service facilities are available.







SPACE-AGE Incubator

You say floor space is at a premium and you have high-volume culturing to do? Install a NATIONAL Air-Flow Incubator and your problem is solved!

The #3512 Air-Flow Incubator offers many advantages besides space-saving, to which a new hinge design contributes by permitting the unit to be placed adjacent to other apparatus, or walls, without interfering with the opening of the door:

- Low-velocity mechanical air circulation minimizes temperature gradient with minimum drying action.
- Top-mounted control panel eliminates accidental temperature control re-settings.
- Adjustable perforated aluminum shelves are rigid to eliminate work-load sag.
- Available in refrigerated model to 5°C...also with full CO₂ facilities and/or modifications for electrical outlets, gas inlets, etc.
- New positive cam lock prevents shock damage to work when closing door ... no stick, no click!

THREE MODELS of Air-Flow Incubators are available: two floor models and one bench model. Contact your nearest NATIONAL franchised dealer for further information. Shown here are selected models from NATIONAL's extensive line: #3212 Water-Jacketed Incubator, #3211 Anhydro Incubator, #3321 Water-Jacketed CO₂ Incubator. There's a NATIONAL Incubator tailored to your needs!



SCIENCE, VOL. 156

What every Ph.D. should know about cage sanitation:

Anything less than a spotlessly clean cage can cause a fatal infection to an experimental animal during his post-operative recovery period and negate all your test results.

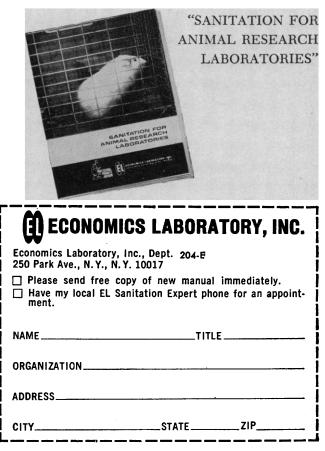
One major cause of unsanitary machinewashed cages is overfoaming in the machine, caused by the reaction of the detergent with the high protein soil loads resulting from the animal's feed and waste matter. This overfoaming cuts pump and wash pressure in the machine, thereby preventing it from doing its sanitation job.

But now, a new Economics Laboratory defoaming agent built into two detergents completely eliminates foam, enabling you to eliminate this major cause of unsanitary conditions. It's called EL F-58, and it may mean the difference between success and failure in your next experimental operation. It is now available in two powerful detergents, EVENT and SPEARHEAD, both of which contain polyphosphate to hold soils in suspension for their complete removal during the final rinse.

The first, EVENT, is recommended for non-aluminum, non-galvanized metal or plastic cages. It is a highly alkaline, nonchlorinated detergent for removing high organic soil loads and is recommended whenever heavy duty cleaning is required.

The second, SPEARHEAD, is recommended for aluminum and galvanized metal cages and racks. Equally effective in hard and soft water, it contains a unique combination of metal corrosion inhibitors. It, too, completely eliminates foaming where organic soil loads are encountered.

For more comprehensive information on cage sanitation, return the coupon below today for your free copy of this new, up-tothe-minute manual,



Whatever your OEM specs for strip-chart or X-Y recorders call for: rack mounting, bench-top or portable, your name plate or ours, and choice of color—we can meet them.

And a lot more.

If you're looking for a recorder as a companion to the instruments you make, or as a component of your systems product line, check Varian's OEM Adaptables. You can specify strip-chart or X-Y recorders with enough versatility for lab work, or enough simplicity and ruggedness for process control applications.

Our broad line of strip-chart recorders comes in 5 and 10-inch versions. You have a wide choice of accessories and options, such as single or dual channels, multiple spans, analytical or thermocouple inputs, event markers, alarm controls, and integrator.

Or, if you need X-Y recorders, we have them in $8\frac{1}{2}$ "x11" and 11"x17" models, with Varian's orig-

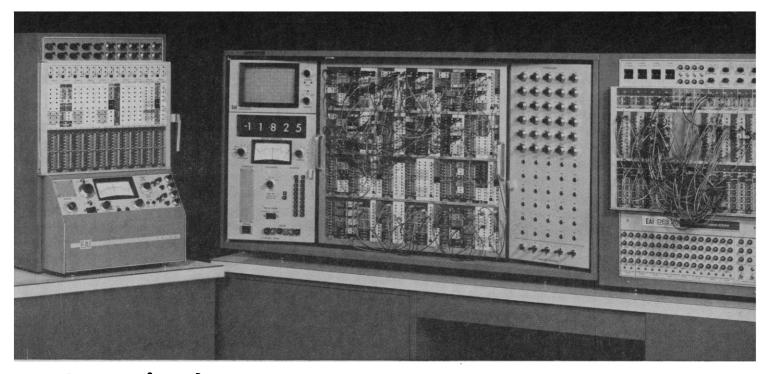
inal positive paper-alignment system. You can order models with or without a time base and single or multiple ranges.

And if what you need isn't standard, let's discuss what we can design for you.

To find out more about our OEM Adaptables, contact our sales manager, Tom McKerlie, at 611 Hansen Way, Palo Alto, California 94303.



SCIENCE, VOL. 156



Our desk-top analog computers: We've sold over 2000.

Our back-up services: We've never sold a dime's worth.

<u>They're free.</u>

Start with the installation. When you buy a TR-20 or a TR-48/DES 30—the computers you see in the picture —an EAI service engineer will be calling on you shortly to see that everything's OK. You get this installation call free. Part of the reason we can do it is that there are over 50 EAI service centers all over the United States.

But this isn't the most valuable of our services. With each TR-20 you get a week of free instruction. With each TR-48, two weeks. The EAI Education and Training group offers a great number of courses at many locations, and you can choose the ones pinpointed to your problems.

Our interest doesn't end there. Only EAI gives you a continually updated Applications Reference Library, a series of studies that show analog and hybrid programming routines illustrating both general techniques and specific problem solutions. For example, we've just introduced a new Educator's Demonstration Series to help busy professors in course preparation. And we keep you continuously informed with regular distributions of technical information and literature.

For additional technical back-up, we've established seven EAI Computation Centers. EAI customers can call

on the most sophisticated skills to solve simulation, design, optimization, data processing and other scientific/engineering problems. Nobody has the experience we do in analog and hybrid computation. And no other manufacturer of analog offers the extent of continuing post-delivery support.

Less servicing is part of our service. We've designed our computers for reliability and precision, with an eye to the future. A TR-10 purchased in 1959 accepts virtually all the latest components designed for the TR-20. Continuing product development has added new high-speed amplifiers, electronic mode control, DES-30 digital logic for hybrid capability, and higheraccuracy components to the EAI TR-48. It's the ultimate desk-top analog/hybrid computer you can buy today.

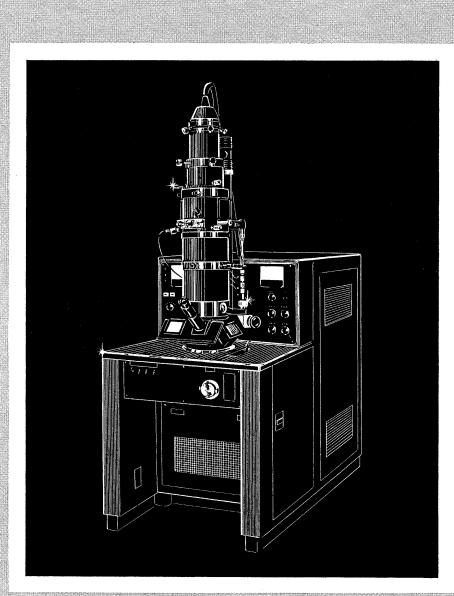
No other computers have been so well accepted by



the scientific and educational community. We'd like to tell you more about the "hardware." The services speak for themselves.

Send for this new brochure on the TR-48/DES-30 desk-top analog/hybrid computing system today.

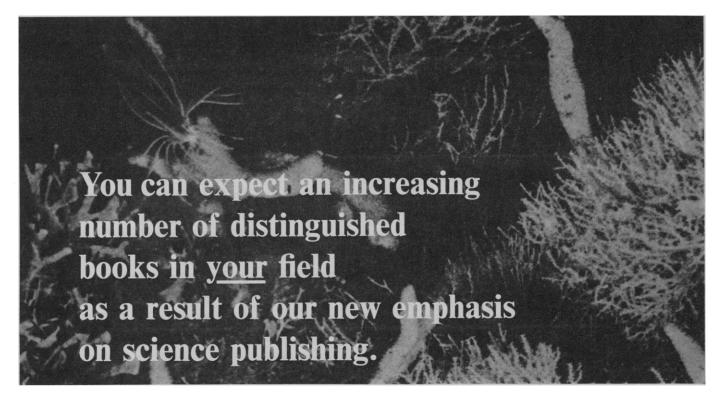
EAR ELECTRONIC ASSOCIATES, INC. West Long Branch, New Jersey



The JEM-T7 Electron Microscope for biological applications ... resolution — 10Å ... continuous magnification — 400X to 80,000X without change of pole piece ... high contrast, wide angle for low magnification work ... accelerating voltage — 60kv ... motor driven valve system ... electromagnetic stigmator ... automatic exposure system ... priced at \$23,228 (duty free).

JEOLCO (U.S.A.), Inc. • Applications centers at Medford, Massachusetts and Burlingame, California Branch offices at Atlanta, Chicago and Montreal





For example:

THE EARTH BENEATH THE SEA Second Edition

By Francis P. Shepard

This popular account of the forces that shape the topography of the ocean floor relates the latest findings of underwater research to the well-established principles of submarine geology. Now revised and augmented, it is filled with the personal experiences accumulated during forty years of marine studies by one of the world's foremost oceanographers. \$6.95

THE PHYSIOGRAPHY OF ARCTIC CANADA

With Special Reference to the Area South of Parry Channel

By J. Brian Bird

Based on a series of RAND studies, this book brings together all that is known of the physiography of arctic Canada: its physical description and geological history, and the geomorphological processes shaping the present-day landscape. \$15.00

MENDELIAN INHERITANCE IN MAN

Catalogs of Autosomal Dominant, Autosomal Recessive, and X-Linked Phenotypes

By Victor A. McKusick

This encyclopedia of genetic disorders in man which show simple Mendelian inheritance is arranged according to the three modes of inheritance. It provides alternating designations, a brief description of phenotype, a summary of genetic peculiarities, methods of recognizing heterozygous carriers of recessive traits, and key references, particularly those with genetic information. \$8.00

SHARKS, SKATES AND RAYS Edited by Perry W. Gilbert, Robert F. Mathewson, and David P. Rall

The thirty-nine papers in this collection provide a comprehensive compendium of our present knowledge of elasmobranch biology. They include information on evolution, shark populations, osmoregulation, nervous systems, dark adaptation, electric organ physiology, metabolism, and immunochemistry. \$15.00

A STEREOTAXIC ATLAS OF THE BRAIN OF THE PIGEON

By Harvey J. Karten and William Hodos

The pigeon is finding increasing use as a laboratory animal. This atlas provides stereotaxic coordinates for placing electrodes in any region of the pigeon brain and identifiles its subdivisions, cell groups, and fiber pathways. \$20.00

THE CHEMICAL SENSES AND NUTRITION

Edited by Morley R. Kare and Owen Maller This book is the outcome of a symposium at which researchers in zoology, psychology, neurophysiology, nutrition, entomology, medicine, and genetics met to exchange information on the senses of taste and smell. A bibliography of more than 3,000 references is included. \$12.50

THE PAPERS OF ALFRED BLALOCK Edited by Mark M. Ravitch

Surgeon-in-chief of The Johns Hopkins Hospital for over twenty years, Alfred Blalock was a pioneer of cardiovascular surgery and the originator of the famous "blue baby" operation. This collection of his papers is of historical and scientific interest, and serves as a monument to the renowned surgeon, who died in 1964. 2 volumes, \$50.00

INVESTIGATIONS INTO GENERATION, 1651-1828 By Elizabeth Gasking

This book traces the history of investigations into sexual generation from 1651, when Harvey published his De Generatione, to 1828, when Von Baer announced his discovery of the mammalian egg. A concluding chapter summarizes subsequent developments during the nineteenth and early twentieth centuries. \$6.00

NUMERICAL MATHEMATICAL ANALYSIS Sixth Edition

By James B. Scarborough

A standard textbook for more than thirty years, this work has now been enlarged to include material on the Trapezoidal Rule, a method of finding the roots of numerical equations, and formulas for solving differential equations by the Runge-Kutta Method. \$8.50

SECOND QUANTIZATION AND ATOMIC SPECTROSCOPY By Brian R. Judd

Professor Judd discusses the most important methods of treating the angular, as distinct from the radial, properties of atoms. Original contributions include studies of configuration interaction, annihilation and creation operators as components of a triple tensor, and developments in the theory of quasispin. \$5.95

THE JOHNS HOPKINS PRESS

BALTIMORE, MARYLAND 21218

703



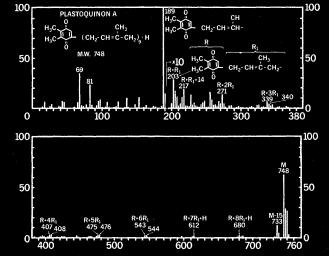
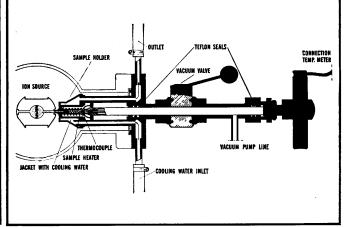


Diagram to illustrate the operation of the Direct Inlet System.



The mass spectrum of PLASTOQUINONE A which occurs widely in plant material.

Even greater versatility by using the New Direct Inlet Probe.

LKB 9000 Produces the Right Answer

The ANSWER-provided by the first commercial instrument to integrate a gas chromatograph, a molecule separator and a mass spectrometer-to analytical problems in chemistry dealing with amino acids, sterols, steroids and bile acid esters, biological toxins and narcotics, barbiturates, tranquilizers, pesticides, carbohydrate derivatives and many others.

The ANSWER to the demand for Speed, Accuracy and Flexibility of operation.

The ANSWER to temperature sensitive or unstable samples as well as to samples with low vapour pressure-The Direct Inlet System. The ANSWER to effluent containing unresolved compounds-The Accelerating Voltage Alternator.

The ANSWER in fact to everything a scientist could ask for in performance, convenience and dependable, troublefree operation-a new dimension in GC-MS. We have given only a few ANSWERS.

We have given only a few ANSWERS.

If you have some QUESTIONS why not write today to the address below for All the ANSWERS on the LKB 9000 Gas Chromatograph-Mass Spectrometer.

LKB INSTRUMENTS INC • 12221 PARKLAWN DRIVE • ROCKVILLE Md 20852



OTHER HEADQUARTERS FOR SALES AND SERVICE SWEDEN LKB-Produkter AB Box 76, Stockholm-Bromma 1 UK LKB Instruments Ltd. LKB House, 137 Anerley Road, London, S.E. 20 **NETHERLANDS** LKB-Produkten N.V. Zeekant 35, The Hague

DENMARK LKB Instrument A/S Amagerbrogade 34, Copenhagen S

Here's why the Model 302 VPO is the most satisfactory way to measure \overline{M}_n of natural and synthetic polymers from 100 to 25,000

Compare the Model 302 Vapor Pressure Osmometer either with classical techniques or with other instrumental methods for determining number average molecular weight and you'll find the 302 easily the most satisfactory. Here are some important reasons.

The 302 is fast: individual sample determinations are completed in two to five minutes. That's only part of the story: the 302 has the capacity to handle four sample syringes *at one loading*. Whether you contemplate making single-point determinations (for routine control work) or running a concentration series (as in research), four samples can be measured in 20 minutes or less, without interruption, since any or all of the syringes may be changed at any time. There are no other hold-ups: instrument calibration for a particular solvent-probe system is permanent and need never be rechecked.

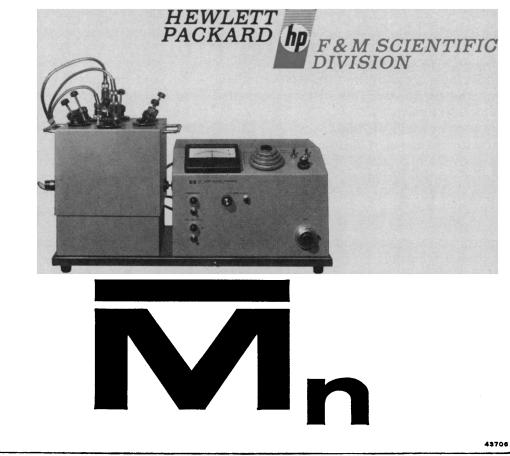
The 302 gives accurate molecular weight data, reproducible within 1%, plus an overall sensitivity

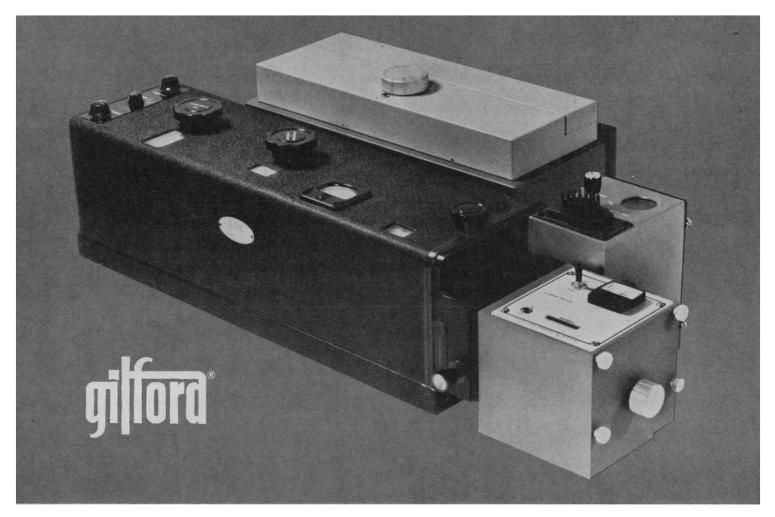
of $2 \ge 10^{-5}$ mols/kg (based on benzene at 37° C).

The 302 offers a wide range of operating temperatures—from 25 to $130^{\circ}C$ —which extends its usefulness to the determination of synthetic as well as natural polymers, in either organic or aqueous solvents. Throughout its temperature range, the 302 is sensitive to a change of 0.0001°C and maintains short-term control of the sample chamber within $\pm 0.001^{\circ}C$.

Is it any wonder that there are more than 1000 satisfied users of Series 300 VPO's? Basic price for the Model 302 is \$2800. For complete information, write for Data Sheet 3020. Or call the nearest H-P sales office.

Hewlett-Packard, F & M Scientific Division, Route 41, Avondale, Pennsylvania 19311. In Europe: 54 Route des Acacias, Geneva, Switzerland. Elsewhere: 1501 Page Mill Road, Palo Alto, California 94304.





Up-Date Your Spectrophotometer For Increased Accuracy, Greater Productivity

Many older spectrophotometers have excellent optics, but the usefulness is limited by outmoded surrounding electronics.

Now you can change all that!

The investment made in hundreds of these units has been protected by the Gilford Spectrophotometer Modernization Program. Accuracy has been up-graded, operation made simpler, and chance for error in readings reduced.

Gilford has developed Model 222 equipment just for this purpose. It may be used with most leading makes of spectrophotometric monochromators.

The Model 222 solid-state power supply smooths

out and regulates power for both the input light source and the output sensing equipment. This assures accuracy and dependability of light input and three decade output reporting.

The Gilford 222 Photometric Unit reports absorbance directly with linear digital indication from zero to 3 A. Sensitivity to 0.001 A. Drift less than 0.005 A per hour.

Find out how little it will cost you to bring your present spectrophotometer up-to-date. Complete and mail the coupon below, or better still, telephone us at:

Area 216 - 774-1041

Gilford Instrument Laboratories, Oberlin, Ohio 44074	Inc.	
Gentlemen: We have a (Make and Model) Please send us your full informat Gilford 222 equipment.	tion and estimate of the cost o	Spectrophotometer. of up-dating this instrument with
Name		
Address		
Ċity	State	Zip

INTERFERENCE CONTRAST (NOMARSKI)

This new contrast technique reveals specimen details not obtainable by any other contrast method. It shows images in colors or black and white in a pronounced halo free relief. This phenomenon is characteristic for interference contrast produced by birefringent optical elements, in this case, a special turret condenser in combination with Wollaston prisms, rotatable filter polarizer and analyzer.

CONTRAST FLUORESCENCE MICROSCOPY

This technique enables examination of fluorescent specimens in positive and negative phase contrast (simultaneous contrast fluorescence) by superimposing a bright fluorescence image on the phase contrast image. It is accomplished by simultaneous application of visible (white) and UV illumination and a unique fluorescence-contrast condenser.

MICROPHOTOMETRIC MEASUREMENTS

For the quantitative determination of reflectivity, absorptivity and extinction or fluorescence intensity and their variation with wave length by means of the new Reichert microphotometer (spectrophotometer) in combination with the "Zetopan". Specimen and measuring diaphragm are viewed simultaneously for infinitely reliable specimen detail location at all objective powers. An integrated photo multiplier assures linearity of indication far exceeding the measuring accuracy of 0.5%. This sensitivity permits measurements of the smallest structural constituents down to 0.5 micron.

AUTOMATIC PHOTOMICROGRAPHY

The new Reichert "Photo Automatic" is a fully automatic photomicrographic camera. It indicates the exposure time *prior* to actual exposure enabling the operator to decide whether the indicated exposure time is reasonable. A beam splitter directs 80% of the light to the camera and 20%to the focusing telescope. The frame size is 24×36 mm with readily interchangeable cassettes. A vibration-free magnetic shutter provides for exposures starting at 1/250 sec. with a range to any exposure time necessitated by film and specimen. The film speed setting can be varied between ASA 6 and 1600. The magnification of the built-in photographic eyepiece is variable from 6.3x to 10x eliminating the need for changing objectives.

These and other advanced techniques in optical microscopy are available to you with the . . .

REICHERT RESEARCH MICROSCOPE "ZETOPAN"

The "ZETOPAN" has built-in illuminating systems for reflected, transmitted and mixed light... Brightfield, Darkfield and Oblique Illumination. Separate independent tube for convenient photomicrography, including new Polaroid Land Camera Back for instant color or black and white pictures. Automatic and semi-automatic exposuremeters. Light sources include high intensity, xenon and mercury arc, iodine quartz and monochromatic lamps.

SEE FOR YOURSELF WHAT THESE MODERN TECHNIQUES CAN DO FOR YOU!

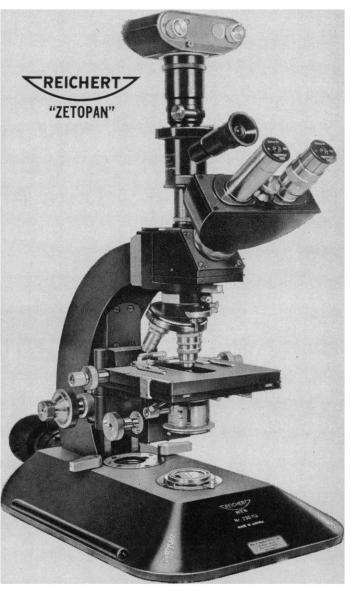
Request literature and demonstration of the "ZETOPAN" Write to:

William J. Hacker & Co., Inc.

Box 646, West Caldwell, New Jersey 07006 (201) 226-8450

Let us Show You —

What these new microscopic techniques Can do for You





We leave you with this thought...

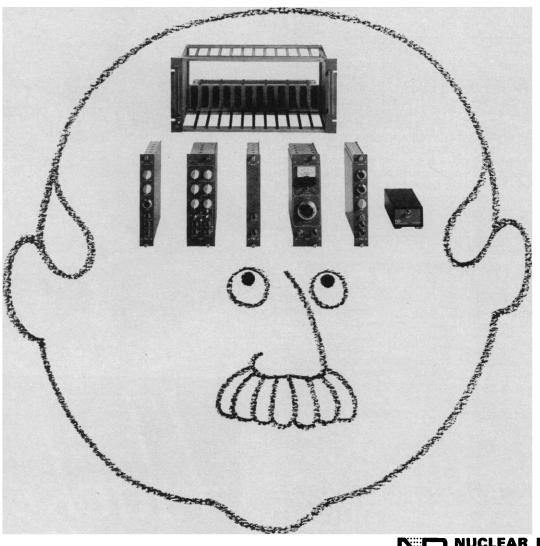
Keep us in mind for a growing line of modules to meet your current and future needs. For example, the ND-525 High Resolution Preamplifier; ND-526 Bias Power Supply; and the ND-524 LARC Linear Amplifier—designed to provide the linear amplification and R.C. pulse shaping required in high-resolution, multi-channel analysis.

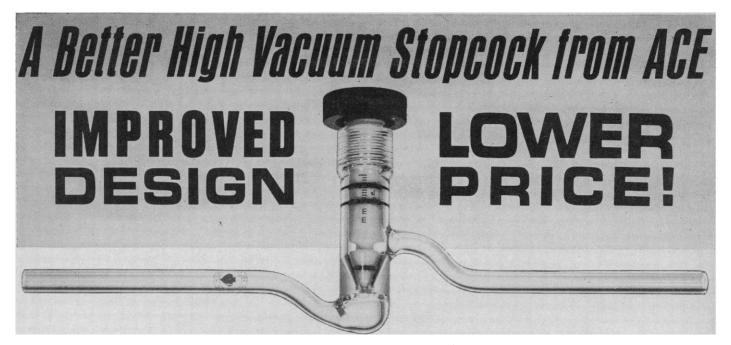
Keep us in mind, too, for bins, power supplies, preamp-amp-discriminator combinations, sin-

gle channel analyzer and mixer/rejector modules. All of them work perfectly with Nuclear Data analyzers (and others as well) and all are built to AEC specifications. But perhaps most important—these modules meet the high standards of craftsmanship researchers expect from Nuclear Data.

Good reasons, we suggest, to hold the thought: Nuclear Data for compatible nuclear instrument modules. (More details? Just write us.)

Compatible NIM modules for your Nuclear Data Analyzers





All glass and Teflon - very easy to operate, can be annealed.
Suitable for use with oxygen and other corrosive gases.
Rugged design: may be used to at least 30 lbs. internal pressure.

8115 HIGH VACUUM STOPCOCK. Variable opening **A**: 0-5 mm. **B**: 0-10 mm. Smooth acting semi-needle valve permits fine adjustment of opening. "O" ring makes positive closure against a precision formed heavy glass seat. Reference marks on body and handle aid repetitive setting. The stem is made of long life Teflon and is triple sealed within heavy walled glass housing, accurately threaded. All glass construction permits annealing. Side arms are also of heavy walled glass. Supplied with plain side arms 120 mm. long. **8115-A** (variable opening 0-5 mm.) **\$22.50, 8115-B** (variable opening 0-10 mm.) **\$24.50**.

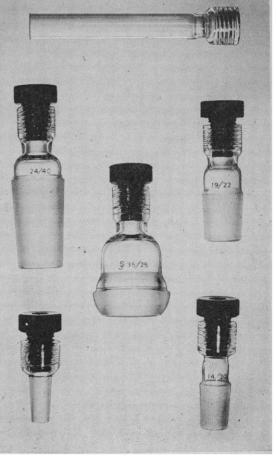
Threaded Glass/Nylon Thermometer Adapters from Ace

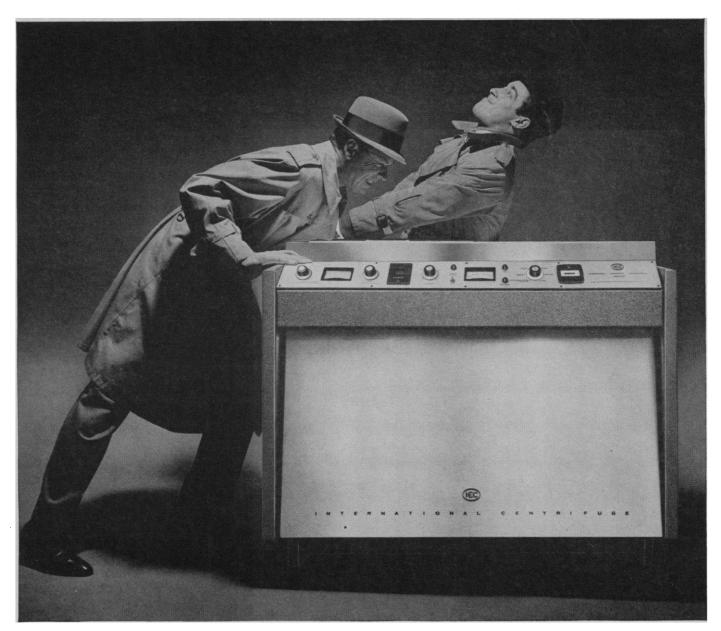
Convenient • Suitable for vacuum application • Wide range of sizes.

5028 ADAPTER, Thermometer Vacuum. Inner joint at bottom and threaded plastic bushing at top which tightens into glass piece to form an "O" ring compression seal with thermometer. Plastic bushing comes complete with Viton A "O" ring. **\$** 10/30 size will accommodate thermometers up to 6.5 mm. diameter, and all others will accommodate 7 mm. diameter thermometers. Suitable for vacuum applications.

Joint	₹ 10/30	0 ₹14/20	\$ 19/22	\$ 24/40	§ 18/9	§ 35/20	§ 35/25
Glass Bottom	2.85	2.90	2.95	3.15	3.25	3.40	3.40
Plastic Bushing	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Complete	4.35	4.40	4.45	4.65	4.75	4.90	4.90
Threaded section	n with	tubing 4"	long x 1/2"	0.D. \$1.5	0.		







Before you invest in an ultracentrifuge ...

call in these G-Men

Together, they carry a lot of weight in the ultracentrifuge field. The IEC man is a specialist in ultracentrifugation systems. The S/P man is an expert in installation and continuing service. Call them in. They arrive as a team to help provide your lab with the most advanced ultracentrifugation system available. Before you spend a load of G's, contact us and investigate them.

SOME INSIDE INFORMATION

IEC features advanced rotor design

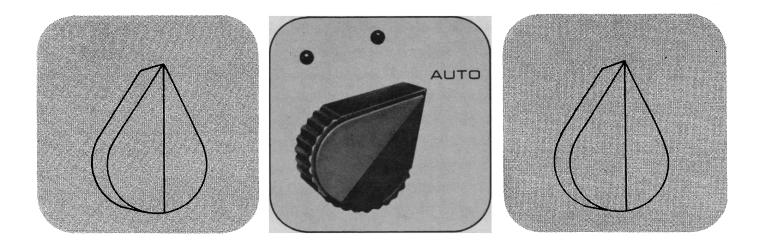
- no derating—you receive a lifetime guarantee
- slotted ball and socket design makes rotors easy to load and unload
- long tube rotor design provides exceptionally high resolution for density gradient studies



DIVISION OF AMERICAN HOSPITAL SUPPLY CORPORATION GENERAL OFFICES: 1210 LEON PLACE, EVANSTON, ILLINOIS Springer-Verlag has decided to create an international journal in marine biology devoted to the publication of original research papers in the following fields:

Marine zoology including fisheries, marine botany, marine microbiology. The journal will be named:

MARINE BIOLOGY **International Journal** on Life in Oceans and Coastal Waters The Editorial Board is composed of: M. Anraku (Nagasaki), B. Battaglia (Padua), G. F. Humphrey (Cronulla, N. S. W.), O. Kinne, (Hamburg), N. K. Panikkar (New Delhi), J. M. Peres (Marseille), E. A. Pora (Cluj), J. E. Smith (Plymouth), E. Steemann Nielsen (Copenhagen), G. L. Voss (Miami). Coverage: Ecological dynamics. Experimental ecology and physiology. Descriptive ecology, distributions, zonations, communities. Cultivation, life histories and diseases. Biochemistry, genetics and evolution of marine and brackish water organisms. Methods and apparatuses employed in marine biological studies. Manuscripts should preferably be written in English, but papers in French or in German will also be accepted. All contributions should be preceded by an English abstract. Papers should be submitted to the regional Editors named above or to "Marine Biology" Editor-in-chief: Professor Otto Kinne D - 2000 Hamburg - 50 Palmaille 9 Accepted papers will be printed within 3 or 4 months. One volume (four to five issues) containing 360 pages, large format with two columns, will be published annually. Annual subscription price US § 24.00, DM 96,- plus postage. There will be no page charge. First issue: May 1967 Please place subscription orders with your bookseller or with: Springer Verlag New York Inc., 175 Fifth Avenue, New York/N.Y. 10010 Springer-Verlag Berlin · Heidelberg · New York



Why are Canalco's UV flow monitors the <u>only</u> ones with automatic scale expansion?

Frankly, we can't imagine why no other manufacturer offers this feature. After all, it's the only way you can have maximum usable sensitivity at all times—even in unattended, overnight operation—with perfect assurance that the recorder's pen won't go off scale and lose vital information.

In addition to automatic 3X expansion, Canalco Wide-Track UV Flow Analyzers also have six other important features that combine to give you extra sensitivity of detection plus reliable, versatile, drift-free performance. Among them are:

■ dual phototube ratio circuitry for accurate linear Transmittance recording, in spite of line voltage or lamp intensity fluctuations. (By the way, linear T recording gives *twice the pen deflection* of linear Absorbance recording at low optical densities, just where you need sensitivity the most. Furthermore, the Wide-Track 3X scale gives direct quantitation; over this chart range, linear T and linear A differ less than 1% T.)

both single-cuvette and dual-cuvette models are available. With two cuvettes, you can flatten your baseline out even if solvent absorption changes, as in gradient elutions;

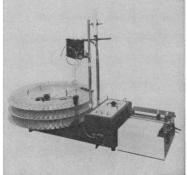
■ you have a choice of *five* optical path lengths, up to 20 millimeters (twice the length, four times the sensitivity our competitors offer);

■ Canalco Wide-Tracks come complete with wide-chart recorder (7½ inches of calibrated grid), including side-of-chart event marking pen to correlate peaks with fraction collector tubes. (Marker pen connection plugs directly into Canalco, Warner-Chilcott and Research Specialties fraction collectors; connection to other makes is also simple.)

■ single-wavelength operation gives optimum sensitivity for both proteins and nucleotides, eliminates filter and source changing:

■ extension cable kits facilitate mounting sensing heads in cold rooms, with recorder conveniently outside. No temperature compensators are required for coldroom use.

Get the full facts about the four models in Canalco's Wide-Track family Write today!

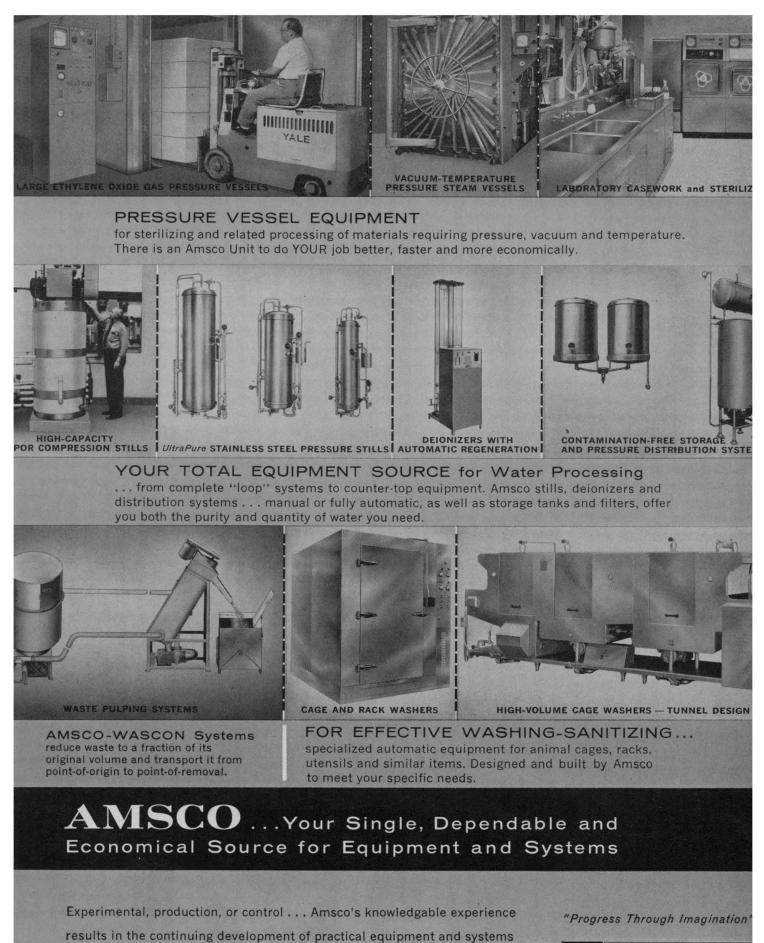


Wide-Track Flow Analyzer with Canalco Fraction Collector



ALCO Sales Offices in: Boston • Chicago • Cincinnati • Cleveland • Denver • Houston • Los Angeles • Minneapolis • New York • Ottawa • Philadelphia • Pittsburgh • San Francisco • Washington, D.C.

SCIENCE, VOL. 156





Ask Your AMSCO Man, Request Literature OR Advise Specific Needs

to serve science and industry. Call Amsco first! Let our experience help

solve your specific needs.

May, 1967 **FISHER PRODUCT REPORT** News about instruments, apparatus and reagent chemicals that make your work guicker, surer, safer and easier.

At its price (\$325), you can't beat the new Fisher Vacuum Oven for usable sample space (313 sq. in.). Besides, it's lined with stainless steel.

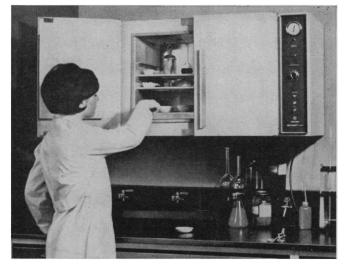


And if this isn't enough, the new Model 48 can be operated under vacuums down to 30" Hg, responds to temperature changes of $\pm 1.0^{\circ}$ over a range of 40°C to 200°C. You can use this compact unit efficiently as a vacuum-drying oven; as a controlled-atmosphere or ordinary air-filled chamber for static drying; and as a purged-atmosphere chamber.

The $\frac{1}{2}$ "-thick, stainless-steel interior and a removable stainless-steel shelf and auxiliary tray guard against corrosion. All controls are conveniently located at the front just below the door, which has a see-through window of half-inch, shatterproof glass. There's a thermometer just inside the door where it's easy to read. Hose connections for the vacuum and purging lines are on the back. Available for 115-volt or 230-volt operation.

If you are hankering after a multipurpose vacuum oven, our free product bulletin will convince you the new Fisher Model 48 is the most for your money. (a) \Box

Newest Fisher Isotemp Oven hangs on useless wall space to free useful counter space.



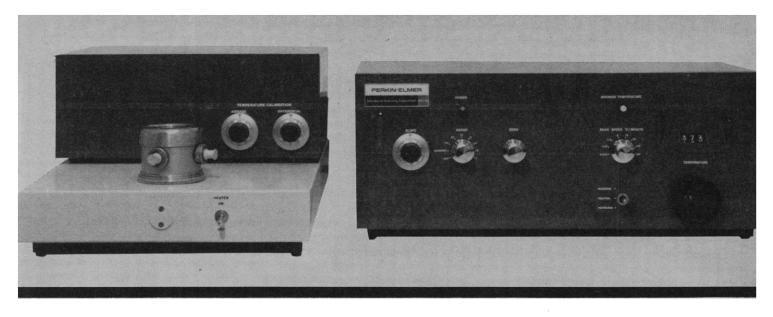
With this latest in the famous Fisher family of Isotemp[®] laboratory ovens mounted on your lab wall, you gain more than 3 running feet and nearly 7½ square feet of usable bench top. To say nothing about the gain in convenience. It's a gravity-convection oven with a roomy double-door chamber having a capacity of more than 3 cubic feet. Temperature from 50°C to 200°C is maintained within $\pm 2^{\circ}$. You'll receive all the details on this \$375 space liberator when you ask for our product brochure. (b)

The Fisher family of Isotemp ovens includes standard gravity-convection and forced-draft types in Junior (1-cubicfoot capacity) and Senior (3-cubic-foot capacity) sizes. Outstanding family features: the "Safety Sentinel" thermostat that protects against overheating; simple controls; magnetic latches on full-width doors; durable construction; remarkable constancy and uniformity of temperature. There is even an Isotemp incubator. Let us know, and we'll send you the family dossier. (c)

Name your literature by check-marking your particular area of interest. Then mail this page, with your name and address, to Fisher Scientific Company, 1398 Fisher Building, Pittsburgh, Pa. 15219.



Instruments, apparatus, furniture & chemicals for laboratories • ATLANTA BOSTON CHICAGO CINCINNATI CLEVELAND HOUSTON PHILADELPHIA PITTSBURGH ST. LOUIS SPRINGFIELD, N.J. WASHINGTON EDMONTON MONTREAL TORONTO VANCOUVER



DISAPPOINTED IN D.T.A.? TRY THE NEW PERKIN-ELMER DSC-1B!

How would you like to have a thermal analysis instrument that gives you all these-

• Direct, simultaneous, quantitative measurement of ordinate displacements as specific heat...of peak areas as energy of transition.

• The fastest controlled heating and cooling rates. Heat to and equilibrate at any temperature to 500° C in less than a minute. Run down to and up from -100° C without elaborate, troublesome coolant systems.

• Operate in vacuum or any desired atmosphere with optimum atmosphere-sample contact and exchange. • Versatile operation—doesn't need costly accessory units.

• Built-in thermal conductivity effluent detector, linear temperature and time-base recorder, analyzer assembly separate from control unit. Observe the sample while running.

• Sample easily encapsulated in a metal pan...removable at any time to observe weight changes. Pressure sealer for volatile samples.

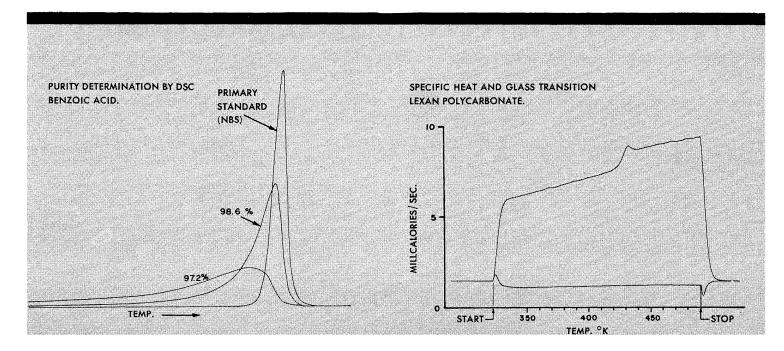
• Unsurpassed temperature precision, resolution, sensitivity, sampling ease and baseline stability.

If you're thinking that no Differential Thermal Analyzer can possibly meet this description at any price—you're right. We call ours a **Differential Scanning Calorimeter.*** It's the only thermal analyzer that takes advantage of modern electronic developments to give the chemist the answers he really wants. It's the lowest-cost *Patent applied for high-performance thermal analysis system commercially available.

Who needs it? You do—if you want to determine purity and heat of fusion of crystalline organic compounds in the same time you now take for a simple melting point to measure temperature, heat, rate, effluent gases and weight change of a reaction in a single experiment—to analyze quantitatively multi-component solid mixtures such as fiber blends—to determine reliable ΔH values for phase changes—even for lowenergy liquid-crystal transitions and protein denaturation.

Detailed information on purity is in Thermal Analysis Newsletter No. 5. Heat capacity is in Newsletter No. 3. Write for these two informative reports today to Instrument Group, Perkin-Elmer Corporation, 723 Main Avenue, Norwalk, Conn. 06852.

PERKIN-ELMER



12 assorted sun-makers. all from stock





200 suns-1" dia beam



.....

X-25 Type 4812 1 sun-12" dia beam



....

X-25LS Type 4416 X-25LR Type 2836 1 sun – 16" x 16" beam 10 suns – 3" x 6" beam

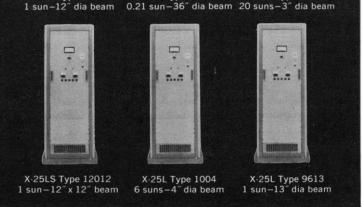


X-25 Type 2412





X-25L Type 9636 X-25 Type 0603 0.21 sun-36" dia beam 20 suns-3" dia beam



One of them probably suits your project perfectly!

Take your pick of beam size, intensity, shape and other functional options. Versions of Spectrosun® X-25 Solar Simulators differ widely, although constructed from the same group of field-proved, off-theshelf accessories and options.

Intensities from 1 to 200 suns, depending on beam size and distance-to-target... beams from 1" to 36" diameter, with partial or close spectral filtering matching outer-space sunlight \ldots square and rectangular beams, too, along with a full complement of optional accessories.

Only what you need goes into your X-25, and its versatility allows you to change output and performance as your programs change. Want proof? Tell us (1) your application; (2) approximate intensity and beam size required; and (3) whether you need partial or close spectral filtering. We'll ask for any necessary further details, then we'll respond fast with price and delivery quote on the recommended model.

Spectrolab, Division of Textron Electronics, Inc. / 12484 Gladstoné Avenue, Sylmar, California 91342 / Phone: (213) EMpire 5-4623. Partial List of Standard Accessories Collimating lenses (6", 12" and **Partial List of Standard Accessories** Collimating lenses (6°, 12° and 13° dia) • Beam folding mirrors • Beam-height adjustment elevator • Close spectral filtering (air-mass-zero match or air-mass-two match) • Intensity reduction screen sets • Remote control panel • Solar-cell testing table • Timer-driven intensity programmer • Remote intensity monitors.



Basic Radiation Biology

By DONALD J. PIZZARELLO, Ph.D., Assistant Professor, and RICHARD L. WITCOFSKI, M.S., Instr., Medical Physics, Department of Radiology, Bowman Gray School of Medicine.

<u>NEW 1967 BOOK</u>. This introductory text is designed to provide readings in the general principles of radiation biology for students who have a limited background in radiation physics and modern biology. Simple illustrations and a straightforward narrative style are used throughout this thorough, but not exhaustive, presentation. Experiments, when used, are cited as examples of general principles and important techniques. Part I, <u>Review of Pertinent Physics</u>, includes origins and types of ionizing radiations, interactions of radiation with matter, and measurement of radiation dose. Part II, <u>Interactions of Radiations</u> with Living Systems, includes two chapters on cytogenetics, target theory and interpretation of survival data, the oxygen effect, radiation effects on immunity and treatment of irradiated organisms.

Just Published_

Atlas of Human Histology

By MARIANO S. H. diFIORE, University of Buenos Aires. 243 Pages, $7'' \ge 10\frac{1}{2}''$. 111 Original Color Plates. 189 Figures. \$9.50

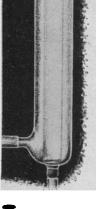
<u>3rd (1967) EDITION</u>. With 10 new full page plates, and 7 new figures added to existing plates, the new edition continues to be the ideal auxiliary text for the beginning student. The exceptional illustrations are composite color drawings of what the student sees only after a study of several slides. The sequence of presentation conforms to that of the major textbooks, the terminology is updated to the recent Nomina Anatomica, and a table of contents has been added.



WASHINGTON SQUARE, PHILADELPHIA, PA. 19106 Canadian Agent: The Macmillan Co. of Canada, Ltd., 70 Bond St., Toronto 2.

12 MAY 1967

Column Chromatography in Three in Three Easy Lessons*



Lesson No.1



Begin by pumping your solvent into the column in a smooth concentration or pH gradient. ISCO's new programmed gradient pump, the DIALAGRAD, will handle this perfectly. In fact any simple or complex gradient formed by combining two liquids can be dialed directly into the DIALAGRAD. Program duration and pumping rates are easily adjustable over very broad ranges. No more mixing numerous solutions to guessed-at concentrations.

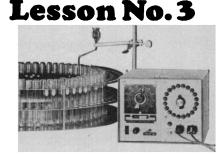
Lesson No.2



Now to identify your fractions. Use an ISCO UA-2 or 222 Ultraviolet Analyzer to get quantitative results with no need for further assay. Select linear absorbance, single or dual-beam monitoring at either 254 or 280 mµ or both. Absorbance recording minimizes need for base-line compensation and allows direct integration of chart record. As each UV absorbing fraction is recorded it is also automatically deposited in a separate collecting tube.

Send For Brochure CC17E

* Three Easy Prices Too! For Complete Information



Collecting the effluent is then a simple task when ISCO fraction collectors are used. Choose from any of four basic models offering timed or volu-metric control. Some have lift-off reels that can be changed as often as they fill, and when not collecting can be used as convenient storage racks. Extras such as drop counters and volumetric dispensers make things even easier. No after-school sessions necessary when you use ISCO equipment.



INSTRUMENTATION SPECIALTIES COMPANY, INC. 5624 SEWARD AVE. • LINCOLN. NEBRASKA 68507, U.S.A. • PHONE (402) 434-8265 • CABLE ADDRESS: ISCOLAB LINCOLN SCIENCE, VOL. 156

Embarrassing questions to ask our salesmen about the β/γ Liquimat liquid scintillation counter.

Prior to beginning the actual questioning, you might consider initiating the discussion with the following preamble or something akin to it:

"Before you discourse on the many virtues of your instrument, let me tell you what is important to *me* the customer in choosing a liquid scintillation counter. First of all, please understand that I don't really care about the instrument *per se*. I'm only interested in this: reliable data, day-in, day-out, easily gotten. To that end, I'll ask two kinds of questions: about the instrument and its capabilities; and

about your company and the local "people" support it's prepared to give me. Accordingly, please always speak to me in terms of my needs, not in esoteric engineering terms -1 don't have an E.E. degree and I'd consider it a favor if you remember this. We begin."

Question 1: Does the β/γ Liquimat qualify as a modern, up-to-date, "state-of-the-art" instrument? For example, does it have three independent channels, automatic external standardization, high E²/B, 200 sample capacity, CPM computation, and can it also be manually controlled?

Question 2: You call this the β/γ Liquimat – do I assume correctly that I can do both beta and gamma counting with this single instrument? Without buying anything else? Is the β/γ Liquimat the only liquid scintillation counter that has an integrated gamma counter? What am I actually paying to get this gamma capability?

Question 3: What does the warranty cover? Do you also guarantee to check back with me and the instrument periodically – without my asking for it – to see whether the instrument is functioning properly and I'm happy with it?

Question 4: Other than yourself, what other Picker Nuclear sales or service people can I rely on in this area?

Question 5: What is the price of the β/γ Liquimat? And exactly what do I get for this?

Question 6: Finally, what else can you tell me about the β/γ Liquimat that's relevant to my real needs as a researcher: an instrument that is current, data I can trust, operation that is simple, an instrument that keeps working, and service people committed to keeping it that way?

Want to try these on a salesman? Ask to see one.

Want detailed written information on the β/γ Liquimat? Ask for file 101 S.

P**icker**nuglear

1275 Mamaroneck Avenue, White Plains, New York 10605



New from Coleman—fast-scanning Double-beam, <u>UV-VIS</u> Spectrophotometer with LINEAR absorbance readout.

Coleman's Model 124 brings you rapid scanning speeds and the *only* linear absorbance readout ever offered in a lowcost, double-beam, grating instrument.

With the new Model 124 Hitachi Spectrophotometer you can now do fully automatic ratio recording in the 190 to 800 m μ range, without logarithmic scales. Model 124 presentation is linear in both absorbance and transmittance. Now, for the first time, you get maximum readability with both high and low absorbance values. You can obtain readings in 0 to 2.0 absorbance, or expand your readings with the 0 to 1.0 absorbance range. You'll get three times as much work done, too. Model 124 operates at four scanning speeds up to 240 m μ per minute. Scans the entire visible range in less than two minutes, with performance comparable to that of slower scanning instruments.

There's much more to Model 124. Plug-in, solid-state circuitry. Automatic filter system. A large sample compartment that accepts cells up to 100 mm. Quick switching to single-beam manual operation. A new, companion Model 165 Linear Recorder that matches the speed, precision and linearity of Model 124.

Learn more about the outstanding performance characteristics of this new spectrophotometer, available in two ranges— 190 to 700 m μ and 190 to 800 m μ . Send today for Coleman Bulletin SB-312.

COLEMAN MAYWOOD, ILLINOIS 60153

COLEMAN INSTRUMENTS

A Division of The Perkin-Elmer Corporation



spectroscopic tricks

edited by Leopold May, Department of Chemistry The Catholic University of America, Washington, D.C.

This unique volume provides the working spectroscopist with insight into the art of current laboratory techniques and presents information on new devices and modifications of existing apparatus. The book is so arranged that it can direct the user straight to that particular technique which is best applicable to his often very specialized problem. Among the items of especially broad interest are a procedure for introducing powder into flames, a description of a calculating board for spectrochemical analysis, a technique for the use of a mirrored test tube for fluorescence analysis, an illustration of the analysis of metal powders at low temperatures using nuclear magnetic resonance, a technique for direct identification of x-ray spectra, and methods for using polyethylene discs in far-infrared spectroscopy of solids, and using wire screens as variable light attenuators.

The text is divided into sections corresponding to the different areas of spectroscopy, and items concerned with the same device are juxtaposed for comparison. Subject, author, and journal reference indexes are included, and these, combined with a detailed table of contents, give the user immediate access to the tricks, hints, techniques, and descriptive material contained in the volume.

APPROX. 318 PAGES DD IUNE 1967 \$9.50

Raman spectroscopy: theory and practice

edited by Herman A. Szymanski

Chairman, Chemistry Department Canisius College, Buffalo, New York

A comprehensive introduction to Raman spectroscopy, this volume also includes specialized articles by eminent researchers in the field describing applications and techniques. It constitutes a coordinated, up-to-date study of one of the most rapidly developing branches of spectroscopy at a level suitable for both the beginner and the advanced researcher.

It will enable the beginner to develop the technique and perspective necessary for effective use of the Raman spectroscopic method, and will suggest to the more advanced practitioner solutions to specific problems and ways to increase the range and precision of his investigations. \$12.50

255 PAGES PP MARCH 1967

introduction to electron spin resonance

a volume in Monographs on Electron Spin Resonance edited by H. M. Assenheim, Hilger & Watts Ltd., London, England

by H. M. Assenheim

This first volume in an important new series of monographs is designed to provide the student with a clear and concise introduction to ESR techniques. The work also presents standard information suitable for a ready reference for practicing ESR spectroscopists. It surveys the theoretical and mathematical aspects of ESR and deals with instrumentation, design, and interpretation of spectra with examples of most types of interaction. The volume concludes with a discussion of current applications in physical, organic, inorganic, and polymer chemistry, biology and medicine, and solid state physics. MARCH 1967 \$9.50 200 PAGES PP

electron spin resonance in semiconductors

a volume in Monographs on Electron Spin Resonance edited by H. M. Assenheim, Hilger & Watts Ltd., London, England

by G. Lancaster, University of Keele, Keele, England

This volume, an authoritative reference work prepared for specialists in the field and for scientists and engineers in allied subjects, covers spin resonance in crystals of silicon and germanium containing specific impurities—materials of greatest interest in this area of research. Ex-tensively indexed, this work will also assist those unfamiliar with current research in semiconductors or ESR.

152 PAGES MARCH 1967 \$9.50 PP

lectures on gas chromatography-1966

based in part on lectures presented at the Eighth Annual Gas Chromatog-raphy Institute, held at Canisius College

edited by **Leonard R. Mattick**, Food Research Laboratory, New York State Agricultural Experiment Station, Cornell University, Geneva, N.Y.

and Herman A. Szymanski, Chairman, Department of Chemistry, Canisius College, Buffalo, N.Y.

Another volume in the continuing series containing papers on variously modified hydrogen flame ionization detectors, several reports on recently developed ancillary equipment for gas chromatography analyses, and studies on biomedical analyses for amino acids, vitamins, and trace amounts of inert gases in blood, as well as a significant chapter on analytical methods for pesticides.

227 PAGES **APRIL 1967** \$12.50 PP

substituent effects in organic polarography

by Petr Zuman, Czechoslovak Academy of Sciences, Prague With a Foreword by J. Heyrovsky

This book develops the mathematical treatment of the half-wave potenrelationships. It provides a unified classification system for the polarographic behavior of organic substances based on correlations between the polarographic half-wave potentials of organic depolarizers and their Hammett constants. Benzene, heterocyclic, polycycylic, aliphatic quinoid, and alicyclic systems are discussed in detail. \$17.50

APPROX. 384 PAGES JUNE 1967 PP

guide to fluorescence literature, volume 2

by Richard A. Passwater, Product Manager of Fluorescence Instruwith the assistance of Jarratt G. Bennett and Barbara G. Passwater

This volume contains nearly 5000 references to the international literature of fluorescence from 1950 to 1964 inclusive. The purpose of the compilation is to give today's scientist ready access to published work on fluorescence and phosphorescence not only to prevent needless duplication but also to suggest new ideas for future research.

The book includes a complete Author Index and a comprehensive Subject Index which is conveniently cross-referenced to facilitate quick information retrieval.

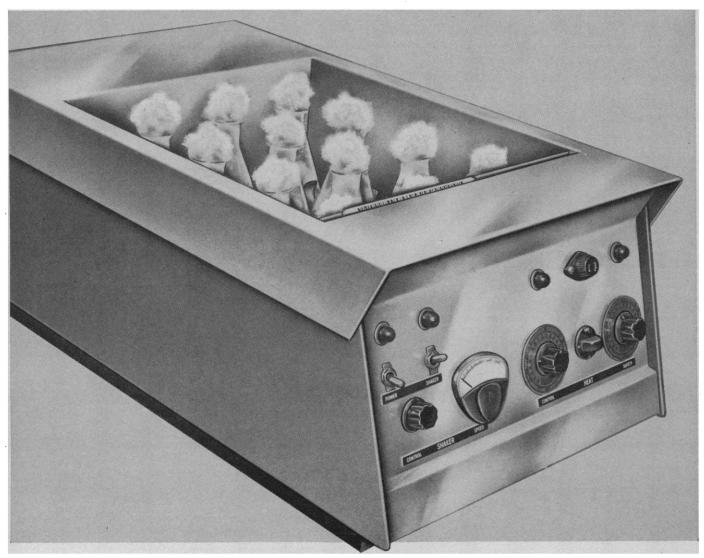
PP DATA DIVISION MAY 1967 \$19.50 367 PAGES

consultants bureau/plenum press Divisions of Plenum Publishing Corporation 227 WEST 17th STREET, NEW YORK, N.Y. 10011, U.S.A.

12 MAY 1967

721

New <u>ELECTRONICALLY</u> Controlled Water Bath Shaker!



Controls Temperature <u>ELECTRONICALLY</u> within ±0.25° C! Controls Agitation <u>ELECTRONICALLY</u> from 40-400 rpm! Controls Water Level <u>ELECTRONICALLY!</u> Controls Heating and Tap-Water Cooling <u>ELECTRONICALLY!</u>

Other new engineering features: Auxiliary safety thermostat protects against overheating. Safety lock-knobs prevent accidental change of thermostat settings. Right-angle mercury thermometer is designed for easier reading without removal, and is also protected against breakage. Extra large shaker capacity.

Send for catalog G77S/5127

New Brunswick Scientific Company, Inc. 1130 Somerset Street, New Brunswick, N. J. 08903



A NEW SERIAL PUBLICATION ... PROGRESS IN THEORETICAL BIOLOGY, VOL. I

edited by FRED M. SNELL, State Univ. of N.Y. at Buffalo CONTENTS: E. C. POLLARD, Erwin Schrödinger 1887– 1961. M. CALVIN, Chemical Evolution. H. J. MOROWITZ, Biological Self-Replicating Systems. H. BREMERMANN, Quantitative Aspects of Goal-Seeking Self-Organizing Systems. F. OOSAWA and S. HIGASHI, Statistical Thermodynamics of Polymerization and Polymorphism of Protein. W. R. STAHL, The Role of Models in Theoretical Biology. Author Index-Subject Index. June 1967, about 230 pp., \$10.00

STATISTICAL MECHANICS

edited by HENRY EYRING, University of Utah Volume 2 of PHYSICAL CHEMISTRY: An Advanced Treatise (in ten volumes)

A comprehensive account of statistical mechanics including such topics as crystal and black body radiation; dielectric, diamagnetic and paramagnetic properties; real gases; electrolytic solutions; and surfaces of solids. 1967, 561 pp., \$17.50, \$14.88*

IN FOUR VOLUMES... METHODS IN CANCER RESEARCH

edited by HARRIS BUSCH, Baylor Univ., College of Medicine CONTENTS OF VOLUME 1: MORPHOLOGY: E. DE HARVEN, Methods in Electron Microscopic Cytology. R. BASERGA, Autoradiographic Methods. T. C. HSU and F. E. ARRIGHI, Karyological Methods. TRANSPLANTA-TION AND METASTASIS: A. G. LIEBELT and R. A. LEIBELT, Transplantation of Tumors. B. FISHER and E. R. FISHER, Metastases of Cancer Cells. CARCINOGENESIS: M. B. SHIMKIN, Epidemiology in Cancer Research. J. H. WEISBURGER and E. K. WEISBURGER, Tests for Chemical Carcinogens. H. TERAYAMA, Aminoazo Carcinogenesis-Methods and Biochemical Problems. F. RAPP, Viral Oncogenesis. K. O. SMITH, Identification of Viruses by Electron Microscopy. Author Index-Subject Index. 1967, 612 pp., \$28.00, \$23.80*

BLOOD CLOTTING ENZYMOLOGY

edited by WALTER H. SEEGERS

Wayne State University College of Medicine

An introduction to the general field of blood clotting enzymology. The application of basic principles in clinical medicine is presented in terms of platelet function, hemorrhagic diseases, thrombosis and physiological integration. May 1967, 629 pp., \$27.50

HYPERFINE INTERACTIONS

edited by ARTHUR J. FREEMAN and RICHARD B. FRANKEL National Magnet Laboratory, M.I.T.

This unique collection of papers covers the entire range of basic principles and latest advances in the field of hyperfine interactions and associated relaxation phenomena. Based on the proceedings of a NATO Advanced Study Institute held at Aix-en-Provence, France, 1966, this book includes papers by such eminent authorities as A. ABRA-GAM, B. BLEANEY, S. GESCHWIND, R. L. MÖSSBAUER, and A. STEUDEL.

1967, 758 pp., \$16.00

ENERGY CHANGES IN BIOCHEMICAL REACTIONS

by IRVING M. KLOTZ 1967, 108 pp., clothbound \$5.95, paperbound \$3.00

IN TWO VOLUMES ...

FERTILIZATION

COMPARATIVE MORPHOLOGY, BIOCHEMISTRY AND IMMUNOLOGY edited by CHARLES B. METZ and Alberto Monroy Volume 1 1967, 440 pp., \$22.00, \$19.00*

SYSTEMS ANALYSIS IN ECOLOGY

edited by KENNETH E. F. WATT 1967, 276 pp., \$11.50

THE MOLECULAR BIOLOGY OF VIRUSES

edited by John S. Colter and William Paranchych June 1967, about 750 pp., \$19.50

CARDIAC STIMULANT SUBSTANCES

by Roland H. Thorp and Leonard B. Cobbin 1967, 288 pp., \$12.00

IN TWO VOLUMES ...

RAREFIED GAS DYNAMICS

edited by C. L. BRUNDIN Proceedings of the Fifth International Symposium on Rarefied Gas Dynamics, held at the University of Oxford, 1966. Volume 1: 1967, 879 pp., \$18.50 Volume 2: 1967, 852 pp., \$18.50

ELECTRONIC ABSORPTION SPECTRA AND GEOMETRY OF ORGANIC MOLECULES

AN APPLICATION OF MOLECULAR ORBITAL THEORY by Hiroshi Suzuki June 1967, 568 pp., \$24.00

ADSORPTION, SURFACE AREA AND POROSITY

by S. J. GREGG and K. S. W. SING 1967, 371 pp., \$18.00

INTRODUCTION TO THE QUANTUM THEORY OF SCATTERING

by L. S. RODBERG and R. M. THALER PURE AND APPLIED PHYSICS SERIES May 1967, 398 pp., \$11.50

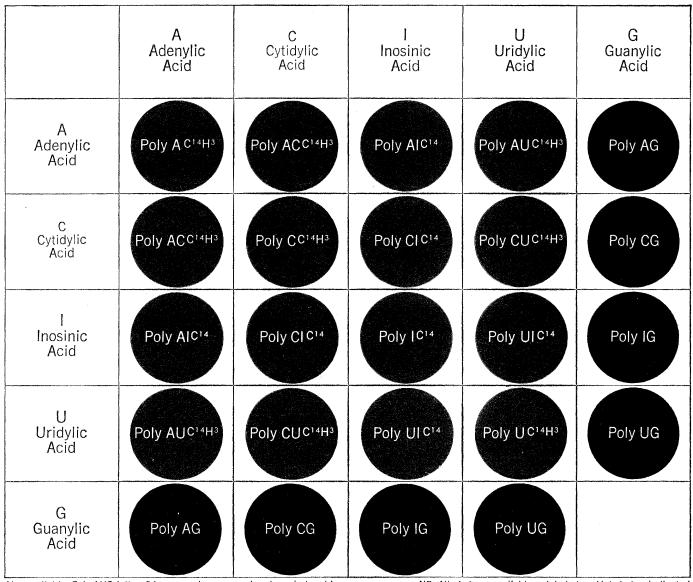
THE FOUR-COLOR PROBLEM

by Oystein Ore Pure and applied mathematics series 1967, 259 pp., \$12.00

ACADEMIC PRESS (P) NEW YORK AND LONDON 111 FIFTH AVENUE, NEW YORK, N.Y. 10003

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

12 MAY 1967



Also available: Poly AUC (other 3-base copolymers coming; keep in touch)

NB: All of above available unlabeled and labeled as indicated

Polyribonucleotides

(synthetic template RNAs from Schwarz)

The checkerboard above shows the polyribonucleotides that we are now manufacturing. (Forgive the checkerboard's redundancy, this being the inevitable nature of such grids.) In any case, note that the first item in the first column—either horizontally or vertically—is a homopolymer, as is the second item in the second column, the third in the third, and, finally, the fourth in the fourth. All others, of course, are copolymers. Everything shown is available *unlabeled*. But some are *also* available labeled with C¹⁴ (in the purine-8 and/or pyrimidine-2 positions) or H³ (in the purine or pyrimidine moieties); the grid shows this too. Accordingly, red means that *both* hot and cold versions are available, whereas black signifies that the compound is only available in the unlabeled form.

Our polyribonucleotides are potassium salts that come to you in the vials in which they have been lyophilized. They are free of nucleases and of low molecular weight materials including nucleosides and nucleotides. Their apparent average molecular weights run in the order of 10^5 to 10^6 .

These compounds are sold on the basis of the poly-

nucleotide phosphorus present (which helps eliminate several unnecessary ambiguities). Each vial contains 2.5 μ Moles of polynucleotide phosphorus per milligram of nominal polymer weight.

To reduce other possible ambiguities, we give you a reassuring Product Analysis Report which recounts the analytical data that we've developed on the specific material you receive. For example: the exact base ratios of the isolated copolymers. And a great deal more.

So: if your research is leading, or has led, into these intriguing areas, consider the possible advantages of using our pure, carefully characterized polyribonucleotides. Such consideration can now be abetted by asking us for two things: (1) more data on our polyribonucleotides, and (2) a selected list of relevant references. And while you're at it, why not ask for our complete 80-page catalog? Your move, please.



first automatic pH stat titrator with all-digital volume indicator and quick-change burets

With the superb craftsmanship that is synonymous with their country, Metrohm of Switzerland brings you the Combititrator-3D—an automatic titration apparatus of unparalleled quality and versatility. It features a pH meter, a controller, and a recording motor buret. The latter is offered with the first bayonet-mounted¹ burets for instantaneous exchange of all glassware components. (SEE CIRCLED AREA IN PHOTO.)



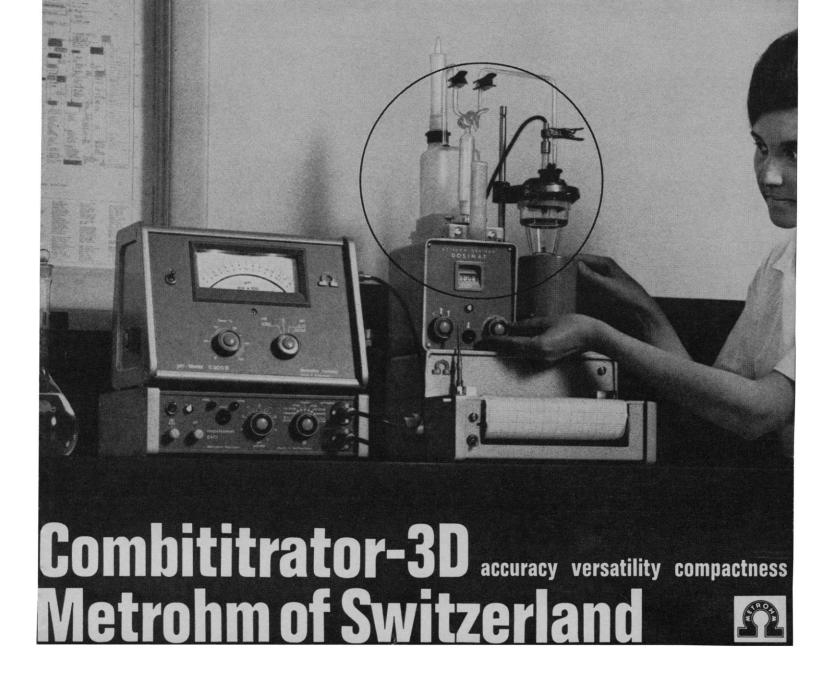
The Combititrator-3D can be set up to perform virtually any common or unusual titration: automatic potentiometric with recording; automatic potentiometric to an endpoint; constant-potential with recording of reagent volume against time (pH stat titration); pH and mV measurements; acid/base, redox, precipitation, non-aqueous, or complex titrations.

The Combititrator offers high operating accuracy, eliminates errors resulting from manual procedures, and provides reproducible results. All the operator has to do is prepare the sample solutions.

The most complete line of accessories is available including titration vessels with capacities ranging from micro to macro quantities, with and without thermostatic control.

Measuring accuracy is 0.01 pH or 10 mV; the chart recorder drive incorporates a 4-speed gearbox; and titrant volume can be read on an all-digital counter (if recording is not required).

For detailed information about all Metrohm automatic titrators write to: Metrohm Division Brinkmann Instruments, Inc. Westbury, New York 11590



laboratory analyses made easy!

Or: How Realtime Systems Inc. automates analytical instruments in the laboratory to give you real-time analysis results.

The chromatograph has been tamed. Likewise, the autoanalyzer and the mass spectrometer. It took Realtime's systems expertise—plus digital computers to do it. Now we provide modular, on-line computer systems that let you acquire and interpret data simultaneously—fast enough, precisely enough to automate laboratory systems that once defied automation.

Realtime's packaged systems for laboratory chromatographs automatically collect and analyze data from flame ionization and thermal conductivity detectors. Currently operating commercial systems correct base-line drift, integrate and resolve simple or overlapped peaks and shoulders, identify components by elution times. Analysis reports are also printed automatically.

Realtime's time-shared process chromatograph systems eliminate peak-reader memory devices and mechanical timers. Our systems control sample-stream-select, column-select and backflush valves as well as trend recorders and other operator display devices. One system now being completed operates on a time-shared basis with a large data-logging computer-control system. Another utilizes its own small-scale computer system. Two other moduler systems are under development for antoanalyzers. Two more are being tailored by Realtime to process data from high-resolution mass spectrometers.

The days are numbered for manual techniques and tedious hand calculations. Realtime Systems Inc. has made laboratory analyses easy with flexible, low-cost digital computer systems.

Complete packaged systems include:

- System definition studies and engineering
- Computer selection and interface equipment
- Programming implementation
- System installation, start-up and documentation

For details, contact: Dr. Terry McMahon Marketing Manager Computer Systems Division Realtime Systems Inc. 866 Third Avenue New York, N.Y. 10022 Telephone: (212) 421-2250



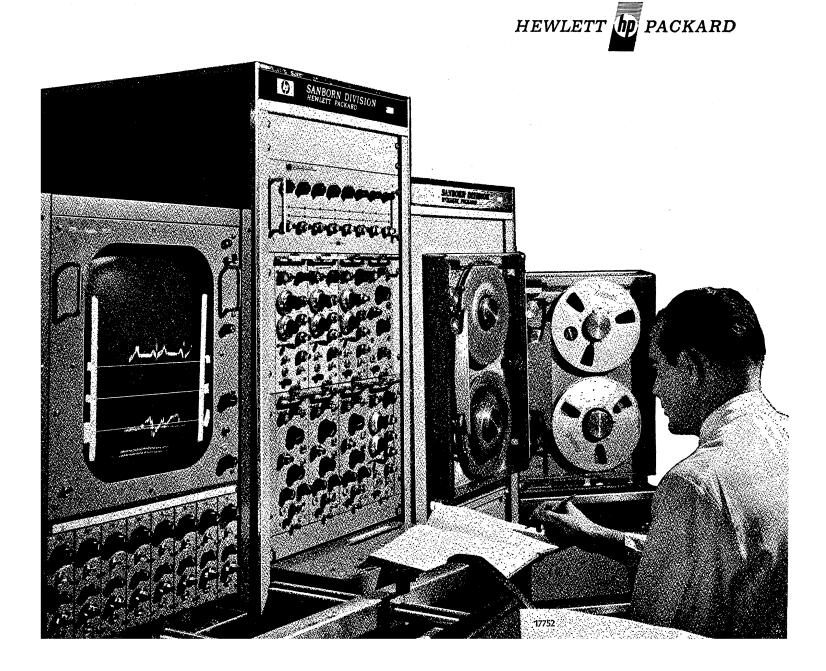
Think what you may want to measure tomorrow

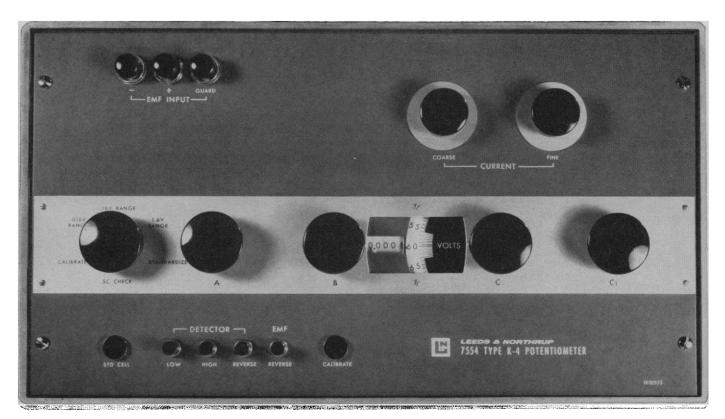
... before you buy a research recording system today

Hewlett-Packard recording systems give you the greatest *long-term* value for your investment because of two important characteristics: (1) you have the choice of the *specific* combination of signal conditioning, tape and chart recording, and display instrumentation most suitable for your *present* investigations . . . and (2) entirely different or additional phenomena can be measured and analyzed in the future without "rebuilding" the system or obsoleting major elements of the system. Simplified operation and "custom" capabilities carry no penalty of limited applicability when you change to new input signal levels, want to perform different operations on the data — or alter the type of readout or display.

This freedom of instrumentation choice from HP means: 9 different series of transducers...heat, photo-

graphic and ultraviolet-writing oscillographs . . . 21 plug-in signal conditioners specifically for medical and biophysical phenomena . . . scopes for one to 8 channels, with 3" to 17" screens, and a variable-persistence "image retaining" model . . . FM and Direct Record/ Reproduce magnetic tape systems with 7 or 14 channels, bandwidths to 100 and 250 kHz. All are standard HP products, compatible with each other --- manufac-tured, installed, warranted and serviced by a single source serving you locally through 47 field offices in the U.S. alone, more than 100 throughout the free world. Call your local HP medical field engineer for complete information and knowledgeable application assistance. Hewlett-Packard Company, Sanborn Division, Waltham, Mass. 02154. In Europe: 54 Route des Acacias, Geneva.





What comes after K-3? K-4, of course.

For more than ten years, the Leeds & Northrup Type K-3 general-purpose potentiometer has served well for precision thermocouple measurements, meter calibration, current and voltage measurements and a host of important research, calibration and engineering applications.

Now-after a decade of continuing improvement-the K-3 has been honorably retired.

The new Type K-4 Potentiometerits highly qualified successor-not only retains the proven features of the K-3 (guarding, central readout, stable circuit components) but also offers so many additional user-oriented features that a new design was required. For example:

1. Higher accuracy. Twice as good as the K-3; on the high range, for example, \pm (50 ppm of reading + 20 μ v). 2. Quick calibration. Provision for convenient internal consistency check between decades and main steps. 3. Mounting flexibility. Dual-angle bench mount, rack mount (with rear

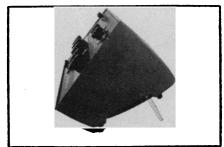
connections) and complete potentiometric facilities. The price? Surprising. Despite the

added features (and inflation), the price is *lower* than the K-3...by more than \$50.

So when you think K-3...remember, it's now K-4.

For descriptive literature, call your

nearby L&N field office or write us at 4926 Stenton Avenue, Philadelphia, Pa. 19144.





The classroom is always the final testing laboratory . . .

in which texts crumble or stand firm.

These books are holding up well in the lab ...

have you tried them in yours?

• BIOLOGY TEXTBOOKS •

Cockrum & McCauley: Zoology Cantarow & Schepartz: Biochemistry Villee, Walker & Smith: General Zoology DeRobertis, Nowinski & Saez: Cell Biology Cockrum, McCauley & Younggren: Biology Lush: Biochemical Genetics Braun: Bacterial Genetics Gause: Microbial Models of Cancer Cells Finter: Interferons Fawcett: The Cell Carlson: The Gene: A Critical History Milhorn: The Application of Control Theory to Physiological Systems Bloom & Fawcett: Histology Gardner & Osburn: Structure of the Human Body

MATHEMATICS •

Lefort: Alegbra & Analysis Hafstrom: Analysis & Abstract Algebra Evgrafov: Analytic Functions Postnikov: Variational Theory of Geodesics Pallu de la Barriere: Optimal Control Theory

• PHYSICS •

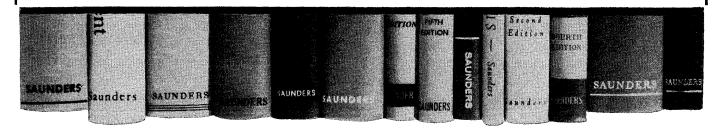
Elton: Introductory Nuclear Physics Kyrala: Theoretical Physics Fujita: Non-Equilibrium Quantum Statistical Mechanics Kalikhman: Elements of Magnetogasdynamics

Chisholm & Morris: **Mathematical Methods in Physics** Stevenson & Moore: **Theory of Physics** Roberts & Kaufman: **Tables of Laplace Transforms** Giese: Cell Physiology Romer: The Vertebrate Body Villee: Biology Barnes: Invertebrate Zoology Guyton: Function of the Human Body Burrows: Microbiology Gardner: Fundamentals of Neurology Carpenter: Microbiology Arey: Developmental Anatomy Florey: An Introduction to General & Comparative Animal Physiology Turner: General Endocrinology Balinsky: Introduction to Embryology King & Showers: Anatomy & Physiology Leeson & Leeson: Histology

• CHEMISTRY •

Noller: Chemistry of Organic Compounds Noller: Textbook of Organic Chemistry Patton: Biochemical Energetics & Kinetics Hutchinson: Chemistry: Elements & Their Reactions Harrow & Mazur: Biochemistry Lee & Van Orden: General Chemistry Christensen & Palmer: Enzyme Kinetics Masterton & Slowinski: Chemical Principles Luder, Shepard, Vernon & Zuffanti: General Chemistry

Why not test one or more of these yourself? We will gladly send texts to college teachers on approval.



W. B. SAUNDERS COMPANY 12 MAY 1967

W. Washington Square, Philadelphia, Pa. 19105



The Answer is the UltroRac!!!

LKB INSTRUMENTS INC • 12221 PARKLAWN DRIVE • ROCKVILLE Md 20852

The NEW ULTRORAC is the smallest fraction collector with a 200 standard test-tube capacity.

Having rugged precision it is as dependable as the world-famous RadiRac. Remove a ten-tube rack, it continues working – put it in the cold, it continues working – treat it roughly, it continues working – preset the run to end at 50 fractions and it stops at your command. ✓ Designed to Save Space

- ✓ Designed for Coldroom use
- ✓ Designed for Standard test tubes
- ✓ Compact, removable electronic unit for remote control
- ν' For time, drop and volumetric capabilities
- ✓ Stainless steel column-support rods polypropylene racks
- ✓ Provision for event marking
- Power outlet for flow pump



We guarantee it for 3 years too.

OTHER HEADQUARTERS FOR SALES AND SERVICE

SWEDEN LKB-Produkter AB Box 76, Stockholm—Bromma 1 UK LKB Instruments Ltd. LKB House, 137 Anerley Road, London, S.E. 20 **NETHERLANDS** LKB-Produkten N.V. Zeekant 35, The Hague

DENMARK

LKB Instrument A/S Amagerbrogade 34, Copenhagen S

SCIENCE, VOL. 156

730

What price signal averaging?

Here's a quick look at the real expense —in data as well as dollars—of signalaveraging devices, including our averager, the Model 7100 Data Retrieval Computer.



Will you pay for less than excellent resolution? You will in any signal averager that has a minimum dwell-time per data point of more than 39 microseconds. Resolution, after all, is a function of the number of data points that can be placed within a region of interest. Our Model 7100 Data Retrieval Computer (DRC) uses all 400 of its data points for signals occurring within as little as 15.6 milliseconds. The DRC, therefore, gives much better resolution than averagers that use only a fraction of their data points to represent the signal of interest.

Will you pay for less than total versatility? You will in any averager that doesn't have the built-in capability—without add-on options —for interval- and time-histogram analysis, as well as transient-averaging. The DRC will operate in *any* of these three modes, which are selected on a front-panel switch.

Will you pay for less than maximum input sensitivity? You will in an averager that needs a pre-amplifier to accept low-amplitude input signals. The DRC has 20-millivolt input sensitivity. So, most of the time, the DRC requires *no* added pre-amps.

What should you pay for a basic signal averager? That's up to you. But for its price, the DRC offers you more performance, versatility, and convenience than any other comparable signal averager.

The Model 7100 Data Retrieval Computer. Now available at a new, lower price.

For more information, consult your local Nuclear-Chicago sales engineer or write to us.



349 E. Howard Ave., Des Plaines, Ill. 60018 U.S.A. Donker Curtiusstraat 7, Amsterdam W. process than if we diffuse our resources on the environmental factors, which are not readily amenable to manipulation. Student attitudes towards life and school have been shown to affect strongly performance in academic studies. These attitudes can be altered directly by good teachers and possibly take root in the relatively short span of the school years (especially if effective "pre-school" programs for ages 3 to 6 are developed and implemented).

Alexander M. Mood Murray Spitzer David S. Stoller Frederic D. Weinfeld

National Center for Educational Statistics, Department of Health, Education, and Welfare, Washington, D.C. 20202

. . . Nichols contends in his review (i) that no inferences can be drawn from the USOE data regarding the effects of desegregation on Negro achievement, and (ii) that the data show differences in educational opportunity (that is, quality of schooling) to be of no importance as a factor in racial differences in achievement. I think his conclusions are unwarranted in both instances.

Regarding the first point: It is true that the USOE data consists entirely of correlations between measurements at a single point in time, and that only a longitudinal study of achievement, involving repeated measurements of pupils who were randomly assigned to different types of schools, could provide a definitive test of the effects of desegregation. However, when longitudinal studies are not feasible, carefully designed ex post facto research can and should be used as a basis for drawing qualified inferences about causality. To deny this would be to discard muchperhaps most-of the accumulated empirical knowledge of the social sciences.

In the USOE survey, cross-tabulations on indicators of socioeconomic status showed that differences in Negro achievement associated with extent of desegregated schooling were not accounted for by measured family-background factors. Admittedly, there may have been important background factors that were not measured. But such assumed differences among families of similar socioeconomic status would have to account for the following obtained trends:

1) The earlier the grade during which

the child first experiences desegregation, the stronger the apparent gain in achievement.

2) The greater the proportion of white classmates at the time of testing, the stronger the apparent gain in achievement.

3) The higher the grade in school, the closer the relationship between proportion of whites in a school and Negro achievement.

It seems to me unreasonable to argue that these relationships merely reflect undetected differences in the family backgrounds of Negro pupils. I am informed that in further cross-tabulations of the data, done for the U.S. Civil Rights Commission, Negro pupils were divided into two groups according to educational level of their own families, and into three according to educational level of their classmates' families, and that for virtually all combinations of categories there were linear trends toward higher Negro achievement as (i) proportion of white classmates increased and (ii) the grade in which desegregation was first experienced was lowered.

For his opinion that the data show the differences in average performance of racial groups not to be the result of differences in educational opportunity, Nichols cites two lines of evidence: (i) the racial gap in achievement, as measured by standard scores on tests, remains quite constant in the Northeast at different grade levels; (ii) the proportions of total variance in achievement accounted for by between-school differences and within-school differences remain constant at different grade levels.

First of all, it should be noted that in the South the racial gap does grow larger at higher grade levels, a showing consistent with the notion of a cumulative effect of inferior educational services. Why in the South, but not in the Northeast? One regional difference is obvious. In the South, racial comparison is tantamount to comparing Negro schools and white schools, since over 90 percent of Negro children in the South are in de facto segregated schools. But in the North almost 50 percent of all Negro pupils are in predominantly white schools. Therefore, the data cited by Nichols (racial averages in test scores) are not relevant to the question of the effects of school quality on racial differences in the North. The relevant data would have to compare performance through time of Negro children in predominantly

Need to record the brightness of stars?

Not only the brightness of stars but just about everything else that can be expressed as an electrical value is being recorded by these wide chart (10") Single-channel Rotary Servos. ■ Why this popularity? Because this servo is priced at \$1,025 and still has this combination of features: > solid state amplifier > 50,000 ohm off balance input impedance or better > response as fast as ½ second even at 0 to 1 MV range > accuracy of ±0.25% span or ±3½ microvolts > dead band 0.1% of span or less > longitudinal stray rejection at 60 Hz, 1,000 times span or 120 V > permanently sealed slidewire which requires no cleaning > 5 chart speeds standard > chart tear-off > tilt-out writing platen > pen lifter. ■ Outstanding options include: > multi-range selector switch > choice of automatic or manual chart drives > up to 6 alarms > two retransmitting potentiometers > event pen > thermocouple fail safe. ■ Add to these features 10 day delivery* and you have every reason to specify Esterline Angus the next time you need rotary servos. ■ Get complete information. Call your Esterline Angus sales engineer or write for our colorful Series ''E'' Catalog. ■ *10 working day delivery (ARO) is available for Rotary Servo Recorder models which have become so popular they're now in production at all times. **INFOLICIENT AND SCOND** ESTERLINE ANGUS INSTRUMENT COMPANY, INC. **INFOLICIENT SCOND** SCOND ESTERLINE ANGUS INSTRUMENT COMPANY, INC.

An equal opportunity employ

MEASURE FLUORIDE ION ACTIVITY

Third in Orion's new series of specific ion electrodes, the Fluoride Activity Electrode for the first time permits direct, rapid measurement of fluoride ion activities in aqueous solutions.

WIDE RANGE, VERSATILE Measurement of fluoride can be made from above 10° down to 10^{-6} moles/liter (20 parts per billion) even in the presence of a tenthousand fold excess of chloride, iodide, bromide, nitrate, sulfate, or bicarbonate. The electrode can also be used as an end point detector for titrations where fluoride is either the titrant or the unknown. **NEW SENSING PRINCIPLE**

A laser-type, rare-earth doped single crystal is used as the ion-exchange sensing element. The electrode body is an acid-base resistant, unbreakable plastic.

INSTRUMENTATION

Measurements are made with any expanded scale pH meter and a conventional pH reference electrode. Technique is similar to single pH measurement. The electrode available thru major laboratory dealers, is priced at \$160.

	e Street, Dept. D fassachusetts 02139 UN 4-5400
Name	States and the second
Org	
Street	and the second
City	State
Literature	Demonstration
	upply Dealer:

Negro schools with white performance in predominantly white schools, and of course, for the sake of completeness, Negro children in white schools, and white children in Negro schools. (As I indicated above, the effect on Negro pupils of attendance in white schools does appear from the USOE report to be cumulative. Moreover, an additional tabulation by the Civil Rights Commission shows that in the 12th grade the average northern Negro child of low socioeconomic background in a school with a predominantly low-status Negro enrollment is reading at the 7thgrade level, whereas the comparable Negro child in a high-status white school is reading at the 11th-grade level.) Note also that the percentage of Negroes in predominantly white schools in the North increases greatly (about doubles) in the higher grades. If the white schools are better schools (and they clearly are in at least one important respect-the verbal ability of teachers), this factor could easily wash out any tendency toward enlargement of the racial gap at higher grades.

Nichols' second argument is that if differences in school quality contribute to racial differences in average achievement, between-school differences in average performance, relative to withinschool differences in individual performance, should increase with increasing grade level. This assumes there are no factors within schools that have a cumulative effect on differences between pupils. If differences within schools were also increasing with grade level, increasing differences between schools would not be apparent, since the relative contributions to total variance would tend to remain unchanged.

There is one likely candidate as a within-school factor having cumulative effects on performance—ability grouping. Over 60 percent of white and Negro children in the Northeast (80 percent of Negro children in the South) are in schools that practice some form of ability grouping. There is enough evidence of a "self-fulfilling prophecy" phenomenon associated with ability grouping to warrant rejecting the comparison of within-school and betweenschool variance as a test of whether differences in educational opportunity affect achievement.

In short, I find Nichols' conclusion that variations in educational opportunity (including the opportunity to go to school with children of different backgrounds) have no material effect on Negro achievement—unwarranted on the basis of the evidence he presents. On the contrary, the Coleman data suggest the opposite.

IRWIN KATZ Center for Research on Conflict Resolution, University of Michigan, Ann Arbor 48104

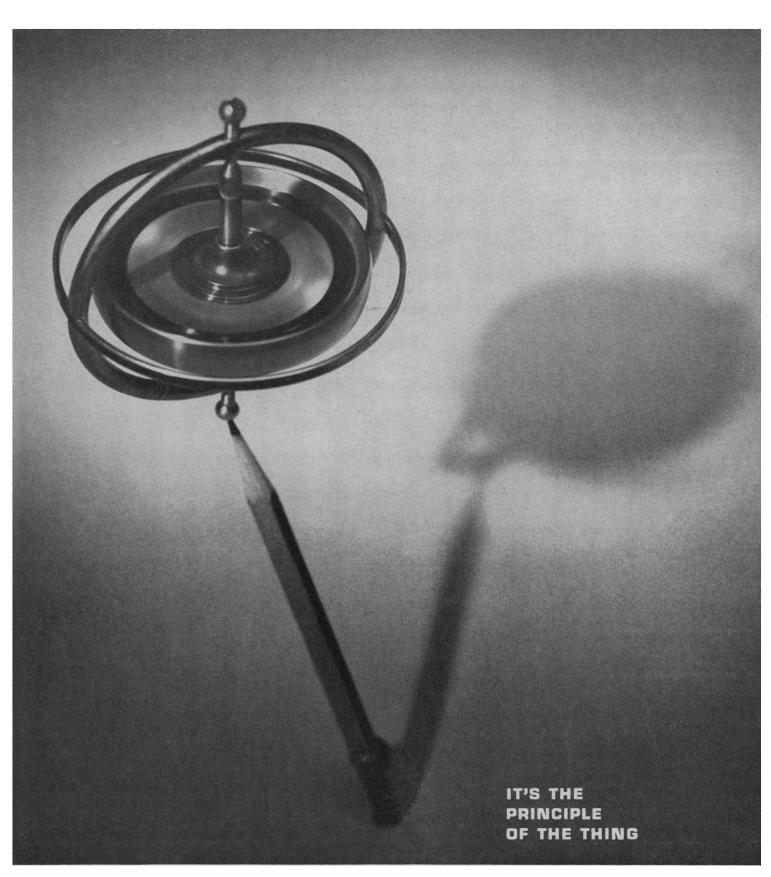
The two foregoing letters support the major conclusion of my review, which was that available data are inadequate to answer the important questions asked of them.

Mood, Spitzer, Stoller, and Weinfeld rightly emphasize the difficulty of isolating the role of differences among schools in bringing about individual differences in ability among students. However, they seem overly to minimize significance of their regresthe sion analysis in which little relationship was found between student achievement and school quality when family background was statistically controlled. The conclusion of the report, "that schools bring little influence to bear on a child's achievement that is independent of his background and general social context" (p. 325), can be contested on methodological grounds, but I know of no better evidence that would suggest the opposite conclusion.

The increasing racial gap and increasing between-school variance with increasing grade level that might be expected if school differences were a major source of individual differences in student performance were not observed in the Coleman study. Katz and Mood et al. have indicated several reasons why this is not conclusive evidence for the absence of school effects. Student migration and dropout and differential test validity at the different age levels are additional sources of error that could obscure the evidence of school effects. But simply explaining away the negative evidence does not establish a strong case for the existence of substantial school effects.

Katz points out that "differences in Negro achievement associated with extent of desegregated schooling were not accounted for by measured familybackground factors," but neither were they accounted for by measures of school quality or of racial balance. They could be accounted for either by the higher socioeconomic level of the other students in integrated schools (the conclusion of the USOE report) or by incomplete control of family background (a possibility mentioned in my review).

I agree with Katz that the data do SCIENCE, VOL. 156





It's the gyroscopic principle, that is, in SORVALL's patented Gyro-Action Direct Drive! This rugged drive assembly allows the rotor maximum freedom of action, eliminates problems of rigidity, slippage, and balance, and gives the smoothest centrifugation available. Tolerance for tube imbalance makes necessary only visual equalization of tube contents. Angle and Horizontal rotors are seated directly on the shaft (no tools needed). In the SORVALL RC2-B* (RCF's to $49,500 \times G$ — Speeds to 20,000 RPM) this unique drive system takes the rotor rapidly, quietly and safely through acceleration, run, and deceleration cycles. And, of course, there's a minimum of resuspension with Gyro-Action operation.

Please write us for Bulletin SC-5G

*Other SORVALL[®]centrifuges with Gyro-Action : SS-3, SS-4, RC-3, GLC-1.



Announcing the New S EA System for ELECTROPHORESIS



EA-4 Power Control Supply Designed especially for electrophoresis. Continuously variable voltage 0 to 500 V. *Stable:* Supplies constant voltage. (Ripple less than \pm 0.1%. Unit regulates to \pm 0.1%.) Also can supply constant current over entire range. No variance in mA with change in load \pm 90%. Double scale meter shows V and mA. Exclusive built-in timer with automatic shut-off. Four chambers – simultaneous operation (7 tests per chamber). Constant current control over entire electrophoretic range.



EA-1 Electrophoresis Chamber High impact polystyrene; water cooling jacket. Domed see-through lid. Safety interlock. Platinum electrodes run entire chamber length. Polarity reversing switch. Simple, accurate method of attaching sample strip with flexible holders in integral part of chamber unit.

This system offers features and advantages never before found in electrophoresis equipment. The design is superb—and the system was precision built by scientists expressly for scientists. Our free brochure will give you a full description complete with additional pictures.

FREE BROCHURE MAIL COUPON TODAY !

Carl Schleicher & Schuell Co. Keene, New Hampshire – Dept. S-5-67 Please send free brochure on new S&S/EA System for Electrophoresis				
Name				
Company				
Address				
City	······			
State	Zip #			
STOCKED BY:	Van Waters & Rogers, Inc.			

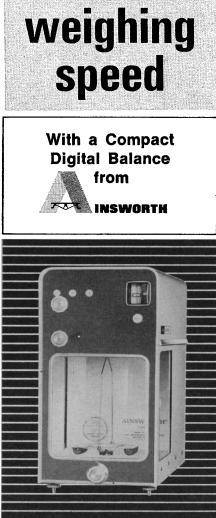
736

not warrant the conclusion "that variations in educational opportunity . . . have no material effect on Negro achievement," but neither do they warrant the opposite conclusion.

The question of the extent to which differences among schools are responsible for differences in student performance is too important to rest on quibblings over inadequate evidence. At a time when we talk matter-offactly about sending men to the moon, I find it hard to accept Katz's statement that "longitudinal studies (of educational effects) are not feasible." The Equality of Educational Opportunity survey has demonstrated that wellfinanced, large-scale studies can provide data relevant to important questions concerning educational effects; but, as a first attempt organized on a crash basis, it has raised more questions than it has answered. Much more research on a similar scale is needed. particularly studies incorporating longitudinal data. The great variation in educational practices in the U.S. provides a vast and continuing natural experiment. Analyses to isolate the effects of the many variables involved can be done at a relatively low cost. We can no longer afford to pass up such a research bargain.

In addition to evaluating the effects of existing differences in educational programs, promising new ideas should receive a fair trial. The educational establishment is so conservative, however, that it is extremely difficult to introduce changes. To get an innovation accepted, such a strong emotional argument for it must be advanced that it then becomes impossible to deny it to anyone who wants it. Thus, the effects of changes in the educational system are never evaluated. Proposed changes in educational programs should be tried in the natural setting, on an adequate scale, on an experimental basis with the control groups and measurements that are necessary to assess the effects of the change. Then a rational decision could be made either to expand or to abandon the program.

As Mood *et al.* point out, we have been questioning the differential effects of schools, not the absolute value of education. As a whole the schools have undoubtedly improved in effectiveness over the years. However, we may be nearing the upper limit on improvement that can be achieved by common sense and experience alone. Future enhancement of the effects of education will increasingly depend on the objective



Increase

Easy access, all controls located on the front panel, an all-digital in-line readout which displays the entire weighing result in six or seven digits (depending on model), and "add weight" and "remove weight" signals contribute to faster weighing when you use an Ainsworth Digital Balance.

Five different models of Ainsworth Digital Balances are available in a variety of colors in baked acrylic or epoxy finishes on a rugged all-metal case. Brighten your laboratory-or match your school colors!
Choose from models with capacities from 80 grams to 200 grams-some with taring capacity-and sensitivities ranging from 0.01 mg to 1 mg. □ Ainsworth Balances are completely fabricated in Denver. Materials, design, production, assembly and testing are the result of Ainsworth's 85 years experience in making precision balances-your assurance of quality, accuracy and long service. \Box For a full description of Ainsworth Digital Balances, request Bulletin 665 from Ainsworth & Sons, Inc., Denver, Colorado 80205.



evaluation of the effects of educational programs, so that the effective can be expanded and the ineffective abandoned.

ROBERT C. NICHOLS National Merit Scholarship Corporation, 990 Grove Street, Evanston, Illinois 60201

Christian Impact on Ecology

In "The historical roots of our ecological crisis" (10 Mar., p. 1203) White helpfully pointed out that "Since the roots of our trouble are so largely religious, the remedy must also be essentially religious, whether we call it that or not. We must rethink and refeel our nature and destiny." Fine! A better general conclusion has rarely been formulated even though his handling of the historical data of Christianity and Scripture leaves much to be desired. He seems to feel that what Christians have said and done adequately represents Christianity. To speak of "orthodox Christian arrogance toward nature" is to miss the heresy and blasphemy and label it normative. Not everything Christians do is Christian in character. . . . The most undeveloped and misunderstood teaching of Scripture relevant here is the cultural mandate given Adam by God. White described some of the data of the mandate but missed the thrust, as have most Christians over the centuries. The cultural mandate makes man the responsible steward of the universe, not its spoiler and looter. Responsible stewardship, not exploitation, is the keynote. As steward of the universe, man is challenged to develop natural resources to benefit all creatures, aesthetically and materially, and by so doing to honor his Creator and Redeemer. Such Christian stewardship of natural resources does not include exploitation for selfish gain at the expense of society, nor pollution of land, air or water.

ERNEST S. FEENSTRA Department of Pathology, Upjohn Company, Kalamazoo, Michigan

The historical impact of Christianity upon ecology has depended not on what we, individually, at present, may think that Christianity should have been, but rather upon what the vast "orthodox" majority of people who called themselves Christians have in fact thought it was. Feenstra, like St. Francis, is trying to reform Christianity. 12 MAY 1967

petroleum derivatives chlorinated solvents peroxide solutions ethylantracene - salt solutions - polymers fruit butters - mapl syrup - acetice acid hydrogenated fats oil contaminants hydraulic fluids essential oils fruit preserves berry preserves egg solids aliphatics biologicals solvents . alcohols jellies flours . coffee pentane solids honey jams - oils waxes cocoa fruit nylon maple juices plasti syrup . soybeans flaxseed plasticizers naphthalene bromonaphthalene ethylantracene tomato products - fluorinated hydrocarbons - ext dense flint glass - organic chemicals - silicone polyester resins - borosilicate crown glass -

20-second quality control

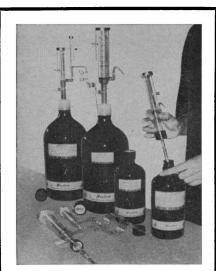
Holding to rigid quality control standards is fast and easy with a Bausch & Lomb Abbe 3-L Refractometer. You just *load*, *light* and *look* . . . get your answer in 20 seconds. Horizontal, up-front prisms load in 10 seconds—wipe off easily. Light-up takes 2 seconds . . . with built-in, push-button scale illuminator. 8 seconds to read . . . any product within the range of ND 1.30-ND 1.71, or percent total solids from 0-85%. Accuracy is to 1 unit in the fourth decimal place. Operation is fast, easy and so comfortable there's no fatigue . . . even after all day production use. This most widely used refractometer is priced right at just \$850*.

For the utmost accuracy over a wide index range, your ultimate choice should be the B&L Precision Refractometer. Three models with different ranges cover a total range of ND 1.20-ND 1.70. Under proper working conditions, it's possible to get index readings to 3 units in the fifth decimal place. And the price is just \$1840*.

Send for our Catalog 33-202, Bausch & Lomb, 77441 Bausch Street, Rochester, New York 14602.

*Suggested list

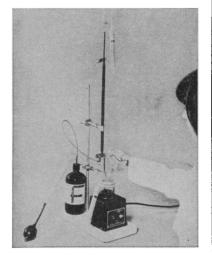




PERFORM CHEMICAL TESTS FASTER, MORE ACCURATELY

Just drop L/I Automatic REPI-PETS* and Automatic Dilutors into your reagent bottles and leave them there. These two instruments sample, dispense, dilute, transfer and mix with a guaranteed accuracy of 1%, reproducibility 0.1%. You'll save between 50-95% of your analysis time!

L/I instruments give you complete freedom from contamination, can handle **any** reagent, require no change in your methods, and never need cleaning. Volumes? From microliters to deciliters. Available in 1, 10, 20 and 50 ml sizes. Prices: REPIPETS \$47.50, Dilutors \$89.50. Write for details.



WATER DETERMINATIONS IN 4 MINUTES!

Use L/I Aquametry Apparatus to measure water content in foods, drugs, organics—all materials. Range 1 ppm. to 100% water without adjustment. 1% accuracy over entire range. Price \$235.

* trademark-(REpetitive PIPETS)
 LABINDUSTRIES
 1802H Second Street
 Berkeley, California 94710
 See us at FASEB

But his proposal is far less radical than that of St. Francis. He seems to suggest an enlightened despotism of man over the rest of nature instead of St. Francis' democracy of all creatures.

LYNN WHITE, JR. Department of History, University of California, Los Angeles 90024

... My only objection to White's presentation concerns the Sister Fire which he attributes to St. Francis of Assisi. Fire, for Francis, was Brother Fire, not Sister, at least in his *Cantico delle Creature*:

Laudato si', mi Signore, per frate focu per lo quale ennallumini la nocte, et ello e' bellu, et iucundu, et robustoso e forte.

While I embrace wholeheartedly Lynn White's proposal to set up a democracy of all God's creatures, I still favor the separation of the sexes.

Renato Baserga

562 Manor Road, Wynnewood, Pennsylvania

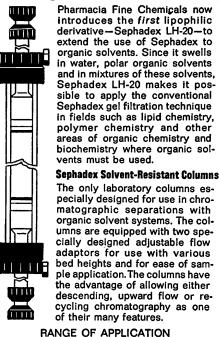
White's stringent demonstration that today's ecological catastrophe results directly from the Judeo-Christian tradition can be expanded to include other catastrophies of similar or greater magnitude which occurred earlier in time. Martin [Nature 212, 339 (1966)] has discussed at some length the early overkills which destroyed 40 percent of the mammalian fauna in Africa and 70 percent in North America. These overkills, which took place, respectively, 50,000 and 12,000 years ago, clearly demonstrate that the Judeo-Christian tradition is considerably older than generally assumed.

CESARE EMILIANI SHALE NISKIN Institute of Marine Science, University of Miami, Miami, Florida 33149

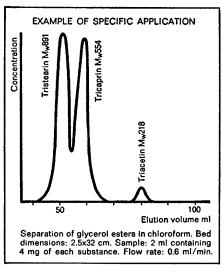
Economics of Reprints

I would like to answer the question posed by Mary E. Clark of the University of Newcastle in her letter, "Reprints unlimited" (17 Feb.). She wondered, "How does one identify those who are really interested when no information comes on the [reprint request] card?" The answer is simple: Have your institution pay for as many reprints as you consider necessary. Don't be too modest—if you feel that 2000 or 3000 would be a convenient number—

NEW from PHARMACIA SEPHADEX[®] LH-20 extends gel filtration to organic solvents



Solvent	Approx. solvent regain ml solvent/g dry gel	Approx. bed volume mi/g dry gel	
Dimethylformamid	9 2.2	4	
Water	2.1	4	
Methanol	1.9	3.5-4.0	
Ethanol	1.8	3.0-3.5	
Chloroform+	1.8	3.0-3.5	
n-butanoi	1.6	3	
Dioxane	1.4	2.5-3.0	
Tetrahydrofuran	1.4	2.5-3.0	
Acetone	0.8	1,5	
*Containing 1% e	thanol. P	article size: 25-100 μ	



For additional technical information, including the booklets Sephadex LH-20 and The Sephadex Solvent-Resistant Columns, write to:



Suite 412, Montreal 11, P. Q.

(Inquiries outside U.S.A. and Canada should be directed to PHARMACIA FINE CHEMICALS, Uppsala, Sweden.)

order them, and send them to all who request reprints and also to those who don't request them, if you believe the latter will make good use of them. This is the common system in many of the good American and a few European institutions. You may believe that the eventual waste of ten reprints is largely compensated by the one that is actually used, and this would not be true in any other system.

The purchase of a large number of reprints is as much a part of the cost of research as the purchase of a desk, a microscope, or a pencil. If your university questions why it should pay for your reprints, ask why it pays for your postage. Should this cause the administrators to begin an economy drive and revoke the practice of paying your postage, you will then have a still clearer picture of one reason for the "brain drain." I know very well the answer to your question, Dr. Clark, because I have plenty of experience, from both sides of the Atlantic.

MIGUEL MOTA Department of Genetics, Estação Agronómica Nacional, Oeiras, Portugal

The Imperturbable Feline

Doty and Jones's report on learningset formation in various mammals (24 Mar., p. 1579) reminds me of a paper prepared for Science by W. A. Rhoads and F. Turner of the UCLA School of Nuclear Medicine and me on learning in cats. The paper was never submitted because, like UFO and Grant Swinger reports, it might have been misconstrued as trivial.

Three cats were observed for 12 months in three widely separate areas of Los Angeles. The cats were two American shorthairs and a cross-eyed pedigreed Siamese. Specifically, eartwitching was observed while the cats were dozing. Sounds which did or, more important, did not cause ear-twitching were noted. None of the three cats ever twitched to the following sounds: (i) wife shouting in kitchen, (ii) champagne cork popping, (iii) people falling into swimming pool, and (iv) approaching police sirens.

I have been unable to persuade my co-authors that we were walking in the footsteps of Pavlov.

H. W. PITTENGER Planning Research Corporation, Los Angeles, California 90024

12 MAY 1967



What else should you expect from plastic **Econo-Cages** besides low price?

Plenty. Like choice of sizes and materials and sturdier construction that takes hard use. Expect them all in the complete Econo-Cage line.

Naturally, you expect to save money when you choose plastic over more costly steel cages. But you get even more value when you choose one from the leading manufacturer of plastic cages. For example, you'll get a cage that meets all your requirements . . . anything you want - permanent cages in a wide variety of sizes and advanced plastics; a special disposable cage, plus metabolism and restraining cages. You'll also get top quality. We're the leader. We have to make our cages better and sturdier than anyone else's. Expect fast service, too. Our distributors across the country will deliver whatever cage you want, when you need it.

PERMANENT ECONO-CAGES

Best buy in cages. Cost much less than stainless steel. Stronger and 20% heavier than competitive cages.

- · 20% thicker walls-won't warp like cages with thinner walls • Take repeated sterilization cycles
- Meet or exceed I.L.A.R. Standards
- Wide choice of sizes and materials

#10 SERIES. Housing hamsters, rats, and mice. 11" x 81/2" x 6" deep

#20 SERIES. Housing and breeding mice. $11\frac{1}{2}$ " x $7\frac{1}{2}$ " x 5" deep.

#30 SERIES. Housing and breeding mice. $19'' \times 10\frac{1}{2}'' \times 5\frac{1}{8}''$ deep.

#40 SERIES. Housing and breeding rats and hamsters. $19'' \times 10\frac{1}{2}'' \times 6\frac{1}{8}''$ deep.

#50 SERIES. Housing and breeding hamsters and rats. $12\%'' \times 14\%'' \times 6\%''$ deep.

#60 SERIES. Housing and breeding mice. 131/8" x 85%" x 51/8" deep.

#70 SERIES. Housing cage for rats, guinea pigs, hamsters. $16'' \times 20'' \times 8\frac{1}{2}''$ deep.

All cages available in these materials . .

POLYCARBONATE. Completely autoclavable, tem-peratures to 290°F (143°C.) Transparent. Unbreakable.

POLYPROPYLENE. Economical, washable and sani-tizable at temperatures to 250°F (121°C). Resists chemicals and solvents. Translucent. Good impact resistance.

ACRYLONITRILE. A clear material at a budget price. Temperatures to 180°F (82°C).

DISPOSABLE ECONO-CAGES

- Low-cost disposable cages make cleaning obsolete.
- Throwaway cages eliminate labor and cleaning equipment costs
- Let you use new cage for each
 experiment
- · Need no supports
- ECOND-CAGE #21. Clear, polystyrene rigid cage for mice.
- 111/2" x 71/2" x 5" deep.

ECONO-CAGE LIDS

Models available to fit all cages: zinc wire mesh; galvanized wire mesh mounted on polycarbonate plastic frame: stainless steel.

ECONO-METABOLISM UNITS

- A plastic metabolism unit with 100% visibility for less than \$40.
- Complete separation of urine and feces
- Clear, unbreakable polycarbonate Withstands temperatures to 290°F (143°C)

ECONO-CAGE #110. For mice and hamsters.

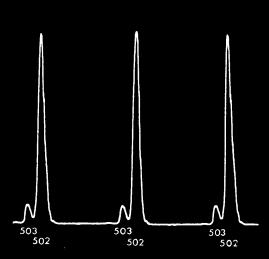
ECONO PLASTIC RESTRAINING CAGES

Provide maximum visibility and easy access to restrained rodents. Avail-able in three sizes.

For complete details call your Econo-Cage distributor ... or send for our new catalog showing the complete Econo-Cage line.



EC-R



. . .

A proven RGA with unit resolution to >500 amu

The Ultek/EAI QUAD 250 also offers high speed and excellent sensitivity with this kind of resolution. Speed: Scans an entire mass range (there are

three -1.50, 10-150, and 50-500 amu) in only 10 milliseconds, and gives you precision analyses in 50 milliseconds (readout equipment limitation). Sensitivity: 10^{-15} torr (nitrogen), with resolution (for that sensitivity) better than 100 at mass 100. Unit resolution at mass 500. Every unit tested and guaranteed to resolve amu 502 and



503. (See above trace — a repeat scan of a complex hydrocarbon.)

There are more than 100 Ultek/EAI quadruple RGA systems of this type now in use throughout the United States. Write us and ask for a demonstration and/or the name of a QUAD

250 user near you. Complete technical literature available. Box 10920, Palo Alto, California 94303.



.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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

Editorial Board

ROBERT L. BOWMAN	EVERETT I. MENDELSOHN	
JOSEPH W. CHAMBERLAIN	NEAL E. MILLER	
JOHN T. EDSALL	JOHN R. PIERCE	
EMIL HAURY	KENNETH S. PITZER	
ALEXANDER HOLLAENDER	ALEXANDER RICH	
WILLARD F. LIBBY	DEWITT STETTEN, JR.	
GORDON J. F. MACDONALD	CLARENCE M. ZENER	

Editorial Staff

Editor

PHILIP H. ABELSON

PublisherBusiness ManagerDAEL WOLFLEHANS NUSSBAUM

Managing Editor: ROBERT V. ORMES

Assistant Editors: Ellen E. Murphy, John E. Ringle

Assistant to the Editor: NANCY TEIMOURIAN

News Editor: DANIEL S. GREENBERG

News and Comment: JOHN WALSH,* ELINOR LANGER, LUTHER J. CARTER, BRYCE NELSON, GIL-LIAN PARRILLO, JOAN ANDERSON

Book Reviews: SYLVIA EBERHART

Editorial Assistants: JOANNE BELK, ISABELLA BOULDIN, ELEANORE BUTZ, BEN CARLIN, CAROLYN CLARK, JANE COLE, GRAYCE FINGER, NANCY HAMIL-TON, OLIVER HEATWOLE, ANNE HOLDSWORTH, KON-SLYNNIETTA HUTCHINSON, ELEANOR JOHNSON, PAULA LECKY, KATHERINE LIVINGSTON, LEAH RYAN, BAR-BARA SHEFFER

*European Office: Lime Tree Farm, East Hagbourne, Berkshire, England. Telephone Didcot 3317

Advertising Staff

Director Production Manager EARL J. SCHERAGO ROSE MARIE ROMAGNOLO Advertising Sales Manager: RICHARD L. CHARLES

Sales: New York, N.Y., 11 W. 42 St. (212-PE-6-1858): ROBERT S. BUGBEE Scotch Plains, N.J., 12 Unami Lane (201-889-

4873): C. RICHARD CALLIS Medfield Mass 02052 4 Rolling Lane (617-359-

Medfield, Mass. 02052. 4 Rolling Lane (617-359-2370): RICHARD M. EZEQUELLE Chicago, Ill. 60611, 919 N. Michigan Ave., Room 426 (312-DE-7-4973): HERBERT L. BURKLUND

426 (312-DE-7-4973): HERBERT L. BURKLUND Los Angeles 45, Calif., 8255 Beverly Blvd. (213-653-9817): WINN NANCE

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

Excessive Educational Pressures

Emotional shock waves following the launching of Sputnik in 1957 have been dissipated. Nevertheless, sequelae linger—notably in American education. During the late 1950's strenuous efforts were directed at improving all aspects of instruction and especially the teaching of science in the secondary schools. To achieve this a number of steps were taken. Summer institutes for science teachers were fostered. Efforts such as the Physics Secondary School Curriculum Project were launched. Campaigns to induce more students to enroll in science courses were conducted. Higher standards of performance were established. An increasing amount of homework was required. At the time, these steps generally met with enthusiastic response. However, today questions are being raised concerning the overall results of the efforts.

The most recent statistics show that campaigns to increase interest in science and engineering have not been very successful. From 1960 to 1965, the number of college juniors majoring in physics dropped by about 15 percent, while overall college enrollment was up over 50 percent. During the same period undergraduate enrollment in engineering increased only slightly. In 1965 more baccalaureate degrees were granted to English majors than to all students in the branches of engineering. Nearly five times as many baccalaureate degrees were granted in the social sciences as in the physical sciences.

To what extent is the current student unrest chargeable to the more stringent secondary school curricula? We do not know. However, there is growing concern that too much is being asked of the young. A recent poll conducted by *School Management* showed that 88 percent of the respondents believed that, in their own school districts, pressure on college-bound students had increased during the last 5 years. A substantial majority felt that pressure had become too intense.

In a speech reported in *Chemical and Engineering News* (20 February 1967), L. Carroll King, a professor of chemistry at Northwestern University, is critical of present-day education. He feels that secondary school students are being asked to do "too much, too fast, too soon." He suggests that some students are enduring 17 hours a day of activity in high school. King charges that "we have committed a crime against a generation." These are strong words, but soundings in various areas of this nation have elicited similar sentiments.

King's concern was aroused by observations on chemistry majors entering his university. He found that too many very good high-school students fail outright or do poorly in college. King believes that the poor performance is a sequel to excessive work in high school. The students quit rather than face seemingly endless years of 17-hour days.

Responsibility for excessive pressure on secondary school students is shared by many. College admission offices, parents, new curricula, teachers, and the students themselves are involved. Results of the excessive pressure seem to be especially evident in the physical sciences and engineering.

In the decade since Sputnik, scientists and others have participated in notable experiments in education. Some of the results are unexpected. Evaluation, looking toward prompt changes, is in order.

-PHILIP H. ABELSON

LIQUID SCINTILLATION BREAKTHROUGH!



New Tri-Carb[®]Absolute Activity Analyzer provides ultimate data automatically for single and double-label experiments

With the new Model 544 Absolute Activity Analyzer it is unnecessary for the investigator to perform any intermediate operations. It is necessary only to put samples into the instrument, and the ultimate data—*the absolute activity levels of each of the isotopes present* —will be typed on the Tri-Carb Data Sheets.

The principle of operation is based on our patented Automatic External Standardization with a Compound Source of americium-241 and radium-226. However, manual reference to efficiency correlation curves is completely unnecessary.

The equivalent of pertinent efficiency correlation curves is programmed into the unit initially, utilizing sets of 10 quenched standards for each isotope to be counted. Then, as each unknown sample is introduced into the counting chamber, an automatic standardization procedure takes place and the system determines exactly the counting efficiencies to be used in the computations for that particular sample.

For double-label samples, the unit not only determines the necessary efficiency factors for the computation, but also solves the appropriate double-label equation. It presents the final absolute activity level for each isotope both as a continuous display and as typed data at the completion of each count.

Model 544 Absolute Activity Analyzers may be ordered now for future installation on existing Model 3375 Tri-Carb Liquid Scintillation Spectrometers or on new instruments just being ordered. Ask your Packard Sales Engineer for complete information or write to Packard Instrument Company, Inc., 2200 Warrenville Road, Downers Grove, Illinois 60515 or Packard Instrument International, S.A., Talstrasse 39, 8001 Zurich, Switzerland.



AAAS Membership Includes These Benefits:

1. Annual dues of \$8.50 include a subscription to SCIENCE, the only U.S. weekly journal of research. Scientists in all fields rely on SCIENCE for news of the significant advances in research. Written and edited by scientists, SCIENCE exploits the speed made possible by modern printing technology for rapid publication of research reports without loss of the reviewing procedures essential for admission of new work to the scientific record. Published by the American Association for the Advancement of Science, SCIENCE is one of the most frequently cited journals in the world's scientific literature.

2. Fellowship in AAAS honors meritorious contributions to science and makes members eligible to serve on the AAAS Council, the Association's governing body, or to be elected as officers or directors. Fellows are nominated from among the membership by section secretaries and by other Fellows.

3. All members receive the quarterly newsletter of Association affairs, the AAAS Bulletin and may order SYMPOSIUM volumes, reporting advanced work in selected fields of science, at a reduced price for direct, prepaid orders.

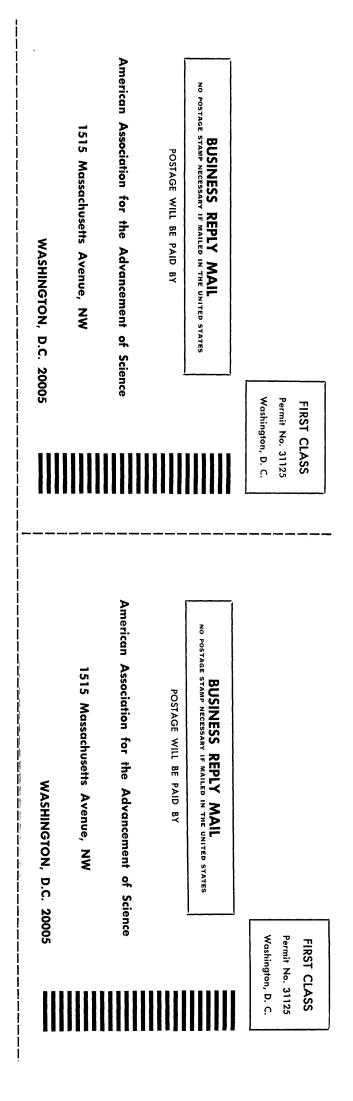
5. Members share the satisfaction of supporting AAAS work to

- Improve the effectiveness of science in the promotion of human welfare.
- Increase public understanding of science.
- Improve science education at all levels.

An Invitation

You are cordially invited to join AAAS by filling out the membership card on this page. Annual dues of \$8.50 include weekly copies of SCIENCE.

Scientists in other countries are cordially welcomed as members of the Association. Membership is open to scientists abroad at the same annual dues as that paid by members in the United States, and this includes weekly copies of SCIENCE. SCIENCE is now reaching a world-wide audience numbering 130,000.



American Association for the	
Advancement of Science	
1515 Massachusetts Avenue, NW	
Washington, D.C. 20005	
() I apply for AAAS membership at	
annual dues of \$8.50:	
Full name	
Address	
City State ZIP	
🗌 Please bill me 🔲 Check enclosed	
	S
Your signature	Adv
() I propose for AAAS membership:	bor
	me
Full name	hur
Addross	1101
Address	anc
City State ZIP	bee
,	
An invitation to join AAAS will be sent to	yea
any colleague you may wish to propose. Sign	
below if we may use your name in extending this invitation.	
	5
Your signature	tist
M-12	1151:
	joir
	Use
	Use
American Association for the	Use are
American Association for the Advancement of Science	are
	are wh
Advancement of Science 1515 Massachusetts Avenue, NW	are
Advancement of Science	are wh
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005	are whi to wea
Advancement of Science 1515 Massachusetts Avenue, NW	are who to
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at	are whi to wea
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50:	are whi to wea ship
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at	are whi to wea
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: [:] ull name	are whi to wea ship
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50:	are whi to ship (yec
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: [:] ull name	are wh to ship
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: [:] ull name Address	are whi to ship (yec
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: [:] ull name Address	are wh to ship yec vid scie
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: :ull name Address City State ZIP Please bill me Check enclosed	are wh to we ship yec vid scie be
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ¹ ull name Address City State ZIP	are wh to ship yec vid scie
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature	are wh to ship yec vid scie be
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: :ull name Address City State ZIP Please bill me Check enclosed	are wh to ship vid scie be
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State City Please bill me Check enclosed 'our signature) I propose for AAAS membership:	are wh to ship yec vid scie be
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature	are wh to ship vid scie be
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City December bill me Check enclosed 'our signature) I propose for AAAS membership: ull name	are wh to we ship vid scie be by Mo
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State City Please bill me Check enclosed 'our signature) I propose for AAAS membership:	are wh to we ship vid scie be by Mo
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City December bill me Check enclosed 'our signature) I propose for AAAS membership: ull name	are wh to we ship vid scie be by Mo
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature I propose for AAAS membership: ull name Address Zity State ZIP	are wh to we ship vid scie be by Mo soc
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature) I propose for AAAS membership: ull name Address Zity State ZIP Address I propose for AAAS membership: ull name Address Ull name Address Address Ity State ZIP Address Ity State ZIP An invitation to join AAAS will be sent to	are wh to we ship vid scie be by Mo soc
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature) I propose for AAAS membership: ull name Address City State ZIP Address Address Yur State ZIP Ull name Address State ZIP An invitation to join AAAS will be sent to iny colleague you may wish to propose. Sign	are wh to we ship vid scie be by Mo soc
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature) I propose for AAAS membership: ull name Address Zity State ZIP Address I propose for AAAS membership: ull name Address Ull name Address Address Ity State ZIP Address Ity State ZIP An invitation to join AAAS will be sent to	are wh to we ship (yec vid scie be by Mo soc
Advancement of Science 1515 Massachusetts Avenue, NW Washington, D.C. 20005) I apply for AAAS membership at annual dues of \$8.50: ^c ull name Address City State ZIP Please bill me Check enclosed 'our signature) I propose for AAAS membership: ull name Address State ZIP Address Our signature It propose for AAAS membership: ull name Address Ull name An invitation to join AAAS will be sent to iny colleague you may wish to propose. Sign relow if we may use your name in extending	are wh to we ship vid scie be by Mo soc

1-12

AN INVITATION TO JOIN THE AAAS

Since 1848 the American Association for the Advancement of Science has been a professional bond linking scientists in all fields and an instrument for securing the benefits of science for human welfare. Virtually all scientific leaders and most other scientists in this country have been members of the AAAS over the past 119 years.

Scientists in other countries as well as scientists in the United States are cordially invited to join and to receive weekly copies of SCIENCE. Use the membership card on this page. If you are already a member, use it to suggest others who would appreciate receiving an invitation to join AAAS. Annual dues of \$8.50 include weekly copies of SCIENCE and other membership benefits.

One of the major scientific events of each year is the annual AAAS meeting, which provides a review of major advances in the various scientific fields. The 1967 annual meeting will be in New York City, from 26-31 December.

Three regional meetings are held annually by the Pacific, the Southwestern and Rocky Mountain, and the Alaska Divisions of the Association.

AAAS also sponsors the Gordon Research Conferences, informal week-long seminars that bring together active research workers from laboratories in the U.S. and abroad for consideration of new directions in chemical research.

l

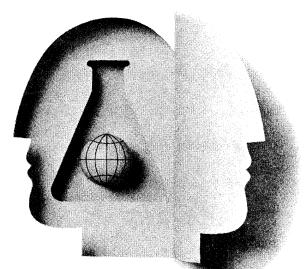
A NEW SERVICE FOR SCIENCE READERS

If you have an instrument problem which is not covered by the ads in this issue write to us directly, giving full details. We will see that you receive the information you need.

PLANNING A NEW LABORATORY OR SCIENCE BUILDING?

Let us help you by putting you in touch with the manufacturers whose equipment you will need. Write a letter on your organization letterhead to the address below. We will forward copies of it to all appropriate manufacturers.

> SCIENCE MAGAZINE Room 1740 11 West 42 Street New York, N.Y. 10036



Challenge and Response

Research, dynamic adventure of the mind into the world of elements. In our industry, research chemicals, the probe is intense, volatile, massive. And the six billion dollars spent annually for discovery creates a never-ending need for quality products and services.

To meet masterfully, the daily demands of research, ICN's corporate structure has diversified into six separate divisions participating in 17 specialized areas. Like basic biomedical research. Radioactive sources. Organic chemicals and radioisotopes. And environmental services.

You might say we are growing as the industry grows. Or better yet, say our growth in the past six years proves we are the leading manufacturer of chemicals for research.

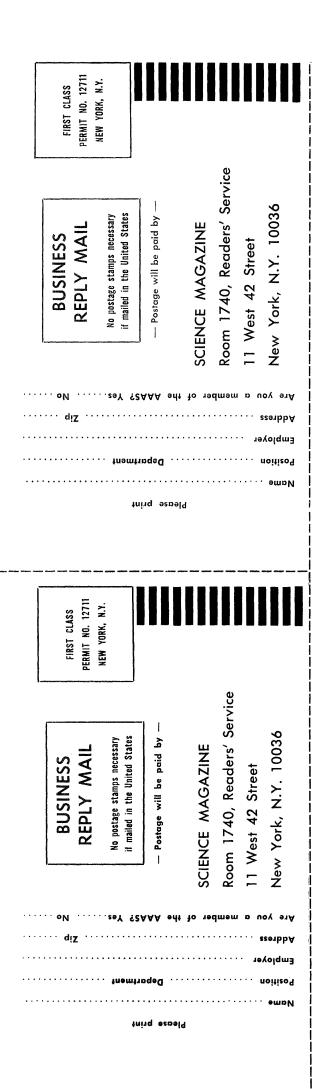
International Chemical & Nuclear Corporation

1333? East Amar Road, City of Industry, California 91743 Tel: 213-962-3475



Readers' ę ear more dell ō Service information Ne ß a about ads lanc Ĩ 12 Febige May З. ā this 1967 issue, (Expires rag circle 12 A Key Rubbei л Ч No. 1967) and return 363 63 BC BC Print n on above name n front ခုခဲ 2 card. of Bird Lomb add ress **Readers'** Pag ę more dell Appli Ang Dat Service information about ads N Rey ------Card 736544 Pag 12 Febige May 3. this 1967 issue, (Expires 12 circle ŝ Key Rubber -uly g, No 1967) and return Page Print name and on front of above ¥a] naci g, 97 card. Bird Lomb add res

Circle 779 on Readers' Service Card





Quick-change chromatography

Change a disc, a reservoir, an adapter, or extend a column. Build up complete chromatographic columns to suit your needs without glassblowing—with Kontes Chromaflex® apparatus.

Reservoir solvents run down column walls without disturbing adsorbent beds; greaseless wetted "O" ring connections have uniform diameters; mixing volumes are minimal below fritted discs; Dualap stopcock barrels accept either glass or Teflon* plugs.

Functional in design and flexible in use, Chromaflex apparatus represents a part of our 11,000 standard technical glassware items.

For detailed information on products for chromatography and our standard line, write for a free copy of our 300-page catalog TG-20.

©Trademark of Kontes Glass Co. *Trademark of DuPont



Regional distributors: KONTES OF ILLINOIS, Franklin Park, III. • KONTES OF CALIFORNIA, Berkeley, Cal. Circle 780 on Readers' Service Card



For your protection, every foot of genuine Tygon Tubing is branded with the Tygon name and formulation number.

crystal-clear • chemically inert non-oxidizing • 73 standard sizes

At laboratory supply houses everywhere, or write Plastics & Synthetics Division, U.S. Stoneware, Inc., Akron, Ohio 44309.



isotope production has been operating at Orsay since April 1965.

J. Kooi of Euratom discussed their production program centered on Am irradiated in the BR-2 reactor at Mol. After gross processing at Karlsruhe, the transcurium elements will be purified in laboratories placed at Euratom's disposal in the Institute for Nuclear Physics Research at Amsterdam. Studies in nuclear physics and inorganic chemistry include decay scheme studies, extraction chromatographic separation procedures, and electrochemical studies of actinides in molten salts.

C. H. Ice of the Savannah River Laboratory reported on research aimed toward large-scale production of transplutonium elements. Using chemical technology developed in the transplutonium program and a newly-developed high flux mode of production reactor operation, the production of 4.5 kg of ²⁴⁴Cm was undertaken in 1963. This program should also yield 9.2 kg of ²⁴²Pu and 3.0 kg of ²⁴³Am. If additional ²⁴⁴Cm is produced by irradiating the 242 Pu and 243 Am intermediates, 5 to 10 mg of ²⁵²Cf per kilogram of ²⁴⁴Cm would be produced as a byproduct. In the high-flux mode, one of the large reactors at SRL was operated at fluxes up to 6×10^{15} neutrons/cm². During the program, 520 grams of ²⁴²Pu was irradiated to produce about 2 mg of ²⁵²Cf and the associated transplutonium elements. SRL experiments are designed to measure cross sections of ²⁵²Cf precursors. Calculations indicate that the production of ²⁵²Cf in a resonance reactor may be increased 100-fold over that in a highly thermalized flux. From this, one can project the possibility of producing hundreds of grams of ²⁵²Cf per year at a cost that would make a variety of applications attractive. The pioneering work in Mössbauer spectroscopy of the actinides has been carried out at SRL with the first observations of the effect in ²³⁷Np and ²³¹Pa.

D. Cohen discussed the transplutonium chemistry program at Argonne National Laboratory, mentioning reduction of actinide oxides in fused chlorides to the metals; Mössbauer studies on neptunium compounds; absorption spectroscopy; extraction chromatography with a quaternary amine of Am-Cm and Es-Cf; electrical resistivity and Hall effect studies on neptunium and americium metal; and the curiumoxygen system.

A. M. Friedman reported the following topics under study in nuclear physics at Argonne National Laboratory: fission kinetics in the ²⁴⁰Pu (α, α' fission) and ²³⁹Pu (d,p fission) reactions, alpha-particle spectra of ²⁵⁴Es and ²⁵⁵Es, production of ²⁵³Md and ²⁴³Cf in (³He,*xn*) reactions, extensive studies of states in odd-A nuclei between ²²⁹Th and ²⁴⁹Cm as observed in (d,p) and (d,t) reactions.

M. Givon of the Israeli Transuranium group reported a comparison of the spectrophotometric and thermodynamic complex constants for the systems Np, Pu, Am-halide, and nitrate.

The Symposium was sponsored by the Oak Ridge National Laboratory. D. E. Ferguson served as program chairman.

O. L. Keller, Jr.

Chemistry Division, Oak Ridge National Laboratory,* Oak Ridge, Tennessee 37831

Note

* Operated by Union Carbide Corporation for the U.S. Atomic Energy Commission.

Calendar of Events

Courses

Actinomycetes and Mycology. Indiana State Univ., 12–16 June. Oriented towards industrial problems. Limited enrollment. Fee, \$125. (F. M. Rothwell, Dept. of Life Sciences, Indiana State Univ., Terre Haute 47809)

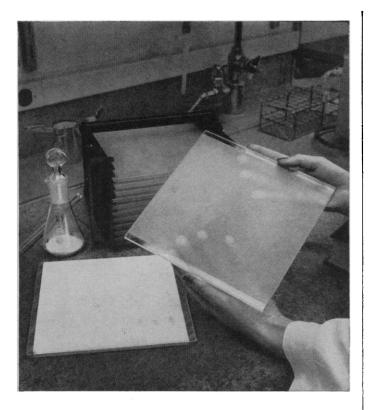
Bacteriology and Virology. Indiana State Univ., 5–9 June. Oriented towards industrial problems. Limited enrollment. Fee, \$125. (F. M. Rothwell, Dept. of Life Sciences, Indiana State Univ., Terre Haute 47809)

Basic Infrared Spectroscopy. Fisk Univ., 14–19 Aug. Designed to introduce beginners to theory and applications of subject. Enrollment limited to 50 participants. Fee, \$150. Partial tuition fellowships available for academic personnel. (Director, Fisk Inst., Box 8, Fisk Univ., Nashville, Tenn. 37203)

Behavior of Liquid Propellants in Space Vehicles 805.9. Univ. of California, Los Angeles, 19-30 June. Designed for control system and propulsion system design engineers concerned with design of advanced launch vehicles and missiles. Prerequisite: Bachelor's degree or equivalent in science or engineering. *Deadline: 12 June*. Fee, \$300. (Engineering Extension, Room 6266, Boelter Hall, Univ. of California, Los Angeles 90024)

Gas Chromatography. Fisk Univ., 14-18 Aug. Enrollment limited to 50 participants. Fee, \$150. Partial tuition fellowships available for academic personnel. (Director, Fisk Inst., Box 8, Fisk Univ., Nashville, Tenn. 37203)

Immuno-serological Methods. Mississippi State Univ., 1–7 June. Orientation towards industral problems. Enrollment limited to 20 participants. Fee, \$125. (J.



Introducing the "unfiat" TLC plate.

This TLC plate is <u>not</u> a conventional flatglass plate. We say it's "unflat" because we've <u>precision-ground</u> the channel for the adsorbent beds <u>into</u> the plate. This Kontes innovation provides an easy, accurate, and reproducible technique for thin layer preparation. And there's a variety of channel depths for

quantitative and preparative scale techniques.

No more tapes and feeler gauges, troublesome applicators and cumbersome mounting boards. With the new Kontes Chromaflex[®] TLC plates, you just pour the slurry, then even it with the precision-ground applicator rod. The channel in the plate and the unground guiding edges control the depth—<u>evenly</u>. The slurry adheres better and you use less of it.

Standard Chromaflex plates are 200 x 200 mm overall with a 180 mm channel and two reference edges. Channel depths are available in 125, 250, 500, 750, and 1,000 microns—edges are permanently marked with the proper depth designation.

(There's also a wedge-type plate with a graded depth that decreases from 1,000 to 125 microns, and a narrow plate with a 30 mm-wide channel.)

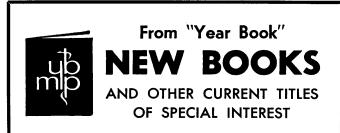
These new Chromaflex plates can be fully integrated with our developing tanks, spotting hoods and pipets, recovery tubes, sprayers, sandwich technique apparatus, storage racks—everything you need for a complete TLC system.

Find out more about the TLC system with the precision-channel plates. Contact your Kontes representative or write for our TLC Catalog (TLC-1).

®Trademark of Kontes Glass Company



Regional Distributors: KONTES OF ILLI NOIS, Franklin Park, III. • KONTES OF CALIFORNIA, Berkeley, Cal. 12 MAY 1967



COLOR ATLAS & TEXTBOOK OF TISSUE & CELLU-LAR PATHOLOGY—By WALTER SANDRITTER, M.D., and JULIUS SCHORN, M.D. Translated, edited and with a Preface by WILLIAM B. WARTMAN, M.D. Approx. 300 pages; 492 illustrations, 324 in color. \$21.00. *Ready mid-summer.*

METHODS & ACHIEVEMENTS IN EXPERIMENTAL PATHOLOGY—Edited by EORS BAJUSZ and GAETAN JASMIN. Vol. 1, 706 pages; 332 illustrations. \$34.00. New.

ESSENTIALS OF PATHOLOGY—By HUBERT J. VAN PEENEN, M.D. 525 pages; illustrated. Paper bound. \$6.50. *New*.

LECTURES IN MEDICAL GENETICS—Edited by DAVID YI-YUNG HSIA, M.D. 241 pages; illustrated. \$8.50. *New*.

BONE MARROW TRANSPLANTATION—By D. E. PEGG, M.D. 192 pages; illustrated. \$8.00. New.

THE LYMPHOCYTES—By MICHAEL W. ELVES, B.Sc., Ph.D. 312 pages; illustrated. \$10.50. New.

METHODS IN MEDICAL RESEARCH—Edited by ROB-ERT F. RUSHMER, M.D. Vol. 11, 320 pages; illustrated. \$10.25.

YEAR BOOK OF NUCLEAR MEDICINE—Edited by JAMES L. QUINN, M.D. Vol. 2, Approx. 400 pages; illustrated. \$10.00. *Ready July*.

MATHEMATICS IN MEDICINE & THE LIFE SCI-ENCES—By GEORGE R. STIBITZ, Ph.D. 391 pages; illustrated. \$12.50.

GENERAL PATHOLOGY: Biological Aspects of Disease. By J. F. A. McMANUS, M.D. 739 pages; 227 illustrations on 198 figures. \$16.00.

MICROFABRIC OF MAN: A Textbook of Histology. By WARREN ANDREW, Ph.D., M.D. 392 pages, 381 illustrations. \$11.00. New.

INTRODUCTION TO THE CLINICAL LABORATORY —By ROBERT P. MacFATE, Ch.E., M.S., Ph.D. 591 pages; illustrated. \$11.50. Second Edition.

Available from Medical Bookstores or The Publisher

YEAR BOOK MEDICAL PUBLISHERS, INC.

A Subsidiary of The Times Mirror Company

35 East Wacker Drive

Chicago, Illinois 60601

841



Invertebrate Zoology

By PAUL A. MEGLITSCH, Drake University

"Both in wealth of detail and in the balance and fairness of its account, citing fact, theory, and diverse interpretations, Meglitsch's *Invertebrate Zoology* is far in advance of any single volume in English. It will surely occupy an honored place on the zoologist's bookshelf for years to come."—Marvin C. Meyer, University of Maine

1967 990 pp. 400 illus. \$11.00

Genetics

Second Edition

By ROBERT C. KING, Northwestern Unversity

In the second printing of this text changes include the addition of two new figures, one showing the complete nucleotide sequence of an alanine transfer RNA isolated from yeast and the other indicating the distinction between two pro-ocytes and fourteen pro-nurse cells on the basis of their nuclear morphology. Of major importance to the work is the inclusion of a Drosophila laboratory exercise which shows students how to perform breeding experiments. Genetic code designations for amino acids have been added to Fig. 2.1. Other revisions have been made where necessary.

1965 (Second Printing, February 1967)450 pp.160 illus.\$9.50

Inorganic Chemistry

By C. S. G. PHILLIPS and R. J. P. WIL- LIAMS, Oxford University					
Vol. I 1965	Non-Metals 700 pp.	illus.	\$8.00		
Vol. II	Metals		+0100		
1966	696 pp.	illus.	\$8.00		

Technology in Western Civilization

Vol. I: The Emergence of Modern Industrial Society—Earliest Times to 1900 *Edited by* MELVIN KRANZBERG, Case Institute of Technology, and CARROLL W. PURSELL, JR., University of California, Santa Barbara 1967 816 pp. illus. \$8.50

The Second Law: An Introduction to Classical and

Statistical Thermodynamics

By HENRY A. BENT, University of Minnesota 1965 442 pp. illus. paper \$3.75 cloth \$8.00

Oxford University Press

200 Madison Avenue New York, New York 10016 842 B. G. Kwapinski, Mississippi State Univ., State College 39762)

Infrared Spectroscopy, 2nd session. Fisk Univ., 21–25 Aug. Enrollment limited to 50 participants. Fee, \$150. Partial tuition fellowships available for academic personnel. (Director, Fisk Inst., Box 8, Fisk Univ., Nashville, Tenn. 37203)

Infrared Spectroscopy. Univ. of California, Los Angeles, 10–21 July. Intended for chemists, biochemists, biologists, and engineers. Fee, \$300. (R. E. Garrels, Physical Sciences Extension, Room 6532, Boelter Hall, Univ. of California, Los Angeles 90024)

Interactive Time-sharing Systems: Hardware and Software. Univ. of California, Los Angeles, 19–30 June. Intended for managers of time-sharing installations, systems programmers, and system users. Fee, \$300. (R. E. Garrels, Physical Science Extension, Room 6532, Boelter Hall, Univ. of California, Los Angeles 90024)

of California, Los Angeles 90024) **On-Line Computer Control Systems.** Univ. of California, Los Angeles, 10–21 July. Designed for engineers engaged in development and application of on-line computer control systems. *Deadline: 3* July. (Engineering Extension, Room 6266, Boelter Hall, Univ. of California, Los Angeles 90024)

Practical Astrodynamics. Univ. of California, Los Angeles, 10–21 July. Designed for persons interested in new approaches to astrodynamics including concepts and methods for solving current and future problems. Fee, \$300. (R. E. Garrels, Physical Sciences Extension, Room 6532, Boelter Hall, Univ. of California, Los Angeles 90024)

Probability and Statistics. Univ. of California, Los Angeles, 19–30 June. Includes basic concepts of probability, recognition of probabilistic and statistical problems and translation into probabilistic language, hypothesis concerning parameters, and statistics. Fee, \$300. (R. E. Garrels, Physical Science Extension, Room 6532, Boelter Hall, Univ. of California, Los Angeles)

Seminar for Managers of Technical Information. Univ. of Iowa, 4–8 June. Designed for editors or supervisors of technical writers; consultants of information storage, retrieval, processing, and transmission; problem solving experts in information and communication. Fee, \$250. (C. A. Andrews, The Seminar, 207 Engineering Bldg., Univ. of Iowa, Iowa City 52240)

Seventh Annual Summer Institute in Dynamical Astronomy. Purdue Univ., 19 June-7 July. Intended for science faculty and graduate students. Enrollment limited to 80 participants. (H. Pollard, Div. of Mathematical Sciences, Purdue Univ., Lafayette, Ind. 47907)

Theory and Applications of Modern Optics. Univ. of California, Los Angeles, 17–28 July. Designed for those in research, development, or education related to modern optics. Fee, \$300. (R. E. Garrels, Physical Sciences Extension, Room 6532, Boelter Hall, Univ. of California, Los Angeles 90024)

Ultra-violet-Visible Spectroscopy. Fisk Univ., 21-25 Aug. Enrollment limited to 50 participants. Fee, \$150. Partial tuition fellowships available for academic personnel. (Director, Fisk Inst., Box 8, Fisk Univ., Nashville, Tenn. 37203)



Variational Theory and Optimal Control Theory. Univ. of California, Los Angeles, 19–30 June. Designed for engineers, physical scientists, mathematicians, and those interested in optimization. Fee, \$300. (R. E. Garrels, Physical Sciences Extension, Room 6532, Boelter Hall, Univ. of California, Los Angeles 90024)

National Meetings

May

22-25. Institute of Electrical and Electronics Engineers, joint technical conf., Cleveland, Ohio. (Office of Technical Activities Board, The Institute, 345 E. 47 St., New York 10017)

22–25. New Aids for Management Decision Making, Washington, D.C. (Director, Center for Technology and Administration, American Univ., 2000 G St., NW, Washington, D.C.)

22-25. URSI-IEEE, spring mtg., Ottawa, Ont., Canada. (R. S. Rettle, Natl. Research Council, Ottawa 2)

Research Council, Ottawa 2) 22-26. Drug Metabolism, 2nd workshop, George Washington Univ., Washington, D.C. (Dept. of Pharmacology, School of Medicine, George Washington Univ., 1337 H St., NW, Washington, D.C. 20005)

23-25. National **Tuberculosis** Assoc. and American **Thoracic** Soc., annual mtg., Pittsburgh, Pa. (NTA, 1740 Broadway, New York 10019)

24–27. Teratology Soc., 7th annual mtg., Estes Park, Colo. (M. D. Runner, Inst. for Developmental Biology, Univ. of Colorado, Boulder 80302)

25-26. **Drug Information** Assoc., 3rd annual, Philadelphia, Pa. (P. de-Haen, The Association, 11 W. 42 St., New York 10036)

26-27. Surface Physics, 5th annual symp., Washington State Univ., Pullman. (E. E. Donaldson, Dept. of Physics, Washington State Univ., Pullman 99163) 29-1. Special Libraries Assoc., New York, NY (P. M. Wasda, The Associa

York, N.Y. (B. M. Woods, The Association, 31 E. 10 St., New York 10003) 29-2. Congress of Canadian Engineers,

Montreal, P.Q., Canada. (Office of Technical Activities Board, Inst. of Electrical and Electronic Engineers, 345 E. 47 St., New York 10017)

31-2. American Soc. for Quality Control, 21st annual technical conf. and exhibit, Chicago, Ill. (R. W. Shearman, The Society, 161 W. Wisconsin Ave., Milwaukee, Wis. 53203)

31-2. Instrument Soc. of America, 13th natl. analysis instrumentation symp., Los Angeles, Calif. (The Society, 530 William Penn Pl., Pittsburgh, Pa. 15219)

June

1-2. Computer Applications in the Earth Sciences, 2nd colloquium, Lawrence, Kan. (R. F. Treece, University Extension, Univ. of Kansas, Lawrence 66044)

1-2. Industrial Water and Waste, 7th conf., Austin, Tex. (J. F. Malina, Jr., 305 Engineering Lab. Bldg., Univ. of Texas, Austin 78712)

1-3. Applied Diving Physiology, Univ. of California, San Francisco Extension

12 MAY 1967



* the ultrasonic probe that converts into an ultrasonic cleaner!

300 WATTS OF ENERGY AT THE TIP ...

93% conversion efficiency. Sturdy ceramic transducer provides high energy at 20 kh. *Fully automatic tuning*, solid state generator circuitry with stepless power control, even an integral probe support ... simple, fool-proof operation.

POWER CONTROL COLOR-CODED TO ACCESSORIES...

Just set the panel dial to correspond to the color index of a specific accessory . . . allows attenuation of ultra-high power to assure maximum tip life.

NEW ACCESSORIES ADD VERSATILITY, BROADEN USEFULNESS...

Among them: Heated 21/2 gallon cleaning tank with many lab applications; syphoned ultrasonic pipet cleaner; and a variety of durable titanium tips for macro, micro and high intensity insonation.

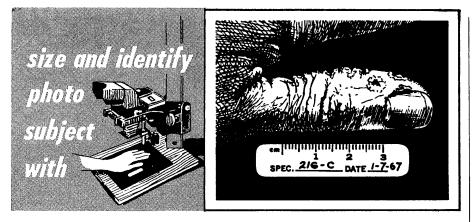
FOR ULTRASONIC CLEANING ...

Disconnect probe from the generator and plug in the cleaning tank or pipet cleaner. Then you can use your ultrasonic system for cleaning chores as well... another reason for a Biosonik III in your laboratory.

Ask your Bronwill dealer for an eye-opening demonstration ... or write us for literature

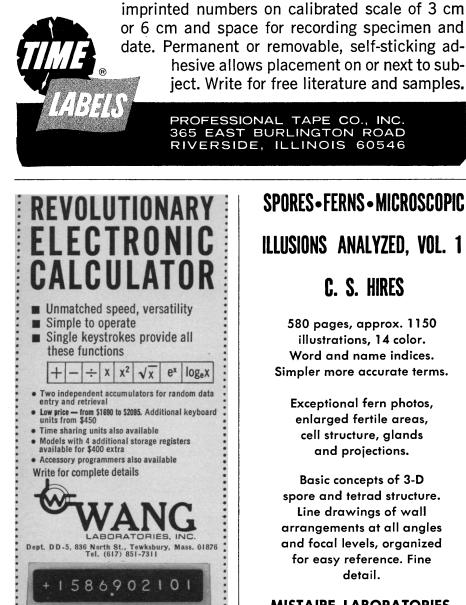


277 N. Goodman St., Rochester, N. Y. 14601



TIME METRIC SCALE LABELS

Make size and identification of subject a permanent part of photograph with easy-to-use labels. Available in two sizes with



SPORES • FERNS • MICROSCOPIC **ILLUSIONS ANALYZED, VOL. 1** C. S. HIRES

580 pages, approx. 1150 illustrations, 14 color. Word and name indices. Simpler more accurate terms.

Exceptional fern photos, enlarged fertile areas, cell structure, glands and projections.

Basic concepts of 3-D spore and tetrad structure. Line drawings of wall arrangements at all angles and focal levels, organized for easy reference. Fine detail.

MISTAIRE LABORATORIES 152 GLEN AVENUE MILLBURN, N.J. 07041

Center. (Letters and Science Extension, Univ. of California, Berkeley 94720)

2-3. Equine Bone and Joint Diseases, symp., Ithaca, N.Y. (H. F. Schryver, Dept. of Large Animal Medicine, New York State Veterinary College, Cornell Univ., Ithaca 14850)

4-7. Tissue Culture Assoc., annual mtg., Philadelphia, Pa. (L. Hayflick, Wistar Inst., 36th and Spruce Sts., Philadelphia 19104)

4-9. American Water Works Assoc., annual conf., Atlantic City, N.J. (R. J. Faust, The Association, 2 Park Ave., New York 10017)

4-9. Underwater Acoustics, seminar, Pennsylvania State Univ., University Park. (Conf. Center, J. Orvis Keller Bldg., Pennsylvania State Univ., University Park 16802)

4-11. Lubrication in Nuclear Applications, symp., American Soc. of Mechanical Engineers, Miami Beach, Fla. (Meetings Manager, The Society, 345 E. 47 St., New York 10017)

5. Integrated Circuit Manufacturing, symp., New York, N.Y. (Miss B. S. Hines, Registration Coordinator, 7830 7830 Hasbrook Ave., Philadelphia, Pa. 19111)

5-7. The New Thrust Seaward, Marine Technology Soc., annual conf. and exhibit, San Diego, Calif. (Conference Manage-ment Organization, Inc., Colonial Bldg., 105 N. Virginia Ave., Falls Church, Va. 22046)

5-7. Recovery and Repair Mechanisms in Radiobiology, Brookhaven Natl. Lab., Upton, N.Y. (D. G. Baker, Dept. of Biology, Brookhaven Natl. Lab., Upton 11973)

5-8. Society for Economic Botany, 8th annual, Coral Gables, Fla. (Miss J. F. Morton, The Society, Morton Collectanea, Univ. of Miami, Box 8204, Coral Gables)

6-7. Deposition of Thin Films by Sputtering, 2nd symp., Rochester, N.Y. (R. D'Aprix, Sputtering Program, CVC, Dept. T, 1775 Mt. Read Blvd., Rochester 14603)

6-9. Laser Engineering and Applica-tions, conf., Washington, D.C. (L. Winner, 152 W. 42 St., New York 10036)

8-9. Post Irradiation Recovery Kinetics, symp., Bethesda, Md. (M. F. Canning, Information Div., Technical Information and Services Dept., Armed Forces Radiobiology Research Inst., Defense Atomic Support Agency, Bethesda 20014) 8-10. Fourth Pacific Northwest Plastics

Workshop, Spokane, Wash. (R. Raff, Research Div., College of Engineering, Washington State Univ., Pullman 99163)

11-14. Apollo and Beyond, American Astronautical Soc., Huntsville, Ala. (S. S. Hu, Northrop Space Labs., P.O. Box 1484, Huntsville)

11-15. American Nuclear Soc., 12th annual, San Diego, Calif. (J. E. Wilkins, Jr., General Atomic, P.O. Box 608, San Diego 92112)

11-15. Industrial Pharmaceutical Research, 9th annual natl. conf., Land O' Lakes, Wis. (A. P. Lemberger, Extension Services in Pharmacy, 190 Pharmacy Bldg., Univ. of Wisconsin, Madison 53706) 11-16. Air Pollution Control Assoc., 60th annual mtg., Cleveland, Ohio. (Seward Covert & Associates, 1059 Leader Bldg., Cleveland 44114)

11-16. Medical Library Assoc., annual mtg., Miami, Fla. (The Association, 919 N. Michigan Ave., Chicago, Ill.)

Teflon needles... from 1 inch to 100 feet

This essentially inert Teflon needle, with its Kel-F hub, eliminates the risk of contamination when syringe pipetting highly corrosive materials. Flexible, 8 thru 22 gauge, leak tight to 100 psi.

Write for Needle Brochure



12 MAY 1967

12-14. American Neurological Assoc., 92nd annual mtg., Atlantic City, N.J. (M. D. Yahr, The Association, 710 W. 168 St., New York 10032)

12-15. Society for Industrial and Applied Mathematics, Washington, D.C. (W. J. Jameson, Jr., Collins Radio Co., 120-09, Cedar Rapids, Iowa 52406)

13-14. Electroexplosive Devices, 5th symp., Philadelphia, Pa. (G. Cohn, Senior Staff Engineer, Franklin Inst. Research Lab., Philadelphia 19103)

13-15. American Astronomical Soc., Yerkes Observatory, Williams Bay, Wis. (G. C. McVittie, Univ. of Illinois Ob-servatory, Urbana 61803)

13-16. Conjugate Point Symp., Boulder, Colo. (Aeronomy Lab. 540.03, Environmental Science Services Administration, Inst. for Telecommunication Sciences and

Aeronomy, Boulder 80302) 13-16. Vacuum Metallurgical Conf., 10th annual, New York, N.Y. (E. L. Foster, Materials Engineering Dept., Battelle Memorial Inst., 505 King Ave., Columbus, Ohio)

14-16. **Densitometry**, seminar, Chicago, Ill. (B. Kettinger, News Service Office, P.O. Box 3404, Rochester Inst. of Technology, Rochester, N.Y. 14614)

14-17. Modern Computer Analysis of Complex Social Science Data Bases, Council of Social Science Data Archives, annual mtg., Los Angeles, Calif. (W. A. Glaser, Bureau of Applied Social Research, 605 W. 115 St., New York 10025)

14-17. Speech-Analyzing Aids for the Deaf, conf., Washington, D.C. (J. M. Pickett, Hearing and Speech Center, Gallaudet College, Washington, D.C.)

15-16. American Rheumatism Assoc., New York, N.Y. (Miss M. Walsh, The Association, 1212 Ave. of the Americas, New York)

15-16. Soil, Water and Suburbia, Dept. of Agriculture and Dept. of Housing and Urban Development, Washington, D.C. (S. Kasper, Room 1201, Dept. of Housing and Urban Development, 1430 K St., NW, Washington, D.C.)

15-17. American Assoc. of Physics Teachers, summer mtg., Canton, N.Y. (A. B. Arons, Physics Dept., Amherst College, Amherst, Mass.)

15-17. Symposium on High Energy Radiation Therapy Dosimetry, American Assoc. of Physicists in Medicine, New York, N.Y. (L. H. Lanzl, Dept. of Radi-ology, Univ. of Chicago, 950 E. 59 St., Chicago, Ill. 60637) 17-18. Academy of Psychosomatic

Medicine, 4th symp. on anxiety and de-pression, Atlantic City, N.J. (E. Dunlop, 150 Emory St., Attleboro, Mass. 02703)

17-18. American Diabetes Assoc., Atlantic City, N.J. (J. R. Connelly, The Associaton, 18 E. 48 St., New York 10017) 18-21. Botanical Soc. of America,

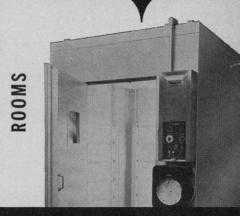
Northeastern Section, summer field mtg., Tuxedo, N.Y. (R. K. Zuck, Dept. of Botany, Drew Univ., Madsion, N.J.)

18-22. American Medical Assoc., 116th annual conv., Atlantic City, N.J. (The Association, 535 N. Dearborn St., Chicago, III. 60610)

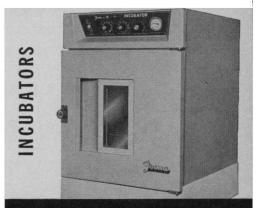
18-22. Health Physics Soc., 12th annual mtg., Washington, D.C. (J. C. Villforth, Radiological Health Lab., 1901

Chapman Blvd., Rockville, Md.) 18-22. Society for Investigative Derma-

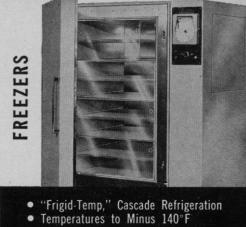




- Heated, Refrigerated, Humidified . Temperatures from Minus 100°F to + 15 • Humidity from 5% R.H. to 98% R.H.



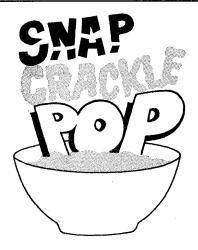
- New! Series 66, Seamless Fiberglass Constru
- CO₂ Control. Humidified
- Direct Dial Control



- Fourteen Standard Models

FORMA SCIENTIFIC INCORPORATED 100 Millcreek Road, Marietta, Ohio 45750

Send for Complete Descriptive Literatur



is great for breakfast. Not for culture tube racks.

Bellco culture tube racks never snap, crackle or corrode (like galvanized racks) . . . never develop bubbles and pop under pressure (like plastic-coated racks) . . . because they're stainless steel. Precision welded with smooth corners. Absolutely rigid. Open construction throughout for easy viewing, light penetration. Sizes for most tubes . . . standardized design configuration. Will not warp, swell or bend. Write today for prices . . . and leave your "snap, crackle and pop" at the breakfast table.



Sherer controlled environment equipment offers wide choice in size, instrumentation



Three walk-in models used in the Animal Department of a state university for swine and rodent research.



512-37 37-14 25-7 • 25-7HL 8 44 34-7 255-6 37 sq. ft. Plant Bed 14 sq. ft. Plant Bed 7 sq. ft. Plant Bed 8 sq. ft. Plant Bed Two 4 sq. ft. Plant Beds 7 sq. ft. Plant Bed 5 sq. ft. Plant Bed 5000 Foot-Candles 5000 Foot-Candles 2500-5000 Foot-Candles 1400 Foot-Candles 1400 Foot-Candles 4500 Foot-Candles 2500 Foot-Candles

A Model CEL 4-4, two-compartments, and CEL-8, one-compartment, with remote temperature recorder, vertical lights, multiple shelves,

Several walk-in and reach-in type chambers In a midwestern university Biochemistry Department.



ENVIRONMENTAL DIVISION SHERER-GILLETT COMPANY Marshall 3 Michigan 49068

tology, Atlantic City, N.J. (G. W. Hambrick, Jr., The Society, Johns Hopkins Hospital, 601 N. Broadway, Baltimore, Md. 21205)

18-23. American Soc. of Ichthyologists and Herpetologists, annual mtg., San Francisco, Calif. (W. I. Follett, California Acad. of Sciences, Golden Gate Park, San Francisco 94118)

19. Scombroid Phylogeny: Ideas and Approaches, symp. of American Soc. of Ichthyologists and Herpetologists, San Francisco, Calif. (B. J. Rothschild, Tuna Ecology Program, Bureau of Commercial Fisheries, P.O. Box 3830, Honolulu, Hawaii 96812)

19-21. Automatic Data Processing Systems in Local Government, 3rd annual conf., New York, N.Y. (H. Sellin, School of Continuing Education, New York Univ., New York 10003)

19-21. Colloid, 41st natl. symp., Buffalo, N.Y. (P. Becher, Chemical Research Dept., Atlas Chemical Industries, Wilmington, Del. 19899)

19-21. Heat Transfer and Fluid Mechanics Inst., La Jolla, Calif. (D. B. Olfe, Dept. of Aerospace and Mechanical Engineering Sciences, Univ. of California at San Diego, La Jolla)

19-21. Microelectronics, symp., St. Louis, Mo. (R. Pellin, Inorganic Chemicals Div., Monsanto Co., 800 N. Lindbergh Blvd., St. Louis 63166)

19-22. American Soc. for Engineering Education, 75th annual mtg., East Lansing, Mich. (L. Winner, 152 W. 42 St., New York 10036)

21–23. Modern Titrimetry, 20th annual summer symp. on analytical chemistry, Claremont, Calif. (A. L. Beilby, The Symposium, Dept. of Chemistry, Pomona College, Claremont 91713)

21-25. Society of Women Engineers, 17th annual conv., Washington, D.C. (Mrs. J. R. Fisher, 12501 Connecticut Ave., Silver Spring, Md. 20906)

21-30. Combustion-Generated Air Pollution, mtg., Berkeley, Calif. (Engineering Extension, 2223 Fulton St., Berkeley 94720)

22-23. Animal Reproduction, 8th symp., Urbana, Ill. (Short Courses and Conferences, 116 Illini Hall, Champaign, Ill. 61820)

22–24. American Soc. of Enologists, annual mtg., Santa Barbara, Calif. (The Society, Box 411, Davis, Calif.)

22-25. American Assoc. of **Bioanalysts**, mtg., Detroit, Mich. (D. Birenbaum, The Association, 805 Ambassador Bldg., St. Louis, Mo. 63101)

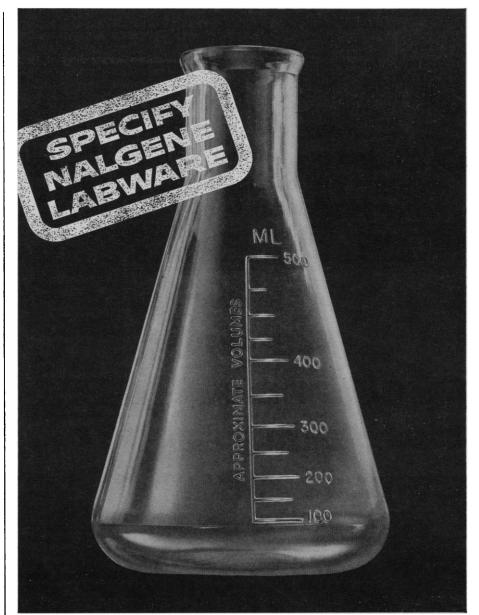
25-28. American Dairy Science Assoc., Ithaca, N.Y. (C. Cruse, The Association, 903 Fairview Ave., Urbana, Ill. 61801)

25-28. American Leather Chemists Assoc., Lake Placid, N.Y. (W. T. Roddy, Executive Secretary, The Association, Univ. of Cincinnati, Cincinnati, Ohio 45221)

25-30. American Soc. for **Testing and Materials**, 70th annual mtg., Boston, Mass. (H. H. Hamilton, Public Relations, The Society, 1916 Race St., Philadelphia, Pa. 19103)

26-27. American Soc. of **Pharmacog**nosy, annual mtg., Ann Arbor, Mich. (A. G. Paul, College of Pharmacy, Univ. of Michigan, Ann Arbor)

26-30. Workshop on Graduate Training

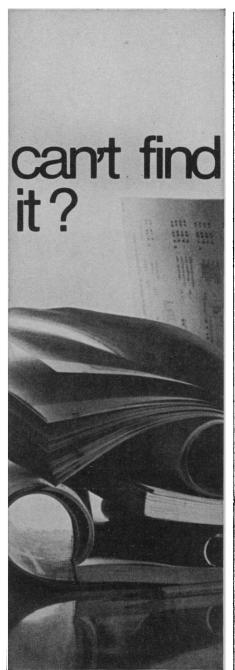


ONLY THREE THINGS OUR NEW ERLENMEYER FLASKS WON'T DO... CHIP, CRACK, OR SHATTER.

New Nalgene[®] Graduated Erlenmeyer Flasks are molded of polycarbonate—transparent, unbreakable and autoclavable. Sizes from 50-500 ml. Polypropylene Erlenmeyers are also available from 50 ml to the new graduated 2000 ml.

The Nalgene name is molded right in—your assurance of highest quality. More labs specify Nalgene Labware than all other brands of plastic labware combined. How about you? Specify Nalgene Labware from your lab supply dealer. Ask for our 1967 Catalog or write Dept. 2705, Nalgene Labware Division, Rochester, New York 14602.





ask MC

Looking for a laboratory chemical that's not commercially available? A new item, or a familiar one made to a higher standard of purity? We're interested-maybe we can produce it for you, or suggest a source. We'd like to hear from you.Write us at 2909 Highland Ave, Norwood, Ohio 45212 or phone (513) 621-3220.



in Scientific Writing, Rockefeller Univ., New York, N.Y. (F. P. Woodford, Rockefeller Univ., New York 10021)

26-8. Immunology, summer course. Lake Forest, Ill. (S. Dray, Univ. of Illinois at Medical Center, P.O. Box 6998, Chicago 60680)

28-30. American Scientific Glassblowers Soc., 12th annual symp., Atlanta, Ga. (R. W. Poole, 100 Cedar Lane, Oak Ridge, Tenn. 37832)

28-30. Joint Automatic Control Conf., 8th annual mtg., Philadelphia, Pa. (L. Winner, 152 W. 42 St., New York 10036) 28-30. Society of **Protozoologists**, To-

ronto, Ont., Canada. (R. W. Hull, Dept. of Biological Sciences, Florida State Univ., Tallahassee, 32306)

29-1. Navigation in the Last Third of the 20th Century: Where Do We Stand; What Needs to be Done, Inst. of Naviga-tion, 23rd annual mtg., Washington, D.C. (The Institute, 711 14th St., NW, Suite 912, Washington 20005)

International and Foreign Meetings June

2-4. Plasticity, intern. mtg., Palermo, Italy. (Instituto di Scienze delle Construzioni, Univ. of Palermo, Via Maqueda, Palermo)

4-7. Chemical Inst. of Canada, 50th natl. conf., Toronto, Ont., Canada. (General Manager, The Institute, 151 Slater St., Ottawa, Ont.)

5-9. International Commission of Sugar Technology, 13th general assembly, Falsterbo, Sweden. (J. Henry, 1, rue Aendoren, Tirlemont, Belguim)

5-10. Northwest Atlantic Fisheries, intern. commission mtg., Boston, Mass. (L. R. Day, Bedford Inst. of Oceanography, P.O. Box 638, Dartmouth, Nova Scotia, Canada)

6-8. Building Materials, intern. conf., Warsaw, Poland. (Secretary, The Conference, Ministry of Building Construction and Materials, Warsaw, Wspolna 2) 7-9. Industrial Physics—The Contribu-

tion of Government Sponsored Laboratories, Harrogate, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

7-10. Transplantation Soc., 1st intern. congr., Paris, France. (J. Dausset, Hopital Saint Louis, Place du Dr. Fournier, Paris 10°)

9-10. Transfer of Genetic Information in Protein Synthesis, intern. symp., New York, N.Y. (D. J. Quinn, Public Relations, Miles Laboratories, Elkhart, Ind.)

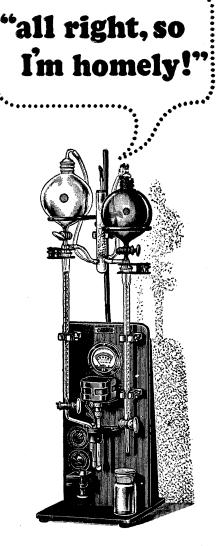
11-16. Eutrophication, intern. symp., Madison, Wis. (G. A. Rohlich, Univ. of Wisconsin, 602 State St., Madison 53706)

11-14. Smoking and Health, 1st intern. congr., New York, N.Y. (J. W. Muckell, Congr. Manager, 54 W. 40 St., New York 10018)

11-14. Society of Professional Well Log Analysts, 8th intern. symp., Denver, Colo. (Executive Secretary, The Society, 13507 Tosca, Houston, Tex. 77024)

12-14. Communications, intern. conf., Minneapolis, Minn. (R. J. Collins, Dept. of Electrical Engineering, Univ. of Minnesota, Minneapolis 55455)

12-14. Drug Research, 1st intern. symp.,



but you save \$215!

When we got tired of the simple, functional lines of our titrator for Karl Fischer moistures, we designed a new, streamlined one. Did everything our homely one did, just as fast and accurate too. When we checked and found the new titrator would cost almost \$600 to produce, we said "Phooey!"

We think it's silly to charge a lot more money for a new model that doesn't do anything more. We're glad you agree—for you bought more WACO titrators this year than in any previous year.

While it still looks the same, our titrator shown above now features ball joint Pyrex glassware that won't drip, a unique drain flask, WACO magnetic stirrer, and many other exclusive advantages. But you still pay just \$435. instead of \$650.

Write for our TITRATOR BULLETIN

LABORATORY SUPPLIES AND EQUIPMENT WILKENS-ANDERSON CO. 4525 W. DIVISION ST. CHICAGO 51, ILL.

Montreal, Canada. (Chemical Inst. of Canada, 151 Slater St., Ottawa 4, Ont.)

12-16. Macromolecular Chemistry, intern. symp., Brussels, Belgium. (Secretariat, The Symposium, 49, Sq. Marie-Louise, Brussels)

12-17. Problem of Identification in Automatic Control Systems, symp., Prague, Czechoslovakia. (V. Strejc, Ustav Teorie Informace a Automatizace, Ceskoslovenska Akademie Ved, Vysehradska 49, Prague 2)

14-15. Light and Vision, intern. symp., Columbus, Ohio. (G. A. Fry, Ohio State Univ., Columbus 43210)

14-16. Catalysis, 2nd symp., Hamilton, Ont., Canada. (R. B. Anderson, Dept. of Chemical Engineering, McMaster Univ., Hamilton)

14-16. Systematic Biology, intern. conf., Ann Arbor, Mich. (A. G. Kluge, The Conference, Dept. of Zoology, Univ. of Michigan, Ann Arbor 48104)

14-17. Mechanized Information Storage, Retrieval and Dissemination, conf., Rome, Italy. (British Computer Soc., 23, Dorset Sq., London, N.W.1, England)

18-24. Oral Education of the Deaf, intern. conf., Northampton, Mass. and New York, N.Y. (G. T. Pratt, Clark School for Deaf, Northampton 01060)

18-30. Algae, Man and the Environment, intern. symp., Syracuse, N.Y. (D. F. Jackson, Dept. of Civil Engineering, Syracuse Univ., Syracuse 13210)

19-23. Electronics, 14th intern. scientific congr., Rome, Italy. (Rassegna Internazionale Elettronica Nucleare e Teleradiocinematografica, Via Crescenzio 9, Rome)

19-23. Spectroscopy, 13th intern. colloquium, Ottawa, Ont., Canada. (Secretary, The Colloquium, Natl. Research Council, Ottawa 7)

19–28. International Commission on Illumination, Washington, D.C. (L. E. Barbrow, Secretary, USNC, c/o National Bureau of Standards, Washington, D.C.)

20-23. International **Data Processing**, conf. and business exhibition, Boston, Mass. (Data Processing Management Assoc., 524 Busse Hgwy., Park Ridge, Ill. 60068)

21–29. ACHEMA 1967, 15th chemical engineering congr. and exhibition, Frankfurt-am-Main, West Germany. (Deutsche Gesellschaft fur chemisches Apparatewesen, Postfach 7746, 6000 Frankfurt (Main), 7)

21-1. International **Plastics** Exhibition and Convention, London, England. (British Plastics, Interplas 67, Dorset House, Stamford St., London, S.E.1)

25-2. Chemotherapy, 5th intern. congr., Vienna, Austria. (Sekretariat, Wiener Medizinische Akademie, Alser Strasse 4, 1090 Wienn, Austria)

26-30. Carbonium Ions, 1st intern. symp. on physical organic chemistry, Athens, Greece. (The Symposium, Dept. of Chemistry, Michigan State Univ., East Lansing 48823; or G. Gregoriou, Nuclear Research Center "Democritos," Aghia Paraskevi, Athens, Greece)

27-4. Protein Foods and Concentrates, intern. symp., Mysore, India. (B. L. Amla or T. N. R. Rao, The Symposium, Central Food Technological Research Inst., Mysore 2)

12 MAY 1967

Magnetic domains made visible by the electron microscope

The magnetic structure of thin films is important in the development of space saving memory cells for computers. The electron microscope furnishes an inertialess image of magnetic domains with good resolution. The Lorentz Device of the electron microscope, Elmiskop I A applies well defined magnetic fields to the specimen. The dynamic alteration of the domain structure can be recorded with a built-in movie camera. (Complete film available on loan basis).

The stripe shows the movement of domain walls during the magnetization reversal of a Fe/Ni alloy. Another example of the flexibility of Elmiskop I A.





SIEMENS AMERICA INCORPORATED 350 Fifth Avenue, New York, N.Y. 10001 SIEMENS CANADA LIMITED 407 McGill Street, Montreal 1, P.Q.

Electron Microscope Elmiskop I A

Siemens Elmiskop Electron Microscopes have won a worldwide reputation for highest resolution, stability and reliability. Over 800 Elmiskops are already in service at leading universities, medical centers and industrial laboratories.



Index of Books Reviewed in Science

1 April 1966 through 5 May 1967

- About Plants: Topics in Plant Biology, F. C. Steward, A. D. Krikorian, R. D. Holsten, 19 Aug. 1966, 855
- About Sharks and Shark Attack, D. H. Davies, 4 Nov. 1966, 641
- About Vectors, B. Hoffman, 2 Dec. 1966, 1159
- The Actions of Chemicals on Dividing Cells, B. A. Kihlman, 27 Jan. 1967, 443
- Adaptation and Natural Selection: A Critique of Some Current Evolutionary Thought, G. C. Williams, 15 Apr. 1966, 338
- Advanced Physical Chemistry: Molecules, Structure, and Spectra, J. C. Davis, Jr., 9 Sept. 1966, 1232
- Advances in Botanical Research, R. D. Preston, Ed., 30 Sept. 1966, 1632
- Advances in Chromatography, J. C. Giddings and R. A. Keller, Eds., 29 July 1966. 517
- Advances in Earth Science, P. M. Hurley, Ed., 3 June 1966, 1364
- Advances in Oxytocin Research, J. H. M. Pinkerton, Ed., 26 Aug. 1966, 968
- Adventures in Living Plants, E. B. Kurtz, Jr., and C. Allen, 13 May 1966, 923 Advances in Marine Biology, Vol. 3,
- F. Russell, Ed., 17 June 1966, 1613 Alaska, A Challenge in Conservation,
- R. A. Cooley, 28 Apr. 1967, 498
- Algebraic Structure Theory of Sequential Machines, J. Hartmanis and R. E. Stearns, 28 Apr. 1967, 498
- Alloy Phase Equilibria, A. Prince, 6 Jan. 1967, 64
- Analysis of Numerical Methods, E. Isaacson and H. B. Keller, 24 Feb. 1967, 993 The Analytic S-Matrix, R. J. Eden,
- P. V. Landshoff, D. I. Olive, J. C. Polkinghorne, 31 Mar. 1967, 1658
- The Anatomy of Plants: With an Idea of a Philosophical History of Plants and Several Other Lectures Read Before the Royal Society, N. Grew, 13 May 1966, 918
- The Anatomy of the Laboratory Mouse, M. J. Cook, 1 Apr. 1966, 65
- Ancient Europe, A Survey, S. Piggott, 29 Apr. 1966, 633
- Ancient Oaxaca: Discoveries in Mexican Archeology and History, J. Paddock, Ed., 1 Sept. 1966, 1370
- Animal Behaviour, R. A. Hinde, 30 Dec. 1966, 1636
- Animal Conflict and Adaptation, J. L. Cloudsley-Thompson, 23 Sept. 1966, 1514
- Annual Review of Information Science and Technology, C. A. Cuadra, Ed., 5 May 1967, 635
- Anorganische und allgemeine chemie in flüssigem Ammoniak, J. Jander, 10 Mar. 1967, 1237
- Antarctic Geology, R. J. Adie, Ed., 1 July 1966, 52
- Applied Geochronology, E. I. Hamilton, 13 May 1966, 955
- Applied Infrared Spectroscopy, D. N. Kendall, Ed., 29 July 1966, 517
- Applied Queueing Theory, A. M. Lee, 24 Feb. 1967, 993
- 12 MAY 1967

- Applied Regression Analysis, N. R. Draper and H. Smith, 24 Feb. 1967, 994
- Archeological Chemistry, M. Levey, Ed., 5 May 1967, 634
- Arms and Influence, T. C. Schelling, 5 Aug. 1966, 623
- Aspects moléculaires de l'adaptation et de la phylogénie, M. Florkin, 27 Jan. 1967, 445
- Aspects of Insect Biochemistry, T. W. Goodwin, Ed., 5 Aug. 1966, 624
- Aspects of Scientific Explanation and Other Essays in the Philosophy of Science, C. Hempel, 8 Apr. 1966, 192
- Astronautics for Science Teachers, J. G. Meitner, Ed., 22 Apr. 1966, 499
- Atlas and Keys of Fruits and Seeds Occurring in the Quaternary Deposits of the U.S.S.R., N. Ja. Katz, S. V. Katz, M. G. Kipiani, 13 May 1966, 942
- Atlas Antarktiki, Ministry of Geology of the U.S.S.R., 25 Nov. 1966, 995
- Atlas of Electrochemical Equilibria in Aqueous Solutions, M. Pourbaix, 23 Dec. 1966, 1537
- Atlas Stéréotaxique du Diencéphale du Rat Blanc, D. Albe-Fessard, F. Stutinsky, S. Libouban, 6 Jan. 1967, 62
- Atmospheric Oxidation and Antioxidants, G. Scott, 4 Nov. 1966, 640
- Atmospheric Reentry: An Introduction to Its Science and Engineering, J. J. Martin, 5 Aug. 1966, 626
- Atomic and Nuclear Physics, D. L. Livesay, 17 Mar. 1967, 1396
- Atomic Collisions: The Theory of Electron-Atom Collisions, V. Ya. Veldre, R. Ya. Damburg, R. K. Peterkop, Eds., 16 Dec. 1966, 1441
- Atomic Energy and Southern Science, W. G. Pollard, 31 Mar. 1967, 1657
- Autobiographical Notes, I. M. Sechenov, 13 May 1966, 930
- Aviation: The Creative Ideas, O. Stewart, 17 Feb. 1967, 817
- Background to Newton's Principia, J. Herivel, 13 May 1966, 915
- The Bamboos: A Fresh Perspective, F. A. McClure, 10 June 1966, 1497
- Basic Developments in Fluid Dynamics,

M. Holt, Ed., 30 Dec. 1966, 1635 Jac. Berzelius, J. E. Jorpes, 3 Feb. 1967, 552

- Beta Decay, C. S. Wu and S. A. Moszkowski, 16 Dec. 1966, 1432
- Bibliography of Levant Geology, Including Cyprus, Hatay, Israel, Jordania, Lebanon, Sinai, and Syria, M. A. Avnimelech, 20 May 1966, 1049
- Biochemical Aspects of Amphibian De-velopment, E. M. Deuchar, 18 Nov. 1966, 877
- Biochemical Energetics and Kinetics, A. R. Patton, 1 Apr. 1966, 63
- Biochemical Engineering, S. Aiba, A. E. Humphrey, N. F. Millis, 10 June 1966, 1497
- Biochemistry Laboratory Techniques, S. Chaykin, 14 Oct. 1966, 253
- The Biochemistry of Animal Development, R. Weber, Ed., 1 July 1966, 50

- Biological Chemistry, H. R. Mahler and E. H. Cordes, 3 Feb. 1967, 549 The Biological Role of the Nucleic Acids,
- D. Cohen, 22 Apr. 1966, 496
- The Biological Significance of Climatic Changes in Britain, C. G. Johnson and L. P. Smith, Eds., 23 Dec. 1966, 1535
- Biologie der Meereshöhlen, R. Riedl, 24 Feb. 1967, 990
- The Biology of Populations, R. H. Mac-Arthur and J. H. Connell, 25 Nov. 1966, 999
- Biology of Suspension Feeding, C. Barker Jørgensen, 9 Dec. 1966, 1315
- The Biology of Viruses, K. M. Smith, 13 May 1966, 940
- Bioluminescence in Progress, F. H. Johnson and Y. Haneda, Eds., 17 Feb. 1967.819
- Birds of Colorado, A. M. Bailey and R. J. Niedrach, 13 May 1966, 944
- Niels Bohr, R. Moore, 3 Feb. 1967, 549 Boston Studies in the Philosophy of Science, Vol. 2, R. S. Cohen and M. W.
- Wartofsky, Eds., 13 May 1966, 918 Boston: The Job Ahead, M. Meyerson
- and E. C. Banfield, 2 Sept. 1966, 1092 Brain and Conscious Experience, J. C.
- Eccles, Ed., 11 Nov. 1966, 754 Breakthrough: The Saga of Jonas Salk,
- R. Carter, 13 May 1966, 911
- Brain Tissue Electrolytes, A. Van Harreveld, 5 May 1967, 633
- Calculus on Manifolds, M. Spivak, 8 July 1966, 164
- Canon of Solar Eclipses, J. Meeus, C. C. Grosjean, W. Vanderleen, 14 Oct. 1966, 255
- Carbocyclic Non-Benzenoid Aromatic Com-
- pounds, D. Lloyd, 24 Feb. 1967, 944 Catalytic Hydrogenation, R. L. Augustine,
- 13 May 1966, 953 Cell Synchrony, I. L. Cameron and G. M.
- Padilla, Eds., 20 Jan. 1967, 315 Ceramics and Man, F. R. Matson, Ed.,
- 13 May 1966, 927
- Cerebrospinal Fluid and the Regulation of Ventilation, C. McC. Brooks, F. F. Kao, B. B. Lloyd, 8 July 1966, 160
- The Chandalar Kutchin, R. A. McKennan, 1 Apr. 1966, 58
- Changing Human Behavior, J. Mann, 28 Oct. 1966, 499
- The Changing Mile, J. R. Hastings and R. M. Turner, 13 May 1966, 919
- Chebyshev Methods in Numerical Approximation, M. A. Snyder, 24 Feb. 1967, 993
- Chemical Investigations of Hot Springs in Japan, Y. Uzumasa, 29 Apr. 1966, 635
- Chemical Oceanography, J. P. Riley and G. Skirrow, Eds., Vol. 1, 19 Aug. 1966, 856; Vol. 2, 27 May 1966, 1232
- Chemistry and Biology Laboratories: Design, Construction, Equip Schramm, 8 July 1966, 162 Equipment, W.
- The Chemistry of Open-Chain Organic Nitrogen Compounds. Vols. 1 and 2, P. A. S. Smith, 28 Oct. 1966, 499
- The Chemistry of Rhenium and Technetium, R. Colton, 28 Oct. 1966, 500

A new paperback Series

THE PRINCIPLES OF MODERN BIOLOGY

Edited by D. A. Coult, University of Liverpool, England

The first volumes available in the Series

STATISTICS FOR BIOLOGY

O. N. Bishop, Worksop College, England

An introduction to quantitative measurement in biology, this supplementary volume describes terminology and major concepts, and guides students through increasingly complex techniques to the chi-squared test and the planning of experiments. Practical applications are emphasized and mathematics kept to a minimum. *Statistical Tables; bibliography; answers to problems; index.*

x + 182 pages, paper, 1967, \$2.75

MOLECULES AND CELLS

D. A. Coult, University of Liverpool

In simple, clear terminology, this brief supplementary text describes the relationships between chemistry and biology at the cellular level. It is organized in four parts which cover the basic structure and function of living cells from the atomic and molecular level through the genetic process, growth, and differentiation to regulation and homeostasis within the cell. *Bibliography; index; 8 pages electron- and photo-micrograph illustrations.*

x + 166 pages, paper, 1967, \$2.75

A new text in Invertebrate Zoology Available for Fall classes

INVERTEBRATE STRUCTURE AND FUNCTION

E. J. W. Barrington, University of Nottingham, England 550 pages; 400 illustrations; cloth; Fall 1967



from The Radiochemical Centre anoon-14

The full range of uniformly labelled and a selection of specifically labelled L-amino-acids.

D-Glucose-1-C14 and D-glucose-C14(U)

The important steroids cholesterol-4-C14, oestrone-4-C14, oestradiol-4-C14, 19-*nor*-testosterone-4-C14

A selection of nucleics including uniformly and specifically labelled thymidine and uridine.

For details of batches now in stock write to The Radiochemical Centre Amersham England

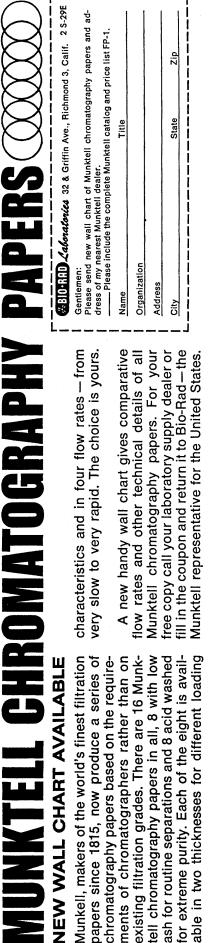


U.S. users should write to Nuclear-Chicago Corporation 333 East Howard Avenue, Des Plaines, Illinois, 60018

> TAS/RC. 160/1 SCIENCE, VOL. 156

- The Chemistry of Selenium, Tellurium and Polonium, K. W. Bagnall, 2 Dec. 1966, 1160
- The Chemistry of the Carbonyl Group, S. Patai, Ed. 7 Oct. 1966, 142
- The Chemistry of the Non-Metals, W. L. Jolly, 31 Mar. 1967, 1659
- The Chlorophylls, L. P. Vernon and G. R. Seely, Eds. 9 Dec. 1966, 1318
- Chromosome Manipulations and Plant Genetics, R. Riley and K. R. Lewis, Eds., 13 Jan. 1967, 184
- Chromosomes. Giant Molecules. and Evolution, B. Wallace, 22 Apr. 1966, 495
- Chromosomes Today, C. D. Darlington and K. R. Lewis, Eds., 13 Jan. 1967, 184
- Chronologies in Old World Archaeology, R. W. Ehrich, Ed., 11 Nov. 1966, 757
- The Circular Functions, C. W. Dodge, 24 June 1966, 1732
- Clinical Roentgenology of Collagen Diseases, C. M. Nice, Jr., 24 June 1966, 1735
- Climates of the U.S.S.R., A. A. Borisov, 22 Apr. 1966, 498
- The Cnidaria and Their Evolution, W. J. Rees, Ed., 30 Dec. 1966, 1638
- The Collected Papers of Enrico Fermi, Vol. 2, E. Amaldi, H. L. Anderson, E. Persico, E. Segrè, A. Wattenberg, Eds., 13 May 1966, 950
- A Collection of Problems in Atomic and Nuclear Physics, I. Ye. Irodov, 17 Mar. 1967. 1396
- College Dropout and the Utilization of Talent, L. A. Pervin, L. E. Reik, W. Dalrymple, Eds., 24 Mar. 1967, 1526
- The College of Agriculture: Science in the Public Service, C. E. Kellogg and D. C. Knapp, 29 Apr. 1966, 636
- Colombia, C. Reichel-Dolmatoff, 13 May 1966, 923
- Commercial Timbers of the World, F. H. Titmuss, 18 Nov. 1966, 877
- The Common Wealth in Ocean Fisheries, F. T. Christy, Jr., and A. Scott, 13 May 1966, 913
- Community Health: Its Needs and Resources, J. D. Porterfield, 8 July 1966, 163
- The Comparative Ethology and Evolution of the Sand Wasps, H. E. Evans, 16 Dec. 1966, 1440
- Comparative Functionalism: An Essay in Theory, Anthropological W. Goldschmidt, 18 Nov. 1966, 874
- Comparative Phytochemistry, T. Swain, Ed., 6 Jan. 1967, 63
- Complex Variable Methods in Science and Technology, J. Cunningham, 13 May 1966, 954
- Concepts of General Chemistry, C. R. McLellan, M. C. Day, Jr., R. W. Clark, 27 May 1966, 1231
- The Conceptual Development of Quantum Mechanics, M. Jammer, 9 Dec. 1966, 1315
- Contracting for Atoms, H. Orlans, 14 Apr. 1967, 230
- Control of Macromolecular Synthesis: A Study of DNA, RNA, and Protein Synthesis, O. Maaløe and N. O. Kjeldgaard, 2 Dec. 1966, 1159
- Controls of Metamorphism, W. S. Pitcher and G. W. Flinn, Eds., 8 July 1966, 162
- The Correspondence of Henry Olden-burg, Vols. 1-3, A. R. Hall and M. B. Hall, Eds., 13 May 1966, 912
- 12 MAY 1967

- CRC Handbook of Tables for Probability and Statistics, W. H. Beyer, Ed., 9 Dec. 1966. 1316
- Crustaceans, W. Schmitt, 13 May 1966, 914
- Current Topics in Thyroid Research, C. Cassaro and M. Andreoli, Eds., 6 May 1966, 748
- Daydreaming, J. Singer, 5 Aug. 1966, 626
- La Découverte des Mers, J.-M. Peres, 27 May 1966, 1230
- The Deer and the Tiger, G. B. Schaller, 3 Mar. 1967, 1093
- Descriptive Micrometeorology, R. E.
- Munn, 3 Mar. 1967, 1093 Desde un Alto en el Camino, J. J. Izquierdo, 31 Mar. 1967, 1658
- TheDevelopment of Sex Differences, E. E. Maccoby, Ed., 21 Apr. 1967, 371
- Developments in Inorganic Nitrogen Chemistry, C. B. Coburn, Ed., 17 Feb. 1967, 817
- Diagnostic Criteria for Plants and Soil, H. D. Chapman, Ed., 15 July 1966, 287
- Diagnostic Methods in Clinical Virology, N. R. Grist, C. A. C. Ross, E. J. Bell, E. J. Stott, 13 May 1966, 942
- The Diatoms of the United States Exclusive of Alaska and Hawaii, R. Patrick and C. W. Reimer, 16 Sept. 1966, 1369
- Differentiation and Growth of Hemoglobin- and Immunoglobin-Synthesizing Cells, 27 Jan. 1967, 445
- Diplomats, Scientists, and Politicians: The United States and the Nuclear Test Ban Negotiations, H. K. Jacobson and E. Stein, 2 Sept. 1966, 1091
- Dipole Radiation in the Presence of a Conducting Half-Space, A. Baños, Jr., 25 Nov. 1966, 999
- Disquisitiones Arithmeticae, C. F. Gauss, 4 Nov. 1966, 642
- Doctors and the State: The British Medical Profession and Government Action in Public Health, 1870-1912, J. L. Brand, 23 Sept. 1966, 1516
- Domebo, a Paleo-Indian Mammoth Kill in the Prairie-Plains; F. C. Leonhardy, Ed., 30 Dec. 1966, 1635
- Drugs and Enzymes, B. B. Brodie and J. R. Gillette, 24 June 1966, 1733
- Dynamics of Chromatography, pt. 1, Principles and Theory, J. C. Giddings, 20 May 1966, 1051
- American Winters, 1604-1820, Early D. M. Ludlum, 14 Apr. 1967, 232
- Early Electrodynamics: The First Law of Circulation, R. A. R. Tricker, Ed., 28 Oct. 1966, 498
- Early Formative Period of Coastal Ecuador: The Valdivia and Machalil-la Phases, B. J. Meggers, C. Evans, E. Estrada, 24 June 1966, 1731
- The Earth Tides, P. Melchior, 2 Dec. 1966, 1157
- Ecological Methods, T. R. E. Southwood, 10 Mar. 1967, 1235
- Ecological Research in Humid Tropics Vegetation, A. J. G. H. Kostermans and F. R. Fosberg, Eds., 12 Aug. 1966, 732
- The Ecological Theater and the Evolutionary Play, G. E. Hutchinson, 24 June 1966, 1736
- Ecology and Field Biology, R. L. Smith, 9 Sept. 1966, 1234



Zip

State

Address

For your

Munktell free copy in the

<u>it</u>

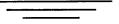
/ supply dealer or t to Bio-Rad — the he United States.

Munktell representative

papers since 1815, now produce a series of chromatography papers based on the requirements of chromatographers based on the requirements of chromatographers based on the requirements of chromatography papers in all, 8 with low tell chromatography papers in all, 8 with low tash for routine separations and 8 acid washed for extreme purity. Each of the eight is available in two thicknesses for different loading h Munkell, makers of the world's finest filtration papers since 1815, now produce a series of

NEW and NOTEWORTHY

TEXTBOOKS from F. A. DAVIS



Handbook of EXPERIMENTAL IMMUNOLOGY —Weir

NEW! This work by thirty authorities from Britain, United States and Europe is designed as a laboratory handbook for the experienced laboratory worker in immunology and related fields. It provides upto-date information on the theory and practice of the newer immunological techniques, outlining the general principles, advantages and limitations of each procedure with a detailed description of techniques recommended by the author.

Edited by D. M. WEIR, M.D. 832 pages, 210 il-lustrations. (Sept.). About \$30.00

HUMAN MICROANATOMY

-Elias & Pauly

The NEW (3rd) Edition. This is the widely praised text in which human microscopic anatomy is presented in a simple, readable and meaningful way . . . illuminated with 1114 effective illustrations that strikingly portray the three-dimensional conception of structure. Now this atlas of microanatomy covers the important findings of electron microscopy, the many advances in histophysiology, new terms, a complete revision of almost every chapter. By HANS ELIAS, Ph.D., and JOHN E. PAULY, Ph.D. 396 pages, 1114 illustrations. *Third Edi-*tion. \$10.00

Atlas of HUMAN ANATOMY

---Spalteholz & Spanner

NEW! This Sixteenth Edition of a great international favorite now comes in a revised one-volume edition that is up-todate, expanded in many departments, enhanced with new illustrations that are part of a striking collection of 1630 pictures that vividly portray human structural features. Each picture is quickly identified by clear, adjoining captions.

New English Translation, by PROF. WERNER SPALTEHOLZ and PROF. RUDOLPH SPAN-NER. 980 pages, 1630 illustrations in color. \$32.50

BASIC ENDOCRINOLOGY

-Brown & Barker

This NEW (2nd) EDITION reveals many advances. All sections of the book have been carefully reviewed by the authors, adding the significant recent developments, helpful new illustrations, and an entirely new chapter on the pineal gland and the thymus. The authors take a unique approach in this noteworthy text for students of biology and medicine. Every page stresses the fundamentals of human endocrinology.

By J. H. U. BROWN, Ph.D. and S. B. BARKER, Ph.D. 236 pages, illustrated. Second Edition. \$4.50

F. A. DAVIS COMPANY

Blackwell Scientific Publications 1914 Cherry Street Phila., Pa. 19103 Economic and Social Aspects of Educational Planning, 1 July 1966, 47

- The Economics of Education, E. A. G. Robinson and J. E. Vaizey, Eds., 1 July 1966.47
- Ecuador, B. J. Meggers, 13 Jan. 1967, 185 Education and Economic Development, C. A. Anderson and M. J. Bowman, Eds., 1 July 1966, 47
- Education and Training in the Developing Countries: The Role of U.S. Foreign Aid, W. Y. Elliott, Ed., 23 Dec. 1966, 1533
- Einstein's Unified Field Theory, M. A. Tonnelat, 10 Mar. 1967, 1233
- Electrical Methods in Geophysical Prospecting, G. V. Keller and F. C. Frischknecht, 10 Mar. 1967, 1234
- The Electromagnetodynamics of Fluids, W. F. Hughes and F. J. Young, 10 Feb. 1967, 683
- Electromagnetism and the Earth's Interior. T. Rikitake, 13 May 1966, 951
- The Electron Microprobe, T. D. McKinley, K. F. J. Heinrich, D. B. Wittry, Eds., 7 Oct. 1966, 141
- Electronics for Experimenters in Chemistry, Physics and Biology, L. F. Phillips, 21 Oct. 1966, 376
- Elementary Plasma Physics, L. A. Arzimovich, 13 May 1966, 955
- Elements of Abstract Algebra, R. A. Dean, 9 Sept. 1966, 1233
- Elements of Psychophysics, G. T. Fechner, 23 Dec. 1966, 1532
- Encyclopedia of Industrial Chemical Analysis, Vol. 1, General Techniques A-E, F. D. Snell and C. L. Hilton, Eds., 4 Nov. 1966, 640
- The Encyclopedia of Physics, R. M. Besançon, Ed., 13 May 1966, 951
- Encyclopedia of Pigeon Breeds, W. M. Levi, 13 May 1966, 946
- Encyclopedia Science Supplement, 1965, 13 May 1966, 917
- Engineering Radiation Heat Transfer, J. A. Wiebelt, 2 Dec. 1966, 1158
- The English Paracelsians, A. G. Debus, 11 Nov. 1966, 758
- Enumerability, Decidability, and Computability, H. Hermes, 13 May 1966, 953
- Environment of the Cape Thompson Region, Alaska, N. J. Wilimovsky and J. N. Wolfe, Eds., 21 Oct. 1966, 372
- Enzyme Kinetics: Open and Closed Systems, C. Walter, 30 Dec. 1966, 1636
- Equality of Educational Opportunity, S. Coleman, E. Q. Campbell, A. M. Mood, C. J. Hobson, J. McPartland, F. D. Weinfeld, R. L. York, 9 Dec. 1966, 1312
- ESP: A Scientific Evaluation, C. E. M. Hansel, 2 Sept. 1966, 1088
- Essays in Geomorphology, G. H. Dury, Ed., 26 Aug. 1966, 969
- Essays on the History of Physiology in Russia, Kh. S. Koshtoyant, 13 May 1966, 930
- The Evolution of Urban Societies: Early Mesopotamia and Prehispanic Mexico, R. McC. Adams, 12 Aug. 1966, 729
- Excursions in Number Theory, C. S. Ogilvy and J. T. Anderson, 6 Jan. 1967, 63
- Experience and Conceptual Activity: A Philosophical Essay Based upon the Writings of A. N. Whitehead, J. M. Burgers, 2 Dec. 1966, 1156

Exploration Medicine: Being a Practical

BELART

lahaids



DESIKET* So low in cost ···a desiccator for every student

An important tool for both general and organic chemistry for drying yields of synthesized chemicals and other desiccator applications. Includes a white styrene dish with a raised center plate surrounded by a V shaped circu-lar trough, and a drying chamber of polyethylene.

* U.S. Pat. 3.288.566



Unbreakable, plastic DESICCATOR

Permits application of high vacuum which is retained by a specially designed retention valve located on the upper section.

Entire unit is strong, very light, un-breakable, has good chemical resist-ance and is easy to handle. Available in three sizes.

Available at your local laboratory supply house.

Send for our catalog supplement listing many NEW items . . . just off the press! Write Dept. E-5 for your FREE copy.

BEL-ART PRODUCTS

PEQUANNOCK, N. J. 07440

⁸⁵⁴

Guide for Those Going on Expeditions, O. G. Edholm and A. L. Bacharach, Eds., 13 May 1966, 911

- Explorations in Elementary Mathematics, S. E. Smith, Jr., 1 July 1966, 49 Explorer of the Universe: George Ellery
- Hale, H. Wright, 26 Aug. 1966, 966 Eye and Brain: The Psychology of
- Seeing, R. L. Gregory, 14 Oct. 1966, 252
- Family Planning and Population Programs, B. Berelson, Ed., 17 June 1966, 1611
- F-Centers in Alkali Halides, J. J. Markham, 5 May 1967, 634
- Ferromagnetic Resonance, S. V. Vonsovskii, Ed., 13 Jan. 1967, 186
- Fertility and Family Planning in the United States, P. K. Welpton, A. A. Campbell, J. Patterson, 13 May 1966, 928
- Fertilization, C. R. Austin, 29 April 1966, 634
- Field Biology and Ecology, A. H. Benton and W. E. Werner, Jr., 22 Apr. 1966, 498
- A First Course in Abstract Algebra, H. Paley and P. M. Weichsel, 9 Sept. 1966, 1233
- A First Course in Partial Differential Equations: With Complex Variables and Transform Methods, H. F. Weinberger, 6 May 1966, 749
- Fishes of the Western North Atlantic, Vol. 5, Order Iniomi, Order Lyomeri, 27 May 1966, 1234
- A Flora of Northeastern Minnesota, O. Lakela, 13 May 1966, 943
- Fluorescence and Phosphorescence Analysis: Principles and Applications, D. M. Hercules, Ed., 30 Sept. 1966, 1631
- Fluorine Chemistry, Vol. 4, H. C. Hodge and F. A. Smith, 13 May 1966, 941
- Fluorocarbons and Their Derivatives, R. E. Banks, 6 Jan. 1967, 61
- The Focal Encyclopedia of Photography, L. A. Mannheim *et al.*, Eds., 4 Nov. 1966, 639
- Forestry in Communist China, S. D. Richardson, 26 Aug. 1966, 967
- The Forests of the U.S.S.R., V. P. Tseplyaev, 21 Oct. 1966, 374
- Forest-Soil Relationships in North America, C. T. Youngberg, Ed., 13 May 1966, 922
- The Foundations of Genetics, F. A. E. Crew, 24 June 1966, 1733
- Foundations of Immunochemistry, E. D. Day, 24 Mar. 1967, 1527
- Foundations of Solid Mechanics, Y. C. Fung, 1 Apr. 1966, 64
- The Fulbright Program: A History, W. Johnson and F. J. Colligan, 13 May 1966, 914
- Fundamentals of Abstract Analysis, A. M. Gleason, 3 Mar. 1967, 1095
- Fundamentals of Phytomorphology, A. D. J. Meeuse, 13 May 1966, 945
- Future Environments of North America, F. F. Darling and J. P. Milton, Eds., 21 Apr. 1967, 370
- Future Perfect: American Science Fiction of the Nineteenth Century, H. B. Franklin, Ed., 13 May 1966, 920
- The Galápagos, R. I. Bowman, Ed., 7 Apr. 1967, 55
- Gardening in Hot Countries, A. Thomas, 10 June 1966, 1496
- 12 MAY 1967



Only an automatic polarimeter this sensitive could be this accurate.

Sensitive to 0.0001° and accurate to $\pm 0.0002^{\circ}$, Bendix[®] Polarimeters are the world's most accurate—and often give more precise results than methods based on any other physical or chemical phenomena.

Bendix automatic polarimeters are all-electronic with no moving parts. They feature the most versatile readout in the business—dual-range meter, chart recorder (directly), digital display and a tape printer. And you can also use a scope for a readout.

The basic model features a four-inch, dual-range meter for reading optical rotation. A recording model incorporates a multi-range, strip-chart recorder. The digital model provides a direct, four-place readout and gives optimum advantage of system accuracy. A printer programmer can be added, to automatically scan a number of measurements, totalize, stop or repeat with readout on a digital tape printer.

Ability to use a very short sample cell extends the effective range to $\pm 50^{\circ}$ and adds to the versatility of Bendix automatic polarimeters for quality control, process control, reaction monitoring, column chromatography and optical and physical property studies.

Bendix scientific instruments—including mass spectrometers, atomic absorption and flame spectrophotometers, polarimeters, polarographic systems and electron multipliers—are used in over 100 areas of research and analysis. For more information, write: The Bendix Corporation, Scientific Instruments Division, 3625 Hauck Road, Cincinnati, Ohio 45241. Or phone (513) 772-1600.





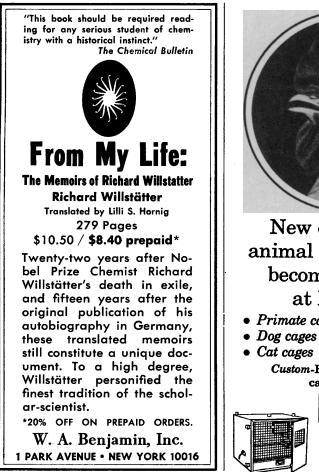
TROEMNER's new, heavy duty 4 Place Magnetic Stirrer speeds your work, increases efficiency and stretches your lab budget! Model 600 is four magnetic stirrers in one, and each will stir two pounds of 100% glycerol at 500 rpm's simultaneously! Stirrers have absolutely synchronous operation with one rheostat and one heavy duty motor giving identical rpm's at each stirrer station! And there's no guessing at speeds . . . tachometer indicates speeds



Model 601 available with 4 heavy duty stirrers in 1!

g at speeds . . . tachometer indicates speeds up to 1000 rpm's! The sturdy, lightweight case design includes air cooling, sound-proofing and mounting rods at each stirrer location. **Model 600** is priced at \$285.00 f.o.b. Phila., and delivered ready for plug-in and use. Order now or write for literature: **Henry TROEMNER, Inc., 6823 Greenway Ave., Phila., Pa. 19142.**







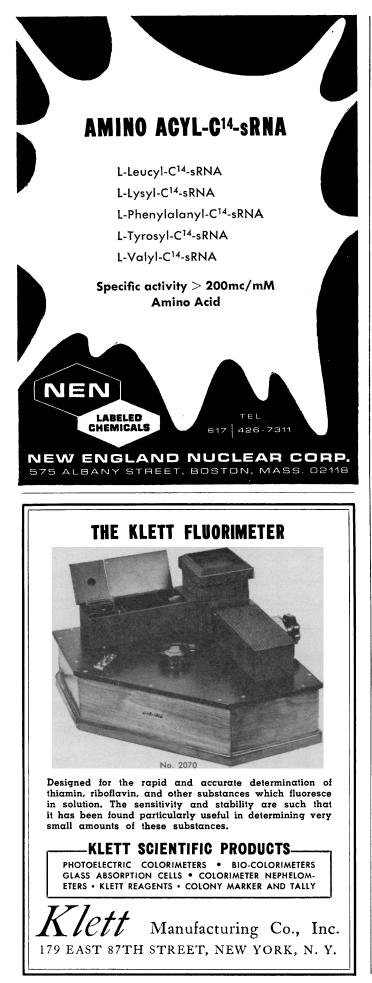
New concepts in animal cage systems become a reality at Harford.

- Primate cages
 Poultry cages
- Dog cages
 Rodent cages

• Cat cages • Rabbit cages Custom-Engineered animal



- Gaussian Quadrature Formulas, A. H. Stroud and D. Secrest, 23 Sept. 1966, 1515
- General Chemistry, N. Glinka, 24 June 1966, 1734
- Genetic Complementation, J. R. S. Fincham, 15 July 1966, 288
- The Genetics of Colonizing Species: Proceedings of the First International Union of Biological Sciences Symposium on General Biology, H. G. Baker and G. L. Stebbins, Eds., 22 Apr. 1966, 495
- Genetics of Sexuality in Higher Fungi, J. R. Raper, 11 Nov. 1966, 758
- Genetics of the Norway Rat, R. Robinson, 13 May 1966, 938
- Genetics Today, Vol. 3, S. J. Geerts, Ed., 22 July 1966, 403
- Geochemistry of Beryllium and Genetic Types of Beryllium Deposits, A. A. Beus, 23 Dec. 1966, 1536
- The Geography of Frontiers and Boundaries, J. R. V. Prescott, 5 Aug. 1966, 624
- Geography of the U.S.S.R., R. E. H. Mellor, 29 July 1966, 519
- Geological Data Processing Using FOR-TRAN IV, F. G. Smith, 6 Jan. 1967, 65 Geology—An Introduction, R. L. Bates
- and W. C. Sweet, 10 June 1966, 1495
- Geology Illustrated, J. S. Shelton, 2 Dec. 1966, 1158
- Geology of Granite, E. Raguin, 22 Apr. 1966, 496
- The Geometry of Incidence, H. L. Dorwart, 17 June 1966, 1615
- Glycoproteins, A. Gottschalk, Ed., 20 Jan. 1967, 315
- The Growth of Cereals and Grasses, F. L. Milthorpe and J. D. Ivins, Eds., 15 July 1966, 285
- Grundlagen der Vererbung, A. Barthelmess, 23 Sept. 1966, 1515
- A Handbook for the Identification of Insects of Medical Importance, J. Smart, 6 May 1966, 748
- A Handbook of Fluorescence Spectra of Aromatic Molecules, I. B. Berlman, 30 Sept. 1966, 1631
- The Handbook of Middle American Indians, Vols. 2 and 3, Archaeology of Southern Mesoamerica, G. R. Willey, Ed., 27 May 1966, 1230
- Handbook of Physiology, Section 5, Adipose Tissue, A. E. Renold and G. F. Cahill, Jr., Eds., 29 July 1966, 516; Section 3, Vol. 2, Respiration, W. O. Fenn and H. Rahn, Eds., 13 May 1966, 941
- A Handbook of Systematic Botany, S. C. Datta, 1 Apr. 1966, 57
- Handbook on the Common Marine Isopod Crustacea of Georgia, R. J. Menzies and D. Frankenberg, 15 July 1966, 286
- The Hepaticae and Anthocerotae of North America, East of the Hundredth Meridian, R. M. Schuster, 5 May 1967, 633
- Herbal, J. W. Krutch, 13 May 1966, 915 High Energy Physics, C. DeWitt and M. Jacob, Eds., 1 July 1966, 51
- High Resolution Nuclear Magnetic Resonance Spectroscopy, J. W. Emsley, J. Feeney, L. H. Sutcliffe, 23 Dec. 1966, 1534
- History and Geography of the Most Important Diseases, E. H. Ackerknecht, 4 Nov. 1966, 641

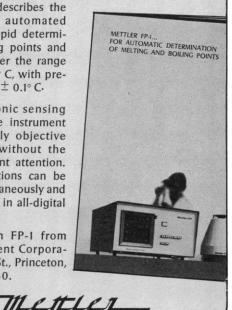


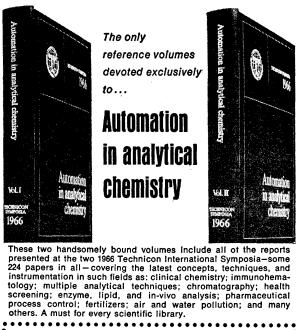
New LITERATURE FROM METTLER Determine Melting and Boiling Points Automatically

A new bulletin describes the Mettler FP-1, an automated instrument for rapid determination of melting points and boiling points over the range of -20° to $+300^{\circ}$ C, with precision as great as $\pm 0.1^{\circ}$ C.

Through electronic sensing of endpoints, the instrument makes completely objective determinations without the operator's constant attention. Three determinations can be performed simultaneously and data is presented in all-digital form.

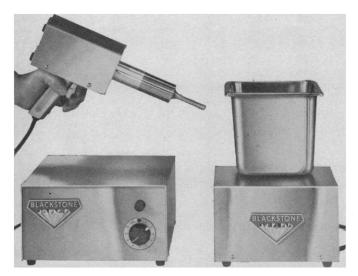
Request Bulletin FP-1 from Mettler Instrument Corporation, 20 Nassau St., Princeton, New Jersey 08540.





TECHNICON	ARDSLEY, NEW YORK 10502 copies of the New York S	
lease sella_	@ \$15.00 per copy	ymposium Proceeunigs
	copies of the European S @ \$12.00 per copy	ymposium Proceedings
	copies of the Two Volume	e Set @ \$24.00 per Set
C.O.D. (p	olus shipping charge) tached (Technicon will pay po	ato ao)
Name	tached (rechnicon win pay po	stage)
Address		
City	State	Zip
		401

This little ultrasonic kit from Blackstone does a very large number of very small jobs.



And in very short order.

This kit is the perfect laboratory combination of ultrasonic probe and cleaner with an interchangeable single generator.

BPO Ultrasonic Probe is ideally suited for cell disruption of small biological samples, dispersal of steroids, degassing and deaeration of oils and other viscous fluids, emulsification of liquids and acceleration of chemical reactions. Compact design allows operator complete freedom of movement in reaching all areas of his work.

CT.5 Cleaning Tank, developed for use with a water-base detergent, enables precision ultrasonic scrubbing for contaminated small parts and instruments. Tank is detachable from transducer housing for ease in filling, emptying and cleaning.

Solid State Generator can be used interchangeably with either the BPO Probe or the CT.5 Cleaning Tank. 0 to 100% power control allows you to select the most efficient power output for your work, or for maximum cleaning efficiency.

Here are some actual applications:

- Probe: Disrupts pills with water-insoluble coating in one minute with 100% recovery for analysis. 5%-10% is lost in mortar and pestle grinding.
- Cleaning Tanks: Precision cleaning of delicate objects such as micro pipets, syringes, needles, clogged micro sieves, and spectrophotometer cells.

Tell us what you propose to do with the BPO/CT.5 kit, so we can tell you more about its capabilities for <u>your</u> laboratory.





Another First for Sigma—

CRYSTALLINE

G-6-P-D

Glucose-6-Phosphate Dehydrogenase Activity about 300 units/mg

As a result of studies we were forced to make when our old suppliers defaulted, we have succeeded in developing this greatly improved preparation.

Although many researchers did not realize it, the best G-6-P-D previously offered was not crystalline and assayed only about 100 units/mg.

Contaminating Enzymes are also greatly reduced:

Myokinase	< 0.03%	
6-Phosphogluconic Dehydrogenase	<0.003%	
Hexokinase	< 0.05%	
Glutathione Reductase	< 0.01%	
Phosphohexose Isomerase	< 0.03%	

Tentative Prices are approx. 50% Lower than the old list even though the purity has been more than doubled!

Giucose-6-Phosphate	50	units	\$ 3.00
Dehydrogenase	100	units	5.00
	250	ųnits	10.00
Type X, from Yeast	500	units	17.00
Crystalline	1000	units	28.50
Ammonium Sulfate Suspension	2000	units	46.25
	5000	units	110.00

Note:—Long term stability has not yet been determined. Preliminary studies indicate almost complete stability at 0-5°C for at least 2 months. Only minor losses occurred after 3 days at 25°C.

For those who prefer the old grades, V & VI, we will continue to supply when available, but at $\frac{1}{2}$ of the 1966 prices.



New monographs and references!

- The History of Cell Respiration and Cytochrome, D. Keilin, 10 June 1966, 1493
- A History of Genetics, A. H. Sturtevant, 13 May 1966, 922
- The History of Psychiatry: An Evaluation of Psychiatric Thought and Practice from Prehistoric Times to the Present, F. G. Alexander and S. T. Selesnick, 18 Nov. 1966, 875
- History of the Indian Ocean, A. Toussaint, 15 July 1966, 287
- A History of the Theories of Rain, W. E. Middleton, 15 July 1966, 285
- Honour and Shame: The Values of Mediterranean Society, J. G. Peristiany, Ed., 8 July 1966, 164
- Huang Ti Nei Ching Su Wen, The Yellow Emperor's Classic of Internal Medicine, I. Veith, 7 Apr. 1967, 53
- Human Aims in Modern Perspective, D. W. Gotschalk, 12 Aug. 1966, 732
- The Human Body in Equipment Design, A. Damon, H. W. Stoudt, R. A. Mc-Farland, 4 Nov. 1966, 638
- Human Ecology: Collected Readings, J. B. Bresler, Ed., 14 Oct. 1966, 254
- Human Geography, A. V. Perpillou, 22 July 1966, 402
- The Humicolous Fauna of South Africa: Pselaphidae and Catopidae: (Coleoptera), R. Jeannel, 13 May 1966, 939
- Huntia, Vol. 2, G. H. M. Lawrence, Ed., 13 May 1966, 916
- Hydrogen Compounds of the Metallic Elements, K. M. MacKay, 10 Feb. 1967, 684
- Hydrogen in Titanium, V. A. Livanov, A. A. Bukhanova, B. A. Kolachev, 27 May 1966, 1233
- Hypotensive Peptides, E. G. Erdös, N. Back, F. Sicuteri, A. F. Wilde, Eds., 16 Dec. 1966, 1434
- The Idea of a World University, M. Zweig, 28 Apr. 1967, 497
- The Identity of Man, J. Bronowski, 4 Nov. 1966, 630
- In the Name of Science, H. L. Neiburg, 9 Sept. 1966, 1229
- Index Bergeyana, R. E. Buchanan, J. G. Holt, E. F. Lessel, Jr., Eds., 14 Oct. 1966, 254
- The Indian: America's Unfinished Business, W. A. Brophy and S. D. Aberle, 17 Mar. 1967, 1394
- Indian Culture and European Trade Goods, G. I. Quimby, 3 Feb. 1967, 552
- Information Theory and Esthetic Perception, A. Moles, 24 Mar. 1967, 1529
- Infrared Radiation, I. Simon, 13 May 1966, 956
- Intelligence in the Universe, R. A. Mc-Gowan and F. I. Ordway III, 30 Sept. 1966, 1628
- Intelligent Life in the Universe, I. Shklovskii and C. Sagan, 30 Sept. 1966, 1628
- Interferons, N. B. Finter, Ed., 14 Apr. 1967, 231
- International Plant Index, Vols. 1 and 2, 13 May 1966, 934
- The Intelligence of Democracy: Decision Making Through Adjustment, C. E. Lindblom, 6 May 1966, 746
- Interpretation Theory in Applied Geophysics, F. S. Grant and G. F. West, 15 Apr. 1966, 339
- Interstellar Gas Dynamics, S. A. Kaplan, 2 Sept. 1966, 1093

12 MAY 1967

THE UFAW HANDBOOK ON THE CARE AND MANAGEMENT OF LABORATORY ANIMALS, 3rd ed.

Edited by the Staff of The Universities Federation for Animal Welfare, this is generally recognized to be the standard reference for all researchers using experimental animals. Breeding, rearing, feeding, handling, and housing are discussed for every species of laboratory animal: rodents lagomorphs and insectivores; carnivores, ungulates and primates; birds, poikilotherms and invertebrates. 1967, 1031 pages, 297 figs., 123 tables, \$23.00

Trease: TEXTBOOK OF PHARMACOGNOSY, 9th ed.

A very thorough revision, including the many developments in phytochemistry and botany. Contents by part: plants and their structure; from plant to crude drug; phytochemistry; biosynthetic pathways; vegetable drugs; animals and animal products; analytical procedures. 1967, approx. 830 pages, 250 figs., \$14.50

Bourne: IN VIVO TECHNIQUES IN HISTOLOGY

A detailed explanation of the various techniques available for the microscopic study of living tissues and organs. In order to best serve the intended audience, researchers and novices in research, emphasis is placed on techniques rather than on specific results. Edited by Geoffrey H. Bourne, Director, Yerkes Regional Primate Center, Emory University. 1967, approx. 425 pages, 100 figs., in press, due May

Luparello: STEREOTAXIC ATLAS OF THE FOREBRAIN OF THE GUINEA PIG

A painstakingly accurate study, using Hartley strain, male guinea pigs weighing 350-358 g. In the preparation a Stellar-Johnson stereotaxic instrument was used. To increase coordinate accuracy, orienting wires were implanted in each brain. 1967, 78 pages, 62 plates, in press, due May



THE WILLIAMS & WILKINS COMPANY 428 E. PRESTON ST. / BALTIMORE, MD. 21202

Publishers of Medical and Scientific Books and Periodicals



Ultrasonic Absorption

AN INTRODUCTION TO THE THE-ORY OF SOUND ABSORPTION AND DISPERSION IN GASES, LIQUIDS, AND SOLIDS

By A. B. BHATIA, University of Alberta. This introduction to the basic theoretical ideas and experimental results in the field of ultrasonic absorption deals with sound propagation in an ideal fluid and in an elastic solid, and with the various physical mechanisms responsible for sound absorption. 102 figures. (Monographs on the Phys-ics and Chemistry of Materials.) \$13.60 \$13.60

Principles of Physical Chemistry for Biology and Pharmacy

By L. SAUNDERS, University of London. Expanding interest in molecular biology has given biologists the need to strengthen their knowledge of the physics of chemical processes. This book provides a sound basis for these studies. Many students in more orthodox chemistry will also find this work of value since, although the selection of material is aimed at the more biologicallyoriented reader, mathematical aspects are developed carefully step-by-step. Illustrated. \$11.50

The Organic Chemistry of Nitrogen

THIRD EDITION

By N. V. SIDGWICK, University of Ox-ford; edited by IAN T. MILLAR, Uni-versity of Keele, and H. D. SPRINGALL, University of Keele. This new edition of a classic study of chemistry begins with an account of the general features and stereo-chemistry of the organic compounds of nitrogen and goes on to cover the quantum theory of valence, major types of noncyclic organic nitrogen compounds, cyclic compounds, and the chemistry of the nu-cleic acids and nucleoproteins. \$26.90

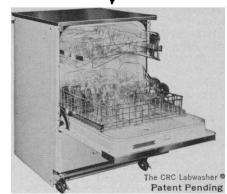
Theory of **Crystal Dislocations**

By F. R. N. NABARRO, University of Witwatersrand, Johannesburg. This study focuses on the geometrical and elastic properties of dislocations in a continuum and in a crystal, and on the interactions of dislocations with point defects. The effects of dislocation on the electrical, magnetic, thermal, and optical properties of crystals are also treated. 231 figures. (International Series of Monographs on Physics.) \$30.25

> OXFORD 🕍 UNIVERSITY 👑 PRESS 💓 200 Madison Avenue, New York, N.Y. 10016

- Introduction to Agricultural Botany in India, G. V. Chalam and J. Venkateswarlu, 19 Aug. 1966, 854
- Introduction to Electrical Discharges in Gases, S. C. Brown, 10 Mar. 1967, 1236
- An Introduction to Electron Paramagnetic Resonance, M. Bersohn and J. C. Baird, 28 Oct. 1966, 500
- Introduction to Environmental Physiology, G. E. Folk, Jr., 31 Mar. 1967, 1660
- An Introduction to General Virology, T. M. Bell, 13 May 1966, 939
- Introduction to Laser Physics, B. A. Lengyel, 27 Jan. 1967, 444
- Introduction to Real Analysis, C. Goffman, 17 Feb. 1967, 816 Introduction to Solid State Physics, C.
- Kittel, 24 Feb. 1967, 991
- An Introduction to the Study of Enzymes, H. Gutfreund, 8 Apr. 1966, 195
- Introduction to Transition-Metal An Chemistry, L. E. Orgel, 14 Apr. 1967, 232
- Invention and Economic Growth. J. Schmookler, 16 Sept. 1966, 1367
- The Invention of the Aeroplane (1799-1909), C. H. Gibbs-Smith, 4 Nov. 1966, 635
- Inventor and Entrepreneur, Recollections of Werner von Siemens, 22 July 1966, 405
- The Investigation of Psychotherapy, A. P. Goldstein and S. J. Dean, Eds., 6 Jan. 1967.60
- Ionic Equilibria, J. E. Prue, 28 Oct. 1966, 498
- Ionizing Radiation: Neural Function and Behavior, D. J. Kimeldorf and E. L. Hunt, 26 Aug. 1966, 968
- Khimiya Tikhogo Okeana, S. W. Brujewicz, Ed., 25 Nov. 1966, 995
- Kinetic Equations of Gases and Plasmas, T.-Y. Wu, 3 Mar. 1967, 1094
- The Klamath Tribe: A People and Their Reservation, T. Stern, 13 May 1966, 928
- Knowledge and Power, S. A. Lakoff, Ed., 31 Mar. 1967, 1660
- Lamotrek Atoll and Inter-Island Socioeconomic Ties, W. Alkire, 16 Sept. 1966, 1371
- Land behind Baghdad, R. McC. Adams, 29 July 1966, 518
- The Language of Life, G. Beadle and M. Beadle, 24 June 1966, 1733 The Laser, W. V. Smith and P. P. Soro-
- kin, 27 Jan. 1967, 444
- Laser Cancer Research, L. Goldman, 9 Dec. 1966, 1315
- Laser Receivers: Devices, Techniques, Systems, M. Ross, 27 Jan. 1967, 444
- Lasers and Their Applications, K. R. Stehling, 27 Jan. 1967, 444
- Lattice Defects in Quenched Metals, R. M. J. Cotterill, M. Doyama, J. J.
- Jackson, M. Meshii, Eds., 15 Apr. 1966, 339
- Lectures on Choquet's Theorem, R. R. Phelps, 2 Dec. 1966, 1160
- Lectures on Functional Equations and Their Applications, J. Aczel, 10 Mar. 1967, 1234
- Lectures on Geology, J. Walker and H. W. Scott, Eds., 28 Oct. 1966, 497

JUST ADD WATER AND PLUG IN 🗲 INSTANT MOBII LABWASHER



Attach the Labwasher's quick disconnect coupling, with universal adapter. to any water tap. Plug in three-wire. eight foot cord to any nearby 115 volt, 60-cycle A.C. outlet. That's it! One plug. One connection. One minute. And your lab is equipped for automated labwashing.

The CRC Labwasher handles most lab glassware. Efficiently. Conveniently. And inexpensively-because it soon pays for itself in man-hours saved. Fifteen different stainless steel racks are available for volume washing.

Request Bulletin No. \$751 for more information.



- Lie Groups for Physicists, R. Hermann, 20 May 1966, 1048
- Life Styles of Educated Women, E. Ginzberg, I. E. Berg, C. A. Brown, J. L. Herma, A. M. Yohalem, S. Gorelick, 26 Aug. 1966, 965
- Ligand Substitution Processes, C. H. Langford and H. B. Gray, 14 Oct. 1966, 254
- The Living Races of Man, C. Coon, 4 Nov. 1966, 628
- Living Tissues: An Introduction to Functional Histology, R. L. Holmes, 1 Apr. 1966, 64
- Love and Hate in China, H. Konigsberger, 4 Nov. 1966, 627
- The Machinery of Life, D. Wooldridge, 10 June 1966, 1496
- Maize in Tropical Africa, M. P. Miracle, 8 July 1966, 161
- Managerial Power and Soviet Politics, J. R. Azrael, 17 Mar. 1967, 1397
- The Managerial Revolution in Higher Education, F. E. Rourke and G. E. Brooks, 3 Mar. 1967, 1092
- Marcello Malpighi and the Evolution of Embryology, H. B. Adelmann, 30 Dec. 1966, 1633
- Man Adapting, R. Dubos, 20 May 1966, 1049
- Manual for Kinship Analysis, E. L. Schusky, 13 May 1966, 926
- Manual for the Calssification and Determination of the Anaerobic Bacteria, A. Prévot, 23 Sept. 1966, 1517
- Marine Archaeology: Developments During Sixty Years in the Mediterranean, J. du Plat Taylor, Ed., 1 Apr. 1966, 58
- Marine Geochemistry, D. R. Schink and J. T. Corless, Eds., 10 June 1966, 1494
- Marquesan Sexual Behavior, R. C. Suggs, 22 Apr. 1966, 497
- Marshall's Physiology of Reproduction, Vol. 3, A. S. Parkes, Ed., 24 Mar. 1967, 1530
- Marsh's Dinosaurs, J. H. Ostrom and J. S. McIntosh, 20 Jan. 1967, 309
- Mathematical Explorations in Behavioral Science, F. Massarik and P. Ratoosh, Eds., 13 May 1966, 925
- Mathematical Methods in the Physical Sciences, M. L. Boas, 24 Mar. 1967, 1530
- The Mathematical Practitioners of Hanoverian England, 1714–1840, E. G. R. Taylor, 30 Sept. 1966, 1630
- Mathematics for Science, W. L. Ferrar, 1 July 1966, 52
- The Mathematics of Space Exploration, M. H. Ahrendt, 10 June 1966, 1495
- Matrices and Linear Transformations, C. C. Cullen, 30 Dec. 1966, 1634
- Matter and Method, R. Harré, 20 May 1966, 1050
- McGraw-Hill Basic Bibliography of Science and Technology, D. I. Eggenberger, Exec. Ed., 12 Aug. 1966, 731
- McGraw-Hill Encyclopedia of Science and Technology, Vols. 1-15, ed. 2, 13 May 1966, 903
- McGraw-Hill Modern Men of Science, J. E. Greene, Ed., 12 Aug. 1966, 731
- McGraw-Hill Yearbook of Science and Technology, I. Eggenberger, Exec. Ed., 12 Aug. 1966, 731
- Measure and the Integral, H. Lebesgue, 24 Feb. 1967, 992
- The Measure of the Universe: A His-12 MAY 1967

You mean I can get \$50,000 of TIAA Life insurance for less than \$100?

That's what an Assistant Professor asked us when he heard about TIAA's low life insurance costs.

It's true. At his age 30 the annual premium for a 20-Year Home Protection policy providing \$50,000 initial amount of insurance is \$159.00. The first year dividend, based on our current dividend scale, is \$61.00, making a net payment of \$98.00. Dividends, of course, are not guaranteed.

The Home Protection plan is level premium Term insurance providing its largest amount of protection initially, reducing by schedule each year to recognize decreasing insurance needs. This is just one example of the many lowcost TIAA plans available. If you need more protection for your family, ask us to mail you a personal illustration with figures for a policy issued at your age. We'll also send the Life Insurance Guide describing other TIAA policies.

ARE YOU ELIGIBLE FOR TIAA?

Yes, if you are employed by a college, university, private school or other nonprofit educational or scientific institution that qualifies for **TIAA** eligibility.

TEACHERS INSURANCE AND ANNUITY ASSOCIATION 730 Third Avenue, New York, N. Y. 10017

Please mail the new Life Insurance Guide and a personal illustration.

Your Date of Birth

college, university, or other educational or scientific institution

71P

tiaa

Address____

Name

Dependents' Ages_

Nonprofit Employer_

ai



with the NEW Bausch & Lomb Concentration Computer

Gone are the days of involved calculations, checking tables or figuring formulas. Today, if you want to know the concentration of a solution . . . read it! Just attach the new Bausch & Lomb Concentration Computer to your spectrophotometer. Most B&L Spectrophotometers attach directly, several other makes are easily adapted. Now the whole job boils down to three quick steps:

1. Set zero.

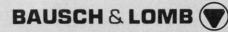
NSTRUMENTATIO

- 2. Calibrate to a known standard.
- 3. Read the unknown concentration directly.

Simple ... Fast ... Accurate!

The price is just \$750 . . . making this the first and only low cost unit that automatically reads concentration directly for any solution obeying Beers law. We'll gladly send you a descriptive brochure (33-2215) or why not let us show you? Write Bausch & Lomb, 20841 Bausch Street, Rochester, New York 14602.

P.S. Want to know about our full line of spectrophotometers? Just ask us.



In Canada, Bausch & Lomb Optical Co., Ltd., 16 Grosvenor St., Toronto, Ontario

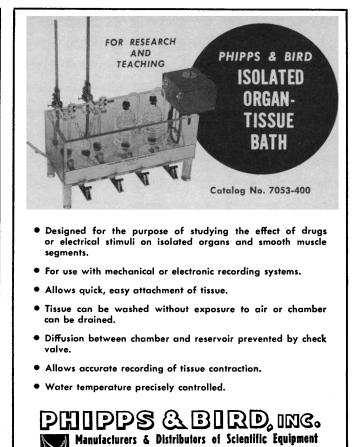
tory of Modern Cosmology, J. D. North, 8 July 1966, 159

- Mechanisms in Bioenergetics, E. Racker, 4 Nov. 1966, 640
- Mechanisms of Release of Biogenic Amines, U. S. von Euler, S. Rosell, B. Uvnas, Eds., 16 Dec. 1966, 1439
- The Medical Formulary or Aqrâbadhin of al-Kindi, M. Levey, Translation, 3 June 1966, 1363
- Medical Practice in Modern England, R. Stevens, 31 Mar. 1967, 1661
- Medicine in America, R. H. Shryock, 6 Jan. 1967, 60
- Meeresbiologie: Eine Einführung in die Probleme und Egenbnisse, H. Friedrich, 13 May 1966, 937
- Men and Pandas, R. Morris and D. Morris, 7 Apr. 1967, 53
- Men, Machines, and Modern Times, E. Morison, 23 Dec. 1966, 1532
- Mendelian Inheritance in Man, V. A. McKusick, 17 Mar. 1967, 1395
- Metabolism of Steroid Hormones, R. Dorfman and F. Ungar, 20 May 1966, 1052
- Methodology of Plant Eco-Physiology: Proceedings of the Montpellier Sym-posium, F. E. Eckardt, Ed., 6 May . 1966. 747
- Methods of Orbit Determination, P. R. Escobal, 15 July 1966, 288
- Methods of Serological Research, J. B. Kwapinski, 15 Apr. 1966, 342
- Michael Scot, L. Thorndike, 1 Apr. 1966, 64
- Microbial Models of Cancer Cells, G. F. Gause, 9 Dec. 1966, 1317
- Microbiology and Soil Fertility, C. M. Gilmour and O. N. Allen, Eds., 22 Apr. 1966, 497
- Mind, Matter, and Method: Essays in Philosophy and Science in Honor of Herbert Feigl, P. Feyerabend and G. Maxwell, Eds., 2 Sept. 1966, 1092
- Modernization and the Structure of Societies: A Setting for International Affairs, M. J. Levy, Jr., 3 June 1966, 1362
- Modes of Reproduction in Fishes, C. M. Breder, Jr., D. E. Rosen, 10 Feb. 1967, 684
- Molecular Approach to Phylogeny, M. Florkin, 27 Jan. 1967, 445 A
- Molecular Biophysics, B. Pullman and M. Weissbluth, Eds., 13 May 1966, 937
- Molecular Photochemistry, N. J. Turro, 18 Nov. 1966, 876 Molecules and Evolution, T. H. Jukes,
- 20 Jan. 1967, 308
- Molecules, Crystals, and Quantum Statistics, E. Fermi, 24 June 1966, 1735
- Monograph of Cyrtandra (Gesneriaceae) on Oahu, Hawaiian Islands, H. St.
- John, 13 May 1966, 936 A Monograph of Lemnaceae, E. H. Daubs, 13 May 1966, 935
- The Morphology of Gymnosperms, K. R. Sporne, 15 Apr. 1966, 340
- The Movement of Beach Sand, J. C. Ingle, Jr., 9 Sept. 1966, 1232
- Muscular Afferents and Motor Control, R. Granit, Ed., 31 Mar. 1967, 1661

The Nature of Matter, G. Amaldi, 17 Feb. 1967, 818

- The Nature of the Lunar Surface, W. N. Hess, D. H. Menzel, J. A. O'Keefe, Eds., 25 Nov. 1966, 998
- Neural Mechanisms of Higher Verte-





6th & Byrd Streets --- Richmond, Virginia

NOW A SIMPLE, <u>DISPOSABLE</u> ELECTROPHORESIS SYSTEM WITH 3 <u>DIFFERENT APPLICATIONS</u>: 1. HYLAND LDH ISOZYMES TEST

for semiquantitative differentiation of lactic dehydrogenase isozymes

2. HYLAND HEMOGLOBIN ELECTROPHORESIS TEST

for separation, differentiation, and identification of human hemoglobins

3. HYLAND HAPTOGLOBIN ELECTROPHORESIS TEST

for semiquantitative determination of human serum haptoglobin

The three tests are separately packaged, each comprising an integrated, easily set-up system for semiquantitative electrophoresis by the agar gel method. Kits contain reference controls,

agar gel plates, and all necessary reagents and equipment, except for a power supply, for up to 60 LDH or hemoglobin determinations and up to 30 haptoglobin determinations. A power supply which will provide a current of up to 100 ma. is available separately. Write for complete details.





Send this coupon NOW to: HYLAND, P.O. Box 39672, Los Angeles, Calif. 90093
Please send complete information on ELECTROPHORESIS SYSTEM
Name
Organization or Firm
Street
CityStateZipSCI 56?

12 MAY 1967



Measuring low light levels

... requires extremely low dark currents coupled with maximum useful sensitivity. The EMI 6256, a 13-stage venetian blind 2" photomultiplier tube has the essential characteristics that are necessary for low light level applications. The unique 10mm cathode-DI geometry, together with the ultra-stable EMI venetian blind design, has resulted in its widely successful use in astronomy, biology



and spectrophotometry. The EMI 6256B has a quartz window and the S-11 cathode (S-13) which has a peak quantum efficiency of 17% at 4,200 A. The EMI type 6256S has 5 to 10 times lower dark current than the 6256B, and should be used when system performance is dark current limited. This type is also available for visible light applications as 9502B/9502S, or with 11 dynodes as 6094B/6094S. Many other EMI photomultiplier tubes are available for special applications from stock in sizes from 1" to 12". EMI photomultiplier tubes are available through qualified engineering representatives located in major marketing areas throughout the United States. A request on your company letterhead will bring you the name of your nearest representative as well as a copy of our latest catalog.



80 Express St., Plainview, L. I., N.Y. 516-433-5900 TWX 516-433-8790 *EMI ELECTRONICS, LTD. brate Behavior, J. S. Beritoff, 13 May 1966, 945

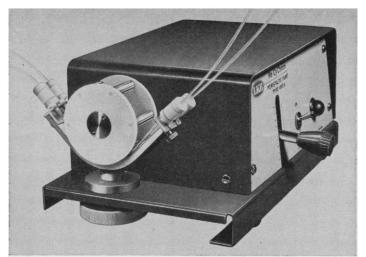
- Neurosecretion, M. Gabe, 6 Jan. 1967, 62
- Neutrino Astrophysics, H. Y. Chiu, 1 Apr. 1966, 57
- A New Look at Geometry, I. Adler, 7 Apr. 1967, 55
- New Roads to Yesterday: Essays in Archaeology, J. R. Caldwell, Ed., 19 Aug. 1966, 856
- New Universities in the Modern World, M. G. Ross, Ed., 13 May 1966, 921
- The New Utopians: A Study of System Design and Social Change, R. Boguslaw, 29 July 1966, 516
- New Views of the Nature of Man, J. R. Platt, Ed., 21 Oct. 1966, 372
- Newer Methods of Nutritional Biochemistry, Vol. 2, A. A. Albanese, Ed., 1 Apr. 1966, 57
- Nitrogen Fixation in Plants, W. D. P. Stewart, 13 May 1966, 936
- Nonlinear Electron-Wave Interaction Phenomena, J. E. Rowe, 17 Feb. 1967, 819
- Normality: Theoretical and Clinical Concepts of Mental Health, D. Offer and M. Sabshin, 23 Sept. 1966, 1513
- Nuclear Hematology, E. Szirmai, Ed., 22 July 1966, 404
- Nucleic Acids: Structure, Biosynthesis, and Function, 13 May 1966, 935
- Numerical Solution of Partial Differential Equations, J. H. Bramble, Ed., 21 Apr. 1967, 372
- The Nunamiut Eskimos: Hunters of Caribou, N. J. Gubser, 13 May 1966, 930
- Nutritional Aspects of Cardiovascular Diseases, E. Bajusz, 13 May 1966, 938
- Occupational and Environmental Cancers of the Respiratory System, W. C. Hueper, 18 Nov. 1966, 875
- Of Scientists and Salamanders, V. C. Twitty, 31 Mar. 1967, 1657
- On Aggression, K. Lorenz, 4 Nov. 1966, 636
- Ontogeny of Minerals, D. P. Grigor'ev, 12 Aug. 1966, 733
- Optical Properties and Electronic Structure of Metals and Alloys, F. Abelès, Ed., 24 Feb. 1967, 911
- Organic Chemistry, B. Pavlov and A. Terentyev, 22 July 1966, 406
- The Organic Chemistry of Titanium, R. Feld and P. L. Cowe, 30 Dec. 1966, 1637
- Organic Foundations of Animal Behavior, J. Altman, 30 Sept. 1966, 1629
- The Organization of Research Establishments, J. Cockcroft, Ed., 3 June 1966, 1365
- The Origin of Cultivated Plants, F. Schwanitz, 23 Sept. 1966, 1514
- The Origin of the Solar System: Genesis of the Sun and Planets, and Life on Other Worlds, T. Page and L. W. Page, Eds., 10 June 1966, 1496
- The Origins of Field Theory, L. Williams, 2 Sept. 1966, 1093
- Origins of Mendelism, R. C. Olby, 24 Feb. 1967, 989
- Otto Hahn: A. Scientific Autobiography, W. Ley, Ed., 24 Mar. 1967, 1528
- The Particle Kinetics of Plasmas, I. P. Shkarofsky, T. W. Johnston, M. P. Bachynski, 20 Jan. 1967, 310

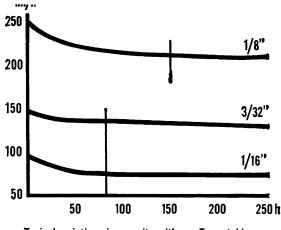
- Particles in the Atmosphere and Space, R. D. Cadle, 23 Dec. 1966, 1536
- Peaceful Uses of Automation in Outer Space, J. A. Aseltine, Ed., 21 Oct. 1966, 375
- Peasants, E. R. Wolf, 5 Aug. 1966, 625 Peptide Synthesis, M. Bodanszky and M. A. Ondetti, 16 Dec. 1966, 1434
- The Peptides, E. Schröder and K. Lübke, 24 June 1966, 1735
- The Peyote Religion among the Navaho, D. F. Aberle, 24 Mar. 1967, 1531
- Phage and the Origins of Molecular Biology, J. Cairns, G. S. Stent, J. D. Watson, Eds., 3 Mar. 1967, 1091
- Phase Diagrams of Titanium Alloys, E. K. Molchanova, 27 May 1966, 1234
- Phénomènes d'Absorption et de Diffsion dans l'Atmosphère, E. Vassy, 12 Aug. 1966, 733
- Philosophical Foundations of Physics, R. Carnap, 10 Mar. 1967, 1235
- Photochemistry, J. G. Calvert and J. N. Pitts, Jr., 6 Jan. 1967, 64
- Photographic Atlas of the Moon, Z. Kopal, J. Klepešta. T. W. Rackham, 13 May 1966, 954
- Photography on Expeditions, D. H. O. John, 4 Nov. 1966, 639
- Physics of the Lower Ionosphere, R. C. Whitten and I. G. Poppoff, 13 May 1966, 952
- Physiology of Echinodermata, R. A. Boolootian, Ed., 7 Apr. 1967, 54
- The Pituitary Gland, G. W. Harris and B. T. Donovan, Eds., 10 Feb. 1967, 682
- The Plankton of the Sea, R. S. Wimpenny, 3 June 1966, 1365
- Physics of the Solar Corona, I. S. Shklovskii, 28 Oct. 1966, 497
- Physiology of Mollusca, Vol. 2, K. M. Wilbur and C. M. Yonge, Eds., 21 Apr. 1967, 372
- Plant Biochemistry, J. Bonner and J. E. Varner, Eds., 21 Oct. 1966, 374
- Plant Diversification, T. Delevoryas, 17 June 1966, 1614
- Plants, Animals, and Man in the Outer Leeward Islands, West Indies, D. R. Harris, 13 May 1966, 940
- Plasmas-Laboratory and Cosmic, F. I. Boley, 13 May 1966, 956
- The Politics of American Science, 1939 to the Present, J. L. Penick, Jr., C. W. Pursell, Jr., M. B. Sherwood, D. C.
- Pursell, Jr., M. B. Sherwood, D. C. Swain, Eds., 9 Sept. 1966, 1229 The Politics of Conservation, F. E.
- Smith, 24 Feb. 1967, 989
- The Politics of Research, R. J. Barber, 9 Sept. 1966, 1229
- Polymer Handbook, J. Brandrup and E. H. Immergut, Eds., 16 Sept. 1966, 1372
- Polymorphism and Polytypism in Crystals, A. R. Verma and P. Krishna, 9 Dec. 1966, 1316
- Population in History: Essays in Historical Demography, D. Glass and D. Eversley, 13 May 1966, 926
- Population Studies of Birds, D. Lack, 17 Mar. 1967, 1396
- Poverty: American Style, H. P. Miller, 3 May 1966, 901
- Poverty in America, L. A. Ferman, J. L. Kornbluh, A. Haber, 13 May 1966, 901
- Prehistoric Societies, G. Clark and S. Piggott, 1 Apr. 1966, 63

SCIENCE, VOL. 156

864

iency of Terer 256S has The Or than the Feld tem per-1637 Dis type Organic





Typical variations in capacity with new Tygon tubing

PumpAbility Plus

- PLUS
- Steady flow over long periods Rugged, Compact, Versatile, Reliable design PLUS
- PLUS Flow rates from 0 to 390 ml/hr/channel
- PLUS Extremely high flow constancy (fluctuations less
- than 0.1 % per 24 hrs after initial run in)
- Roller change from 6 to 12 to give minimal pulsa-PLUS tions even at slowest speeds.

THE LKB PERISTALTIC PUMP

For Liquids (Corrosive and Highly Volatile) Emulsions-Slurries-Gases For the Laboratory and the Process Plant

Write for our illustrated leaflet giving full details of the Peristaltic Pump



OTHER HEADQUARTERS FOR SALES AND SERVICE

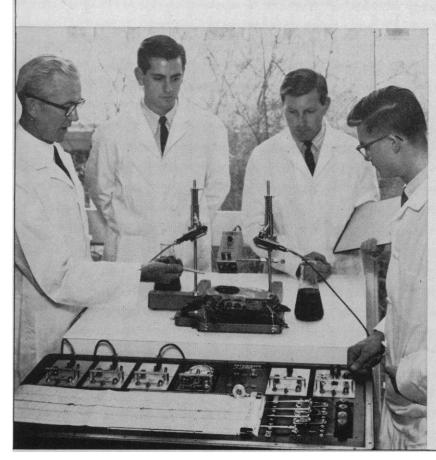
SWEDEN LKB-Produkter AB Box 76, Stockholm—Bromma 1

υĸ LKB Instruments Ltd. LKB House, 137 Anerley Road, London, S.E. 20

LKB INSTRUMENTS INC • 12221 PARKLAWN DRIVE • ROCKVILLE Md 20852

NETHERLANDS LKB-Produkten N.V. Zeekant 35, The Hague

DENMARK LKB Instrument A/S Amagerbrogade 34, Copenhagen S



how the PHYSIOGRAPH* saves time and ... increases teaching efficiency

This precise physiological recording system permits the professor and student alike to place the emphasis where it belongs—on the actual laboratory experiment-rather than on the technicalities of complicated equipment. Operational simplicity allows the students to set up their own experiments rapidly and efficiently. The E & M PHYSIO-GRAPH*, with its wide variety of available transducers and accessories, has unparal-leled versatility in teaching and research sit-uations in any of the biological sciences. Write for 32 page, illustrated catalog.

E & M INSTRUMENT CO., INC.

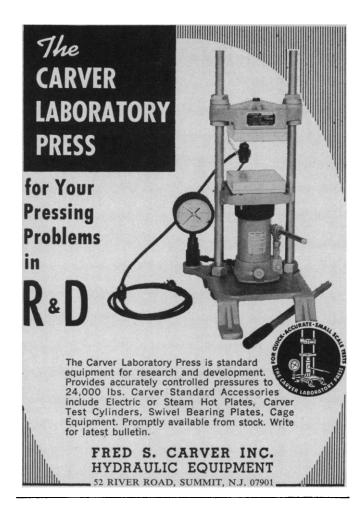
Instrumentation for Research & Education

Box 14013 · 6030 England Street · Houston, Texas 77021

* Physiograph is a trademark of E & M Instrument Co., Inc.

(F)





New AAAS Symposium Volume ENVIRONMENTAL VARIABLES IN ORAL DISEASE

Editors, Seymour J. Kreshover and F. J. McClure, 328 pp., illus., bibliography index, 1966. Price: \$8.75. AAAS members' cash orders: \$7.75.

Recent research on the role of environmental factors in oral disease is reported in this collection of papers from a symposium held at the AAAS meeting in Montreal, December 1964.

Twenty-four distinguished scientists present their findings in 17 chapters under four general headings:

Geographical and clinical consideration.

Nutrition and dental caries.

Experimental considerations in oral soft tissue lesions.

Prenatally induced oral anomalies.

AMERICAN ASSOCIATION FOR THE **ADVANCEMENT OF SCIENCE**

1515 Massachusetts Ave., N.W. Washington, D.C. 20005



VOLTAGE to PULSE RATE CONVERTER for:

- Flow Totalizing—from 4 to 20 Ma signal; 10 to 50 MV signal
- KW and Ampere Hour Totalizing
- In and Out Power Totalizing
- Megawatt Hour Totalizing
- Average Computing
- Analog to Digital Conversion

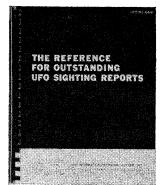
This exceptionally accurate ROYSON instrument offers: a complete floating system with input and output isolated from the ground, line and each other; long term stability; a wide choice of inputs and outputs. Typical Inputs: D.C. volts; D.C. millivolts; D.C. amps;

D.C. ma; slidewire or pot position

Digital Output (counts per minute): self-contained counter; remote counter; pre-determining counter; electronic counter; eput meter

With available transducers you can integrate: AC KW Hours ■ AC Ampere Hours or Minutes ■ Pneumatic Pressure Signals ■ Mechanical Position ■ Temperature Write, wire or call us today

ROYSON ENGINEERING COMPANY Phone: (215) OS5-2800 HATBORO, PA.



If you want to dig deeper.

OUTSTANDING UFO SIGHTING OUTSTANDING UFO SIGHTING REPORTS brings you the largest collection of "hard core" cases avail-able anywhere—160 in all, each so clear-cut, detailed, unambiguous and unconventional it cannot be a rational misinterpretation of natural or man-made phenomena. You'll find a world-wide selection, from the files of Project Blue Book, NICAP, APRO, the British Flying Saucer Review, Aimé Michel, Frank Edwards and many others. many others.

ALL These Features in One Convenient Volume

- The full story on each report-unabridged testimony, sketches of The full story on each report—unabridged testimony, sketches of the UFO, weather and astronomical data, photographs, and the official USAF conclusion. Landing reports include a topographic map, showing houses, roads, contours, vegetation, reservoirs, power lines and other details of the sighting area. **Reliability tables**—compiled by electronic computer and fully ex-plained, to give you numerical assurance that each report truly de-scribes an unusual phenomenon. **Extensive bibliographies**—more than 100 entries to help you locate important documents and organizations from which further in-formation is available.
- formation is available.
- Actually designed for reference—reports are indexed by date, place and information source. Large size, $8\frac{1}{2} \times 11$, and open-flat plastic binding for easy reading and handling.

And There's No Conjecture Or Speculation-You Make Your Own Conclusions! Circle Reader's Service Card number (we'll bill you) or use coupon (save p. & h.)

Please send me	copies of The Refer \$5.95 each, postpaid and and will return my purc	Riderwood, Maryland 21139 rence For Outstanding UFO d by return mail. I enclose hase within 10 days for full
NAME	·- ·- ·-	(PLEASE PRINT)
ADDRESS		ZIP CODE

A new text on ----

BASIC PRINCIPLES OF MOLECULAR GENETICS

IRWIN H. HERSKOWITZ, Hunter College, The City University of New York

In this new text Professor Herskowitz has selected a set of basic facts and principles from a vast amount of recent research in the area of molecular genetics. Beginning with a chemical and physical description of nucleic acid molecules — DNA and RNA the author tells how genetic information is encoded in these materials and how it is used for their selfmaintenance and self-reproduction.

The book is written so clearly that a reader with a limited scientific background can understand and work with the most modern concepts of biology. The material is presented through a series of principles and postulates, each of which is individually proved, supported, or discussed. Each chapter is preceded by a brief introduction and followed by questions and a bibliography.

paperbound 6" x 9" 320 pages \$6.00

Also by Professor Herskowitz -

GENETICS SECOND EDITION

Completely rewritten for clarity and perused by experts, the Second Edition of Genetics provides substantive additions in both the classical and modern sections, including information on the recent advances in human, corn, and Drosophila genetics and in our understanding of the genetic code and the regulation of gene synthesis and action.

Suggestions from users all over the country as well as recent changes in the literature are reflected in the additional statistical material, new illustrations, and several additions to various sections. A new appendix on Elementary Biometrical Inferences and expanded and revised Question-Problem sections have also been added.

cloth 7¹/4" x 9³/4" 554 pages \$10.00

COLLEGE DEPARTMENT LITTLE, BROWN AND CO. 34 BEACON STREET BOSTON, MASS. 02106 Radioecology of Aquatic Organisms, G. G. Polikarpov, 5 May 1967, 635 Radioekologiya Morskikh Organizmov,

G. G. Polikarpov, 25 Nov. 1966, 995

The RAND Corporation, B. L. R. Smith, 19 Aug. 1966, 857

Rare Earth Research, III, L. Eyring, Ed., 4 Nov. 1966, 635

Readings in Animal Behavior, T. E. Mc-Gill, Ed., 13 May 1966, 933

- Rebuilding Cities, P. Johnson-Marshall, 13 May 1966, 911
- Recent Advances in Optimization Techniques, A. Lavi and T. P. Vogl, Eds., 14 Apr. 1967, 231
- Red China Today, H. Portisch, 4 Nov. 1966, 627
- Reflectance Spectroscopy, W. W. Wendlandt and H. G. Hecht, 7 Oct. 1966, 143
- Reflexes of the Brain, I. M. Sechenov, 13 May 1966, 930
- Regeneration in Animals and Related Problems, V. Kiortsis and H. A. L. Trampusch, Eds., 1 July 1966, 49
- The Report of the International Clearinghouse on Science and Mathematics Curricular Developments, 1966, J. D. Lockard, Compiler, 16 Dec. 1966, 1441
- Lockard, Compiler, 16 Dec. 1966, 1441 Research on the Nature of Mineral-Forming Solutions, N. P. Yermakov et al., 30 Dec. 1966, 1634
- Research Papers in Statistics, F. N. David, Ed., 20 Jan. 1967, 316
- The Reverend John Clayton: A Person with a Scientific Mind—His Scientific Writings and Other Related Papers, E. Berkeley and D. S. Berkeley, 13 May 1966, 918
- Reviews of Plasma Physics, Vol. 2, M. A. Leontovich, Ed., 21 Apr. 1967, 373 Revolutionary Doctor: Benjamin Rush, 1746-1813, C. Binger, 17 Feb. 1967,
- 1746–1813, C. Binger, 17 Feb. 19 818 The Bine and Fell of Mana Civiliant
- The Rise and Fall of Maya Civilization, J. E. S. Thompson, 28 Apr. 1967, 499
- The Rise of the Technocrats: A Social History, W. H. G. Armytage, 9 Sept. 1966, 1231
- Science and Culture: A Study of Cohesive and Disjunctive Forces, G. Holton, Ed., 13 May 1966, 903
- Science and Economic Development; New Patterns of Living, R. L. Meier, 14 Oct. 1966, 252
- Science and Man, R. Brain, 21 Oct. 1966, 372
- Science and Medicine in Central Africa, G. J. Snowball, Ed., 8 July 1966, 160
- Science and Society, N. Kaplan, 9 Dec. 1966, 1317
- Science and Survival, B. Commoner, 27 Jan. 1967, 441
- Science and the University, B. R. Keenan, Ed., 29 July 1966, 520
- Science in Hungary, T. Erdey-Grúz and Trencsényi-Waldapfel, Eds., 1 July 1966, 51
- Scientific and Engineering Manpower in Communist China, 1949–1963, C. Cheng, 19 Aug. 1966, 852
- Scientific and Managerial Manpower in Nuclear Industry, J. W. Kuhn, 13 Jan. 1967, 183
- Screening Methods in Pharmacology, R. A. Turner, 27 May 1966, 1231
- Selected Papers of Norbert Wiener, 13 May 1966, 956
- Semiconductor Surfaces, A. Many, Y.

THERMOLYNE

Laboratory Apparatus for: HEAT

STIR-PLATE



STIRS and/or HEATS

- BEST SLOW SPEED STIRRING CONTROL --strong magnetic coupling stays locked in with stirring bar, no "jitterbugging", maintains speeds.
- HEATS from near ambient to 700°F with cast aluminum 7" x 7" top.
- STIRS GENTLY OR churns STRONGLY even in heavy liquids.
- EMBEDDED HEATING ELEMENT is supported by refractory, heats evenly.
- STRONG, PERFORATED STAINLESS STEEL CASE thoroughly ventilates motor and controls, stays attractive.
- PRECISE CONTROL—choose any heat or speed separately or combined and it will hold.

Price with 2 Teflon Stirring Bars \$84.50

New CATALOG 67

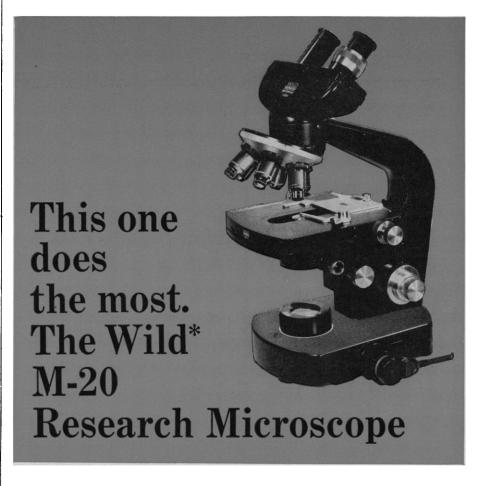
Write today for your free copy 48-Page catalog shows expanded line: furnaces, controls, h o t plates, mag. stirrers, Stir - Plates, Stir -Lights, Dri-Baths, incubators, lab-lights, meters, Owner -Built furnace accessories. THERMOLYNE CORPORATION 2555 KERPER BLVD.

DUBUQUE, IOWA 52001 U.S.A.

Contact Dept. 5680 for name of nearest dealer SCIENCE, VOL. 156 Goldstein, N. B. Grover, 16 Sept. 1966, 1371

- Séminaire Bourbaki, 1948–1965, 16 Dec. 1966, 1440
- The Senses Considered as Perceptual Systems, J. J. Gibson, 10 Mar. 1967, 1232
- Sequences, H. Halberstam and K. F. Roth, 27 Jan. 1967, 442 Signal Detection Theory and Psychophys-
- Signal Detection Theory and Psychophysics, D. M. Green and J. A. Swets, 5 May 1967, 632
- Simulation Techniques for Design of Water-Resource Systems, M. M. Hufschmidt and M. B. Fiering, 21 Oct. 1966, 375
- Size and Cycle, J. T. Bonner, 8 July 1966, 165
- Sleep, G. G. Luce and J. Segal, 19 Aug. 1966, 854
- Sleep, Dreams, and Arousal, E. J. Murray, 8 Apr. 1966, 195
- The Slowing Down and Thermalization of Neutrons, M. M. R. Williams, 30 Dec. 1966, 1638
- Social Indicators, R. A. Bauer, Ed., 3 Feb. 1967, 550
- Social Insect Populations, M. V. Brian, 8 July 1966, 161
- The Sociology of Development: Iran as an Asian Case Study, N. Jacobs, 16 Dec. 1966, 1433
- Solar Radiation, N. Robinson, Ed., 4 Nov. 1966, 639
- The Social System of Science, N. W. Storer, 7 Oct. 1966, 139
- Solar Radio Astronomy, M. R. Kundu, 8 July 1966, 163
- The Solar Wind, R. J. Mackin, Jr., and M. Neugebauer, Eds., 10 Feb. 1967, 681
- Soviet Sociology, A. Simirenko, Ed., 17 Feb. 1967, 815
- Sovremennye Osadki Morei i Okeanov, N. M. Strakhov, P. L. Bezrukov, V. S. Yablokov, Eds., 25 Nov. 1966, 995
- Spectral Studies of the Photographic Process, Yu. N. Gorokhovskii, 4 Nov. 1966, 639
- Spore Liberation, C. T. Ingold, 13 May 1966, 939
- Spores, Their Dormancy and Germination, A. S. Sussman and H. O. Halvorson, 16 Dec. 1966, 1434 Standard Methods of Chemical Analysis,
- Standard Methods of Chemical Analysis, Vol. 3, pts. A and B, Instrumental Methods, F. J. Fletcher, Ed., 7 Oct. 1966, 141
- The Statistical Analysis of Series of Events, D. R. Cox and P. A. W. Lewis, 11 Nov. 1966, 757
- Statistical Methods, S. Szulc, 17 June 1966, 1613
- The Step to Man, J. R. Platt, 21 Oct. 1966, 372
- Stroboscopes for Industry and Research, J. Rutkowski, 7 Oct. 1966, 142 Structural and Tectonic Principles, P. C.
- Badgley, 13 May 1966, 950
- The Structure and Evolution of Galaxies, 16 Dec. 1966, 1439 The Structure of Associations in Lan-
- guage and Thought. J. Deese, 16 Sept. 1966, 1372
- The Structure of Number Systems, F. D. Parker, 25 Nov. 1966, 998
- The Structure of Polymers, M. L. Miller, 27 Jan. 1967, 443
- Studies in Plant Chemistry, Including 12 MAY 1967

Some things any optical microscope can do. Other things some can do. A few things a few can do.

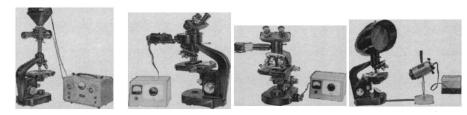


Photoautomat

EPI Attachment

Drawing Tube

Projection Head



Illustrated are a few of the numerous accessory combinations. Permits every observation method for your field of research. Precisely. Conveniently. Write for Bulletin M-20

*First name in a complete line of instruments for Surveying, Photogrammetry and Microscopy.





Chemistry Taxonomy, Ontogeny, Phylogeny, Etc., J. B. McNair, 29 July-1966, 518

- Studies in Real and Complex Analysis, I. I. Hirschman, Jr., 13 May 1966, 952
- Submarine Canyons and Other Sea Val-leys, F. P. Shepard and R. F. Dill, 16 Dec. 1966, 1433
- Superconductivity of Metals and Alloys, P. G. de Gennes, 30 Dec. 1966, 1634
- The Superior Student in American High-er Education, J. W. Cohen, Ed., 13 May 1966, 912
- Supply and Competition in Minor Metals, D. B. Brooks, 30 Sept. 1966, 1631
- A Survey and Illustrated Catalogue of the Teredinidae (Mollusca: Bivalvia), Sword of Pestilence: The New Orleans
- Yellow Fever Epidemic of 1853, J. Duffy, 19 Aug. 1966, 855
- Symbiosis, S. M. Henry, Ed., 14 Oct. 1966, 255
- Symbolic Logic and the Real Number System: An Introduction to the Foun-dations of Number Systems, A. H. Lightstone, 29 July 1966, 519
- Symmetry Groups in Nuclear and Particle Physics, F. J. Dyson, 20 May 1966, 1048
- A Symposium on Continental Drift, 13 May 1966, 946
- A Synopsis of the Siphonophora, A. K. Totton and E. Bargmann, 13 May 1966, 944
- The Systematics and Distribution of Permian Miospores, G. F. Hart, 10 Mar. 1967, 1236
- Tensor Calculus through Differential Geometry, J. Abram, 9 Sept. 1966, 1234
- Theoretical Numerical Analysis, B. Wendroff, 24 Feb. 1967, 993
- The Theory of Beta Radioactivity, E. J. Konopinski, 16 Dec. 1966, 1432
- Theory of Groups in Classical and Quantum Physics, T. Kahan, 10 Feb. 1967, 683
- The Theory of Neutron Slowing Down in Nuclear Reactors, J. H. Ferziger and P. F. Zweifel, 28 Apr. 1967, 499
- The Theory of the Microscope, L. C. Martin, 2 Dec. 1966, 1157 Thermodynamics, J. T. Vanderslice, H. W. Schamp, Jr., E. A. Mason, 14 Oct. 1966, 256
- Thirty Years That Shook Physics, G. Gamow, 13 May 1966, 917
- Dr. Thomas Sydenham (1624-1689), K. Dewhurst, 3 Mar. 1967, 1094
- Three Theories of Child Development, H. Maier, 20 May 1966, 1050
- Ticks of the Genus Ixodes in Africa, D. R. Arthur, 6 May 1966, 750
- Tides, D. H. Macmillan, 6 Jan. 1967, 61
- T'ien-Kung K'ai-Wu. Chinese Technology in the Seventeenth Century, S. Ying-hsing, 12 Aug. 1966, 730
- Toward a Psychology of Art, R. Arn-heim, 24 Feb. 1967, 992 Toward a Theory of Instruction, J. S.
- Bruner, 8 Apr. 1966, 193
- Traité de Tectonique, J. Goguel, 3 June 1966, 1363
- Traité de Zoologie, pts. 2 and 3, P.-P. Grassé, 6 May 1966, 749

HERE'S SOME HOT AIR FROM PERCIVAL!



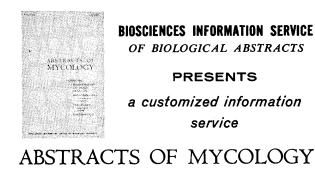
Yes, we're rather proud of the fact that our new I-36L incubator can produce a full 18 cubic feet of precisioncontrolled hot air. As a matter of fact, it can do as well with warm air, cool air, cold air, lighted air and dark air.

The convenient monitor panel indicates as well as controls the chamber environment and the heavily constructed light-tight cabinet keeps all that hot air where it belongs.

Keep up to date with Percival -- write for Bulletin No. 6741 for more information about the I-36L.



PERCIVAL REFRIGERATION & MFG. CO. 1442 WALNUT ST. • DES MOINES, IOWA 50307



Published with the advice and cooperation of prominent mycologists around the world.

- Abstracts of the current literature in mycology: Over 6000 journals reviewed to obtain the material, Reports from 91 countries screened. Estimated 5000 abstracts per year.
- Abstracts indexed for your easy reference: Subject Finder Index to locate types of studies. Author Index to locate colleagues' work. Systematic Index to locate studies by taxonomic categories.
- Abstracts in convenient format for supplementing personal files:

Printed on only one side of the page. Page ruled for cutting to $3'' \times 5''$ card size.

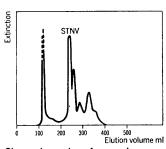
You can subscribe to 12 issues of *Abstracts of Mycology* for a limited time in this first year for only \$22.50. Check or money order should be sent to *Abstracts of Mycology*, 2100 Arch Street, Philadelphia, Pa. 19103.

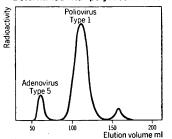
new Sepharose

Extends gel filtration separation and fractionation of high molecular weight substances: viruses, nucleic acids, proteins, polysaccharides

The new "bead form" of agarose — Sepharose — now extends the gel filtration method to the separation and fractionation of molecules with molecular weights in the millions. Sepharose is prepared in the "bead form" from agarose, the neutral portion of agar. By altering the concentration of agarose during preparation, Sepharose gels with different fractionation ranges are produced. Sepharose gels complement the present series of Sephadex[®] gels, and together they extend the limits of the gel filtration method for the fractionation of molecules with molecular weights ranging from essentially zero to approximately 25 million.

SEPHAROSE				
Sepharose Type	Particle Size Microns	Percent Agarose	Fractionation Range	
2B	60-250	2	2x10 ⁶ to 25x10 ⁶ *	
4B	40-190	4	3x10 ⁵ to 3x10 ⁶ *	



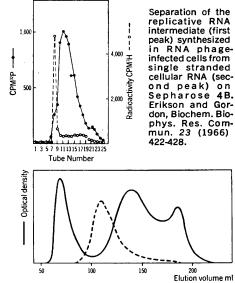


Separation of ³²P-labeled adenovirus and poliovirus on Sepharose 2B.

Radioactivity

*Determined with polysaccharides.

Elution volume ml Chromatography of a crude preparation of satellite tobacco necrosis virus on Sepharose 4B.

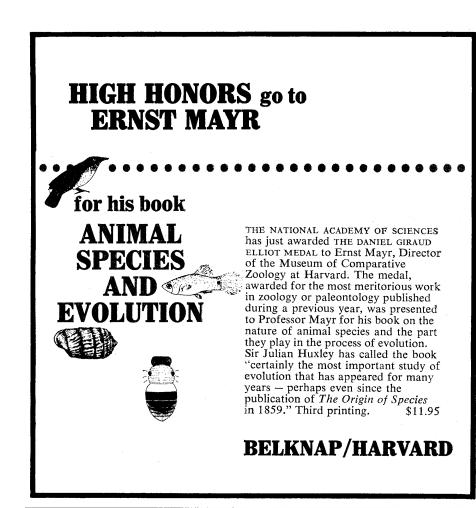


Separation of a mixture of KB-cell nucleic acids and ³²P-labeled poliovirus RNA on Sepharose 2B. The first peak contains KB-cell DNA, followed by poliovirus RNA, KB-cell r-RNA and KB-cell s-RNA.

For additional technical information on SEPHAROSE, write to

PHARMACIA FINE CHEMICALS INC. 800 Centennial Avenue, Piscataway, N. J. 08854 Pharmacia (Canada) Ltd., 110 Place Crémazie, Suite 412, Montreal 11, P. Q.

(Inquiries outside U.S.A. and Canada should be directed to PHARMACIA FINE CHEMICALS, Uppsala, Sweden.)



IMPACT TENSILE - IZOD **INSTRUMENTED**



Model CS-137

The Model CS-137 was developed by the Summit Research Laboratories of the Celanese Corporation of America. The unit was designed to measure the energy to break and how the energy is absorbed or a load-time curve. The instrumentation required is load cell, electromagnetic trigger device, oscilloscope and oscilloscope camera. The unit set up to operate is shown above. The "sample in base" impact tester can be converted to conduct izod impact tests by interchanging head and base.

Brochure and price upon request. **Custom Scientific Instruments, Inc.** WHIPPANY, N.J. 07981 P.O. Box A

DO YOU HAVE AN **INSTRUMENT PROBLEM..**

which is not covered by the ads in this issue? Write to us directly, giving full details and we will try to see that you receive the information you need.

SCIENCE MAGAZINE

Room 1740 11 West 42 Street New York, N.Y. 10036

- A Treatise on Analytical Dynamics, L. A. Pars, 29 April 1966, 634
- Treatise on Invertebrate Paleontology, Vols. 1 and 2, pt. H, Brachiopoda, A. Williams et al., 22 Apr. 1966, 494
- Treatise on Irreversible and Statistical *Thermophysics*, W. Yourgrau, A. van der Merwe, G. Raw, 30 Sept. 1966, 1630
- Tropospheric Radiowave Propagation beyond the Horizon, F. du Castel, 13 Jan. 1967, 183
- Twilight: A Study in Atmospheric Op-tics, R. B. Rodman, 2 Dec. 1966, 1160 Twins and Twin Relations, H. L. Koch, 7 Apr. 1967, 52
- Two-Person Game Theory: The Essential Ideas, A. Rapoport, 4 Nov. 1966, 642
- Underwater Guideposts: Homing of Salmon, A. D. Hasler, 22 July 1966, 405 Universities: British, Indian, African, E.
- Ashby, 10 Feb. 1967, 680 University Algebra, R. E. Johnson, 9
- Sept. 1966, 1233 The University in Transition, J. A. Per-
- kins, 1 Apr. 1966, 56 Upper Cambrian Trilobite Faunas of Northeastern Tennessee, F. Rasetti, 15 July 1966, 286
- Urban Design, P. D. Spreiregen, 13 May 1966, 911
- The Use of Computers in Anthropology, D. H. Hymes, Ed., 15 Apr. 1966, 340
- The Use of Induced Mutations in Plant Breeding, 22 July 1966, 404
- Venezuelan Orchids Illustrated, G. C. K. Dunsterville and L. A. Garay, 13 May 1966, 943
- Viruses of Plants, A. B. Beemster and J. Dijkstra, Eds., 20 Jan. 1967, 310 Vitamin B₁₂, L. Smith, 29 Apr. 1966, 633
- The Voices of Time: A Cooperative Survey of Man's Views of Time as Expressed by the Sciences and by the Humanities, J. T. Fraser, 29 Apr. 1966, 632
- Volunteers for Peace, M. I. Stein, 17 Feb. 1967, 816
- Whales, Dolphins, and Porpoises, K. S. Norris, Ed., 17 June 1966, 1613
- Where the Sea Breaks Its Back, C. Ford, 10 Feb. 1967, 682
- Wild Flowers of the United States, H. W. Rickett, 6 Jan. 1967, 65
- Women in the Soviet Economy: Their Role in Economic, Scientific, and Technical Development, N. T. Dodge, 11 Nov. 1966, 756 The Works of William Harvey, R. Wil-
- lis, Ed., 8 Apr. 1966, 194
- The World Book Science Annual, 1965, 13 May 1966, 917
- The World of the Atom, H. A. Boorse and L. Motz, Eds., 16 Sept. 1966, 1370
- Worlds-Antiworlds, H. Alfvén, 24 Mar. 1967, 1527
- Ylid Chemistry, A. W. Johnson, 17 Mar. 1967, 1394
- A Zoo Man's Notebook, L. S. Crandall, 24 June 1966, 1734

BOOKS RECEIVED

(Continued from page 818)

Some Theory of Sampling. William Edwards Deming. Dover, New York, 1966. 620 pp. Illus. Paper, \$3.50. Reprint, 1950 edition.

Sources of Quantum Mechanics. B. L. van der Waerden, Ed. North-Holland, Amsterdam, 1967. 442 pp. Illus. \$14. There are 17 papers, written between 1916 and 1926.

Space Research VII. vols. 1 and 2. Proceedings of the Seventh International Space Science Symposium (Vienna), May 1966. Sponsored by Committee on Space Research, International Union of Geodesy and Geophysics, and International Scientific Radio Union. R. L. Smith-Rose, S. A. Bowhill, and J. W. King, Eds. North-Holland, Amsterdam, 1967. vol. 1, 693 pp.; vol. 2, 820 pp. Illus. \$50 set. There are 204 papers; most of the papers are in English, others are in French.

Spectroscopic Calculations for a Multielectron Ion. H. H. Theissing and P. J. Caplan. Interscience (Wiley), New York, 1966. 217 pp. Illus. \$10.

Standard Industrial Hydraulics Questions and Answers. Stephen Michael Elonka and Orville Howard Johnson. Mc-Graw-Hill, New York, 1967. 318 pp. Illus. \$10.95.

The Stars: A New Way to See Them. H. A. Rey. Houghton Mifflin, Boston, revised edition, 1967. 160 pp. Illus. \$6.

Statistical Mechanical Theories of Transport Processes. Robert M. Mazo. Pergamon, New York, 1967. 180 pp. Illus. \$9.50. The International Encyclopedia of Physical Chemistry and Chemical Physics.

Statistics for the Behavioral Sciences. Woodrow W. Wyatt and Charles M. Bridges, Jr. Heath, Boston, 1967. 407 pp. Illus. \$8.95.

Statistics for Biology. O. N. Bishop. Houghton Mifflin, Boston, 1967. 192 pp. Illus. Paper, \$2.75. The Principles of Modern Biology Series.

Sterilisation, Desinfektion, Konservierung, Chemotherapie: Verfahren, Wirkstoffe, Prüfungsmethoden. K. H. Wallhäusser and H. Schmidt. Thieme, Stuttgart, Germany, 1967. 586 pp. Illus. DM 48.

A Study of the Cat. Warren F. Walker, Jr. Saunders, Philadelphia, 1967. 189 pp. Illus. Paper, \$3.50.

Surface Contamination. Proceedings of a symposium (Gatlinburg, Tenn.), June 1964. B. R. Fish, Ed. Pergamon, New York, 1967. 425 pp. Illus. \$21.50. Fiftyfour papers.

Symmetries and Reflections: Scientific Essays. Eugene P. Wigner, Indiana Univ. Press, Bloomington, 1967. 288 pp. Illus. \$7.50.

Systemic Pathology. vols. 1 and 2. G. Payling Wright and W. St. Clair Symmers, Eds. Elsevier, New York, 1967. vol. 1, 1135 pp.; vol. 2, 761 pp. Illus. \$57.50 set.

Systems Analysis in Ecology. Kenneth E. F. Watt, Ed. Academic Press, New York, 1966. 290 pp. Illus. \$11.50. Ten papers.

Technical Drawing. Frederick E. Gie-12 MAY 1967

Now... High Flux Densities in a 1-Micron Spot



Biolaser Model 513 — A Complete Laser System for Biomedical Research

The versatile new TRG Biolaser offers the medical and biological researcher a powerful new tool for use in studies at the cell level. Specific areas of application are: cell microsurgery and coagulation; electric field interaction; pathology; genetics; other branches of microscopic research.

Adapters are available to permit simultaneous photography and irradiation of the specimen. Cinemicrography, time-lapse photography, and closed-circuit television techniques can be applied to broaden the instrument's capabilities as a research tool.

Special Features The coherent light output of the Biolaser can be focused to spots as small as one micron • A simple x-y control permits precise spot positioning • Triggering can be remote or by panel pushbutton.

For more information write: TRG, Electro-Optical Products, Section S, Route 110, Melville (Long Island), New York 11749. Tel: (516) 531-6343. **Specifications**

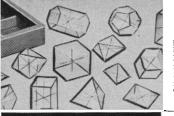
Flux Density on Stage: up to 10⁴ Joules/cm² Wavelength: 6943Å Pulse Length: 150 μsec Repetition Rate: 1/min

Microscope: Leitz Ortholux or Labolux standard; others optional

Camera: 2¼″ x 3¼″ Polaroid standard; others optional

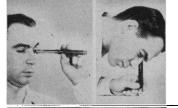


TRG / A Division of Control Data Corporation ORDER INDUSTRIAL MART VALUES Products available by mail. Money-back guarantee. Order by Number. Send check, m.o. or open account to rated firms, \$10. minimum order.



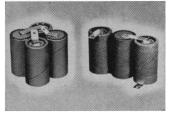
MAIL













NEW . . . TRANSPARENT CRYSTAL MODELS

UNUSUAL

CRYSTAL MODELS Set of 15 Basic Symmetries with Built-in Crystallographic axes. For lab study, exhi-bition, demonstration. Colored threads built into each precision-made hollow plastic model show position of all axes. Easily marked with china pencil. Cube measures 1%"-14 others (see at left) in proportion. Packed in poly bags separately in compartmental wooden case. \$64,00 ppd. Order #70.821W. Edmund Scientific Co., Barringotn, New Jersey 08007.

AMAZING NEW HOLOGRAMS New evaluate tremendous impact of almost unbelievable new 3-D photo-technique for small cost. Simple transmission-type holo-gram (on film or glass) result of splitting laser beam. Dimension appears carved in stone. Cut in half repeatedly—parts still contain full scene. Fantastic future poten-tial. Use slide projector light source or thashlight bulb flament. Filler incl. Film: 4"x 3'24", \$15.00 Ppd, Order No. 30,574W. Glass: (4"x 5"), \$30.00 Ppd, No. 30,074W. Glass: (4"x 5"), \$30.00 Ppd, No. 40,084W, Jechmund Scientific Co., Barrington, New Jersey 08007. AMAZING NEW HOLOGRAMS

LOW-COST 50X MICROSCOPE LOW-COST 50X MICROSCOPE Dowerful pocket-size scope with measur-ing reticle. Direct measurements to .001". Compact, easy to handle. Excellent for surface measuring of metals, fibers, print-ing; checking, measuring small metal parts; quality control; speeding produc-tion; detecting inferior mdse. Clear plas-tic base keeps scope in sharp focus for measuring $1/10^{\circ}$ x .001" divisions without calculations-estimating to .005". Re-movable from base. \$10.95 Ppd. Order No. 60,465W. Edmund Scientific Co., Barring-ton, New Jersey 08007.

DUPONT PLASTIC LIGHT GUIDE KIT

KIT Experiment with amazing new plastic fiber optic light guides, 1001 uses for mirs., ex-perimenters, hobbyists. Use for exciting new projects and products. Guides trans-mit light same as wire conducts electricity. Use to illuminate remote arcas, multiple locations from single source, confine light to small arcas, conduct sensing and con-trol systems, Incl. 2 guides, source, lens, dyes, connectors, \$10 ppd, Order No. 70,855W. Edmund Scientific Co., Bar-rington, New Jersey 08007.

3" ASTRONOMICAL TELESCOPE

3" ASTRONOMICAL TELESCOPE See the stars, moon, phases of Venus, planets close up. 60 to 180 power. Alumi-nized and overcoated 3" diameter f/10 pri-mary mirror ventilated cell. Equatorial mount with locks on both axes. Equipped with 60X eyepiece and mounted Barlow lens. 3X finder telescope, hardwood tripod, Included FREE: "STAR CHART"; 272-page "HANDBOOK OF HEAVENS"; "HOW TO USE YOUR TELESCOPE" book, \$29.95 ppd, Order No, 85,050W, Ed-mund Scientific Co., Barrington, New Jer-sey 98007.

VARIABLE DENSITY FOLARIZING FILTEIS Tremendous bargain. Two optical quality polarizing filters (sandwiched between butrate plastic sheets) control amount of light transmission from approx. 22% to 1%. Rotate by means of ball bearing in sturdy zinc-plated steel mounts. Total thick-ness 0.30". Many uses for production, as-sembly & test benches, experiments. Easily mounted. 6" x 6" x 5/16" thick, 4%". dear aperture \$6.00 Ppd. Order No., 40,902W. 4" x 4" x 5/16" thick, 2%". uperture \$4.00 Ppd. No. 40,901W. Ed-mund Scientific Co., Barrington, New Jersey 68007.

Jersey 08007. NEW SURPLUS Ni-Cd BATTERIES Save more than 50% 1 Long-life—accept 300 charge and discharge cycles. 1.25 Volts per cell—750 milliamper hours ca-pacity. Excel. charge retention. Hermet-ically seeled. Indefinite storage life. Mul-tiple cells welded in serios—casily cut. Combine to form buy. %" dia. x 1 %" high. Spec. price for 100 up. Low-cost charger separate. Order No. Cells DC Volts Price Ppd. 40,986W 1 1.25 \$ 1.50 40,987W 2 2.372 2.75 60,633W 3
 Construct, Construction
 DU Voits
 Price Ppd.

 40,986W
 1
 1.25
 \$ 1.50

 40,987W
 2
 2.50
 2.75

 60,633W
 3
 3.75
 3.60

 60,633W
 4
 5.00
 4.80

 70,812W
 Trickle Charger (1-10 cells)
 10.95

 Edmund
 Scientific
 Co.,
 Barrington, N.J.

 08007.

GIANT FREE CATALOG

GIANT FREE CATALOG Completely new 1967 edition-148 nages. Bargains galorel New categories, items, illustrations. 1,000's of buys for industry --Optics, Science, Math. On-the-job helps, quality control aids. Optics for research labs, design engineers, experimenters. In-struments for checking, measuring ..., to speed work, improve quality, cut costs, Hard-to-get war surplus bargains. Write for Catalog-W, Edmund Scientific Co., Barrington, New Jersey 08007.



The answer depends on your needs and not on an attempt to dimensionalize sensation. That is, do you want it small, medium or large? Minifreezer solves the small requirement. An island of cold in a tiny container, Minifreezer is a controlled temperature chamber that can be used anywhere to save time, effort, money and space.

Consider the advantages of having a self-contained freezer that will take the temperature as low as -55° C and yet is about the size of a standard thermos bottle. No trips to a big freezer - quick freezing of samples where they are gathered — environmental testing — storage you name it. Capacities range from 80 ml to 1500 ml and you can control the temperature set point directly.

If the dimension of cold for your needs runs around the size of a cocktail shaker, you ought to see the Minifreezer. Catalogs on request. Cocktails, if you are brave enough to ask for a demonstration.



SCIENCE, VOL. 156