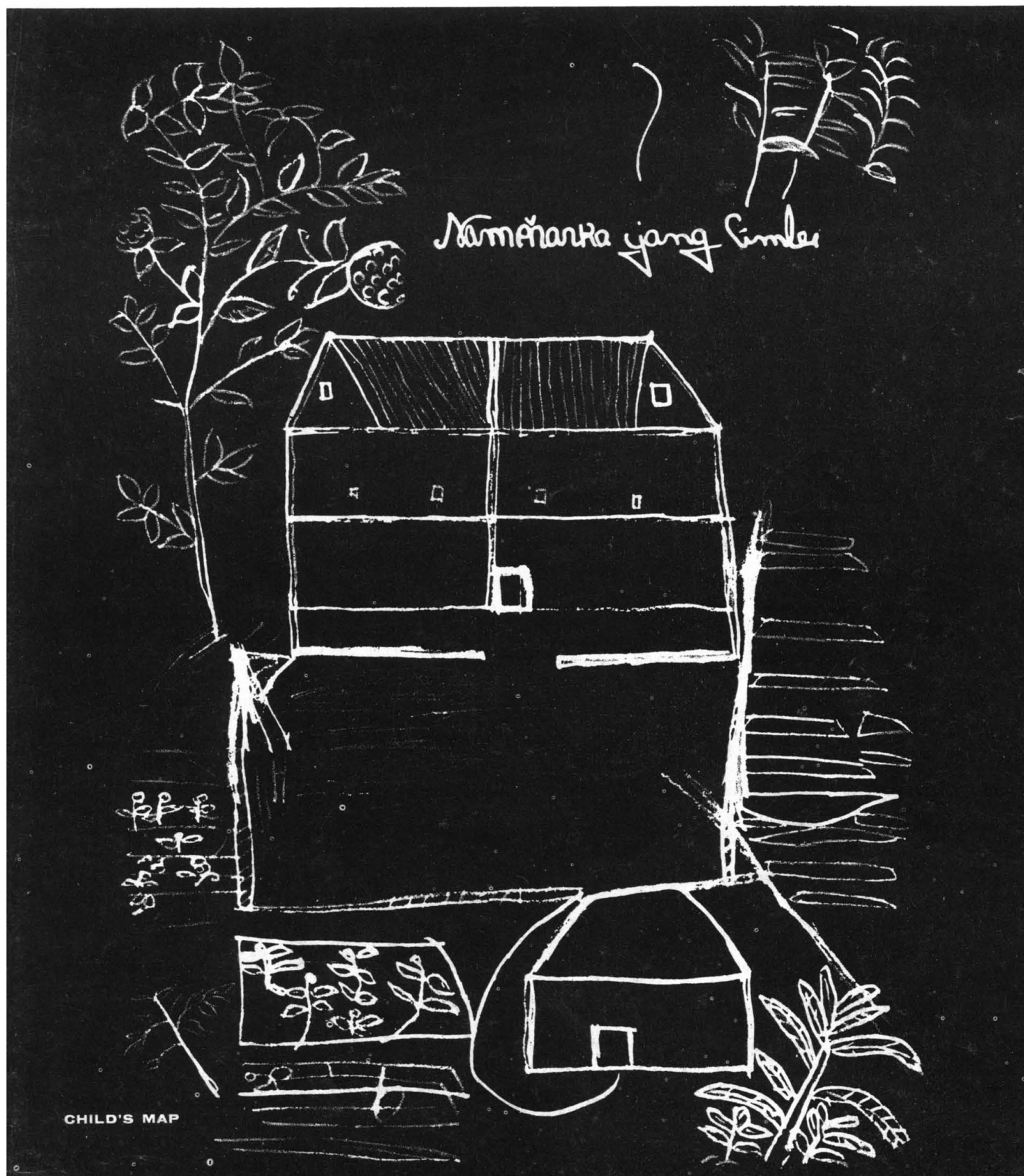


SCIENCE

10 February 1967

Vol. 155, No. 3763

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



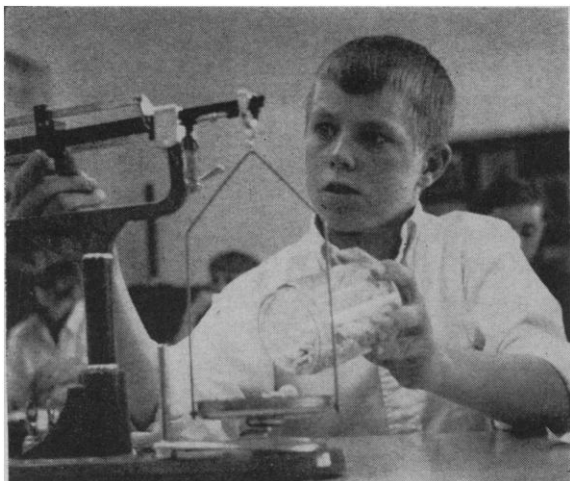
For more information, just send us the coupon. There's a lot more to be said for the Beckman Fraction Collector!

please print

City _____ State _____ Zip No. _____

PALO ALTO, CALIFORNIA • 94304

INTERNATIONAL SUBSIDIARIES: GENEVA; MUNICH; GLENROTHES, SCOTLAND; TOKYO; PARIS; CAPETOWN; LONDON; MEXICO CITY



Courtesy Earth Science Curriculum Project, Boulder, Colorado.

Teaching Science Creatively

By Nathan S. Washton, Ed.D.,
Queens College, City U. of N.Y.

This new text gives the present or prospective secondary school teacher research-based principles and classroom-tested methods for teaching science creatively by stimulating inquiry. Dr. Washton discusses the new curricula in biology, physical science, and general science, and the research that is evaluating them. He shows how to organize curricula, prepare unit and lesson plans, select equipment, and construct tests. Every point is illustrated with practical examples—even a complete classroom-tested syllabus for a unit on matter and energy. Valuable lists of sources and materials are included.

About 432 pages, illustrated. About \$8.50. Ready February.

New Saunders Books

Behavior Problems of Children

By Elinor Verville, Ph.D.,
Consulting Psychologist.

An experienced clinical psychologist has brought together in this book a wide range of facts, insights, and conclusions garnered by many professional workers in the field of child behavior problems. Dr. Verville first sets forth what is known of the determinants of behavior, and shows how multiple factors in the child, his environment, and his rearing produce deviant behavior. She shows how proper treatment can help the child become self-respecting through the adequate use of his own capacities and acceptable to society through the attainment of self-control. She describes rehabilitation techniques that take advantage of developmental changes to achieve these ends. Then she traces the normal development and specific problems characteristic of the preschool, elementary school, and adolescent periods, plus the particular problems of the handicapped child. Fifty case histories illuminate the points discussed.

About 550 pages. About \$8.50. Ready February.

Theories of Psychopathology

By Theodore Millon, Ph.D., Lehigh University.

For this new anthology, Dr. Millon has selected papers in which such theoreticians as Bleuler, Sheldon, Freud, Sullivan, Rogers, Maslow, Skinner, and Dollard apply their theories to abnormal psychology. Dr. Millon groups these theories according to the kinds of data they emphasize—biophysical, intrapsychic, phenomenological, or behavioral. For each of these categories he presents papers that discuss the bases of the theory and the views of its proponents regarding the etiology and development, pathological patterns, and therapy of abnormal behavior—and others that critically examine its philosophical presuppositions and empirical support. In an introductory essay Dr. Millon shows how, although they appear contradictory, the theories actually complement one another. As a text for courses in abnormal psychology, for supplementary reading, or for reference, this book is a valuable contribution.

Hard cover about \$7.50. Soft cover about \$4.50.
444 pages. Ready February.

W. B. Saunders Company West Washington Square, Philadelphia, Pa. 19105

Please send on approval and bill me: (discount to full-time teachers listing affiliation)

Author.....Title.....

Name.....

Address.....Zip.....

Sc 2/10/67

10 February 1967
Vol. 155, No. 3763

SCIENCE

LETTERS	Psychiatry: <i>L. Linn, J. E. Schowalter, G. Domino, M. F. Shore, D. Bronkema, R. Roy, J. T. Flynn</i> ; Specialization and Medical Education: <i>H. R. Blank and S. E. Ross</i> ; Automatic Language Processing: Source of Funds: <i>A. H. Roberts</i>	641
EDITORIAL	Goals, Priorities, and Dollars	647
ARTICLES	Cross-Cultural Teaching of Science: <i>F. E. Dart and P. L. Pradhan</i>	649
	Human Echo Perception: <i>C. E. Rice</i>	656
	Developments in Federal Policy Toward University Research: <i>H. Orlans</i>	665
	Chemistry of Silicon Difluoride: <i>J. C. Thompson and J. L. Margrave</i>	669
NEWS AND COMMENT	Medicine and Politics—A New Look at the British Experience; Carnegie University—Merger in Pittsburgh; Electric Utilities—Technology and Regulation; Investments—The Ivy League Pattern; Grand Canyon Dams—Conservations Scent Victory	671
BOOK REVIEWS	<i>Universities: British, Indian, African</i> , reviewed by <i>R. C. Pratt</i> ; other reviews by <i>E. N. Parker, C. H. Li, S. F. Olson, J. L. Johnson, A. O. Barut, J. A. Ibers, L. P. Schultz</i>	680
REPORTS	Superconductivity of Metallic Aluminum Antimonide: <i>J. Wittig</i>	685
	Indium as an Impurity in Ancient Western Mexican Tin and Bronze Artifacts and in Local Tin Ore: <i>E. R. Caley and D. T. Easby, Jr.</i>	686
	Molluscan Faunal Changes around Bermuda: <i>R. T. Abbott and R. Jensen</i>	687
	Fission-Fragment Synthesis of a New Nitrogen-Fluorine Compound: <i>A. R. Miller, R. R. Tsukimura, R. Velten</i>	688
	Synthetic Zeolites: Growth of Larger Single Crystals: <i>J. Ciric</i>	689
	Clathrate Hydrates of Some Amines: <i>G. A. Jeffrey, T. H. Jordan, R. K. McMullan</i>	689
	Zinc Retention in Rabbits: Effect of Previous Diet: <i>E. R. Graham and P. Telle</i>	691
	Autosomal Deletion Mapping in Man: <i>W. E. Nance and E. Engel</i>	692

BOARD OF DIRECTORS		ALFRED S. ROMER Retiring President, Chairman	DON K. PRICE 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	PHYSICS (B) Allen V. Astin Stanley S. Ballard	CHEMISTRY (C) Herman F. Mark Milton Orchin	ASTRONOMY (D) John S. Hall Frank Bradshaw Wood	
		ANTHROPOLOGY (H) Cora Du Bois Anthony Leeds	PSYCHOLOGY (I) Leo J. Postman Frank W. Finger	SOCIAL AND ECONOMIC SCIENCES (K) David Truman Eugene B. Skolnikoff	HISTORY AND PHILOSOPHY OF SCIENCE Peter J. Caws Norwood Russell Hanson	
		PHARMACEUTICAL SCIENCES (Np) André Archambault Joseph P. Buckley	AGRICULTURE (O) Richard Geyer Ned D. Bayley	INDUSTRIAL SCIENCE (P) Ellis A. Johnson Burton V. Dean	EDUCATION (Q) Herbert A. Smith Frederic B. Dutton	
DIVISIONS		ALASKA DIVISION A. B. Colyer President Eleanor Viereck Executive Secretary		PACIFIC DIVISION Daniel G. Aldrich, Jr. President Robert C. Miller Secretary		SOUTHWESTERN AND ROCKY MOUNTAIN DIVISION Earl D. Camp President Marlowe G. Anderson Executive Secretary

SCIENCE is published weekly on Friday and on the fourth Tuesday in November by the American Association for the Advancement of Science, 1515 Massachusetts Ave., N. Washington, D.C. 20005. Now combined with *The Scientific Monthly*. Second-class postage paid at Washington, D.C. Copyright © 1967 by the American Association for the Advancement of Science. Annual subscriptions \$8.50; foreign postage, \$1.50; Canadian postage, 75¢; single copies, 35¢, except *Guide to Scientific Instruments*, which is \$1.00. School year subscriptions: 9 months, \$7; 10 months, \$7.50. Provide 4 weeks' notice for change of address, giving new and old address and zip numbers. Send a return address label. SCIENCE is indexed in the *Reader's Guide to Periodical Literature*.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Tetrahymena: Effect of Freezing and Subsequent Thawing on Breeding Performance: <i>E. M. Simon and S. W. Hwang</i>	694
Siliceous Urinary Calculi in Calves: Prevention by Addition of Sodium Chloride to the Diet: <i>C. B. Bailey</i>	696
Protein Subunits: A Table: <i>I. M. Klotz</i>	697
Activity and Responsivity in Rats after Magnesium Pemoline Injections: <i>G. Beach and D. P. Kimble</i>	698
Primordial Rare Gases in Unequilibrated Ordinary Chondrites: <i>D. Heymann and</i> <i>E. Mazor</i>	701
Mixed Leukocyte Reactions and Histocompatibility in Rats: <i>W. K. Silvers,</i> <i>D. B. Wilson, J. Palm</i>	703
Microincision of Sickled Erythrocytes by a Laser Beam: <i>W. N. Jensen,</i> <i>P. A. Bromberg, M. C. Bessis</i>	704
Fatty Acids in Eleven Species of Blue-Green Algae: Geochemical Significance: <i>P. L. Parker, C. Van Baalen, L. Maurer</i>	707
Structural Aspects of Reversible Molecular Oxygen Uptake: <i>J. A. McGinnety,</i> <i>R. J. Doedens, J. A. Ibers</i>	709
Visual Adaptation to Gradual Change of Intensity: <i>S. M. Anstis</i>	710
Gluthathione Reductase in Red Blood Cells: Variant Associated with Gout: <i>W. K. Long</i>	712
Metabolism of Rotenone in vitro by Tissue Homogenates from Mammals and Insects: <i>J.-I. Fukami, I. Yamamoto, J. E. Casida</i>	713
Conditioning with Delayed Vitamin Injections: <i>J. Garcia et al.</i>	716
Visually Guided Reaching in Infant Monkeys after Restricted Rearing: <i>R. Held and J. A. Bauer, Jr.</i>	718
Brain Stem Structures Responsible for the Electroencephalographic Patterns of Desynchronized Sleep: <i>O. Candia, G. F. Rossi, T. Sekino</i>	720
Technical Comment: Genetics of <i>Mitochondria</i> : <i>L. Van Valen</i>	722
MEETINGS Cell Cultures: <i>F. T. Perkins and L. Hayflick</i> ; Paleomagnetism: United States-Japan Committee on Scientific Cooperation: <i>A. Cox and N. Kawai</i> ; Forthcoming Events	723

MINA S. REES ATHELSTAN F. SPILHAUS	H. BURR STEINBACH JOHN A. WHEELER	PAUL E. KLOPSTEG Treasurer	DAEL WOLFLE Executive Officer
GEOLOGY AND GEOGRAPHY (E) Louis Quam Richard H. Mahard	ZOOLOGICAL SCIENCES (F) Richard B. Roberts David E. Davis	BOTANICAL SCIENCES (G) William C. Steere Warren H. Wagner	
ENGINEERING (M) Paul Rosenberg Newman A. Hall	MEDICAL SCIENCES (N) Britton Chance Robert E. Olson	DENTISTRY (Nd) Lester R. Cahn Richard S. Manly	
INFORMATION AND COMMUNICATION (T) Phyllis V. Parkins		STATISTICS (U) William G. Cochran Rosedith Sitgreaves	

COVER

Map drawn by a Nepalese schoolboy depicts his house and its surroundings. The line leading to the door of the smaller house represents the process of going, not an actual path. The two houses actually face each other. Such maps are used to help determine the readiness of children or adults of another culture to understand and use scientific models and abstractions. See page 649. [Francis E. Dart and Panna Lal Pradhan, University of Oregon, Eugene]

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

Let's do a little counting in liquid scintillation.



Model X - \$15,000

Beckman - \$ 7,995
(at left)

Minor
Difference - \$ 7,005

MAJOR DIFFERENCES

Beckman systems are easier to use. By far. Just one knob does all the work of 76 knobs on Model X. Almost unbelievable. But true.

And speaking of counting, Beckman systems do it faster. And with greater efficiency and reliability. The analytical performance is far superior to any other. Unbelievable? Let us prove it.

Beckman

INSTRUMENTS, INC.

SCIENTIFIC AND PROCESS
INSTRUMENTS DIVISION

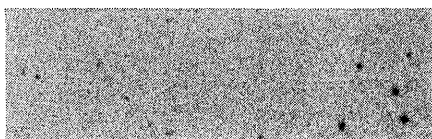
FULLERTON, CALIFORNIA • 92634

INTERNATIONAL SUBSIDIARIES: GENEVA; MUNICH;
GLENROTHES, SCOTLAND; TOKYO; PARIS; CAPE TOWN; LONDON; MEXICO CITY

The hope of doing each other some good prompts these advertisements

You want a fast emulsion?

We have recently made a photographic emulsion based on a new line of reasoning (*J. of the Optical Society of America*, 55:907) and sent it out on some plates to the Palomar Observatory. Here is a comparison at 10× of what the new plate saw (*top*) with what was seen before in a

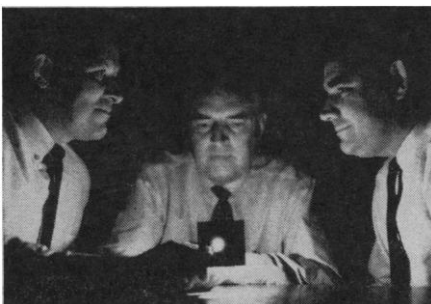


certain tiny piece of sky near Messier 101.

The new emulsion extends the limit of optically observable celestial objects by another magnitude or two. You might think that to record such a faint trickle of photons—perhaps the oldest physical entities sensible to man—might require a new high in emulsion speed. Not so. The trick was turned by going to a slower emulsion, but of a very special nature. It doesn't lose the tiny difference made by the age-old photons among all the other photons around, even with the hour-

long exposure required for a statistically significant sampling of the photons.*

Though a plateful of spaghetti impresses far more inhabitants of this planet than does a plateful of new galaxies, we ourselves are sufficiently impressed to make the plate a regular product, hereafter designated KODAK "Spectroscopic" Plate, Type IIIa-J. Information about it and other plates and films designed for long-time exposures can be obtained from Dept. 918, Eastman Kodak Company, Rochester, N. Y. 14650.



Here are three men from Dept. 918 photographed by the light of a single match. They are exploring the extent of customer interest in the film on which they were photographed. Unlike the

*Controlled baking of the plate yields greater sensitivity by improving its reciprocity characteristic and its quantum efficiency. This means that you get to use a lot of photons that would otherwise be lost and therefore get your sampling done in a shorter time. Contrary to our naive conjecture, you do not lose the advantage of improved S/N which was acquired by going to a fine-grain emulsion and long exposure. Moral: you can have your cake and eat it too—if it's baked twice, once at the factory and once in your own oven!

emulsion for plumbing the universe, this one is just plain more sensitive to light than any we have ever before offered.

Plain? That depends. It depends on processing. An experimental product still designated "S.O. 166," this film can be processed to a negative in the routine way—by hand or in a KODAK VERSAMAT Film Processor—and appear to be no faster than our older superfast films. With those films, if you try to compensate for too skimpy exposure by tripling the development time, all you do is convert more silver halide into black silver without much reference to the light values in the subject you were trying to photograph. With S.O. 166, extended development can multiply the effective light sensitivity as much as fourfold before the fog closes in. There is some sacrifice in sharpness and granularity, but the resolving power is enhanced by the higher contrast that is obtained. For streamer chambers (research hardware for the other end of the scale from galaxies), re-entry studies, fast rises on P-11 phosphor screens, surveillance of dimly lit antisocial activities, and applications that require fleeting signals to be recorded on a go or no-go basis, S.O. 166 is probably great and should outsell galactic plates by a factor of many thousands.

The three on a match would be interested to learn of your requirements. Don't expect any S.O. 166 yet for the family camera.

Vitamin E in Pittsburgh and Rochester

We have reported a curious finding in *The American Journal of Clinical Nutrition* (17:351). Blood level of α -tocopherol (the substance principally responsible for the physiological vitamin E effect) averaged $358 \pm 21 \mu\text{g}$ per cent in a group of 37 Pittsburghers whose serum lipids we were permitted to analyze. None of them

had given their physicians any clinical evidence of vitamin E deficiency, but many were in an economic status that had brought them with other medical problems to a public hospital. This compared with $507 \pm 32 \mu\text{g}$ per cent for a group of 37 persons in Rochester, N. Y., randomly picked from a healthy, working population, some of whom had been taking multivitamin tablets but no special

vitamin E supplementation.

Besides vitamin E in bulk for the pharmaceutical and animal agriculture industries, Distillation Products Industries (Division of Eastman Kodak Company), Rochester, N. Y. 14603, also markets EASTMAN CHROMAGRAM Sheet, the convenient new medium for thin-layer chromatography—convenient for anyone in a position to see for himself how significant might be the differences in tocopherol level in the population's plasma. Paper cited gives suggestions on the procedure.

Two Indians

At a station in Montana two members of the Blackfeet tribe boarded a train we were riding. The soft-voiced young men were leaving home and parents for a distant city where one could learn to be an x-ray technician, they told us as the coniferous forests clicked past.

Coniferous forests today are grown and processed by firms like Weyerhaeuser Company. The game that the forests support make excellent sport, but for sustaining human life a regular paycheck proves far more convenient. People trained in handling x-ray film serve Weyerhaeuser, for example, in:

- Showing why the cones of noble fir must not be picked and immediately processed in an attempt to cut loss of viable seed.
- Selecting seed reasonably unriddled by larvae.
- Saving vast amounts of tedious dissection of bark samples in studies of Douglas-fir beetle populations and behavior.
- Finding an effective systemic insecticide that is translocated into the growth and needles of Sitka spruce and grand fir seedlings.

The big market for our radiographic products is not in the forest products industry but in the healing arts, in certain

routine procedures in structural safety assurance, and in industrial quality control. Otherwise x-ray technique is easy to shove off into a seldom frequented corner of the technical mind. Too bad.

Weyerhaeuser Company's address is Tacoma, Wash. 98401. Ours is Eastman Kodak Company, Dept. 740, Rochester, N. Y. 14650, in case you care to propose a suitable audience for a new informational film of ours—an audience of Indians or other people willing to open their minds to x-ray. It's called "More Than Meets the Eye."

Kodak

New PAR Lock-In Amplifier Measures Signals in the Presence of Noise by Crosscorrelation



The PAR Model HR-8 Lock-In Amplifier represents a significant advance in signal processing equipment for experimentalists who must measure low-level signal intensities in the presence of noise. It employs the theoretically optimum technique for signal recovery, and can be incorporated into a large class of experiments in which the signal of interest is, or can be made periodic, and in which a reference voltage related in frequency and phase to the signal can be obtained. The Model HR-8 first amplifies and bandlimits the input signal and then crosscorrelates it with the reference signal, suitably phase shifted and shaped. The crosscorrelation of input and reference signals yields a DC output voltage proportional to the signal of interest, while the crosscorrelation of the reference and noise results in no net DC voltage. The system can also be described as a continuously integrating, highly sensitive, phase conscious voltmeter, the response of which is "locked" to that particular frequency and phase at which the signal information has been made to appear.

Technical Features:

Frequency Range: 1.5 cps to 150 KC continuously tunable in 5 ranges.

Time Constants: 11 values in 1-3 sequence extending from 0.001 to 100 seconds. Single or double section RC filtering.

Pre-Amplifiers: Interchangeable low-noise pre-amplifiers, operable either within the HR-8 or remotely, are used.

Type A: Differential 10 megohm input.

Type B: Low impedance transformer input for low source impedances.

Sensitivity: 21 calibrated full scale ranges in 1-2-5 sequence.

With Type A Pre-Amplifier: 100 nanovolts to 500 millivolts rms.

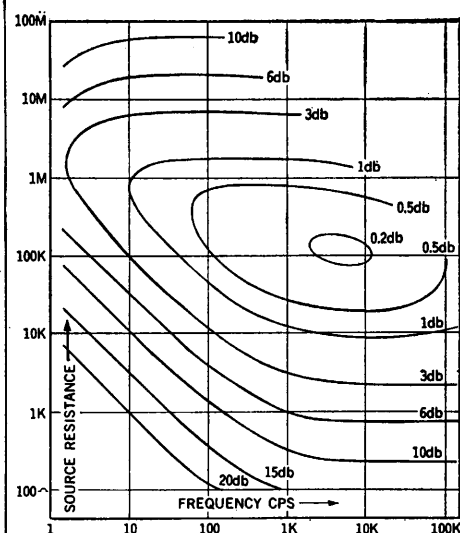
With Type B Pre-Amplifier: 1 nanovolt to 5 millivolts rms.

Output: ± 10 volts full scale, single-ended with respect to ground. Will drive galvanometric and servo recorders.

Frequency Selective Amplifiers: Notch network in negative feedback loop used in both signal and reference channel tuned amplifiers. Reference channel Q of 10. Signal channel Q adjustable from 5 to 25 with calibrated dial (no gain change with Q adjustment).

Phase Adjustment: Calibrated 360° phase shifter, providing continuous rotation as well as a four position quadrant switch which shifts phase in 90° increments.

Price: \$2,250 with either Type A or Type B Pre-Amplifier.

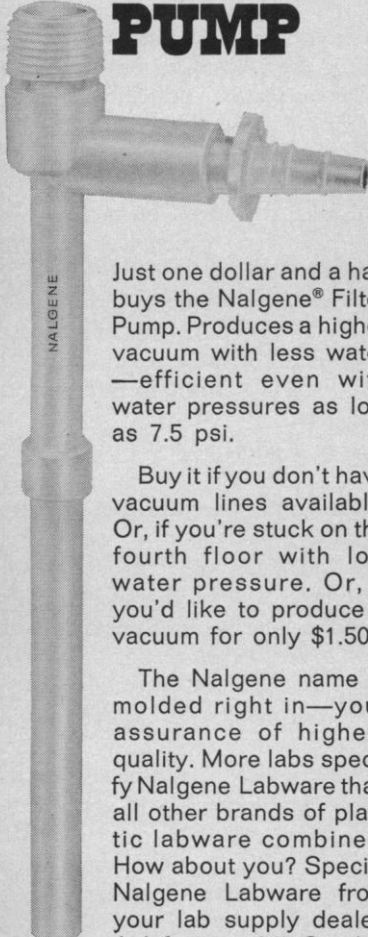


Contours of constant noise figure for a typical PAR Type A preamplifier plotted to show dependence on frequency and source resistance at 300°K . Amplifier operated single-ended.

Write for bulletin No. 120 on the HR-8 or ask for information on PAR's complete line of Lock-In Amplifiers and accessories.

PAR PRINCETON APPLIED RESEARCH CORP.
Dept. G
Box 565, Princeton, N. J., Tel. (609) 924-6835

WORLD'S ONLY
\$1.50
VACUUM PUMP



Just one dollar and a half buys the Nalgene® Filter Pump. Produces a higher vacuum with less water—efficient even with water pressures as low as 7.5 psi.

Buy it if you don't have vacuum lines available. Or, if you're stuck on the fourth floor with low water pressure. Or, if you'd like to produce a vacuum for only \$1.50.

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. 2102, Nalgene Labware Division, Rochester, N.Y. 14602.

SPECIFY NALGENE LABWARE

NALGE
 RITTER PFAUDLER CORPORATION

... Studies of psychiatric effectiveness, whether their conclusions are favorable or not, characteristically overlook the meaning of the patient's "choice" of adaptive responses to a painful world. One may say that the patient and the person reporting spontaneous remission of symptoms are equally programmed by their experiences, but that the program elicits a different adaptation in each case. Isn't it fortunate, then, that clinical psychiatry can serve those whose programs dictate a mode of secular medical assistance? The very fact of therapy may influence the individual's "choice" of responses, but that proves nothing more than its perceived usefulness. Realistically, psychiatric insights are so influential that whether they are absolutely true or not is historically irrelevant. They came into existence to meet a need, and modern society could not be imagined without them. They are probably necessary first steps toward a true science of the mind.

DON BRONKEMA

110 Bleecker Street,
 New York 10012

... If the hypothesis is correct, and I as an interested nonprofessional find the evidence impressive, that psychoanalysis does not in fact contribute to the cure of mental disease or to measurable improvement in mental health, what should the scientific community do about it? The Hoxsey clinic with its cures for cancer was eventually effectively quarantined on the basis of scientific opinion. Recently we have had the "battery additive" and Krebiozen cases. These are simpler issues and much less dangerous for the scientific community. The responsibility of the scientist in shielding the public from more pervasive possible frauds is even greater. If typical psychoanalysis is basically a fraud insofar as it does not deliver what it purports to deliver, and in return for a fee, then surely something should be done about it.

As the evidence accumulates and the minority of psychologists and psychiatrists become more vocal, it may be wise for a responsible body, such as the National Academy of Sciences, to set up a committee to study the matter before it is sensationalized by the press some years hence. One of the special difficulties that can be anticipated is that deeply religious believers in the mythical thought structure of Freudian analysis are to be found at the highest educational levels. Will such an en-

quiry into basic beliefs be permitted by those who feel that psychiatry has helped them personally? Has society a right to ask for such validation? I believe it has only as long as fees are charged. Perhaps herein lies the eventual solution to the psychiatrists' proposal reported in Linn's book review. Surely if believers in the psychoanalytic world-view were to take their rightful place as another religion or way of life, they could then carry their gospel of "psychiatry out of the hospitals and clinics into the community" as a charitable service.

RUSTUM ROY

Materials Research Laboratory,
 Pennsylvania State University,
 University Park 16802

Rimland's letter reveals anger over the failure of psychiatrists to make impartial judgments about the effectiveness of their daily work and about the soundness of their theories. ... Psychiatry and psychology are infant sciences in the 20th century, swathed in superstition and under authoritarian control. The visible inadequacies of psychiatry should be not a source of anger but rather a spur to the inquiring mind; they should also be a stimulus to scientific humility.

The psychiatrists of the 21st century will look back with amusement and tolerance (let us hope) at the psychiatry of today. Let us pray that they are that much ahead of us!

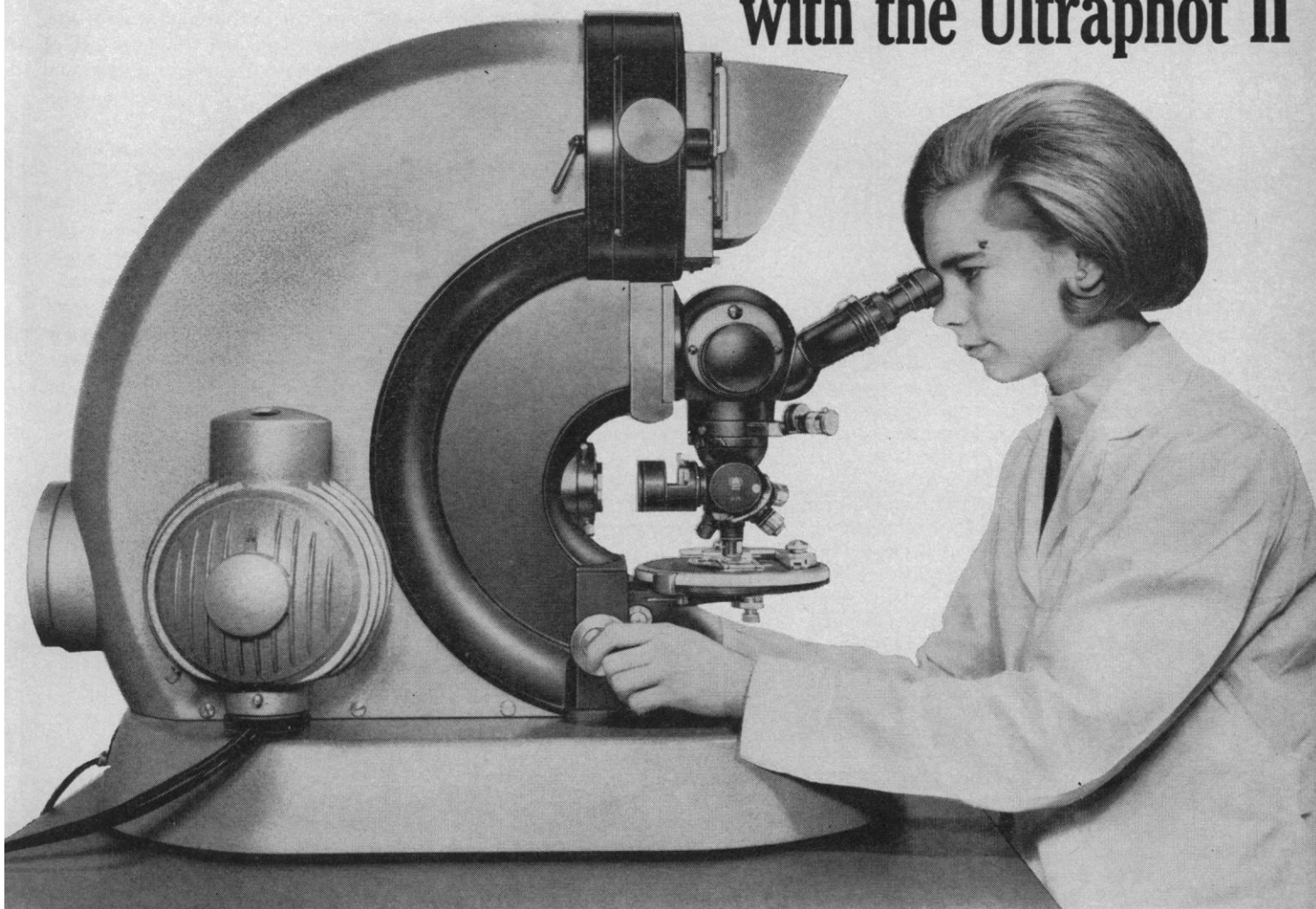
JOHN T. FLYNN

Beekman-Downtown Hospital,
 170 William Street, New York 10038

Specialization and Medical Education

The lucid letters of Mellinkoff and King (11 Nov.) go to the heart of several of the many complex problems afflicting medical education, whereas much of the current writing on the subject is characterized by stereotypical and wishful thinking. For example, proposals to produce greater numbers of general practitioners more often reflect the myth of the old-fashioned family doctor than familiarity with the history of medicine and current medical needs and social problems. Ignored, among other facts, are the increasing mobility of the average individual and average family, and the increasing demand by the public for direct access to specialists.

Anyone can take perfect micrographs with the Ultraphot II



ZEISS

Because all you do is focus and touch a button. Ultraphot II's automatic bellows-type camera system does the rest. Result: sharp, perfectly focused micrographs by anyone in the lab. □ Zeiss has coupled easy, automatic operation with unmatched versatility to make the Ultraphot II the most practical photomicroscope available. No other instrument offers versatility like this: (1) You can use 4 x 5 plate, sheet film or Polaroid 500 (attachment for 35mm film also available). (2) Use Luminar lenses for sharp, high-contrast, wide-angle macrographs at magnifications as low as 2.5x. (3) Work with reflected or transmitted light—or both simultaneously. (4) Choose any of three light sources: tungsten, high-pressure mercury or carbon arc with automatic feed. (5) Replace the camera head with a projection head for group viewing. (6) Use any objective out of more than 120 available. (7) Increase magnification by 1.25x, 1.6x or 2x—without changing focus or eyepieces—with the built-in Zeiss OPTOVAR. (8) Choose from a full complement of accessories to do any kind of study in your specialty. For complete information, write Carl Zeiss, Inc., 444 Fifth Avenue, New York, New York 10018. In Canada: 14 Overlea Boulevard, Toronto. COMPLETE SERVICE FACILITIES AVAILABLE.

Dept. SC.

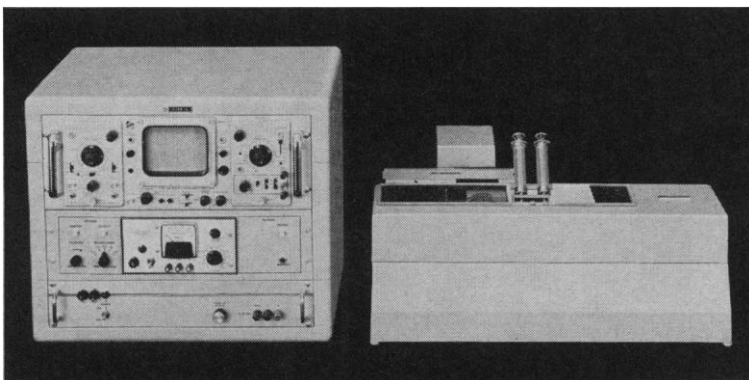
THE GREAT NAME IN OPTICS



ATLANTA, CHICAGO, LOS ANGELES, SAN FRANCISCO, SEATTLE, WASHINGTON D. C., BOSTON

IN CANADA: TORONTO, MONTREAL, WINNIPEG, VANCOUVER

DURRUM STOPPED-FLOW SPECTROPHOTOMETER



ABSORPTION RECORDINGS IN 5 MILLISECONDS

New Durrum instrument simplifies rapid kinetic studies based on the stopped-flow technique, permitting measurement of chemical reaction half times as short as five milliseconds. It mixes two liquid components, follows their change in monochromatic light absorption at selected wavelengths from 2500 to 8000 Angstroms, and records the change as a function of time on a storage oscilloscope. You can retain several successive traces for comparison, and photograph the CRT for a permanent record.

The instrument measures sample volumes as small as 0.2 ml of each component. Built-in heat exchange coil and circulating pump permit operation at elevated or reduced temperatures when used in conjunction with readily available laboratory water baths. Instrument parts contacting sample are fabricated of stainless steel, Teflon, Kel-F, glass or fused silica, and are capable of withstanding a wide variety of component solutions and reaction products.

MULTIPLE-USE VERSATILITY

Modular design facilitates addition of new accessories and techniques as they become available in the fast-moving field of kinetic studies. The standard instrument measures absorption of visible light through a 20 mm light path. Standard equipment (price \$10,800) includes mixing chamber, monochromator and light source, power supplies and electronics, circulating pump and heat exchange coil, storage oscilloscope and camera. Accessories and attachments expand capabilities for fluorescence, ultraviolet, and short path length measurements. Prices for partial or complete systems range from \$4,900.00 to \$11,835.00.

TYPICAL APPLICATIONS

Enzyme-substrate reactions, catalytic studies, metal-ligand reactions, bioluminescence, concentration jump, fluorescence, and absorption measurements are a few potential applications for the instrument.

FOR FURTHER INFORMATION

Write Durrum for references, four page price list of systems and accessories, and new illustrated brochure describing the instrument.

Available through Techmation, Ltd., in London, Paris, Dusseldorf, and Amsterdam. Write for name of agent in other overseas locations.



DURRUM

Durrum Instrument Corp., 925 E. Meadow Dr., Palo Alto, Calif. 94303. Tel. (415) 321-6302

Cable: DURRUM, Palo Alto

Among the many economic problems, insufficient attention is given to the high cost of medical education. If we are to recruit enough highly qualified students to study medicine, medical education will have to be subsidized by direct federal grants to the student, without a means test. While I am familiar with noteworthy exceptions, most medical students are being contaminated by a value gradient along which "basic research" is placed in a hallowed shrine, with clinical or applied research and teaching in descending order of value. That such valuation is specious is recognized by those department chairmen, as King indicates, who encourage the highest standards in every area of professional work, and who thereby tend to elicit the most productive and creative work from students and co-workers.

H. ROBERT BLANK

*Department of Psychiatry,
Albert Einstein College of Medicine,
New York 10061*

One is relieved to read that the more medicine tends to become a science "the more it becomes simple and easy to understand" (Mitchell, Letters, 11 Nov.). In one field, radiology, the time when it will be simple and easy seems to be receding. So much knowledge has been acquired since 1945 that one person cannot know it all; not that it is too difficult; there is too much.

Radiation therapy is a separate discipline; curable types of cancer (larynx, cervix, tongue, and others) are now being treated by people with special experience and proven ability. The scope of diagnostic radiology in a large hospital practice is too great for any one man to handle with authority. Therefore, it is divided into subspecialties, not only according to organ systems, but according to the age of the patient. Pediatric radiology has some 100 practitioners in the United States, even though it became an established subspecialty only in the past 20 years. Knowledge in this field alone has increased to the extent that one man can no longer be expected to be thoroughly familiar with all aspects of radiographic manifestations of diseases in children.

Generally 5 to 6 years of training after the internship are necessary for a radiologist to acquire expert knowledge in an area of pediatric x-ray diagnosis. Some specialize in children's diseases of the heart, especially congenital heart disease, others in diseases of the genitourinary tract, still others in dis-

eases of the skeleton; of the latter, one man is particularly interested in the pelvic bones. There is one person in the country who can rightfully be called a pediatric neuroradiologist.

One must agree with Mitchell that "a foundation of trained clinical observation is necessary" in medicine. It is hard to see how this makes specialization unnecessary. Even if man's capacity for knowledge were limitless, his time to acquire it is not. A boy with a removable brain tumor or a surgically curable congenital cardiac malformation would benefit more from being seen by a physician with relevant special experience than by one without it.

Specialization is not evil; what is to be deplored is *specialism*, a parochial attitude. The general physician is not immune to it, as we can see when he deplores specialization.

STEVEN E. ROSS

University of California School of
Medicine, San Francisco 94122

Automatic Language Processing: Source of Funds

In discussing the report of the Automatic Language Processing Advisory Committee, National Academy of Sciences—National Research Council entitled *Language and Machines: Computers in Translation and Linguistics*, Bryce Nelson reported an interview with R. Ross Macdonald, director of the Georgetown University Machine Translation Research Project (6 Jan., p. 59). According to the article Macdonald denied that the National Science Foundation had ever supported the Georgetown MT group—as stated in the Automatic Language Processing Advisory Committee report. "Macdonald argued that this was one of the errors in the report, since it was known that all NSF money given to the Georgetown project came from the CIA." It happens that the National Science Foundation did make grants (G-2723, G-3867, and G-5513) of \$106,000 to the Georgetown MT Project. My authority for these figures is page v of the Georgetown University Machine Translation Research Project "General Report" (June 1963) prepared by R. Ross Macdonald.

A. HOOD ROBERTS

Automatic Language Processing
Advisory Committee, National
Academy of Sciences,
Washington, D.C. 20418

10 FEBRUARY 1967

Senior and visiting scientist appointments in Fundamental Research

The Space Sciences Department, Douglas Missile & Space Systems Division, Santa Monica, has openings for full-time and visiting Senior Scientists in the following areas:

- ☀ *Solar Astrophysics*
- ☀ *Plasma Geophysics*
- ☀ *Theoretical Physics*
- ☀ *Planetary Interiors, Atmospheres, & Surfaces*
- ☀ *Ocean Sciences*
- ☀ *Space Radiation Experiments*
- ☀ *Planetary Meteorology*
- ☀ *Atmospheric Physics*

If you are interested in working with a dynamic research group and have a Ph.D. or equivalent, submit your resume to K.F. MacDonald, Douglas Missile & Space Systems Division, 5300 Bolsa Ave., Huntington Beach, California.

An equal opportunity employer

ANALOG MONOLOGUE

On Means for Modelling, Measuring, Manipulating, & Much Else

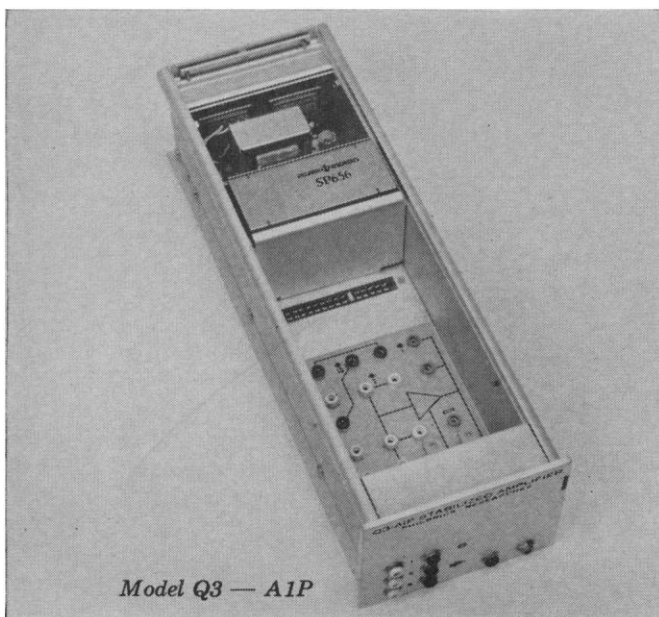
Volume 1, No. 4

A SHORTER PATH TO PRACTICAL ELECTRONIC MEASUREMENTS

One requirement is common to all scientific research . . . threads through all development engineering . . . marks every empirical exercise — *the need to measure*. Our interest in this arises from the fact that electronic circuits (often with transducers) are generally the most practical means for measuring and recording parameters. Moreover, an increasing number of practical and economical electronic measuring circuits employ Operational Amplifiers — our specialty in analog computing devices since before 1946, and as a circuit component since their introduction as such in 1952.

During the past twenty years, we have been privileged to work closely with specialists in many disciplines, helping them to design and build literally thousands of different kinds of circuits — instruments, signal “conditioners”, and data “processors” and others ad infinitum. We have learned that our “opposite numbers” in Chemistry, Metallurgy, Aerodynamics, Hydraulics, Mathematics, Stress Analysis, Physics, Thermodynamics, etc., are generally enthusiastic about what Analog Operational circuits *can do*, but almost totally disinterested in *how* they can be made to do it . . . and that is pretty much as it should be. To each his own.

We have observed that a major deterrent to more widespread use of the powerful Analog Way (of sensitive, accurate measurement and data processing) has been the time, effort, and considerable skill required to convert the circuit diagram into a complete, functioning instrument. Now we have found a way to speed and simplify that process. We call it the *Universal Operational Module* (U.O.M.): One such module, the Q3-A1P, is shown here.



The Q3-A1P consists of a unique mechanical structure, in which are mounted a high-performance, chopper-stabilized Operational Amplifier, a compatible power supply, and an “Operating Deck”, on which is located a cluster of conveniently-disposed, clearly-labeled jacks, for interconnecting input and feedback components with the amplifier and its supply. The structure also provides connectors and space for auxiliary networks, for input and output cables, and a front panel with duplicate input/output terminations. With a Q3-A1P and a few simple pluggable components (i.e., resistors, capacitors, etc.) any one of literally thousands of useful circuits — complete and ready to use — may be realized . . . *minutes after it is conceived*, without punching a hole, or soldering a wire.

Best of all, the physical organization of the Q3-A1P has been carefully planned to anticipate and prevent or circumvent most of the tiresome and unproductive “debugging” and “tweaking” that plagues almost any original design. Shielding, guarding, wire-routing; “strays”, “sneaks”, “parasitics” — you may forget them all, in almost every instance.

The Q3-modular packaging system which includes a variety of universal operational modules, some of which are listed in Table 1, permits concentration on the *important things* — What and Why, instead of How.

TABLE 1

Q3-A1P	Compact, self-powered, chopper-stabilized amplifier complete with patch panel and accessory socket.
Q3-A2P	As above, but using a low noise, low current-offset, differential amplifier.
Q3-J1P	A switch-programmable, self-powered integrator-differentiator.
Q3-M1P	A switch-programmable, self-powered unit capable of performing non-linear functions such as multiplying, dividing, squaring and rooting.
Q3-M2P	As above, less switches, programmable via a patch panel.
These universal operational modules (U.O.M.'s) consist of a standard Q3 series package, equipped with a carefully optimized interface facility to permit the combination of amplifiers, networks, components, and power supplies into highly-flexible, universal analog devices.	

If you have been thinking of adding staff, perhaps to accelerate important programs, consider this alternate possibility: reducing the instrumentation burden on your present staff, with Philbrick Q3 U.O.M.'s and Philbrick Applications Engineering assistance — both distinguished by their versatility, integrity and reliability.

Write today for MBA Package #4 which contains a short form catalog. Philbrick Researches, Inc., 25-F Allied Drive at Route 128, Dedham, Massachusetts 02026. Phone (617) 329-1600.



PHILBRICK

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. MENDELSON
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

Publisher

DAEL WOLFLE

Business Manager

HANS 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, NAOMI PANUSH, JANE AYRES, GILLIAN PARRILLO

Book Reviews: SYLVIA EBERHART

Editorial Assistants: JOANNE BELK, ISABELLA BOULDIN, ELEANORE BUTZ, BEN CARLIN, CAROLYN CLARK, JANE COLE, GRAYCE FINGER, NANCY HAMILTON, OLIVER HEATWOLE, ANNE HOLDSWORTH, KONSLYNNIETTA HUTCHINSON, ELEANOR JOHNSON, KATHERINE LIVINGSTON, BARBARA SHEFFER

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

Advertising Staff

Director

EARL J. SCHERAGO

Production Manager

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 (617-359-2370): RICHARD M. EZEQUELLE

Chicago, Ill. 60611, 919 N. Michigan Ave., Room 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.

Goals, Priorities, and Dollars

In 1975 the U.S. will spend over \$30 billion for research and development if the projections of *Goals, Priorities, and Dollars** are confirmed. This book, by Leonard Lecht, is the first report of the National Planning Association's Center for Priority Analysis. It projects the amount of money likely to be available for 16 classes of expenditure and the cost of meeting national goals in each class, as those goals have been formulated by legislative enactment, expert studies, or knowledgeable public bodies. The classes are: consumer expenditures and savings, private plant and equipment, urban development, social welfare, health, education, transportation, national defense, housing, research and development, natural resources, international aid, space, agriculture, manpower retraining, and area redevelopment. The listing is in decreasing order of the amounts expected to be spent in 1975.

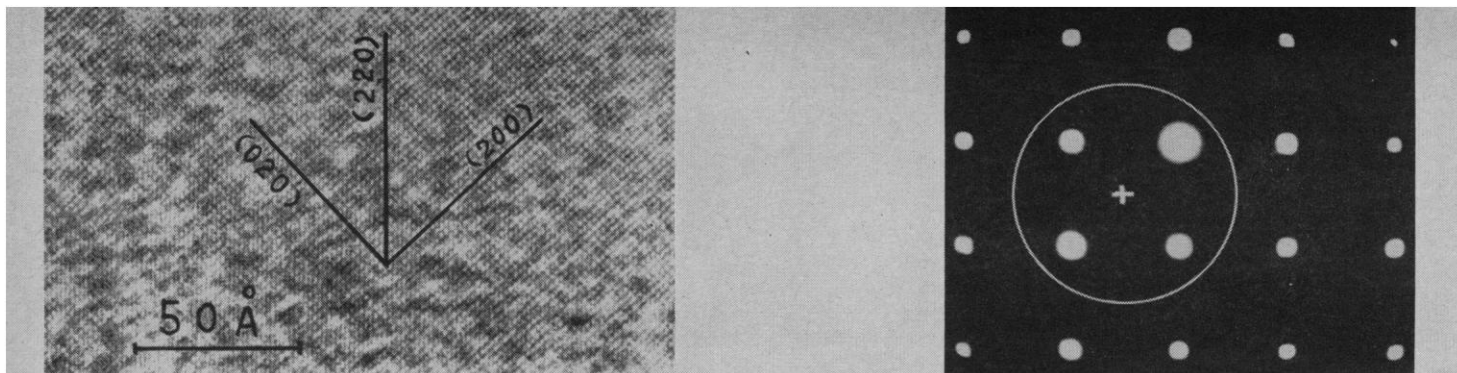
The U.S. population is expected to increase to 226 million in 1975. For a population of this size, a gross national product (GNP) of \$770 billion will be required to equal 1962 per-capita expenditures for civilian goods, education, health care, and the rest of the 16 areas. The actual GNP for 1975 is likely to be higher—\$981 billion, if Lecht is right in assuming a steady 4-percent-a-year increase from 1962 to 1975. This rate is higher than that in recent years, but he considers it reasonable and attainable. A GNP of \$981 billion will be \$211 billion above the amount necessary to maintain 1962 standards, but it will not be enough to meet in full the goals in all 14 areas. That would require a GNP of \$1127 billion.

The projections give hope of \$211 billion for discretionary use in raising standards above present levels for some or all of the goal areas, and they also give warning that we will fall short by \$146 billion of having enough to satisfy all the aspirations. For research and development, continuation of the 1962 expenditure rate of 3 percent of GNP would provide \$30 billion in 1975, an amount that seems reasonable in light of actual increases from 1962 through 1967. The aspiration level for 1975 is \$39 billion.

Obviously choice will be necessary. Every budget-maker knows this necessity, yet Lecht's calculations help to define the area in which we can maneuver. Moreover, projection of the R & D range and of the size and range of other claims on the GNP strengthen the argument that we need better information on which to base our choices.

Traditionally, individual companies, universities, foundations, government agencies, and congressional committees have each looked at some portion of the total research and development realm. Their individual decisions, made for their individual reasons, collectively determine the national total and distribution of R & D expenditures. We will not depart from this decentralized system, yet we could provide many decision-makers with two kinds of help to make better-informed choices. One is additional, updated, and more refined projections and analyses of the kind Lecht has given us. The other is the clearer formulation of criteria for choice among various scientific and technological alternatives. Choices are inevitable; scientists can lead in establishing the criteria on which they are made, or they can leave this responsibility to others.—DAEL WOLFLE

* Leonard A. Lecht, *Goals, Priorities, and Dollars*, Free Press, New York, 1966, \$2.95.



Electron micrograph and diffraction pattern taken on the HU-11C showing the crossed lattice images of the (200) planes of gold. The (020) and (200) planes = 2.04 Angstroms. The (220) plane = 1.44 Angstroms. All important factors such as contamination, stage drift, astigmatism and aberrations must be negligible to achieve this ultra-high resolution. The HU-11C was operated at an accelerating voltage of 100 KV and an electron optical magnification of 270,000 X. The illumination was tilted until the three reflections showed nearly equal intensity in the diffraction pattern; then the micrograph was taken.

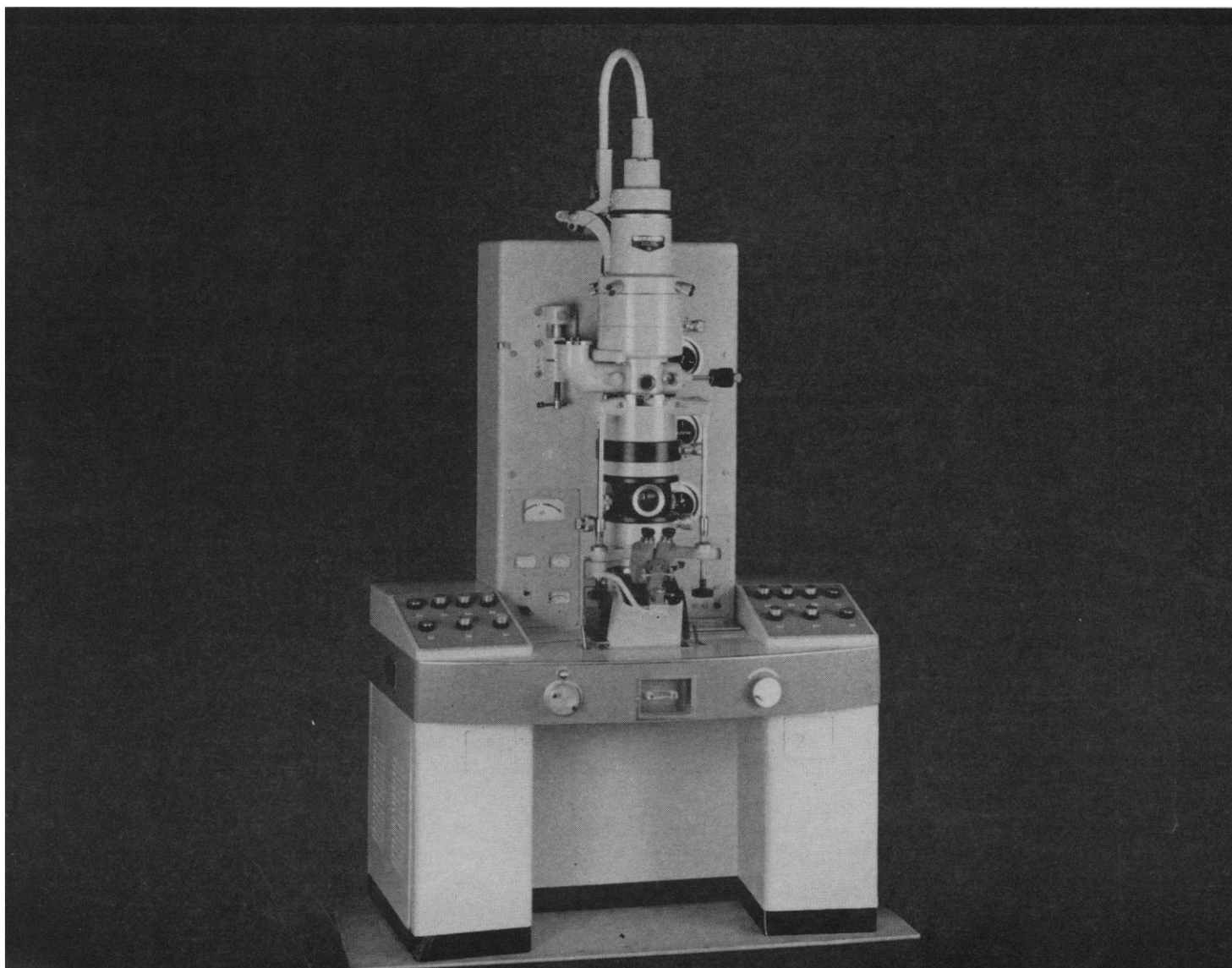
FROM HITACHI PERKIN-ELMER

THE HU-11C: LEADER IN A NEW GENERATION OF ELECTRON MICROSCOPES

Here is the highest-resolution electron microscope in the world. The unique electromagnetic alignment and focusing system, centered on the objective lens, assures that ultra-high resolution conditions will be maintained on a day-to-day basis with unexcelled ease of operation. Resolution of better than five Angstroms is guaranteed. Resolution of better than 1.5 Angstroms has been demonstrated (see micrograph). Accelerating voltages of 50 KV, 75 KV and 100 KV provided. Magnification range: 400 X to 250,000 X. A 125 KV

version of the HU-11C is available. A wide range of accessories extends the research capabilities of the HU-11C Electron Microscope. Electron Microprobe Attachment, Image Intensifier and Electromagnetic High Resolution Darkfield Attachment are but a few of the many outstanding accessories available. For full details, write to: The Perkin-Elmer Corporation, Electron Microscope Dept. 723 Main Avenue, Norwalk, Conn. 06852.

PERKIN-ELMER



RESEARCH GRADE
**PHOSPHORIC
ACID-P³²**

NEX-054

0-1mc-\$15	10mc-\$30
2mc- 17	15mc- 38
5mc- 22	20mc- 45

Carrier free in 0.02N HCl. Polyphosphates and heavy metal phosphates < 0.05% as verified by paper chromatography. Write for specifications and 1967 Radionuclide brochure.

NEN

**LABELED
CHEMICALS**

HAcock 6-7311

NEW ENGLAND NUCLEAR CORP.
575 ALBANY STREET, BOSTON 18, MASSACHUSETTS

Air Conservation

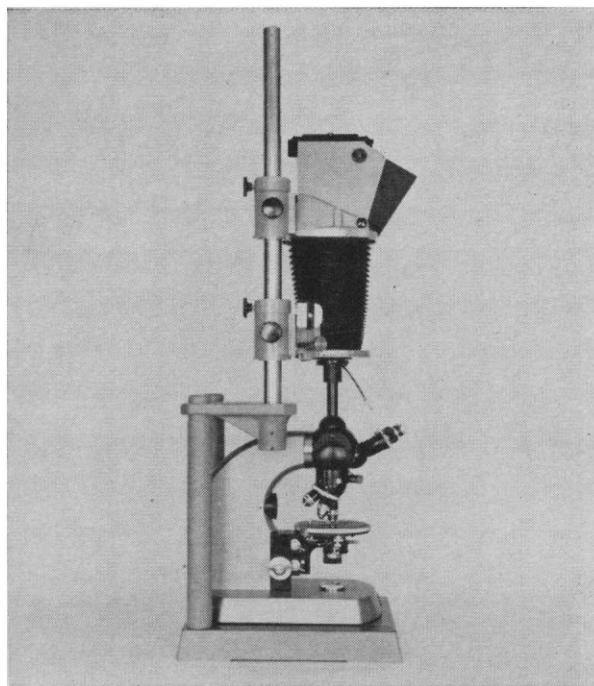
Report of the AAAS Air Conservation Commission 348 pp., illus., bibliography, index. 1965. Price: \$8. AAAS members' cash orders: \$7.

"Chaired by Dr. James P. Dixon, the twelve member Commission provided an outstanding representation of the many physical, chemical and social disciplines involved in the definition and dissection of the problem of air pollution. In the course of their deliberations the Commission called upon no less than fifty-five experts; a situation which led to acknowledgments to a list of people which reads like 'Who's Who in Air Pollution.' As the result of these deliberations, this book probably represents the most thoughtful, realistic, and penetrating analysis of air pollution as a factor in the societies of today and tomorrow now available. It is a 'must' for the serious student and professional, and can be highly recommended to the interested citizen."—(*Bulletin American Meteorological Society*, December 1966)

**American Association for the
Advancement of Science**

1515 Massachusetts Ave., NW
Washington, D.C. 20005

photo- micrography?



The Brinkmann Mark-V Camera can be used with all laboratory and research microscopes. Accessories include a 4x5" Graflok Back for cut film, Polaroid, No. 120 roll film and 35 mm. adaptors. A built-in exposure meter and low-power stage are optional.

**BRINKMANN
INSTRUMENTS**
CANTIAGUE ROAD, WESTBURY, N. Y. 11590/ED 4-7500