

SCIENCE

7 August 1959

Volume 130, Number 3371

Editorial	Dither	301
Articles	Stochastic Models of Population Dynamics: <i>J. Neyman</i> and <i>E. L. Scott</i>	303
	A few simple chance mechanisms may combine to reproduce many manifestations of a complex phenomenon.	
	Radiocarbon from Nuclear Tests: <i>W. S. Broecker</i> and <i>A. Walton</i>	309
	During the past 4 years man has been producing carbon-14 about 15 times faster than nature.	
	Emotion in Prejudice: <i>J. B. Cooper</i>	314
	Physiological tests support the thesis that prejudicial attitudes are attended by relatively strong emotion.	
	William Fielding Ogburn, Social Scientist: <i>A. J. Jaffe</i>	319
News of Science	Scientist Exchange Pact Signed by Nesmeyanov and Bronk; Nuclear Ship <i>Savannah</i> Launched; Seven NATO Allies To Get Atomic Data from U.S.	321
Book Reviews	A. Koestler's <i>The Sleepwalkers</i> , reviewed by <i>M. K. Munitz</i> ; other reviews	326
Reports	Taxonomic "Descriptions": <i>R. D. Shenefelt</i>	331
	Bomb Carbon-14 in Human Beings: <i>W. S. Broecker</i> , <i>A. Schulert</i> , <i>E. A. Olson</i>	331
	Carrier State in Human Acatlasemia: <i>E. T. Nishimura</i> et al.	333
	Presence of Myoglobin in "Cartilage" of the Marine Snail <i>Busycon</i> : <i>J. W. Lash</i>	334
	Notes on the Champlain Sea Episode in the St. Lawrence Lowlands, Quebec: <i>J. Terasmae</i>	334
	Growth Responses of Phycomyces to Polarized Light Stimuli: <i>W. Shropshire, Jr.</i> ..	336
	On the Instrumental Conditioned Reaction Evoked by Electrical Stimulation of the Hypothalamus: <i>W. Wyrwicka</i> , <i>C. Dobrzecka</i> , <i>R. Tarnecki</i>	336
	Isolation of Several Peptides with Relaxin Activity: <i>E. H. Frieden</i> , <i>N. R. Stone</i> , <i>N. W. Layman</i>	338
Departments	Letters	298
	Contamination of the Moon; Forthcoming Events; New Products	340

A Superior New Concept Developed

MODULAR UNITS

for

Gas Chromatography

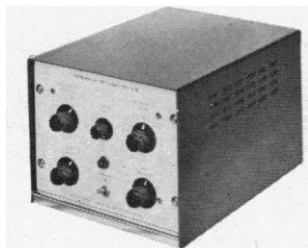
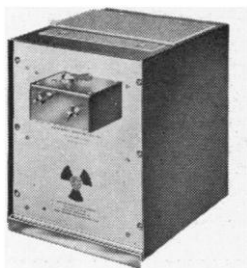
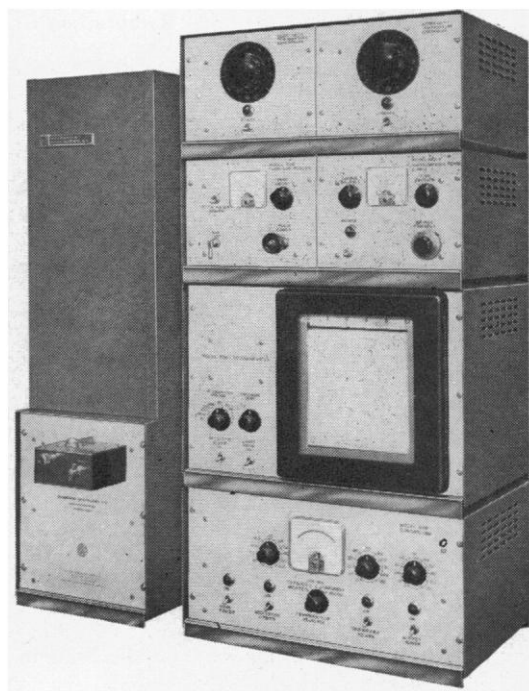
by



- Ten separate modules to provide exactly the right combination to meet your chromatography needs •
- The flexibility to meet your future research requirements by the simple addition of other modules •
- Adaptability to future developments in the field of Gas Chromatography.

The Complete System shown at right is composed of 8 modules.

- **CONTROL UNIT** –
provides power and monitors temperature throughout the system
- **COLUMN OVEN** –
uniform temperature up to 300°C.
- **COLUMN OVEN TEMPERATURE CONTROLLER** –
proportional control over entire operating range.
- **KATHAROMETER DETECTOR and OVEN** –
conductivity cell with uniform temperature distribution
- **KATHAROMETER POWER SUPPLY** –
regulated current to conductivity cell
- **DETECTOR OVEN TEMPERATURE CONTROLLER** –
proportional control over entire operating range.
- **FLOW CONTROLLER and METER** –
constant and reproducible gas flow
- **POTENTIOMETRIC RECORDER** –
5mv for high sensitivity and reproducible chromatographs.



For the Ultimate in MICRO-DETECTION

- **Model 600-2 IONIZATION DETECTOR and OVEN** –

Sensitivities up to 10^{-13} moles Unparalleled stability Adaptable to your present system

- **Model 605-2 IONIZATION DETECTOR POWER SUPPLY** –

regulated high voltage stable electrometer circuit attenuation of 1:1000

WRITE TO DEPARTMENT A
FOR FURTHER INFORMATION

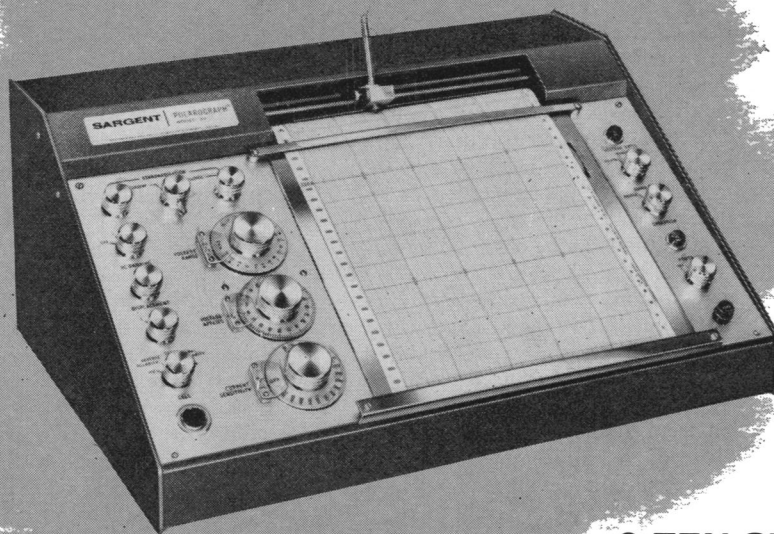


RESEARCH SPECIALTIES CO.

200 SOUTH GARRARD BOULEVARD

RICHMOND, CALIFORNIA

The New SARGENT Model XV RECORDING POLAROGRAPH®



offers you—

- **FULL 10 INCH CHART**
- **1/10% ACCURACY OF MEASUREMENT**
- **TEN STANDARDIZED POLARIZING RANGES**

This new Sargent Polarograph gives you a large 250 mm (10 inches) chart and the highest accuracy and current sensitivity at the lowest price of any pen writing polarographic instrument on the market.

It offers you optimum specifications based on over twenty years of leadership in design, manufacture and service in this specialized field of analysis.

The polarographic method is capable of reproducibility to 1/10% and analytical accuracy to 1/2%. To make use of this facility, the instrument must be accurate to 1/10% and chart space must be provided for recording large steps to achieve measuring precision. We strongly advise against the purchase of any polarographic instrument using miniature (5 inch) charts and low gain balancing systems in the 1% order of precision.

This Model XV is adaptable to 10^{-6} M determinations with the S-29315 Micro Range Extender.

®Registered Trade Mark, Patents Pending

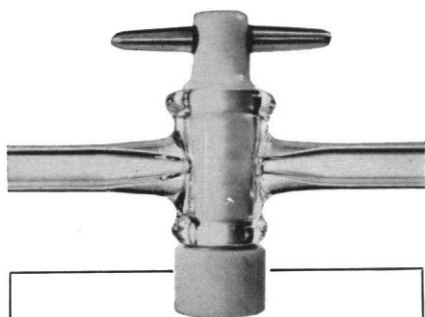
Current Ranges:	19, from .003 to 1.0 $\mu\text{A}/\text{mm}$.
Current Sensitivity:	standard specifications, $10^{-4}\mu\text{A}/\text{mm}$.
Polarizing Ranges, volts:	0 to -1; -1 to -2; -2 to -3; -3 to -4; +.5 to -5; 0 to -2; -2 to -4; +1 to -1; 0 to -3; +1.5 to -1.5.
Balancing Speed:	standard, 10 seconds; 1 second or 4 seconds optional.
Bridge Drive:	synchronous, continuous repeating, reversible; rotation time, 10 minutes.
Chart Scale:	current axis, 250 mm; voltage axis, 10 inches equals one bridge revolution.
Current Accuracy:	1/10%
Voltage Accuracy:	1/4%
Chart Drive:	synchronous, 1 inch per minute standard; other speeds optional.
Writing Plate:	10 1/2 x 12 1/2 inches; angle of slope, 30°.
Standardization:	manual against internal cadmium sulfate standard cell for both current and voltage.
Damping:	RC, four stage.
Pen:	ball point; Leroy type optional.
Suppression:	zero displacement control, mercury cell powered, 6 times chart width, upscale or downscale.
Potentiometric Range:	2.5 millivolts, usable as general potentiometric recorder.
Finish:	case, enameled steel; panels, anodized aluminum; writing plate, polished stainless steel; knobs and dials, chromium plated and buffed.
Dimensions:	23 x 17 x 10.
Net Weight:	65 pounds.
Catalog number S-29310 with accessories and supplies... \$1585.00	

For complete information write for Sargent Polarograph XV literature

SARGENT

SCIENTIFIC LABORATORY INSTRUMENTS • APPARATUS • SUPPLIES • CHEMICALS

E. H. SARGENT & COMPANY, 4647 W. FOSTER, CHICAGO 30, ILLINOIS
DETROIT 4, MICH. • DALLAS 35, TEXAS • BIRMINGHAM 4, ALA. • SPRINGFIELD, N. J.



Now you can use self-lubricating **TEFLON® STOPCOCKS** on an everyday basis!

**Kontes saves you money
three ways on chemically-
inert* Teflon items!**

Increased production has lowered prices substantially on all Kontes Teflon Stopcocks and apparatus which incorporate them. You save, in fact, three ways by getting Teflon products from Kontes: by reduced individual prices, by lower quantity prices, and by combining Teflon items with your regular orders for Kontes Technical Glassware for even greater discounts.

COMPARE KONTES QUALITY! Teflon Stopcock barrels are ground and polished, providing the ultimate in smooth, even turning without lubricant. Special spring-loading device keeps plug properly seated and leak-free without dangers inherent in over-tightening. Wall thickness is appreciably greater than other brands. Sidearms increase gradually in o.d. and decrease in i.d. at seals to barrels for greater strength and improved flow characteristics.

Order now for immediate delivery! Write for your free copy of our new Bulletin TP-1. It describes all Kontes Teflon ware including beakers, burettes, pipettes, separatory funnels, stopcocks, etc.

K-81100 STRAIGHT STOPCOCK
prices below are typical—

Size	Bore, mm.	Plug size, mm.	Each
2 A	2	10/25	4.50
3 A	3	10/25	4.50
2	2	12/30	6.90
4	4	17/40	9.20

*Teflon has almost universal chemical inertness.
©Reg. T.M., E. I. du Pont de Nemours & Co., Inc



**KONTES
GLASS COMPANY**

First Choice For Quality Technical Glassware
Vineland, New Jersey

Midwest Distributor: Research Apparatus, Inc., Wauconda, Ill.

Letters

On Supplementing Human Faculties

It was hardly to have been predicted that when a human being is completely isolated from external stimuli, as was the case in an experiment conducted by the Office of Naval Research in 1956 [discussed at the Interdisciplinary Conference on Self-Organizing Systems, Chicago, May 1959], he loses his sense of orientation and cannot change a set idea in his mind. Rather one would have assumed that he could continue to meditate on past experiences, much as if he were sitting alone in the dark of a warm, silent cave. The question occurs: Can a person be thrown into a higher level of consciousness by supplementation of his faculties? Certainly the effect of faculty supplementation can be observed in ourselves to a mild degree when we are listening to music or sitting in a Cinerama theater. What would happen if a more complete coupling were achieved between man and an artificial world, or between a person and more intense stimulation from his natural world?

This leads to another question: What faculties would have to be added to a monkey to make him react like a human being? For one thing, a monkey lacks the ability to formulate and recognize symbols. But he can learn a great deal. Conceivably, an electronic aid to symbol recognition or formulation might be provided for one of our simian friends, and he could be conditioned to use it, say, to recognize and indicate the letters of the alphabet. How much aid in grammar formulation and word categorization would we have to provide him (by means of a computer, perhaps) before he could begin to talk sensibly to us? Would this aid be less than that required by a computer operating alone?

The crux of the matter is undoubtedly in the coupling between external devices and animals. A device has to be more perfectly woven into our nervous system before we can begin to tap it as we naturally tap our other faculties. Also, some control, perhaps even a random control, must be provided, because if the extrasensing devices were not controllable they might assume the upper hand. Of course, in a movie we can shut our eyes, but more control would be necessary with extrasensing devices. If an electronic memory could be coupled into our brain we would have to have some means of scanning it in order to get at arbitrary information.

Before coupling of any higher degree of sophistication than that achieved in a stereophonic Cinerama theater can be achieved, a more thorough understanding must be had of the coding of signals

in the brain. Yet, if a person (or a monkey) were conditioned to substitute senses (as, for instance, if supersonic tones in a spectrum of frequencies were transduced into pinpricks along the spine) or coupled to a more perfect form of Cinerama, would he react normally under this greater degree of stimulation?

These speculations may perhaps seem fantastic, but in the light of the results of the Office of Naval Research experiment they must be given serious consideration.

ROBERT E. MUELLER

*Astro-Electronic Products Division,
Radio Corporation of America,
Princeton, New Jersey*

Phosphorus and Phytoplankton

In the article "Bound phosphorus and growth of phytoplankton," by Whitford and Phillips [*Science* **129**, 961 (1959)], the implication that phosphorus was not limiting because total phosphorus showed no correlation with phytoplankton pulses does not appear to be valid. Not only do the authors point out that total phosphorus varied with the rainfall but they acknowledge that the phytoplankton populations were low (and presumably, therefore, would require a relatively small amount of phosphorus). Also, and more significant, total phosphorus includes a galaxy of compounds, particulate and soluble, organic and inorganic, of which the only fraction now unequivocally known to be utilizable by algae is soluble orthophosphate. This fraction generally accounts for only about 10 percent of the total phosphorus in lakes, and even in the attempt to correlate this fraction with phytoplankton, the problem is complicated by the fact that certain plankton algae are known to be able to store up phosphate under conditions of plenty and to use this reserve for growth in times of phosphate deficiency. Therefore, any correlations observed between total phosphorus and phytoplankton are likely to be fortuitous, and any lack of correlation is likely to be without significance.

JOSEPH SHAPIRO

*Department of Zoology,
University of Washington, Seattle*

The criticism by Shapiro of our report is probably justified on the basis of data given. We believe, however, that our conclusions, which were based on data not adequately presented in the article, are valid. We are aware of the number and complexity of phosphorus compounds in natural aquatic habitats. Our analyses of total phosphorus were

(Continued on page 347)

Packard
TRI-CARB[®]
LIQUID SCINTILLATION
SPECTROMETERS

Precision . . .
Convenience . . .
Simplicity . . .

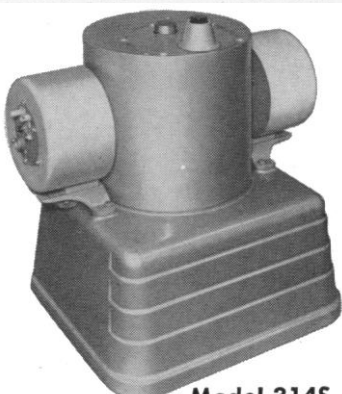
For Counting Tritium And Carbon-14



Model 314X

Automatic

Where considerable counting is done, the Model 314X Tri-Carb Spectrometer has proved invaluable in saving overall time and in utilizing laboratory personnel to better advantage. Completely automatic, it handles up to 100 samples and permanently records all data on paper tape. It can be operated around the clock without attendance.



Model 314S

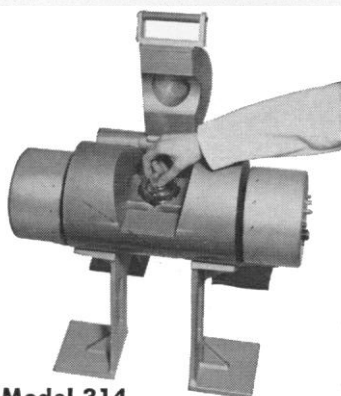
Semi-Automatic

For laboratories that anticipate increased counting in the foreseeable future, Model 314S provides efficient handling of present requirements, plus easy conversion to fully automatic operation at moderate cost. This can be done at any time simply by adding the 100-sample turntable, digital printer and the transistorized automatic control cabinet.

Manual

Model 314 is for laboratories not anticipating increased counting in the near future. Even this model, however, can be converted to fully automatic operation, if and when required. This is done by replacing the manual with the automatic sample chamber and shield and by adding the digital printer and transistorized automatic control cabinet.

All three models offer *all* the advantages of the Tri-Carb Liquid Scintillation Method for counting alpha- and beta-emitting isotopes: *sensitivity, versatility, simplicity of operation and ease of sample preparation.*



Model 314



For detailed information on the Tri-Carb Liquid Scintillation Method and specifications on Tri-Carb Spectrometers request latest bulletin.

Packard

Instrument Company, Inc.

DEPT. A • P.O. BOX 428 • LA GRANGE, ILLINOIS
 San Francisco • Chicago • New York

Kodak reports on:

why it pays to be patient with the scientific mind . . . clear, competitive vision in the 2-8 μ region of the infrared . . . before and after yogurt

Color film, fast but good

Has anything big come out of the Kodak Research Laboratories lately? Sure—Kodak High Speed Ektachrome Film,

now on sale at thousands of film counters in 20-exposure 135 magazines,

an outcome worth all the soothing of temperaments, all the technical conferences, all the writing and reading of reports,

a film with an Exposure Index of 160 in Daylight Type and 125 in the Type B (for 3200°K),

admitting no impairment of definition in return for speed,

asking little more light than fast black-and-white film in return for full color, in slides that look right even if the photographer has not fussed much about the frigidity of his film storage cabinet or the color balance of his illumination,

and awfully near right at twice the official Exposure Index with three minutes more in the first developer.

Your dealer can arrange to have this film processed by Kodak or any other laboratory offering this service. You can also do it yourself with the Kodak Ektachrome Processing Kit, Process E-2, Improved Type.

"Irtan"—ask for it by name

By dint of perseverance, knowledge, inspiration, judgment, experience, ambition, ingenuity, and the concentrated power of many clear heads and skillful hands, we have learned how to mold, grind, and polish a certain substance to make rugged, optically precise windows and domes that transmit efficiently the 2-8 μ region of the infrared.

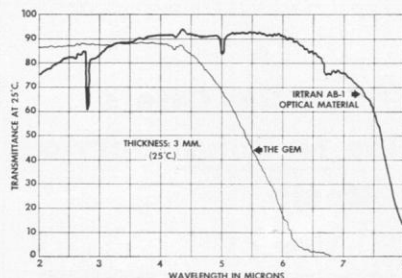
Around this whole package of technology we put a convenient string and tag it with a new trademark, "Irtan." Immediately—so robust is the American economy—we find ourselves in competition with some excellent fellows who also possess the above-named qualities and who make a most excellent infrared-transmitting optical material—a gem, synthetic but true, with a gem's name. To spell that name out would be as unmannerly as it is unnecessary for those caught up with

infrared-actuated swords and plowshares.

Rather, we want such cognoscenti to spell out Kodak Irtan Optics, Type AB-1.

They cost a lot less than the gem makers have a right to ask.

They see clearly through the 3-5.5 μ windows of the atmosphere.



They stay clear to at least 800°C instead of permitting Herr Kirchhoff's law to blind them by their own emissivity.

They have a refractive index of only 1.301 at 6.7 μ , paying scant tribute to M. Fresnel's celebrated equation about reflection losses.

They survive all the high temperature, thermal shock, weathering, humidity, and abrasion that the current tests for swords require.

Type AB-1 is only the beginning of the Irtan business, we suspect. Quartz was fine when lead sulfide was the practical detector; PbS quits at 4 μ . Now the longer wavelength sensitivity of cooled lead selenide, lead telluride, and indium antimonide has outrun the transparency of good old quartz. Soon the boys will be banging on the 8 to 13 μ window of the atmosphere. For lenses with optical power they'll want infrared-transmitting material of higher refractive index. Type AB-1 may be only the beginning.

With what excitement the specifications for us to quote on will be drawn up and shot off to Eastman Kodak Company, Special Products Division, Rochester 4, N. Y.!

Acido orotico

Around the turn of the century it was brought to the world's attention that the inhabitants of certain Bulgarian villages were a) living to ripe old ages and b) consuming vast quantities of

the ripe old fermentation products of the local dairying. Echoes of this coincidence have rumbled forth at intervals since.

In the twenties a certain elderly biochemist who had seen much importance in the correlation was a celebrated figure of Paris. In the thirties American milk wagons were bedizened with signs advertising a certain brand of fermented milk. In the forties the word "yogurt" entered the vocabulary of the American intelligentsia. With the dawn of the fifties, the Journal of the American Chemical Society (72, 2312) reported that certain strains of *Lactobacillus bulgaricus* thrive when supplied with 6-carboxyuracil, a substance first synthesized in 1897 for academic exercise and later shown to be identical with orotic acid. This name was derived from *ορος*, whey, by two Italians who had encountered the substance while making lactose from milk whey liquors.

The flowering of biochemical sophistication in the mid-fifties has excited a deeper curiosity about orotic acid. To some it looks like a significant intermediate in the process by which living organisms fabricate nucleotides for their DNA—the stuff of genes—out of the amino acids at their disposal. This is big talk.

In Italy interest in *acido orotico* has been rekindled to a small-scale frenzy. At the University of Urbino last June a colloquium on pyrimidines (*Acta Vitaminologica*, 12, 195-328) devoted much of its attention to the compound. One man claimed his evidence showed that a dietary deficiency of orotic acid affects pregnancy, lactation, and growth in the rat, that it is a vitamin-like factor essential for the survival of the newborn. One senses the closing of a circle.

If we had not been invited to quote on 100 kilos of Orotic Acid recently, we might not have looked up all this lore. We didn't get the order, but in trying we made enough of it to stock as Eastman 7784 (along with 2-Thioorotic Acid, Eastman 7783) for the convenience of biochemical investigators. Anybody who wants to sell it from milk trucks is strictly on his own.

We have some 3700 Eastman Organic Chemicals to worry about. Catalog on request from Distillation Products Industries, Rochester 3, N. Y. (Division of Eastman Kodak Company).

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

Kodak
TRADE MARK

Meetings

Contamination of the Moon

A committee to consider the implications of contamination of the moon and planets by extraterrestrial exploration (CETEX) was established by the International Council of Scientific Unions (ICSU) in March 1958 and held its first meeting two months later in The Hague. On the basis of two days of discussions, CETEX decided that there is a real pos-

sibility that exploration experiments could contaminate the moon or the planets in such a way that other experiments, particularly biological, would be made impossible. The dangers of such contaminations, and steps to avoid them, were pointed out in the report of CETEX [*Science* 128, 887 (1958)] which was accepted by ICSU at its general meeting in Washington in October 1958. In addition, the parent organization asked CETEX to meet for a second time, with the help of appropriate technical experts, to draw up a code of con-

duct for space research and to suggest the correct sequence of experiments of different types.

The second meeting was held at The Hague 9-10 March 1959, the following members being present: M. Florkin, convener (Belgium); P. Alexander (Great Britain); J. Bartels (Germany); W. O. Fenn (U.S.); D. J. Hughes (U.S.); J. Roche (France); and J. Röscher (France).

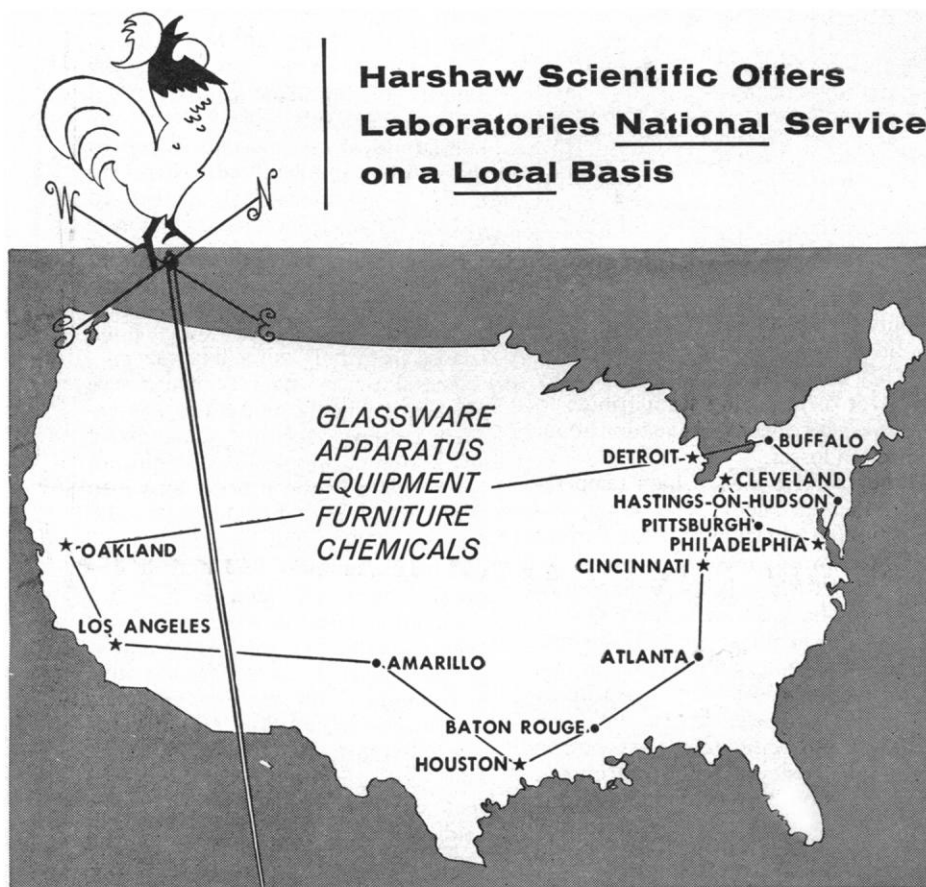
It was impossible for CETEX to prepare a detailed sequence of space experiments, principally because of the short time interval between its two meetings and the complexity of the problems involved. Instead, it drew up some general principles governing space exploration that could serve as suggestions to COSPAR, the newly organized space research committee of ICSU, which presumably will include the work that CETEX has begun. These general principles are given below. Although the first report of CETEX was considered in detail at the second meeting, primarily only minor changes of a technical nature were made in it. The committee reaffirmed its position that the presence of life of any type on the moon is extremely unlikely and decided, as well, that the possibility that free radicals in explosive amounts exist on the moon is remote. A suggestion was added to the report that methods for sterilization of rockets be developed as rapidly as possible, and that sterilization be instituted as a standard procedure.

The general principles governing space research drawn up at the meeting are as follows.

"1) Space research offers a challenge and opportunities which should appeal to the most imaginative minds. The greatest encouragement must be given to novel and unconventional approaches and no proposal should be sanctioned which would hamper the experimenters' freedom of action unless there are compelling reasons. On the other hand, equally imaginative thinking is required when considering possible complications which can follow a particular type of experiment. Surprises are certain and unlikely possibilities must be borne in mind when dealing with the problem of contamination, which is better defined as the problem of reducing the risk whereby one experiment may spoil the situation for other subsequent enquiries. The question of deciding whether such a conflict is likely to arise can best be dealt with by a committee or working group engaged in planning, or advising on scientific experiments.

"2) Ideally scientists should be asked to inform COSPAR as early as possible of each space experiment which is envisaged and of the methods to be used in its execution. The broadly based committee of COSPAR containing scientists

Harshaw Scientific Offers Laboratories National Service on a Local Basis



BRANCHES ★

CLEVELAND 6, OHIO
1945 East 97th Street
Tel. VULcan 3-2424

CINCINNATI 13, OHIO
6265 Wiehe Rd.
Tel. REdwood 1-9100

DETROIT 28, MICHIGAN
9240 Hubbell Avenue
Tel. VERmont 6-6300

HOUSTON 11, TEXAS
6622 Supply Row
Tel. WALnut 3-1627

LOS ANGELES 22, CALIFORNIA
3237 So. Garfield Ave.
Tel. RAYmond 3-3161

OAKLAND 1, CALIFORNIA
5321 E. 8th Street
Tel. KELlogg 3-9169

PHILADELPHIA 48, PA.
Jackson & Swanson Sts.
Tel. HOWard 2-4700

SALES OFFICES ●

AMARILLO, TEXAS, 3409 S. Jackson Street, Tel. DRake 4-9948 • ATLANTA 5, GEORGIA, 3130 Maple Drive, N.E., Tel. CEDar 7-1626 • BATON ROUGE 6, LOUISIANA, 3160 Florida Street, Doherty Building, Room 103, Tel. DICKens 3-1933 • BUFFALO 2, NEW YORK, 260 Delaware Avenue, Tel. GARfield 9200 • HASTINGS-ON-HUDSON 6 NEW YORK, Tel. LORraine 2-6250 • PITTSBURGH 22, PENNSYLVANIA, 505 Bessemer Building, Tel. ATLantic 1-6668

Our Branch Warehouses and Sales Offices are strategically located to serve you. Select the one nearest you and contact them today. Our combined stock, which is probably the largest in the country, is at your disposal regardless of where it is located. Tell us what you need. We'll get it to you, *when you need it*.

Harshaw Scientific, Division of The Harshaw Chemical Company is unique among laboratory supply houses. We know what laboratories require since our company employs several hundred chemists, scientists, engineers and technicians in its many research, development and control laboratories and we stock accordingly...Glassware - Apparatus - Equipment - Furniture - Chemicals

HARSHAW SCIENTIFIC

Division of the Harshaw Chemical Company
Cleveland 6, Ohio

NEW! 1959 Edition CHART OF THE ATOMS

Chart and 48-page Key Booklet both completely revised. New type faces for maximum legibility. Lithographed in six colors. LATEST OFFICIAL DATA ON ALL 102 ELEMENTS THROUGH NOBELIUM. Prepared under the editorial supervision of DR. WILLIAM F. MEGGERS, National Bureau of Standards.

PERIODIC CHART OF THE ATOMS

Electronic The Atoms Grouped According to the Number of Outer [Valence] Electrons Planetary electrons in the completed shells

1 2 3 4 5 6 7

1 H 2 He 3 Li 4 Be 5 B 6 C 7 N 8 O 9 F 10 Ne 11 Na 12 Mg 13 Al 14 Si 15 P 16 S 17 Cl 18 Ar 19 K 20 Ca 21 Sc 22 Ti 23 V 24 Cr 25 Mn 26 Fe 27 Co 28 Ni 29 Cu 30 Zn 31 Ga 32 Ge 33 As 34 Se 35 Br 36 Kr 37 Rb 38 Sr 39 Y 40 Zr 41 Nb 42 Mo 43 Tc 44 Ru 45 Rh 46 Pd 47 Ag 48 Cd 49 In 50 Sn 51 Sb 52 Te 53 I 54 Xe 55 Ba 56 La 57 Ce 58 Pr 59 Nd 60 Pm 61 Sm 62 Eu 63 Gd 64 Tb 65 Dy 66 Ho 67 Er 68 Tm 69 Yb 70 Lu 71 72 Hf 73 Ta 74 W 75 Re 76 Os 77 Ir 78 Pt 79 Au 80 Hg 81 Tl 82 Pb 83 Bi 84 Po 85 At 86 Rn 87 Fr 88 Ra 89 Ac 90 Th 91 Pa 92 U 93 Np 94 Pu 95 Am 96 Cm 97 Bk 98 Cf 99 Es 100 Fm 101 Md 102 No

W. M. Welch Manufacturing Company

W. M. WELCH SCIENTIFIC COMPANY

DIVISION OF W. M. WELCH MANUFACTURING COMPANY

ESTABLISHED 1880

1515 Sedgwick Street, Dept. E, Chicago 10, Illinois, U.S.A.

No. 4854

The Periodic Chart of the Atoms, published exclusively by Welch, is recognized throughout the world as a most authoritative and comprehensive presentation of the principal facts about all known atoms, including artificial transuranic elements recently manufactured.

Its information is sufficiently detailed to serve the most advanced workers in atomic physics, yet it presents basic facts clearly to students of elementary high school chemistry and physics. The characteristics most used in elementary classes, such as the Atomic Number, the Atomic Weight, and the Symbol of each element are in large display type, the rest being less prominent. Its organization is such that the student is constantly made to visualize each characteristic in its proper place with respect to the whole picture of atomic structure.

The chart is beautifully lithographed in six colors on heavy chart paper coated with a plastic film especially treated to prevent glare. The atomic number is black, the atomic weight red. Other color differentiations make the symbols easily distinguished and their meaning clear.

4854A. CHART OF THE ATOMS, 1959 Edition.

Mounted on a spring roller within a metal case, suitable for permanent wall mounting, non-glare protective coated, and with Key booklet. Each, \$15.00

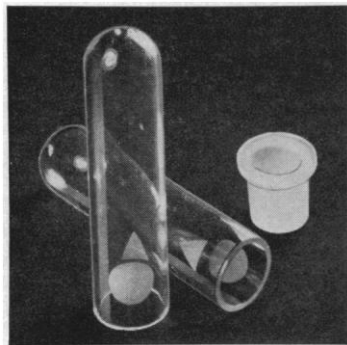
4854. CHART OF THE ATOMS, 1959 Edition.

With formed-metal chart molding at top and bottom with eyelets for hanging, non-glare protective coating, and Key booklet. Each, \$7.50

4858. KEY. For Chart of the Atoms.

Many students want their personal copy of the key booklet for further study and review. Teachers often make the study of the key a class project or the subject of special reports.

Each, \$1.00
Per Dozen, \$9.00 Lot of 100, \$65.00



LOW COST / ALOE U-V CUVETTES

ROUND / MATCHED / ULTRAVIOLET TRANSMITTING

For use with
Beckman DU Spectrophotometers

Available for the first time, these low cost, Aloe, ultraviolet transmitting, round cuvettes offer distinct advantages to all educational, industrial and other research laboratories. Multiple problem of low cost, accurate U-V cuvettes now solved with these round, matched cuvettes. Proven in laboratory use over a year. No unusual etching noted when 4 normal acid or alkali concentrations were allowed to stand for as long as two hours.

They compare most favorably in accuracy, to say nothing of cost, with conventional square "quartz" cuvettes in the 235-340 mu range where 95% of all U-V measurements are made.

74147A — Aloe U-V Cuvettes, round, set of 4, matched to tolerance of 1/2% T.....\$20.00

74147B — Aloe U-V Cuvettes, round, set of 12, matched to tolerance of 1% T.....\$24.00

Accessories:

Precision Molded Adapter — holds cuvettes in firm position.

74217F — Aloe U-V Cuvette Adapter, Each.....\$5.00

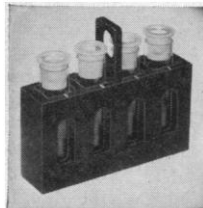
74217E — Aloe U-V Cuvette Adapter with matched set of 4 cuvettes.....\$25.00

Aloe U-V Cuvette Adapter Carriage — precision made, yet versatile.

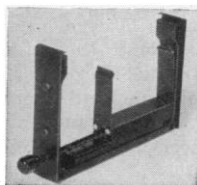
74217D — Aloe U-V Cuvette Adapter Carriage, Each.....\$32.00

74147B

74217E



74217D

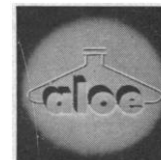


Direct your order or request for additional information to:

aloe scientific 5655 Kingsbury, St. Louis 12, Mo.

DIVISION OF THE BRUNSWICK-BALKE-COLLENDER COMPANY

FULLY STOCKED DIVISIONS COAST-TO-COAST



PhDs for ASW

(antisubmarine warfare)

Fine minds are needed to develop defenses against missile-firing subs.

Chance Vought — a widely diversified company active in both research and development, with current ASW study contracts — has five key openings for PhDs:

Physicist, Chemist, or Electronics Engineer to perform theoretical analyses of physical phenomena resulting from the interaction of a submarine and its environment; to propose and execute laboratory and field experiments to confirm theory.

Physicist to conduct theoretical, laboratory and field investigations of acoustical sources, signatures, propagation, detection and analysis. Desired: research experience in sonar, sonobuoys, transducers and data processing.

Physicist (Geophysicist) to develop devices for measurement of natural and induced emanations and effects from a submarine arising from mechanical, electromagnetic, electrochemical, nuclear biological and gravitational interactions.

Physicist or Electronics Engineer to investigate electromagnetic propagation in diverse media in all frequency bands; to describe propagation modes in presence of anomalies and various states of the sea.

Mathematician to analyze complex problems in defining various theoretical models; to apply mathematical analyses in areas of stochastic processes, time series, and information theory to the detection of signals in a noise background.

Each of these five key positions offers a stimulating scientific challenge with salary to match. Write in complete confidence to:

DR. J. F. REAGAN
Dept. MS-1



AERONAUTICS • ASTRONAUTICS • RESEARCH
ELECTRONICS • RANGE SYSTEMS

from all disciplines may be able to see much more clearly than the space research specialists possible conflicts introduced by such experiments and may be able to suggest ways of overcoming these difficulties.

"3) There are a number of obvious and necessary experiments which are bound to be done and here the COSPAR working group dealing with experiments may be able to suggest priorities. While it may not be possible to avoid all types of contamination a proper sequence can ensure that the collection of data is not thereby hindered. For example CETEX recommends positively that no 'soft' landing, which requires the release of large quantities of gases, should be made on the moon until experiments have been successfully carried out—or at least all reasonable attempts made—to determine the nature of the moon's atmosphere.

"4) In view of the great uncertainties which face space research all operations which are not capable of conveying meaningful scientific data are to be discouraged even if they do not appear to carry with them a known source of contamination. Risks with the unexpected must be taken as otherwise no space exploration is possible but such risks must be justified by the scientific content of the experiment."

DONALD J. HUGHES
Brookhaven National Laboratory,
Upton, Long Island, New York

Forthcoming Events

September

1-3. Association for Computing Machinery, natl., Cambridge, Mass. (J. Moshman, Council for Economic and Industry Research, Inc., 1200 Jefferson Davis Highway, Arlington 2, Va.)

1-6. College of American Pathologists, Chicago, Ill. (A. H. Dearing, Suite 2115 Prudential Plaza, Chicago 1.)

1-7. History and Philosophy of Science (General Assembly, History Div., Intern. Union of the History and Philosophy of Science), Barcelona, Spain. (R. Taton, IUHPS, 64, rue Gay-Lussac, Paris 5^e.)

1-8. Acoustics, 3rd intern. cong., Stuttgart, Germany. (E. Zwicker, Breitscheidstrasse 3, Stuttgart N.)

1-7 Oct. International Civil Aviation Organization (Meteorological Div.), Montreal, Canada. (ICAO, Maison de l'Aviation Internationale, Montreal.)

2-4. Allergy, 4th European cong., London, England. (British Assoc. of Allergists, Wright-Fleming Inst., St. Mary's Hospital, London, W.2.)

2-4. Cryogenic Engineering Conf., Berkeley, Calif. (K. D. Timmerhaus, CEC, Chemical Engineering Dept., Univ. of Colorado, Boulder.)

2-4. Crystal Imperfections and the Chemical Reactivity of Solids (Faraday discussion), Kingston, Ontario, Canada. (Faraday Soc., 6 Gray's Inn Sq., London, W.C.1, England.)

2-5. American Mathematical Soc. and Mathematical Assoc. of America (joint summer), Salt Lake City, Utah. (E. Pitcher, AMS, Lehigh Univ., Bethlehem, Pa.)

2-8. Foundations of Mathematics: Infinitistic Methods, symp., Warsaw, Poland. (A. Mostowski, Dept. of Mathematics, Univ. of California, Berkeley 4.)

2-9. British Assoc. for the Advancement of Science, 121st annual, York, England. (Secretary, BAAS, 18 Adam St., Adelphi, London, W.C.2, England.)

3-4. Magnesium in Agriculture, symp., Morgantown, W. Va. (D. J. Horvath, Dept. of Animal Husbandry, West Virginia Univ., Morgantown.)

3-5. Nephrology, 1st intern. cong., Geneva, Switzerland, and Evian, France. (G. Richet, Hospital Necker, 149, rue de Sevres, Paris 7^e, France.)

3-6. American Sociological Soc., natl., Chicago, Ill. (D. Young, Russell Sage Foundation, New York 22.)

3-9. American Psychological Assoc., annual conv., Cincinnati, Ohio. (R. W. Russell, APA, 1333 16 St., NW, Washington 6.)

4-7. International Federation of Surveyors, annual (by invitation), Gracow, Australia. (IFS, 4, Kanaalweg, Delft, Netherlands.)

5-12. Application of Radiation Sources in Industry, intern. conf., Warsaw, Poland. (P. Fent, IAEA, Vienna, Austria.)

6-12. Standards on a Common Language for Machine Searching and Translation, intern. conf., Cleveland, Ohio. (Secretariat, Center for Documentation and Communication Research, Western Research Univ., Cleveland 6.)

6-12. World Confederation for Physiotherapy, 3rd intern. cong., Paris, France. (A. Nicolle and J. Dupuis-Deltor, Société d'Organisation des Congrès Français et Internationaux, 1, rue Chanez, Paris 16^e.)

7-9. Psychometric Soc., Cincinnati, Ohio. (P. H. DuBois, Washington Univ., St. Louis 5, Mo.)

7-9. Society of General Physiologists, Urbana, Ill. (F. G. Sherman, Dept. of Biology, Brown Univ., Providence 12.)

7-10. Institute of Management Sciences, Paris, France. (A. S. Manne, Dept. of Economics, Yale Univ., New Haven, Conn.)

7-11. American Soc. of Clinical Pathologists, Chicago, Ill. (C. E. Wells, 2052 N. Orleans, Chicago 14.)

7-11. Illuminating Engineering Soc., annual natl. conf., San Francisco, Calif. (A. D. Hinckley, IES, 1860 Broadway, New York 36.)

7-12. European Soc. of Haematology, cong., London, England. (E. Neumark, Dept. of Pathology, St. Mary's Hospital, London, W.2.)

7-12. World Medical Assoc., 13th general assembly, Montreal, Canada. (WMA, 10 Columbus Circle, New York 19.)

8-15. Sociology, 4th world cong., Milan and Stresa, Italy. (Intern. Sociological Assoc., Skepper House, 13 Endsleigh St., London, W.C.1, England.)

9-10. Air Pollution, 2nd intern. cong., New York, N.Y. (American Soc. for Mechanical Engineers, 29 W. 39 St., New York 18.)

(See issue of 19 June for comprehensive list)

New Products

The information reported here is obtained from manufacturers and from other sources considered to be reliable, and it reflects the claims of the manufacturer or other source. Neither Science nor the writer assumes responsibility for the accuracy of the information. A coupon for use in making inquiries concerning the items listed appears on page 350.

■ **IONIZATION GAGE** achieves linearity over a wide operating range by enclosure of the ionization region with a grid-like end covering that prevents straying of ions. Range of the gage for accurate measurements is said to be 10^{-10} mm-Hg with direct readings possible down to 10^{-12} mm-Hg. Flash filament technique permits estimation of partial pressures of adsorbable gases to 10^{-12} mm-Hg. Full-scale ranges from 0-to- 10^{-3} to 0-to- 10^{-10} mm-Hg are selectable. (N. R. C. Equipment Corp., Dept. 954)

■ **PULSE-HEIGHT ANALYZER** uses a ferrite-core memory system to store information in 400 channels. Capacity per channel is 65,545 counts. Linearity is better than 0.5 percent. Average dead time is 120 μ sec. Maximum input counting rate without distortion or shift of data is greater than 5×10^6 count/min. Features include automatic print-out, memory subgrouping, and external programming. (Radiation Instrument Development Laboratory, Inc., Dept. 955)

■ **ELECTRIC BENCH FURNACE** for continuous operation at 1900°F and intermittent duty to 2100°F is said to achieve unusual compactness and efficiency by use of fibrous potassium titanate for insulation. One model with chamber volume 222 in.³ has an over-all volume of 1160 in.³; heat-up time 25 min from 70° to 1830°F ; power consumption to hold at 1900°F , 580 w; and case temperature 260°F for inside temperature 1920°F . Weight is 17 lb. (Electric Hotpack Co., Dept. 957)

■ **VISCOMETER** of rotating cone type provides a constant rate of shear adjustable from 2 to 20,000/sec by a ten-turn potentiometer. Three models are available for maximum sample temperatures 30° , 100° , and 200°C . Speed is indicated directly, and full torque is available at all speeds. Gap is reproducible within ± 0.0001 in. Three cone diameters and three torque springs provide a wide range of viscosity. (Ferranti Electric Inc., Dept. 958)

■ **ANALOG COMPUTING COMPONENT** accepts three variable inputs e_1 , e_2 , e_3 , and provides as output e_1e_2/e_3 . Accuracy as a multiplier, including drift, is said to be better than ± 0.1 v in all four quadrants. A three-digit decade provides an adjustable voltage which serves as an adjustable scale factor for opera-



Roland Gohlke, Dow Chemical Company engineer, using Bendix Mass Spectrometer to identify compounds emerging from a gas chromatograph.

NOW BENDIX* TIME-OF-FLIGHT MASS SPECTROMETER RECORDS MASS SPECTRA

The ability to record either mass spectra or mass ratios further widens the versatility of the Bendix Mass Spectrometer. The speed and ease of using this new Analog Output System are illustrated by the following example:

During a recent routine analysis performed at our Research Laboratories Division, one hundred mass spectra were recorded on a direct writing recorder in less than two hours. These were the mass spectra

of the eluted components of a mixture being separated by a gas chromatograph and fed continuously into the Bendix Spectrometer for identification.

For complete details contact the Cincinnati Division, Dept. E6-5, 3130 Wasson Road, Cincinnati 8, Ohio. Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y. Canada: Computing Devices of Canada, Ltd., Box 508, Ottawa 4, Ontario.

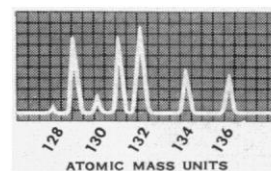
*TRADEMARK

APPLICATIONS

- Chromatograph output identification.
- Molecular beam analysis, including solids' analysis and high temperature research.
- Fast reaction studies such as rocket exhaust analysis.
- Analysis of ions created outside the mass spectrometer.
- Negative ion studies.
- Simple, rapid analysis.

FEATURES

- **RUGGED**—The Dow Chemical Company experienced only $\frac{1}{2}$ of one percent downtime for maintenance during the first six months of operation.
- **FAST**—10,000 mass spectra per second.
- **HIGH RESOLUTION**—Usable adjacent mass resolution beyond 500 a.m.u.
- **VARIOUS OUTPUTS**—Oscilloscope used alone or in combination with ion pulse counting or recording outputs.



Oscillogram of xenon spectrum.

- **WIDE MASS RANGE**—Each spectrum covers 1 through 4000 a.m.u.
- **SIMPLE, OPEN CONSTRUCTION**—Permits easy modification for special problems.
- **ALUMINUM GASKETS, HIGH TEMPERATURE FEEDTHROUGHS**—Permit effective bakeout.

Cincinnati Division

CINCINNATI, OHIO



tions involving only two variables. Dynamic response may be set, for example, to give less than 1-deg phase shift at 1 kcy/sec or 3 db attenuation at 14 kcy/sec. Standard range of inputs and outputs is ± 50 v. No external equipment is necessary to obtain products, ratios, squares, square roots, or absolute values. (George A. Philbrick Researchers, Inc., Dept. 962)

■ **VOLTAGE MONITORING DEVICES** are available as indicators and relays. The indicator is an expanded-scale instrument graduated in arbitrary units and said to be accurate at the point monitored to ± 0.25 percent for d-c and ± 0.5 percent for a-c. Trip-point accuracy of the relay is claimed to be within ± 0.25 percent for d-c and ± 0.5 percent for a-c. A response delay of 75 msec is standard, but delay as high as 2 sec can be provided. (Voltron Products, Dept. 959)

■ **DIGITAL MICROMETER** scans up to 99 gaging points and prints dimensional data with accuracy ± 0.0001 in. and identification number. Operation can be manual, semiautomatic, or completely synchronized with manufacturing and inspection processes. Optional outputs include digital display, card-punch input, or alarm. (Daytronic Corp., Dept. 969)

■ **OSCILLOGRAPH** records a laterally undulating track on a narrow plastic tape. The track is optically projected within the instrument to produce an enlarged image on its viewing screen. No processing is required. The tape is loaded into the instrument on 3-in. reels. According to the manufacturer, frequency response for direct recording is from d-c to 5000 cy/sec. A magnetic memory unit will be available as an accessory to permit higher frequencies to be recorded. A pickup head to permit playback of the record will also be available. (Microsound Inc., Dept. 967)

■ **VOLTAGE REFERENCE** uses a silicon diode element to provide output reference voltage either 8.4 or 16.8 v d-c. Voltage regulation is ± 0.01 percent for ± 10 percent line voltage variation. Temperature coefficient is ± 0.001 percent/ $^{\circ}\text{C}$ from -55° to $+100^{\circ}\text{C}$. Units are available for a-c or d-c operation. Output ripple of a-c types is less than 0.004 percent. (International Rectifier Corp., Dept. 964)

■ **DEW-DURATION RECORDER** uses a sensitive element of goldbeater's skin said to be unaffected by relative humidity conditions and to respond only to actual water deposition. The instrument is designed to be placed between rows of

plants and is made of noncorroding materials. Recording is said to start and cease within 5 min of the appearance or disappearance of visible dew on foliage. The waxed-paper chart is driven by a spring clock at 1 rev/day for 7 days. (American Instrument Co., Dept. 960)

■ **ALPHANUMERIC PRINTER** accepts digital data from digitizers, magnetic or perforated tape, and electronic counters or computers and prints out at rates up to 48,000 digits per second. For logging digitized data from a series of analog-to-digital converters a scan and print-out rate of 200 three-digit numbers is said to be realizable. Up to 63 characters are available. Printing is on multiple-copy fanfold paper; up to four copies can be made. (Potter Instrument Co., Dept. 966)

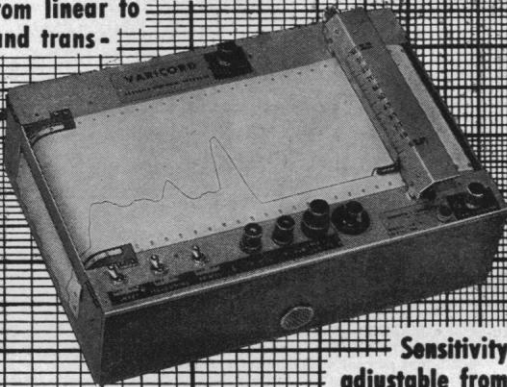
■ **PROGRAMER** is a 13-channel tape device giving a program duration of 10.6 min at a tape transport speed of 3 in./sec. Designed to control up to 13 functions simultaneously, it provides electrical pulses at predetermined intervals. Pulses are produced by a brush which senses slots punched in 35-mm insulating tape. (Beattie-Coleman Inc., Dept. 961)

JOSHUA STERN

National Bureau of Standards
Washington, D.C.

VARICORD
VARIABLE-RESPONSE RECORDER
for densitometry in paper electrophoresis

Recording function electrically adjustable from linear to logarithmic and trans-logarithmic



Sensitivity adjustable from 10 to 200 millivolts

Designed specifically to be used with scanning densitometers for correctly-compensated quantitative evaluation of electrophoretic patterns on filter paper

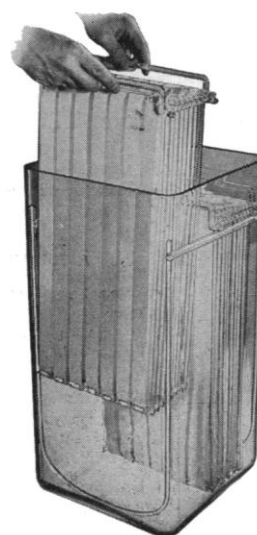
Write for Bulletin #1100

Also: Densitometers pH Meters Colorimeters Fluorescence Meters Electronic Photometers Multiplier Photometers

PHOTOVOLT CORP.
95 Madison Ave. New York 16, N. Y.

FOR PAPER CHROMATOGRAPHY— A NEW & SIMPLE METHOD OF CHROMATOGRAPHING PAPER STRIPS

The New Kurtz-Miramón Technique



...permits chromatographing large numbers of paper strips at one time in a small space.

...eliminates fumbling with dangling, wet paper strips.

...prevents papers from touching or rubbing together while being developed, washed, sprayed, and dried.

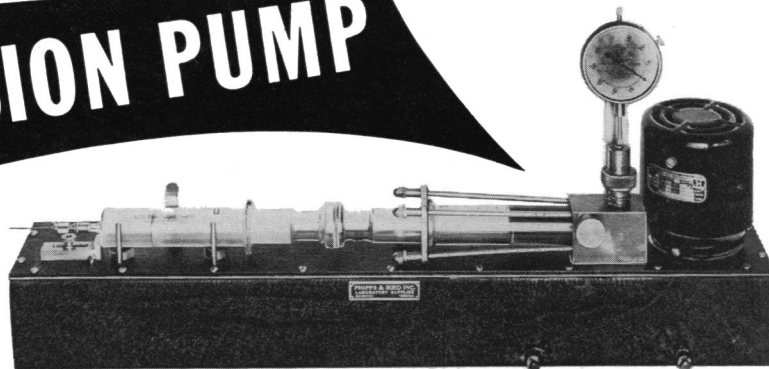
...eliminates use of anchor and anti-siphon rods.

...utilizes all-glass apparatus.

Write for Brochure SK

CALIFORNIA LABORATORY EQUIPMENT CO.
98 Rincon Road • Berkeley 4, California

Bird INFUSION PUMP



This pump is used for metering accurately and continuously small quantities of liquid which do not react with glass. It consists of three units; a motor-driven, hydraulic, adjustable metering pump; a hydraulic operated driving plunger, and delivery syringe. This rate of liquid delivery is easily adjusted. A reference dial indicating gauge shows the setting of the pre-determined rate of delivery. Its readings may be translated, approximately by the graph furnished, into volume delivered per minute. The rate can be accurately read to a hundredth of a cc. per minute. In addition,

the rate of flow may be adjusted continuously from .01 cc. to a maximum of 2.5 cc. per minute. And this rate may be changed, if desired, without stopping the pump. Complete with 50 cc. standard glass syringe for operation on 115 V. 60 C., A.C. only.

CAT. NO. 71-049

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

SCIENTISTS and ENGINEERS GOVERNMENT and NON-GOVERNMENT

SAVE UP TO \$30 OF EVERY \$100

THAT YOU SPEND ON Auto Insurance



IMPORTANT NEWS FROM GEICO

If you are in Non-Government employment in a technical or professional capacity, you are now entitled to the same guaranteed savings on auto insurance that government employees have enjoyed for 22 years.

Standard Family Policy. You get the Standard Family Auto Policy, the same policy used by nearly all leading insurance companies.

Personal 24-Hour Claim Service. Your GEICO claim representatives stand ready to help you day and night—24 hours a day. Settlements are prompt and fair without red tape.

819 Claim Representatives, Coast-to-Coast, to serve you wherever you drive in the U. S., its possessions, and Canada.

Satisfies All Laws. Your GEICO policy can comply with all Financial Responsibility Laws and the compulsory insurance requirements in New York and North Carolina.

Guaranteed Savings. You save a full 30% on Collision coverage—as much as 30% on Comprehensive coverage and 25% on Liability coverage. Average country-wide savings for all auto insurance coverages is 25%.*

GEICO rates are on file with state insurance regulatory authorities and are guaranteed by GEICO to represent above savings from Bureau Rates.

Pay In Installments if you wish. Over 550,000 Policyholders—97% renew their expiring policies every year.

*In Texas where rates prescribed by the State Board of Insurance must be charged, dividends up to 30% are being paid on currently expiring policies.

Here Is How GEICO Can Offer You Such Big Savings

GEICO'S "direct-to-the-policyholder" sales system successfully eliminates the major expenses of the customary method of selling insurance. GEICO insures only drivers in "preferred risk" occupational groups—that is, careful drivers who are entitled to preferred rates.

MAIL COUPON TODAY FOR YOUR EXACT RATE
NO OBLIGATION • NO AGENT WILL CALL

Must Be Over
Age 21 and
Under 65

Name..... 111

Residence Address.....

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

Age..... ☐ Single ☐ Married ☐ Male ☐ Female

Occupation.....

Location of Car (if different from residence address).....

Is car principally kept and used on a farm or ranch?.....

Yr.	Make	Model (Dlx., etc.)	Cyl.	Body Style	Purchase Date	☐ New
					Mo. Yr.	☐ Used

1. (a) Days per week car driven to work?..... One way distance is.....miles.
(b) Is car used in any occupation or business? (Excluding to and from work)
☐ Yes ☐ No

2. Additional male drivers under age 25 in household at present time:

Age	Relation	Married or Single	% of Use

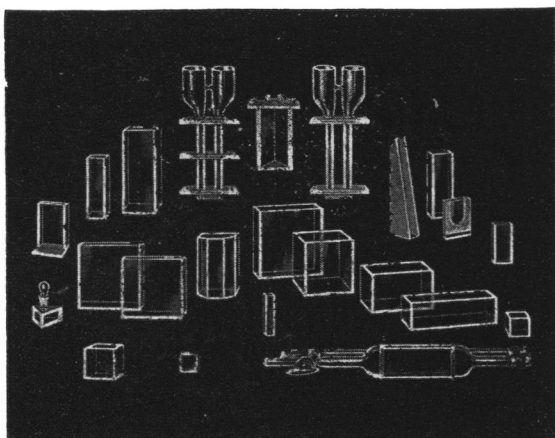


GOVERNMENT EMPLOYEES INSURANCE COMPANY

Capital Stock Company not affiliated with U. S. Government
WASHINGTON 5, D. C.

GOVERNMENT EMPLOYEES INSURANCE CO.
Government Employees Insurance Bldg., Washington 5, D. C.

GLASS ABSORPTION CELLS made by **KLETT**



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

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

The Latest ANNUAL REVIEWS

PSYCHOLOGY
Vol. 10 (Jan. 59)

PLANT PHYSIOLOGY
Vol. 10 (June 59)

ENTOMOLOGY
Vol. 4 (Feb. 59)

BIOCHEMISTRY
Vol. 28 (July 59)

PHYSIOLOGY
Vol. 21 (Mar. 59)

PHYSICAL CHEMISTRY
Vol. 9 (Sept. 58)

MEDICINE
Vol. 10 (May 59)

MICROBIOLOGY
Vol. 12 (Oct. 58)

NUCLEAR SCIENCE
Vol. 8 (Dec. 58)

Most Back Volumes also available

\$7.00 postpaid (U.S.A.) ; \$7.50 postpaid (elsewhere)

ANNUAL REVIEWS, INC.
Grant Avenue, Palo Alto, California

Dried Firefly Lanterns



...for a simple, specific and accurate assay of **ATP** in a mixture with other compounds. The determination is based on a linear luminescence response when ATP is added to an extract of firefly lanterns.

It is also applicable to the quantitative measurement of other compounds or reactions involving ATP stoichiometrically.

REFERENCES

Strehler, B. L. and Totter, J. R.; *Methods of Biochemical Analysis*, Vol. 1, page 341. Editor, David Glick, Interscience Publishers, Inc., New York, 1954.

McElroy, W. D. and Strehler, B. L.; *Arch. Biochem.* 22, 420, 1949.

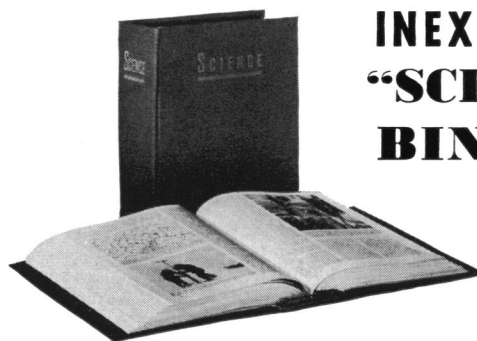
Strehler, B. L. and Totter, J. R.; *Arch. Biochem. Biophys.* 40, 28, 1952.



For information write
WORTHINGTON BIOCHEMICAL CORP.

FREEHOLD • NEW JERSEY

INEXPENSIVE "SCIENCE" BINDERS



Keep your copies of **SCIENCE** always available for quick, easy reference in this attractive, practical binder. Simply snap the magazine in or out in a few seconds—no punching or mutilating. It opens **FLAT**—for easy reference and readability. Sturdily constructed—holds 26 issues.

Now made of stronger materials to accommodate heavier volumes.

This beautiful maroon buckram binder stamped in gold leaf will make a fine addition to your library. Only \$3.25 postpaid; add 50¢ for orders outside U.S.A. (Personal check or money order, please.) Name of owner, 75¢ extra; year of issues, 50¢ extra.

SCIENCE • 1515 Massachusetts Ave., NW,
Washington 5, D.C.