

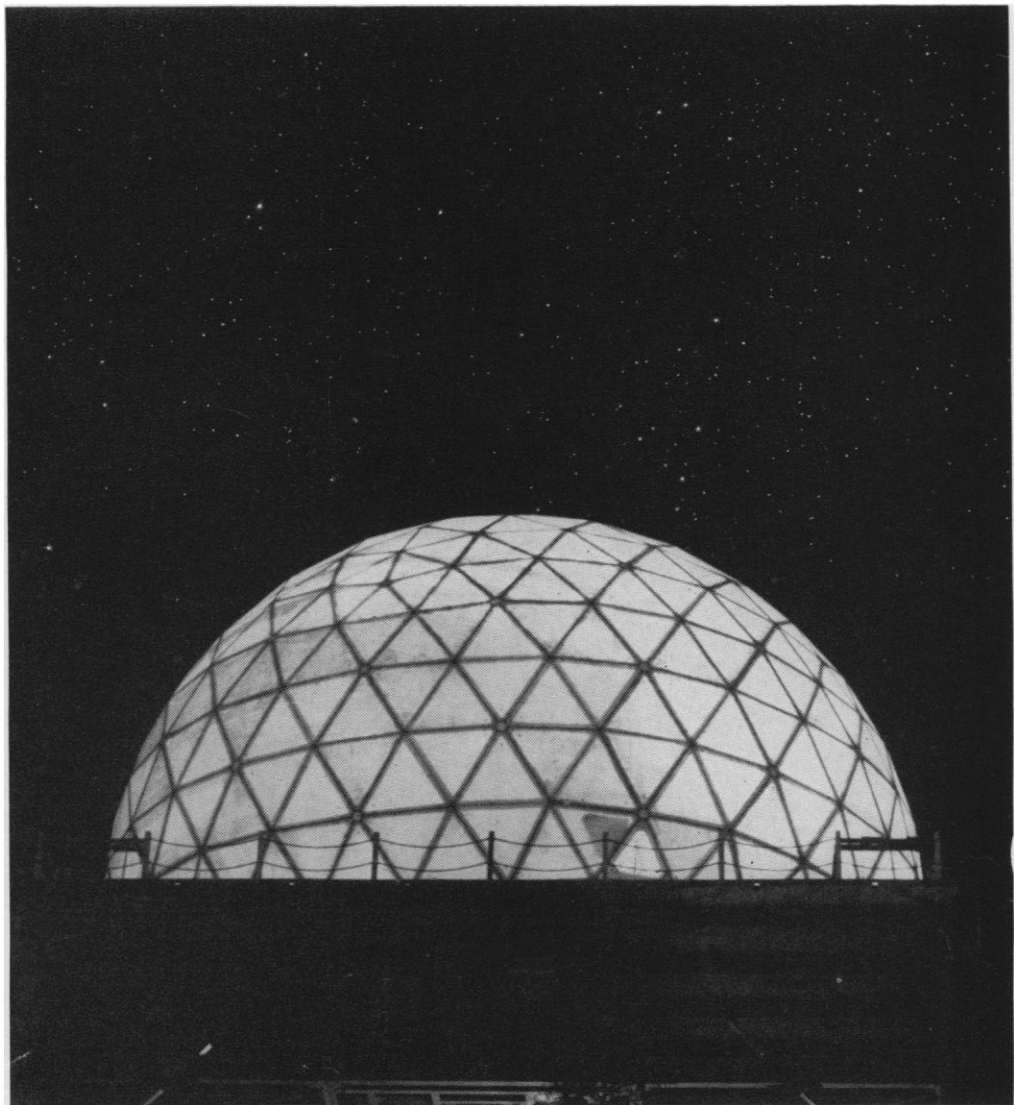
SCIENCE

3 April 1959

Volume 129, Number 3353

Editorial	Small Country with Big Problems	869
Articles	Origin and Migration of Oil: <i>E. G. Baker</i>	871
	Oil may consist of hydrocarbons that collected from waters containing natural solubilizers.	
	Resources, Population Growth, and Level of Living: <i>V. E. McKelvey</i>	875
	A society's wealth depends on the use it makes of raw materials, energy, and especially ingenuity.	
	Francisco Duran-Reynals, Bacteriologist: <i>C. C. Little</i>	881
News of Science	Greater Role for United Nations Specialized Agencies Seen in Meeting Problem of Population Outrunning Resources; recent events	882
Book Reviews	S. Fabricant's <i>Basic Facts on Productivity Change</i> , reviewed by <i>G. Colm</i> ; other reviews	890
Reports	Propagation of Poliovirus, Measles, and Vaccinia in Guinea Pig Spleen Cell Strains: <i>C. C. Mascoli, L. V. Stanfield, L. N. Phelps</i>	894
	Role of Magnesium in Acetyl Coenzyme A Formation by Acetothio kinase: <i>P. Berg; L. L. Ingraham and D. E. Green</i>	895
	Interaction of Gibberellic Acid and Indoleacetic Acid in <i>Impatiens</i> : <i>J. Weijer</i>	896
	Drug Metabolism in the Newborn Rabbit: <i>J. R. Fouts and R. H. Adamson</i>	897
	Resistance to Sevin by DDT- and Parathion-Resistant Houseflies and Sesoxane as Sevin Synergist: <i>M. E. Eldefrawi, R. Miskus, W. M. Hoskins</i>	898
	Multiple Hemoglobins in Fishes: <i>D. R. Buhler and W. E. Shanks</i>	899
	Analysis of Gas in Biological Fluids by Gas Chromatography: <i>L. H. Ramsey</i>	900
	Tritium Tracer in Arctic Problems: <i>B. J. Giletti and J. L. Kulp</i>	901
	Comparison of the Effects of Delayed Auditory Feedback on Speech and Key Tapping: <i>R. A. Chase et al.</i>	903
	Great Basin Petroglyphs and Prehistoric Game Trails: <i>R. F. Heizer and M. A. Baumhoff</i>	904
Departments	Letters	864
	Space Science; Meeting Notes; Forthcoming Events; Equipment	906

**THE
ARCTIC EYE
THAT NEVER
SLEEPS**



This plastic radome houses a radar antenna constantly scanning the skies to detect the presence of aircraft. A line of these radars provides early warning of any threatening approach to the North American continent.

The Distant Early Warning Line is now on perpetual guard duty. Spanning the Arctic from Baffin Island to Alaska, this great system was conceived at the Lincoln Laboratory of M.I.T. and produced under the leadership of Western Electric.

But first the DEW Line had to be engineered into a workable system. This was done at Bell Telephone Laboratories.

The obstacles were formidable. Conventional means of communication—telephone poles, cables and even line-of-sight microwave radio—weren't feasible. A complicated system had to be made to operate reliably in a climate so cold that outdoor maintenance is impracticable farther than a few hundred feet from heated habitation.

Whenever possible, Bell Laboratories engineers utilized well-proven art. But as it became necessary, they innovated. For example, they designed and directed the development of a new and superior radar which automatically scans the skies, pinpoints a plane and alerts the operator.

To reach around the horizon from one radar station to another, they applied on a massive scale a development which they pioneered—transmission by tropospheric scatter. Result: at a DEW Line Station you can dial directly a station more than a thousand miles away and converse as clearly as with your home telephone.

Bell Laboratories' contribution to the DEW Line demonstrates again how telephone science works for the defense of America.

BELL TELEPHONE LABORATORIES

WORLD CENTER OF COMMUNICATIONS RESEARCH AND DEVELOPMENT



The Library of Science

INVITES YOU TO ACCEPT

FREE with membership
this monumental one-volume library
of scientific knowledge

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA



D. VAN NOSTRAND
COMPANY, INC.

AERONAUTICS
ASTRONOMY
BOTANY
CHEMICAL
ENGINEERING
CHEMISTRY
CIVIL ENGINEERING
ELECTRICAL
ENGINEERING
ELECTRONICS
GEOLOGY
GUIDED MISSILES
MATHEMATICS
MECHANICAL
ENGINEERING
MEDICINE
METALLURGY
METEOROLOGY
MINERALOGY
NAVIGATION
NUCLEAR SCIENCE
AND ENGINEERING
PHOTOGRAPHY
PHYSICS
RADIO
AND TELEVISION
STATISTICS
ZOOLOGY

VAN NOSTRAND'S SCIENTIFIC ENCYCLOPEDIA

- OVER 1800 PAGES
- 1,400 ILLUSTRATIONS
- 10,000 DEFINITIONS
- MORE THAN 14,000 SEPARATE ARTICLES
- THUMB-INDEXED
- CROSS-REFERENCED

FREE

to new members of
THE LIBRARY OF SCIENCE

Retail Value **\$2975**

Newly revised and enlarged, this giant compendium (actual weight 8½ lbs.) places at your fingertips the most advanced theories, research findings and applications of every important field of modern science. Lavishly illustrated, with many beautiful color plates, the SCIENTIFIC ENCYCLOPEDIA is indispensable to any home or professional library.

"An amazing job of editing for both the general and scientific reader."

The New York Times.

FOR THE FINEST selection of serious scientific literature published today, scientists themselves turn in growing numbers to The Library of Science. Nearly 45,000 working scientists, educators and advanced readers in all walks of life now belong. To these members, The Library of Science offers each month their choice of the authoritative, genuinely important volumes from every area of the world of contemporary science—and always at substantially reduced Member's Prices.

To join this select group of readers, simply choose your first selection from among those listed below. As a member, you need purchase as few as 5 more selections in the next 24 months from the 75 or more fine volumes available at reduced Member's Prices. After every fourth Selection, you receive a free Bonus Book of your choice—in addition to your Membership Gift of the *Scientific Encyclopedia*.

CHOOSE YOUR FIRST SELECTION from among these six important works

ATOMIC PHYSICS AND HUMAN KNOWLEDGE

By Niels Bohr

& PHYSICS and PHILOSOPHY

By Werner Heisenberg

Two volumes—the latest works on the philosophy of science by the Nobel Prize winners.

LIST PRICE \$7.95

Member's Price \$5.50

MATHEMATICS IN WESTERN CULTURE

By Morris Kline

"A stimulating and readable book . . . unflatteringly clear in explaining mathematical ideas." *Scientific American*.

LIST PRICE \$8.00

Member's Price \$5.75

FRONTIERS IN SCIENCE

Edited by

Edward Hutchings, Jr.
The latest findings in the important areas of scientific research — Pauling, Oppenheimer, 27 others.

LIST PRICE \$6.00

Member's Price \$4.95

PROJECT SHERWOOD

By Amasa S. Bishop

The first complete story — prepared for the Atomic Energy Commission — of the United States program in controlled nuclear fusion.

LIST PRICE \$5.75

Member's Price \$4.75

ROCKETS, MISSILES & SPACE TRAVEL

By Willy Ley

New, revised edition of this definitive source book on rocket development and space travel.

LIST PRICE \$6.75

Member's Price \$5.25

THEORIES OF THE UNIVERSE

Edited by

Milton K. Munitz

Space, Time and the Creation of the Universe — the development of cosmology from Plato to the present day.

LIST PRICE \$6.50

Member's Price \$4.95

The Library of Science

L-13

59 Fourth Avenue, New York 3, N. Y.

Enroll me as a member and send as a Membership Gift the SCIENTIFIC ENCYCLOPEDIA along with my first Selection at the reduced Member's Price, as indicated below. I need take as few as 5 more Selections during the next 24 months, and in addition to my Membership Gift I will receive a free Bonus Book of my choice after every four Selections I accept.

First Selection _____

Additional Selection Desired _____

Name _____

Address _____

City _____ Zone _____ State _____

FIBERGLAS
REINFORCED
PLASTIC
CAGES
for small
laboratory
animals

• will not crack or
dent • one-third the
weight of stainless steel
• seamless corners rounded
for easier cleaning • can be
autoclaved repeatedly •
chemically resistant to
acids and staining

• low thermal
conductivity and special
lid design reduce attrition
from chilling and upper
respiratory diseases • available
in a variety of sizes and
styles at reasonable
prices

See ECONO-CAGES at
Booth 5—E. H. Sargent Co.
Booth 137—Aloe Scientific
Booths 174-175—Arthur H. Thomas Co.
Booths 207-208—Will Corp.
Federation of American Societies
for Experimental Biology
ATLANTIC CITY,
April 13-17

econo
- cage

MARYLAND PLASTICS, INC.
FEDERSBURG, MARYLAND

Letters

Nuclear Tests

I cannot conceal my disappointment, even shame, on reading the pious platitudes of our Council's Resolution on Control of Nuclear Weapons Tests, printed in the issue of 16 January [*Science* 129, 137 (1959)]. One might rather have expected such a resolution from an association of scientific civil servants, too terrified of losing their jobs to risk offending Dulles and the Atomic Energy Commission. An embarrassed silence would have been preferable to this type of sickening hypocrisy.

Instead of emitting "profound hope that the Geneva Conference negotiations will prove successful," the Council might well have told the world in a clear, straightforward way (i) whether they consider that nuclear bomb test explosions constitute a probable danger to the future of our species; (ii) whether they favor discontinuance of such explosions (that is, *yes* or *no*); (iii) whether they are alarmed at the present situation in which two armed, cynical, irresponsible, and dishonest giants are daily threatening each other and the rest of the world with total destruction; and (iv) how the international scientific community can bring pressure to bear on Tweedledum and Tweedledee to restore calmness and sanity where it is most needed.

J. GORDIN KAPLAN
*Department of Physiology, Dalhousie
University, Halifax, Nova Scotia*

Beneficiation of Soils Contaminated by Strontium-90

I have read with surprise and concern W. F. Libby's report [*Science* 128, 1134 (1958)] on his experiments which were made, as he says, to test two proposals: (i) that the addition of sulfates to contaminated soils might be helpful in making strontium unavailable for plant nutrition, and (ii) that potassium might have a considerable beneficial effect with respect to absorption of radiostrontium.

I will attempt to justify my surprise on purely technical grounds, for what Libby refers to in his report are not experiments but, at best, "high spot tests," which could not, on any grounds, allow one to arrive at valid conclusions.

The soil is such a complex system that it must be fully characterized before one can undertake to do anything with it. To say that the soil used was taken from a garden in Washington, D.C., and that it had an exchange capacity of 32 milliequivalents per 100 g is utterly useless, if this information was intended to help the scientific reader interpret the sig-

IS YOUR GUESS WORTH \$100?

ENTER
CONTEST
TODAY

see our ad
on page 674
of the
march 6th
issue . . . or
write for
details

NUCLEAR
ELECTRONICS
CORPORATION

2925 N. BROAD ST., PHILADELPHIA 32, PA. • BALDWIN 6-2300
Export Representatives: AD. AURENA, INC., New York

P. S. See us at the Atom Fair, April 6-10
Cleveland Public Auditorium
Booth #701

Get UNITRON's FREE
Observer's Guide and Catalog on
ASTRONOMICAL TELESCOPES

This valuable 38-page book
is yours for the asking!

With artificial satellites already launched and space travel almost a reality, astronomy has become today's fastest growing hobby. Exploring the skies with a telescope is a relaxing diversion for father and son alike. UNITRON's handbook contains full-page illustrated articles on astronomy, observing, telescopes and accessories. It is of interest to both beginners and advanced amateurs.

Contents include—

- Observing the sun, moon, planets and wonders of the sky
- Constellation map
- Hints for observers
- Glossary of telescope terms
- How to choose a telescope
- Amateur clubs and research programs

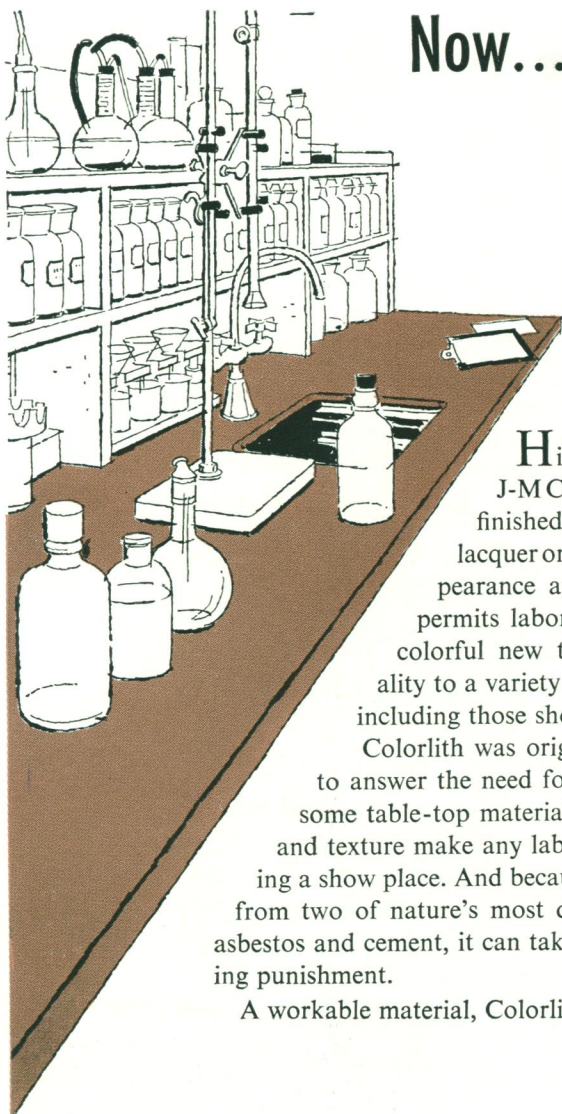


UNITRON

INSTRUMENT DIVISION of UNITED SCIENTIFIC CO.
204-206 MILK STREET • BOSTON 9, MASS.

Please rush to me, free of charge, UNITRON's new Observer's Guide and Telescope Catalog, 4P-1.

Name _____
Street _____
City _____ State _____



Now...laboratory "table-top toughness"
for many busy interior surfaces

...J-M Colorlith®

handsome, tough, colorful

Highly functional J-M Colorlith (properly finished with clear coat lacquer or equal for best appearance and performance) permits laboratories to add a colorful new touch of personality to a variety of interior areas, including those shown here.

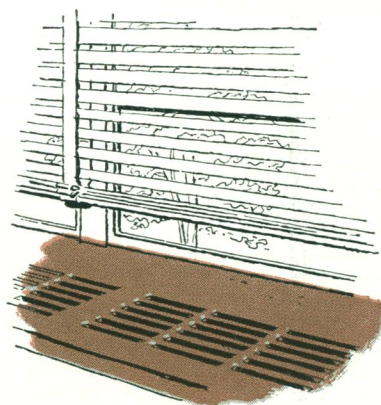
Colorlith was originally developed to answer the need for a tough, handsome table-top material. Now its colors and texture make any lab or school building a show place. And because it's fabricated from two of nature's most durable minerals, asbestos and cement, it can take the most grueling punishment.

A workable material, Colorlith comes in large

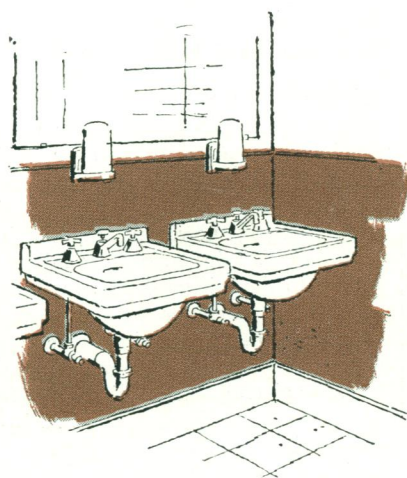
4' x 8' sheets which can be cut in any shape. Thicknesses range from 1/4" to 1 1/4". Because it has great uniform strength, it can be used in thicknesses down to 1/4" for fume hoods, or for resurfacing old table tops and walls. Its color runs completely through the sheet.

Many laboratory furniture manufacturers now feature Colorlith. And there are cutting shops convenient to you which can easily custom-fabricate Colorlith sections to your needs. For names and addresses, plus Colorlith specification and maintenance data, contact your J-M representative, or write direct.

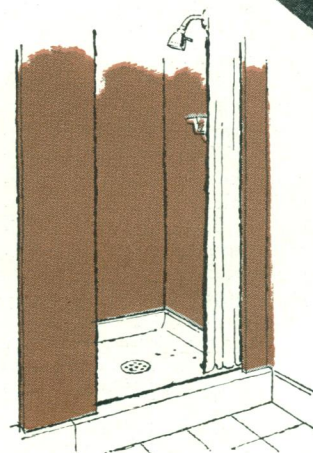
Colorlith comes in 3 popular decorator colors: Cameo Brown, Surf Green, and Charcoal Gray.



Office, classroom window sills, built with Colorlith, have unusual strength and durability... won't warp. Color doesn't fade. Louver slots can be readily machined.



Washroom wainscots, made of Colorlith, withstand moisture and heavy abuse for years. Material resists cracking, chipping... is easily cleaned... and stays attractive.

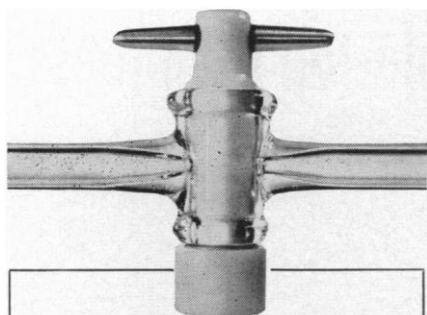


Shower stalls present a new application. Large sheets reduce number of joints. Material is strong, rigid—can't rust or deteriorate with prolonged exposure to moisture.

Johns-Manville, Box 14, New York 16, N. Y.
In Canada, Port Credit, Ontario

JOHNS-MANVILLE





**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.

nificance of the pot tests. Since we should be interested in facts, I would have preferred to see a minimum of basic information on: (i) the ion components of the exchange capacity, particularly K^+ , Ca^{+2} , NH_4^+ , and Na^+ ; (ii) the ease of availability of the "native potassium," both by actual chemical tests and by plant growth tests, and (iii) an analysis of the soluble and insoluble sulfates.

This information would have contributed greatly to understanding the significance of Libby's initial additions of the potassium and strontium salts in amounts of about 1 percent of the total exchange capacity of the soil mass used per pot. The lack of this type of information is perhaps understandable, for it still appears to be the exclusive property of that breed of men known as soil scientists.

The tests themselves were faulty, because their design ignored some basic characteristics of the experimental material and disregarded some elementary principles of experimentation.

The soil cannot be treated as if it were a chemical reagent, for, above all, it is a complex entity with its essential characteristics of variability and a sensitive ability to change with the treatments given, and with environment. To control this inherent variation, an essential part of any experimentation with a soil is replication—not just duplication, as is customarily done in a simple titration, but, say, from three to five repetitions for each treatment. Moreover, these treatments should be laid out in accordance with a design that will strengthen the scientist's chances of beating nature!

Libby's claims, I would assume, must be based on a subconscious acceptance of the findings obtained by Peech, Bradfield, Reitemier and others. His data could not support any of his conclusions.

The use of the ABCD type of tests to arrive at conclusions which have a direct bearing on the health of all mankind should be a question of great concern to all responsible people. I was delighted to read front-page newspaper reports about "Dr. Libby's solution of Sr^{90} fallout by adding to the soil potassium fertilizers," only to find out later, with great disappointment, that the claims were totally unwarranted. But, alas, public opinion has been given one more pill of relief.

L. A. ROMO

945 Savitt Place,
Union, New Jersey

The recent report by W. F. Libby demonstrates a surprising lack of information on matters that are relatively well known to biologists. It has been known for at least a quarter of a century that potassium in the soil reduces the uptake of calcium, and, since calcium and strontium are so closely related, it

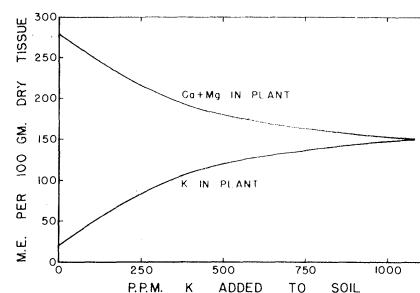


Fig. 1. Ion content of tomato plants as a function of potassium added to soil. [From data of D. R. Hoagland and J. C. Martin, *Soil Sci.* 36, 1 (1933); redrawn by D. R. Hoagland.]

would seem obvious that added potassium would reduce strontium uptake from soil. See Fig. 1, which is slightly modified from one that was published in 1933.

Would it be too much to suggest that the Atomic Energy Commissioners, when confronted with botanical problems, might employ a botanist?

KENNETH V. THIMANN
BRUCE B. STOWE

Harvard Biological Laboratories,
Cambridge, Massachusetts

I have read with disappointment L. A. Romo's criticism of my article, "Beneficiation of soils contaminated with strontium-90: beneficial effects of potassium." I know well how incomplete the work is, but I hope it has more scientific value than Romo finds in it. Perhaps its best value will be to encourage further research into what is a very important practical problem. The extensive research on radioactive fallout which has been conducted during the past years shows that the type of work I tried to do is urgently needed.

Thimann and Stowe are correct in questioning my knowledge of botany, but I hasten to assure them that the Atomic Energy Commission does employ very capable botanists. It is true, of course, that the effect of potassium on calcium uptake by plants has long been known. The corresponding effect on strontium has not been established so firmly, however, especially for the very low concentrations resulting from radioactive fallout on acid soils.

I hope the work has more merit than the tone of these letters indicates. The problem is a very important one for civilian defense, and it was only after failing to persuade professionals to undertake it that I made this attempt.

I hope Romo and Thimann and Stowe will turn to and do a better job for us all.

W. F. LIBBY

Atomic Energy Commission,
Washington, D.C.



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

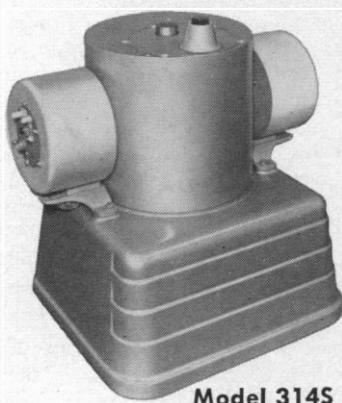
For Counting Tritium And Carbon-14



Model 314X

Automatic

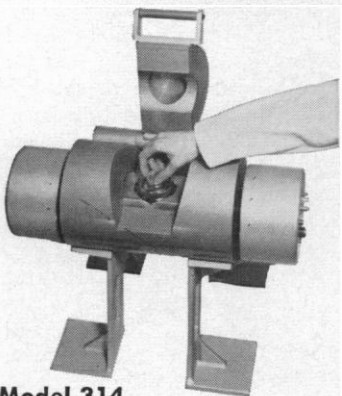
Where considerable counting is done, the Model 314X Tri-Carb Spectrometer has proved invaluable in saving overall time and in utilizing laboratory personnel to better advantage. Completely automatic, it handles up to 100 samples and permanently records all data on paper tape. It can be operated around 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.



Model 314

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.*



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

RADIOACTIVITY AT WORK...#1

Our business is radioactivity—applying it, measuring it, protecting against it

Since our business might have bearing on yours, this is the first in a series of reports on work we're doing for a variety of clients, not only in the nuclear industry but in such diverse fields as chemicals, petroleum, pharmaceuticals, medicine, steel and coal.

Nuclear reactor developers and operators call on us for such services as analysis of reactor fuels, decontamination studies, and the development of data relating to the production of atomic power.

Research people and industrialists in all fields draw upon our specialized skills and equipment for applying the phenomena of radioactivity to improving processes and for highly complex studies which were not possible with "yesterday's" techniques.

So many people these days are curious about the possibilities of applied radioactivity, we thought you might be interested in reading about some of our current projects.

ENVIRONMENTAL RADIOACTIVITY SURVEYS

Since we started in business, one of our important activities has been conducting site surveys for operators of nuclear reactors. These studies are undertaken prior to start-up to determine the level of "background" radioactivity in the area surrounding the reactor.

This then provides a basis for measuring any increase in radioactivity after the reactor is in operation. Environmental radioactivity studies are required. Such studies should also be made on a continuing basis not only for safety's sake but to provide "third party" legal protection against lawsuits and insurance claims.

In conducting a site survey, NSEC takes samples from the surrounding area. These may be soil, ground water, plants, animals, fish, rainwater, dust, sewage or other materials. We consider carefully the nature of the facility, the terrain, direction of air movement, and surface and ground water flow. The samples are processed and analyzed in our labs. We are then able to establish the radioactivity level, the kinds of isotopes producing it, and the possible sources of these isotopes.

NSEC has conducted more site surveys of nuclear facilities than any other company in the United States. *For information on environmental radioactivity surveys of your nuclear site, phone us at HOMestead 2-4000 in Pittsburgh. We can either conduct the survey for you, or train your personnel on proper procedures.*

PREVENTING BEACH POLLUTION

Recently, in the largest radioactive tracer study ever conducted in the United States,

We'll be glad to furnish detailed information on any of these studies. And if you'd like to keep abreast of new developments in the field, just ask us to put you on the mailing list for our monthly publication "Radioactivity at Work."

Our expanding business requires additional qualified technical personnel. Interested? Submit resume to Personnel Manager.

Nuclear Science and Engineering Corporation

DEPT. S-4, P. O. BOX 10901, PITTSBURGH 36, PENNSYLVANIA

906

NSEC successfully traced the dispersion of sewage effluent flowing into ocean waters. Our study helped the City of Los Angeles in planning expansion of its sewage system. First we injected the isotope scandium-46 into sewage about to be released into Santa Monica Bay. This enabled us to measure the pattern of sewage diffusion and its dilution in sea water to one part in ten thousand.

Write for a copy of "Radioactive Tracer Study of Sewage Field in Santa Monica Bay" by Dr. Ralph L. Ely, Jr. (He's our Vice President and Technical Director.) Or ask about our forthcoming study for the Republic of Venezuela, in which we will investigate littoral drift, using radioactive sand, to determine the feasibility of a certain harbor location.

RADIATION SICKNESS

It's common knowledge that excessive radiation produces harmful effects in human beings, ranging from mild nausea or skin burns to cancer and death. Recent experiments under the direction of Dr. A. Edelmann, Manager of our Department of Biology and Medicine, have indicated that radiation can also produce a toxic factor which appears in the blood. Analysis of the blood of rats subjected to X-rays under varying conditions not only indicates that a toxic element is produced but that it may be transferred by injection from one animal to another.

When and if this toxic substance is identified, it may be possible to devise an antitoxin to alleviate some of the effects of atomic radiation. *Medical and pharmaceutical applications of controlled radioactivity open up entirely new means of studying existing problems. Contact Dr. Edelmann about your problem.*

DETERMINATION OF BORON IN SILICON

A major problem plaguing the electronics industry is achieving ultra-pure silicon for transistors. Current methods are slow and costly, but effective. Nevertheless, boron still remains as a damaging impurity even in minute quantities of only a few parts per billion. Ordinary chemical methods cannot detect the presence of boron in such small concentrations.

However, NSEC scientists are now perfecting a process by which the boron is transmuted into radioactive carbon-11 and subsequently measured by its radioactivity.

This new method of analysis will be helpful in the quality control of silicon during production. *Once a routine method is established it will be offered on a commercial basis. Interested? Drop us a letter.*

Meetings

Space Science

Astronomers have for a long time known that interplanetary space is not completely empty and that the skies are not as still and serene as they seem to the poet. It comes as an exciting revelation of the first few satellites and rocket flights that space is filled with dynamic physical and chemical phenomena, some of which had not been accessible to direct observation. Physical phenomena found in space, the principles of rocketry, space biology, and space medicine were discussed in detail at a symposium held in San Antonio, Tex., on 10-12 November 1958. The symposium, the 2nd International Symposium on the Physics and Medicine of the Atmosphere and Space, was sponsored by the School of Aviation Medicine of the U.S. Air Force University. The staff of the Southwest Research Institute was responsible for the arrangements and will also edit the papers, which are to be published in book form. Over 600 scientists and many scientific leaders of government agencies attended the 42 invited presentations.

Otis O. Benson, Jr., introduced the symposium, on the note that physical and biological sciences must work hand in hand in the conquest of space. The discussions may be divided into the following categories: (i) interplanetary physics and chemistry: pressure, temperature, and chemistry of the interplanetary space; electromagnetic and ionization properties of interstellar matter; meteorites and cosmic rays; (ii) factors in space of importance to biology and medicine: gravitational environment, acceleration and weightlessness; biological effects of primary and secondary cosmic rays; time and the relativity theory; (iii) satellite physics and engineering: methods and limitations of chemical and nuclear rocket propulsion; problems in launching, tracking and re-entry; manned orbital and lunar vehicles and the "rocket booster glider"; (iv) human factors: the ecology and physiology of sealed cabins; gas exchange, photosynthesis, metabolism, limits of perception, stress and adaptation, psychological problems; human tolerance to acceleration, weightlessness, vibration, temperature, and radiation; (v) problems of escape and rescue in space operations; (vi) solar and planetary environments: physics of the solar, lunar, and planetary surfaces; the possibility of life on planets and survival of living cells under simulated Martian conditions.

An intense new component of cosmic radiation was discovered from data provided by Explorer I by James Van Allen and his group, working at the University

SCIENCE, VOL. 129

of Iowa. This radiation is most intense above the magnetic equator and is much less intense near the poles. The radiation appears to consist of two belts of charged particles, trapped by the magnetic field of the earth, which form a giant magnetic bottle akin to those which are being studied in the laboratory for hydrogen fusion. The charged particles, electrons or protons or both, spiral around the magnetic lines of force and seem to be accelerated to considerable energies. The new component is first found at an altitude of about 600 kilometers, where the particle flux starts to increase by a factor of about two for each 100 kilometers of altitude. Its maximum intensity is reached at about two and one-half earth radii (about 16,000 kilometers), where the dose is as much as 3 to 5 roentgens per hour. At ten earth radii the dose rate drops to 0.2 roentgen per hour.

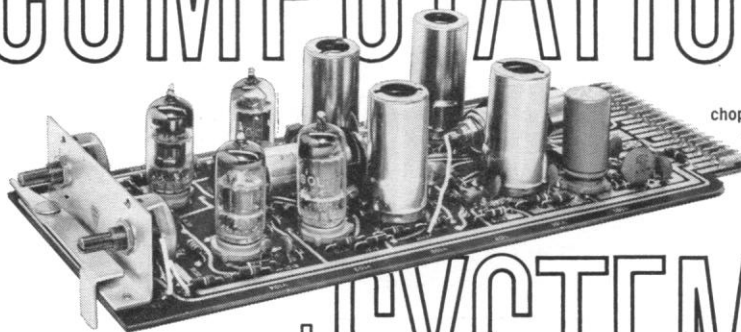
Several physicists have given theoretical explanations for the radiation belt. According to the model of S. Fred Singer of the University of Maryland, the primary cosmic-ray particles, high-energy protons, helium ions, and light nuclei are responsible for maintaining the radiation level. Near the top of the atmosphere the primaries undergo inelastic collisions. Some of the neutrons are thermalized and escape. Eventually these decay into protons, electrons, and neutrinos. It is assumed that the charged products of neutron decay make up at least part of the radiation belt.

Another explanation is that the particles possibly originate in the sun and travel in ionized magnetic clouds. When these clouds collide with the magnetic field of the earth, exchange of the particles can take place. Crucial to these theories are observations of energy, time, and spatial variation of the rays; additional data are being obtained.

The heavy-ion primaries, which we have known since their discovery by the Minnesota cosmic ray group about 10 years ago, were discussed by Herman J. Schaefer of Pensacola, Fla. The intensity of these particles is low, but they produce very heavy ionization tracks unlike those known to radiobiologists. The heavy-ion primaries are associated with solar events, and it is anticipated that during large solar flares there may be as much as a 1000-fold increase in the low-energy end of the spectrum.

It is fortunate that some knowledge already exists, from work at the 184-inch cyclotron of the Lawrence Radiation Laboratory, about the nature and severity of biological effects of high-energy protons, deuterons, and alpha particles. In addition, there are new heavy-ion linear accelerators both at Berkeley and at Yale University that have accelerated beams of several heavier ions with about 10-Mev energy per nucleon. Some biological studies on unicellular organisms

COMPUTATION



Model 3101
chopper-stabilized
dual amplifier

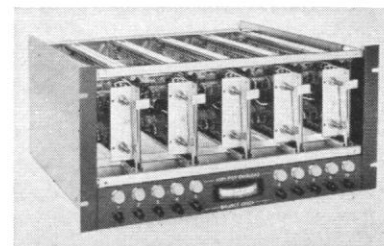
and SYSTEMS CONTROL

DONNER
Precision
Plug-in Amplifiers,
Function Generators,
Multipliers,
Power
Supplies

New Donner computer and control elements are designed to simplify the job of the analog systems engineer.

If you are interested in expanding the capacity of your analog computer, no matter what make or size, constructing a special purpose computer, or erecting an analog control loop, Donner analog systems components will perform a precision job at an economical price.

Typically, key specifications for the chopper stabilized amplifier shown above are dc gain in excess of 50 million; maximum offset of a unity inverter, less than 100 $\mu\text{V}/\text{day}$; drift of unity integrator, less than 100 $\mu\text{V}/\text{sec}$; phase shift of unity inverter, less than 0.5 degrees at 1 kc. Price of this dual amplifier is only \$230 or \$115 per channel. Even lower prices on quantity sales.



Donner plug-in amplifiers
in rack-mount configuration

Your nearby Donner engineering representative will be happy to supply you with complete applications data or you may write us here in Concord if you choose. Please address

Dept. 504

**DONNER SCIENTIFIC
COMPANY**

CONCORD, CALIFORNIA

11

Electronic engineers, exciting opportunity exists at Donner. Write today for full details.

and animal skin have been in progress for a year. Further reports on cosmic ray effects were made by Jakob Eugster of Zurich, who made studies at sea level, high altitudes, and underground, and by J. E. Pickering of Randolph Field, who estimated some "permissible dose levels" for pioneer space fliers. Cosmic rays present definite hazards for the future space flier. However, the radiation belt can be avoided by selecting low or polar orbits, and it is conceivable that it will be possible to shield against it, at the same time cutting out the low-energy heavy primaries.

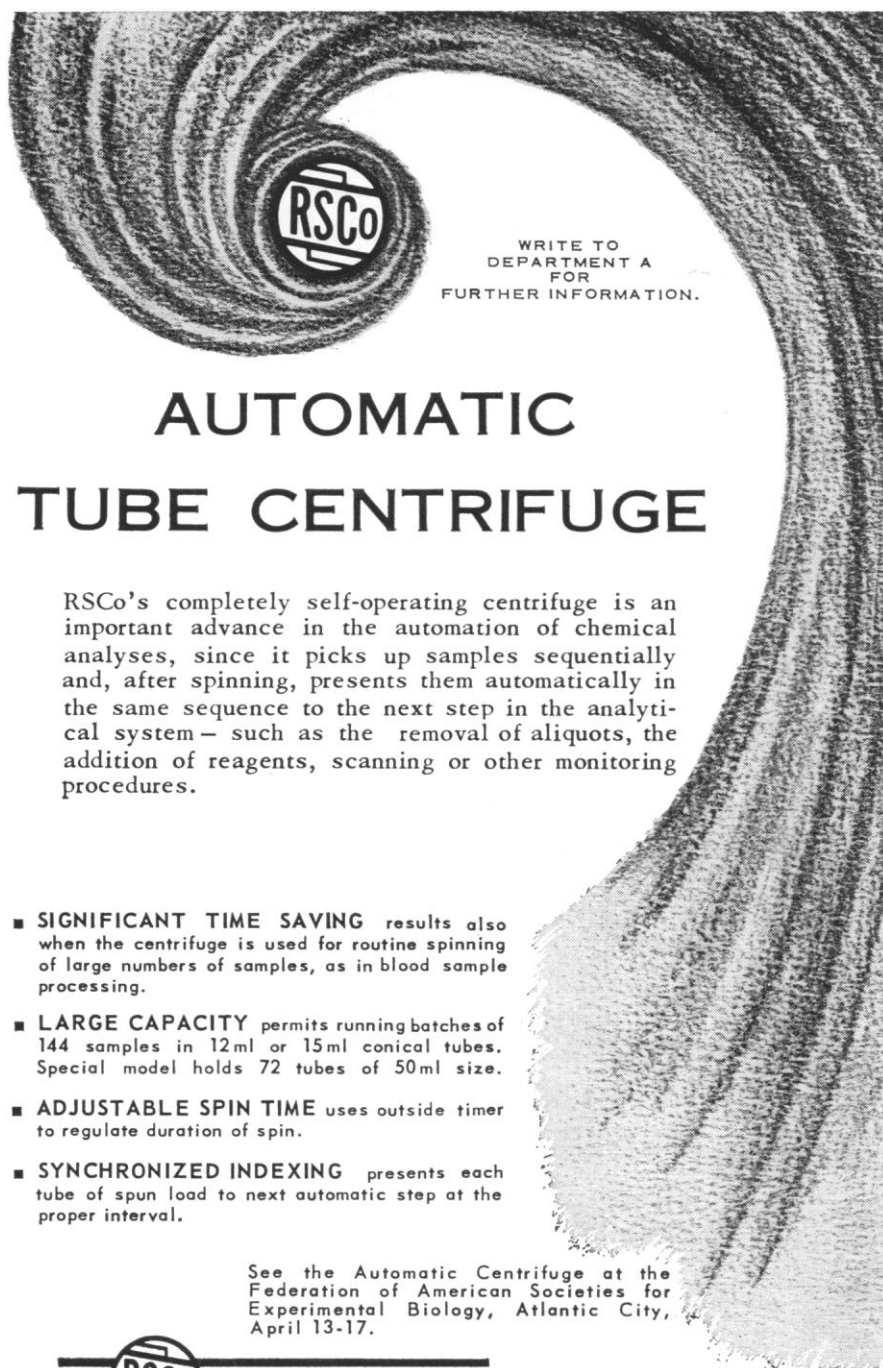
Fred L. Whipple of Harvard University described our knowledge of meteoritic material in space. The larger fragments originate in meteoritic zones of the solar system and are quite rare; interplanetary dust contains tiny particles originating from comets and ending up on the sun or on the planets. Dust counts from Russian and American satellites indicate that perhaps 3000 tons of dust fall on the earth daily. Falling through the atmosphere, the tiny particles may then act as condensation centers for rain and are thus a factor in meteorology.

John W. Townsend of the U.S. Naval

Research Laboratory explained that at very high altitudes the air density is much higher than had been previously expected. A small portion of the solar corona appears to extend down to the earth. Hans Clamann of the School of Aviation Medicine and Marcel Nicolet of the Royal Meteorological Institute of Belgium discussed the chemistry of the upper atmosphere. Under the influence of sunlight the very noxious gas ozone forms. Ozone protects life at the surface of the earth from short-wave ultraviolet rays of the sun, which would otherwise be absorbed by nucleic acids and proteins and could be lethal. At altitudes above 100 kilometers, the air molecules ionize and dissociate. Free electrons and a variety of radical species appear—combinations of atoms N, O, and H. Whether or not thermal equilibrium is established at very low pressures is being questioned. There is an interaction between photochemical reactions and intermolecular action involving diffusion and collisions. At an altitude of 1000 kilometers, half of all molecular species are ions.

Walter Dieminger of the Max Planck Institute of Aeronomy, Göttingen, Germany, discussed the propagation of electromagnetic waves in the upper regions of the atmosphere. If the wavelength is below 5 meters, the atmosphere is quite transparent. Longer wavelengths are reflected and bent by the electron layers. The Russian satellites obtained particularly useful data in this field: the bending of the signals from the sputniks was correlated with electron density.

Thorough and detailed exposition was given to various phases of rocket engineering aimed at putting man into space. There is no doubt that existing rocket-propulsion systems are capable of lifting man into orbit. These were discussed by B. A. Schriever, U.S. Air Force. L. R. Shepherd, chairman of the council of the British Interplanetary Society, claimed that atomic propulsion may extend rocket capability to any place in the solar system. The most promising nuclear systems are reactor-heat exchanger, ion propulsion, and nuclear fusion. Many interesting phases of launching, tracking, cabin design, and reentry were discussed, by Wernher von Braun, Ernst Stuhlinger, Dean Chapman, and Krafft Ehrlicke, respectively. R. Wellner of the Bell Aircraft Corporation discussed the space plane or "rocket booster glider." A whole morning was devoted to the problem of emergency escape and rescue from a space vehicle, with discussions by P. A. Campbell, R. M. Stanley, Krafft Ehrlicke, N. V. Pedersen, and A. M. Mayo. Members of the staffs of the School of Aviation Medicine, the Wright Aero Medical Center, and the Lovelace Foundation—namely, R. T. Clark, G. R. Steinkamp, G. R. Hauty, S. J. Gerathewohl, W. R. Love-



WRITE TO
DEPARTMENT A
FOR
FURTHER INFORMATION.

AUTOMATIC TUBE CENTRIFUGE

RSCo's completely self-operating centrifuge is an important advance in the automation of chemical analyses, since it picks up samples sequentially and, after spinning, presents them automatically in the same sequence to the next step in the analytical system—such as the removal of aliquots, the addition of reagents, scanning or other monitoring procedures.

- **SIGNIFICANT TIME SAVING** results also when the centrifuge is used for routine spinning of large numbers of samples, as in blood sample processing.
- **LARGE CAPACITY** permits running batches of 144 samples in 12ml or 15ml conical tubes. Special model holds 72 tubes of 50ml size.
- **ADJUSTABLE SPIN TIME** uses outside timer to regulate duration of spin.
- **SYNCHRONIZED INDEXING** presents each tube of spun load to next automatic step at the proper interval.

See the Automatic Centrifuge at the Federation of American Societies for Experimental Biology, Atlantic City, April 13-17.



RESEARCH SPECIALTIES CO.

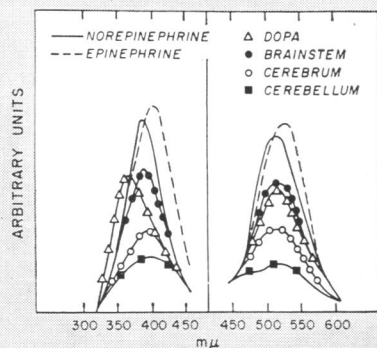
200 SOUTH GARRARD BLVD.

RICHMOND, CALIFORNIA

"IDENTIFICATION AND CHEMICAL ASSAY OF NOREPINEPHRINE IN BRAIN AND OTHER TISSUES"*

"A simple, rapid fluorometric method for the estimation of catechol amines in brain and other tissues is described.

The procedure involves extraction of catechol amines from tissue homogenates into butanol. After returning the amines to an aqueous phase, they are oxidized to form fluorescent derivatives which are measured in a spectrofluorometer."



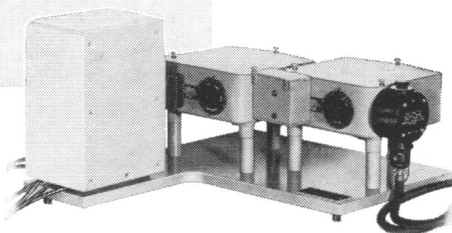
Activation spectra (left) and fluorescence spectra (right) of various catechols and rabbit brain extracts.

To obtain the activation spectra, the fluorescence monochromator of a Farrand Recording Spectrofluorometer was set at 520 mμ and the spectra from the activating monochromator were scanned. To obtain the fluorescence spectra, the activating monochromator was set at 400 mμ and the spectra from the fluorescence monochromator were scanned.

*Ref: Parkhurst A. Shore and Jacqueline S. Olin, *Journal of Pharm. and Experim. Therapeutics*, Vol. 122, No. 3.

FARRAND® SPECTROFLUOROMETER

Spectrofluorometric assay has distinct advantages over physical methods using light absorption. Fluorescent methods, where applicable, are far more discriminating than either Colorimetric or Spectrophotometric assay and yield a sensitivity at least two orders of magnitude greater than Spectrophotometry.



Bulletin No. 820 Supp. 1 sent on request

FARRAND OPTICAL CO., INC.

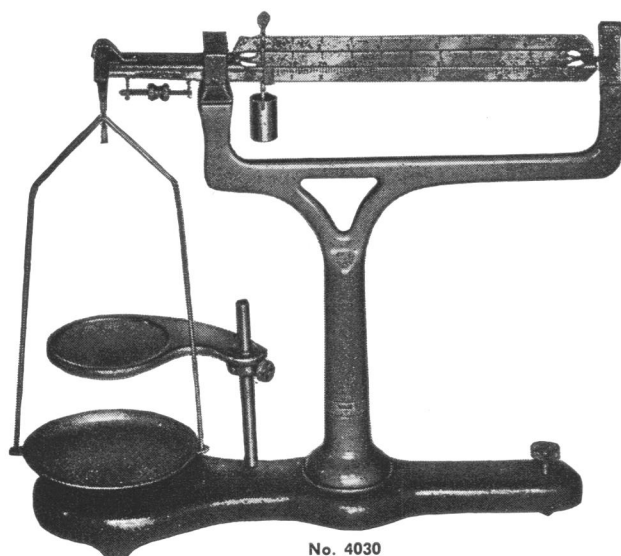
Bronx Boulevard and East 238th Street, New York 70, N. Y.



Engineering • Research
Development • Design • Manufacture
Precision Optics • Electronic and
Scientific Instruments

• Serviceable • Dependable • Rugged • Compact

Welch **TRIPLE-BEAM BALANCE**



No. 4030

*provides rapid,
accurate weighing*

All Exposed Parts of *Stainless Steel*

• Good Sensitivity • High Stability

Capacity 111 grams

(201 grams using auxiliary weight)

SENSITIVE TO

• 0.01 grams or less

3 Graduated Scale Levels for easy reading. Riders move easily. Hard, Cobalite Knife Edges maintain true edge indefinitely.

Grooved Agate Bearings are protected against damage, yet highly resistant to corrosive action of laboratory fumes.

One-Piece Beam Construction — Silver-Gray Hammerloid Finish
Rapid Zero Setting — Beam Arrest for faster weighing.

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.
Manufacturers of Scientific Instruments and Laboratory Apparatus

4030. TRIPLE-BEAM BALANCE, High Form. The balance is 13 inches long and 11 inches high. The pan is 4 inches in diameter and removable, and the hanger is 10½ inches high. Each, \$27.50

4031. AUXILIARY WEIGHT. For use on the 100-gram notch of No. 4030 Balance to increase weighing capacity from 111 grams to 201 grams. This weight is matched to the balance with which it is to be used and should be ordered at the same time as the balance. Each, \$1.50

4030C. PLASTIC COVER, For No. 4030. Each, \$1.60

lace, II, and J. P. Stapp—reported on parameters of human adaptation and stress, including factors such as anoxia, acceleration, weightlessness, heat, diurnal variation, and psychological stress. These studies, as well as the statement of Scott Crossfield, famous test pilot and design specialist, make it appear that, when the time comes, people will be available who can cope with the stress of orbital flight.

If man is to spend considerable time in interplanetary space or on a planet, he will have to take part of his environment along. He will have to produce on a small scale an ecological cycle com-

parable to that which now exists between plants, animals, and man on earth. This intricate problem was discussed by Jack Myers of the University of Texas and H. G. Clamann of the School of Aviation Medicine. The final solution should bring much greater insight into the science of bioecology than we now have.

A number of distinguished astronomers discussed the physics of the sun and the environment on the surface of the planets. Walter Orr Roberts of the University of Colorado discussed the role of sunspots and solar flares in terrestrial weather. G. P. Kuiper of the Yerkes and

McDonald observatories showed the best photographs of the lunar surface yet made. Gerard de Vaucouleurs of Harvard University cited evidence for "life" on the planet Mars: infrared spectra obtained from scattered infrared rays from light and dark areas of the planet, which resemble spectra obtained from lichens. The problem of extraterrestrial life and of the origin of life is a very fascinating one which interests some of the most outstanding bioscientists. John D. Fulton of the School of Aviation Medicine simulated Martian atmosphere, soil, moisture, and temperature conditions in his laboratory and found three different microorganisms which were still capable of multiplying. Further work, in the presence of solar radiation, is needed. Hubertus Strughold, the first professor of space medicine and the originator of many basic concepts of space biology, discussed the interactions of the gravitational fields of the sun, earth, and moon.

Many basic biological questions remained necessarily unanswered at the conference, among them that of the exact nature of life elsewhere in the solar system. When experiment can answer these questions, then the scope of our knowledge of life processes will be greatly widened. For nature is far more resourceful than we can imagine, and life may originate, exist, or adapt itself to environments in greater richness of forms than we know.

CORNELIUS A. TOBIAS

Donner Laboratory,
University of California, Berkeley

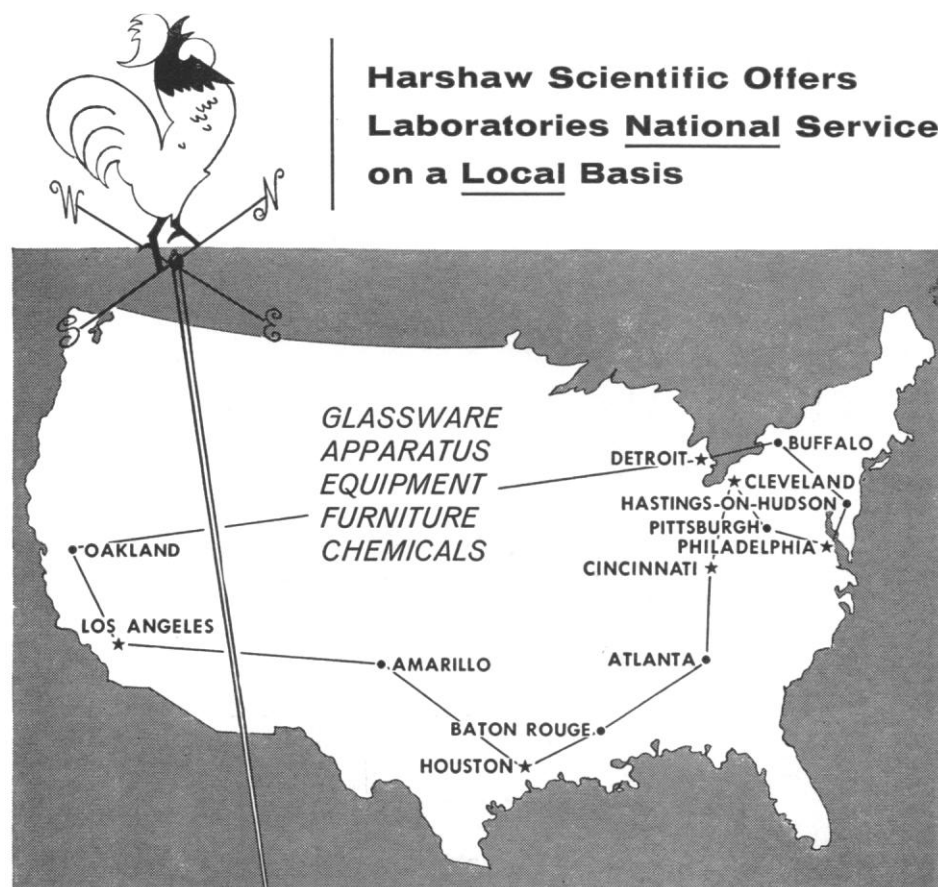
Differentiation

The Roscoe B. Jackson Memorial Laboratory, in celebration of its 30th anniversary, will hold a symposium 15-17 June at Bar Harbor, Me., on "Some Problems of Normal and Abnormal Differentiation and Development." Attendance will be limited to 100. Application should be made *not later than 15 April*, to: Dr. Nathan Kaliss, Symposium Chairman, Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Me.

Laurentian Hormone Conference

The 1959 Laurentian Hormone Conference of the AAAS will be held at Mont Tremblant Lodge, Mont Tremblant, Quebec, between 30 August and 4 September. Investigators interested in attending this conference should make application to the Committee on Arrangements of the Laurentian Hormone Conference, 222 Maple Ave., Shrewsbury, Mass., at an early date and in any event no later than *11 May*.

A conference rate of \$13 per day per person is extended to all invited partici-



BRANCHES ★

CLEVELAND 6, OHIO
1945 East 97th Street
Tel. RAndolph 1-8300

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

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

SALES OFFICES ●

AMARILLO, TEXAS, 3409 S. Jackson Street ● ATLANTA 5, GEORGIA, 3130 Maple Drive, N.E., Tel. CEdar 3-3560
BATON ROUGE 6, LOUISIANA, 3160 Florida Street, Doherty Building, Room 103, Tel. DIckens 3-1933 ● BUFFALO 2,
NEW YORK, 260 Delaware Avenue, Tel. GARfield 9-2000 ● HASTINGS-ON-HUDSON 6, NEW YORK, Tel. HASTings 5-8250
OAKLAND 11, CALIFORNIA, 3826 Piedmont Avenue, Tel. OLympic 5-6511 ● PITTSBURGH 22, PENNSYLVANIA,
504 Bessemer Building, 6th St. & Fort Duquesne Boulevard, Tel. ATLantic 1-7930

Harshaw Scientific Offers Laboratories National Service on a Local Basis

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*.

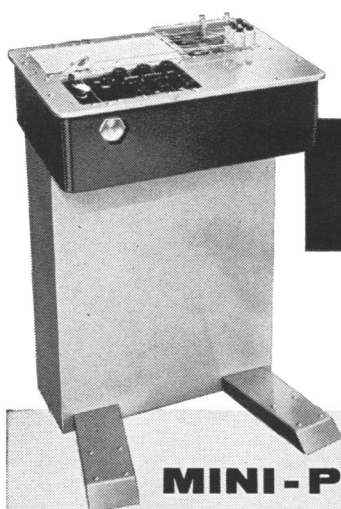
Harshaw Scientific, Division of The Harshaw Chemical Company is unique among laboratory supply houses. We know what laboratories require since our company employs several hundred chemists, scientists, engineers and technicians in its many research, development and control laboratories and we stock accordingly...Glassware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



HARSHAW SCIENTIFIC

Division of the Harshaw Chemical Company

Cleveland 6, Ohio



GME's

New

MINI-POLYGRAPH

"Simplicity and accuracy for student or scientist"

- Compact versatility — EEG, ECG, and 2 pressure channels or ECG and 3 pressure channels
- Transducers plug in directly — no extra power supply or pre-amplifiers needed
- Rugged and sturdy
- Plug-in printed circuits
- Rectilinear recording with ink on 6" paper with millimeter square marking; simple and reliable linkage — only two moving parts
- Anti-clogging inking system
- Instantaneous speed change — 6 speeds

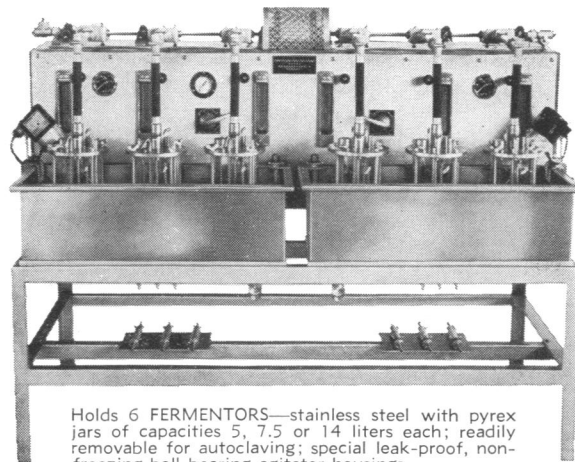
GILSON MEDICAL ELECTRONICS

On Madison's West Beltline Highway
Middleton, Wisconsin

FERMENTOR DRIVE ASSEMBLY

For laboratory and pilot plant application

- Aerobic or Anerobic Fermentations • Tissue Cultures
- Other Metabolic Studies in Submerged Cultures



Holds 6 FERMENTORS—stainless steel with pyrex jars of capacities 5, 7.5 or 14 liters each; readily removable for autoclaving; special leak-proof, non-freezing ball bearing agitator housings.

Stainless steel baths, thermostatically controlled within $\pm 1/2^\circ\text{C}$. Twin, anti-friction drives afford wide range of agitation and aeration rates.

Machine available with automatic anti-foam addition system. Single fermentor and 3-fermentor drive assemblies also available.

Write for Bulletin FS-S43



NEW BRUNSWICK SCIENTIFIC CO.

PRECISION LABORATORY APPARATUS

P.O. BOX 606 • NEW BRUNSWICK, N. J.

SAVE With The ALL NEW Aloe-Petrolite VENTILATED FUME HOOD

***Removes fumes without
loss of conditioned air***

Simple in design / Economical to install / Easy to maintain. In addition to protecting laboratory personnel from obnoxious or toxic gases, the Aloe-Petrolite Fume Hood saves conditioned air. Not only in the room where it is installed, but in the entire building. Losing cooled or heated air through fume hoods places an extra load on refrigeration and heating equipment. Result: unnecessary expense. But—by using *outside* air instead of room air, to carry off fumes, waste of conditioned air is stopped. This hood does just that. It operates as an independent unit, completely isolated from rest of room. And in air conditioning savings it can pay for itself.

Descriptive bulletin and all details are yours for the asking. Write or call us today.

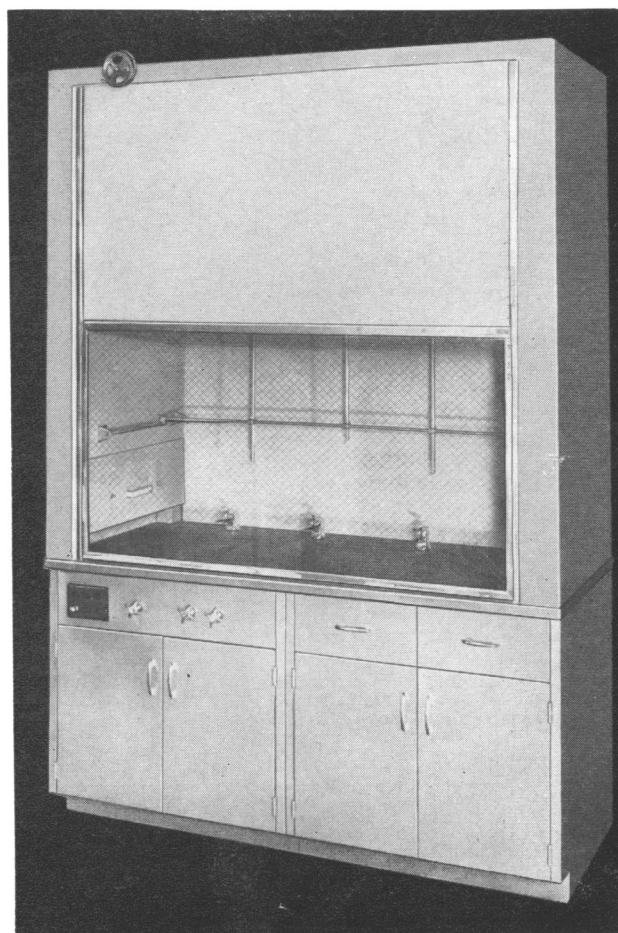
ANOTHER MEMBER OF THE
MODULINE
FAMILY OF FINE CASEWORK



aloe scientific

DIVISION OF A. S. ALOE COMPANY
General Offices

5655 Kingsbury • St. Louis 12, Missouri
FULLY STOCKED DIVISIONS COAST-TO-COAST



pants. Since the number of participants is necessarily limited by available accommodations, all applications are screened and invitations to attend are issued by the Committee on Arrangements by 12 June.

Biophysics

Yale University will sponsor a conference on opportunities in biophysics research on 29 June–3 July at the J. W. Gibbs Laboratory under a grant from the National Science Foundation. The conference will be directed by E. C. Pollard, chairman of the biophysics department, with the assistance of Harold J. Morowitz.

During the last 18 months, visiting physicists have repeatedly pointed to the importance of providing research opportunities in physics in the smaller colleges. Physicists situated in these institutions need encouragement and assistance in carrying on small-scale, but significant research. Opportunities for research are often as important as the salaries offered in attracting competent young physicists to the staffs of colleges.

The Yale conference will review opportunities for college physicists in biophysics research. Other universities are

considering similar conferences in other areas of physics.

Participants in the conference will receive stipends at the rate of \$15 per day and travel allowances at the rate of about 4 cents per mile. Approximately 30 participants can be accommodated. The major criteria for their selection will be interest in conducting some form of research in biophysics, tenure of a teaching position in a small institution where expensive research equipment in physics would be hard to come by, and an advanced degree in physics. Inquiries about the conference should be directed to Professor E. C. Pollard, Department of Biophysics, Yale University, New Haven, Conn.

Wistar Institute Symposium

At the Symposium on the Structure of Science that will be held in Irvine Auditorium at the University of Pennsylvania, 17–18 April, national and international figures in science will suggest some possible directions for future scientific thought and activity. The symposium accompanies the formal opening of new laboratories and a new museum at the Wistar Institute of Anatomy and Biology in Philadelphia.

Senator Lister Hill of Alabama and LeRoy Burney, surgeon general of the U.S. Public Health Service, will join with physicists, philosophers, mathematicians, chemists, biologists, and research institute officials from the United States, Canada, England, and Sweden as speakers at the symposium.

Forthcoming Events

May

3. American Federation for Clinical Research, annual, Atlantic City, N.J. (G. E. Schreiner, Georgetown Univ. Medical Center, Washington 7.)

3. Periapical Lesions-Pacific Coast Oral Pathology Workshop, 1st annual, Los Angeles, Calif. (W. Bullock, Dept. of Pathology, Univ. of Southern California School of Medicine, 1200 N. State St., Los Angeles.)

3–7. American Assoc. of Cereal Chemists, 44th annual, Washington, D.C. (J. W. Pence, AACC, Western Utilization Research Laboratories, Albany, Calif.)

3–7. Electrochemical Soc., Philadelphia, Pa. (Electrochemical Soc., Inc., 216 W. 102 St., New York 25.)

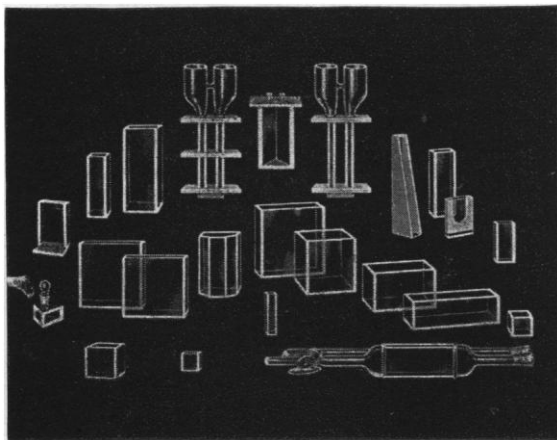
3–7. Electrode Processes, symp., Philadelphia, Pa. (Headquarters, Air Force Office of Scientific Research, Washington 25.)

3–7. Mechanical Properties of Inter-

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

AAAS SYMPOSIUM VOLUMES

6" x 9", illustrated, clothbound

Zoogeography, 510 pp., 1958	\$12.00
The Species Problem, 404 pp., 1957	8.75
Atomic Energy and Agriculture, 460 pp., 1957 ..	9.50
The Beginnings of Embryonic Development, 408 pp., 1957	8.75
Alcoholism, 220 pp., 1957	5.75
Tranquilizing Drugs, 205 pp., 1957	5.00
Venoms, 480 pp., 1956	9.50
The Future of Arid Lands, 464 pp., 1956	6.75
Water for Industry, 140 pp., 1956	3.75
Psychopharmacology, 175 pp., 1956	3.50
Luminescence of Biological Systems, 466 pp., 1955	7.00
Advances in Experimental Caries Research, 246 pp., 1955	6.75
Antimetabolites and Cancer, 318 pp., 1955	5.75
Monomolecular Layers, 215 pp., 1954	4.25
Fluoridation as a Public Health Measure, 240 pp., 1954	4.50

7 1/2" x 10 1/2", double column, illustrated, clothbound

Centennial, 319 pp., 1950	5.00
Mammary Tumors in Mice, 231 pp., 1945	3.50

AAAS,

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

metallic Compounds, Philadelphia, Pa. (J. H. Westbrook, General Electric Research Laboratory, P.O. Box 1088, Schenectady, N.Y.)

4. American Soc. for Clinical Investigation, annual, Atlantic City, N.J. (W. W. Stead, J. Hillis Miller Health Center, Gainesville, Fla.)

4-5. Microcirculatory Conf., 7th annual meeting, NIH, Bethesda, Md. (B. W. Zweifach, 550 First Ave., New York 16.)

4-7. American Geophysical Union, annual, Washington, D.C. (W. E. Smith, AGU, 1515 Massachusetts Ave., NW, Washington 5.)

4-7. National Instrumentation Flight Test Symp., 5th, Seattle, Wash. (H. T. Noble, Boeing Airplane Co., Flight Test Station, Wichita 1, Kan.)

4-8. American Soc. of Civil Engineers, Cleveland, Ohio. (W. H. Wisely, 33 West 39th St., New York 18.)

5-6. Association of American Physicians, annual, Atlantic City, N.J. (W. W. Stead, vice president, AFCR, J. Hillis Miller Health Center, Gainesville, Fla.)

5-6. Self-Organizing Systems, conf., Chicago, Ill. (S. Cameron, ICSOS Conference Secretary, Armour Research Foundation, 10 W. 35 St., Chicago 16.)

5-7. International Scientific Radio Union, spring meeting, Washington, D.C. (J. P. Hagen, National Acad. of Sciences, 2101 Constitution Ave., NW, Washington 25.)

5-9. Southwestern and Rocky Mountain Div., AAAS, Laramie, Wyo. (M. G. Anderson, New Mexico College of Agriculture and Mining, State College.)

5-12. Electronic Distance Measuring Equipment, Intern. Assoc. of Geodesy symp., Washington, D.C. (C. A. Whitten, Coast & Geodetic Survey, Washington 25.)

6-8. American Inst. of Chemists, Atlantic City, N.J. (L. Van Doren, American Inst. of Chemists, Inc., 60 E. 42 St., New York 17.)

6-8. American Pediatric Soc., Buck Hill Falls, Pa. (A. C. McGuinness, 2800 Quebec St., Washington 8.)

6-8. Metal-Binding in Medicine, symp., Philadelphia, Pa. (M. J. Seven, Hahnemann Medical College and Hospital of Philadelphia, 230 N. Broad St., Philadelphia 2.)

6-9. National Science Fair, 10th, Hartford Conn. (Science Clubs of America, 1719 N St., NW, Washington 6.)

6-10. Infectious Pathology, intern. cong., Milan, Italy. (A. Janussi, Secretary General, via Boccaccio 25, Milan.)

7-9. Midwestern Psychological Assoc., Chicago, Ill. (I. E. Farber, Dept. of Psychology, Univ. of Michigan, Ann Arbor.)

7-9. World Cong. on Agricultural Research, International Confederation of Agricultural Engineers and Technicians, Rome, Italy. (CITA, Regional Secretariat, 86, via Barberini, Rome.)

8-10. Uranium, 4th annual symp., Moab, Utah. (AIME, 29 W. 39 St., New York 18.)

9-11. International Soc. of Acupuncture, 10th cong., Paris, France. (SIA, 8 avenue Franklin Roosevelt, Paris 8°.)

10-15. Society of American Bacteriologists, St. Louis, Mo. (E. M. Foster, Univ. of Wisconsin, Madison 6.)



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. E2-6, 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.

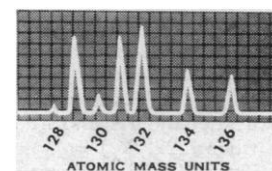
*TRADEMARK

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 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

