

SCIENCE

4 October 1963

Vol. 142, No. 3588

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

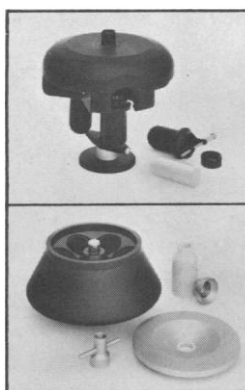


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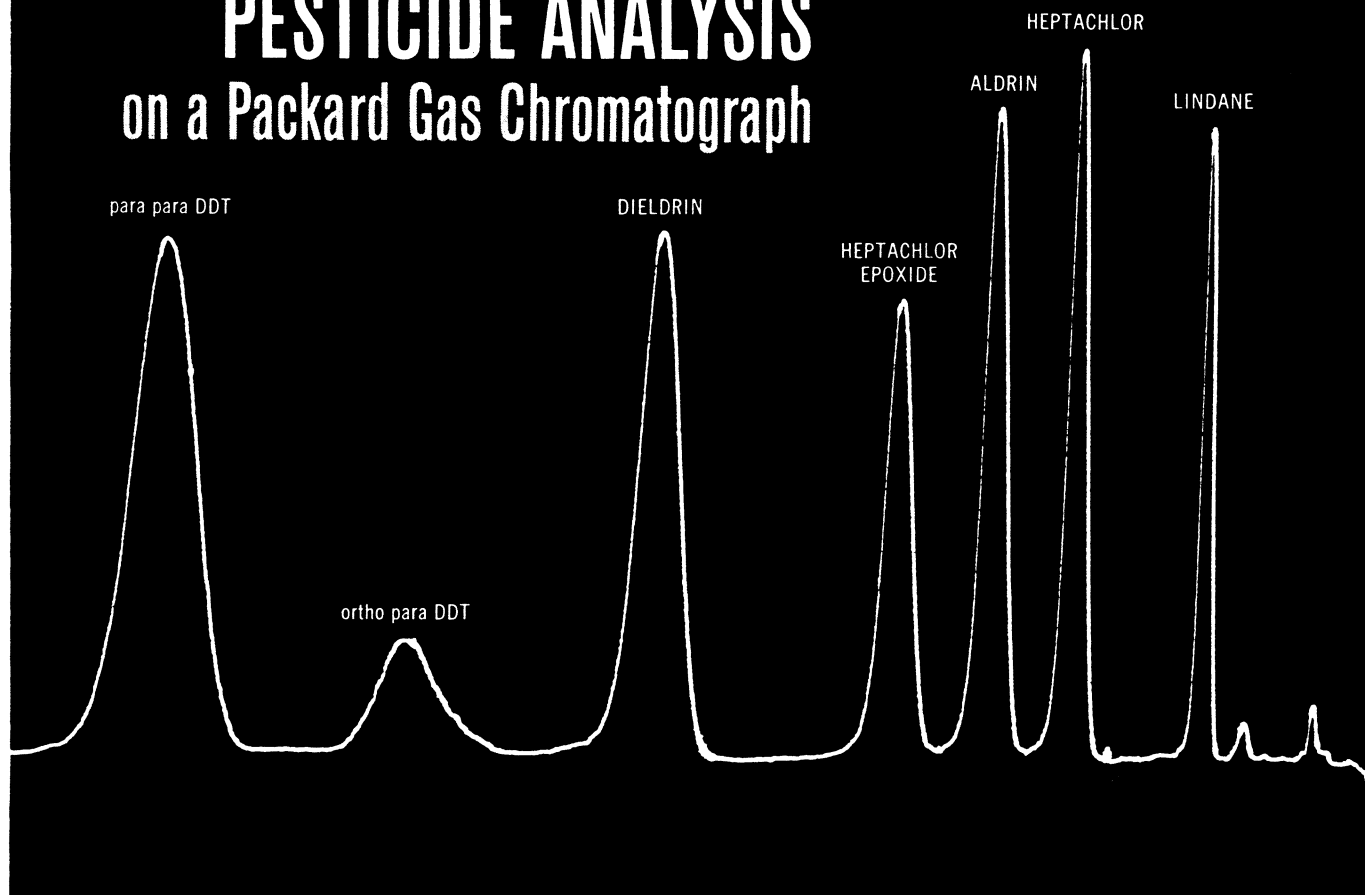
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EXPERIMENTAL CONDITIONS:

SAMPLE—2 microliters of hexane solution containing:
Lindane .25 x 10⁻⁹ gm.
Heptachlor .5 x 10⁻⁹ gm.
Aldrin .5 x 10⁻⁹ gm.
Heptachlor Epoxide .5 x 10⁻⁹ gm.
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COLUMN: 5' x 1/4" all glass
LIQUID PHASE: 10% Dow Corning Silicone Fluid (DC200)

SUBSTRATE: 60-80 mesh Chromosorb W (acid and base washed)

CARRIER GAS FLOW RATE: 120 cc Nitrogen/min.

INLET HEATER TEMP.: 225°C

COLUMN TEMP.: 190°C

DETECTOR TEMP.: 195°C

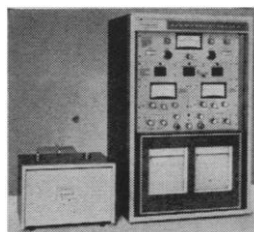
OUTLET TEMP.: 200°C

DETECTOR: Packard Electron Capture with 150 millicurie Tritium Source

ELECTROMETER RANGE: 3 x 10⁻⁹ amperes full scale

DETECTOR VOLTAGE: 50
NOISE LEVEL: 3 x 10⁻¹² amperes

CHART SPEED: 30 inches/hour



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4 October 1963

Vol. 142, No. 3588

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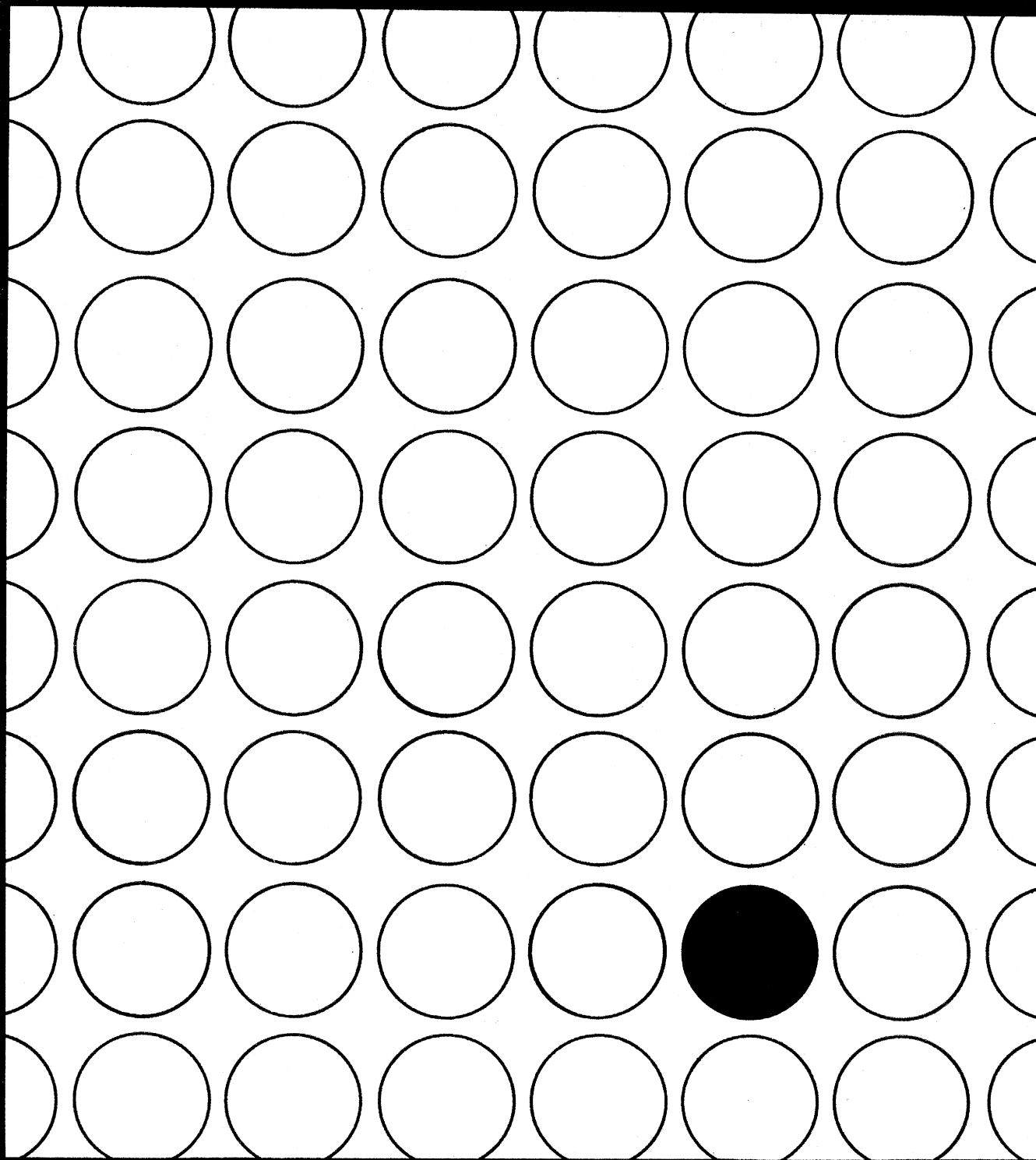
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COVER

Saguaro (*Cereus giganteus*, *Carnegiea gigantea*), paloverde (*Cercidium microphyllum*), and low shrub bursage (*Franseria deltoidea*) located on the stony upper bajada of the Sonoran Desert just north of Tucson, Arizona. Situated at the base of the snow-capped Santa Catalina Mountains, this saguaro population is reproducing itself in an area where vegetation has not been degraded by overgrazing. See page 15. [Walter S. Phillips]



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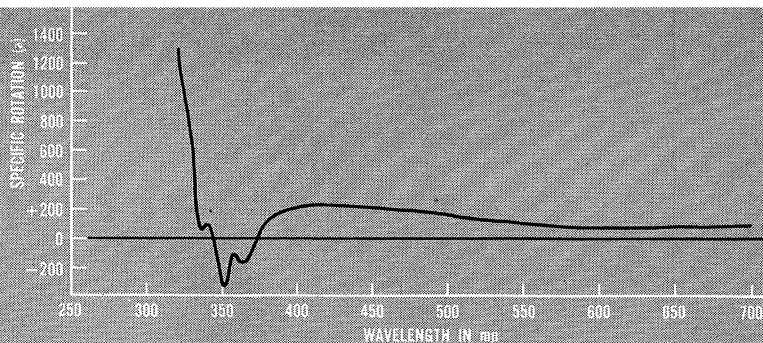


Chart shows spectral analysis by Optical Rotatory Dispersion of 2mg of testosterone in p-dioxane. With identical calcite polarizer-analyzer combinations in each beam, absorption by the sample is canceled out. Rotation of the light by the sample appears as a pen deflection on the chart, whence it is readily convertible to angular units by conversion tables provided with the accessory. The high scale expansions available on the Model 350 can be used to advantage in ORD work.

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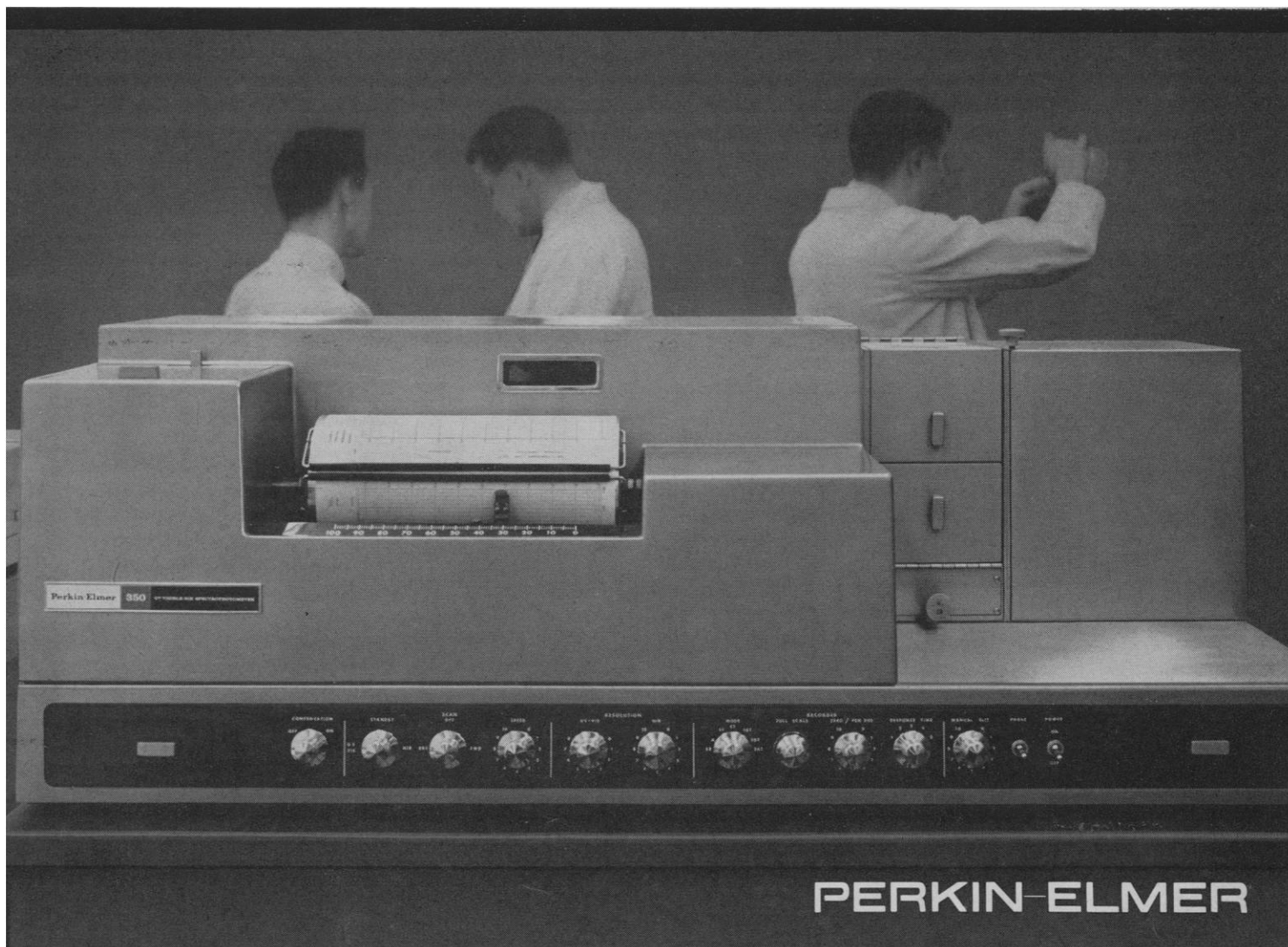
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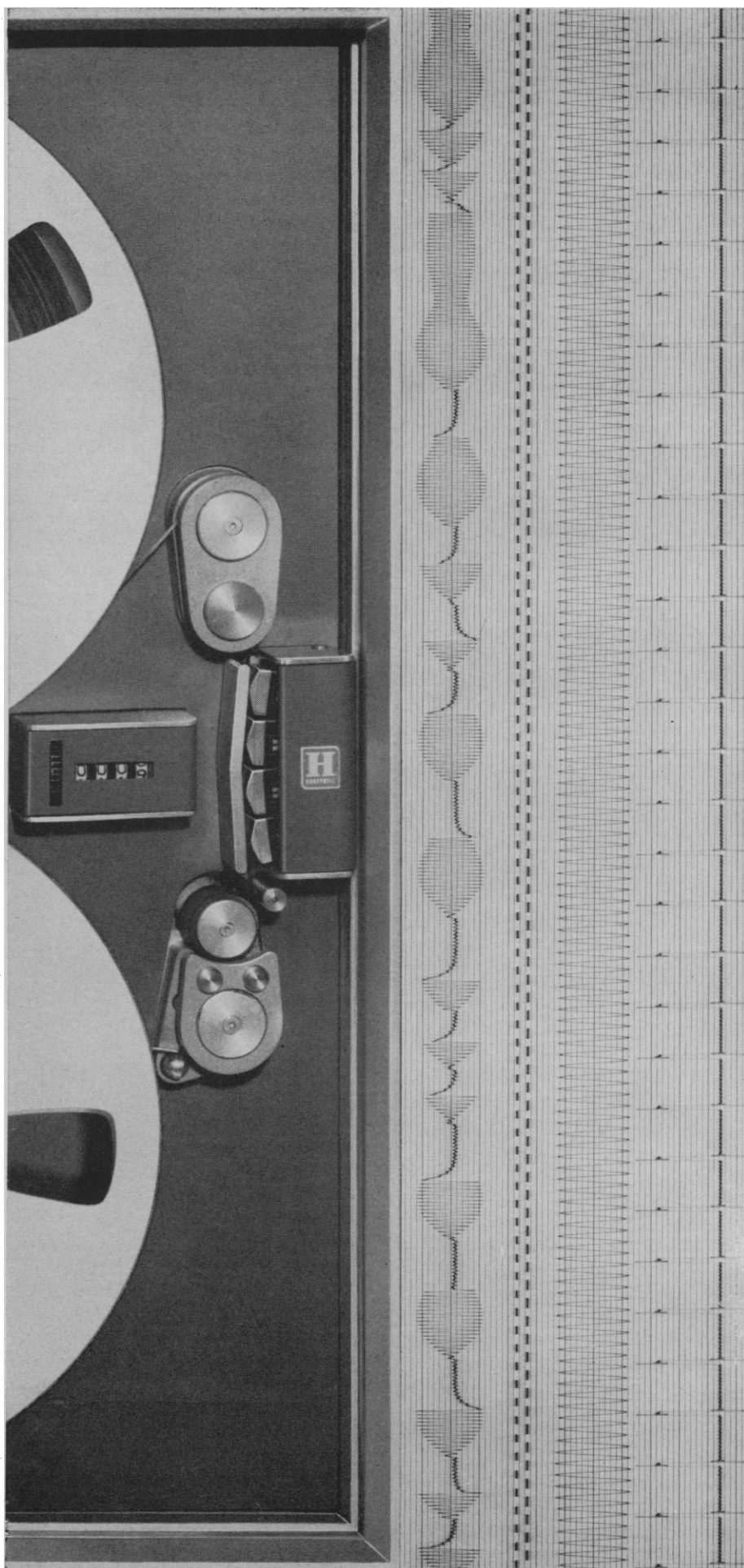
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For immediate readout, the Visicorder gives you an instantaneous record of 1 to 36 channels of data from DC to 5000 cycles per second. A variety of paper speeds from .1 to 160 inches per second gives you the trace resolution you need. Five models of the Visicorder are available.

At the same time, you can record up to eight channels (plus voice and compensation) of data up to 10,000 cycles on the 8100 portable. Later on, you can play selected portions of your data into the Visicorder. Four tape speeds (1½, 3¾, 15, and 30 ips) give you record and playback versatility for whatever frequency you're recording.

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For complete information about the Honeywell 8100, the Visicorder Oscillograph, and other recording equipment, contact your nearest Honeywell office, or write: Honeywell, Denver Division, Denver 10, Colo. Or call us direct at 303:794-4311. In Canada, contact Honeywell Controls, Ltd., Toronto 17, Ontario.

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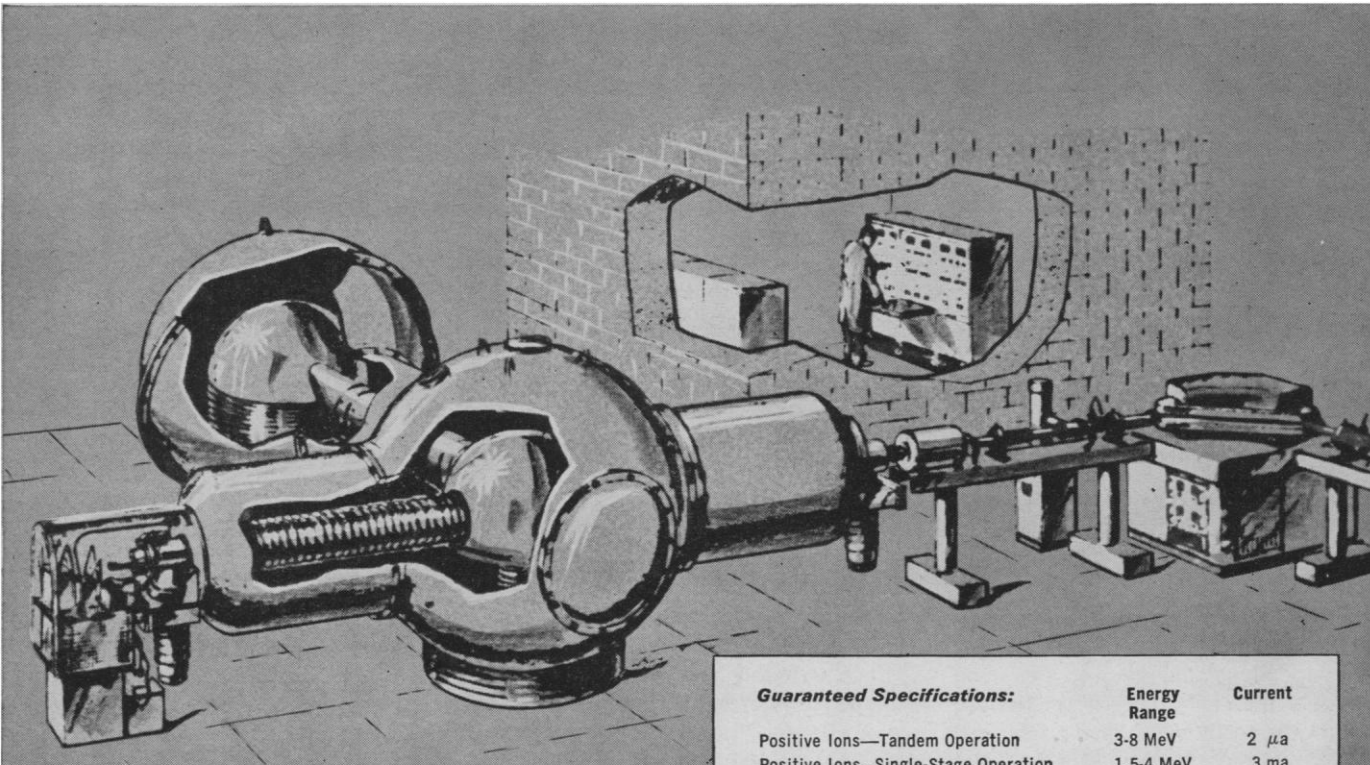
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Features:
Ion source at ground potential
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ICT voltage generator has 12 milliamper rating to handle future high current ion sources and targets
*Single-purpose ICT electron accelerator with vertical beam tube and scanner (not shown) will offer 20 ma or 60 kilowatts of electrons at 3 MeV. At this energy, 6 kilowatts of x-rays will be available for a variety of studies in radiation chemistry.

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

The Image of the Scientist

That the public image of the scientist is a confused one has often been remarked. The confusion undoubtedly results in part from the speed with which the scientist's role in society has been changing. Most adults grew up when the ties between science and military affairs were not nearly so strong as they are now, when governmental support for science and interest in scientific matters were far weaker than they are now, when outer space could be dreamed about but not probed and entered, when the fruits of science were beneficial or neutral, but not to be feared as many people fear them now.

In time, and with better science education in schools and through the public media, much of the confusion can be cleared away, and most scientists seem to agree that the task of giving the public a better understanding of science is worth a lot of hard work.

But the clarification will apply chiefly to science and much less to the scientist as a person. For, as a person, he is usually out of sight of most of the public, and even when he appears he does not seem to fit the standard American pattern. In many ways he does not match that pattern, and even when he does the match is likely to go unrecognized. Several years ago David McClelland and his co-workers questioned a sample of small-town residents to determine the factors on which they based their ratings of personal achievement. One that loomed large was the extent to which a person had risen above his background. The son of a janitor who becomes a banker gains greater esteem than the son of a banker who follows in his father's footsteps. Many scientists have risen above the occupational status of their fathers, but they are such a mobile lot that few of their neighbors have any idea of the family backgrounds from which they came.

All in all, the scientist frequently is a "different" sort of person, but he probably fits the American ideal of a successful, contributing member of society better than his confused public image does. The degree of fit, however, is not generally recognized because for many Americans he is only an image and never a reality in the sense that the local doctor, lawyer, banker, and merchant are living realities. His works may be feared, appreciated, or ignored, but he remains a dim figure in the background. The use of Swiss cheese, French perfume, or a German automobile gives one little knowledge of the inhabitants of the lands from which these goods were imported; the use of antibiotics, synthetic fibers, or textbooks gives one little knowledge of the scientists whose work made possible their production.

Biographies, of which there have been some good ones, public lectures, and a rare motion picture or television program partially bridge the gap. But it seems likely that the image of the scientist will remain pretty unclear for most people. If this seems inevitable, why not stop worrying about the matter? In so far as they can be divorced, public attitudes toward science are more important than attitudes toward scientists. It is more useful for the public to have a fair understanding of science than an accurate knowledge of the personal characteristics of scientists. And it is more worth while for scientists to help develop an understanding of their work than to try to improve their own image.—D.W.

Spectrum of K and L conversion electrons from Ba^{137m}

Conditions:

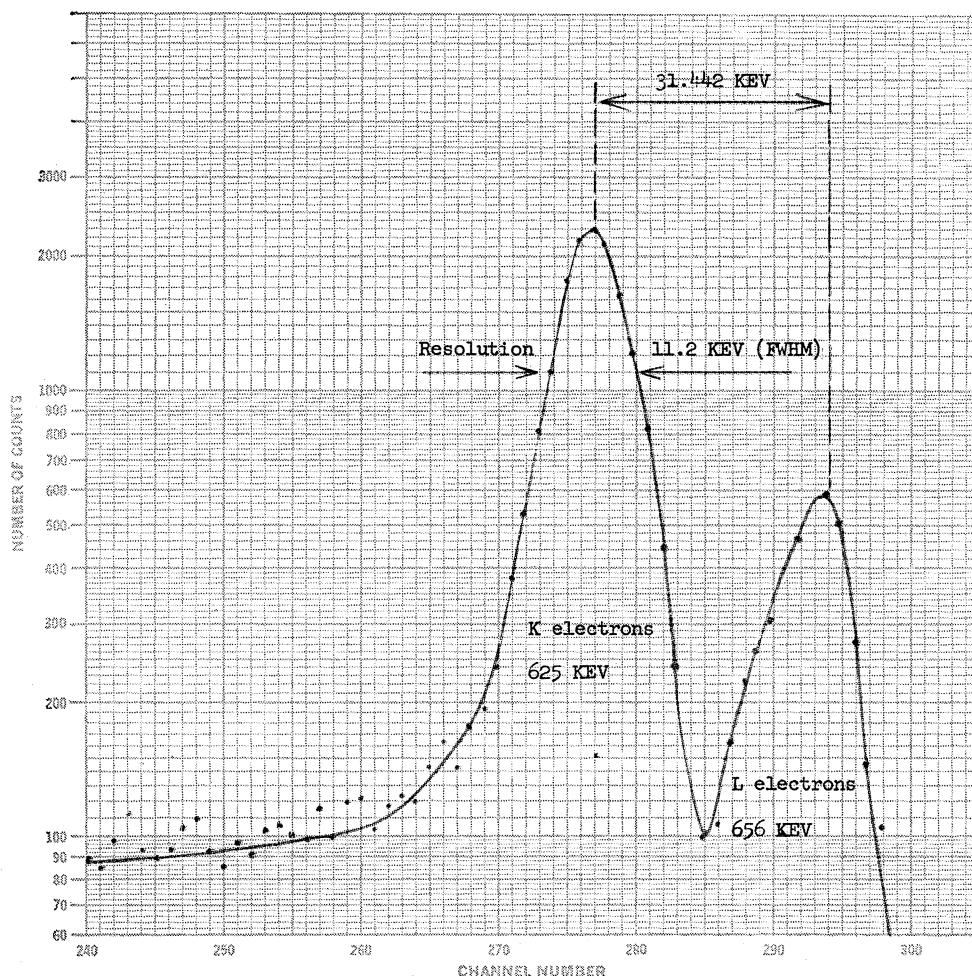
Li-drift detector
3 mm thickness
56 mm² active area
300v bias
0.5 microsec. time constant
Room temperature

Source:

Cesium-137

Pulse Height Analyzer:

TMC Model 404-6



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(This curve is the latest word)

At least don't pay attention to the part that says resolution is "better than 20 KEV" for the new Lithium Ion Drift Detector (some even said 30 KEV). Instead look at the resolution shown in the curve above. It is 11.2 KEV (FWHM) — at room temperature — or what we should have called "better than 12 KEV". The rest of the information in the folder is correct. Window thicknesses from 25-50 microns and deep depletion regions combine to give linear response over a wide range of energies . . . leakage is less than 2 microamperes at 100 volts . . . prices are sensible . . . and the detectors are on the shelf.

The description of the new Double Diffused Planar Passivated Detectors for low energy charged particles was correct. They have dead layers of less than a micron. A new patented passi-

vation technique gives them much higher resistance to fingerprints, moisture, gases and other environmental problems. It also gives them high resolution and low leakage current that is shown in a curve provided with each detector. Furthermore, the detectors are fully guaranteed for six months.



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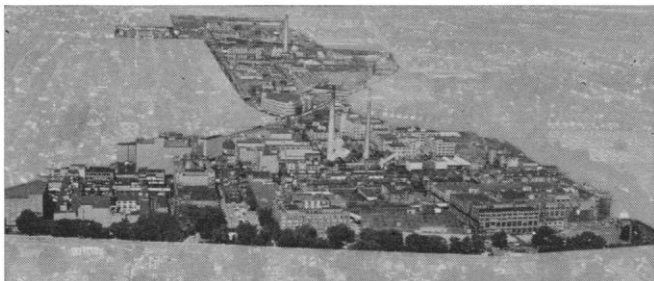
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why the new KODAK EKTACHROME MS Film ... that oldtime physics, which is sometimes good enough for us ... why some people journey to Rochester

No longer particularly narrow

Several parcels of farm land that George Eastman began picking up on the outskirts of Rochester in 1890 now look like this:



The site is principally devoted to the manufacture of photographically sensitized goods, with whatever supporting activity seems advisable. The scale of operations, as you will note, is more than trivial. While much of the output does indeed get used for trivial purposes (such as reminding you many years from now of the red and gold on an autumn day when the children were little), more and more of it lacks any connection with frivolity.

Few men have the knack of making a good piece of color film—far fewer than can sew a good overcoat or brew a good glass of beer. As a matter of fact, not a single man in the world knows all by himself how to do it. Only the gigantic organization knows. The people constituting the organization spend their time at small tasks, like broadening the exposure latitude. It was quite narrow when color film first became important.

Today on an instrumentation range when the button is pressed that makes the thingamabob go off and simultaneously starts the 31 movie cameras that will show afterwards what happened, the thingamabob might be sadly wasted if unanticipated light levels resulted in bad underexposure or overexposure. One 16mm, 35mm, and 70mm color film that we endowed with much tolerance against this risk is now being superseded by another with more tolerance. The new one, KODAK EKTACHROME MS Film, can stand four stops (2^4) of underexposure and two stops of overexposure and provides better resolution of fine detail than the older film.*

Note that the concept of underexposure and overexposure implies the possibility of a most admirable on-the-nose exposure. As for the two ends of the tolerance curve and how good the results must be to get inside them, one places one's trust in an expert, much as one trusts one's tailor or brewer.

One's consultant on these matters is Eastman Kodak Company, Photorecording Methods Division, Rochester 4, N. Y.

Infrared advantageously reflected or refracted

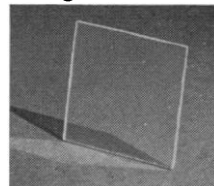
A gnat can fascinate as much as a hippopotamus. Though the polycrystalline infrared media business is considerably smaller than the film business, it continues to yield its own satisfactions. To our four KODAK IRTAN Optical Materials, we are now able to add IRTAN 5. The new one commends itself, among other merits, for *reststrahlen*.

Being only a manufacturer instead of an institution of learning, we try to avoid robbing academic circles of too many scholars who can invoke the Fermi surface in discussing ionic crystals that behave like metals in the extent to which they reflect radiation of certain long wavelengths. The monumentally casual and clever oldtimer R. W. Wood simply tells us in his *Physical Optics* that in 1897 Rubens and Nichols worked out a scheme for using several bounces off a crystal to attenuate wavelengths subject to simple Fresnel reflection (e.g., $(4\%)^3 = 0.006\%$), so that only the metalically reflected infrared bands remained; hence, *reststrahlen*. A thin plate of

*The user can run the old (EKTACHROME ER Film) head-to-tail with the new in his processing machines.

KODAK IRTAN 5 Optical Material, largely MgO, effectively isolates $15\mu - 25\mu$ by one bounce under the right conditions.

On the other hand, the transparency you see here is good from 0.5μ to 8μ , without the water band at 2.8μ . Thermal conductivity exceeds that of any of the other IRTAN materials by several times. Its dispersion suggests pairing with some of the others to make achromats.



Apparatus and Optical Division, Eastman Kodak Company, Rochester 4, N. Y. can send much data about IRTAN materials. If you would rather have real infrared lenses than data and can contrive to avoid the need for achromatism, a purchase order would probably result in shipment within a week of any of the following IRTAN 2 f/1 menisci, which transmit $1\mu - 14\mu$ and are very rugged thermally, chemically, and mechanically:

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*diameter of axial image of point source at which measured intensity drops to 5% of center peak intensity, for $2 - 4.5\mu$ range.

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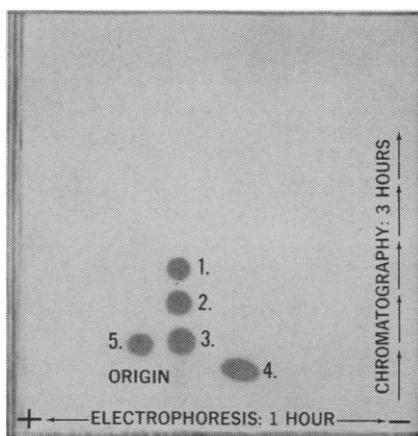
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earth and its history. While such a definition includes almost all scientific endeavors, only four essential aspects related to the marine environment were considered at the symposium: (i) the concentration of elements in the shell and soft parts of marine organisms; (ii) the production of compounds by organisms during their activities; (iii) the fractionation and separation processes which occur in the marine environment; and (iv) marine biogeochemical cycles.

Little is known about the spectrum of trace elements in carbonate shells; most of the information concerns strontium and magnesium. It is known that the uptake of these two elements is affected by the biochemistry and growth stage of the organism and the crystal phase of the shell, as well as by the temperature, chlorinity, and possibly the total chemistry of sea water. In addition, the substrate upon which the organisms grow plays a vital role in the entire system.

Since trace elements are an integral part of the mineral in which they occur, one must know all the mineral species which are precipitated by marine organisms. Little information is now available on this point. This is true even for the "extensively" studied organisms which secrete carbonates. Relatively recent investigations on the organic matrices of mineralized carbonate shells indicate that their physical structure and amino acid residues can be utilized to define the biochemistry of species, as they are affected by ecologic factors. Moreover, preliminary studies indicate that protein chemistry may be a controlling factor in the formation of particular mineral phases, that is, calcite or aragonite. In this type of investigation knowledge of the trace-element chemistry of the soft parts and body fluids is essential because some are involved in the physiology of the organisms as well as affecting the chemical processes in the ocean. Information obtained from such studies may aid in tracing the biochemical evolution of marine organisms and may be used for monitoring the temperature, chlorinity, and total chemistry of the ancient oceans, and for distinguishing between original and altered composition of fossil skeletons.

Two basic questions arise in the study concerned with the organic content of both sea water and sediments. What is present? What function does it have? Reference to the literature will disclose an extensive bibliography of

description: determinations of the organic carbon and nitrogen content of sea water and sediments; correlations between organic matter and sediment particle size, or with plankton bloom; variations of organic matter, at different depths, in both sediment and water in some environments. These studies, even with their shortcomings, have provided the groundwork for the future. With the advent of more sophisticated techniques such as mass spectroscopy and chromatography, the scientist has been able to ascertain the presence of carbohydrates, proteins, fatty acids, hydrocarbons, and other compounds in sea water and sediments. However, present analytical knowledge is inadequate for determining some of the individual compounds and a serious attempt is being made to obtain the necessary information.

Organic matter in sea water is present in dissolved form, in particulate form, and in the living organisms. In the sediments it is present as discrete particles, living organisms, dissolved in the interstitial water and also associated with the inorganic minerals present in a manner not yet thoroughly understood. It ranges in type from that which is extremely unstable and that which is readily utilized by marine organisms all the way to highly stable products which have been termed kerogen or described as "lignin-like."

Dissolved organic matter in water has usually been estimated at 1 to 2 milligrams per liter with values of greater than 5 milligrams per liter in some bodies of water. In sediments the average amount of total organic matter is estimated at 1.5 percent or less. These represent relatively low concentrations but at least part of the organic matter is metabolically active, thus being a very significant component.

While organic matter acts as an energy source for marine organisms, especially microorganisms, in both water and sediments, the details of this system are not yet known. The rates of turnover of biologically utilizable organic compounds are of primary concern for the elucidation of energy cycles in the environment. An intimate relationship exists between the organic matter, the minerals present, and the bacteria. This affects not only the living population of any portion of the sea floor, but also the alteration of the sediment itself. Thus, sediments begin their alteration or diagenesis simultaneously with deposition. In addition, it has been demonstrated that the forma-

tion of calcite or aragonite is affected not only by the physiology of an organism and the physical factors of the environment around it, but also by the presence of certain organic compounds. Certain metals may also be accumulated in sediments and shells by the presence of specific organic compounds and by living organisms, or they may be precipitated by micro-organisms.

Studies concerning the abundance and fractionation of isotopes in the sea and its contents are of great and growing importance; most investigations have been concerned with hydrogen, carbon, and oxygen. Both hydrogen and oxygen isotopes may be useful tracers of water masses, but from the standpoint of oceanic biogeochemistry a thorough study of the isotopic effect of these three elements (H^1 and H^2 , O^{16} and O^{18} , C^{12} and C^{13}) will aid in studying biochemical processes in the marine environment.

For instance, the isotope effect of carbon is extremely useful in photosynthesis investigations because the extent of fractionation indicates activity. It is also possible to use this effect as a tool in studying carbonate precipitation, the decomposition of marine organic material, and the fossilization of carbon.

From the ratios of oxygen isotopes in marine organisms, such as foraminifera and belemnites, ancient ocean temperatures have been estimated. This has been most effectively used for determining oceanic paleotemperatures during the last ice age and during earlier periods.

Oxygen isotopes may also indicate the origin of certain marine calcium carbonate deposits by revealing if they precipitated directly from sea water, if they have passed through the biological cycle, or if they have been reworked from earlier deposits. In addition, fractionation studies between mineral phases can help in understanding the origin of authigenic feldspars. In addition to carbon, hydrogen, and oxygen, another isotope, silicon, is important because it may indicate the source used by organisms in the formation of their skeletons.

Many elements have a wide variation of concentration with depth of water in the sea. For instance the concentration of barium, mercury, the rare earths, radium, uranium, and others is 2 to 4 times greater at depths below 1 to 2 kilometers than at the surface. A common reason for con-

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Carbon-14 Fat Oxidation Test, A New Method of Measuring Fat Utilization in the Human	SUSANNE VON SCHUCHING & ARTHUR F. ABT V. A. Center, Martinsburg, W. Va.
Diffusion of Labeled Molecules in Heart Muscle	ERNEST PAGE Harvard Univ. Medical School
The Use of Labeled Non-Metabolized Amino Acids in Biochemical Research	THOMAS R. RIGGS & HALVOR CHRISTENSEN University of Michigan
Use of Carbon-14 Labeled DMO to determine pH.	THOMAS C. BUTLER Univ. of North Carolina Medical School
Iodine-125 as a Clinical and Biological Tracer	PAUL V. HARPER Argonne Cancer Research Hospital
Biosynthesis of Carbon-14 Labeled Bilirubin	RUDI SCHMID University of Chicago
Isotope Fractionation Effects in the Chromatography of Doubly-Labeled Compounds	PETER KLEIN Argonne National Laboratories
Radioassay of Thin Layer Chromatograms	FRED SNYDER Oak Ridge Inst. of Nuclear Studies
Continuous Scintillation Counting of Amino Acid Analyzer Column Eluates	DAVID ELWYN Michael Reese Hospital
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centration at depth appears to be an extraction of the elements in question from solution in the surface layers of the ocean by living organisms, which upon death sink into the deeper layers or to the bottom. During this process decomposition takes place and the elements are entirely or partially released into solution.

Copper, nickel, and zinc appear to have uniform concentrations from the surface of the water to the bottom. However, these and other trace elements are sensitive to the presence of organic matter, thus, the published values may not be real. For instance, a column extraction of zinc does not equally absorb three or four of the various species present. Also, certain organic complexes of zinc are known to exist in the sea and these are not generally measured by the methods used.

Although in recent years there has been remarkable advancement in oceanic biogeochemistry, answers to many presently known problems are still lacking and continually elude the scientist. Continued development and refinement of analytical methods are needed, and caution should be exercised when applying a method to one substrata which was devised for another. It is also essential that more data be obtained by existing methods. This naturally requires that samples and data be made available to laboratory specialists by seagoing oceanographers.

Additional information is required on the trace element composition and mineralogy of shells and soft parts of organisms. Rather than obtaining isolated data on a few shells per species, it is essential to collect enough statistically valid information to permit a knowledge of concentration ranges and of their relations to biologic and ecologic controls. It is also necessary to know more about the organic composition of sea water and sediments, not only the dissolved organic fraction in water but also the particulate fraction. Attention must be directed not only to the rarer components and those easy to analyze but also to the mass of the organic material; these are both the original and decomposition products resulting from the environmental history. It is also important that molecular determinations be quantitatively related to the total organic carbon present.

A greater potential lies ahead with further studies on variations in isotope abundances and fractionation proc-

esses. These must be investigated in natural waters, in the shells and soft parts of organisms, in inorganically deposited minerals, and in the atmosphere. Data on the presence and availability of nutrients and biologically essential elements in time and space are required as well as on the mineralization and concentration by microorganisms during diagenesis. After all, biological processes are the key to biogeochemistry and the mechanisms concerned.

When considering the development of both laboratory and field experiments it becomes apparent that the growing of organisms under controlled conditions and under close observation must be expanded. Investigations should be designed not only for correlation but also to determine the various mechanisms of inclusion. Likewise, experimental techniques can aid in separating the innumerable and seemingly unfathomable interrelationships which the natural environment portrays when the incorporation of organic material in sedimentary deposits is studied. Simple experiments, increasing in sophistication with time, may well point toward basic processes.

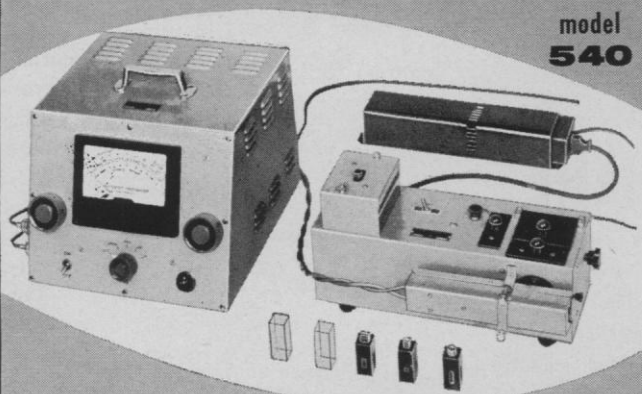
The setting up of bacteriological experiments in order to determine how the environment affects the bacteria and vice versa are of prime importance. Laboratory work may indicate how bacteria function in decomposing marine organic matter and ultimately produce the large mass of highly stable organic compound present in sediments. Likewise, experiments should be devised where recycling processes and rates of cycling can be obtained. Problems concerning the isotope effect, such as degradation of organic compounds, carbonate precipitation, and photosynthesis and its associated problems in the sea, may be answered by experimental means.

Finally, we should combine the analytical data from natural samples with the understanding obtained from experimental endeavors, expend much effort in thought, and arrive at logical, reasonable conclusions.

The programmed participants in this symposium were: F. F. Koczy, H. A. Lowenstam, L. J. Greenfield, G. O. S. Arrhenius, C. H. Oppenheimer, J. R. Vallentyne, R. G. Bader, S. Epstein, I. A. Breger, P. E. Cloud, J. D. Strickland, E. D. Goldberg, and M. C. Sargent. In addition, many specialists from various disciplines were invited and they also participated. This sym-

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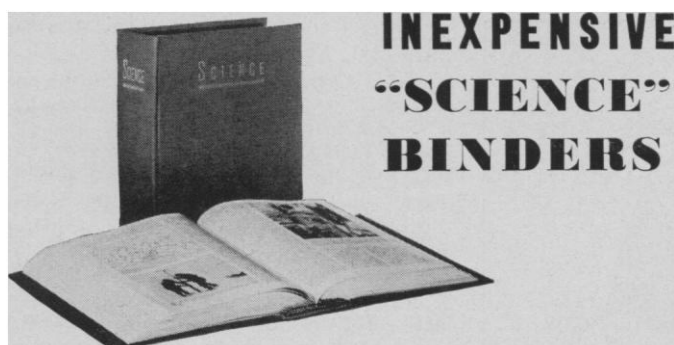
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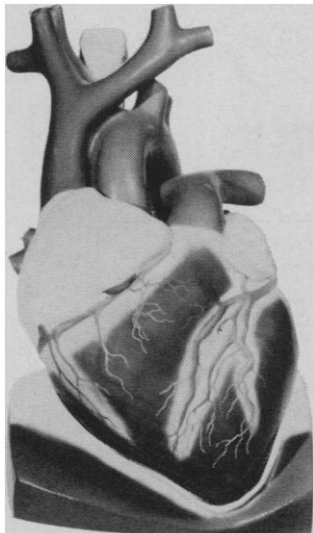
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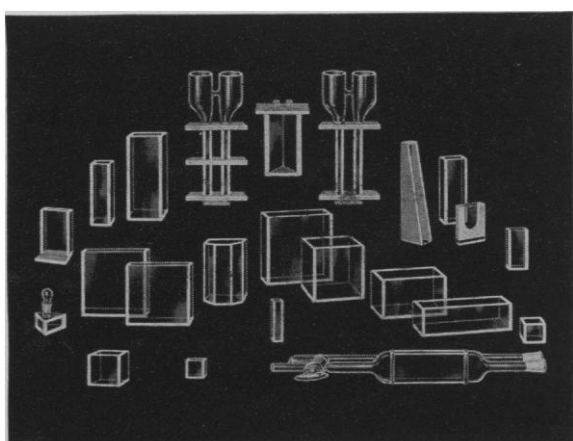
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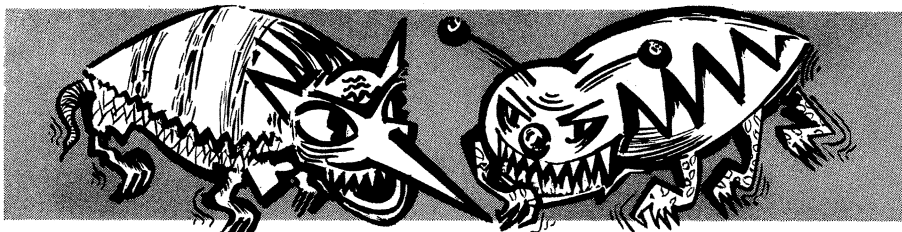


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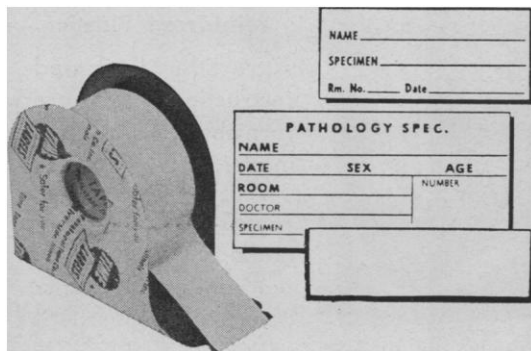
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Forthcoming Events

October

8-10. **Science and Engineering**, 10th annual symp., U.S. Air Force Academy, Colo. (Maj. J. Shafer, RROND, U.S. Office of Aerospace Research, Washington, D.C.)

8-11. **Electromagnetic Relays**, intern. conf., Sendai, Japan. (C. F. Cameron, School of Electrical Engineering, Oklahoma State Univ., Stillwater)

8-11. **American Roentgen Ray Soc.**, Montreal, P.Q., Canada. (American College of Radiology, 20 N. Wacker Dr., Chicago 6, Ill.)

9. **American Acad. of Arts and Sciences**, Brookline, Mass. (R. W. Burhoe, American Acad. of Arts and Sciences, 280 Newton St., Brookline Station, Boston, Mass.)

9-11. **Aerospace Electronics**, exposition and conf., Los Angeles, Calif. (E. Niles, Aerospace Electrical Soc., 3540 Wilshire Blvd., Los Angeles 5)

9-13. **Cytophotometry and Interference Microscopy**, symp., Giessen, Germany. (W. Sandritter, Pathologisches Institut, Justus Liebig Universität, Giessen)

10-11. **Bioassay and Analytical Chemistry**, 9th conf., San Diego, Calif. (G. Bucolo, General Atomic Div., General Dynamics Corp., Box 608, San Diego)

10-11. **Engineering** conf., Long Beach, Calif. (Natl. Soc. of Professional Engineers, 2029 K St. NW, Washington, D.C.)

10-11. **Kidney**, 15th annual conf., New York, N.Y. (Natl. Kidney Disease Foundation, 342 Madison Ave., New York 17)

10-11. **Lipid Transport**, intern. symp., Nashville, Tenn. (H. C. Meng, Vanderbilt Univ. School of Medicine, Nashville)

10-13. **American Soc. of Clinical Hypnosis**, 6th, San Francisco, Calif. (W. T. Heron, American Soc. of Clinical Hypnosis, 800 Washington Ave., SE, Minneapolis 14, Minn.)

13. **American College of Dentists**, Atlantic City, N.J. (O. W. Brandhorst, 4236 Lindell Blvd., St. Louis, Mo.)

13-17. **Neurosurgery**, 10th Latin American conf., Buenos Aires, Argentina. (R. Morea, Callao 1685, Buenos Aires)

13-18. **Society of Motion Picture and Television Engineers**, 94th technical conf., Boston, Mass. (H. J. Hall, Itek Corp., Lexington, Mass.)

13-18. **Plastic Surgery**, 3rd intern. congr., Washington, D.C. (Capt. Joseph Connelly, Bethesda Naval Hospital, Bethesda 14, Md.)

14-16. **Geological Sciences**, intern. un-