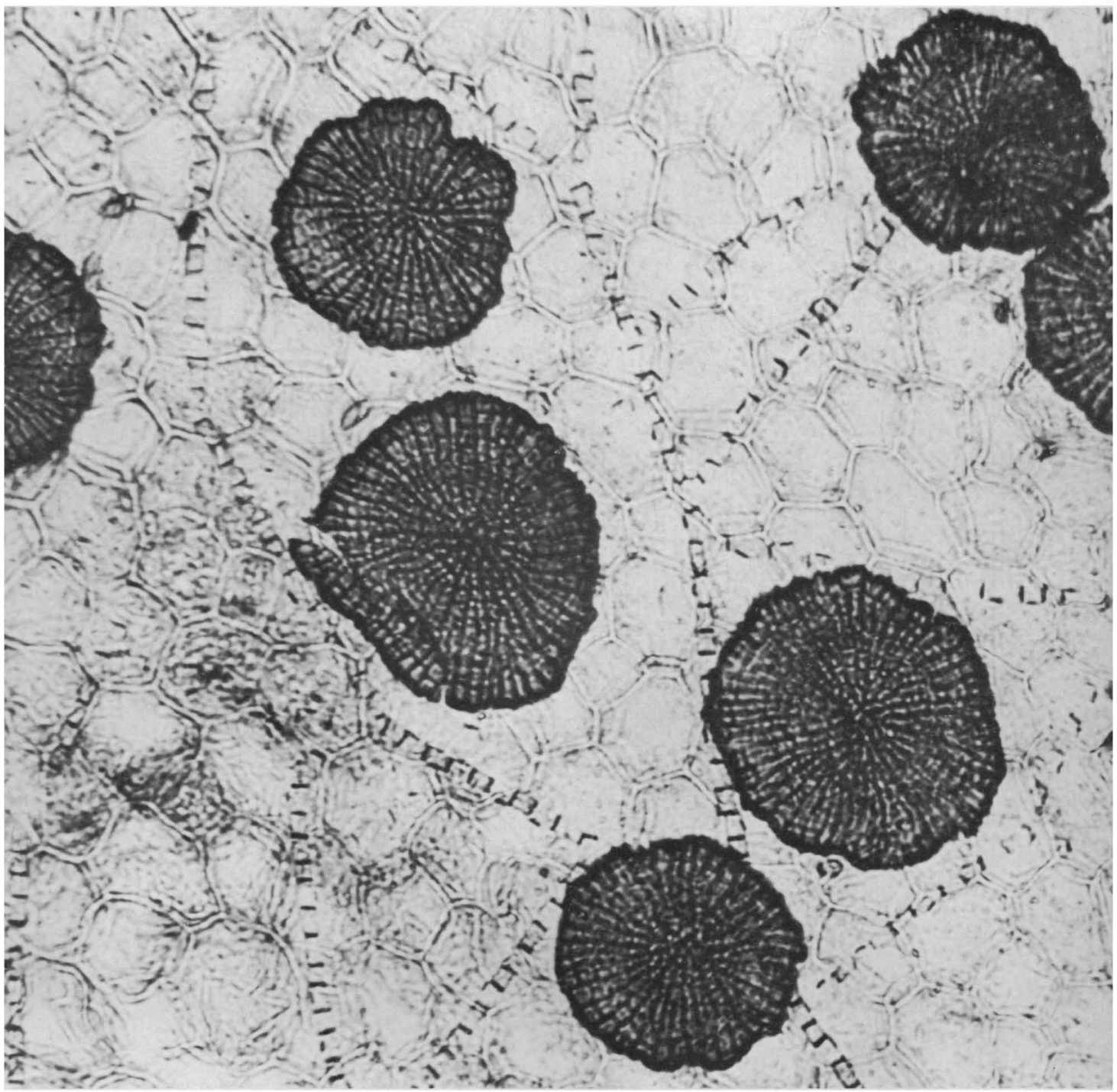
# SCIENCE

8 November 1963

Vol. 142, No. 3593

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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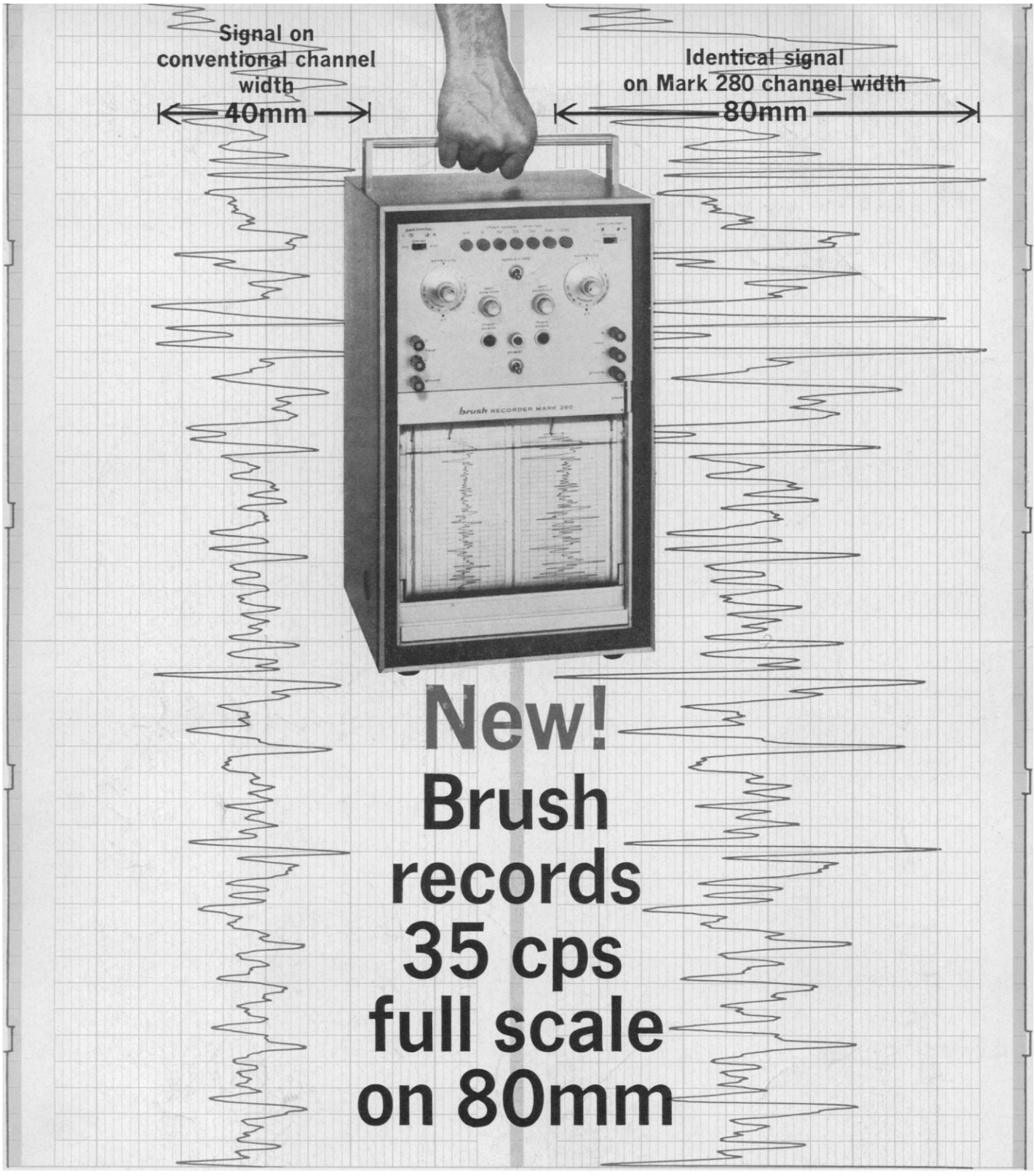


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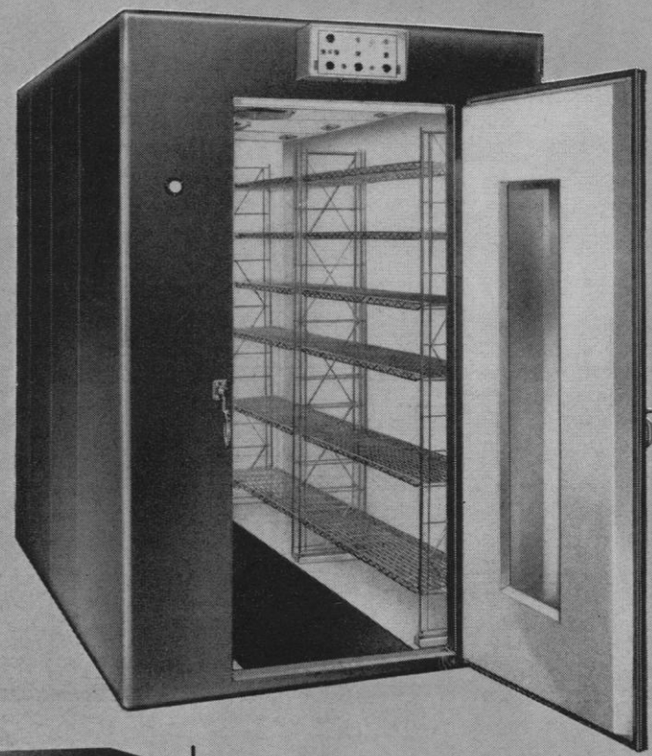


## MODU-LAB ROOMS

. . . Guaranteed Performance—in *writing*—because they are pre-tested and then certified to control temperatures and humidities as *specified!* Modu-Labs can do this because of their seamless, modular, one-piece molded fiberglass construction and sensitive, **solid state** temperature controllers.

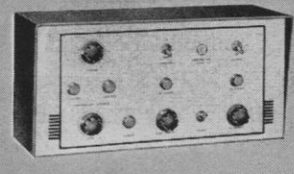
- **0°C to +60°C (32°F to +140°F)**
- **Slightly above ambient to +60°C**
- **−20°C to +10°C (+4°F to +50°F)**
- **10% to 98% Relative Humidity**
- **Available in special temperature and humidity ranges**
- **Modular sections are 76″ high and 54″ wide inside; 4 ft., 6 ft., and 8 ft. deep. Rooms in unlimited width or length; with side door, front door or multiple doors**

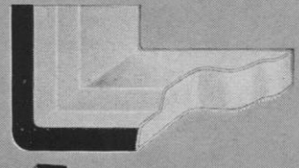
Modu-Lab rooms are **completely prefabricated** and electrically wired. They assemble quickly without special tools; merely plug-in to operate. They have thermistor sensors; scientifically engineered, forced-air circulation; no ducts on walls and floor; Thermopane window in door; fluorescent lighting; tubular finned heaters, and free-standing shelving.

Available only in Lab-Line Modu-Lab Rooms.

### Solid State CONTROLLERS

Dynatrol controls to ±0.5°C (±1.0°F); **optional** Dynapac controls heated rooms to ±0.25°C (±0.5°F). Each provides "pin-point" temperature control; obsoletes mechanical controllers. Slight temperature variations are instantaneously sensed and corrections made automatically to achieve remarkable temperature control throughout the room. Built-in Hi-Lo temperature safeties are standard equipment.





### Exclusive POLYGLAS construction

Two inches of polyurethane insulation—equal to 5″ of glass wool—is foamed in place between double walls of tough, resin-reinforced fiberglass. Gleaming, inner and outer surfaces have color molded in; never need painting. Rounded corners cannot collect dirt, are easy to wipe clean.

## *choose* MODU-LAB

**for dependable environmental testing**

**. . . with Certified Performance! . . .**

the answer to your built-in room problems, too!

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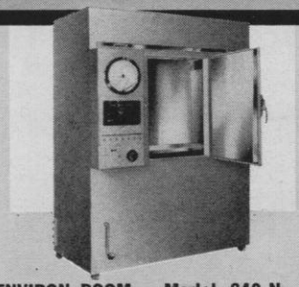
**ENVIRON-ROOM • Model 870-P.** Just one example of the finest line of Plant Growth Rooms on the market. Interlocking panel construction. Fully controlled HEAT, COLD, HUMIDITY, ILLUMINATION AND AIR EXCHANGE provide all the essentials for careful plant and animal studies. Wide choice of other models.



**ENVIRON-ROOM • Model 840-N.** Completely packaged, mobile environmental chamber. Test platform is raised and lowered from the light source by an external winch. Temperature range from 48°F to 100°F; from 20% to 95% R.H. Optional recorder, controller, programmer equipment. Variations to your requirements.

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**Write for Bulletin 277**

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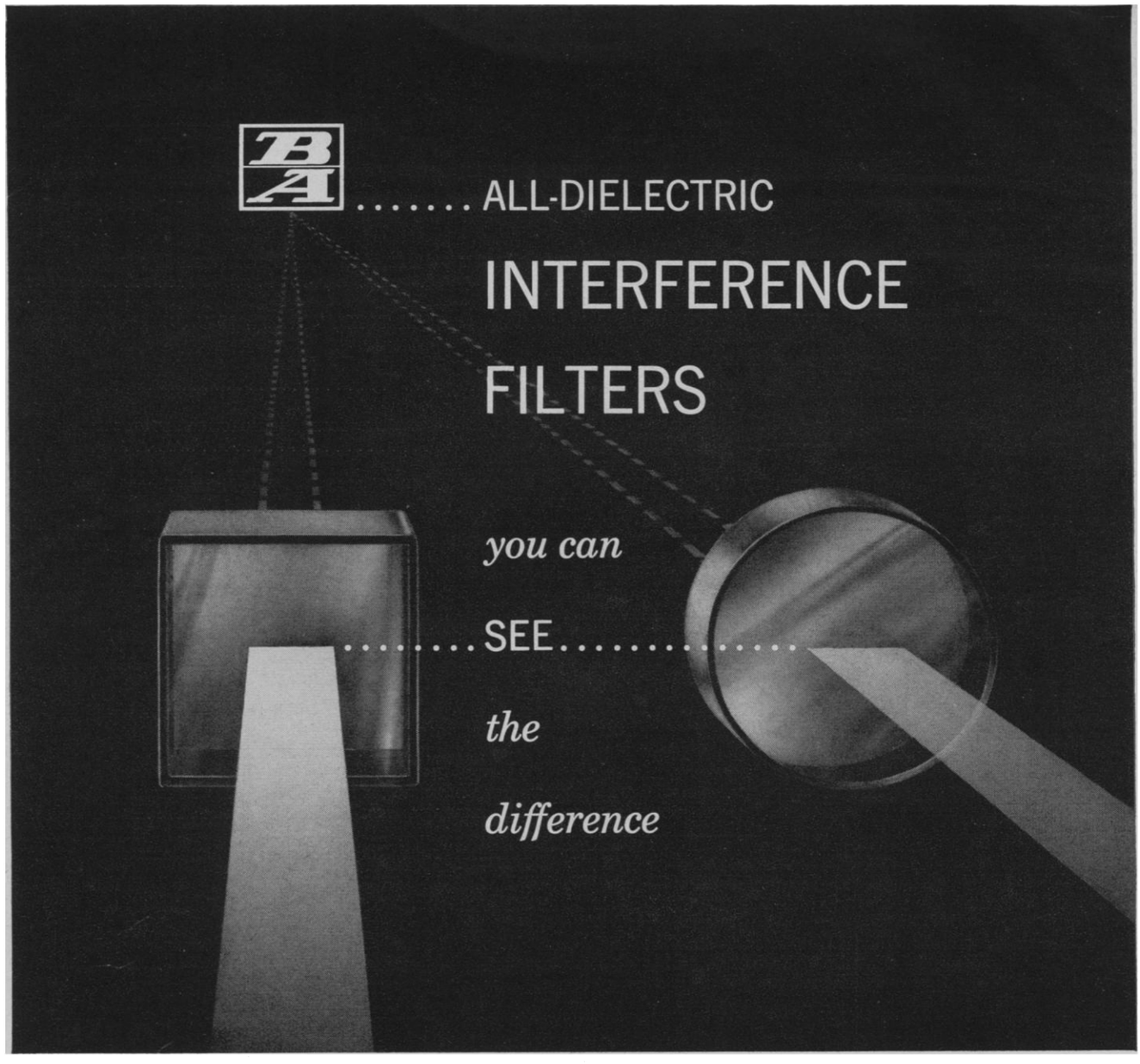
**COVER**

Epiphyllous fossil fungi on leaves in Eocene deposits from western Tennessee. The large, round, radiating, fruiting bodies are members of the Microthyriaceae and the hyphae belong to another form in the same family. Because of their delicate nature, fossil fungi are rarely found so well preserved. Although this family is very abundant at present in tropical areas in the Americas, this is the first record of these fungi from fossil deposits in the Western Hemisphere (about × 600). See page 667.

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ADVANCED OPTICS AND ELECTRONICS...SERVING SCIENCE

8 November 1963, Volume 142, Number 3593 **SCIENCE**



# Waste and Duplication

Part of the difficulties now facing the scientific community arise from a lack of effective communication between scientists and the public. In view of the highly specialized content of much of science, some failure of communication is inevitable. However, even on an elementary level there is imperfect transfer of views which arises out of semantics. Consider the words *research* and *development*. In the press, in Congress, and even sometimes among scientists the two words are used interchangeably. Newspapers and other media usually refer to the $15 billion of the budget devoted to R&D as if it were to be spent for research; actually only about one-tenth of the total is devoted to this purpose. The public cannot discriminate in this matter, and as a result science carries much of the burden for justifying great expenditures for hardware. An additional confusion arises from the coupling of *research* and *development*. If the two words are synonymous, then all who are engaged in either pursuit must be scientists. Now, most scientists feel comfortable in the presence of engineers, but there is no reason why we should be blamed when some engineering effort goes awry. "Scientists fail in effort to orbit space vehicle" is a typical headline.

One of the worst examples of an inappropriate coupling of words is the phrase "waste and duplication in research." Perusal of the *Congressional Record* shows that this phraseology is often employed. Indeed, being against waste and duplication is a modern equivalent of being against sin. The coupling has been used so much and has gone so long unchallenged that in many minds waste and duplication have become synonymous. In reality, duplication in research activities is often desirable. If a study is intrinsically worth doing and leads to positive results, confirmation of the work is essential. This helps maintain the integrity of science and markedly enhances the value of findings. In basic research there is usually no such thing as duplication, even when two scientists or groups start out to investigate the same phenomena. They approach the problem in different ways either conceptually or technically. During research, unexpected side avenues appear, and these are followed in differing ways. As results become available, interpretations of the data differ. If one group makes significant progress, the results are quickly communicated either by the grapevine or in formal meetings. Research activities of the second group are adjusted accordingly. Thus, "duplication" in basic research occurs only when results are not freely communicated, as for instance in highly classified studies.

One can defend the view that duplication is desirable purely on the basis of the benefits of competition. When two or more groups are known to be active in the same area of research, constructive rivalry sets in. This is a spur to imagination, to the exercise of ingenuity, and to devoted immersion in hard work. The situation is analogous to competition in the business world. With few exceptions, monopoly situations do not lead to optimal progress.

"R&D is an abbreviation that corrupts the true meaning of the word *research* while enhancing *development*, giving it, by association, implicit scientific status. To couple waste tightly to duplication in the context of research merely demonstrates ignorance, for duplication is vital to research and invigorates it. Scientists should seize every opportunity to correct semantic errors of this type, for they are barriers to effective and needed communication between us and the public.—P.H.A.

# Pulse Summation IN NEW TRI-CARB® SPECTROMETERS

*Pulse summation is an exclusive Packard Tri-Carb development for utilizing essentially all of the light energy produced in liquid scintillation solutions, rather than only half of the light as in all older coincidence-type liquid scintillation spectrometers. The benefits to the user are:*

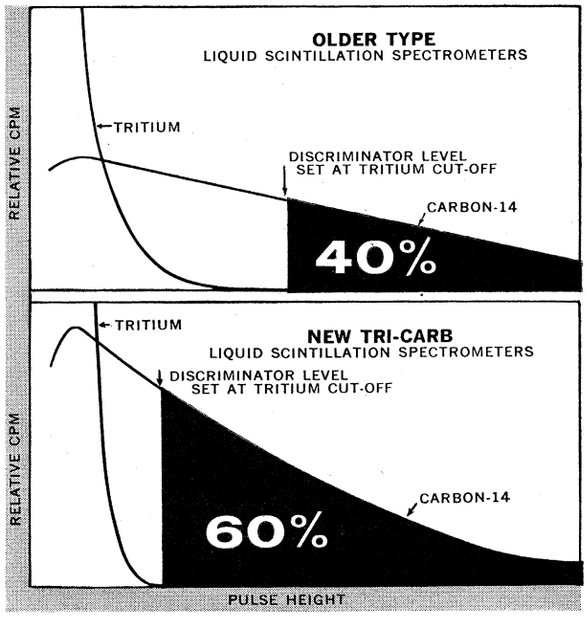
(a) *Higher counting efficiencies, especially for low energy emitters such as tritium*

(b) *Greatly improved isotope separation in double-label counting*

## HIGHER COUNTING EFFICIENCIES

Previously, coincidence-type liquid scintillation spectrometers were able to utilize the pulse output from only one of the two photomultiplier tubes—the Analyzer—for pulse height analysis. Pulses from the second photomultiplier tube—the Monitor—served only to provide coincidence signals.

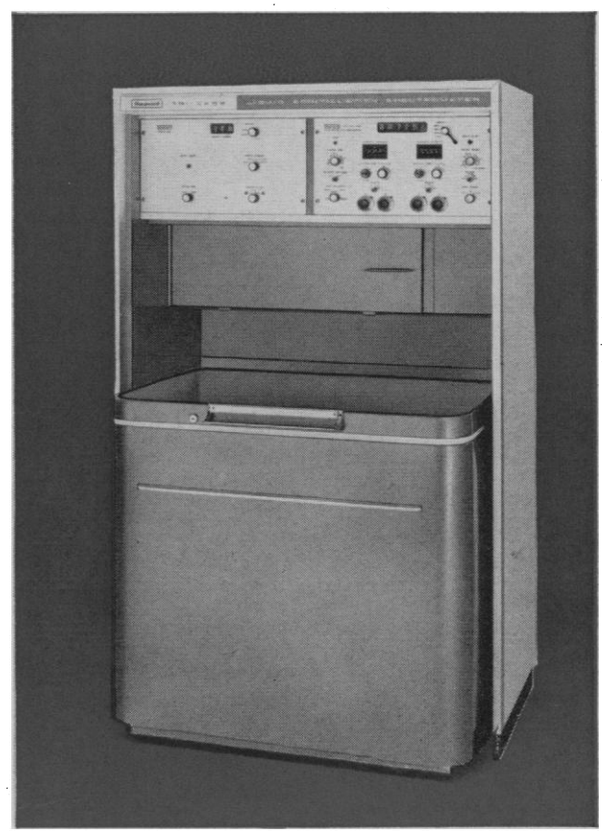
New Tri-Carb Spectrometers incorporate a pair of carefully matched 13-dynode photomultiplier tubes. Pulses from *both* tubes are used to establish coincidence, and simultaneously they are summed prior to pulse height analysis. This results in an improvement in the signal-to-noise ratio by a factor of two, since random noise pulses do not sum and coincident pulses do. Further, the use of 13-dynode photomultiplier tubes obviates the need for preamplifier circuits which inherently tend to slow down the pulse rise time and which contribute to the noise level. This permits much faster coincidence resolving time and relatively lower discriminator settings. The overall benefit is to **provide higher counting efficiencies for low energy isotopes.**




Comparison demonstrating greatly improved isotope separation obtainable with new TRI-CARB Spectrometers by showing percentage of total carbon-14 which appears beyond tritium cut-off. Data is directly comparable in both cases: discriminator levels were set so that only 0.01% tritium remained in the carbon-14.

## GREATLY IMPROVED ISOTOPE SEPARATION

A further advantage of pulse summation is the more faithful reproduction of the true spectral shapes of low energy isotopes. The total number of photons emitted for each low energy beta particle is very small. Even with the best light collection and photocathode conversion efficiencies, only one or two photoelectrons are produced in each photomultiplier tube from an average 6 KeV tritium particle. Obviously, with such small numbers, a substantial advantage can be achieved in the statistics of photon collection and photoelectron utilization by doubling the numbers through the full use of *both* photomultiplier tubes for pulse summation and subsequent pulse height analysis. The more precise spectral curves achieved in new Tri-Carb Spectrometers, as a result of better statistics, provide **very greatly improved separation of low energy isotopes such as tritium and carbon-14.**



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ion bombardment at low temperatures in the electron microscope itself and the structural changes in NaCl wafers held at low temperatures during observation with an electron microscope. Other applications of electron microscopy have been in the fields of analysis, lubrication, structure of glass, and polymer research.

Rapid advances in the electron microscopy of biological specimens in the last few years has been closely related to developments in embedding techniques; the current status was reviewed in a symposium on embedding of cells and tissues with J. Luft as chairman. The requirements and properties of embedding materials for electron microscopy were discussed and evaluated in terms of the most commonly used materials, that is, methacryates, vestopal, and the epoxy resins. The use of water-soluble embedding media for cytochemical localization was also covered. While the epoxy resins are now probably the most widely used, it was concluded that no one material can render consistently good general embedding. It was suggested that a major factor may be the lack of standardization of the various production lots of the component materials. The biologist must continually adapt the embedding procedures and materials to obtain optimum results.

A very wide variety of biological subjects covered general animal and plant cell morphology, viruses, neoplasms, and protein fibers. Reports covered the structure of viruses and the changes they bring about in various cell types. The methods of negative staining and enzyme digestion were widely employed in elucidating viral structure. Various aspects of normal morphology, experimental pathology, and human biopsy were covered during several talks on electron microscopy of liver.

The wide variety of topics presented in the biological sessions gave the participants a good spectrum of the progress of electron microscopy outside their own specialty.

Abstracts of the papers have been published in the August 1963 issue of the *Journal of Applied Physics.*


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## British Association for the Advancement of Science

The 125th annual meeting of the British Association for the Advancement of Science was held in Aberdeen, England, 28 August–4 September 1963. As usual, the sessions were directed chiefly to the informed public, and consisted primarily of a series of reports by outstanding British scientists on current developments in scientific affairs which might have popular interest. In the traditional manner there were many splendid receptions by the University, with conferring of honorary degrees, and with special dinners, lunches and receptions by civic groups.

At the opening session, Sir Eric Ashby delivered the presidential address; his subject was "Investment in man." Honorary degrees were conferred upon Sir George Allen, secretary of the British Association; Sir Charles Morris, vice-chancellor of the University of Leeds; and J. M. Robertson, Gardiner professor of chemistry at the University of Glasgow.

Featured were the presidential addresses in the various sections. For the section on physics and mathematics, J. S. Forrest considered the problems of "High voltage insulation." J. M. Robertson discussed "A physical approach to chemical structure" for the section on chemistry. F. F. Darling, for the section on zoology, outlined "The unity of ecology," and for the section on medicine, J. McMichael reported on "The contribution of clinical medicine to physiology." For the section on geography, H. C. Darby discussed British National Parks, and for the section on agriculture, Martin Jones analyzed food supplies for man and beast. The section on psychology heard a discussion from O. L. Zangwill on "Cerebral localization of psychological function."

A significant part of the Aberdeen meeting, which extended through 4 half-day sessions and was appealing both to the public and to specialists, was a symposium on land use in the Scottish uplands. In these sessions, the British Association emphasized two of its important functions: (i) it allowed for public presentation of contributions of scientists to the solution of an urgent practical problem in the management of natural resources; and (ii) it demonstrated the value of a broadly based scientific approach to a major topical question by bringing together geographers, botanists, zoologists, agriculturists, economists, and other repre-