# SCIENCE

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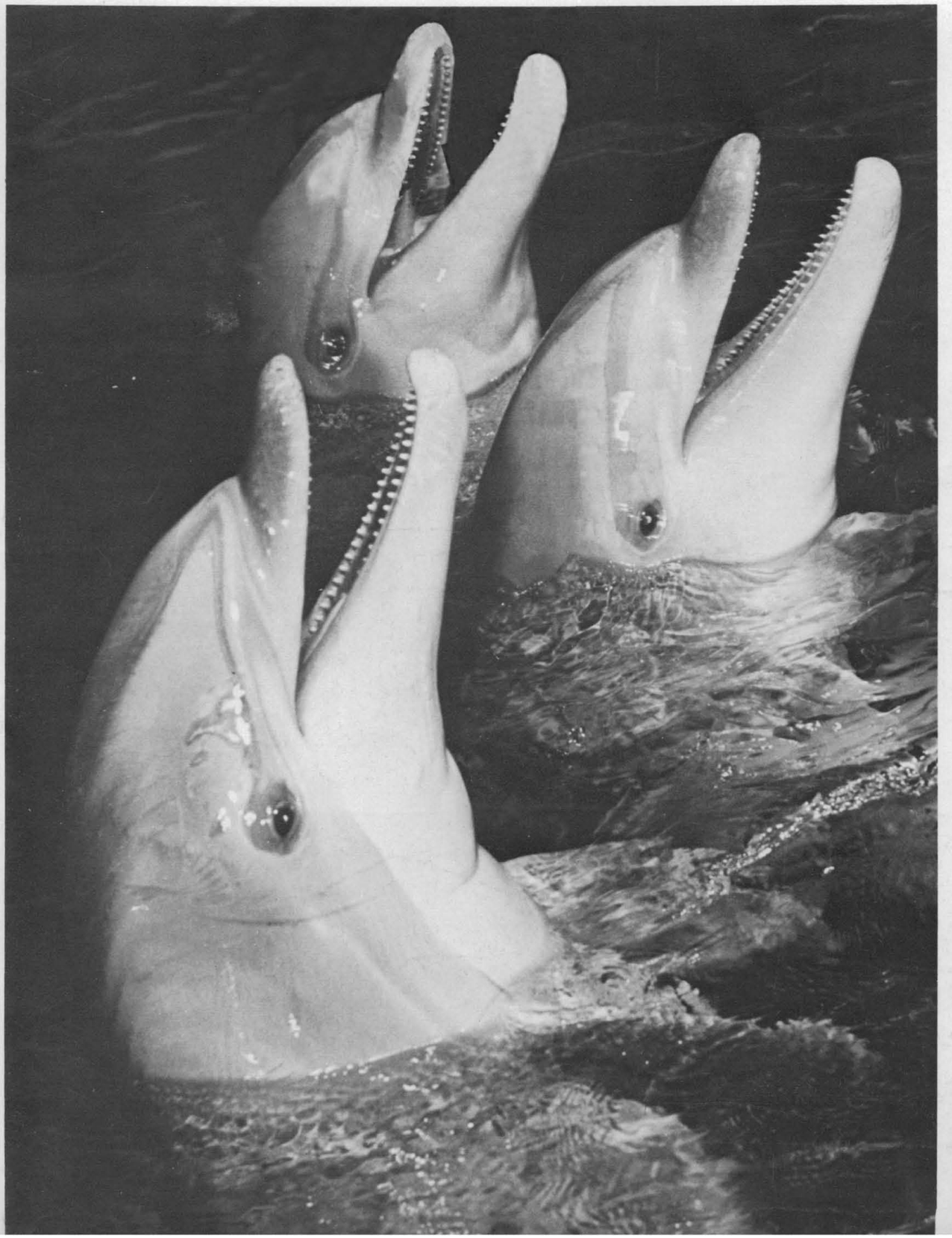
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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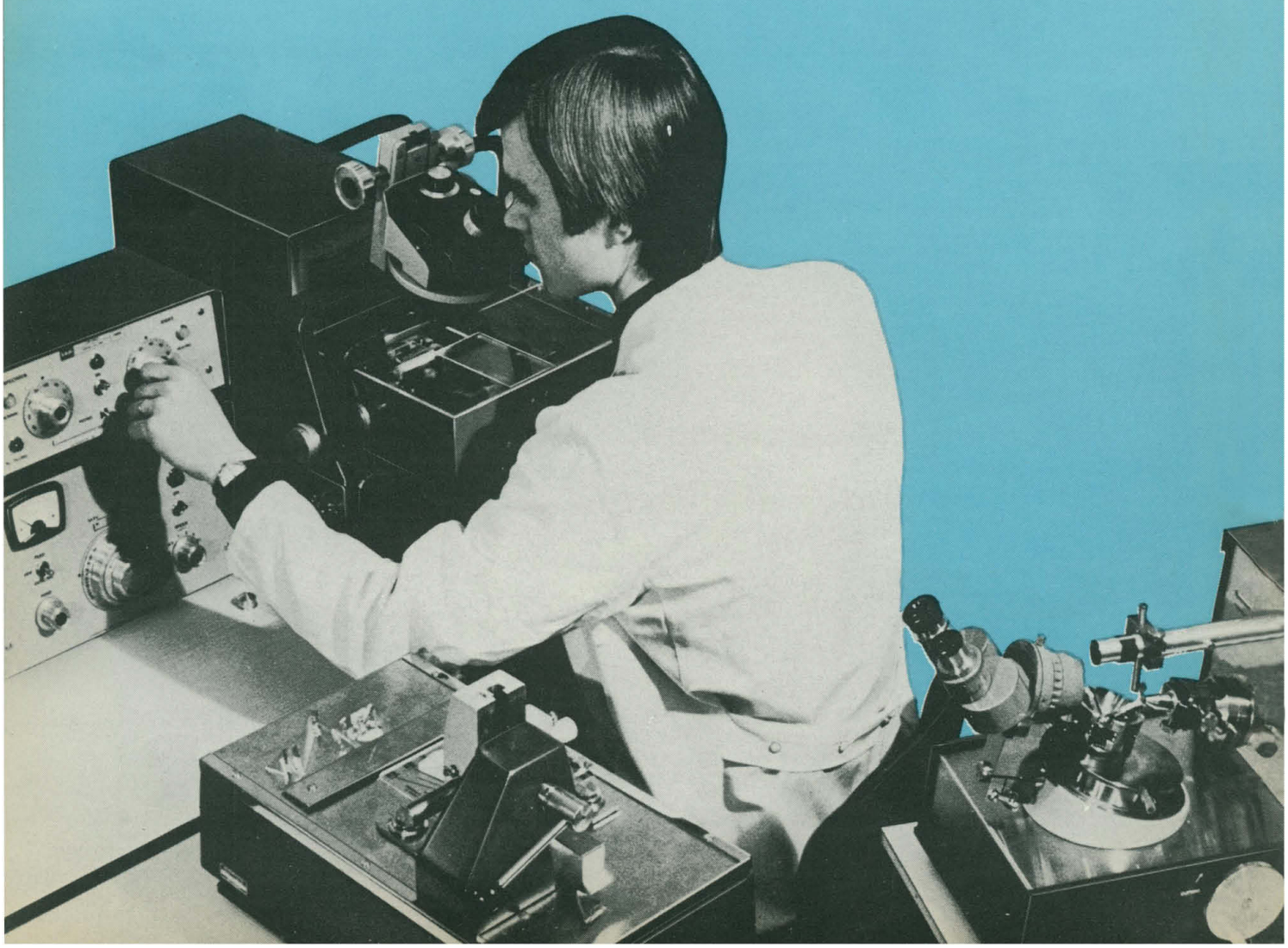

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– Einstein

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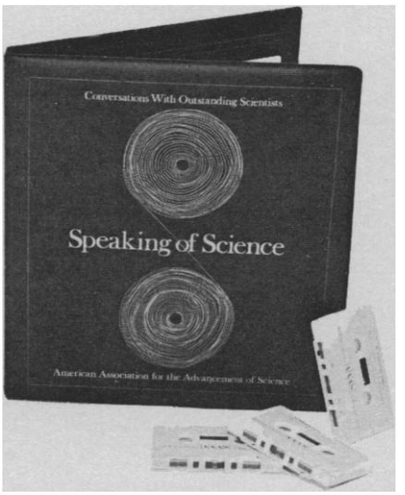


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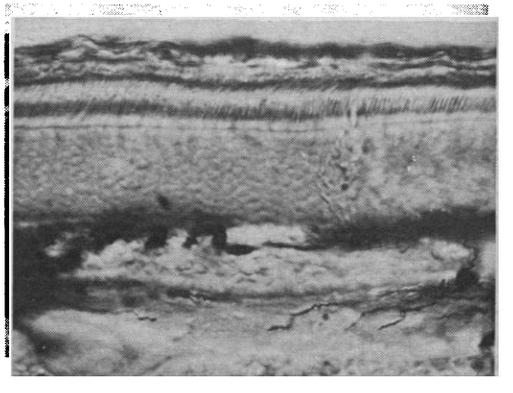
(Cover) Dolphins. [Jesse, Cologne, West Germany] (Below) Section of a dolphin retina. Unique among aquatic species are giant ganglion cells (lower left) and transplexaform cells (middle far-right). The receptor layer is at the top. This section was prepared by the Golgi method for the interference contrast microscope (× 40). See page 747 [William W. Dawson, University of Florida, Gainesville]



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## Hazards of Chemical Carcinogens and Mutagens

As pointed out in recent letters (26 Jan., p. 329; 11 May, p. 542; 13 July, p. 109), the lack of control of even the most potent of carcinogens is rather surprising, especially in view of the present degree of sophisticated control, at both the national and international levels, of ionizing radiation and radioisotopes (*1*). A recent laboratory incident with a potent carcinogen illustrates very well the reason for my concern.

In the course of our experiments, it was deemed necessary to have a supply of *N*-nitrosomethylurea (NMU), and we accordingly ordered 100 grams from a chemical supply company in this area. The container was an ordinary glass reagent bottle with no special warning of the hazardous nature of the contents on the label. The material was shipped to us via United Parcel and processed in a completely routine manner by our receiving department. Again, there were no labels on the carton indicating the hazardous nature of the chemical, precautions in handling or storage, or what to do in case of a spill. Since NMU is not only a carcinogen, and a very potent one, but also is a mutagen and teratogen, it is thus a triple threat (*2*), biologically speaking. Experienced users of this material generally keep it under refrigeration, but since we had not had previous experience and instructions given for its use did not indicate the necessity for keeping it refrigerated, it was simply placed on the shelf in the laboratory. A few weeks later we were greatly dismayed upon entering the laboratory to discover that sufficient pressure had built up in the bottle to blow the lid off and distribute most of the contents of the bottle over a considerable area of the laboratory. Fortunately, no one was present at the time of the accident, as it occurred on a weekend. After discovering the accident, the laboratory was sealed temporarily, and a committee was appointed to formulate procedures for cleaning up the laboratory in the safest possible manner and for making recommendations to prevent future occurrences of this kind.

The day after discovery of the accident, a phone call was made to the chief chemist of the company selling the material to warn him of the accident, and later a letter was sent giving more details of what had happened in the hopes of preventing a similar accident there or elsewhere.

The possible hazards to employees of the chemical company, those involved in the distribution, or laboratory personnel are obvious (*2, 3*). Surely it is time that some organized effort be made to more adequately label such hazardous materials and to better control the conditions under which they are packaged and distributed. Regulations concerning use and disposal would also seem desirable. Physical carcinogens and mutagens have rigorous handling codes. Why none for equally potent chemical substances that are at least as hazardous in terms of their biological effect?

A. H. SPARROW

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*Upton, New York 11973*

### References

1. For instance, see Committee on the Biological Effects of Ionizing Radiation, *The Effects on Populations of Exposure to Low Levels of*

*Ionizing Radiation* (National Academy of Sciences, Washington, D.C., 1972).
2. L. Fishbein, W. G. Flamm, H. L. Falk, *Chemical Mutagens* (Academic Press, New York, 1970).
3. H. Druckrey, R. Preussmann, D. Schmähl, M. Müller, *Naturwissenschaften* **48**, 165 (1961).

## Inspiration

We were "inspired" by John Worrall's letter (26 Jan., p. 329), in which he talks of the "hissing" of trees disturbed by dissecting needles. A few years earlier we had stumbled upon this phenomenon while looking for inner bark color in order to differentiate certain species of oak. This experience reminded one of us, Daniel Smiley, of hearing a sucking sound from hickory while trail clearing in the 1930's. It had seemed curious to us, and we spent several hours perforating the bark of various species of trees and characterizing the responses. We checked with several of our plant physiologist friends and perused many current plant physiology texts to learn that the phenomenon simply did not exist. We put our notes away with some embarrassment. During our investigations, walkers had stared at us with something beyond mild curiosity, and had even started asking questions which we found difficult to answer.

Now we would like to augment the somewhat sparse record on this subject with several observations. First, we suggest that "hissing" is not quite the right word. It implies (as per the dictionary) exhalation and a simplicity of sound which demeans that produced by trees in the act of inspiration. The true sound, a tremulous and high-pitched burbling, can be well matched by pursing the lips and sucking in air at the corner of the mouth.

We also worry about the efficacy of using a dissecting needle. In our attack on the problem we used knives, awls, drills, ice picks, punches, and other devices and learned that a rude and somewhat conical opening was usually the most productive, probably because it tore the vessels rather than just displacing them.

Several specimens each of *Fraxinus americana, Acer rubrum, Acer saccharum, Nyssa sylvatica, Carya ovata, Quercus prinus, Quercus borealis, Pinus strobus, Pinus rigida,* and *Tsuga canadensis* were persecuted on the fall afternoon of 16 October 1972, when the temperature was around 65°F, and on 20 to 24 March 1973, several clear days with temperatures ranging from 40° to 55°F. Most trees examined were from 10 to 20 meters tall, with diameters at breast height of from 25 to 50 centimeters.

Three to five perforations at breast height were made in each tree, and, with the exception of the conifers and maples, sounds of inspiring air were heard in all species. Specifically, we noted a rapid ticking, clicking, and often the tremulous and high-pitched burbling comparable to that produced by pursing the lips and sucking in air at the corner of the mouth. Usually, the sound was vigorous at first, and then within 10 to 20 seconds it diminished to nothing. The white ash was the loudest and most persistent. One tree examined on 16 October, with only 10 percent of its leaves remaining, continued to inspire for 5 minutes and several seconds. The northern red oak was also notable; one tree that had shed only 5 percent of

its leaves made sounds for 3 minutes. In March, with all leaves gone, red oak produced sounds of from 4- to 7-second duration in five different holes. The chestnut oak, more typical of drier sites, produced much more feeble sounds that rarely lasted for more than 15 seconds. The chestnut oak, like the red oak, sweet gum, and shag bark hickory, produced inspirational sounds in the absence of leaves in March, when air temperatures were in the 50's. The white ash, on the other hand, a noisy tree in the fall, was fully inactive in March.

At low temperatures, trees with few leaves produced less (or no) sound. In some cases, trees had both noisy and quiet sectors. We disturbed the tissue sufficiently to ensure that vessels were broken. This suggests a multiplicity of moisture supply routes within a single tree. It also indicates that a single woodpecker or population of boring insects will not "short-circuit" an entire forest.


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## Methadone Treatment and Drug Experimentation

At least one aspect of methadone treatment has not been discussed widely, although it warrants further investigation; that is, when a chemical solution is tried as a remedy for a chemical problem [to paraphrase H. L. Lennard, L. J. Epstein, M. S. Rosenthal, and A. Bernstein, (Letters, 16 Mar., p. 1079)] the chemical strategy as a solution for all sorts of problems may generalize and several drugs may be explored.

This concept is illustrated by our observation that long-term heroin users, supposedly inflexible in their choice of a drug, suddenly experience a rebirth of drug experimentation when they attempt the shift from illegal narcotic use to methadone maintenance.

The first stage in the addict's pattern usually begins with a sporadic, inconsistent use of methadone, with heroin at times used interchangeably with methadone. This stage subsides within several months, after an optimal methadone dosage level is found. This is followed by a second stage—shooting heroin "over" methadone, that is, using both drugs simultaneously to achieve a euphoric effect. Then a third stage occurs, characterized by greater experimentation and considerably more curiosity-seeking and risk-taking—that is, "backing up" methadone with barbiturates and ethanol, apparently to support the effects of methadone by adding the impact of barbiturates and alcohol. Reportedly, the synergism of these chemicals in combination produces a qualitatively different "high" than that experienced from other drugs alone or combined—an effect especially euphoric for heroin addicts. This stage generally diminishes when such nonchemical strategies as psychosocial rehabilitation take hold. The fourth stage is marked by the heavy use of marihuana (for some addicts, the first time it has been heavily used); as in an earlier time, when "cured" addicts shifted to alcohol abuse, the use of marihuana frequently becomes a well-integrated part of daily living, persisting for a long time. These stages are not necessarily fixed in the order cited nor are they delineated only by the combinations noted above.

Such stages in drug use after an addict enrolls in a methadone maintenance program have all the appearances of phases in experimentation or testing. But perhaps such periods of assessing drug effects should not be too surprising, since the act of voluntarily seeking admission to a methadone maintenance program itself already may be indicative of a decision to experiment with different types of chemicals—a cognitive choice to explore further dimensions in the chemical strategy as a means of handling everyday problems.

It would appear that, for a long-term user of narcotic drugs, the introduction of a methadone program is a manifestation of a direct challenge to cognitively fixed behavior and that subsequent behavior is characterized by a cycle of experimentation with new drugs in new combinations. Any future debate about treatment should include documentation of frequency and types of drugs chosen throughout the therapeutic course.


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# A Notable Anniversary

One hundred years ago this week—on 22 August 1873, to be exact—the American Association for the Advancement of Science took an historic action that led to the establishment of forestry policy as a function of the federal government.

At the 22nd AAAS annual meeting, held that year in Portland, Maine, Franklin Benjamin Hough of Lowville, New York, delivered an address titled "On the duty of governments in the preservation of forests."* A doctor of medicine, Hough was also an historian, a naturalist, and a statistician. While director of the United States census of 1870, he was impressed and concerned by widespread forest devastation caused by logging and fires throughout the East, the Great Lake states, and then starting in the South.

After the Civil War, a few observant citizens, alarmed at the rapid destruction of the virgin timber and fearing an eventual wood shortage, warned state legislatures and Congress of the need for forest protection, but without effect. Most government officials ignored the threat of timber scarcity and discounted the possible depletion of this valuable natural resource, which, indeed, many people believed to be inexhaustible. Thus, when Hough submitted the problem of forest preservation to the AAAS meeting, he was appealing to the scientists as the only organized citizens' group having sufficient influence to inspire public attention. Hough decided that the scientific community would have to initiate action for forest conservation, if it was to be done at all. In his paper, he emphasized the relationship of woodland to soil stabilization, to maintenance of streamflow, and, of course, to wood production for domestic and industrial use. He urged the AAAS to alert federal and state governments to the need for forest protection.

At his suggestion, the AAAS appointed a committee "to memorialize Congress and the several State Legislatures upon the importance of promoting the cultivation of timber and the preservation of forests, and to recommend proper legislation for securing these objects."† Nine scientists served on this committee; Hough was chairman. The others were William Henry Brewer of Yale; George B. Emerson of Boston, educator and author of a book on trees; Asa Gray, the nation's leading botanist; Eugene W. Hilgard, soil scientist, of the University of Michigan; Lewis Henry Morgan, anthropologist, of New York, later to become president of the AAAS; John Strong Newberry, botanist and geologist, and Charles Whittlesly, a horticulturist, both of Ohio; and Josiah Dwight Whitney, a geologist of California.

The committee's memorial was delivered to President U. S. Grant, who, on 19 February 1874, transmitted it to Congress with a special message of approval. There the proposition languished for 2 years. Finally, on 15 August 1876, Congress enacted legislation appropriating $2000 for the appointment to the Department of Agriculture of a man to investigate forest conditions. Hough was selected on 30 August and thus became the federal government's first forestry agent. From his appointment evolved the present Forest Service, with its nationwide network of forest and range experiment stations and forestry and wood science laboratories, its thousands of professional and scientific personnel, and its 187 million acres of national forests managed in the public interest.

On this centennial anniversary, it is appropriate to recall the extraordinary influence of Hough's paper, presented as a private citizen before a small assemblage of scientists. Historically, it is appropriate also to acknowledge the energizing role of the AAAS in starting forestry work on a national scale in the United States government.—HENRY CLEPPER, *American Forestry Association, 1319 18th Street, NW, Washington, D.C. 20036.*

* *Proceedings of the AAAS Twenty-Second Meeting, held at Portland, Maine, August 1873* (AAAS, Salem, Mass., 1874), part II, section B, "Natural History," p. 1. † *Ibid.*, p. 429.

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The Biopulse system uses a sonic probe to monitor activity of aquatic organisms. Any shape of enclosure may be used and secretive organisms may be monitored. The device consists of three modules: the frequency generator and activity monitor unit, the timer/counter/printer unit, and the transducer assembly unit. The manufacturer offers to provide the unit to qualified investigators at no charge to conduct projects up to 60 days in duration. Alpine Geophysical Associates. Circle No. 134 on Readers' Service Card.

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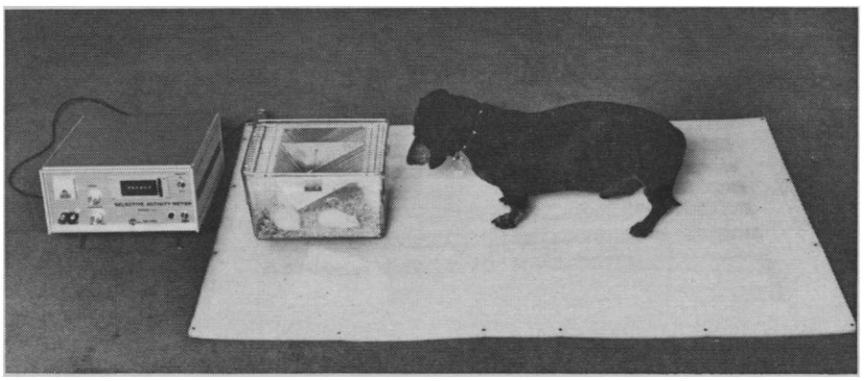

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### Automatic Gamma Counter

The MS 588 automates radioimmunoassay sample processing, centrifuging, and counting procedures. The model number refers to the sample capacity. The device has three drawers; for multiple user operation, they may be programmed individually. There are factory-set windows for up to seven isotopes, including iodine-125, cobalt-57, and iodine-131. Count or time can be set by the operator. Micromedic Systems, Incorporated. Circle No. 136 on Readers' Service Card.

### Electron Beam Evaporator

Model EVU 10 features a 10-kilowatt electron beam with a 270° deflection and four interchangeable crucibles. The motor drive of the crucible is remote controlled and positioning is automated. The beam is focused electrostatically and the spot is stable be-

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (see pages 710A and 774C) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

cause the cathode is heated by direct current. Applications include semiconductors, thin-film electronics, optics, surface improvement, and nuclear research. Crucibles include one of each: four-way, oscillating, grooved, and pot. The electron beam may be deflected periodically through a variable range because of the X-Y sweep characteristic. Balzers High Vacuum Corporation. Circle No. 139 on Readers' Service Card.

### Single Grating Monochromator

The quarter-meter Ebert monochromator model 82-415 utilizes a single grating, selectable from six standard gratings between 1180 and 50 grooves per millimeter. Blaze characteristics are selectable from a high of 200 nanometers to a low of 100 nanometers per minute. The manufacturer offers a number of accessories such as digital stopping drive, filter wheels for entrance or exit slits, a quantum photometer, and a recorder. Fisher Scientific Company. Circle No. 138 on Readers' Service Card.

### Calcium Analyzer

The model 940 (Fig. 2) eliminates manual titration in determining calcium content of a sample. The content is expressed in milliequivalents per liter or as milligrams percent within 30 seconds after insertion of sample. Sample size may be as small as 0.02 milliliter. Model 940 operates by quenching the fluorescence produced by calcein in the presence of calcium ions in an alkaline medium. The quenching is accomplished by titration with ethylenebis(oxyethyenenitrilo)tetraacetic acid which automatically stops upon cessation of fluorescence. Corning Scientific Instruments. Circle No. 130 on Readers' Service Card.

### Carbon Dioxide Incubator

The Mark I incubator (Fig. 3) has a temperature range of 65°C with a control of ± 0.2°C and a uniformity of ± 0.5°C. A temperature safety prevents high-temperature damage. Relative humidities to 98 percent are achieved with the bubbling device, reservoir, and regulator. There are 4 square feet of shelf space and the unit occupies 306 square inches of bench

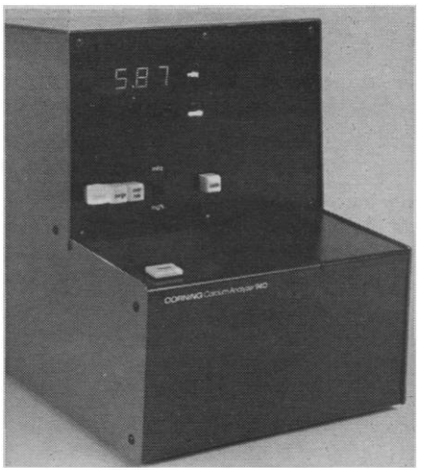

Fig. 2. The Corning model 940 calcium analyzer reads calcium content directly in milligrams percent or in milliequivalents per liter within 30 seconds after sample insertion.

space. Lab-Line Instruments, Incorporated. Circle No. 137 on Readers' Service Card.

### Literature

*Biomedical Apparatus & Equipment* is a 44-page catalog of supplies for medical research and clinical applications. Included are such items as glassware, water stills, stirrers, and liquid dispensers. Wheaton Scientific. Circle No. 140 on Readers' Service Card.

*Constant Temperature Controlled Equipment for the Scientific and Laboratory Field* lists ovens, baths, furnaces, environmental chambers, and temperature control devices. The 216-page catalog also includes temperature, humidity, and measurement conversion tables. Blue M Electric Company. Circle No. 141 on Readers' Service Card.

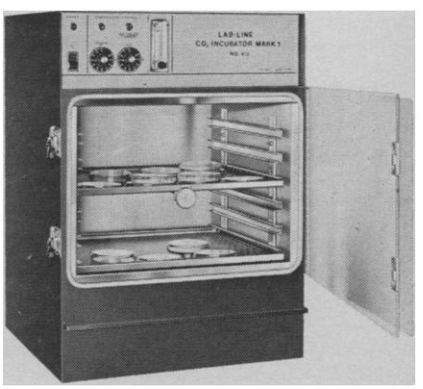

Fig. 3. The Mark I carbon dioxide incubator from Lab-Line provides 4 square feet of shelf space (with two shelves).

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