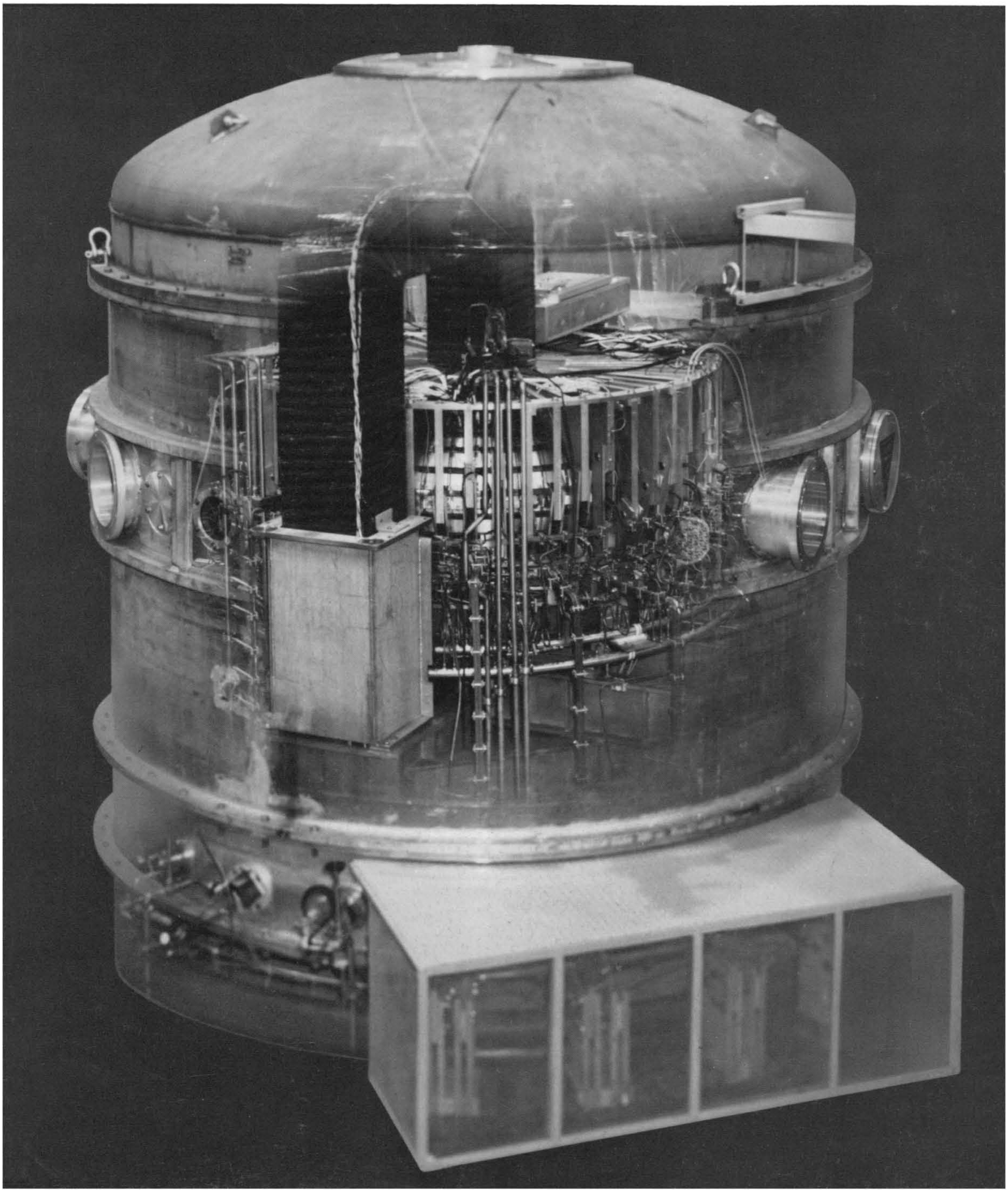
# SCIENCE

21 May 1971

Vol. 172, No. 3985

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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# SCIENCE





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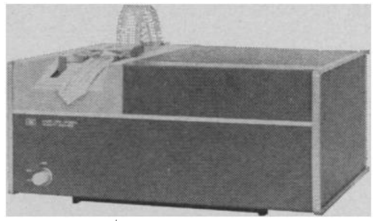
**COVER**

Composite photograph of the exterior vacuum tank and interior confinement region of the recently constructed toroidal, magnetic field plasma confinement experiment—ORMAK—a diffuse, toroidal pinch device at the Oak Ridge National Laboratory. Dimensions: diameter, 13 feet; height, 15 feet; weight, 40 tons. See page 797. [Oak Ridge National Laboratory, Oak Ridge, Tennessee]



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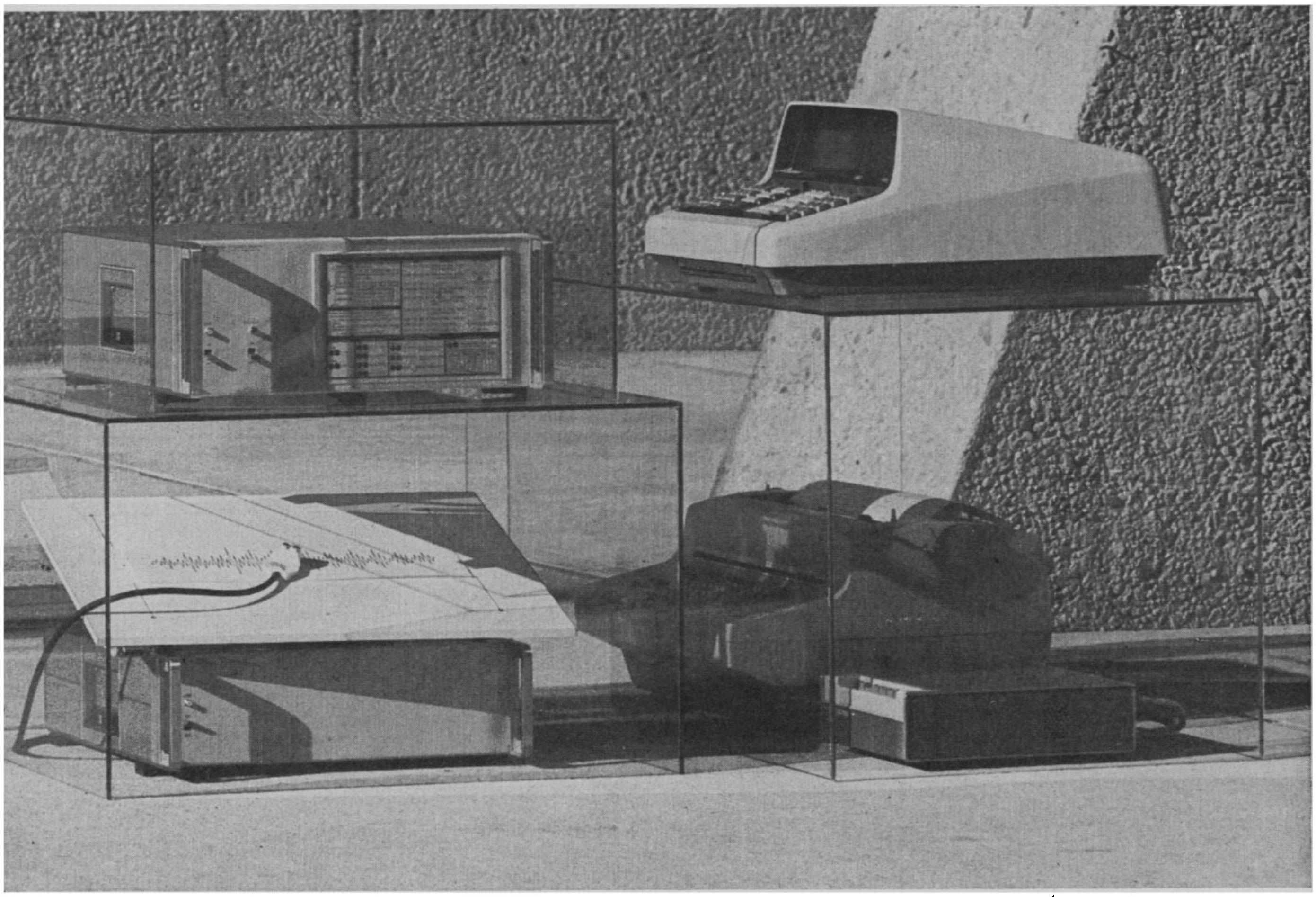

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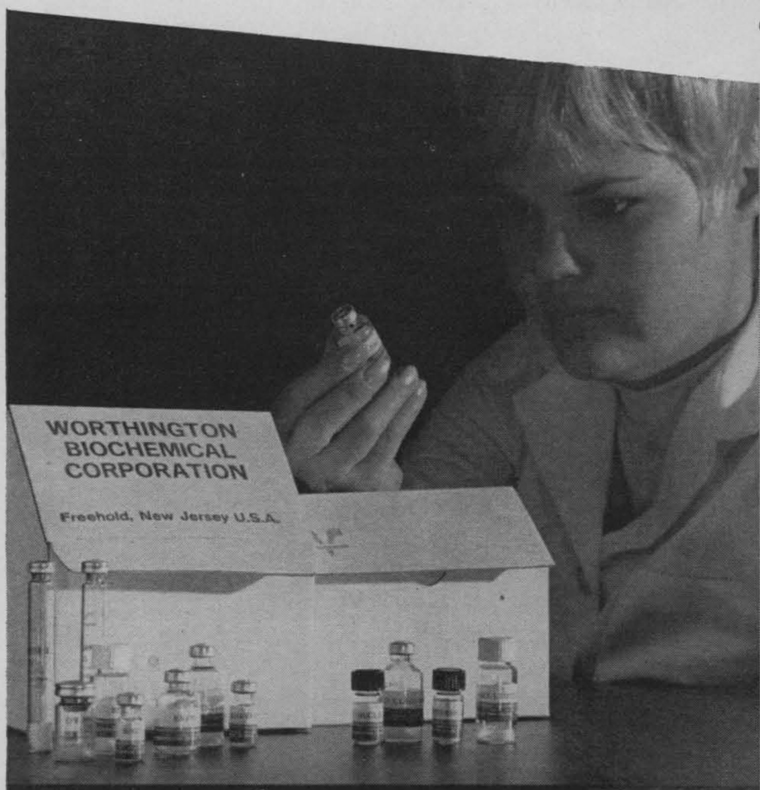


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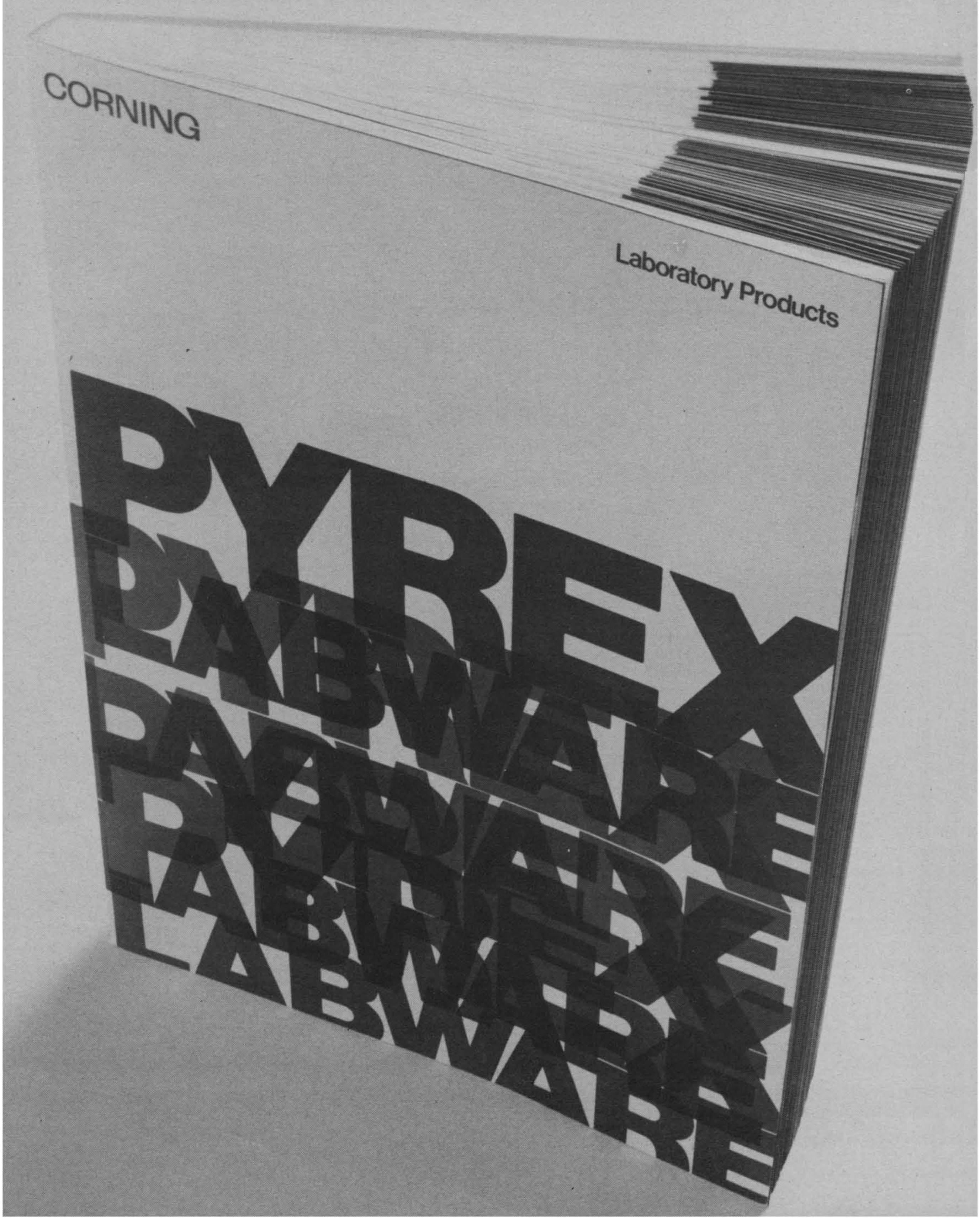

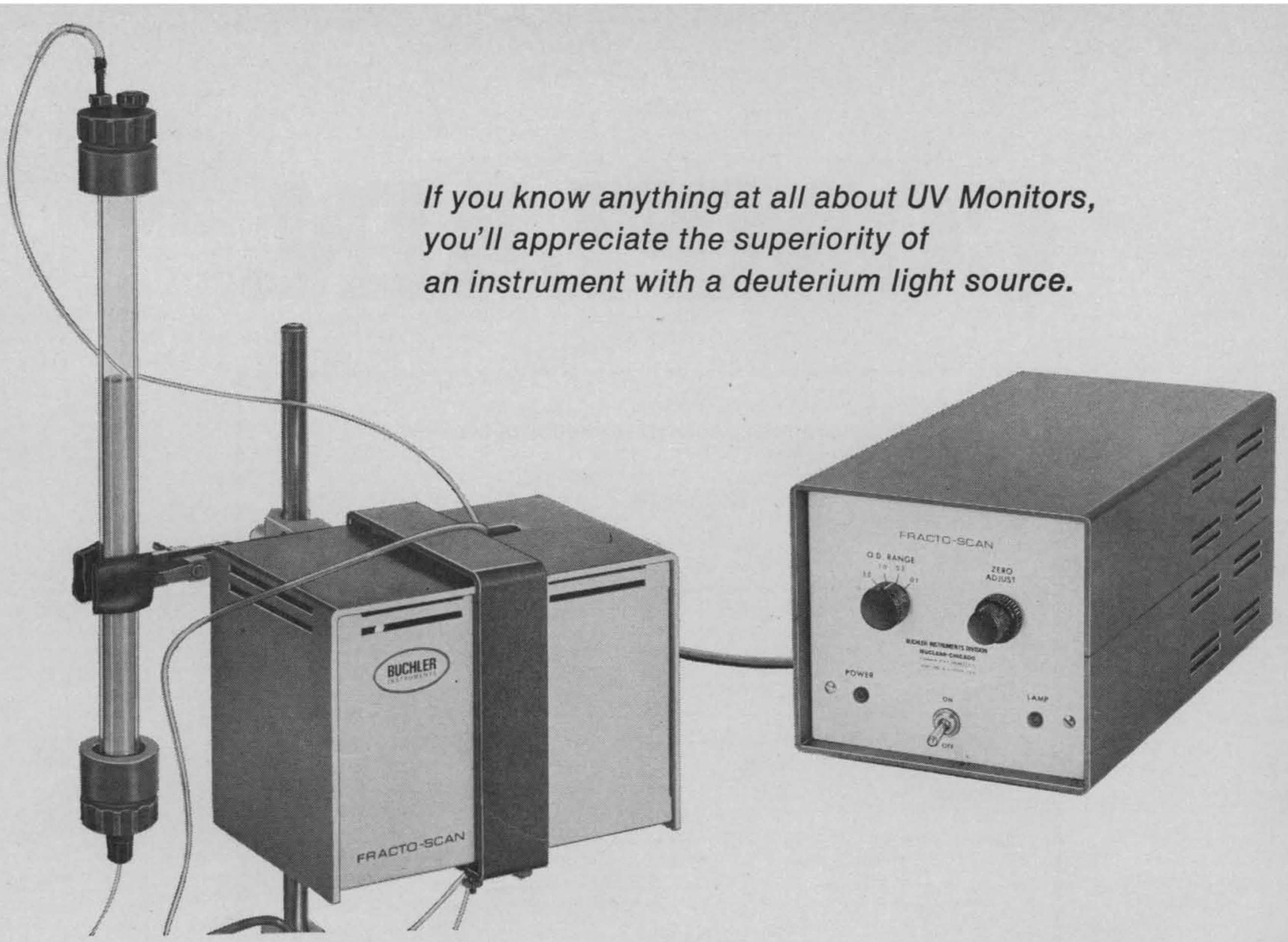


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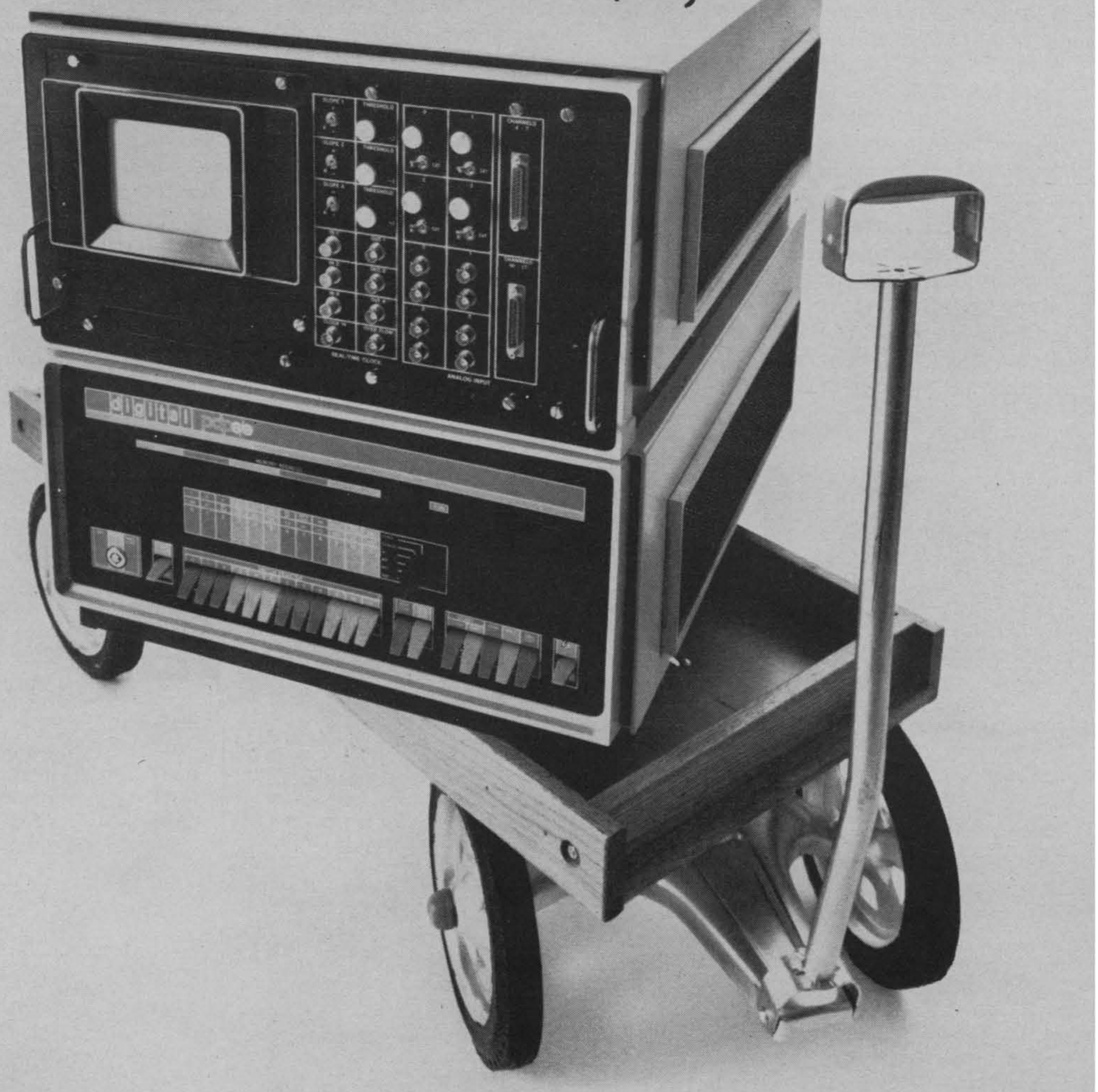

On simple price comparison alone, the LAB 8/e wins hands down. But that's only the beginning of the benefits. This is a general purpose computer system. Using any lab oscilloscope it becomes many instruments in one . . . signal averager, data correlator, histogram analyzer, frequency analyzer, and NMR data system. All for the cost of one good single-purpose instrument.

For the imaginative researcher, LAB 8/e is an innovation machine – all of the software and hardware capability built into it lets you develop your own experiment control features, data reduction techniques, and analysis programs. Lots of software is provided: FOCAL, BASIC, and FORTRAN languages.

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LAB 8/e is the lowest cost entry into laboratory computing, yet complements the more powerful PDP-12. And DIGITAL, the world's largest manufacturer of mini-computers, backs this versatile research tool with the training and service that a large company can provide.

But, start by thinking of the LAB 8/e as a bargain. Remember, it costs no more than a single single-purpose instrument.

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*The oscilloscope display shown is a modified Tektronix Model 602, available from DIGITAL at an additional charge.

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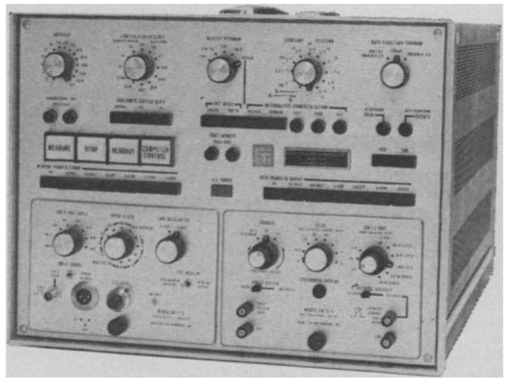

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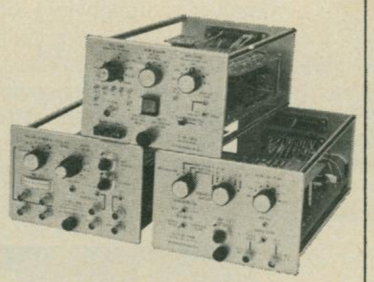

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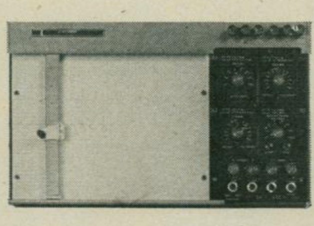

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# Some things are changing for the better.

## A better way to measure photons from UV to IR

It's our guess that any scientist who has ever made optical power measurements will greet the new HP 8330A/8334A Radiant Flux Meter System with more and more enthusiasm as he finds out more about it. Because it measures total radiant power over the entire IR to UV spectrum, with a flat response that remains accurate regardless of the spectral composition of the source of radiation. Because it's calibrated to better than $\pm$ 5% traceable to NBS, at all wavelengths and at any power level, and reads out directly in absolute radiometric units. And because it is the first to have an automatic zero and a built-in self-calibrator that maintain system accuracy with no more effort than pushing a button.

Underlying many of these improvements in the state of the art is a unique thin-film thermopile detector whose extremely low thermal mass gives it a 10 to 100 times faster overall response than conventional thermopiles. Manufactured by vacuum deposition on a thin but tough substrate that gives it body without mass, the HP thermopile is considerably more rugged than previous laboratory designs. But the thermopile derives its most important characteristic—flat response—from a thin layer of gold, the likes of which no jeweler would care to use. Vaporized and deposited on the thermopile's 64 series-connected thermocouples, this gold has such a combination of particle size and structure that it traps and absorbs all incident photons from less than 0.3 to beyond 10 microns . . . and therefore looks black, exactly the opposite of the jeweler's requirements. Since it remains chemically inert, it does not form surface oxides that would act as mirrors. The gold layer also assumes an abnormally high electrical resistivity, so high that it does not "short" the thermocouple junctions which it overlays. Certainly not a jeweler's gold, but a great one for thermopiles.

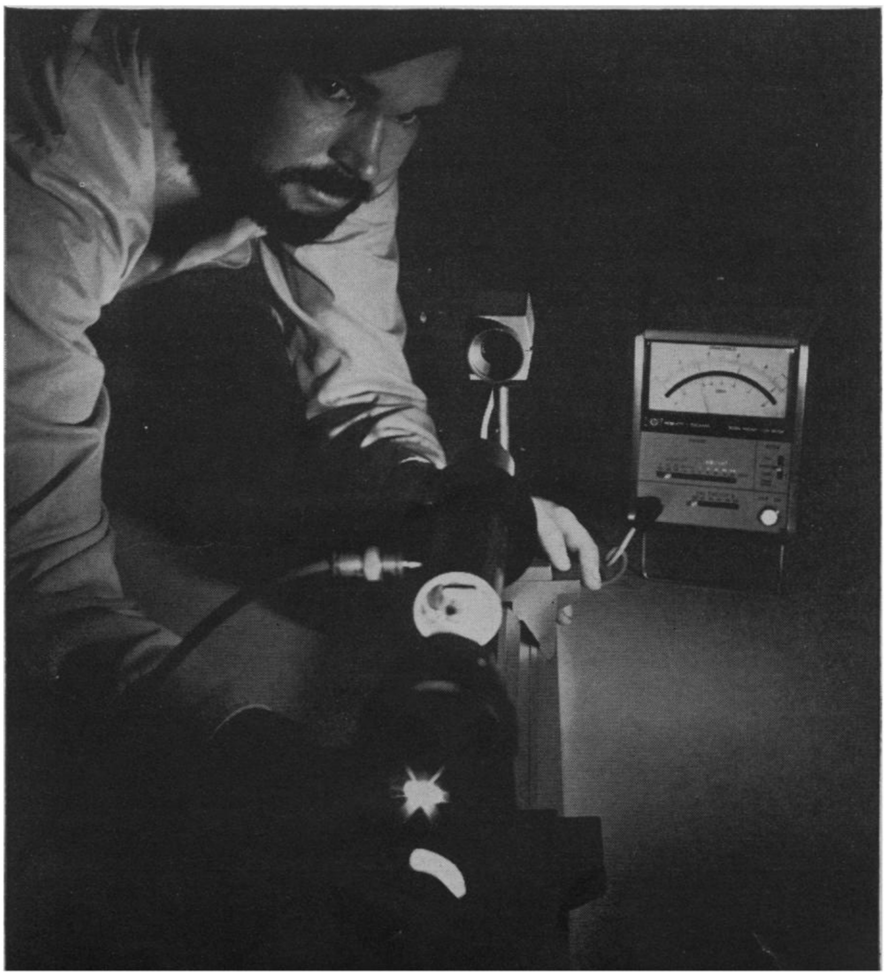
Equally important in terms of performance, a built-in self-calibrator maintains the accuracy of the system... at the touch of a pushbutton. Incorporating a low-frequency oscillator that delivers a precise amount of power to the thermopile, the automatic calibrator adjusts the gain of the measurement system to match the response of the thermopile. Thus compensated for all changes in sensitivity due to temperature, overload, mechanical shock, aging or even change of detector, the instrument always measures radiant power accurately and directly.

At $1100 for a complete system, the price of the 8330A/8334A represents another quantum improvement in the state of the art that will certainly encourage its use in a variety of electro-optical, analytical and process control applications. A descriptive brochure of the system awaits your request.

## Cardiac Catheterization: A better way for patient and physician

Over 100,000 victims of both cardiac congenital defects and cardiovascular disease visit a catheterization laboratory each year, a necessary step on the road back to good health. For this is where the physician performs cardiac catheterization by inserting a small tube (catheter) into a peripheral blood vessel and pushing it into the heart. Measurements are made of blood pressure in the heart and other physiological factors which give the doctor information he needs for diagnosis and treatment.

A typical "cath" procedure takes about two hours after which the physician spends two to three more



hours examining the data. Complex calculations convert the raw measurements into usable information about the condition of heart and valves.

Now, data sampling, analysis and display can be done automatically *during* catheterization, with HP's new 5690A computerized system. So fast

that the physician can verify each step of the procedure and decide whether additional measurements should be made—thus avoiding the possibility of incomplete or faulty data.

Developed in a joint effort with the Stanford University Medical Center, the new HP 5690A computerized system is a completely integrated hardware and software system, performing data acquisition and real-time cardiac analysis from on-line sampling of pressure waveforms and from patient information the physician enters on a keyboard. The computer calculates all the hemodynamic parameters most often required—displaying results immediately. Price is approximately $85,000.

Where the usage level doesn't justify the full interactive capabilities of a computer-based system, an alternative approach uses the HP Programmable Electronic Calculator to perform the calculations. Merely by inserting a small magnetic card into the instrument, the physician enters instructions for the complex calculations. Then all he has to do is enter on the keyboard the catheterization measurement data.

Once basic data is entered, calculation takes less than five minutes and the desired information—cardiac output, stroke volume, total peripheral resistance, pulmonary and systematic A-V differences, % shunt—appears on the calculator's visual display and printer while the patient is still in the cath lab.

Fully documented HP cardiology programs available to all calculator users help speed catheterization data analysis. Additional programs to meet special requirements are easily prepared and permanently stored on magnetic cards for instant reuse. Calculator prices start at $3950.

Write us of your interest in either system and we'll respond with complete information.

## Computer helps GC simulate distillation

A far cry from the alembic used by the 16th century alchemist, the artful glassware used by the modern oil chemist for True Boiling Point (TBP) distillation nevertheless employs the same basic technique: boil and condense. To this day, TBP distillation remains the accepted way to establish the basic marketing specification of petroleum products . . . and it leaves a lot to be desired. Those who refine petroleum products don't like it because it takes so long: TBP distillation of a wide-boiling distillate can take as long as 100 hours, and the results are useless in controlling the operation of a refinery. Those who buy petroleum products don't like it because the method is not very reproducible, especially as it applies to the initial and final boiling points. Those who perform the distillation don't like it because the procedure itself is a long and boring task.

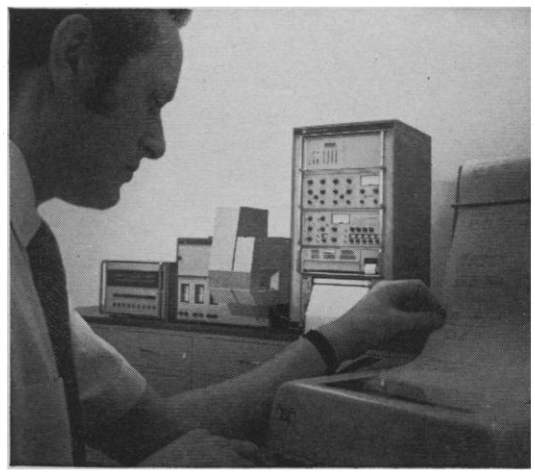
A group of scientists at HP's Avondale Division have devised a completely automatic method that employs gas chromatography (GC) to simulate distillation and produces boiling point distribution data more precisely and in much less time—about 40 minutes—than TBP distillation. The new method employs the HP 7600A Chromatograph System which is capable of automatic unattended operation from sample measurement and injection to final analysis report.

The recipe for simulated distillation with the 7600A is relatively simple. Set the GC for a linear program of 6 to 10°C/minute starting at —20°C, load the sample tray with as many as 36 different calibration and analytical samples, even of widely diverse boiling ranges up to 1000°F . . . and push the *start* button: the rest is automatic.

Complete sets of programs provided with the 7600A enable its HP computer (opt. 003) to determine the initial and final boiling points of each sample and print out the analysis report of boiling point distribution at 1% increments.

No knowledge of computer programming is required by the analyst. At each stage of the computer-performed calculations, the computer asks for the information it requires and the operator answers by typing the requested number or word on the keyboard.

The precision of the 7600A Simulated Distillation method with wide boiling range samples is greater than is possible by any distillation method. Its speed—an average of 40 minutes per sample—completely outclasses distillation methods.



This new automated Simulated Distillation method is examined in much more meaningful detail in Data Sheet 7600. Write to Hewlett-Packard, 1507 Page Mill Road, Palo Alto, California 94304. In Europe: 1217 Meyrin-Geneva, Switzerland.

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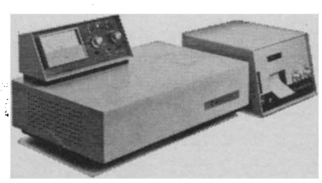

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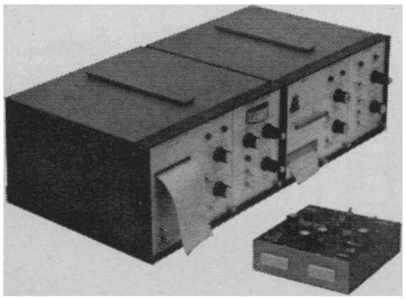





## Handler's "Dissent" Explained

It has been reported that "Handler dissents on NSF budget" (16 Apr., p. 247). And, indeed, I did make known my very serious concerns. But the report also contained some unfortunate inaccuracies.

1) I said that the House committees which relate to National Science Foundation affairs had expressed misgivings concerning the inauguration of Interdisciplinary Research Relevant to Problems of our Society. I did not, as you indicated, relate misgivings on the part of the National Science Board.

2) You stated that I reiterated my fears that too much emphasis on applied research might turn NSF into a "job shop," whereas I said that, although such concern might justifiably be felt, Leland Haworth and I had promised that we would be conscious of this danger and not permit it to happen. Nor do William McElroy or Herbert Carter so intend.

3) My concern is not that "too much applied research will erode the country's basic research capability." That erosion, if it continues, will reflect failure to adequately support basic research; education in science at the undergraduate, graduate, and postdoctoral levels; and the institutions in which these occur.

My "dissent," then, consisted in making it clear that not only is the increment in support of basic research proposed for fiscal year 1972 seriously inadequate, it is to be accomplished by drastic reduction of NSF's educational and institutional support programs, a process which began with substantial reduction in the funding of fellowship and traineeship support in fiscal 1971.

PHILIP HANDLER
*National Academy of Sciences, Washington, D.C. 20418*

## Boston's Sufferance of Sulfur Dioxide

In their report on the effects of sulfur dioxide emissions from power plants (29 Jan., p. 381) Golden and Mongan argue that large point sources contribute only small amounts to the annual average $SO_2$ dosage received in urban areas. They conclude that power plants are likely to cause relatively uniform "background" pollution over a wide area and that this background pollution will be within the limits of standards for air quality set by most communities. On the basis of our own extensive analysis of several power plants in and near Boston we take exception to these conclusions.

Our calculations (employing the model suggested by the Department of Health, Education, and Welfare in *Workbook of Atmospheric Dispersion Estimates*) were performed in preparation for a recent public hearing at which our local utility sought a variance from the state's low-sulfur requirement on precisely the grounds presented in the report. The utility claimed that it contributed no more than 10 percent to the *average annual dosage* received anywhere in the Boston area. While this statement may be correct, we believe it is misleading. One knows that the plume from a large point source typically affects a relatively small (though perhaps densely populated) area at any one time, a behavior verified by experience and our own mathematical modeling. During the time of exposure, however, the affected area is being subjected to very high levels of pollution, levels which *by themselves* far exceed the state's recently adopted 1-hour standard. For a variety of reasons (changes in wind direction, reduced generating loads at night, changes in atmospheric stability, and so forth), the average of these intense exposures over the period of a year gives a total annual dose at a given point which may indeed be only 10 percent of the total accumulated exposure from all sources. This is no guarantee, however, that damage to public health and welfare is not being incurred through these short-duration episodes. Indeed, many persons who live in areas in Boston affected in this way attended the public hearing and offered dramatic testimony that they were being subjected to undue hardship. The pitting of automobiles and the destruction of clothing by "acid smut" from power plants were described by local residents in very strong terms.

These physical losses could likely be reduced in direct proportion to the sulfur content of the fuel burned by the utility. Health damage during such episodes is difficult to document, but a prudent public health policy would assume that it occurs unless it can be shown otherwise. The emphasis on annual average concentrations from large power plants obviously fails to present the total impact of these sources.

Because of our findings we are concerned that the Environmental Protection Agency has failed to include 1-hour standards for $SO_2$ in its proposed National Primary and Secondary Ambient Air Quality Standards. Without such a standard in Massachusetts we would have had no bench mark with which to compare the calculated concentrations. We hope EPA will correct this oversight when standards are promulgated.

JAMES J. MACKENZIE
*Committee on Environmental Pollution, P.O. Box 289, M.I.T. Branch Station, Cambridge, Massachusetts 02139*

## Drug Abuse?

If more evidence were needed of the schizophrenia of our society, the sanction of the use of amphetamines for hyperkinetic children (26 Mar., p. 1223) supplied it.

I have worked in the Los Angeles Juvenile Hall, and have seen many kids "busted" for using the same "yellow jackets," "reds," and "bennies" that my Beverly Hills patients use regularly. And here they are sanctioning the use of drugs for which other children are arrested. No proof—but let's try it. No proof marijuana is harmful—but let's jail its users.

Schizophrenia if I ever saw it!

MAURICE L. KAMINS
*6333 Wilshire Boulevard, Los Angeles, California 90048*

## Snake Eggs

Burghardt's report "Chemical-cue preferences of newborn snakes . . ." (5 Mar., p. 921) states, "Newborn garter snakes . . . responded similarly to worm and fish surface extracts regardless of whether the mothers were fed exclusively on fish or worms during the gestation period."

All snakes are either oviparous or ovoviviparous. In neither case is there any connection between the mother and the young which is developing within the egg. Consequently, any experience by the mother regarding food or environment would have nothing to do with the young.

CHAPMAN GRANT
*1114 Idaho Street, Escondido, California 92025*

The founder and former editor of *Herpetologica* has stated a commonly held view which, by implication, renders my experiment superfluous. However, contrary evidence has been in the literature for many years. In a recent review, Bellairs (*1*) states, "Viviparity in reptiles thus shows all gradations between a state of affairs where the mother does little more than act as a mobile incubator for her unborn young, to one in which she probably supplies the embryo with a fair amount of food to supplement its inadequate yolk." In the species I used (*Thamnophis sirtalis*) there is a functioning placental connection with the mother (*2*).

GORDON M. BURGHARDT
*Department of Psychology, University of Tennessee, Knoxville 37916*

#### References

1. A. d'A. Bellairs, *The Life of Reptiles* (Universe, New York, 1970), vol. 2, p. 452.
2. H. Clark *et al.*, *Copeia*, pp. 9–13 (1955).

## Calculus of Risk

In his review of *Nuclear Power and the Public* (Book Reviews, 26 Feb., p. 792) Lee Loevinger has performed a long-needed service in pointing out the sophistry in comparing risks from automobile and aircraft accidents to risks from radioactive pollution. I have listened with impatience many times to this argument, which, as often as not, is made by well-known and competent persons. [Loevinger said: "The implicit suggestion that (these risks) are comparable illustrates some of the confusion in this field. Most of the concern about nuclear power plants has to do with the effects of . . . normal operation . . . , not the danger of nuclear accidents. . . . The hazard from radioactive pollution is cumulative, genetic, and statistically almost indeterminable —quite in contrast to the discrete, nongenetic, and quite determinable hazard of automobiles and airplanes."]

I would like to add that, although automobile transportation is a necessity, the driver has some choice as to when, where, how long, and how carefully he will drive—in other words, he has a reasonable control of the risk. Populations exposed to fallout and either planned or accidental releases not only have no control of the risk but are often unaware that a risk exists.

PHILIP S. RUMMERFIELD
*University of California, San Diego, La Jolla*

21 May 1971, Volume 172, Number 3985 SCIENCE



# Continuing Increase in Use of Energy

Consumption of energy is the principal source of air pollution, and energy production, transportation, and consumption are responsible for an important fraction of all our environmental problems. Use of energy continues to rise at the rate of 4.5 percent per year. Even if fuel supplies were infinite, such an increase could not be tolerated indefinitely. But fuel supplies are not inexhaustible, and this combined with the need to preserve the environment will force changes in patterns of energy production and use.

Our economy has been geared to profligate expenditure of energy and resources. Much of our pollution problem would disappear if we drove 1-ton instead of 2-ton automobiles. Demand for space heat and cooling could be reduced if buildings were properly insulated. Examples of needless use of electricity are everywhere. Promotional rates and advertising tend to encourage excessive consumption.

Slowing down the rate of increase in use of energy will not be easy. Public habits of energy consumption will not be quickly altered, and a sudden change in the rate of growth of energy consumption would cause major additional unemployment.

Most people are at least somewhat aware that their consumption of various forms of energy adds to pollution. Yet despite all the publicity and exhortations, little effect has been noted in overall energy consumption. Increase in use of energy has not abated. Some signs of impact can be detected. Sales of smaller automobiles have increased somewhat. However, the rate of increase of "clean" electricity was 6 percent last year in spite of brownouts and the economic recession. Consumption of natural gas in the production of electricity rose 11 percent, reflecting in part a desire to use cleaner fuel.

A major factor in the burgeoning use of energy is its low price—one that does not take into account all the costs to society. In the generation of electric power from coal and oil, millions of tons of sulfur dioxide are released, which cause billions of dollars worth of damage to health and property. We are consuming rapidly, at ridiculously low prices, natural gas reserves that accumulated during millions of years. Prices for energy should reflect their full cost to society. The Nixon Administration's proposed tax on sulfur in fuel should be enacted. The rate structure for electric power should be modified to discourage excessive use. A substantial increase in the price of natural gas, including a new federal tax, would diminish waste of this resource. Taxes on automobiles should increase sharply with weight and horsepower.

Measures to cut excessive use of energy are likely to come only after a long time, if ever. We should face the possibility that increased consumption of energy will continue and prepare to meet that possibility. Atmospheric pollution is not an inevitable consequence of production of energy. In the use of fossil fuels, production of sulfur dioxide is not an essential by-product. Destruction of the environment is not a necessary consequence of strip mining. Pollution from almost every method of producing and utilizing energy could be sharply attenuated either through better practices or through development of new methods. In view of the importance of energy to society, present expenditures on research and development related to energy are small and these are not well apportioned. Two areas that particularly merit increases in support are thermonuclear research and development of pollution-free means of using coal for electricity, liquid fuels, and methane.—PHILIP H. ABELSON

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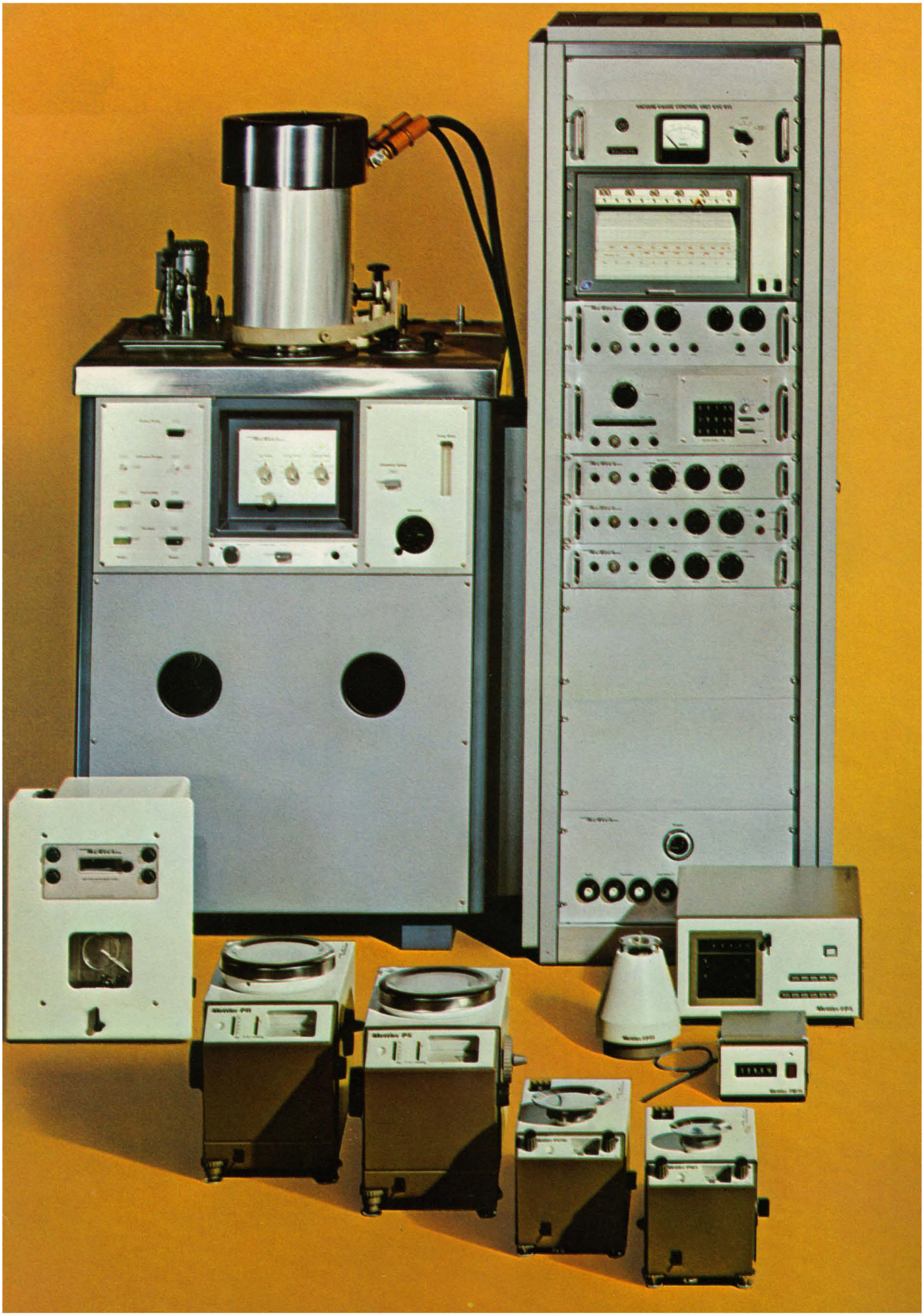

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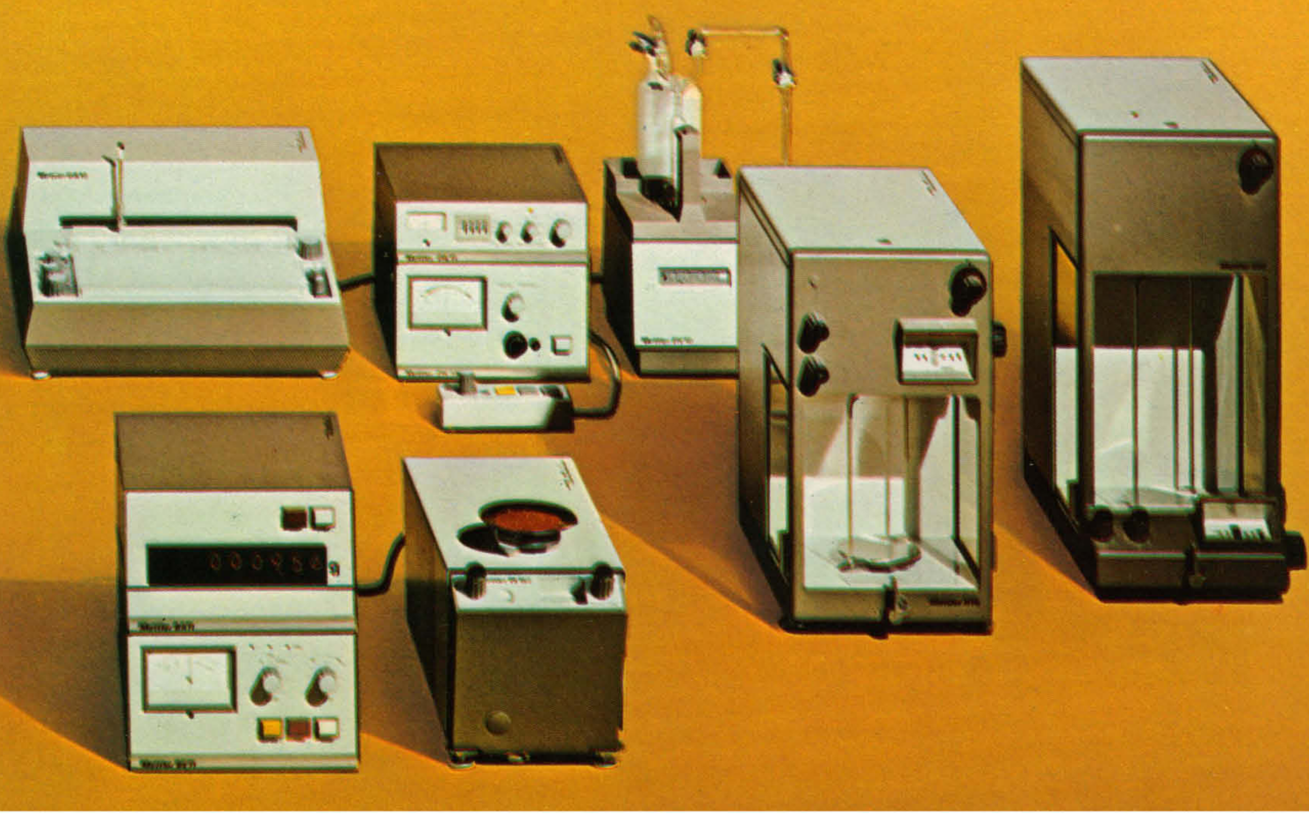

## July

*1–2.* **Effect of Environment on Material Properties in Nuclear Systems**, intern. conf., London, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1)

*1–3.* **European Dialysis and Transplant** Assoc., 8th annual, East Berlin, Germany. (R. Natusch, 2nd Medical Clinic, Charite, Schumannstrasse 20/21 104 Berlin)

*5–7.* **Rare Earths and Actinides**, Durham, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*5–8.* **Shock Tube**, 8th annual intern. symp., London, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1)

*5–9.* **Crystal Growth**, Marseille, France. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*5–9.* **Gas Kinetics**, 2nd annual intern. symp., Swansea, Wales. (H. M. Frey, Dept. of Chemistry, The University, Whiteknights Park, Reading, England)

*5–9.* **Rapid Methods for Measuring Radioactivity in the Environment**, intern. symp., Neuherberg, Germany. (B. Sansoni, Gesellschaft fur Strahlenforschung m.b.H., Ingolstadter Landstr. 1, D-8042 Neuherberg bei Munchen, West Germany)

*5–10.* **General Relativity and Gravitation**, intern. conf., Copenhagen, Denmark. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*7–9.* American Inst. of Aeronautics and Astronautics and Canadian Aeronautics and Space Inst., 12th Anglo-American **Aeronautical** Conf., Calgary, Alta., Canada. (Secretary, AIAA, 1290 Ave. of the Americas, New York 10019)

*7–9.* Northwest Pacific **Plastics** Conf., 8th annual, Pullman, Wash. (M. Adams, Head, Chemical Research Section, College of Engineering, Washington State Univ., Pullman 99163)

*9.* **Phonon-Photon Interactions**, Acoustics Group jointly with Optical Group, York, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*10–13.* International **Bronchoesophagological** Soc., 13th congr., Lyon, France. (C. M. Norris, 3401 N. Broad St., Philadelphia, Pa. 19140)

*11–13.* Denver Research Inst., 20th **X-ray** conf., Denver, Colo. (J. B. Newkirk, Metallurgy and Materials Science Div., Univ. of Denver, Denver 80210)

*11–15.* **Health Physics** Soc., 16th annual, New York, N.Y. (L. Gemmell, Health Physics Div., Brookhaven Natl. Lab., Upton, N.Y. 11973)

*11–16.* **Weights and Measures**, natl. conf., Washington, D.C. (Executive Secretary, Natl. Bureau of Standards, Washington, D.C. 20234)

*11–17.* **Molecular Basis of Biological Activity**, Caracas, Venezuela. (K. Gaede, Instituto Venezuela de Investigaciónes Cientìficas, Apartados 1827, Caracas)

*12–14.* **Aircraft Design and Operations**, 3rd annual mtg., Seattle, Wash. (R. E. Hage, McDonnell Douglas Corp., 3855 Lakewood Blvd., Long Beach, Calif. 90801)

*12–14.* **Calorimetry and Thermodynamics**, 2nd intern. conf., 26th annual, Orono, Maine. (S. R. Gunn, Univ. of California Radiation Lab., Box 808, Livermore 94550)

*12–14.* **Reliability and Maintainability,** 10th annual conf., Long Beach, Calif. (American Inst. of Aeronautics and Astronautics, 1290 Ave. of the Americas, New York 10019)

*12–16.* Society of **Analytical Chemistry,** 3rd annual symp., Durham, England. (C. A. Johnson, 9/10 Savile Row, London W1X 1AF, England)

*12–16.* **Owner-Engineer-Contractor Relations in Tunneling,** Deerfield, Mass. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*12–16.* **Microbiology and Sanitation in the Food Industry**, St. Paul, Minn. (Inst. of Sanitation Management, Univ. of Minnesota, St. Paul)

*12–16.* Pacific **Science** Congr., 12th, Canberra, Australia. (O. Frankel, Australian Acad. of Sciences, Gordon St., Canberra City 2601)

*12–16.* International Union against **Tuberculosis,** 21st annual conf., Moscow, U.S.S.R. (Secretariat, IUAT, 20, rue Greuze, 75-Paris 16ᵉ, France)

*12–16.* **Women in Engineering, Bridging the Gap between Technology and Society,** Henniker, N.H. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*12–17.* **Industrial Measurement by Radiation Techniques,** London, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1)

*12–17.* **Useful Wildland Shrubs, Their Biology and Utilization,** intern. symp., Logan, Utah. (C. M. McKell, Dept. of Range Science, College of Natural Resources, Utah State Univ., Logan 84321)

*12–19.* **Relativity and Gravity,** Trieste, Italy. (A. M. Hamande, Centre for Theoretical Physics, Miramare, P.O. Box 586, 34100 Trieste)

*13–15.* **Electromagnetic Compatibility,** intern. symp., Philadelphia, Pa. (F. Haber, Moore School of Electrical Engineering, Univ. of Pennsylvania, Philadelphia 19104)

*13–15.* **Plastics in Building and Construction,** Pullman, Wash. (R. A. V. Raff, College of Engineering, Research Div., Washington State Univ., Pullman 99163)

*13–16.* **Synthesis in Organic Chemistry,** Cambridge, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*13–17.* Society for the **Study of Fertility,** Nottingham, England. (Secretary, SSF, 141 Newmarket Rd., Cambridge, CB5, 8HA, England)

*14–16.* **Molecular, Cellular and Developmental Biology,** National Cancer Soc. Conf., Boulder, Colo. (K. R. Porter, Dept. of Molecular, Cellular and Developmental Biology, 126 Biosciences, Univ. of Colorado, Boulder 80303)

*14–17.* British Conf. on **Audiology,** Dundee, England. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*14–17.* **Noise Control** Conf. and Exhibi-


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tion, West Lafayette, Ind. (M. J. Crocker, School of Mechanical Engineering, Purdue Univ., Lafayette 47907)

*15–17.* **Extra-Corporeal Technology**, 9th intern. conf., St. Paul, Minn. (E. C. Berger, American Soc. of Extra-Corporeal Technology Inc., 287 E. 6 St., St. Paul 55101)

*17–21.* **Transportation Engineering**, Milwaukee, Wis. (Secretary, American Soc. of Civil Engineers, United Engineers Center, 345 E. 47 St., New York 10017)

*18–21.* **Multimedia in the Health Sciences**, natl. conf., Cincinnati, Ohio. (G. Grupp, Dept. of Biomedical Communication, College of Medicine, Univ. of Cincinnati, Cincinnati)

*18–22.* American Soc. of **Pharmacognosy**, Columbus, Ohio. (J. L. Beal, College of Pharmacy, Ohio State Univ., Columbus 43210)

*18–22.* American **Veterinary Medical** Assoc., 108th annual, Detroit, Mich. (M. R. Clarkson, AVMA, 600 S. Michigan Ave., Chicago, Ill. 60605)

*18–23.* **Otolaryngology**, 3rd congr., Edinburgh, Scotland. (J. W. Dixon, Dept. of Otolaryngology, Royal Infirmary, Glasgow, C4, Scotland)

*18–24.* American **Medical Technologists**, Columbus, Ohio. (C. B. Dziekonski, AMT, 710 Higgins Rd., Park Ridge, Ill. 60068)

*19–21.* **Space Systems**, American Inst. of Aeronautics and Astronautics, Denver, Colo. (P. K. Eckman, Mission Analysis Div., Jet Propulson Lab., California Inst. of Technology, 4800 Oak Grove Dr., Pasadena 91103)

*19–21.* **Computer Simulation** Conf., Boston, Mass. (D. H. Niesse, Dept. K676, McDonnel Automation Co., Box 516, St. Louis, Mo. 63166)

*19–23.* **Clinical Engineering**, Deerfield, Mass. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*19–23.* **Cultural Factors in Mental Test Development, Application, and Interpretation**, Istanbul, Turkey. (L. J. Cronbach, 16 Laburnum Rd., Atherton, Calif. 94025)

*19–23.* Quantitative Decision Making for the **Delivery of Ambulatory Care**, Henniker, N.H. (A. R. Jacobs, Statistics and Evaluation Unit, Univ. of Rochester School of Medicine, Rochester, N.Y.)

*19–23.* **Light Scattering in Solids**, 2nd intern. congr., Paris, France. (M. Balkanski, Laboratoire de Physique des Solides, Faculte des Sciences, Tour 13, 9, Quai Saint-Bernard, Paris 5e)

*19–23.* British **Medical** Assoc., scientific mtg., Leicester, England. (Secretary, BMA, BMA House, Tavistock Sq., London, W.C.1, England)

*19–23.* **Molecular Energy Transfer** Conf., Cambridge, England. (A. B. Callear, Dept. of Physical Chemistry, Univ. of Cambridge, Lensfield Rd., Cambridge)

*19–24.* **Continuous Culture**, 5th intern. symp., Oxford, England. (F. J. Griffin, Soc. of Chemical Industry, 14 Belgrave Sq., London, S.W.1, England)

*19–24.* **Mathematical Models in Hydrology**, Intern. Assoc. of Scientific Hydrology, Warsaw, Poland. (Z. Kaczmarek, Warsaw Technical Univ., Plac Jednosci Robotniczej, Warsaw 1)

*20–23.* **Mechanised Information Storage**

**and Retrieval Systems**, 3rd annual conf., Cranfield, England. (C. Cleverdon, Cranfield Inst. of Technology, Cranfield, Bedford)

*20–23.* **Nuclear and Space Radiation Effects**, Durham, N.H. (T. M. Flanagan, Gulf Radiation Technology, P.O. Box 608, San Diego, Calif. 92112)

*20–23.* **Physiology and Pharmacology of Cyclic AMP**, intern. conf., Milan, Italy. (R. Paoletti, Inst. of Pharmacology, Univ. of Milan, via Vanvitelli, 32, 20129 Milan)

*20–25.* International Assoc. of **Geochemistry and Cosmochemistry**, Moscow, U.S.S.R. (A. P. Vinogradov, Vernadsky Inst. of Geochemistry, Moscow V-334)

*21–23.* Visual Performance When Using **Optical Instruments**, Munich, Germany. (Meetings Officer, Inst. of Physics and Physical Soc., 47 Belgrave Sq., London, S.W.1, England)

*21–25.* International Soc. of **Clinical Laboratory Technologists**, New York, N.Y. (D. Birenbaum, 805 Ambassador Bldg., St. Louis, Mo. 63101)

*22–30.* Pacific Coast **Oto-Ophthalmological** Soc., Honolulu, Hawaii. (F. A. Sooy, Dept. of Otolaryngology, Univ. of California Medical Center, San Francisco 94122)

*23–27.* **High-Energy Electrons and Photons**, Ithaca, N.Y. (Conference Secretary, Lab. of Nuclear Studies, Cornell Univ., Ithaca 14850)

*24–30.* International Assoc. of **Applied Psychology**, 17th congr., Liège, Belgium. (Prof. Piret, 47 rue Cesar Franck, Liège)

*25–30.* **Pure and Applied Chemistry**, 23rd intern. congr., Boston, Mass. (A. T. Winstead, American Chemical Soc., 1155 16th St., NW, Washington, D.C. 20006)

*25–30.* Engineering Properties of **Sea Floor Soils and Their Geophysical Identification**, Seattle, Wash. (R. C. Bostrom, Earthquake Engineering Group, Dept. of Civil Engineering, Univ. of Washington, Seattle 98105)

*25–30.* **Transportation Engineering** Conf., American Soc. of Civil Engineers, Seattle, Wash. (W. H. Wisely, ASCE, 345 E. 47 St., New York 10017)

*25–31.* **Physiological Sciences**, 25th intern. congr., Munich, Germany. (K. Thurau, Theresienhoehe 15, 8000 Munich)

*26–30.* **Automatic Cytology** Conf., Henniker, N.H. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*26–30.* **Instrumentation Science**, 30th annual conf., Instrument Soc. of America, Geneva, N.Y. (S. Lees, Forsyth Dental Center, 140 Fenway, Boston, Mass., 02115)

*26–30.* **Teaching the Handicapped Child**, intern. conf., Norrkoping, Sweden. (R. Hermelin, 85/86 Newman St., London, W.1, England)

*26–31.* **Physics of Electronics and Atomic Collisions**, 7th intern. conf., Amsterdam, Netherlands. (J. Kistemaker, Inst. of Atomic and Molecular Physics FOM, Kruislaan 407, Amsterdam-O)

*28–30.* Montana **Radiological** Soc., Bozeman. (C. H. Agnew, MRS, Box 1543, Billings, Mont. 59101)

*29–5.* World Federation of the **Deaf**, 6th congr., Paris, France. (Organizing Committee of the 6th Congr. of the

WFD, Confederation Nationale des Sourds de France, 20, rue Therese, Paris 1e)

*30–1.* **Linguistic** Soc. of America, Buffalo, N.Y. (T. A. Sebeok, Patton House, Indiana Univ., 516 E. 6 St., Bloomington 47401)

*30–8.* **Ophthalmological** Conf., Portillo, Chile. (Resort Representation Service, 30 Rockefeller Plaza West, Rockefeller Center, New York 10020)

*30–13.* International Assoc. of **Meteorology and Atmospheric Physics**, Moscow, U.S.S.R. (W. L. Godson, Meteorology Office, Dept. of Transportation, 315 Bloor St. W., Toronto, Ont. Canada)

**August**

*1–5.* American Soc. of **Animal Science**, Davis, Calif. (G. P. Lofgreen, Imperial Valley Field Station, 1004 E. Holton Rd., El Centro, Calif. 92243)

*1–6.* International Congr. of **Immunology**, Washington, D.C. (H. B. Lemp, Union of Immunological Soc., 9650 Rockville Pike, Bethesda, Md. 20014)

*2–4.* **Olfaction and Taste**, 4th intern., Munich, Germany. (D. Schneider, Max-Planck-Institut fur Verhaltensphysiologie, 8131 Seewiesen, Munich)

*2–4.* **Operations Research: Implications for Libraries**, 35th annual, Chicago, Ill. (D. R. Swanson, Graduate Library School, Univ. of Chicago, 1100 E. 57 St., Chicago, 60637)

*2–6.* **Engineering and Social Costs in Environmental Control**, Deerfield, Mass. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*2–6.* **Engineering in Medicine—Biotelemetry**, Henniker, N.H. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*2–6.* **Molecular Biology and Pathology**, 4th annual conf., Saratoga Springs, N.Y. (K. T. Lee, Dept. of Pathology, Albany Medical College, Albany, N.Y. 12208)

*2–7.* European Soc. for **Comparative Endocrinology**, 6th congr., Montpellier, France. (I. Assenmacher, Science Faculty, Univ. of Montpellier, Place East Bataillon, 34 Montpellier, Herault, France)

*2–7.* International Conf. on **Stochastic Point Processes, Statistic Analysis, Theory and Applications**, Yorktown Heights, N.Y. (P. A. W. Lewis, Mathematical Sciences Dept., IBM Research Center, P.O. Box 218, Yorktown Heights 10598)

*2–8.* **Electric Field of the Heart**, Intern. Union of Physiological Sciences, Brussels, Belgium. (P. Rijlant, Medical Faculty, Inst. for Physiology, Univ. of Brussels, 115 Blvd. de Waterloo, Brussels, 1000)

*2–14.* American **Geophysical** Union, 15th general assembly, Moscow, U.S.S.R. (A. Spilhaus, Jr., AGU, 2100 Pennsylvania Ave., NW, Washington, D.C. 20037)

*3–5.* Association for **Computing Machinery**, Chicago, Ill. (C. L. Bradshaw, General Computer Services, Inc., P.O. Box 4163, Huntsville, Ala. 35802)

*3–5.* **Counter** Conf., Boulder, Colo. (M. A. Harrison, Dept. of Computer Science, Univ. of California, Berkeley 94720)

*3–6.* **Crystal Structure and Chemical Bonding**, Intern. Union of Crystallography, Twente, Netherlands. (A. Schuijff, Univ. of Utrecht, Utrecht, Netherlands)

*3–6.* Intersociety Energy Conversion **Engineering** Conf., Boston, Mass. (F. A. Creswick, Battelle Memorial Inst., 505 King Ave., Columbus, Ohio 43201)

*3–6.* **Operator, Engineer and Management Interface with the Process Control Computer,** Lafayette, Ind. (Organizing Committee, Lab. for Applied Industrial Control, Purdue Univ., Lafayette 47907)

*4–5.* **Regulation of Coronary Blood Flow**, Intern. Union of Physiological Sciences, Antwerp, Belgium. (W. Schaper, Janssen Research Foundation, Koninklijke laan 17, 2340 Beerse, Belgium)

*5–6.* Association of American **Feed Control Officials,** 61st annual, Jackson, Wyo. (R. McDonald, Texas Feed and Fertilizer Control Services, Box 3160, College Station 77840)

*5–8.* Singapore-Malaysia Congr. of **Medicine**, 6th intern., Singapore, Malaysia. (C. Beng Keng, c/o Medical Unit 1, General Hospital, Singapore 3)

*5–20.* International **Geographic** Union, European regional conf., Budapest, Hungary. (G. Bora, IGU Hungarian Natl. Committee, Nepkoztarsasag utja 62, Budapest VI)

*8–12.* **Clay Minerals** Soc., 8th annual, and Clay Minerals Conf., 20th annual, Rapid City, S.D. (W. F. Bradley, Dept. of Chemical Engineering, Univ. of Texas, Austin 78712)

*8–12.* National **Medical** Assoc., Philadelphia, Pa. (R. D. Watkins, NMA, P.O. Box 29050, Washington, D.C. 20017)

*8–13.* **Amorphous and Liquid Semiconductors,** 4th intern. conf., Ann Arbor, Mich. (J. C. Thompson, Dept. of Physics, Univ. of Texas, Austin 78712)

*8–13.* American Assoc. of **Clinical Chemists,** Seattle, Wash. (D. A. H. Roethel, AACC, 1155 16th St., NW, Washington, D.C. 20006)

*8–14.* North American Acad. of **Manipulative Medicine**, Honolulu, Hawaii. (A. Bobb, P.O. Box 2071, Sante Fe, N.M. 87501)

*9–10.* Rocky Mountain **Spectroscopy** Conf., Denver, Colo. (G. M. Pachelo, Dow Chemical Co., Bldg. 559, P.O. Box 888, Golden, Colo. 80401)

*9–11.* **Weightlessness and Artificial Gravity**, Williamsburg, Va. (American Inst. of Aeronautics and Astronautics, 1290 Ave. of the Americas, New York 10019)

*9–13.* **Electron Microscopy** Soc. of America, Boston, Mass. (G. G. Cocks, Olin Hall, Cornell Univ., Ithaca, N.Y. 14850)

*9–13.* Engineering Foundation Conf. on **Enzyme Engineering**, Henniker, N.H. (L. B. Wingard, Jr., Dept. of Pharmaceutics, Health Sciences Bldg., State Univ. at Buffalo, Buffalo, N.Y. 14214)

*9–13.* **Mixing Operations**, 3rd annual conf., Andover, N.H. (Secretary, Engineering Foundation, 345 E. 47 St., New York 10017)

*9–13.* International Soc. for **Photogrammetry**, London, England. (D. W. Proctor, Dept. of Photogrammetry and Surveying, University College, Gower St., London, W.C.1)

*10–20.* International **Statistical** Inst., Washington, D.C. (Secretariat, ISI, 2 Oostduinlaan, The Hague, Netherlands)

*11–13.* **Applications of X-Ray Analysis,** 20th annual, Denver, Colo. (C. O. Ruud, Dept. of Metallurgy and Materials Science, Univ. of Denver, Denver 80210)