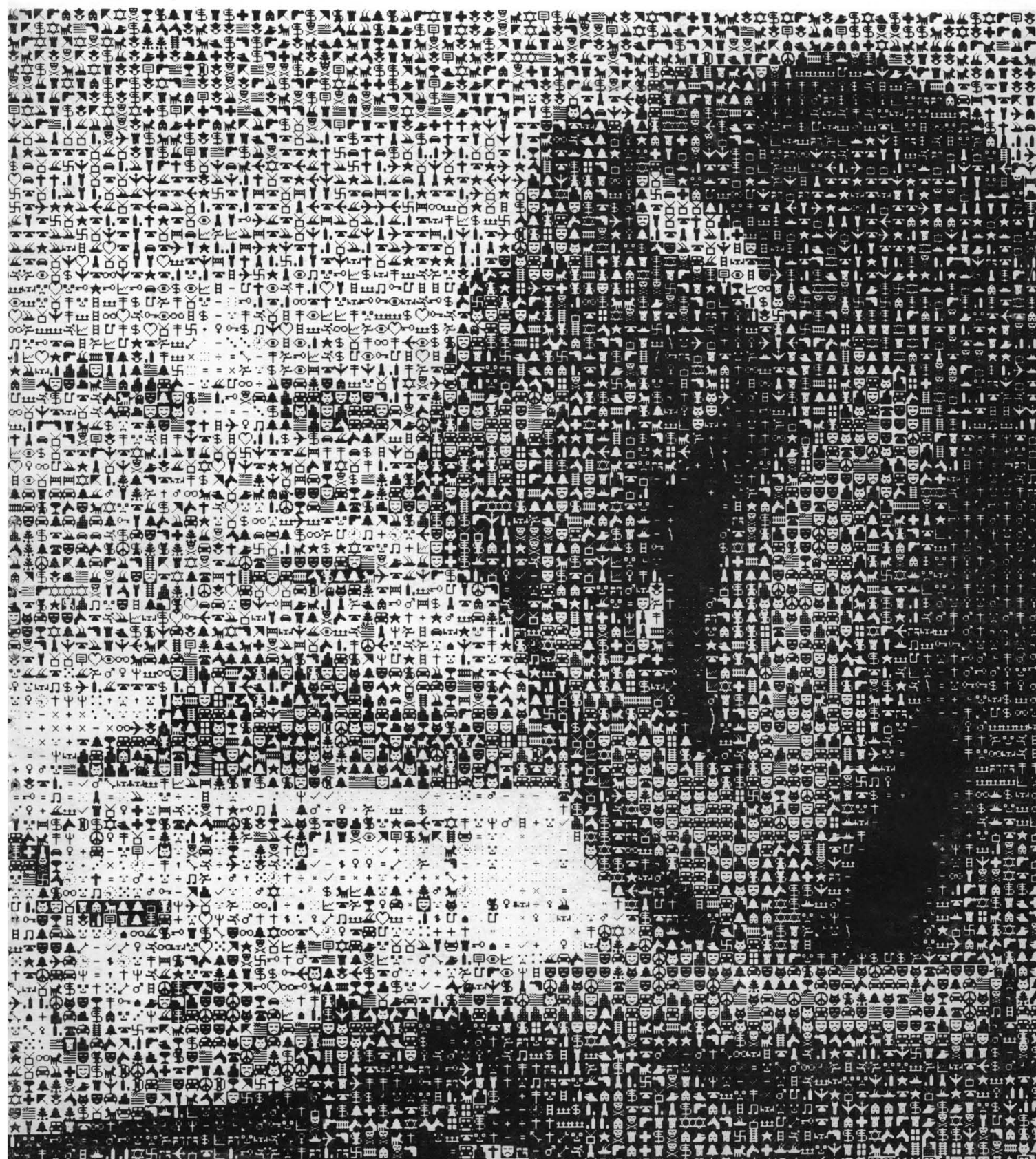


# SCIENCE

4 April 1969

Vol. 164, No. 3875

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





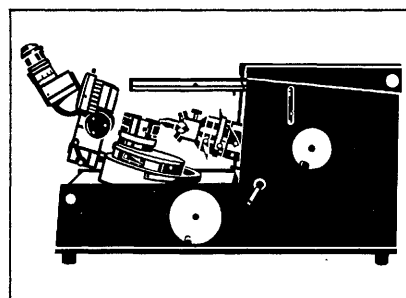
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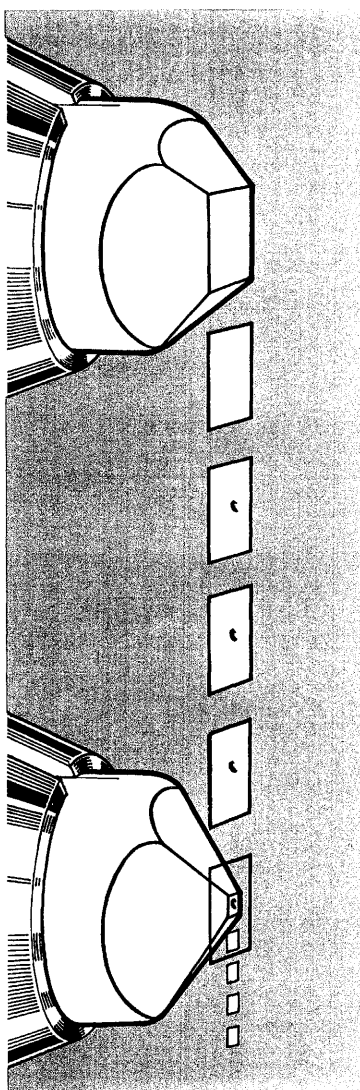


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## COVER

Computer-processed picture; gray scale is generated proportion of black-dot occupancy of 11 by 11 matrices. Dots are arranged to form micropatterns so that picture can be viewed on two levels. The apparent detail of Paris (overlooked by Notre Dame's famous gargoyle, Quasimodo) increases with increased viewing distance. See page 19. [© 1967 Bell Telephone Laboratories, Inc.]

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.

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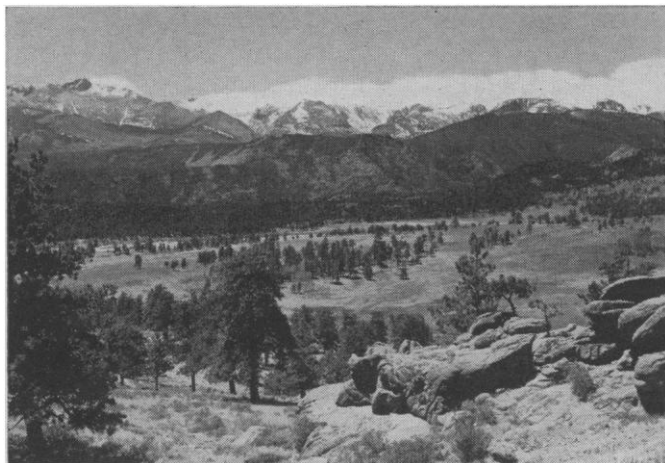




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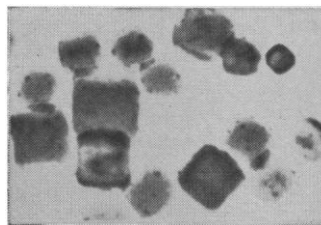
Nuclear magnetic resonance was once a game which had for its object the confirmation of one's suspicions about the structure of a molecule in solution from the way its protons (or other nuclei of odd atomic number or odd atomic weight) resonate under the combined influence of a strong magnetic field and r.f. irradiation.

Now NMR is taught to smart sophomores. Since ambitious industrial laboratories must do it or be considered backward, they have to be able to prove that NMR is done for more than the pleasure of the practitioner. Chemists unafraid of playing games have lately had to take up a more advanced form of NMR. Here the molecules under study are held in the grip of a special kind of solvent which orients them to the magnetic field. This vastly complicates the resonance spectrum. Protons formerly indistinguishable because their differences in position are blurred by random motion no longer appear identical when the randomness diminishes. Now

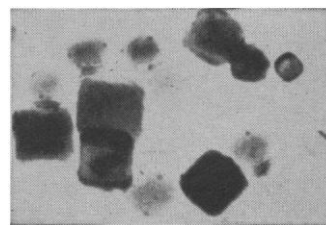
angles and relative distances within the molecule can be calculated. With one of the intramolecular distances independently measured by some other technique, such as electron diffraction, the complete molecular construction is bared—provided there are no more than about eight protons in the molecule. If there are many more, it gets a little tough in the present state of the game to adjust the player's preconception of the configuration to the observed spectrum. X-ray diffraction data must have looked just as formidable to the brave workers who first hacked at organic architecture in the solid state.

*This game, too, will quit being a game when the present players will have robbed it of intrigue and moved on to something more challenging. Meanwhile a "Bibliography on Liquid Crystals in NMR" is available from Eastman Kodak Company, Eastman Organic Chemicals, Rochester, N.Y. 14650. The orienting nematic liquid-crystal compounds named at left form eutectic mixtures with desirably low ("semi-") melting points in the thirties instead of the seventies as for the individual compounds (Angew. Chem., Intern. Ed., 6:450 (1967)). They can be ordered from the familiar distributors of Eastman laboratory chemicals: B&A, CURTIN, FISHER, HOWE & FRENCH, NORTH-STRONG, SARGENT-WELCH, VAN WATERS & ROGERS, or WILL.*

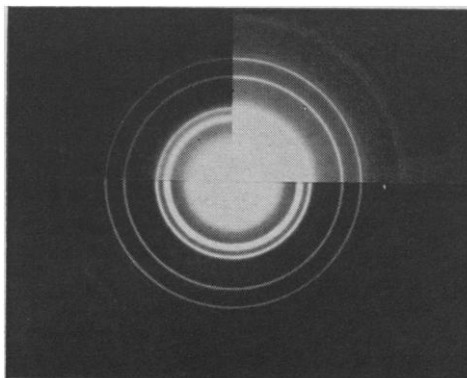
### On the other hand, complexity and progress are not synonymous . . .



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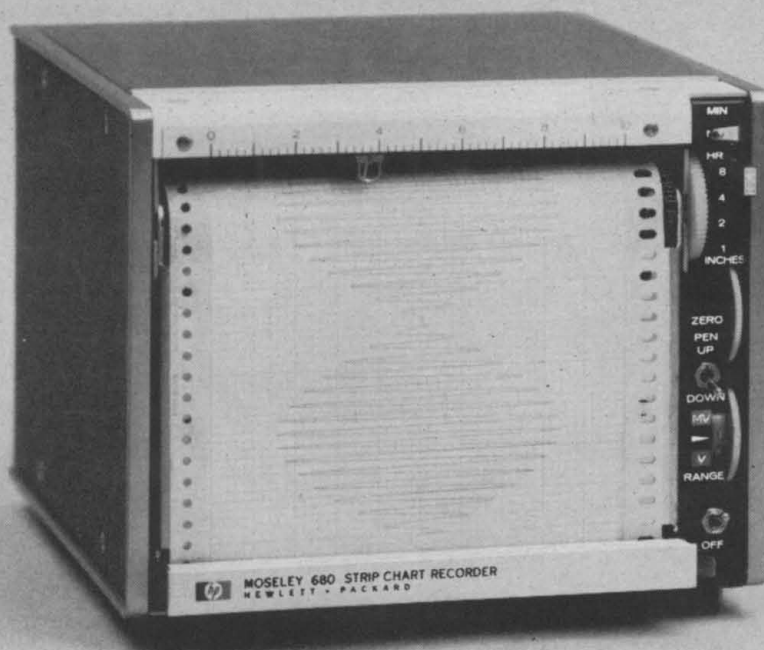
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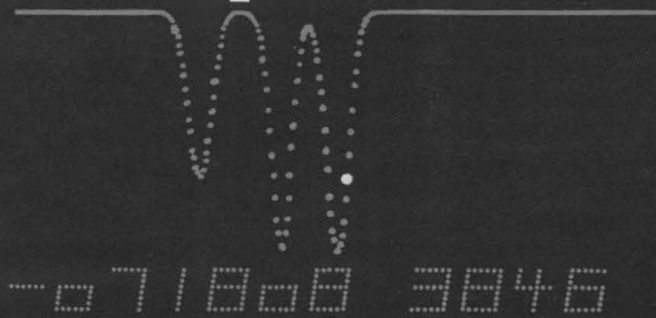
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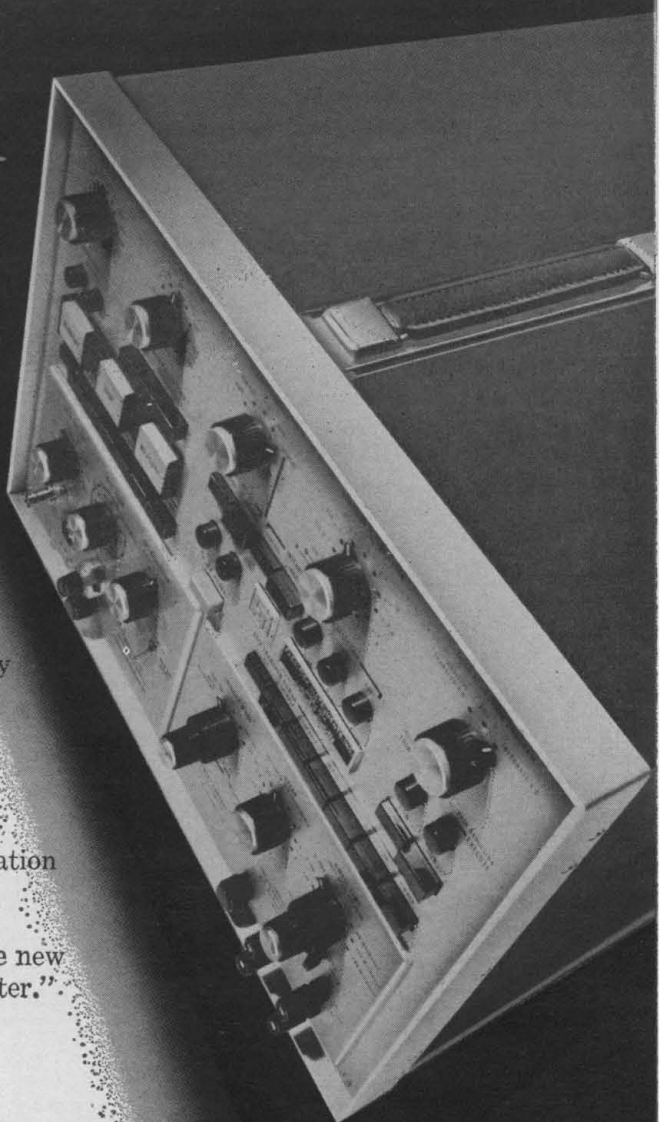
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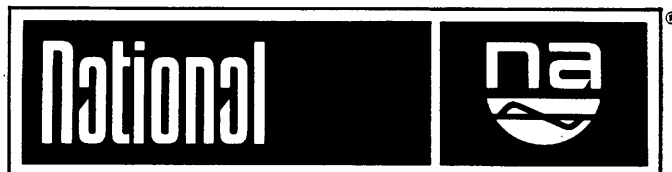
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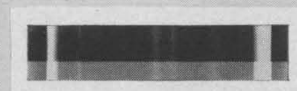
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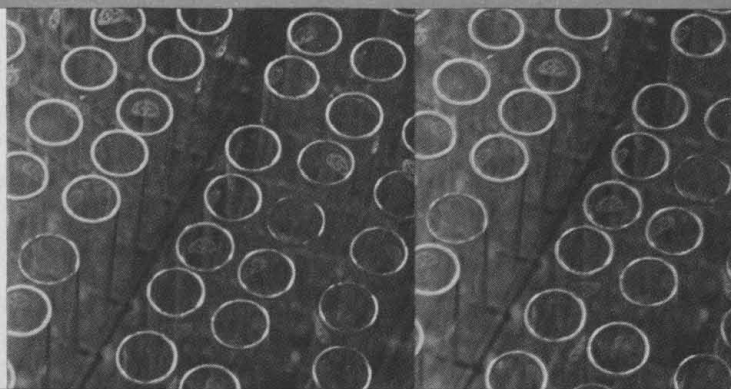


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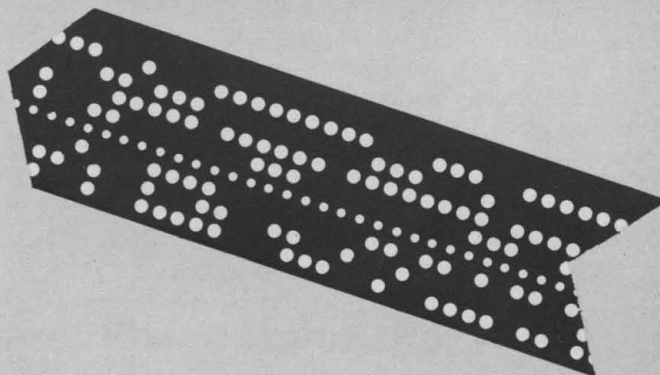
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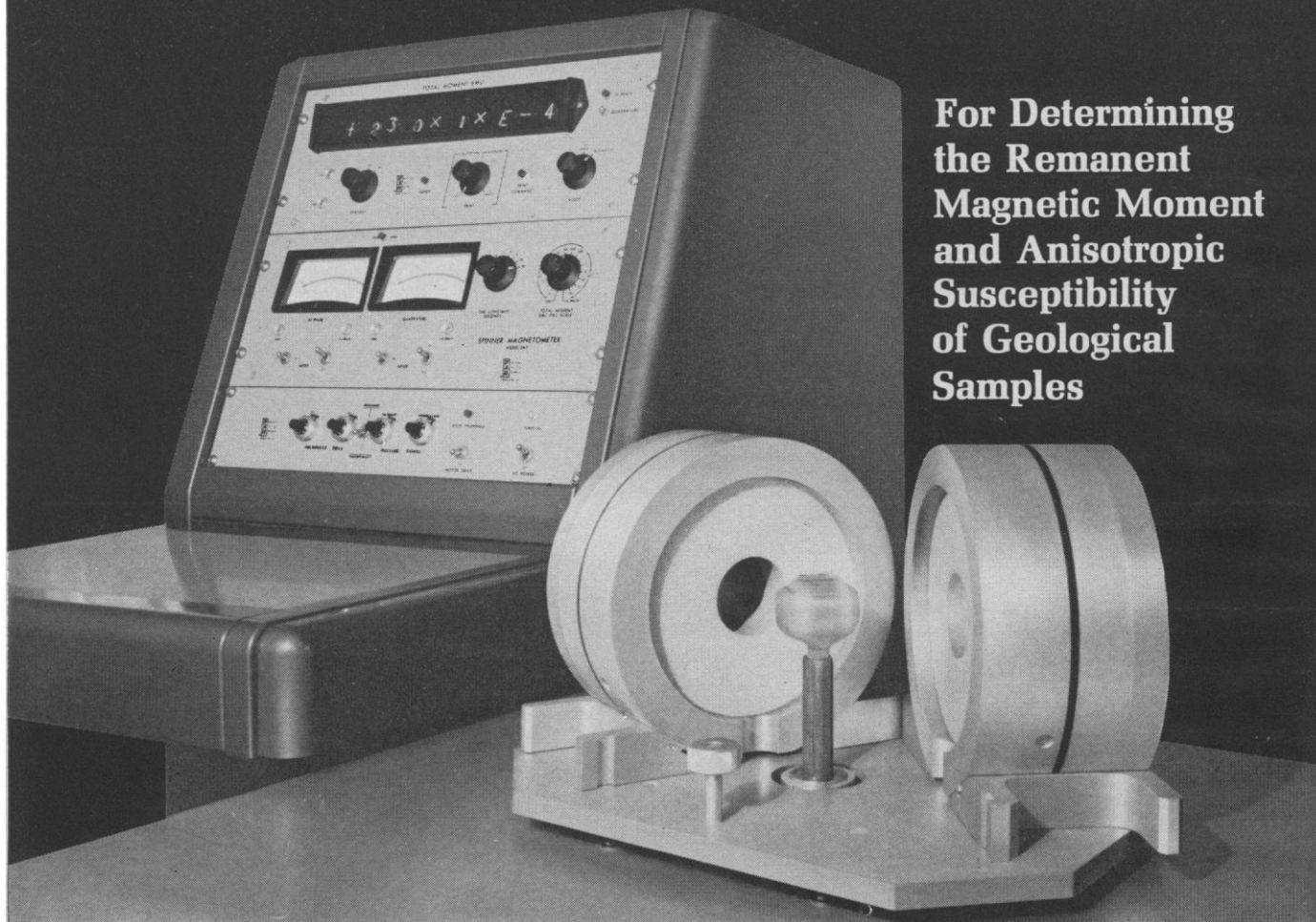
Analog to digital conversion, digital multiplexing, and the conversion to punch tape provide you with data that can then be transmitted to a computer.

A demonstration of enzyme rate analysis by a time share computer will be made at our FASEB exhibit. The Gilford Data Logging System will take the four enzymes under study and convert absorbance and time data into computer acceptable form. This data will then be transmitted by computer link (com-share) to a computer facility. The results will be returned to the exhibit floor via teletype.





# Spinner Magnetometer



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Samples**

Recent results in paleomagnetic research have pointed out the importance of remanent magnetic moment studies in dating events in the Earth's history. This new application of remanent moment measurement together with earlier uses in drilling core orientation and studies of continental drift, polar wandering and magnetic anomalies have greatly increased interest in this technique. To facilitate work in these fields, PAR<sup>TM</sup> is making available its Model SM-1 Spinner Magnetometer. This instrument, which incorporates the results of PAR's wide experience in small-effect measurement and weak signal processing, has been designed to increase measurement sensitivity to the limits imposed by the thermal noise of the pick-up coils.

The Model SM-1 simultaneously measures and displays two orthog-

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## **Brief Specifications:**

**Minimum Detectable Signal:** Will detect changes in magnetic moments smaller than  $7 \times 10^{-9}$  EMU/cc.

**Sensitivity Ranges:** 21 full scale ranges calibrated in TOTAL MOMENT from  $0.5 \times 10^{-6}$  to 5 EMU in a 1, 2, 5 sequence.

**Calibration Accuracy:** The system is factory calibrated to within  $\pm 0.5^\circ$  phase and within 1% magnitude.

**Sample Size:** Cylinder 2.54 cm diameter, 2.28 cm length. Slightly larger or smaller samples can be accommodated.

**Sample Rotational Speed:** 105 Hz (52.5 for anisotropic susceptibility measurements). 105/15 Hz unit available at additional cost.

**Price:** \$9,600 for complete system; with automatic digital readout (as shown in the photograph) to monitor the orthogonal components of the moment alternately, \$11,350. Export price approximately 5% higher, except Canada.

Write for Bulletin No. T-157 to Princeton Applied Research Corp., Dept. G, P.O. Box 565, Princeton, N. J. 08540. Telephone: (609) 924-6835.

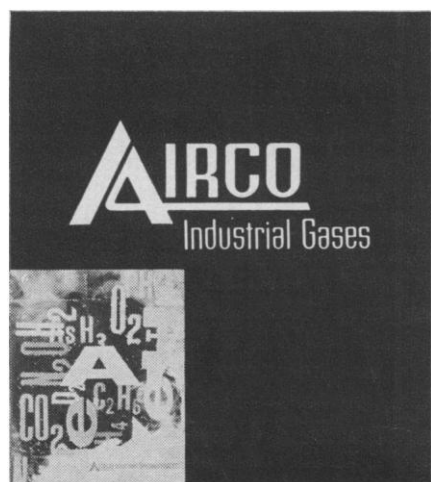


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careers in the United States. In any case, I believe that they would agree with me that the creation of so many excellent science departments in the "non-Ivy League" universities of the United States since World War II is not compatible with the argument that "institutional origins are the primary determinants of later rewards."

With regard to Medlin's letter: I am, of course, aware that research is carried on in Soviet universities (having paid six visits to the Soviet Union since 1956). However, in the natural sciences (to which I was limiting my remarks), the contrast in the quality of research (and facilities) of the universities and the academy institutes is striking. This is especially true in places like Moscow and Leningrad; in the new academic town of Novosibirsk, the liaison between the university and the academy institutes has been patterned on the American model. I am convinced that one of the chief reasons for the outstanding American performance in basic science is our system of graduate education (and I think the Russians are now recognizing this fact) and, in these days of student rebellion, I used the Soviet comparison to underline this point. I do not believe that the Soviet dichotomy exists in Western Europe.

R. E. MARSHAK

*Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627*

#### **Australia's Appeal to Ph.D.'s**

Rodney Willix (Letters, 22 Nov.), commenting on the lack of opportunities for Ph.D.'s in Australia, has stated only one aspect of a complex situation relating to the employment of scientists here. A presumed glut in the physical sciences is said to be confirmed by the number of Ph.D.'s "who continue to live in the United States for longer periods than they originally intended."

While it is probably true that Ph.D.'s do not return because of the comparatively poor level of research support provided both by government and industry, it is also very relevant to point out that, unless an individual has pressing personal reasons, he may be reluctant to return to a country where professional salaries and hence real purchasing power are close to half those pertaining to appointees of equivalent status in the United States. Also it comes as a shock to experience the

substantially higher taxation rate levied on individual incomes in Australia.

Australians as a whole are barely aware of the importance of research and its effect both directly and indirectly on the economy. It is significant that many research projects both large and small are relying heavily on funds from U.S. sponsors. While it should be possible to reduce this component over the next decade, it would be catastrophic to have it cut off overnight. I, for one, am grateful for the amount of continuing U.S. research support for nuclear physics which we have received over the past few years; I am proud of the calibre of Ph.D.'s that have been produced; and am agreeably surprised that employment in industry has been found in the last year for those seeking it.

EDMUND G. MUIRHEAD

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3052, Victoria, Australia*

#### **Fluoride: Nature's Own**

A. R. Miller's criticism (Letters, 3 Jan.) of Sopolsky's comparison of fluoridation to chlorination and pasteurization is right but for the wrong reasons. Chlorination and pasteurization—valuable though they are—are nevertheless actions in which man surmounts the threats of nature. Fluoridation, on the other hand, is an action in which man restores the benefits of nature. Fluoride is an essential trace element, found in many local water supplies but deficient in others. If government authorities assume the responsibility of supplying water—as the public would have them do—then they would be culpable if they did not supply the essential trace elements which under optimum circumstances are furnished by nature. At any rate, we can be sure that nature never intended them to be supplied in toothpaste!

GEOFFREY EDSALL

*375 South Street,  
Boston, Massachusetts 02130*

#### **The Pill Doesn't Poison**

The comment on "Oral contraceptives: Government supported programs are questioned" (7 Feb., p. 553) contains a statement which to my knowledge is absolutely untrue. Mueller states that the accidental ingestion of oral

contraceptives by children accounts for almost as many deaths as aspirin does. This information is attributed to the Food and Drug Administration.

The September-October 1968 bulletin from the National Clearinghouse for Poison Control Centers does not even place oral contraceptives in a separate listing as it does aspirin. In 1967 aspirin accounted for 23 percent of the accidental ingestions in children under 5, while hormones accounted for only 1.9 percent. In 1966 there were 92 deaths in children under 5 from aspirin and salicylate ingestion while the total for all drugs was 155.

The other argument against such a statement is that the amount of active hormone, progesterone and estrogen, in oral contraceptives is relatively small in comparison to the amount that would be required to cause an adverse pharmacological reaction in a small child. . . .

CHARLES R. BRINKMAN, III  
*Department of Obstetrics and  
Gynecology, School of Medicine,  
University of California, Los Angeles*

Brinkman is correct. The Poison Control Center of the Public Health Service says the latest figures, for 1967, show that there were an estimated 800 reported ingestions of oral contraceptives that year, but no deaths. I was incorrectly informed by a former FDA official who apparently received the information from the Poison Control Center of the St. Louis Children's Hospital. It is believed that the error occurred at the source when ingestions were equated with accidental poisonings.

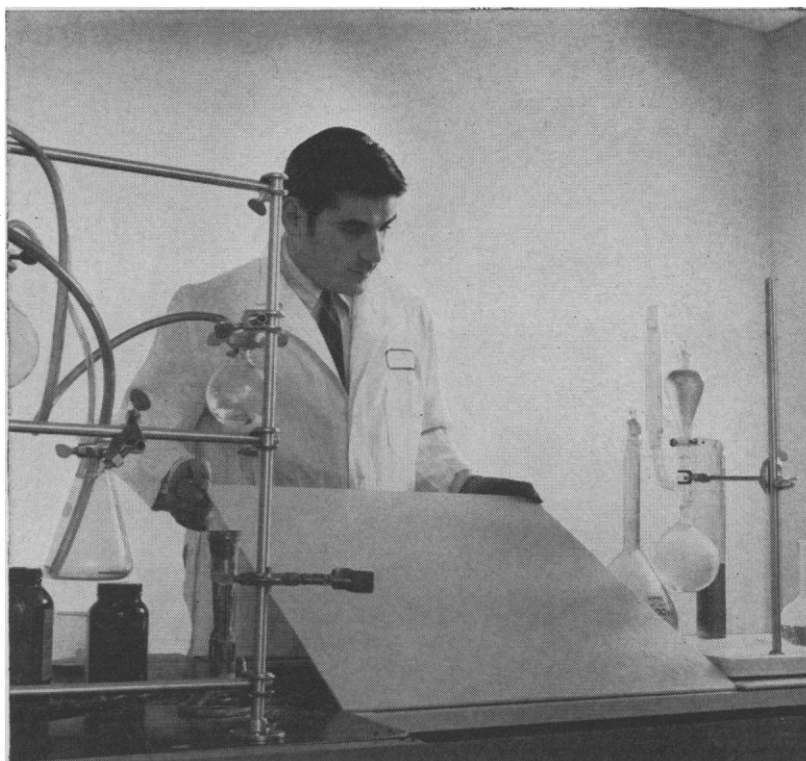
MARTI MUELLER  
Science

### Extinction by DDT

Although one cannot help but notice the similarities between the disasters associated with the use of DDT in Wisconsin (7 Feb., p. 548) and the Santa Barbara oil spillage, there is one important difference. The loss of bird and marine life at Santa Barbara, while tragic, does not appear to threaten any one species with extinction as does the continued use of DDT. In both cases, however, conservationists' warnings have gone unheeded.

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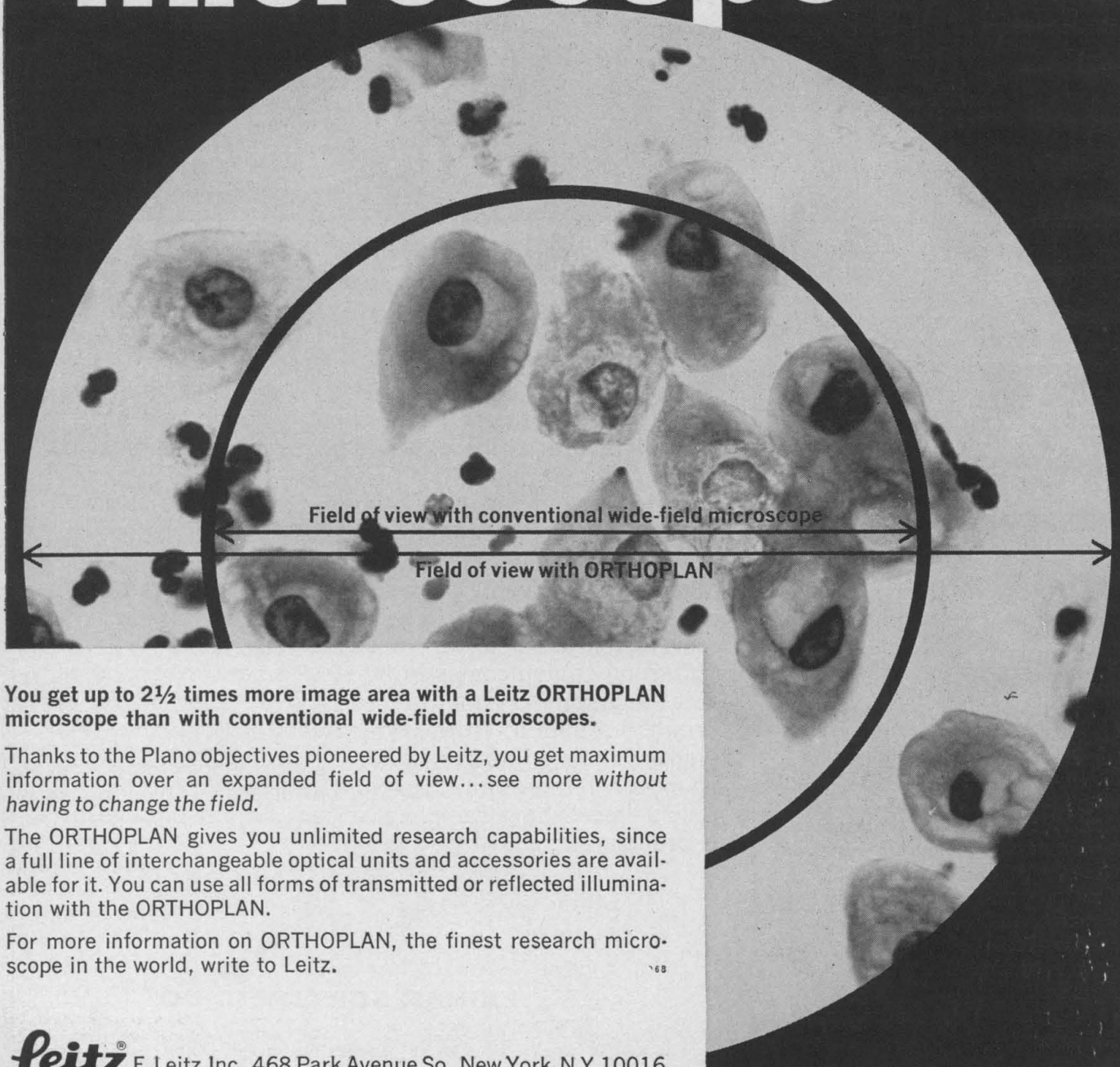
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## Malnutrition, Learning, and Behavior

Children reared in poverty tend to do poorly on tests of intelligence. In part this is due to psychological and cultural factors. To an important extent it is a result of malnutrition early in childhood. This matter is discussed in a recent article in *Science*\* and in a report of an International Conference on Malnutrition, Learning, and Behavior.† Both publications survey the effects of deprivation at an early age. It seems likely that millions of young children in developing countries are experiencing some degree of retardation in learning because of inadequate nutrition, and that this phenomenon may also occur in the United States.

Because of complex social and psychological factors associated with malnutrition, it is not easy to assess the effects of dietary deficiencies in man. However, observations in underdeveloped countries, coupled with studies on animals, provide substantial evidence. In rats and pigs the brain reaches 80 percent of adult size by normal weaning time. At that stage, body weight is 20 percent of that at maturity. During the period of rapid growth the brain is vulnerable to nutritional damage. A relatively short period of undernutrition results in smaller brain size at maturity even if the animals are maintained on a good diet after weaning. Changes in brain size are accompanied by persistent anatomical and biochemical changes.

In humans, the brain of the infant attains 80 percent of adult weight by age 3, when the body weight is about 20 percent of that at maturity. Thus the animal experiments suggest that good nutrition during the first 3 years of life is particularly important.

In some countries undernutrition involves a deficit in calories, proteins, and vitamins. Usually lack of protein is the most serious problem, but vitamin deficiencies are also important. Throughout much of the world, grains are the principal sources of protein. These do not contain a full complement of all the essential amino acids—lysine is usually in short supply. Many individuals, even in the United States, who have adequate caloric intake primarily from low-cost foods may be malnourished. This possibility has become a matter of increasing concern to the federal government.

Desirable objectives for a U.S. food program have been described by Dr. Aaron M. Altschul of the Department of Agriculture‡: (i) no one must go hungry; (ii) hunger or malnutrition must not be a deterrent to economic development; and (iii) the American diet must provide for optimum health throughout life.

These are laudable goals, but they will not be easily attained. Enough food can be provided, but that is not the whole answer. The consumer must choose to eat nourishing foods. In part the problem can be met by enriching commercial food products. For example, cereal foods such as wheat flour or products made from it are markedly improved by the addition of lysine (0.2 percent) and of needed vitamins and minerals.

Good nutrition is desirable at all ages, but it is evident that the first 3 years are crucial. To respond to this need, the federal government has begun to distribute, in some places, a special supplementary food package to new and expectant mothers, through health centers and clinics. This program should be expanded. However, unless mothers understand how to care for their young, bountiful supplies of food will not suffice. There is real need for general education in the basic principles of nutrition and for continuing effort to assure that no one, and especially no infant, fails to develop properly because of malnutrition.

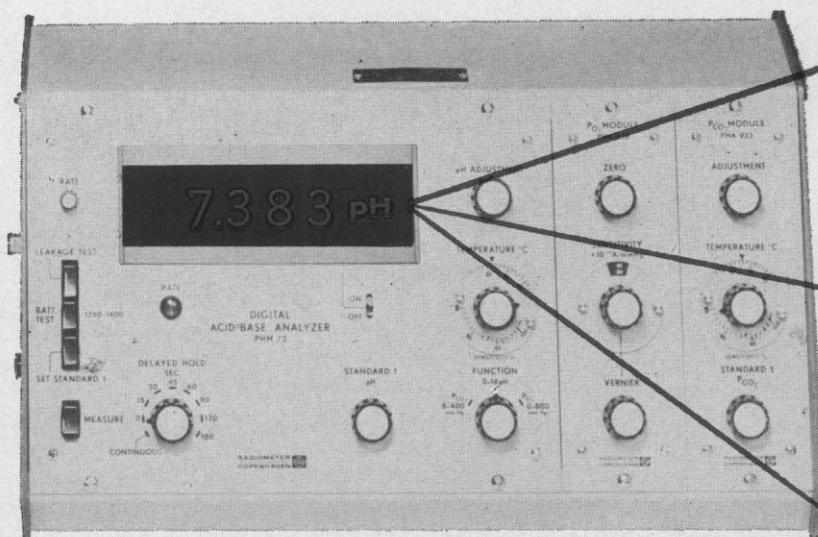
—PHILIP H. ABELSON

\* H. F. Eichenwald and P. C. Fry, *Science* 163, 644 (1969). † N. S. Scrimshaw and E. Gordon, Eds., *Malnutrition, Learning, and Behavior* (MIT Press, Cambridge, 1968). ‡ A. M. Altschul, testimony before the Senate Select Committee on Nutrition and Human Needs, 18 December 1968.

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