

SCIENCE

26 July 1974

Vol. 185, No. 4148

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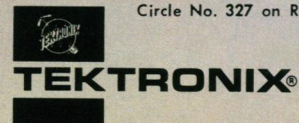
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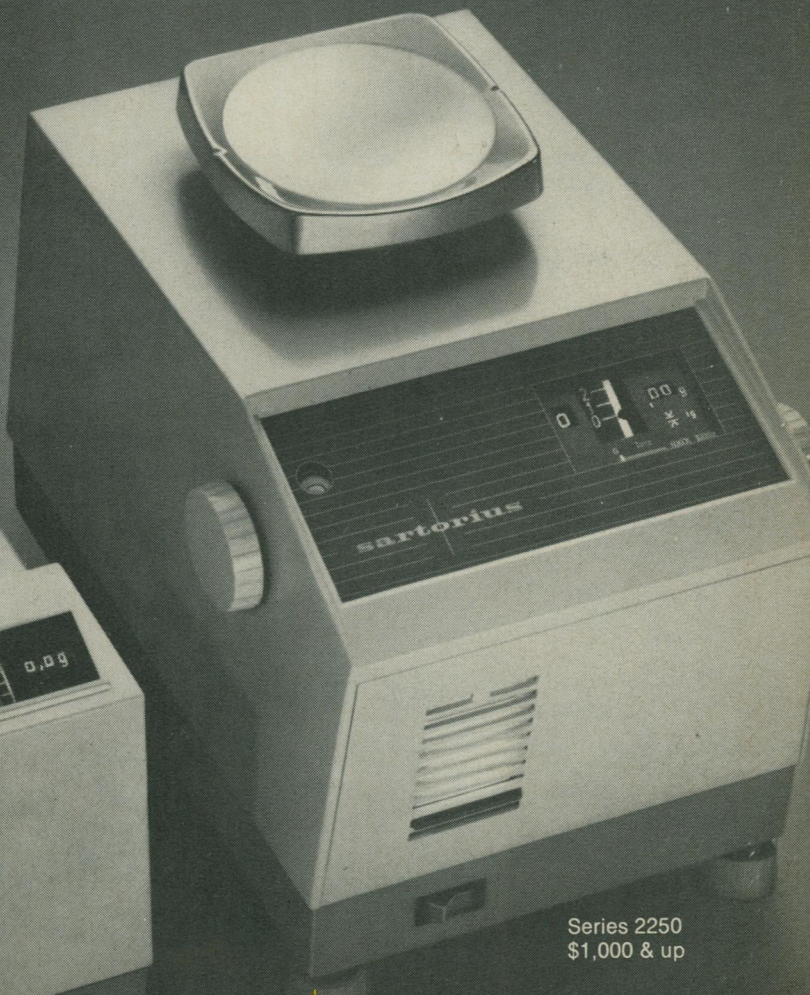
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COVER

Tiger swallowtail butterflies "puddling" on a sand bar. The presence of sodium in the sand appears to be the stimulus for this behavior. See page 372. [P. Feeny, Department of Entomology, Cornell University, Ithaca, New York]

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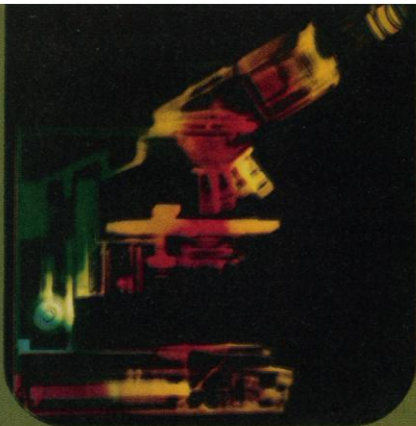
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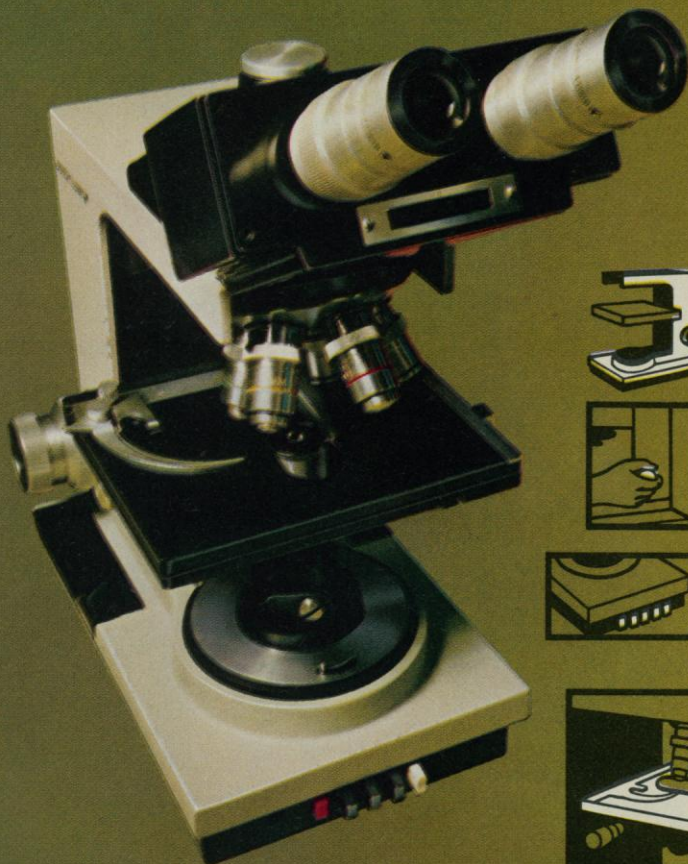
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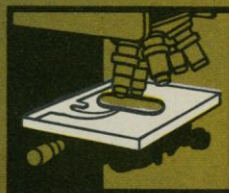
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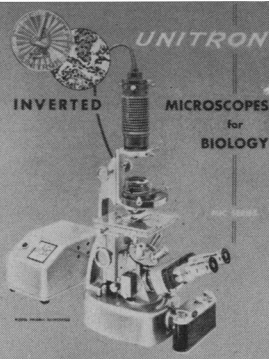


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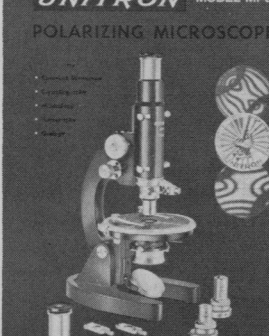
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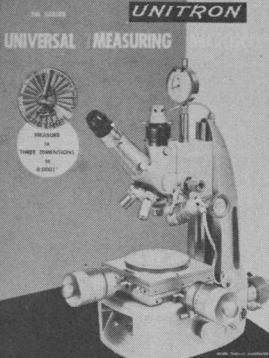
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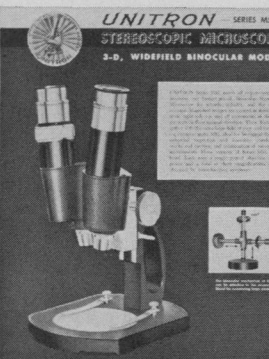
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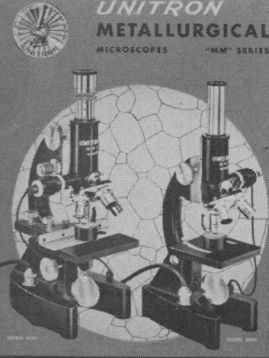
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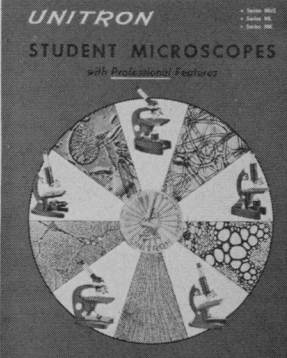
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7.5	43	24.1	10.7	22.4
10.0	50	20.7	9.8	19.6

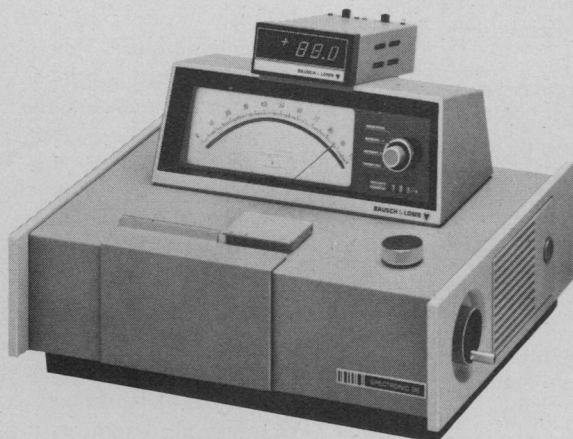
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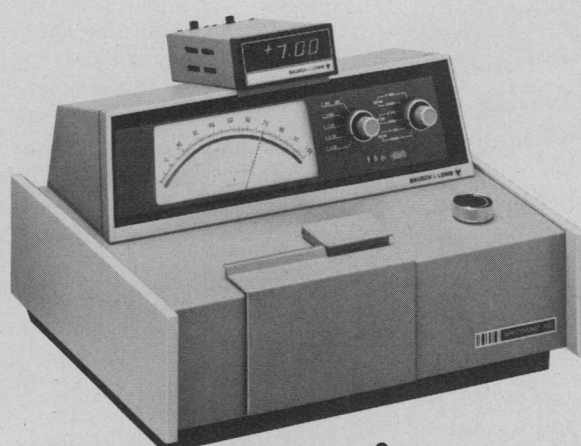
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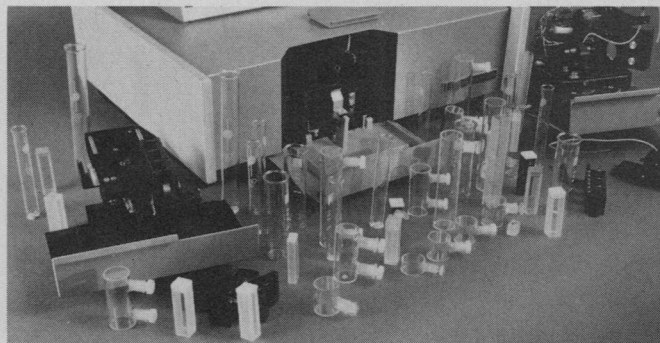
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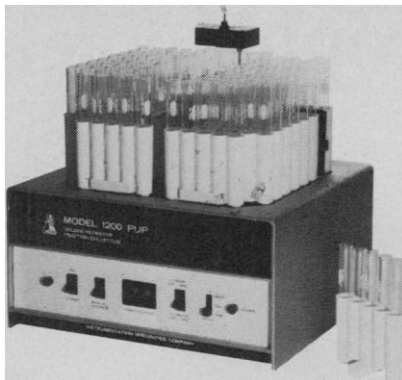
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ductive such medium would be the one that is both the cheapest and is listened to constantly by everyone. But few listeners would deny that certain of their music-listening man-hours are better spent than others and that possibly some—I'm thinking of a few Saturday afternoons in supermarkets equipped with the latest in Muzak—are better not spent at all.

Mathews *et al.* speculate about computers and the future of music, but as is usually the case with such predictions about art, nearly everything they suggest is not new at all. There is, for example, much music for traditional instruments that falls between the extremes of complete prespecification and free improvisation. Jazz, which is cited by the authors in a different connection, is only the best known of many such musics. Much of the proposed flexibility to be developed in Groove-like systems seems calculated not to innovate but rather to program computers for precisely those aspects of music for traditional instruments that computers have heretofore not been able to simulate. As early as 1597, Thomas Morley (1) argued for the instruction of amateurs in singing so that they might avoid embarrassment in ordinary social situations. Apparently "audience participation" is not new either.

Few thoughtful composers these days are looking for "new sounds." Those who are will find Risset's catalog (2) interesting but not a solution to the problem of specifying timbre. Mathews *et al.* do not cite my earlier attempt (3) to solve this "psychoacoustic problem."

Nested definitional structures, sophisticated editing programs, and a mix of real-time digital and analog input and output devices are all important techniques—introduced in some cases by Mathews and his co-workers—that *may* lead to new kinds of musical organization. The major difficulty is to involve composers in the design phases of such research and to devise ways of learning from them what is needed. The hope for interesting musical developments is more than adequate justification of work with computers. It is not necessary to cite presumed shortcomings of the other media for which music is composed.

A. WAYNE SLAWSON

Department of Music,
University of Pittsburgh,
Pittsburgh, Pennsylvania 15260

References

1. T. Morley, *A Plaine and Easy Introduction to Practical Music*, R. A. Harmon, Ed. (Norton, New York, 1953).
2. J. C. Risset, *An Introductory Catalog of Computer-Synthesized Sounds* (MIT Press, Cambridge, Mass., in press).
3. A. W. Slawson, *J. Music Theory* 13, 94 (1969).

We agree with Allen's opinion of the importance of the performer's contribution in some music. The Groove system was developed specifically to make possible performance on the computer in exactly the same way that traditional instruments are played. The performer can play on the Groove keyboard, can hear the music he is playing as he is playing it, and can interpret the score in any way he wishes. We believe Groove completely duplicates the functions of traditional instruments. Of course, it can do many other things that traditional instruments cannot.

We must also point out that some composers disagree with Allen. They wish to make music without benefit of performers—to have complete personal control of the final sound. These composers tend to prefer Music V-type programs to Groove.

With the exception of his first statement, we do not essentially disagree with Slawson's thoughtful comments. We recognize the fallibility of speculations about the future. Their function is not to predict what will happen, but rather to direct present work along fruitful lines. We also agree that our picture of the future is an extrapolation of the past.

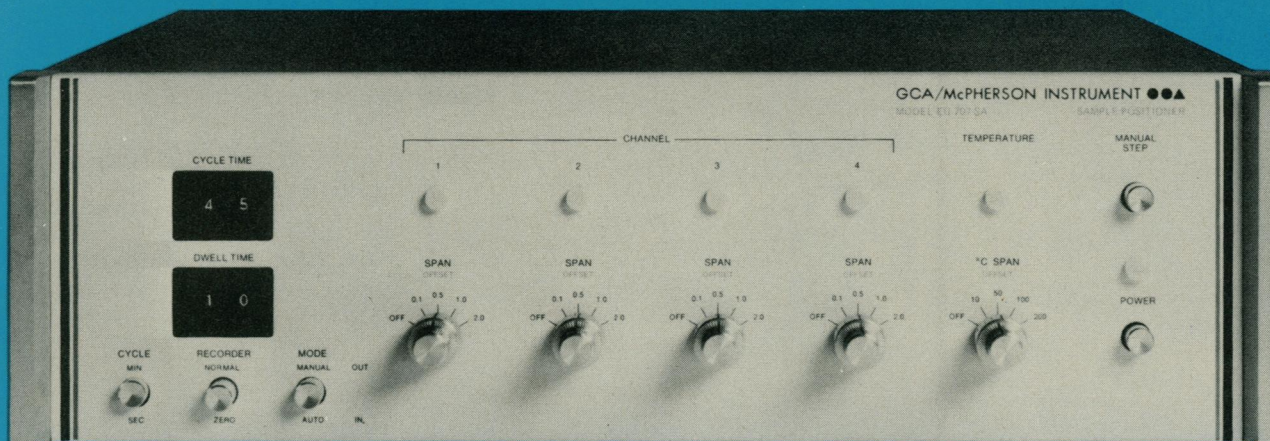
Although we can respect Slawson's desire for oblivion in the supermarket, we believe oblivion of popular taste in music is very dangerous indeed. Popularity is a source of financial support and, we believe, a source of valid criticism and new ideas. Some of us would even accept a commission from Muzak.

Recently developed technology has a great deal to offer to music. Whether the most important contributions will be musical programming languages, or new timbres, or new instruments, we don't know. We hope contributions in all these areas will be significant. Our intuition tells us the new technology will neither modify nor destroy existing music. Rather, it may create a uniquely different sonic experience which will compete with existing music for the time and interest of the public.

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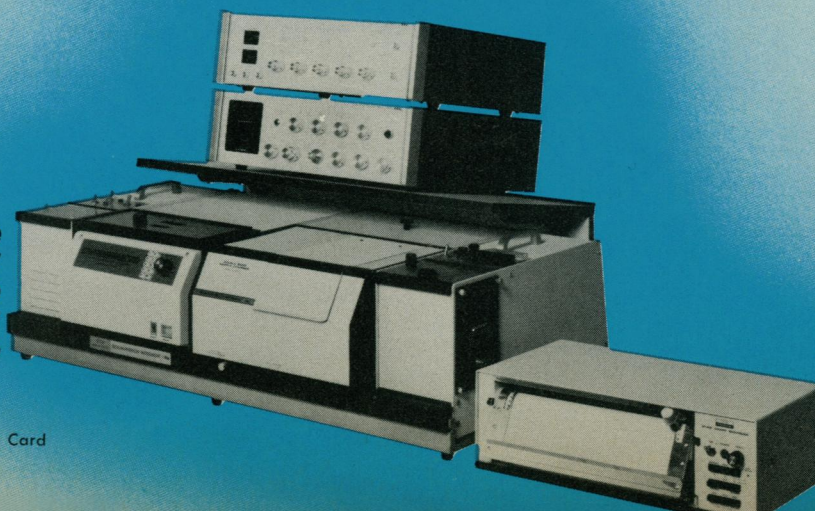
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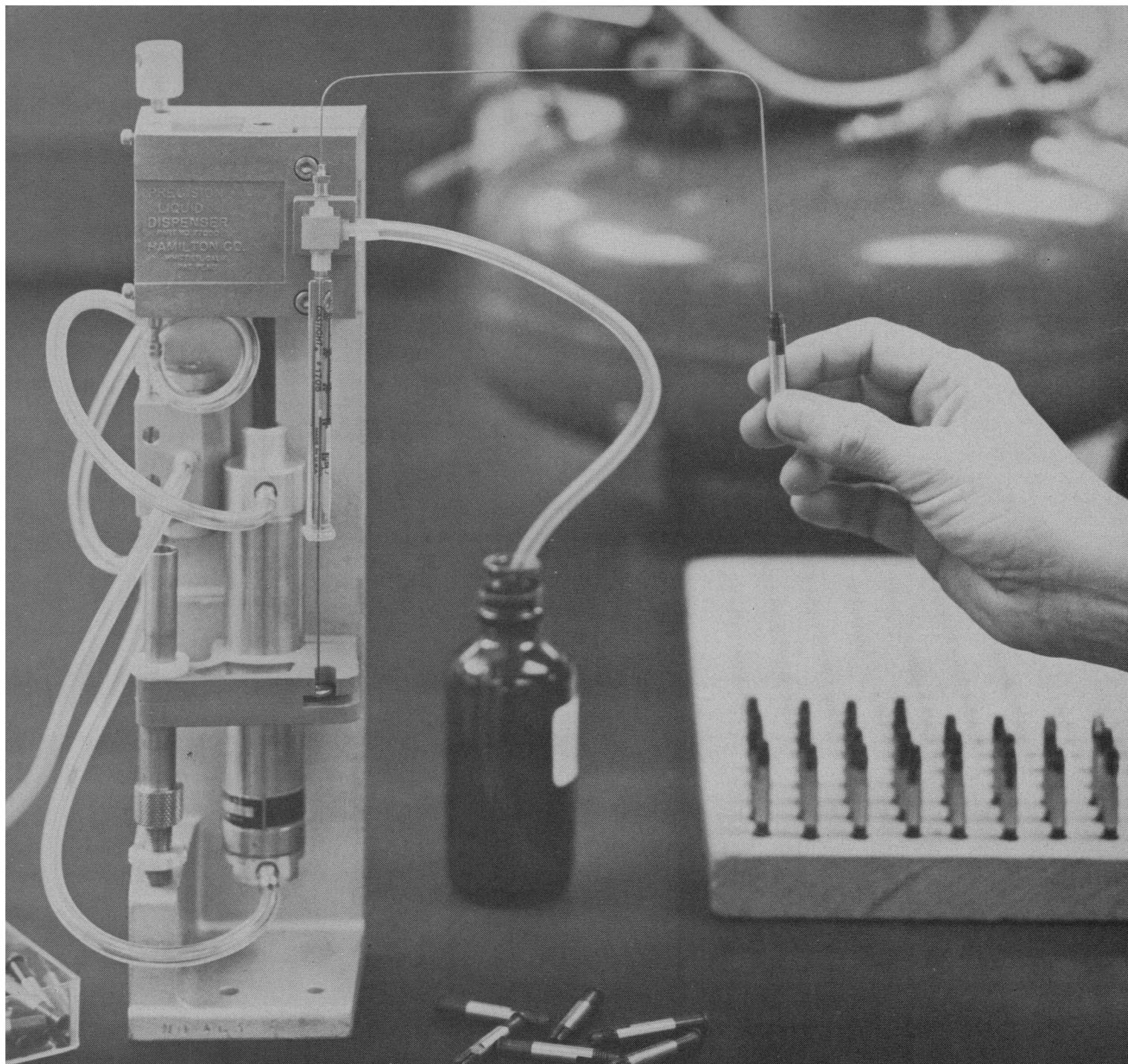
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The Deteriorating Energy Position

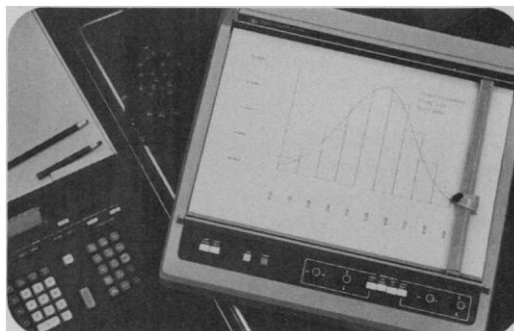
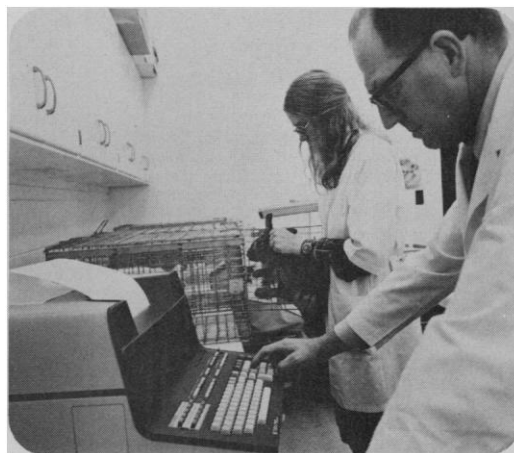
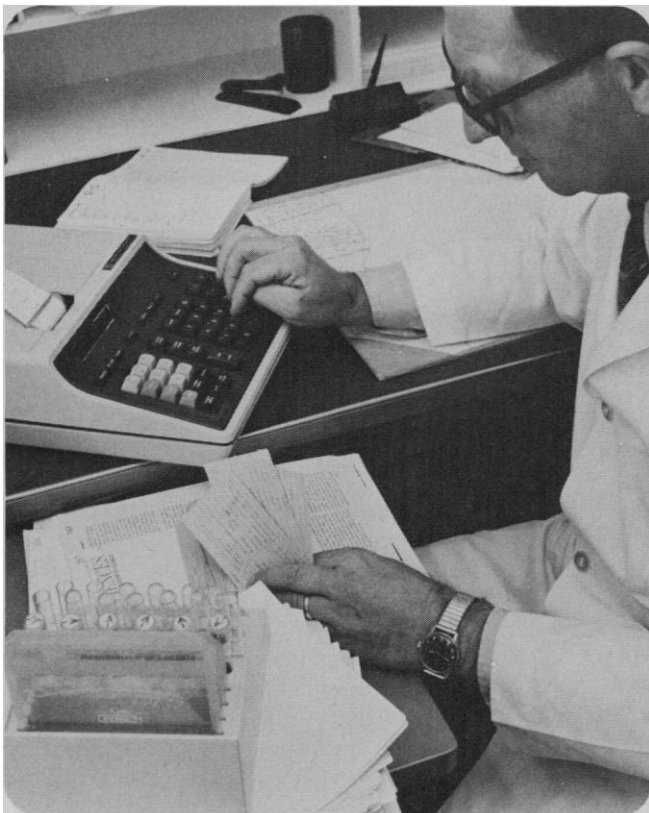
The energy position of the United States continues to deteriorate, and Congress and the Administration provide few indications that they are going to do anything substantive about it quickly. Efforts at conservation have diminished. Hydrocarbons are being consumed at the same rate as they were a year ago. But because of declining domestic reserves and production, we are more dependent on foreign sources than ever and are obliged to pay enormous sums for the imports. We are bringing in 40 percent of our needs, and the current volume of imports is 16 percent above that of a year ago. At the moment world supplies of petroleum are more than adequate and some prices have softened. We have increased our inventories by the equivalent of 3 days' consumption. However, more than before we are vulnerable to the actions of others in the form of new embargoes, price squeezes, or economic chaos elsewhere.

Congress is nearing final passage of legislation that will create an Energy Research and Development Agency (ERDA), and also a Nuclear Safety and Licensing Commission. Creation of the Nuclear Safety and Licensing Commission represents a desirable separation of those functions from others of the Atomic Energy Commission (AEC). However, ERDA is largely to be a mixture made up of most of the AEC, the Office of Coal Research, a small piece of the National Science Foundation, and major functions of the Bureau of Mines thrown in. As for the funding of ERDA, the largest budget component is for nuclear weapons production and development. The next largest component is for the civilian nuclear program—including the breeder reactor. Coal research and development are slated for only about 10 percent of the budget, conservation efforts 3 percent, while the total of geothermal and solar energy funding will come to only 1 percent. In the light of our recognized need to move toward energy independence, two clichés are applicable: (i) the mountain labored and brought forth a mouse; and (ii) the more things change, the more they remain the same.

In the Senate version of legislation creating ERDA, the intent of Congress is stated to be that "no energy technology be given an unwarranted priority." In practice, priorities are established by budgets. In effect, Congress is saying that nuclear energy has an overwhelmingly high priority. By budgeting comparatively little money for conservation, Congress gives the impression that such efforts are not important. By providing comparatively small sums for liquefaction of coal, Congress is saying that increased production of hydrocarbons is not urgent. Failure of the Congress to put more emphasis on development of processes for obtaining hydrocarbons from coal is puzzling. A nation that could spend tens of billions of dollars on going to the moon is unable to spend a few billion dollars on demonstration plants for meeting urgent needs.

During the past year, prospects for finding additional quantities of domestic oil have receded. Wildcat drilling has been largely unsuccessful. As noted in the 12 July issue of *Science*, major companies have recently issued low estimates of producible undiscovered petroleum in the conterminous 48 states. These figures are in disagreement with those of the U.S. Geological Survey, which has estimated that large amounts remain undiscovered. However, the companies retort, "If you know where oil is, show us. We will be pleased to drill." Ultimately, additional Alaskan oil will flow, and perhaps some more will come from the outer continental shelves. However, there is no chance that we will come close to meeting domestic hydrocarbon needs from crude oil production. As the new sources come in, older sources will be closer to exhaustion.

Thus, despite a sharp lesson in the folly of excessive dependence on foreign sources of oil, we are now drifting into still deeper dependence with no real relief in sight. Apparently, we will have to endure a more jarring experience with crippling shortages before vigorous action can be taken.—PHILIP H. ABELSON



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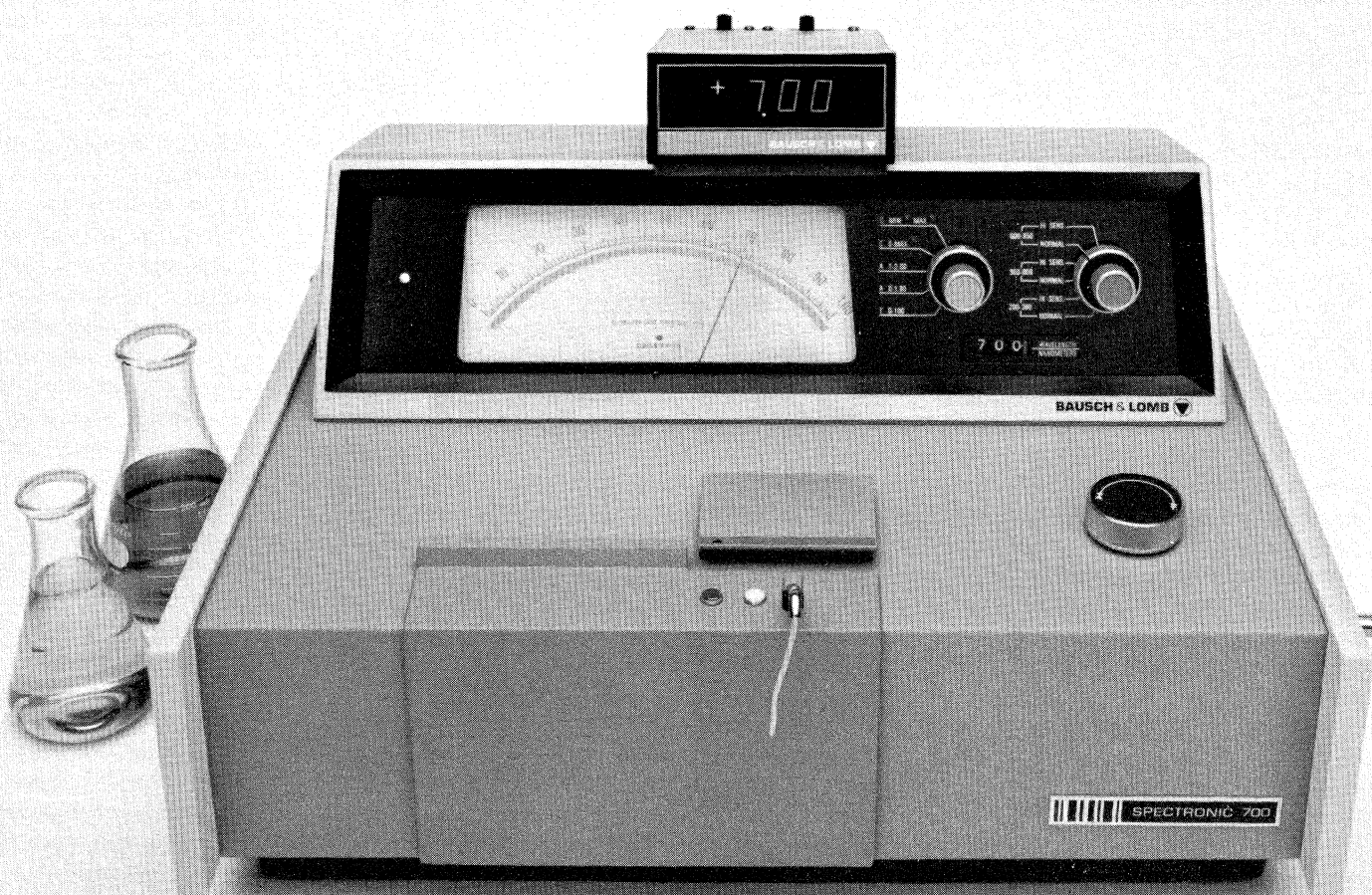
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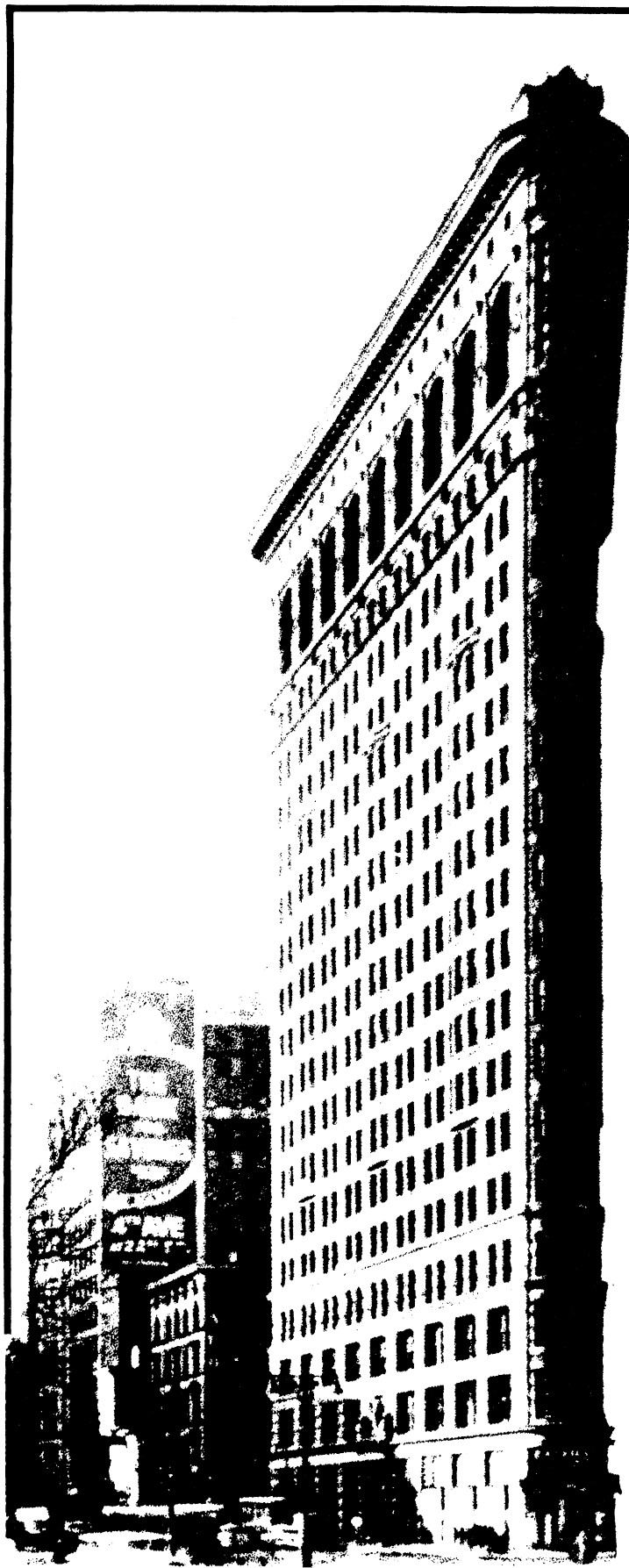
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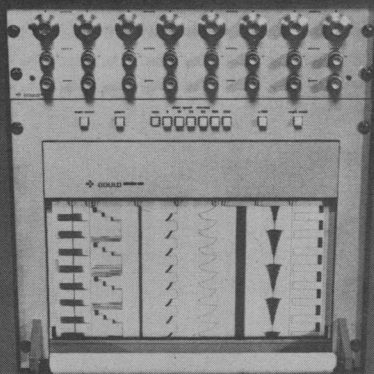
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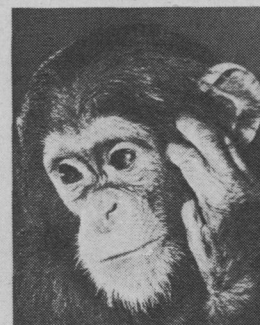


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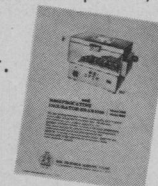
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The Minitek system consists of a plastic plate with multiple wells, into which substrate-impregnated disks are placed by a special dispenser. The disks are selected by the user for the substrates needed to identify microorganisms of interest. Other materials include the pipettor and disposable tips to add inocula to the plate, inoculum broth, and color standards. The system has a shelf life of 1 to 2 years. It is easily adaptable to specific laboratory programs because almost any microorganism that can be classified to species by biochemical reactions may be identified. BioQuest Division, Becton, Dickinson and Company. Circle No. 884 on Readers' Service Card.

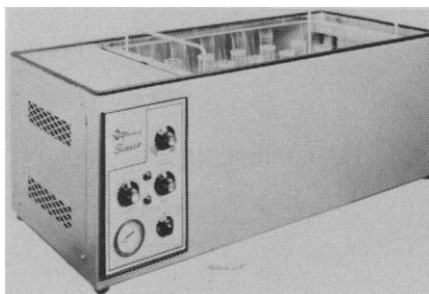
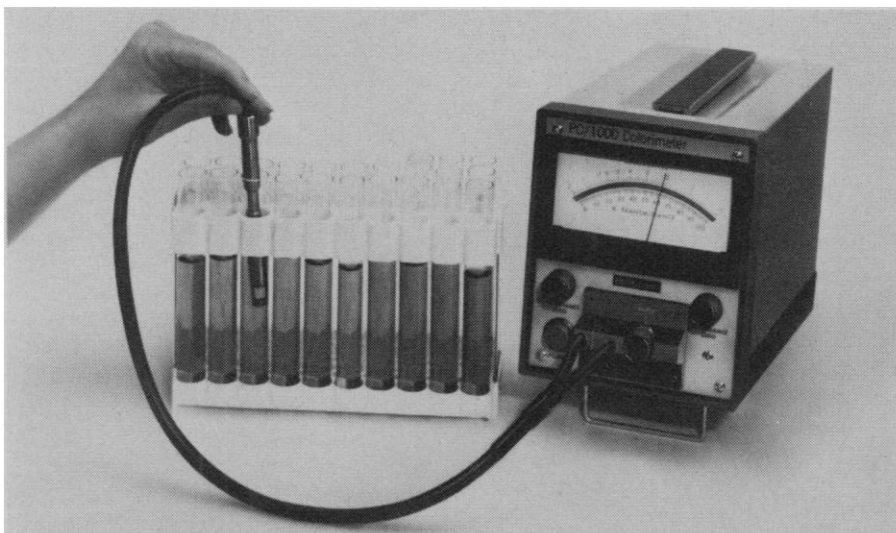


Fig. 1 (top). The Hydor Therme Corporation model 645000 performs the dual function of shaker bath and incubator and provides temperature control for 35° to 100°C . Fig. 2 (bottom). The PC/1000 probe colorimeter from Brinkmann Instruments analyzes water and wastes directly or in any convenient container.



low profile Refrigerated Bath

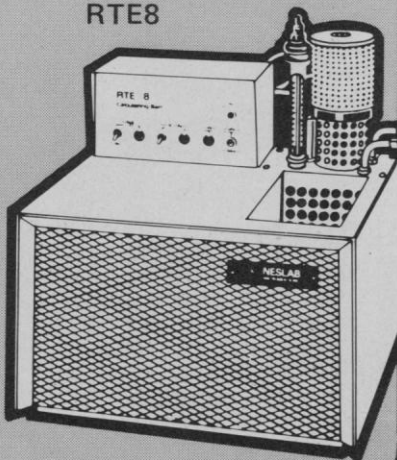
Work area of the new Model RTE8 is only eleven inches above bench surface . . . less than half the height of many refrigerated baths.

Clear work space, 4 $\frac{3}{4}$ " x 8 $\frac{3}{4}$ " x 9" deep. Bath volume, 8 liters. External circulation. Stainless steel construction. Range, -30 to +100°C. 1/4 H.P. compressor.

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Capillary Rheometer

The Sieglaff-McKelvey rheometer measures polymer melt flow at both constant shear rate and constant shear stress. The self-contained, benchtop device can develop a complete flow curve of non-Newtonian melts over more than four decades of shear rate on samples as small as 2 grams. Shear rate and stress are plotted on a dual-channel recorder. The device consists of a load frame, which houses the hydraulic-pneumatic driving system, the barrel and capillary, the furnace and transducers; and a control cabinet, which houses operating controls, furnace controller, and recorder. Imass, Incorporated. Circle No. 881 on Readers' Service Card.

Literature

Fingertip Math describes how to use an electronic calculator. It is priced at \$2.95. Texas Instruments. Circle No. 885 on Readers' Service Card.

700 Series Spectrophotometric Systems is a color-illustrated catalog of all components of these analytic devices. GCA/McPherson Instrument. Circle No. 886 on Readers' Service Card.

Biochemical Catalog offers information on enzymes, ultrapure reagents, tissue culture media, peptides, and new products. Schwarz/Mann Division, Becton, Dickinson and Company. Circle No. 887 on Readers' Service Card.

The Family of PDP-11's introduces this line of computer systems including hardware, software, training, and peripherals. Digital Equipment. Circle No. 888 on Readers' Service Card.

Catalogue 1974 is a compendium of biochemical materials for all methods of separation, characterization, and analysis. Pharmacia Fine Chemicals, Incorporated. Circle No. 889 on Readers' Service Card.

Models 920/940 Gas Chromatographs are described and illustrated in a 12-page brochure. Varian Associates, Instrument Division. Circle No. 890 on Readers' Service Card.

Standards and Practices for Instrumentation (ed. 4) is the subject of a free brochure. Instrument Society of America. Circle No. 891 on Readers' Service Card.

WWVB Waveform Synchronizer Handbook describes theory and applications of time synchronization by radio. Datametrics, Incorporated. Circle No. 892 on Readers' Service Card.

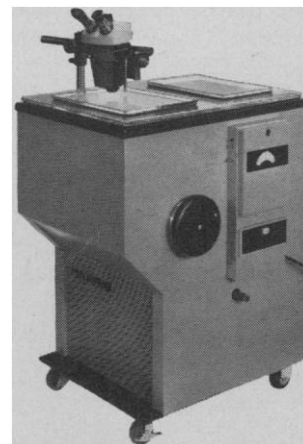
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BOOKS RECEIVED

(Continued from page 345)

Divided Legacy. A History of the Schism in Medical Thought. Vol. 3, Science and Ethics in American Medicine 1800-1914. Harris L. Coulter. McGrath, Washington, D.C., 1973. xviii, 546 pp. \$17.50.

Elements of Physical Metallurgy. Albert G. Guy and John J. Hren. Addison-Wesley, Reading, Mass., ed. 3, 1974. xiv, 618 pp., illus. \$16.95. Addison-Wesley Series in Metallurgy and Materials.

Elliptic Functions. Serge Lang. Addison-Wesley, Reading, Mass., 1974. xiv, 326 pp., illus. \$17.50. Addison-Wesley Advanced Book Program.

Ellsworth Huntington. His Life and Thought. Geoffrey J. Martin. Archon (Shoe String Press), Hamden, Conn., 1973. xx, 316 pp., illus. \$20.

Environmental Health and Safety. Herman Koren. Pergamon, New York, 1974. xxii, 316 pp., illus. Cloth, \$16; paper, \$8.75. Pergamon Bio-medical Sciences Series.

Essays in Biochemistry. Vol. 9. P. N. Campbell and F. Dickens, Eds. Published for the Biochemical Society by Academic Press, New York, 1973. x, 180 pp., illus. Paper, \$6.75.

Experimental Physics for Students. R. M. Whittle and J. Yarwood. Chapman and Hall, London, 1973 (U.S. distributor, Halsted [Wiley], New York). xii, 370 pp., illus. \$16.25.

General Meteorology. Horace Robert Byers. McGraw-Hill, New York, ed. 4, 1974. xvi, 462 pp., illus. \$14.95.

A General Theory of Elastic Stability. J. M. T. Thompson and G. W. Hunt. Wiley-Interscience, New York, 1974. xiv, 322 pp., illus. \$22.

Genetics. Ursula Goodenough and Robert Paul Levine. Holt, Rinehart and Winston, New York, 1974. xiv, 882 pp., illus. \$14.50.

Genetics of Host-Parasite Interaction. Peter R. Day. Freeman, San Francisco, 1974. xiv, 238 pp., illus. \$8.50. A Series of Books in the Biology of Plant Pathogens.

Insights. A Selection of Creative Literature About Childhood. Child Study Association of America, Eds. Aronson, New York, 1974. 462 pp. \$12.50.

Interrelationships of Fishes. Papers from a symposium, London, England, June 1972. P. H. Greenwood, R. S. Miles, and Colin Patterson, Eds. Published for the Linnean Society of London by Academic Press, New York, 1974. xvi, 536 pp., illus. + plates. \$31. Supplement No. 1 to the *Zoological Journal of the Linnean Society*, vol. 53, 1973.

Introduction to Carbohydrate Chemistry. R. D. Guthrie. Clarendon (Oxford University Press), New York, ed. 4, 1974. x, 120 pp., illus. Paper, \$5.50.

Introduction to the Primates. Living and Fossil. S. I. Rosen. Prentice-Hall, Englewood Cliffs, N.J., 1974. x, 246 pp., illus. \$8.50.

An Introduction to Quantitative Ecology. Robert W. Poole. McGraw-Hill, New

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LIFESPAN—AND FACTORS AFFECTING IT: Aging Theories in Gerontology by Daniel Hershey, *Univ. of Cincinnati, Cincinnati, Ohio*. The first part of the book discusses the effects of radiation, body weight, diet and hormones on lifespan, bodily strength and function. The second part examines body temperature, basal metabolism and aging, correlating temperature effects on oxygen consumption, basal metabolism and life expectancy. '74, 176 pp., 57 il., 29 tables, \$9.75, paper

BLOOD COMPATIBLE SYNTHETIC POLYMERS: An Introduction by Stephen D. Bruck, *National Institutes of Health, Bethesda, Maryland*. This introductory book contributes to the development of a satisfactory dialogue among physical and biological scientists, physicians and engineers working in the area of blood compatible materials. It represents an effort to bring together the diversified theories that are involved in the understanding of the interactions between synthetic polymers and blood. '73, 142 pp., 69 il., 14 tables, \$9.75

ENVIRONMENT AND POLLUTIONS: Sources, Health Effects, Monitoring and Control by Francis K. V. Leh, *Univ. of California, Riverside* and Richard K. C. Lak, *The Shell Company of the British Crown Colony of Hong Kong*. Designed to provide college students and research workers with a guide to available information on environmental study, this book is primarily concerned with the various aspects of the global environmental problems. '74, 308 pp., 25 il., 71 tables, \$14.75

DRUG RESISTANCE IN ANTI-MICROBIAL THERAPY by E. J. L. Lowbury, and G. A. J. Ayliffe, *Birmingham Accident Hospital, Birmingham, England*. In this book two bacteriologists consider the biological mechanisms of resistance and put forward general recommendations on antibiotic policies aimed at preventing the emergence of resistant pathogens while offering the clinician effective chemotherapy. '74, about 167 pp., 4 il., 4 tables

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York, 1974. xii, 532 pp., illus. \$13.95. McGraw-Hill Series in Population Biology.

Ion Implantation in Semiconductors and Other Materials. Proceedings of a conference, Yorktown Heights, N.Y., Dec. 1972. Billy L. Crowder, Ed. Plenum, New York, 1973. xii, 658 pp., illus. \$35. IBM Research Symposia Series.

Mineable Coal Reserves in Missouri. Charles E. Robertson. Missouri Geological Survey and Water Resources, Rolla, 1973. viii, 72 pp., illus. Paper, \$.75. Report of Investigations, No. 54.

Misuse of Psychiatry in the Criminal Courts. Competency to Stand Trial. Group for the Advancement of Psychiatry. Mental Health Materials Center, New York, 1974. ii + pp. 853-922. Paper, \$3. Group for the Advancement of Psychiatry, vol. 8, report No. 89.

Molecular Cytogenetics. Proceedings of a conference, Gatlinburg, Tenn., Apr. 1973. Barbara Ann Hamkalo and John Papaconstantinou, Eds. Plenum, New York, 1973. xvi, 360 pp., illus. \$20.

Monolayer and Submonolayer Helium Films. Proceedings of a symposium, Hoboken, N.J., June 1973. John G. Daunt and E. Lerner, Eds. Plenum, New York, 1973. viii, 160 pp., illus. \$15.

Mycology Guidebook. Russell B. Stevens, Ed. University of Washington Press, Seattle, 1974. xxiv, 704 pp., illus. \$15.

Myocardial Biology. Proceedings of a conference, Winnipeg, Canada, June 1972. Naranjan S. Dhalla, Ed. University Park Press, Baltimore, 1974. xii, 614 pp., illus. \$39.50. Recent Advances in Studies on Cardiac Structure and Metabolism, vol. 4.

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The New Space Encyclopedia. A Guide to Astronomy and Space Exploration. Harold Spencer Jones, Ed. Sunrise (Dutton), New York, ed. 2, 1972. 326 pp., illus. + plates. \$14.95.

North American Symposium on Drugs and Drug Abuse. William White, Jr., and Ronald F. Albano, Eds. North American Publishing Co., Philadelphia, 1974. 376 pp., illus. \$27.50. North American Reference Encyclopedia Series, vol. 3.

The North, the South and the Powers 1861-1865. D. P. Crook. Wiley, New York, 1974. x, 406 pp., illus. \$11.95.

Nuclear Magnetic Resonance Spectroscopy of Nuclei Other Than Protons. T. Axenrod and G. A. Webb, Ed. Wiley-Interscience, New York, 1974. xvi, 408 pp., illus. \$18.95.

Opportunistic Pathogens. Proceedings of a symposium, Philadelphia, Nov. 1972. James E. Prier and Herman Friedman, Eds. University Park Press, Baltimore, 1974. xvi, 304 pp., illus. \$14.50.

Paleobiology of the Invertebrates. Data Retrieval from the Fossil Record. Paul Tasch. Wiley, New York, 1973. xxvi, 946 pp., illus. \$19.95.

Papers in Biochemical Genetics. Geoffrey L. Zubay and Julius Marmur, Eds. Holt, Rinehart and Winston. New York,

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