SCIENCE

22 February 1974

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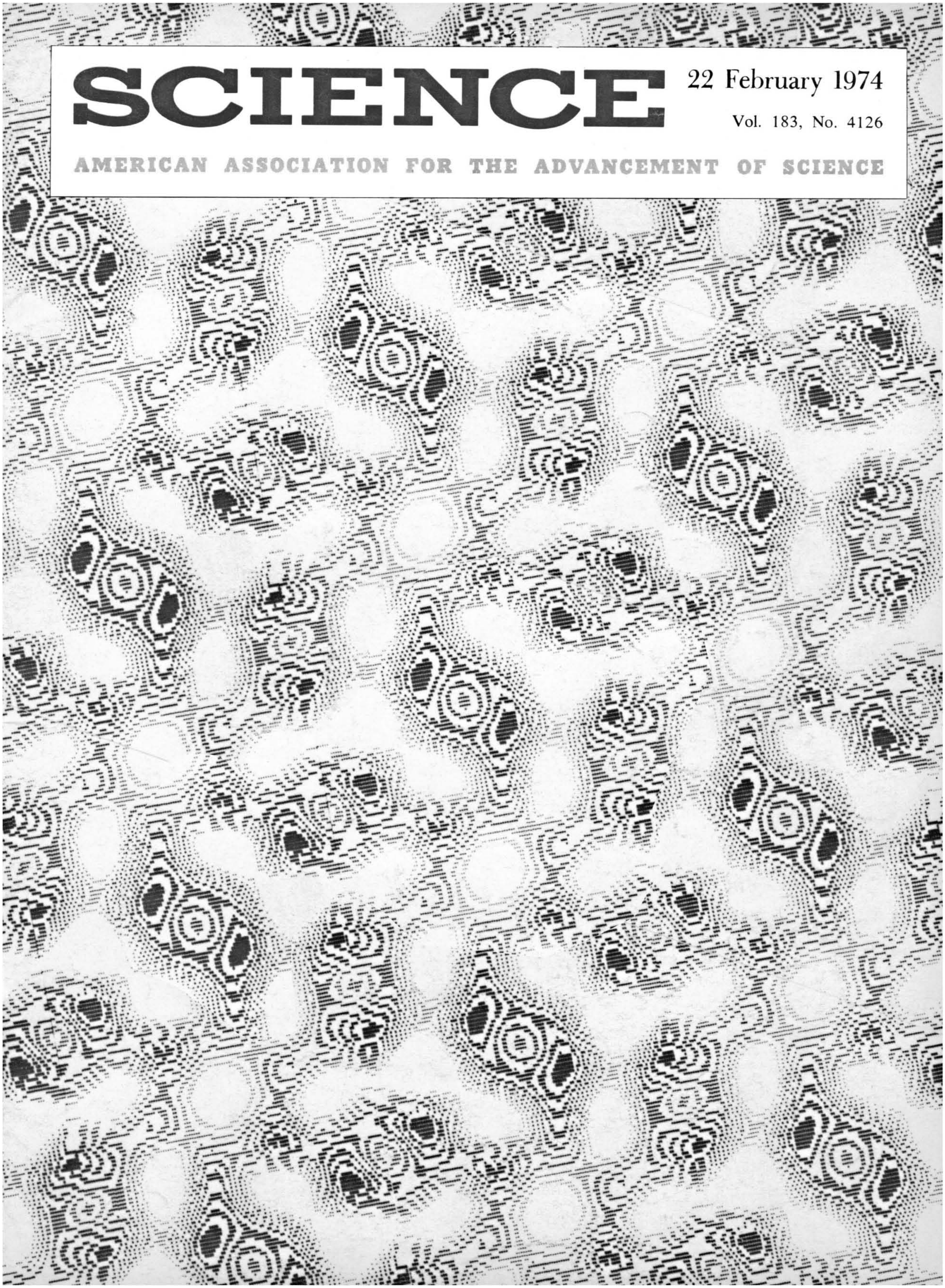
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE



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Volume 183, No. 4126

SCIENCE

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COVER

Isodensity computer display of the capsid structure of bacteriophage ϕCbK (1 centimeter = about 20.5 angstroms). See page 744. [J. A. Lake and K. R. Leonard, New York University School of Medicine]

Science and Man in the Americas Audiotapes

For two weeks last summer (June 20-July 4, 1973) a significant international scientific meeting took place in Mexico City. "Science and Man in the Americas" was attended by more than 5000 scientists, engineers, government officials, representatives of business and industry, science journalists, students, educators and laymen from scores of countries. They deliberated a wide range of topics central to the future development and well-being of the Western hemisphere. The meeting, co-sponsored by AAAS and the Consejo Nacional de Ciencia y Tecnologia of Mexico, was created in the belief that science is of overriding importance in the world today and that, being universal, it transcends national boundaries. Here now, captured on audiotape, are many of the most compelling sessions, available for listening, study, and reflection in your home, library, laboratory, automobile. Another service of the AAAS.

NON-NUCLEAR ENERGY FOR DEVELOPMENT: Arranged by Edmundo de Alba and J. Frederick Weinhold.

- Session I ☐ **The World's Energy Situation:** David Freeman, Jean C. Leclercq
- Session II ☐ **Energy in the Americas:** J. Frederick Weinhold, Fernando Hiriart, Gordon McNabb, Guillermo O. Zubaran, et al.
- Session III ☐ **Energy for Rural Communities:** Francisco Monteverde, Thomas Venables, J. Neal Thompson.
- Session IV ☐ **Wind and Solar Energy:** Edmundo de Alba, Julio Hirschmann, Peter Glaser, Robert Axtmann, et al.
- Session V ☐ **Geothermal Power:** Federico Mooser, Robert Decker, Richard Stoiber.
- Session VI ☐ **Relationship Between Environmental Protection and Energy:** Juan Eibenschutz, Miguel Angel Garcia Lara, et al.

EARTHQUAKE AND EARTHQUAKE ENGINEERING: Arranged by Don Tocher and Enrique del Valle C.

- Session I ☐ **The 1972 Managua Earthquake:** Emilio Rosenblueth, R. B. Matthiesen, John A. Blume, Enrique del Valle C., et al.
- Session II ☐ **Seismicity:** Alan Davenport, Luis Esteva, Donald E. Hudson, William Milne, and Jose Grases.
- Session III ☐ **Earthquake Engineering:** Julio Kuroiwa, Joseph Penzien, Jorge Prince, Patrico Ruiz, Roberto Meli, et al.
- Session IV ☐ **Seismic Intensity and Smooth Spectra, Zoning and Structural Design:** Enrique del Valle C., R. B. Matthiesen, Arturo Arias, et al.

CIVILIZATION'S FUTURE: WAS MALTHUS CORRECT?

- Session I ☐ Lecture by Norman E. Borlaug

THE SEA AND ITS RESOURCES: Arranged by Agustín Ayala-Castañares, and Arthur E. Maxwell

- Session I ☐ **Introduction, Coastal Zone Resources, Ocean Effects and their Management:** Harris B. Stewart, Jr., Bostwick H. Ketchum, and Julian Adem.
- Session II ☐ **Resources of the Sea:** Robert R. Lankford, Martha Vannucci, and Warren S. Wooster.
- Session III ☐ **Coastal Resources:** Bostwick H. Ketchum, Hermann Ugarte, Richard G. Bader, Robert Warren, et al.
- Session IV ☐ **Ocean Effects on Weather and Climate:** Julian Adem, Donald Gilman, R. Simpson, J. Kuettner, Jay S. Winston, and Kirk Bryan.
- Session V ☐ **Non-Renewable Resources:** Robert R. Lankford, Fred B. Phleger, Alberto G. Lonardi, John P. Albers, Melvin Peterson, et al.
- Session VI ☐ **Living Resources:** Martha Vannucci, Mario Ruivo, Paul E. LaViolette, James Joseph, A. Novak, et al.
- Session VII ☐ **Ocean Affairs:** Warren S. Wooster, John A. Knauss, Jorge A. Vargas, Harris B. Stewart, Geoffrey Kesteven, et al.

THE IMPORTANCE OF EDUCATION IN DEVELOPMENT: Arranged by Albert V. Baez and Guillermo Massieu.

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- Session II ☐ **Laboratory Materials and Teaching Aids:** Nahum Joel, Ernst Hamburger, Rafael Ferreyra, Thomas Taylor, David Lockard, et al.
- Session III ☐ **Motivation and Learning Processes:** David Ehrenfreund, Mary Budd Rowe, Felix Morales, Claudio Dib, et al.
- Session IV ☐ **Science Teaching at High School, Junior College and University Levels:** Manuel Servin Massieu, Michael Pentz, Gabriel Camara Cervera, et al.
- Session V ☐ **Toward Qualitative Educational Planning:** Don Adams, Manual Bravo Jimenez, Hernan Vera, William Platt, Douglas Wright, Bernard Kaplan, et al.
- Session VI ☐ **The Improvement of Teachers Education:** Ernst Hamburger, Nahum Joel, Carlos Gomez, Olac Fuentes, Luis S. Capurro, et al.

DESERTS AND ARIDS LANDS: Arranged by Harold E. Dregne and Fernando Medellín Leal.

- Session I ☐ **Planning Problems and Dilemmas in the Development of Arid Zones:** Fernando Medellín Leal, Enrique Beltran, and Thomas Maddock, Jr.
- Session II ☐ **Solar Energy in Arid Lands:** Hector Ruiz Elias, Gustavo del Castillo, Adam B. Meinel, Marjorie P. Meinel, Edward F. Haase, et al.
- Session III ☐ **Water Use Efficiency in Arid Regions:** Terah L. Smiley, Jose Lizarrage Reyes, Ronald F. Probstein, Hasan Qashu, Lloyd E. Myers, et al.
- Session IV ☐ **Educational and Cultural Needs of Desert Zone Inhabitants:** Richard B. Woodbury, Patricio Dreckman, Everett D. Edington, Theodore Downing, Marion F. Baumgardner, Carl N. Hodges, et al.
- Session V ☐ **Storage and Retrieval of Arid Zone Data:** Dean F. Peterson, Antonio J. Prego, Patricia Paylore, Guadalupe Carrion, et al.

SCIENCE, TECHNOLOGY, AND DEVELOPMENT: A NEW WORLD OUTLOOK:

Session I ☐ **A lecture by Glenn T. Seaborg.**

THE EARTH SCIENCES IN WORLD DEVELOPMENT: Arranged by Guillermo P. Salas and Earl Ingerson.

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Session II ☐ **Geologic Research, Exploration and Development in Mexico, Central and South America:** Diego A. Cordoba M., Carlos Ruiz Fuller, and Enrique Levy.

Session III ☐ **Application of Earth Sciences in the Development of Civilization:** Charles F. Park, P. T. Flawn, Eduardo J. Guzman, et al.

SCIENCE, DEVELOPMENT AND HUMAN VALUES: Arranged by Harrison Brown and Victor L. Urquidi.

Session I ☐ **Where Have the Rich Nations Gone Wrong? Where Have the Poor Nations Gone Wrong?** Guillermo Massieu, Hollis Chenery, Kenneth E. Boulding, et al.

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Session III ☐ **Research Priorities for Economic Development in Latin America:** Jose Valenzuela, David Ibarra, and Norman Borlaug.

Session IV ☐ **The Value of Science and Technology to Human Welfare:** Luis Manuel Penalver, Gerhard Jacob, George Bugliarello, Joseph B. Platt, et al.

Session VI ☐ **Science, Technology, and Human Values:** Victor Urquidi, Harrison Brown, et al.

VIOLENCE AND BEHAVIOR: Arranged by Santiago Genovés and J. P. Scott.

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HURRICANES: Arranged by Julián Adem, and Louis J. Battan.

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TRANSFER OF TECHNOLOGY AND NATIONAL ECONOMIC DEVELOPMENT: Arranged by Jordan J. Baruch and Miguel S. Wionczek.

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Session III ☐ **Current Vehicles of Technological Trade I:** C. J. Meechan, Robert B. Staubaugh, Ronald Muller, K. D. N. Singh, et al.

Session IV ☐ **Current Vehicles of Technological Trade II:** Mark S. Massel, Luis Soto Krebs, Enrique Aguilar, Luis Figueira Barbosa, et al.

Session V ☐ **Determinants of Technological Policy I:** Francisco R. Sagasti, Manuel Bravo Jimenez, Rodrigo Medellin, Shlomo Argov, Alejandro Nadal, et al.

Session VI ☐ **Determinants of Technological Policy II:** Maximo Halty Carrere, Carlos Bazdresch, Jorge Sabato, Michael Michaelis, et al.

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Contrary to popular opinion, present conditions in the United States are not favorable for academic and specialized publications. Severe cutbacks in funding for research and development have thrown the burden of disseminating of medical and scientific-industrial information upon the small scientific journals. A setback in the financial health of these journals would seriously affect the competitive position of the United States in the world technical market. Already the price of new technical journals is rising at an incredible rate, and the court's decision could mean that many small, specialized medical and industrial journals will be forced to cease publication. This would render the American scientific and industrial community a great disservice at a time when it is hard pressed for funds and expected to find quick solutions to massive problems.

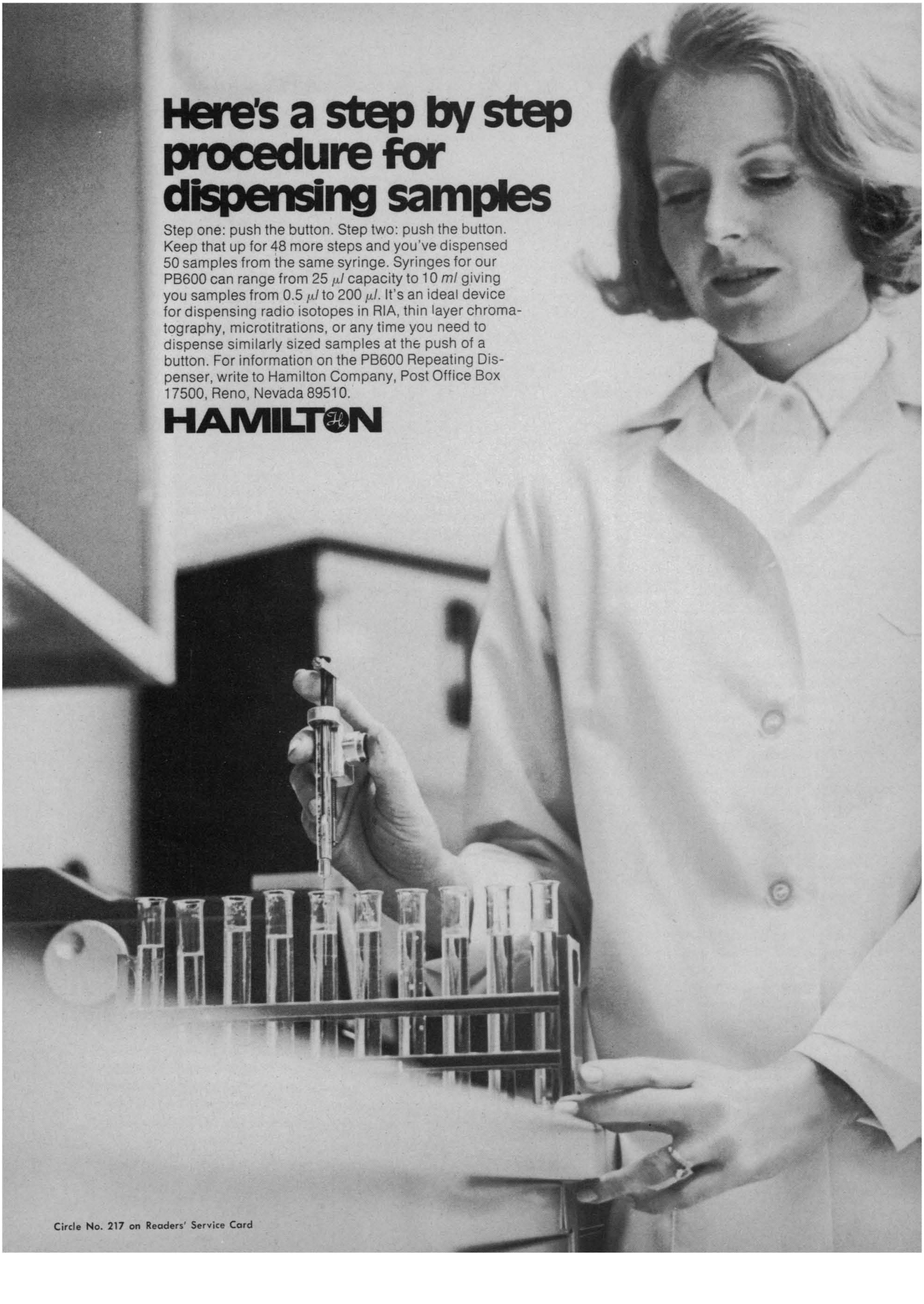
Our reaction to the ruling is to deny the National Institutes of Health and the National Library of Medicine any further purchase of our publication *Health Devices* unless they pay a fee sufficient to cover all secondary franchising. If the publishers of other specialized scientific journals take similar action, the result will be the disappearance of many papers and much data from *Index Medicus* and other specialized computer-based information systems. With the increased difficulty of travel and the subsequent reliance upon publications for the interchange of scientific data and qualified opinion, it is truly sad that the very institutions who should be aiding and increasing the flow of information may be choking it off.

WILLIAM WHITE, JR.
Emergency Care Research Institute,
913 Walnut Street,
Philadelphia, Pennsylvania 19107

Genetic Heterogeneity

Crops with better yield, stability in yield over the years, and resistance to diseases and insect pests are the goal of all crop farmers. The development of new Mexican wheat varieties and improvements in agricultural technology in recent years have helped farmers realize high yields even in less developed countries. However, because an increasing amount of acreage has been planted with new wheat varieties, local genetic resources are being lost, which poses a serious problem for the future success of plant breeding. There is a growing awareness of this problem, as is reported by Judith Miller (News and Comment, 21 Dec. 1973, p. 1231). Miller deals mainly with the problems of collection and maintenance of genetic resources and with the efforts being made in this direction. This step is vital for the future of plant breeding. Analogous to this long-term problem, there is a short-term, but much more serious, problem to which I want to draw attention.

Before the broadly adapted crop varieties came into existence, farmers used to grow several varieties that were locally adapted. If any one of these varieties became susceptible to some disease, it could be either withdrawn forever or corrected by genetic manipulation so that it was resistant to the disease. In the meantime, the acreage could be planted with some other equal-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22 February 1974, Volume 183, Number 4126

SCIENCE

Out of the Energy Crunch by 1976

At the moment, the chief hope for an amelioration of the energy crisis lies in an easing of the oil embargo, but valves that can be opened can be closed. Solemn agreements with the oil producing and exporting countries, ostensibly valid for decades, have been scrapped in weeks. The public and the economy cannot long tolerate the uncertainties of being a Yo-Yo in the hands of others.

Prior to the embargo, we were importing 35 percent of our consumption. If we were to lower that to 20 percent, consumers would pay less for hydrocarbons, foreign exchange problems would ease, and we would no longer need to obtain oil from the Arabs. Such a major step to energy independence could and should be taken by 1976.

The quickest path toward balancing supply and demand is conservation combined with the replacement of use of hydrocarbons by coal. Thus far, the main burden of conservation has been carried by the public, which consumes directly only a minor fraction of the energy. The major potential for quick savings of hydrocarbons lies with industry. It is the largest consumer of energy; it has substantial technical resources; and, with costs soaring, it has incentives to seek economies. Like the public, industry generally has governed its behavior on the assumption of cheap energy. Thus it has much room for improvement.

All of industry has not been asleep. Two good examples of organizations with foresight and ingenuity are DuPont and Dow. Both companies have emphasized conservation of energy in their plant designs and operation. During the past decade, DuPont increased its volume of products 100 percent, while energy used rose only 50 percent. DuPont has advised other large consumers about conservation through a consultant service. Broad experience has shown that significant conservation at an industrial plant will, on the average, result in a 15 percent reduction in the plant's total energy consumption, and about half the saving can be achieved without new investment.*

At Dow Chemical during 1972, the company achieved a 10 percent reduction in energy used while increasing yield. The company had as its goal a like reduction in 1973.†

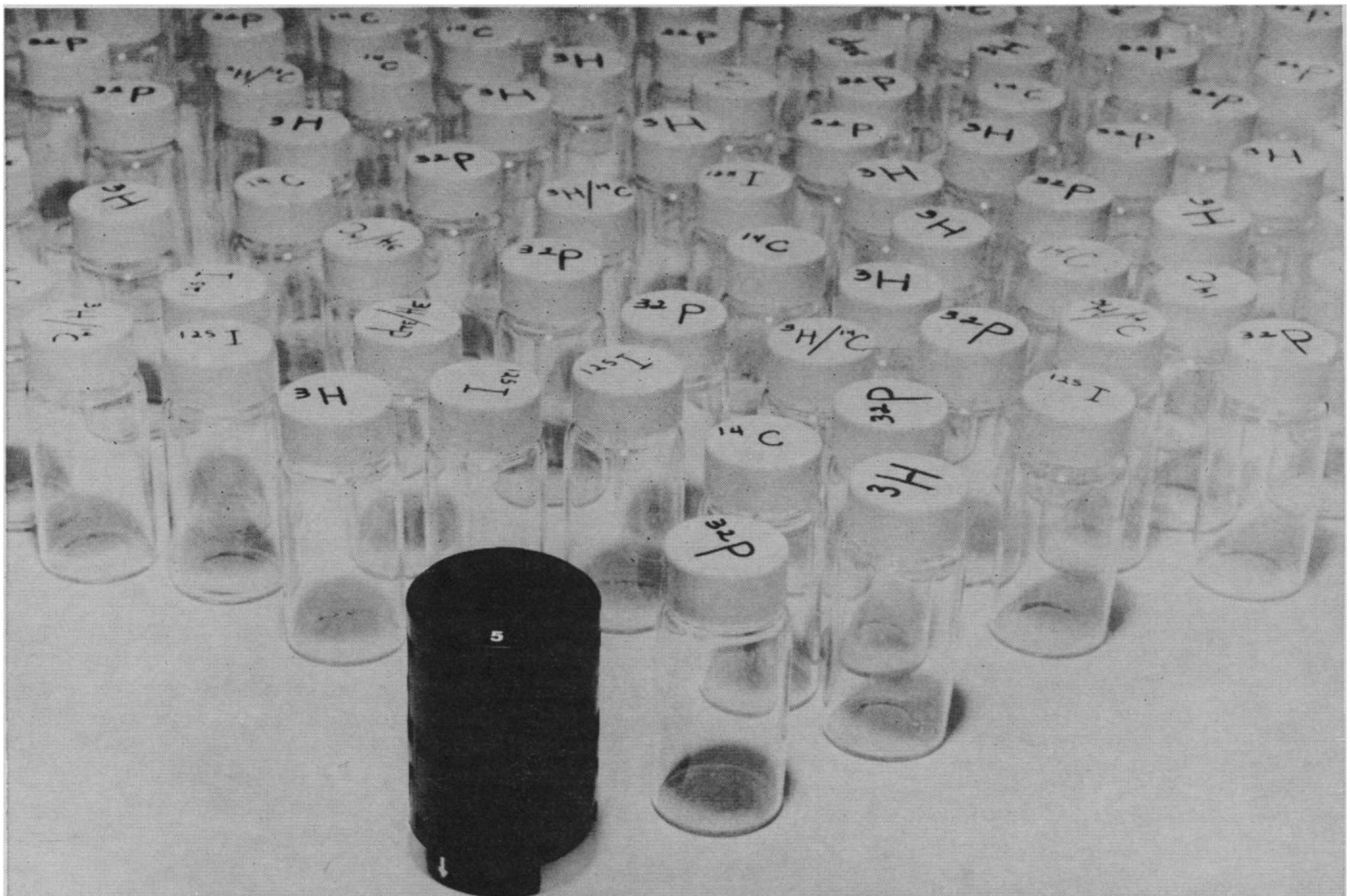
Another way of conserving hydrocarbons is to avoid burning them merely to produce heat. "One of the quickest and most effective ways to reduce short-falls in gas and oil is to substitute coal for them under electric utility and industrial boilers. Approximately 65 percent of the natural gas used goes to the electric and industrial sectors. Some 30 percent of the oil used goes to the same sectors. . . ."‡

Thus far, the Administration has not been even-handed in its efforts to meet the energy crisis. The consumer has been the target of exhortations, shortages, and higher costs. Industry, and especially the utilities, which usually can pass on higher prices, have been largely protected from shortages.

By concentrating more attention on industry and the utilities, by invoking some of the can-do attitudes of World War II, by setting up a priority system to expedite procurement of scarce items, by unleashing coal as a primary energy source, and by making its use mandatory in some applications, an effective government could get us out of the energy crisis within 2 years. It could free us from any need to use oil from undependable sources, and our example and reduced imports would contribute to loosening the worldwide grip of the oil cartel.

—PHILIP H. ABELSON

* D. H. Dawson, *Context* **2**, 17 (1973). † J. C. Robertson, *Chem. Eng.* **81**, 104 (21 January 1974). ‡ *Report of the Cornell Workshops on the Major Issues of a National Energy Research and Development Program* (College of Engineering, Cornell University, Ithaca, N.Y., rev. ed., 1973), p. 24. The report of the Cornell workshops provides an excellent summary of many aspects of the energy problem. It was prepared for the Atomic Energy Commission. Copies can be obtained from the U.S. Atomic Energy Commission, Technical Information Center, P.O. Box 62, Oak Ridge, Tenn. 37830.



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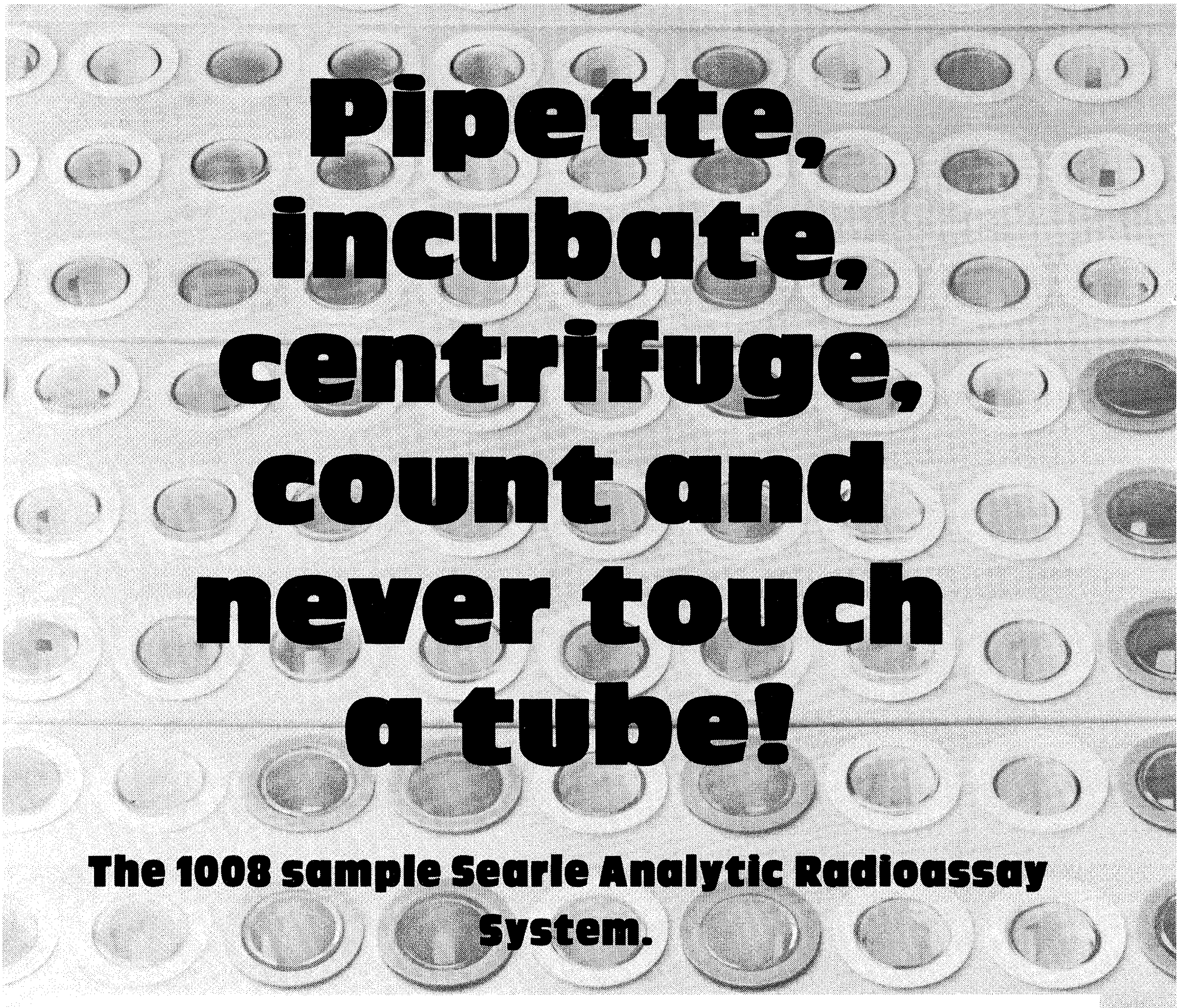
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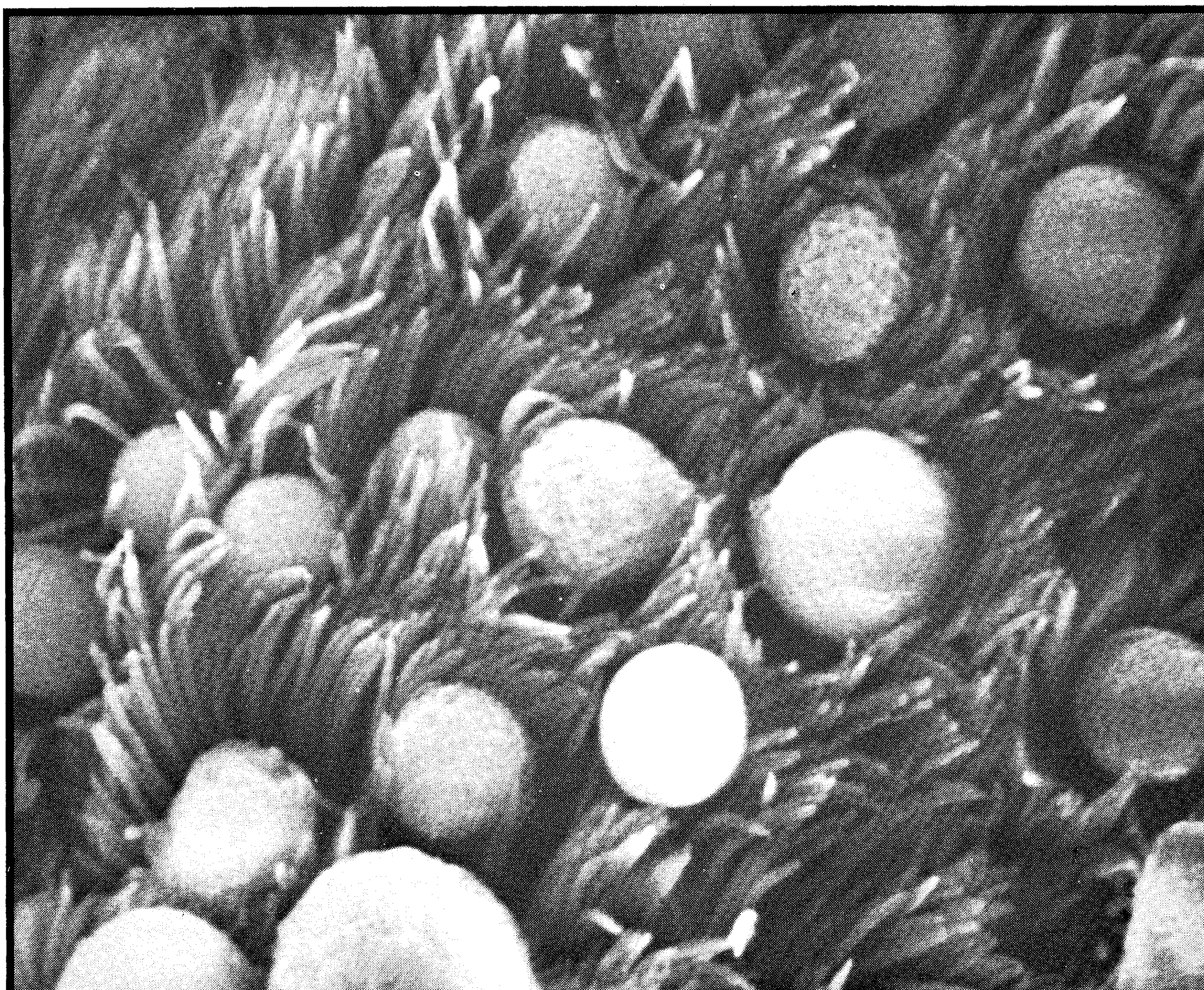
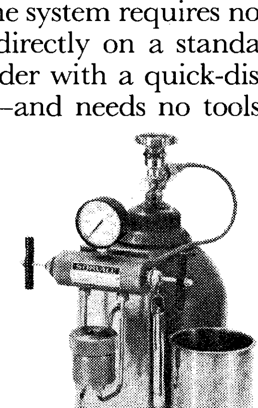


Surface of tracheal epithelium, dried by the Du Pont/Sorvall Critical Point Drying System. 17,500×.



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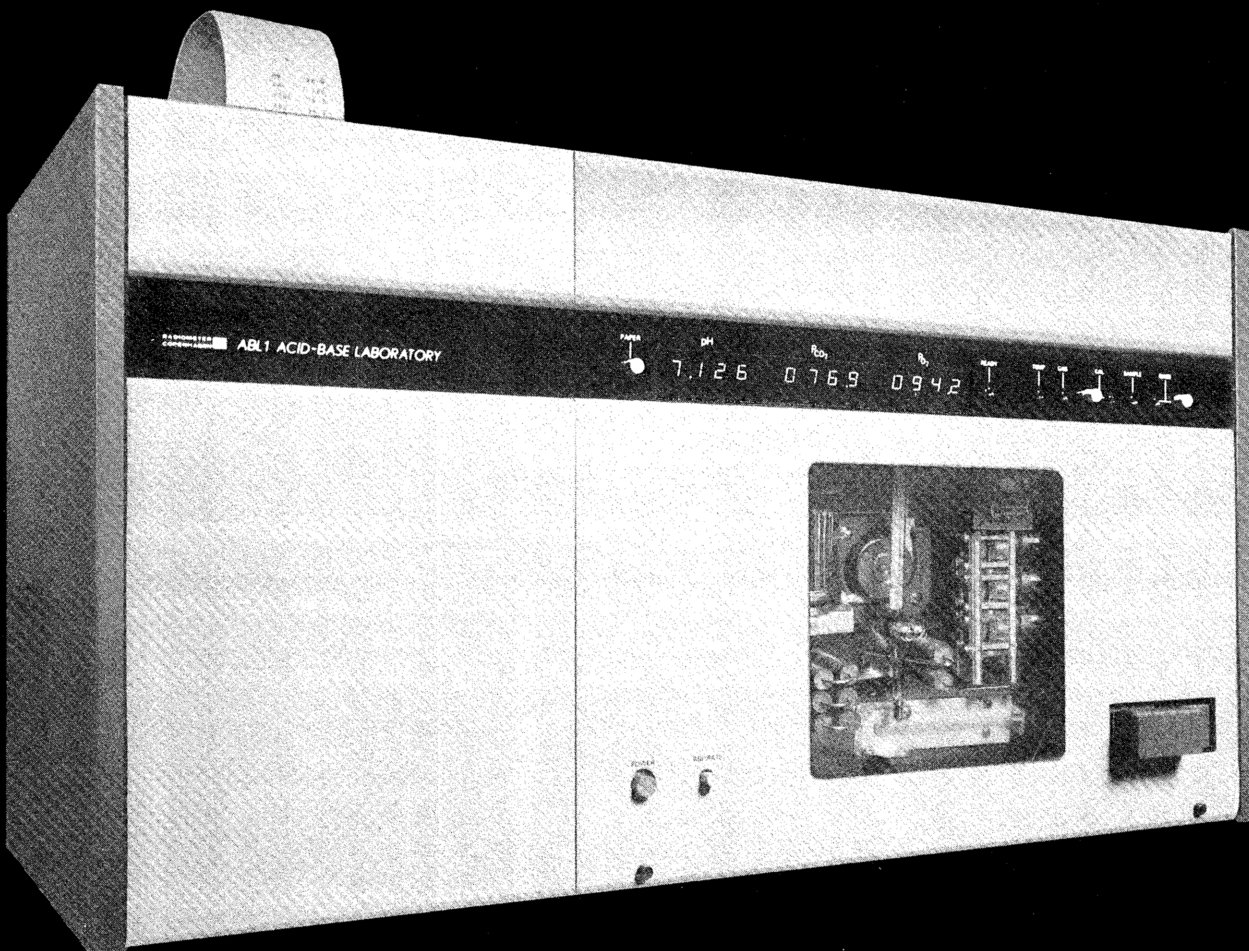

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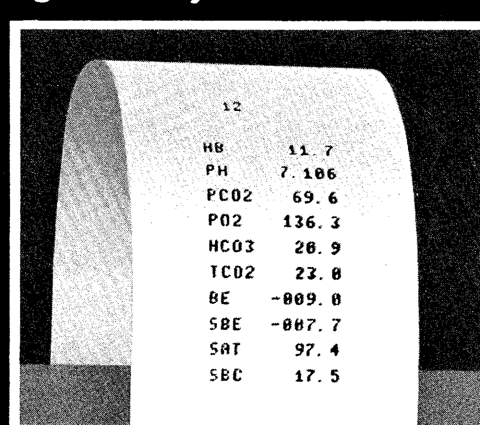

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*Publication in manuscript, "Culturing of Anaerobic and Aerobic Micro-organisms Using a Mobile Unit (Anaerobile) in a Nosocomial Environment", by Dr. Jerome Abramson, Baltimore Cancer Research Center, Baltimore, Md.

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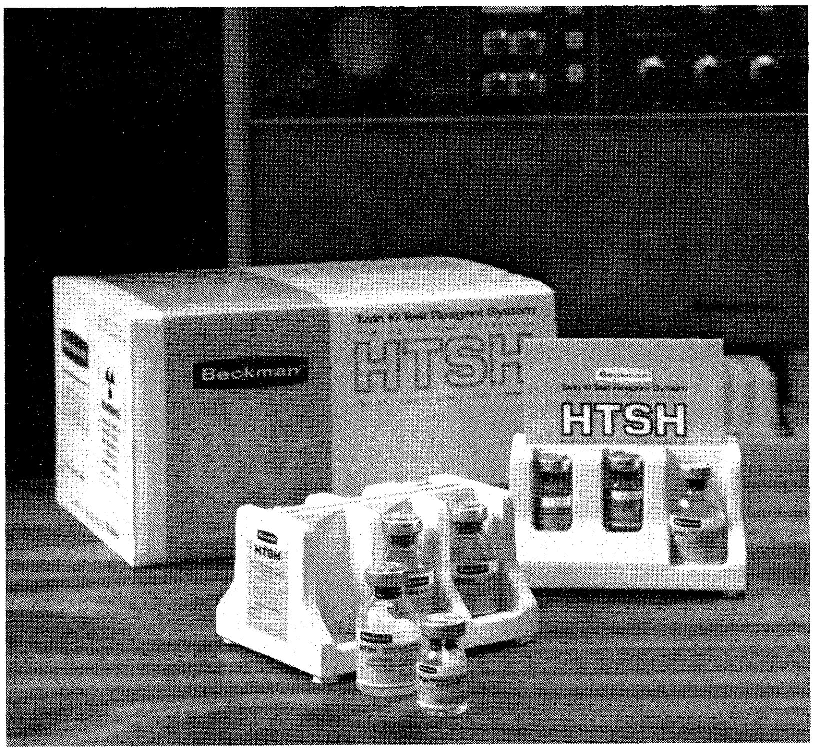

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Electron Microscopy In Pathology

NORELCO REPORTER/VOL. 20 NO. 3, 1973

by George Bridges and J. H. Martin, Baylor University Medical Center, Dallas, Texas

Introduction

Electron microscopy has become a useful diagnostic tool of the pathologist. Although its use on every specimen is impractical and, in fact, wasteful at our present level of knowledge and technical capability, the electron microscopic examination of selected surgical specimens and autopsy specimens is every bit as practical and useful as many of the "special" stains routinely employed in many pathology laboratories.

The principal developments allowing for the increased current application of electron microscopy in diagnostic pathology as we see them are: (1) the collection of specimens in a dual purpose aldehyde fixative allowing for both light and later electron microscopy on the same biopsy specimen, (2) rapid, simplified and reliable dehydration, embedding, staining and photographic techniques making the results of electron microscopy available within twenty four hours of receiving the specimen, (3) wide-spread usage of the "adjacent" or "thick" 0.5 micron epoxy embedded and cover slipped sections for light microscopy as a selective device and bridge between conventional paraffin embedding techniques and electron microscopy and (4) the relatively recent development of excellent, reliable ultramicrotomes and high-quality, simplified electron microscopes opening the door to technologists as operators rather than highly skilled artisans.

The purpose of this paper is to outline briefly some of these viewpoints on methodology, instrumentation, and current applications of electron microscopy in diagnostic pathology.

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(Continued from page 734)

Wisconsin, Madison. . . . **Paige Mulhollan**, associate dean, College of Arts and Sciences, Kansas State University, to dean, College of Arts and Sciences, University of Oklahoma. . . . **Paul R. Paslay**, professor of engineering, Brown University, to dean, School of Engineering, Oakland University. . . . **Vaughnie J. Lindsay**, professor of business education, Southern Illinois University, Edwardsville, to dean, Graduate School at the university. . . . **Jonathan O. Cole**, former superintendent, Boston State Hospital, to chairman, psychiatry department, Temple University. . . . **Peter J. Jannetta**, former director, neurological surgery division, Surgery Department, School of Medicine, University of Pittsburgh, to chairman, neurological surgery department at the school. . . . **Charles E. Blevins**, associate professor of anatomy, Northwestern University Medical School, to chairman, anatomy department, School of Medicine, Indiana University. . . . **James M. Watson**, assistant professor of sociology, University of Rochester, to chairman, sociology department, State University of New York Teachers College, Geneseo. . . . **Quentin Peterson**, chairman, chemistry department, Monmouth College, to chairman, chemistry department, Central Michigan University. . . . **Wadi A. Bardawil**, professor of pathology, School of Medicine, Tufts University, to chairman, pathology department, Creighton University. . . . **Ralph L. Llewellyn**, executive secretary, board on energy studies, National Academy of Sciences/National Research Council, to chairman, physics department, Indiana State University. . . . **Richard D. Berlin**, associate professor of physiology, School of Medicine, Harvard University, to chairman, physiology departments, Medical and Dental Schools, University of Connecticut. . . . **Richard J. Popp**, assistant professor of psychology, State University of New York, Buffalo, to chairman, psychology department, University of Dayton. . . . **Joseph A. Brink**, director of development, Monsanto Enviro-Chem Systems Inc., to chairman, chemical engineering department, Washington State University. . . . **Tomlinson Fort, Jr.**, professor of chemical engineering, Case Western Reserve University, to chairman, chemical engineering department, Carnegie-Mellon University. . . . **J. Joseph Doerr**, acting Dean, School of Education, University of Missouri, Kansas City, to dean of the school.

RECENT DEATHS

Emory S. Bogardus, 91; dean emeritus, Graduate School, University of Southern California; 21 August.

Leonard Carmichael, 74; vice president, National Geographic Society, and former head, Smithsonian Institution; 16 September.

Nelson S. Fisk, 59; associate professor of civil engineering, School of Engineering and Applied Science, Columbia University; 2 October.

George Gold, 61; attending professor of psychiatry, College of Physicians and Surgeons, Columbia University; 29 September.

George D. Humphrey, 76; former president, University of Wyoming and Mississippi State College; 10 September.

Elmer E. Jukkola, 68; retired advanced systems materials engineer, Wright-Patterson Air Force Base; 15 June.

Frank D. Kern, 90; first dean, Graduate School, Pennsylvania State University; 28 September.

Laura A. Kolk, 82; former associate professor of biology, Brooklyn College; 11 August.

Beatrice G. Konheim, 64; dean, Institute of Health Sciences, Hunter College; 1 October.

Thomas B. Ledbetter, 53; professor of mechanical and aerospace engineering, North Carolina State University; 25 August.

Frank T. McClure, 57; deputy director, Applied Physics Laboratory, Johns Hopkins University; 18 October.

Robert E. Ohm, 55; dean, College of Education, University of Oklahoma; 14 October.

Frank E. Rice, 86; former professor of agricultural chemistry, Cornell University; 19 August.

Gordon L. Roene, Jr., 43; associate professor of physiology and health science, Ball State University; 7 September.

Karl Sax, 81; professor emeritus of botany, Harvard University; 8 October.

Madan M. Singh, 49; professor of medicine, State University of New York, Buffalo; 24 August.

Erratum: In the issue of 25 January, p. 291, *Science* reported that Representative Charles A. Mosher (R-Ohio), vice chairman of the Technology Assessment Board, would become chairman of the board in January 1975. However, by law, any House member of the board may become the chairman. It is likely that a member of the majority party, in this case a Democrat, will be chosen. Edward Wenk, Jr., is chairman of the Committee on Public Engineering Policy of the National Academy of Engineering.

RESEARCH NEWS

(Continued from page 738)

between his program and the final form of the report. "I was just one of the infantry for the tanks to run over," he said. Geologists seem to have been particularly alienated during the preparation of the report, which took more than 2 years.

But the report of the U.S. Geodynamics Committee serves a useful function in drawing up a coordinated program for scientists from the many disciplines now involved in the earth sciences. There was no previous tradition of comprehensive earth science reports. The only obvious predecessor is the report of the Upper Mantle Project in 1962, which is just 36 pages long and much more limited in scope. In the view of some scientists, the report also comes at a time when better monitoring of the various funds spent for earth science research is badly needed. The committee made a hesitant attempt at monitoring by denoting the areas to which various federal agencies contributed research monies, although it did not publish the figures.

The report could also have the effect of making the importance of geodynamics much more visible to Congress and the public. The idea that North and South America split away from Africa and Europe has fascinated people for years. Unfortunately, the report is probably too technical for a nonscientific audience.

Much research in the earth sciences is also relevant to another important public concern—the availability of fossil fuels and minerals. Although the report underplays economic aspects, plate tectonics is clearly related to the formation of oil and mineral deposits. Long-term vertical movements have resulted in sediment-filled basins which are important sources of hydrocarbons, and the locations of minerals may be influenced by tectonic spreading centers. Geodynamic research may thus have a substantial economic impact. Geophysical exploration cruises are already followed quite closely by those hoping to find oil.

A comment by John Sclater, of the Massachusetts Institute of Technology, seems to sum up the view of many others. "We've got a nice model which works damn well for 70 percent of the world, but that's all ocean. How's it going to work for the continents?"

—WILLIAM D. METZ AND ALLEN L. HAMMOND

BOOKS RECEIVED

(Continued from page 742)

Communication and Affect. Language and Thought. Proceedings of a symposium, Mississauga, Canada, Mar. 1972. Patricia Pliner, Lester Krames, and Thomas Alloway, Eds. Academic Press, New York, 1973. xii, 200 pp., illus. $9.95.

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Drug Design. Vol. 4. E. J. Ariëns, Ed. Academic Press, New York, 1973. xvi, 490 pp., illus. $35. Medicinal Chemistry, vol. 11.

Embryology and Phylogeny in Annelids and Arthropods. D. T. Anderson, Pergamon, New York, 1973. xiv, 496 pp., illus. $24. International Series of Monographs in Pure and Applied Biology, Zoology, vol. 50.

Energy Metabolism. Eric G. Ball. Addison-Wesley, Reading, Mass., 1973. xii, 84 pp., illus. Cloth, $12; paper, $6.50. Advanced Book Program.

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Essays in Fundamental Immunology 1. Ivan Roitt, Ed. Blackwell Scientific, Oxford, England, 1973 (U.S. distributor, Davis, Philadelphia). vi, 66 pp., illus. Paper, $5.25.

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The Freshwater Molluscs of the Canadian Interior Basin. Arthur H. Clarke. Institute of Malacology, University of Michigan, Ann Arbor, 1973. 510 pp., illus. Paper, $25. *Malacologia*, vol. 13, No. 1–2, 1973.

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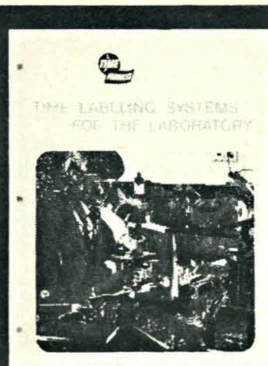

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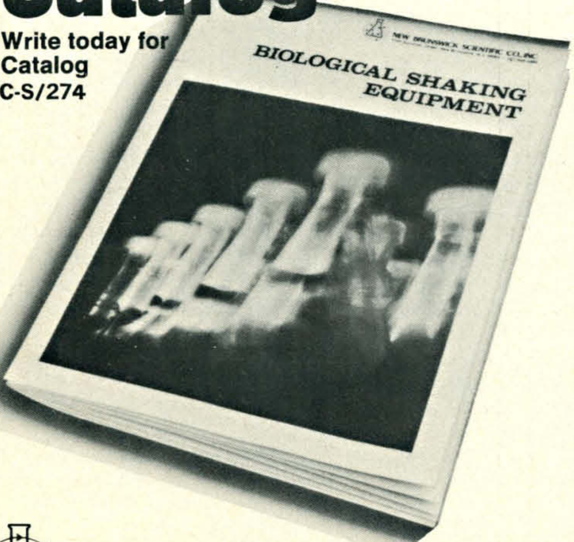

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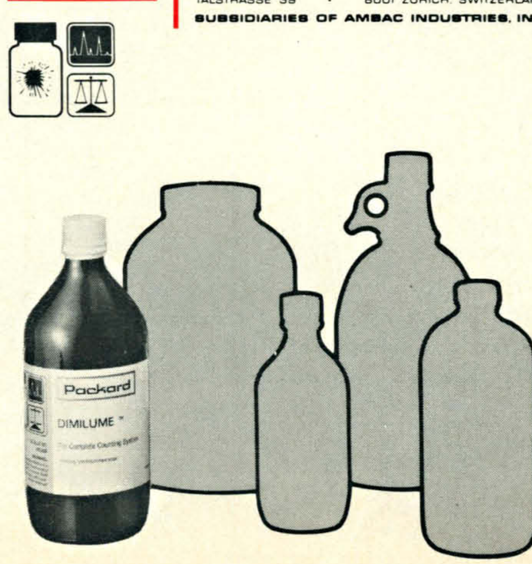

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