SCIENCE

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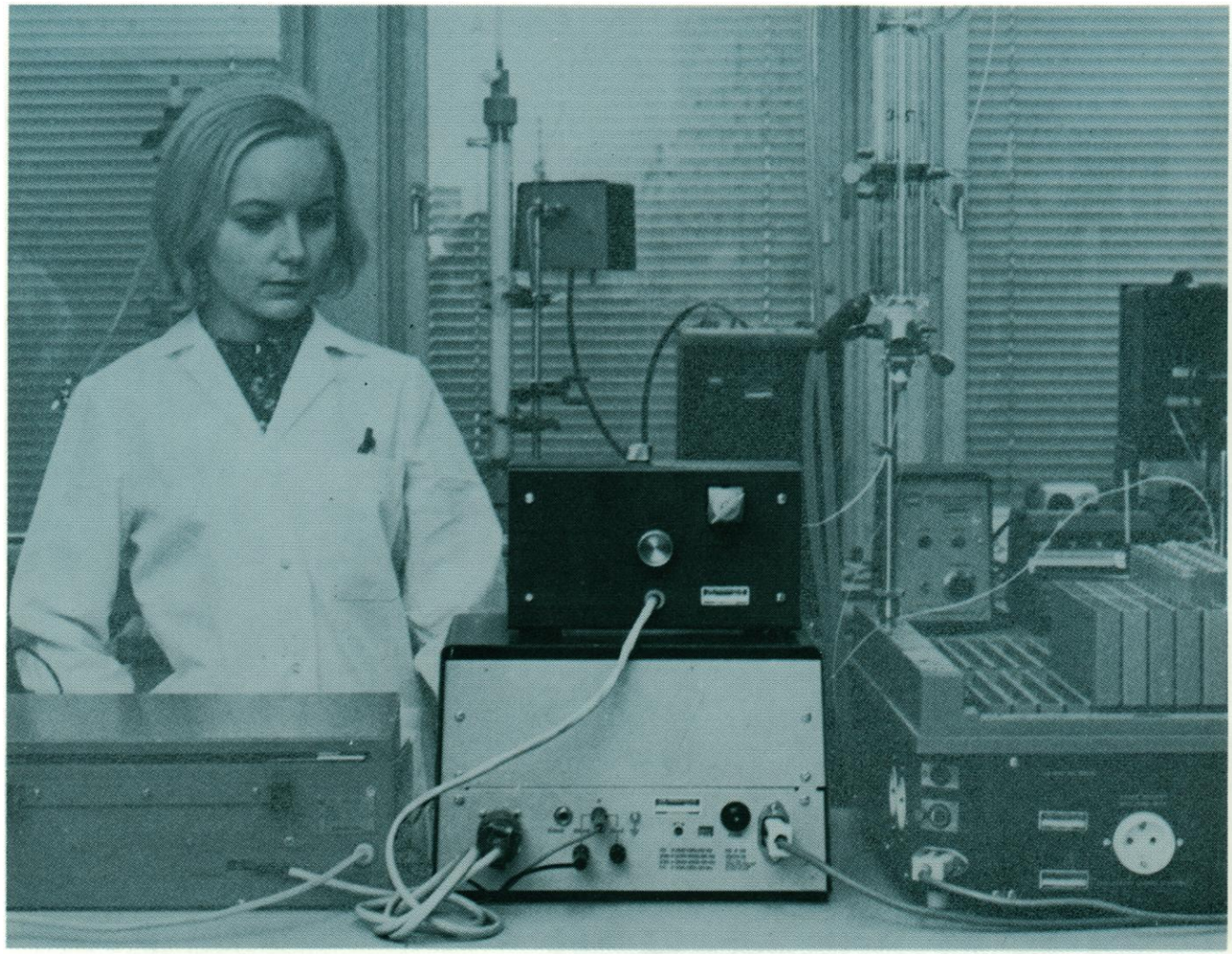

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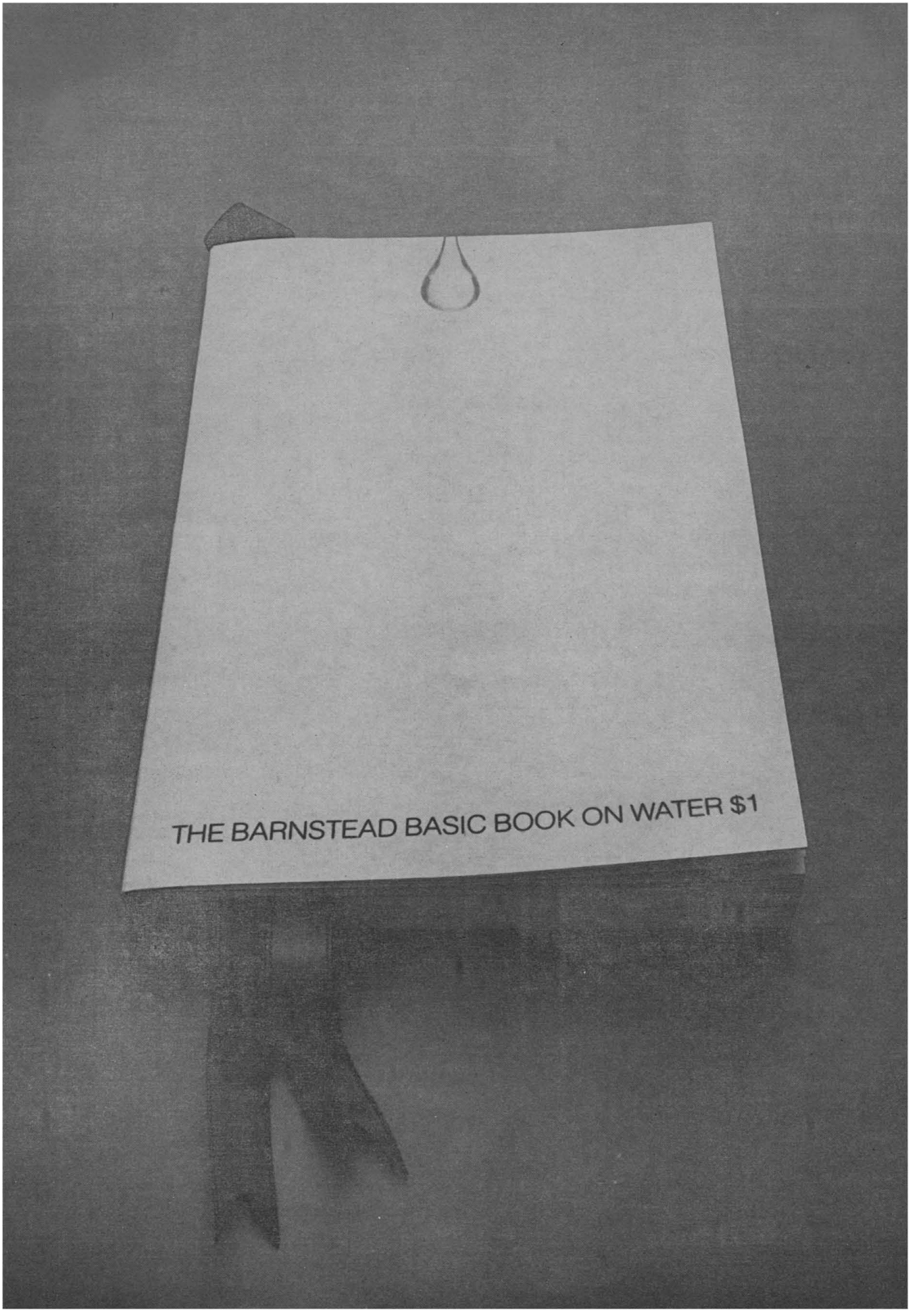
COVER

Soft shell turtle (*Trionyx ferox*). The turtle is mainly a carnivore which may prey on a large number of animals but also scavenges. See page 936. [Leland LaFrance, Chicago Zoological Park, Brookfield, Illinois]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manism in Social Science" (also 14 May, p. 661) Simpson, reviewing Friedrichs' *A Sociology of Sociology* and Gouldner's *The Coming Crisis of Western Sociology*, uses the word "paradigm" at least seven times and also refers explicitly to Kuhn's work. The widespread acceptance of Kuhn's ideas by scientists indicates that his insights illuminate the circumstances in which they actually practice science. His rejection by philosophers indicates that concepts that are clear to the research worker whose situation and environment they describe are unclear to the philosopher.

Nowhere, either in *Criticism and the Growth of Knowledge* or in Shapere's review, is the paradigm concept considered as a construct in the field of sociology. It is perhaps in this role that the paradigm concept will ultimately stand or fall. That Galileo recants or that Kuhn retreats has little to do with the descriptive and predictive power of their insights or with the productivity of the research that can go on under the aegis of their conceptual frameworks. Obviously, my approach here is intentionally Kuhnian. The acid test of the paradigm concept is not logic but effect, that is, its descriptive and predictive power. If the concept is effective it will survive and then the philosophers will have to find a way to deal with it.

WALTER J. FRASER
James Jerome Hill Reference Library, Saint Paul, Minnesota 55102

Indicators of Drug Effectiveness

One of the major problems in the practice of preventive medicine in developing countries is guaranteeing that drugs and biologicals are still effective at the time of use. This is especially true for live virus vaccines which must be kept within a narrow temperature range. Because of the hazardous conditions that sensitive pharmacologicals encounter in transit from the laboratory to the patient, many ineffective (and thus potentially harmful) drugs and biologicals are administered, or many effective drugs and biologicals are discarded because of a suspicious history.

Field workers desperately need a fail-safe indicator which either changes the color of the material or appears on the label (perhaps obliterating it) when temperature, time, or other factors have adversely affected the effectiveness of the material. Sterilization indicators, which are routinely used in autoclaving, operate according to the same principle.

If the United States were to adopt similar devices for drugs and biologicals, the immediate benefits would be international.

KIT JOHNSON
Department of Preventive Medicine and Public Health, College of Medicine, Yonsei University, Seoul, Korea

Reform at the National Academy of Sciences

Page's editorial (14 May, p. 635) on the new Institute of Medicine of the National Academy of Sciences (NAS) raises some important issues that deserve further discussion. The most serious problem is whether the NAS or an institute within it can provide the kind of leadership that is needed to "encourage creative change" [Stewart Udall, quoted in C. E. Barfield, *Nat. J.* **3**, 111 (1971)]. Clearly some of the innovations outlined by Page are attempts to improve the situation. Especially laudable is the intent to make a candidate's election to the Institute of Medicine contingent upon a commitment of time for public service. Perhaps this same stipulation should be extended to the entire Academy, which in the past has been a kind of exalted Phi Beta Kappa.

Unfortunately, such minor reforms do not go far enough. The most regressive feature of NAS—the election of members by a closed group—would be retained. This virtually assures that the institute and the NAS would remain unaccountable to the public and to the scientific community at large. I cannot help but feel that the problems of the poor and of minority groups will continue to be neglected under these circumstances.

The model provided by NAS is so deficient that a wholly different institution should be established to supply scientific and medical advice to the government. It should be designed to encourage inputs from competent scientists and nonscientists who are not necessarily members of the elite establishment.

D. MAX SNODDERLY, JR.
Retina Foundation, Boston, Massachusetts 02114

Trouble

Conidiospores—really somatic cells—ride the wind. In effect, a single organism spreads genetically identical extensions of itself over a continent. Infection marks this "wind slot" from a narrow opening in the woods. Entire field was finally affected.

Mississippi State College photo

From spore to leafspot to new spore can take as little as 60 hours where and when dew is plentiful.

Mississippi State College photo

In 1970 Johnson grass, relative of corn, stayed healthy. Weeds and grass favor the blight by slowing the drying of the dew.

The mutant attacks the ears. The original race of Southern Corn Leaf Blight concentrated pretty much on leaves.

We want to be useful ...and even interesting

Corn, 1971

This is how Southern Corn Leaf Blight is being tracked this summer—by its color on KODAK AEROCHROME Infrared Film 2443 (ESTAR Base). (Useful also in estimating dwelling units in a congested central city and in many other kinds of "remote sensing.") This film, instead of trying to imitate the colors of the real world, works by shifting man's color vision a short way into the infrared. Has nothing to do with temperature sensing but something to do with the way the brain works and a lot to do with the spectral reflectance of green plants.

Fortnightly since June 14, cameras have been flying 11 miles above 200 sample sites, each 1 mile by 8 miles, that have been thoroughly studied on the ground. Film goes to the Laboratory for Applications of Remote Sensing at Purdue University, where the interpreters work. From their reports, judgments are made that relate Race T of the asexually reproducing fungus *Helminthosporium maydis* to the price of hamburgers, steaks, chicken, milk.

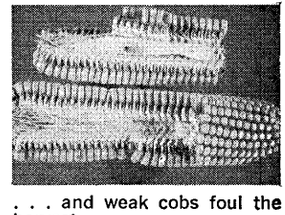
"T" stands for Texas, as in Texas male-sterile cytoplasm, an invention in genetic engineering that cuts out the heavy cost of detasseling the hybrid seed plants (so that they shall be pollinated only by the adjacent row of the male parent in the cross). This was a most fruitful idea until, early in 1970, there appeared in Florida a mutant of the previously unimportant *H. maydis* that specializes in Texas male-sterile cytoplasm. With the dewy nights and warm days of the 1970 summer proving ideal for the development of the fungus, Race T swept north. But hybrid corn from seed produced the costly old way kept its high yield and the cob strength that corn-handling machinery requires. Such seed, though, has become scarce.

This year each grower has needed all the information he could get for picking his own best strategy against this unfamiliar threat to profitable farming. Switch to soy beans? Take a chance on hybrid seed corn blended with a percentage produced by detasseling? Plant thickly or thinly? Deep or shallow? Weed control? Liming against soil acidity? Crop insurance? Hedge through the futures market? Participate in the program for taking some acreage out of production, specifically bottom land where dew is frequent? What a tangled web of biology, economics, and divination extends back from the meat counter to the not-so-simple farmer!

Never has the biologist's need to communicate by means of photographs been more strongly felt than in comparing findings on the Race T problem and getting the new-found facts out to all those individual decision-makers. See glimpses at left and right of images that deliver their impact via TV and press away from the cities and suburbs. A good communicator, Dr. Luther Farrar of Auburn University in Auburn, Ala., gave them to us with a little advice ▶

The toxin hits only corn tissue, but when it goes all the way to stem rot it opens the way for secondary organisms. Some of these might produce toxins for the animal kingdom.

Just poor quality and quantity are trouble enough . . .



. . . and weak cobs foul the harvest.

- Take time for the careful composition that lets a picture speak for itself.
- Shoot important subjects in both color and black-and-white. (Color slides are best for meetings, but converting them to black-and-white for low-cost publications brings problems in picture quality.)
- Picture quality is vital. Focus with care, then stop down to f/16 for depth of field. If that calls for a slow shutter speed, use a tripod.
- For TV appearances, bring 11" x 14" prints mounted on cardboard.

3 September 1971, Volume 173, Number 4000 **SCIENCE**

The Importance of Being Ernest Rutherford

Ernest Rutherford's good friend and colleague, A. S. Eve, once playfully depreciated his immense contributions to physics by charging that he rode the crest of a wave. Rutherford responded, "Well, I *made* the wave, didn't I?" The centennial of Rutherford's birth on 30 August of this year makes this an opportune time to look at that wave.

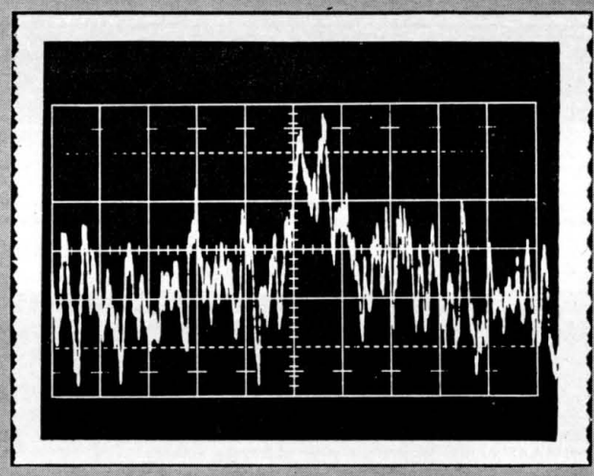
It has long been accepted that "great men" only accelerate scientific progress a bit, but this cliché does not seem to apply to the man hailed as the greatest experimentalist since Faraday. Consider radioactivity early in this century: the significant workers could be counted on one's fingers, and none of them had the range of interests or the fertile, intuitive mind that Rutherford had. He advanced the disintegration theory of radioactivity (with Frederick Soddy, in 1902 and 1903), proposed a nuclear structure to the atom (1911), and succeeded in artificially transmuting a nucleus (1919).

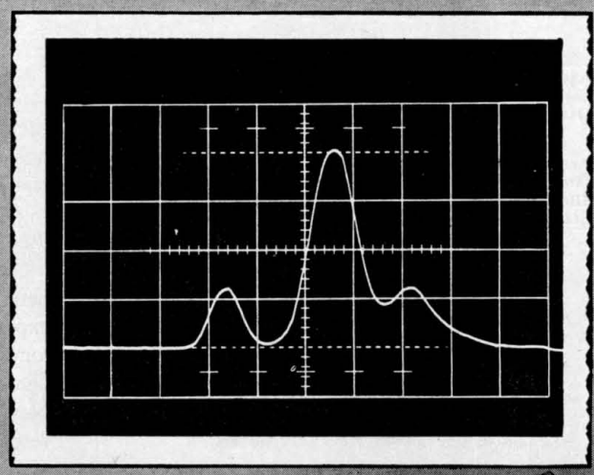
Although Rutherford was no mathematical physicist, there is a notable theoretical component to each of these major achievements. He was, moreover, the leading prophet (in 1920) for the existence of the neutron (and ^2H and ^3He as well, though all this was based on faulty experimental data!). Theoreticians who worked closely with his laboratory, with varying degrees of personal influence from Rutherford, included Soddy, Kasimir Fajans, Niels Bohr, C. G. Darwin, Ralph Fowler, Neville Mott, and George Gamow. Indeed, Rutherford was as great a research director as a discoverer, and Otto Hahn, George Hevesy, Hans Geiger, H. G. J. Moseley, James Chadwick, P. M. S. Blackett, Peter Kapitza, John Cockcroft, and E. T. S. Walton are only the most eminent of his distinguished pupil-colleagues.

For almost the last 20 years of his life Rutherford was director of the Cavendish Laboratory in Cambridge, England. There, he influenced the transition from little science to big science. Kapitza, Cockcroft, and Walton were among those responsible for introducing large machines and high costs into physics, and the electronic counters of C. E. Wynn-Williams and Geiger also presaged the new look. Although these departures from the "sealing wax and string" tradition were not entirely to his taste and Rutherford disliked looking for research funds, his "boys" generally acquired the equipment needed. As president of the Royal Society and later as chairman of the advisory committee to the government's Department of Scientific and Industrial Research, he was in a position to exert considerable influence throughout the "Establishment" of science.

A number of writers have pointed out that Rutherford said that the energy of the atom would never be harnessed. In effect, the criticism means that he failed to foresee a new physical phenomenon discovered a year after his death in 1937. In the early days of radioactivity, when Rutherford recognized that decaying radioelements eject alpha and beta particles, he actually wondered if larger chunks of the atom also broke off, but no evidence for what later was called fission could then be found. Still, with Chadwick's discovery of the neutron and with the discovery of fission by Hahn, Rutherford had a connection with applications of nuclear energy. We find his presence even in the beginnings of fusion research, as when in 1934, with M. L. E. Oliphant and Paul Harteck, he bombarded deuterium with deuterons. As a major participant in the transition from classical to modern physics, it would seem that the wave Rutherford created was even larger than he may have thought!—LAWRENCE BADASH, *Department of History, University of California, Santa Barbara*

Noisy Signal?





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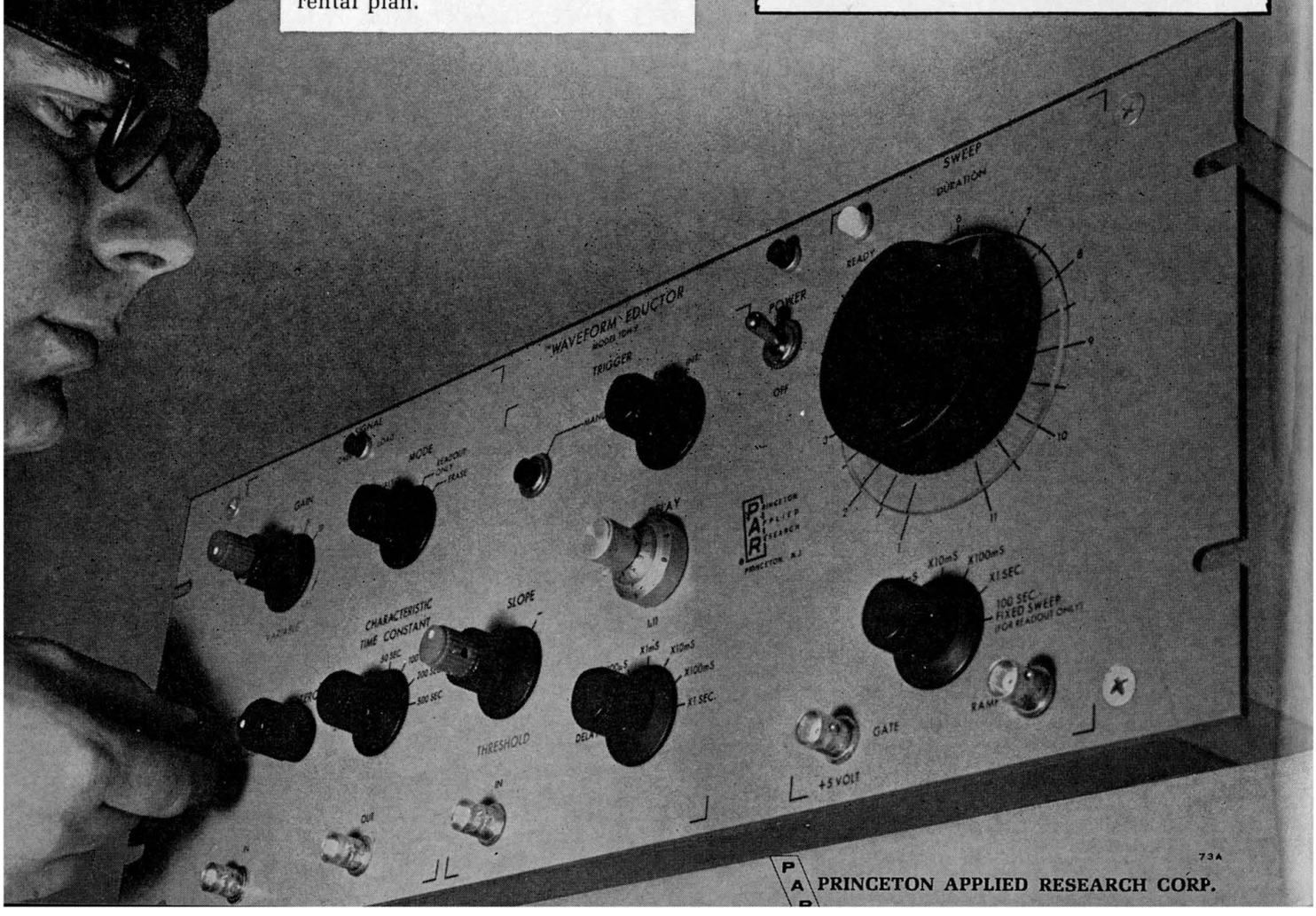

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BOOKS RECEIVED

(*Continued from page 906*)

The Difference between a Man and a Woman. Theo Lang. Day, New York, 1971. 414 pp. $9.50.

Diffusion Processes. Vol. 1. Proceedings of a symposium, Glasgow, Scotland, September 1969. J. N. Sherwood, A. V. Chadwick, W. M. Muir, and F. L. Swinton, Eds. Gordon and Breach, New York, 1971. xiv, 394 pp., illus. $29.50.

Dynamic Probabilistic Systems. Ronald A. Howard. Vol. 1, Markov Models, xviii + pp. 1–576, illus. + index, $17.95. Vol. 2, Semi-Markov and Decision Processes, xx + pp. 577–1108, illus. + index, $19.95. Series in Decision and Control.

Economic Dimensions in Education. Martin O'Donoghue. Aldine-Atherton, Chicago, 1971. viii, 224 pp. $5.95.

Electronics for Medical and Biology Laboratory Personnel. A. R. Tammes. Williams and Wilkins, Baltimore, Md., 1971. xiv, 254 pp., illus. $9.50.

Elements of Calculus for Technical Students. Lee W. Davis. Canfield, San Francisco, 1971. viii, 312 pp., illus. $10.

Encyclopedia of Industrial Chemical Analysis. Vol. 12, Dyes to Flour. Foster Dee Snell and Leslie S. Ettre, Eds. Interscience. New York, 1971. xiv, 618 pp., illus. $45; by subscription, $35.

The Enzymes. Vol. 3, Hydrolysis: Peptide Bonds. Paul D. Boyer, Ed. Academic Press, New York, ed. 3, 1971. xxii, 886 pp., illus. $39.

Essays in Chemistry. Vol. 2. J. N. Bradley, R. D. Gillard, and R. F. Hudson, Eds. Academic Press, New York, 1971. x, 124 pp., illus. Paper, $4.25.

Explorations in the Life of Fishes. N. B. Marshall. Harvard University Press, Cambridge, Mass., 1971 xiv, 204 pp., illus. $6.50. Harvard Books in Biology, No. 7.

Far-Infrared Spectroscopy. Karl Dieter Möller and Walter G. Rothschild. Wiley-Interscience, New York, 1971. xx, 798 pp., illus. $29.95.

The First American. A Story of North American Archaeology. C. W. Ceram. Harcourt Brace Jovanovich, New York, 1971. xxii, 358 pp. + plates $9.95.

The Fishes of Zanzibar. Acanthopterygii. R. Lambert Playfair. Pharyngognathi Etc. Albert C. L. G. Günther. Gregg, Kentfield, Calif., 1971. 154 pp. + plates. $99.50. Hand Colored Reprint Series, No. 1.

Fourier Series and Partial Differential Equations. A Programmed Course for Students of Science and Technology. I. M. Calus and J. A. Fairley. Wiley-Interscience, New York, 1971. Variously paged, illus. Paper, $5.50. Series of Programmes on Differential Equations.

Free-Radical Substitution Reactions. Bimolecular Homolytic Substitutions (S_H2 Reactions) at Saturated Multivalent Atoms. K. U. Ingold and B. P. Roberts. Wiley-Interscience, New York, 1971. x, 246 pp., illus. $11.95.

Functional Differential Equations. J. Hale. Springer-Verlag, New York, 1971. x, 238 pp., illus. Paper, $6.50. Applied Mathematical Sciences, vol. 3.

The Functions of Mathematical Physics. Harry Hochstadt. Wiley-Interscience, New York, 1971. xii, 322 pp., illus. $17.50. Pure and Applied Mathematics, vol. 23.

General Chemistry Workbook. How to Solve Chemistry Problems. Conway Pierce and R. Nelson Smith. Freeman, San Francisco, ed. 4, 1971. x, 370 pp., illus. Paper, $2.95.

General Physiology. The Cellular and Molecular Basis. Howard Rothstein. Xerox College Publishing, Waltham, Mass., 1971. xxii, 602 pp., illus. $13.50.

Geography of Domestication. Erich Isaac. Prentice-Hall, Englewood Cliffs, N.J., 1971. x, 132 pp., illus. Cloth, $6.95; paper, $2.95. Foundations of Cultural Geography Series.

Geology. William C. Putnam. Second edition, revised by Ann Bradley Bassett. Oxford University Press, New York, 1971. xvi, 586 pp., illus. $10.

Gilbert White's Journals. Walter Johnson, Ed. M.I.T. Press, Cambridge, Mass., 1971. xlviii, 464 pp., illus. Paper, $3.95. Reprint of the 1931 edition.

Graph Theory and Feynman Integrals. Noboru Nakanishi. Gordon and Breach, New York, 1971. xii, 224 pp., illus. $14.50. Mathematics and Its Applications, vol. 11.

Hibernation and the Hypothalamus. Nicholas Mrosovsky. Appleton-Century-Crofts, New York, 1971. x, 288 pp., illus. $16. Neuroscience Series.

The Highway Risk Problem. Policy Issues in Highway Safety. Robert F. Baker. Wiley-Interscience, New York, 1971. xvi, 176 pp., illus. $9.95.

History of Binary and Other Nondecimal Numeration. Anton Glaser. Published by the author, 1237 Whitney Road, Southampton, Pa., 1971. x, 196 pp., illus. Paper, $4.

Hormonal and Attractant Pesticide Technology, 1971. Yale L. Meltzer. Noyes Data Corporation, Park Ridge, N.J., 1971. viii, 282 pp., illus. Paper, $35.

International Encyclopedia of Pharmacology and Therapeutics. Section 71, Pharmacology and Toxicology of Naturally Occurring Toxins. Vol. 1. O. B. Henriques, K. Mašek, S. B. Henriques, and H. Rašková. Pergamon, New York, 1971. x, 398 pp. + plates. $20.

Interplanetary Flight and Communication. Vol. 1, No. 1, Dreams, Legends, and Early Fantasies. N. A. Rynin. Translated from the Russian edition (Leningrad, 1928). Published for the National Aeronautics and Space Administration and the National Science Foundation by the Israel Program for Scientific Translations, Jerusalem, 1970 (available from the National Technical Information Service, Springfield, Va.). iv, 114 pp., illus. Paper, $3.

Introduction to Elementary Mathematical Logic. Abram Aronovich Stolyar. Translated from the Russian edition (Moscow, 1965). Elliot Mendelson, Transl. Ed. M.I.T. Press, Cambridge, Mass., 1971. x, 208 pp., illus. $5.95.

An Introduction to Modern Structural Analysis. David G. Elmes. Gordon and Breach, New York, 1971. 224 pp., illus. $17.50.

Introduction to Modern Physics. John D. McGervey. Academic Press, New York, 1971. xiv, 688 pp., illus. $4.

Introduction to the Study of Animal

Populations. H. G. Andrewartha. University of Chicago Press, Chicago, ed. 2, 1971. xiv, 284 pp., illus. $7.50.

Introductory Botany. Arthur Cronquist. Harper and Row, New York, ed. 2, 1971. x, 886 pp., illus. $14.95.

Introductory Organic Chemistry. Robert J. Ouellette. Harper and Row, New York, 1971. xvi, 430 pp., illus. Paper, $7.

Investigations on the Gray Snapper, Lutjanus griseus. Walter A. Starck, II, and Robert E. Schroeder. University of Miami Press, Coral Gables, Fla., 1971. 224 pp., illus. $12. Studies in Tropical Oceanography, No. 10.

Isolation of Anaerobes. D. A. Shapton and R. G. Board, Eds. Academic Press, New York, 1971. xiv, 270 pp., illus. $11.50. Society for Applied Bacteriology Technical Series, No. 5.

Isotope Effects in Chemical Reactions. Clair J. Collins and Newell S. Bowman, Eds. Van Nostrand Reinhold, New York, 1971. xii, 436 pp., illus. $22.50. American Chemical Society Monographs.

The Language of Space. A Dictionary of Astronautics. Reginald Turnill. Day, New York, 1971. xxxiv, 166 pp. $6.95.

Leitfaden für das zoologische Praktikum. Maximilian Renner. Fischer, Stuttgart, ed. 16, 1971. xvi, 530 pp., illus. DM 44.

The Logical Structure of Mathematical Physics. Joseph D. Sneed. Reidel, Dordrecht, Netherlands, and Humanities Press, New York, 1971. xiv, 312 pp., illus. $21. Synthese Library.

Man across the Sea. Problems of Pre-Columbian Contacts. Papers from a symposium, Santa Fe, N.M., May 1968. Carroll L. Riley, J. Charles Kelley, Campbell W. Pennington, and Robert L. Rands, Eds. University of Texas Press, Austin, 1971. xviii, 552 pp., illus. $12.50.

Man, Mind, and Heredity. Selected Papers of Eliot Slater on Psychiatry and Genetics. James Shields and Irving I. Gottesman, Eds. Johns Hopkins Press, Baltimore, Md., 1971. xx, 406 pp. $15.

Mathematics through Statistics. Preliminary Edition. Louis Auslander, Frank J. Avenoso, Philip Cheifetz, Eldon Dyer, Allan Gewirtz, Beryl E. Hunte, Louis V. Quintas, Harry E. Rauch. Mathematical Dimensions, Inc. (Aldine-Atherton), Chicago, 1971. iv, 388 pp., illus. Paper, $4.95.

Measurement and Control of Indirect Work. Dennis A. Whitmore. Elsevier, New York, 1971. xii, 276 pp., illus. $10.50.

Mechanics of Fluids. W. J. Duncan, A. S. Thom, and A. D. Young. Elsevier, New York, ed. 2, 1971. xiv, 726 pp., illus. $27.50.

Methods in Mammalian Embryology. Joseph C. Daniel, Jr., Ed. Freeman, San Francisco, 1971. xviii, 532 pp., illus. $22.50.

Methods of Biochemical Analysis. Vol. 19. David Glick, Ed. Wiley-Interscience, New York, 1971. viii, 632 pp., illus. $21.

Metric Trends in Hominid Dental Evolution. Milford H. Wolpoff. Press of Case Western Reserve University, Cleveland, Ohio, 1971. xiv, 244 pp. Paper, $5.95. Case Western Reserve University Studies in Anthropology, No. 2.

Microbes and Biological Productivity. Society for General Microbiology Symposium No. 21, London, April 1971. D. E.