

# SCIENCE

11 July 1975

Volume 189, No. 4197

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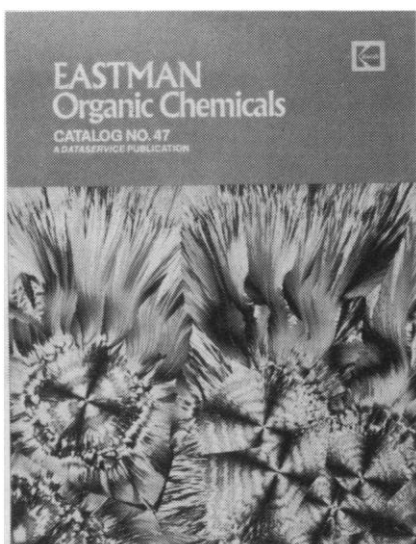
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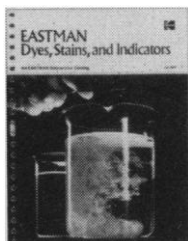
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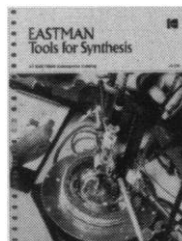
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## COVER

Female mountain bluebird at nest box in the Little Belt Mountains, Montana. Most birds were reproductively selfish when given the opportunity to behave altruistically toward the young of others. See page 142. [Robert L. Cushman, Missoula, Montana]

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$S_x$

A

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C

D

E

DSP

$x \neq y$

GTO

$x \leq y$

LBL

$x = y$

RTN

$x > y$

SST

f

$f^{-1}$

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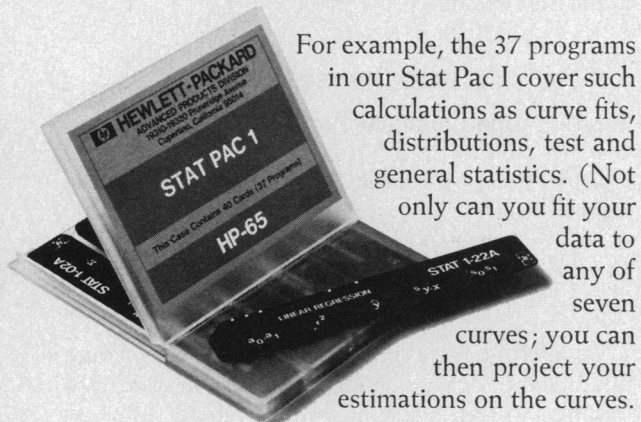


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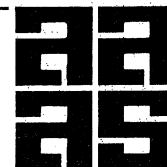
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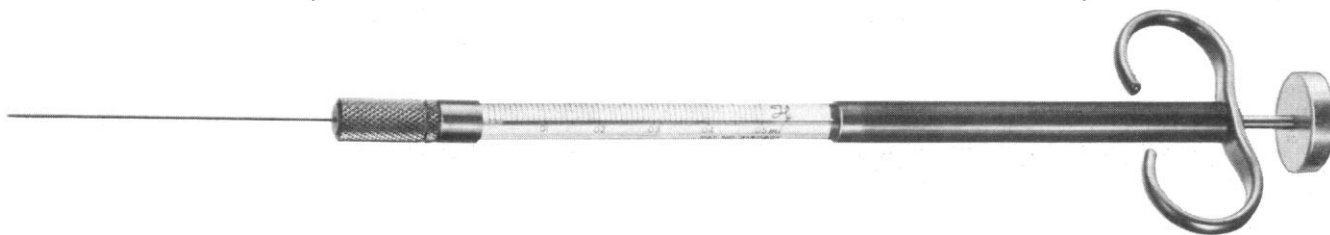
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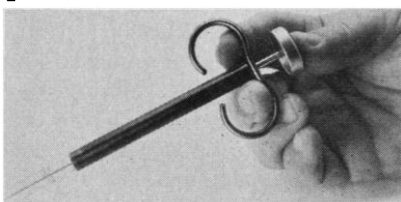
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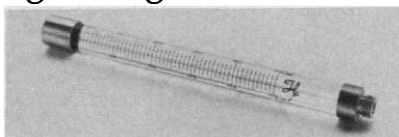
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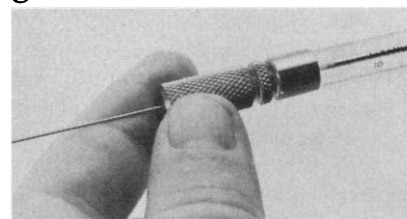


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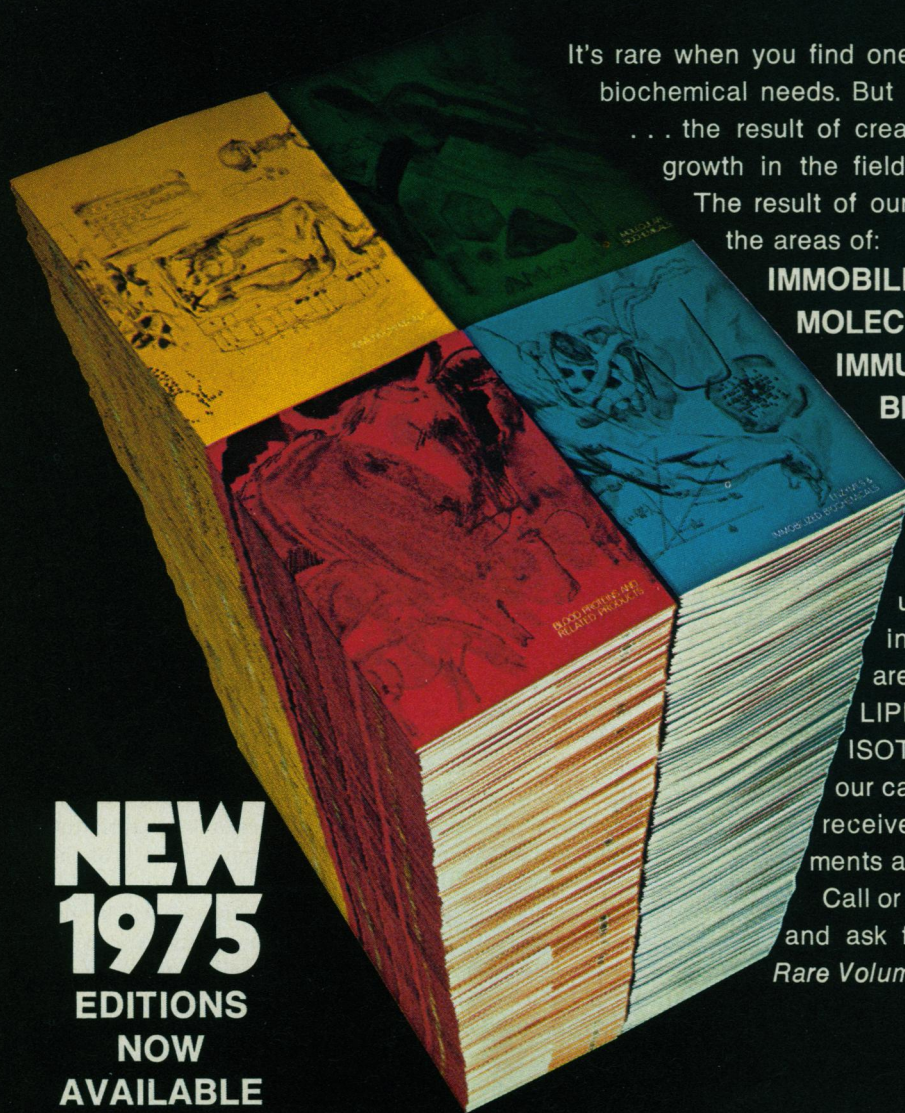
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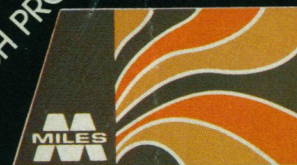
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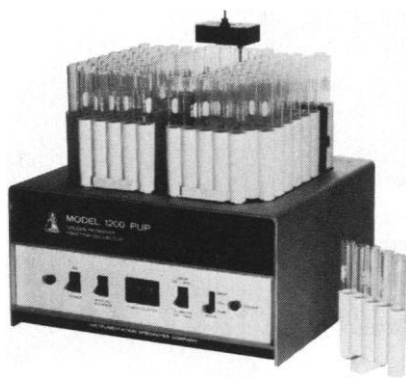
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Eq. 1, namely,  $N \approx 5$  billion, than to other estimates being made now by those who do not see the millennium arriving quite so early as we do.

JAMES SERRIN

*Department of Mathematics,  
University of Minnesota,  
Minneapolis 55455*

## References

1. H. von Foerster, P. M. Mora, L. W. Amiot, *Science* **132**, 1291 (1960).
2. P. F. Myers, L. F. Bouvier, J. R. Echols, 1975 *World Population Data Sheet* (Population Reference Bureau, Washington, D.C., 1975).
3. H. von Foerster, P. M. Mora, L. W. Amiot, *Science* **133**, 936 (1961); *ibid.*, p. 1931; H. F. Dom, *ibid.* **135**, 283 (1962); H. von Foerster, P. M. Mora, L. W. Amiot, *ibid.* **136**, 173 (1962).

## Crowding on Yosemite Buses

Lack of riders has plagued many public transportation systems around the country. However, the free Yosemite Valley shuttle-bus system in Yosemite National Park, California, had the opposite problem during the summer of 1974. Bus routes connect stores, trailheads, the visitor center, campgrounds, and motels in the valley. During the afternoon and evening hours of July and August, ridership averaged 80 percent of bus seating capacity. Often there was standing room only. On Friday and Saturday nights, bus drivers often had to leave many people stranded at bus stops because buses were full. Overloaded buses overheated and had to be taken out of service. At the busiest stops, visitors were frequently observed jockeying for position and pushing one another in preparation for boarding.

These and other findings were obtained in a study of crowding in natural settings funded by the National Science Foundation. Our research team recommended, and the Yosemite National Park Service has adopted, a number of changes which should help alleviate some of the problems described.

Given the general reluctance of people to use mass transportation, it is worth speculating on the factors which contribute to the popularity of the Yosemite Valley shuttle-bus system. These may include the following. There is no fare; the system is completely subsidized by the National Park Service. Some of the shuttle buses are double-decked, and all are open-air, thus providing unobstructed views of the scenic valley. Many younger visitors may have no alternative means of transportation (except walking). For adolescents and young adults, the buses provide a place for meeting peers and for "partying." Visitors who are unfamiliar with the park may not wish to risk becoming

lost while driving. Visitors, being on vacation, may not be in a hurry to arrive at their destinations. The area served by the bus system is small (only a few square miles), and routes include stops at most points of interest. A few miles of one route are on roads not open to private vehicles.

ALLAN W. WICKER

*Faculty in Psychology,  
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## Scientists and Politicians

As a political scientist working at a scientific center (the National Center for Atmospheric Research), I am in general sympathy with some of the views expressed in Roger Revelle's farewell address as AAAS president (21 Mar., p. 1100). However, one point that he makes may in fact undermine the type of cooperation between scientists and politicians that he seeks to bring about.

Revelle writes that "The politician is publicly egotistical, gregarious, garrulous, and has a strong gambling instinct. The scientist, at least in his own image, is publicly modest, introverted, relatively inarticulate, and seeks certainty rather than risk."

Here Revelle compares two unlike things: the public (or realist's) view of the politician and the self-image (or idealist's view) of the scientist. In fact, the politician and the scientist are more like each other than Revelle leads the reader to believe. In the realist's view, politicians are seekers of votes, but not necessarily of sound policy or rational decisions, and scientists are seekers of grants, but not necessarily of truths. Scientists, just like politicians, are guilty of myth-making, "Appealing to the emotional and the irrational in other men as well as to their calculating self-interest." Revelle notes that "For the politician in a democratic society, infinity is the election after the next one." A realist might say that, for the scientist in a democratic society, infinity is the research grant after the next one.

What Revelle says about the real politician could be said about the real scientist and what he says about the ideal scientist could be said about the ideal politician. Awareness of this point is an important place to begin for those who seek to establish more cooperation between these two professions. The similarities are much more pronounced than are the differences.

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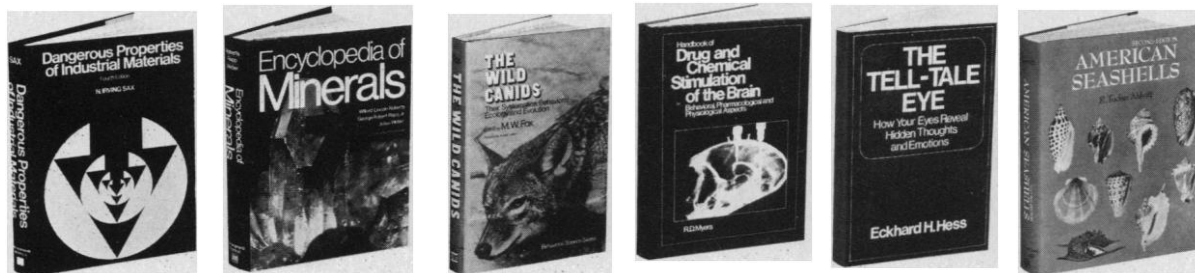
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# Effects of Small Computers on Scientists

Scientists vainly struggling to catch up with their reading may greet with an unappreciative sigh the Organization for Economic Cooperation and Development (OECD) forecast that "in 1985-87, six or seven times the present volume of new information will be produced." Scientists may though, at least at first, be relieved to read in the same document that by 1987 "the degree of automation of information will approach a hundred times that of today." Thus machines, the OECD says, will do more of the work of coping with the avalanche of information. So far, so good.

The present new wave of computerization, leading to a growing use of mini- and microcomputers (*Science*, 20 December 1974), illustrates both the positive and negative potential of the kind of automation the OECD foresees. Inexpensive, versatile, compact, and easy to combine with other instruments, mini- and microcomputers are increasingly used to accelerate the collection and processing of information.

Indeed, in a world of growing bureaucratization, the miniaturized computer is a rare source of delight for the shift to compact computers allows a much greater degree of decentralization. Instead of feeding data into a central computer, every researcher, indeed soon every research assistant, may have one or more computers at his disposal or linked to his instruments.

Similarly, in a world of increasing shortages, budget squeezes, and inflation, tiny computers will make the processing of information cheaper and more accessible. And in a world rich in routine and rut, small computers will be able to take on many of the menial tasks scientists, or their apprentices, now must do.

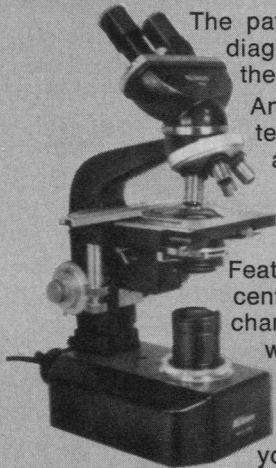
There is, however, a catch. The very rapid turnabout time compact computers allow between obtaining readings on instruments as well as between data processing runs practically eliminates the time once allotted to examining the findings, reflecting on their implications, and evolving hypotheses. Now empiricists will be more sorely tempted than ever to keep shooting in the dark on the assumption that with enough shots some interesting reading or correlation will be hit. While no computer can stop a scientist from reflecting, with rapid response tools ready and waiting the temptation to "see what will happen," rather than evolve a suggestive theorem will be greater than ever. Increasingly, scientific work may be done by what is, in effect, a trial-and-error search, rather than a focused effort. And, in consequence, the findings may be an aggregate of data rather than confirmation of a theorem.

Such a development would be a latter-day repeat performance of the impact the introduction of prepackaged computer programs has had on some branches of the social sciences. There, the ability to use a prepackaged program to "analyze" a data set, say of the opinions of a random national sample of adults, often results in interpretations that have all the convenience but also the bite of a precooked, frozen TV dinner. This is because existing categories are used even if they do not capture well the variables under study. Thus, opinions are analyzed in terms of sex, age, income, and size of city, even if these correlate poorly with the issues at hand. Much to-do then is made over a difference of a few percentage points between subgroupings (say young versus old), while much greater differences would be found if more suitable but less commonly tapped variables (or combinations thereof) were teased out. Finding such variables, however, requires considerable intellectual, not mechanical, effort—less use of prepackaged programs and more of scientific creativity.

The solution is not to stop the evolution of inexpensive, versatile, indefatigable automated assistants. Perhaps one way to enjoy the benefits of compact computers without falling into their empiricistic clutches is to train graduate students to recognize the danger of allowing the computers to set the pace and direction of their work and the need to protect time for reflection. Also, partial automation of the higher order of data processing, developing theories and deriving hypotheses, may be advanced in the future so that these capacities may be used to correct for the empiricism the new generation of mini- and microcomputers seems to promote.—AMITAI ETZIONI, *director, Center for Policy Research; Columbia University, New York 10027*



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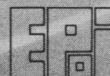
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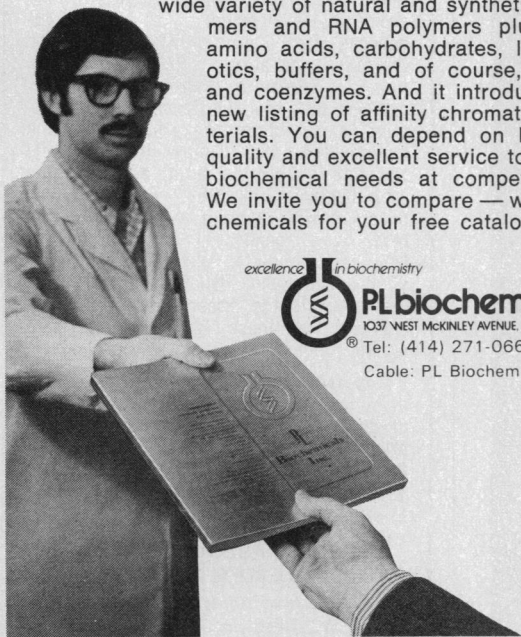
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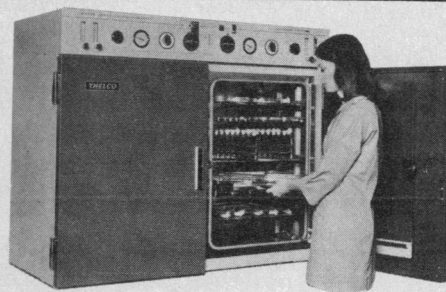
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# PRODUCTS and MATERIALS

## Scanning Spectrophotometer

The model 200 (Fig. 1) features scanning speeds up to 240 nanometers per minute. It has a variable band pass over the range from 0.2 to 4 nanometers. Stray light is less than 0.1 percent at 220 nanometers. This ultraviolet-visible device may be used with cylindrical long-path cells up to 100 millimeters, with microcells or flow cells and with an integrating sphere to allow measurements of reflectance. The device will also accommodate an automatic sampling device, an automatic zero feature, derivative scanning, an X-Y recorder interface, and a wavelength programmer. Perkin-Elmer Corporation, Instrument Division. Circle 809.

## Data Storage System

Diskette (Fig. 2) is available in 315K-byte (single drive) or 630K-byte (dual drive) configurations and includes a controller for up to four drives, a power supply, and necessary cabling and terminations. Software support for the system as an input-output device is provided. The system uses low-cost, flexible recording media introduced through a slot on the front of the drive unit. A head positioning system controls the radial positioning of the read/write head to any of 77 tracks. Data General Corporation. Circle 810.

## Drafting System

System 1 accepts a freehand sketch as input. The sketch is entered into a computer through a data tablet. The computer performs a layout and produces a final drawing. Changes may be plotted and corrected drawings may be generated easily.

Newly offered instrumentation, apparatus, and laboratory materials of interest to researchers in all disciplines in academic, industrial, and government organizations are featured in this space. Emphasis is given to purpose, chief characteristics, and availability of products and materials. Endorsement by *Science* or AAAS is not implied. Additional information may be obtained from the manufacturers or suppliers named by circling the appropriate number on the Readers' Service Card (on pages 90A and 154A) and placing it in the mailbox. Postage is free.—RICHARD G. SOMMER

The operator uses a Symbol Selection Sheet and a Keyboard and Control Panel to enter the text. The advantage of this system is that the engineer's rough sketch does not have to be laid out on a grid before it is digitized or constructed on a panel. Processing routines standardize symbol size and lettering, straighten lines, and move symbols and lines to produce a final sketch. Design Aids Incorporated. Circle 808.

## Polarizing Microscope

Model POH-3 includes a 6-volt, 15-watt transformer; a centered flat-filament lamp; a solid-state dimmer control with its own on-off switch; and a voltmeter. The base is larger and more stable than the previous model in this line. Bulbs are easily replaced by sliding the lamp socket assembly out toward the rear of the base. In place of the field diaphragm and centerable collector lens, there is a large fixed diffusion filter above which is a receptacle for 45-millime-

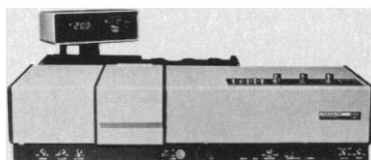


Fig. 1. The Perkin-Elmer model 200 double beam ultraviolet/visible spectrophotometer displays results in absorbance units, concentration, and percent transmittance.

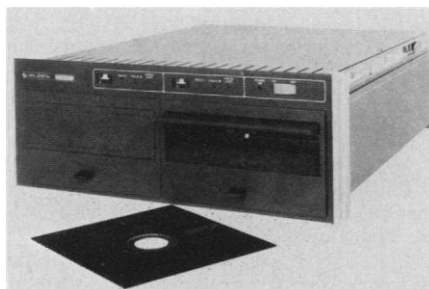


Fig. 2. Data General's Diskette uses a flexible recording medium. A single controller can accommodate four-drive units at 315K bytes each for a total of 1.26 megabytes per controller.

ter filters or a mirror and fork assembly. Ehrenreich Photo-Optical Industries, Incorporated. Circle 811.

## Fraction Collector

The PF-30 is designed for preparative use. It will collect up to 30 fractions of any size. There is an internal control which is programmable for 1- to 99-minute collection intervals per fraction. It is controllable from an external source. The unit is free-standing; its design permits the use of a variety of collection vessels. Components in contact with the liquid stream are easily dismantled for cleaning. The PF-30 provides event-marker output for all types of recorders. Flow rates of up to 2.5 liters per minute may be achieved. Pharmacia Fine Chemicals. Circle 816.

## Literature

*Photon Counting* is a catalog that explains the measurement of low-level signals from photomultipliers and electron multipliers. Princeton Applied Research Corporation. Circle 801.

*Arc Source Catalog* lists xenon and mercury short-arc lamps and discusses applications. Oriel Corporation of America. Circle 804.

*No. 903 Specimen Collection Paper* features scientific abstracts to illustrate clinical uses of the products. Schleicher & Schuell, Incorporated. Circle 805.

*1975 Catalog* is available from the American National Standards Institute. It includes fields from acoustics to information systems to nuclear to welding and wood products. Circle 806.

*Thermix Hot Plate-Stirrer* is the subject of a product bulletin. Fisher Scientific Company. Circle 807.

*Molecular Filtration Manual* describes the concentration, desalting, purification, and fractionation of macromolecules, colloids, and viruses. Millipore Corporation. Circle 812.

*Dissolved Oxygen/BOD Instrument Catalog* includes probes and accessories for the portable electronic instruments listed. Yellow Springs Instrument Company. Circle 813.

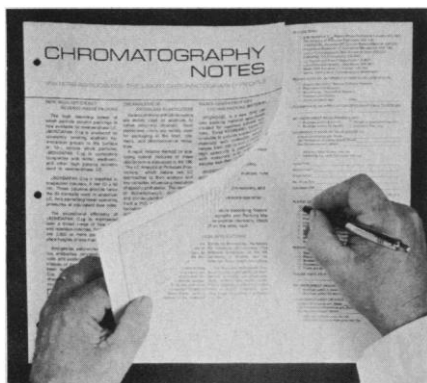
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## BOOKS RECEIVED

(Continued from page 134)

**Biochemistry of Cell Differentiation.** J. Paul, Ed. Butterworth, London, and University Park Press, Baltimore, 1974. xii, 380 pp., illus. \$19.50. MTP International Review of Science. Biochemistry, Series One, vol. 9.

**Biochemistry of Nucleic Acids.** K. Burton, Ed. Butterworth, London, and University Park Press, Baltimore, 1974. xii, 364 pp., illus. \$19.50. MTP International Review of Science. Biochemistry, Series One, vol. 6.

**Biology and Paleobiology of Ostracoda.** Proceedings of a symposium, Newark, Del., Aug. 1972. Frederick M. Swain, Louis S. Kornicker, and Robert F. Lundin, Eds. Paleontological Research Institution, Ithaca, N.Y., 1975. 688 pp., illus. Cloth, \$22.60; paper, \$18.60. *Bulletins of American Paleontology*, vol. 65, 1975.

**Butterflies of Lebanon.** Torben B. Larsen. Photographs by Peter Harrison Smith. National Council for Scientific Research, Beirut, Lebanon, 1974 (U.S. distributor, Entomological Reprint Specialists, Los Angeles). xvi, 256 pp. + plates. \$22.50.

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**Clinical Radioassay Procedures.** A Compendium. Paige K. Besch and six others, Eds. American Association of Clinical Chemists, Washington, D.C., 1975. x, 338 pp., illus. \$12.

**The Compton Effect.** Turning Point in Physics. Roger H. Stuewer. Science History Publications (Neale Watson), New York, 1975. xii, 368 pp., illus. \$25.

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**Ecosystems, Energy, Population.** Jonathan

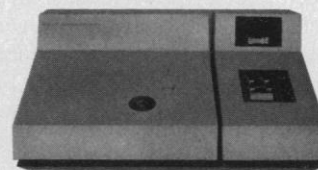
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Turk, Janet T. Wittes, Robert Wittes, and Amos Turk. Saunders, Philadelphia, 1975. xii, 296 pp., illus. Paper, \$7.95. Saunders Golden Series in Environmental Studies.

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**Future Directions for Engineering Education.** System Response to a Changing World. A Report by the Center for Policy Alternatives prepared for the School of Engineering of the Massachusetts Institute of Technology. American Society for Engineering Education, Washington, D.C., 1975. 108 pp., illus. Paper, \$1.50.

**Genetics of Flowering Plants.** Verne Grant. Columbia University Press, New York, 1975. xiv, 514 pp., illus. \$20.

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**Life Stress and Illness.** Papers from a symposium, Beito, Norway, June 1972. E. K. Eric Gunderson and Richard H. Rahe, Eds. Thomas, Springfield, Ill., 1974. x, 264 pp., illus. \$19.50.

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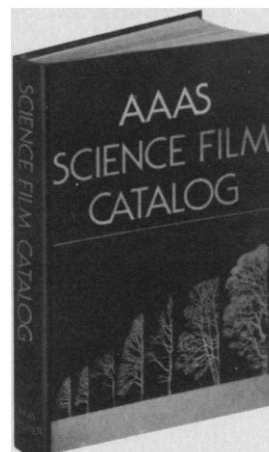
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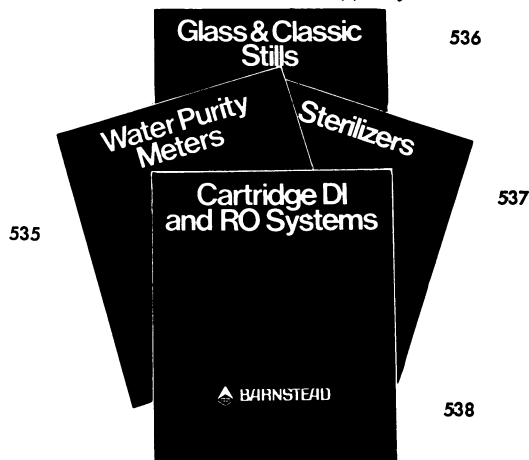
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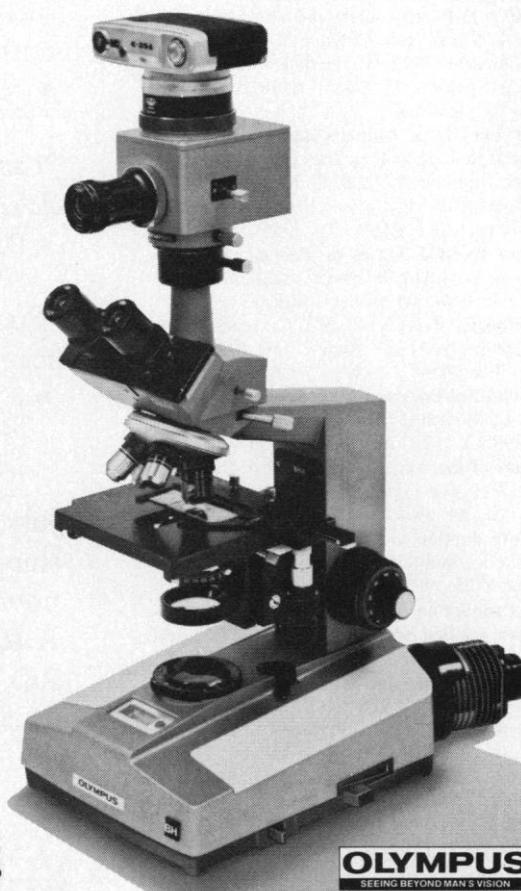
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**Man and the Natural World.** An Introduction to Life Science. Coleman J. Goin and Olive B. Goin. Macmillan, New York, ed. 2, 1975. xiv, 640 pp., illus. \$12.95.

**Manual of Quantitative Genetics.** Walter A. Becker. Program in Genetics, Washington State University, Pullman, ed. 3, 1975. xii, 170 pp. Spiral bound, \$8.

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**Nomads of the Nomads.** The Āl Murrah Bedouin of the Empty Quarter. Donald Powell Cole. Aldine, Chicago, 1975. 180 pp. + plates. Cloth, \$10; paper, \$3.45. Worlds of Man.

**Il Nuovo Pokorny.** La Botanica Illustrata. Arturo Ceruti. Loescher, Turin, Italy. iv, 706 pp. + plates. Paper, L7500.

**Oral History of Twenty-Five Years of American Cardiology.** Celebrating the 25th Anniversary of the American College of Cardiology, 1949-1974. American College of Cardiology, Bethesda, Md., 1974. Album with booklet and five tape cassettes. \$25.

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**Poverty.** A New Perspective. George L. Wilber, Ed. University Press of Kentucky, Lexington, 1975. viii, 200 pp., illus. \$13.50.

**The Precious Metals of Medicine.** Geoffrey Marks and William K. Beatty. Scribner, New York, 1975. xxvi, 294 pp., illus. \$7.95.

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**Principles of Systems Programming.** Robert M. Graham. Wiley, New York, 1975. xvi, 422 pp., illus. \$16.95.

**Prostaglandin Synthetase Inhibitors.** Their Effects on Physiological Functions and Pathological States. Proceedings of a symposium, New York, Nov. 1973. Harry J. Robinson and John R. Vane, Eds. Raven, New York, 1974. xii, 396 pp., illus. \$24.

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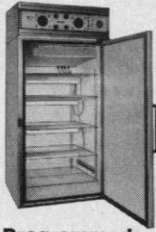
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**Schoolteacher.** A Sociological Study. Dan C. Lortie. University of Chicago Press, Chicago, 1975. xii, 284 pp. \$9.95.

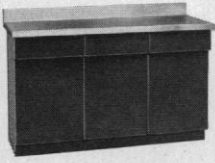
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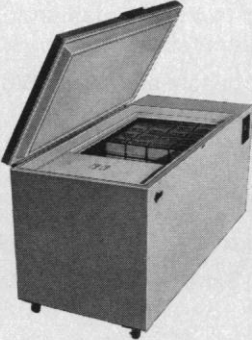
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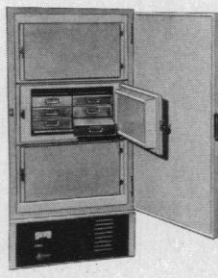
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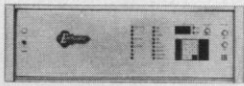
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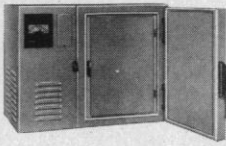
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