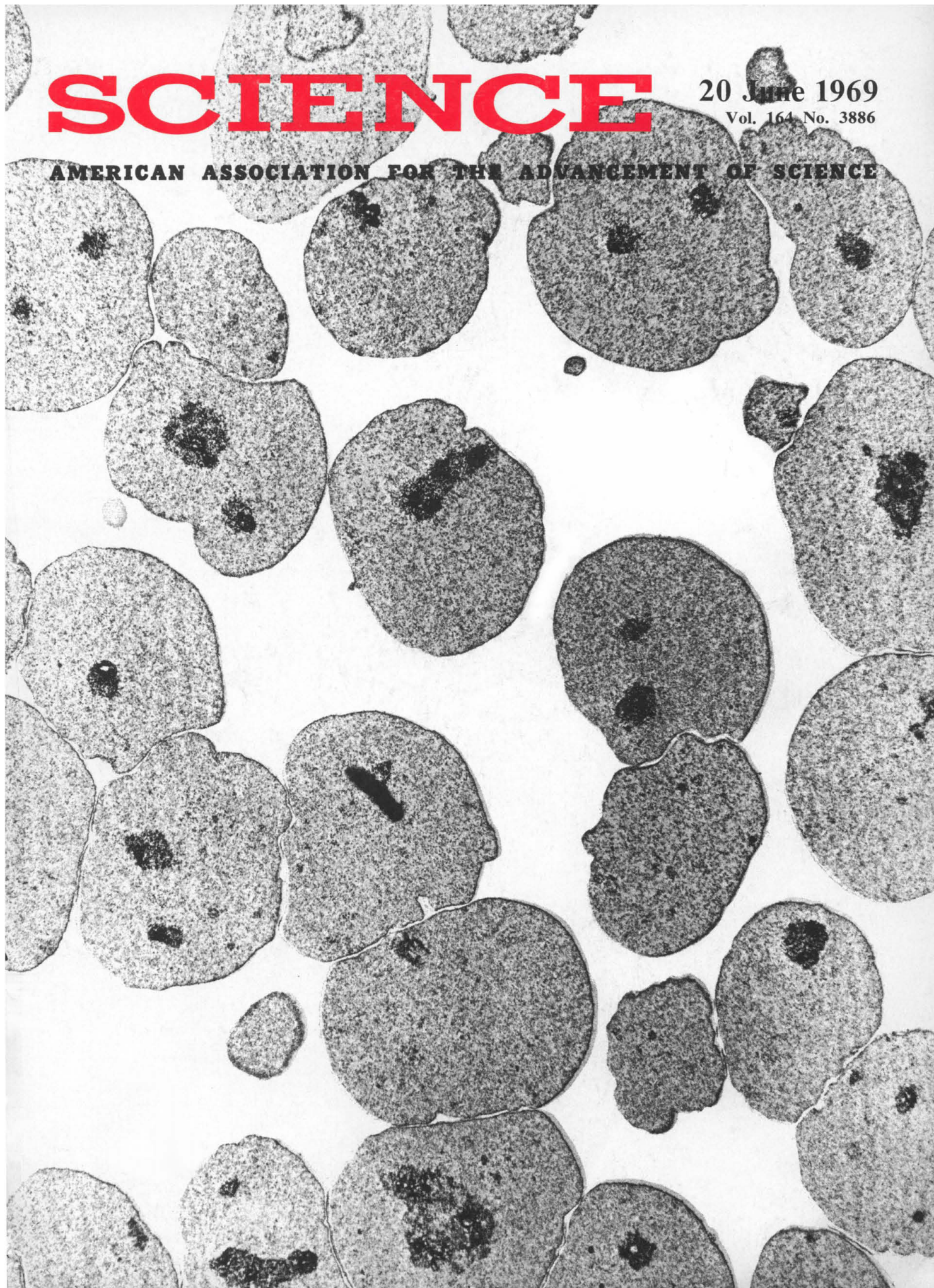


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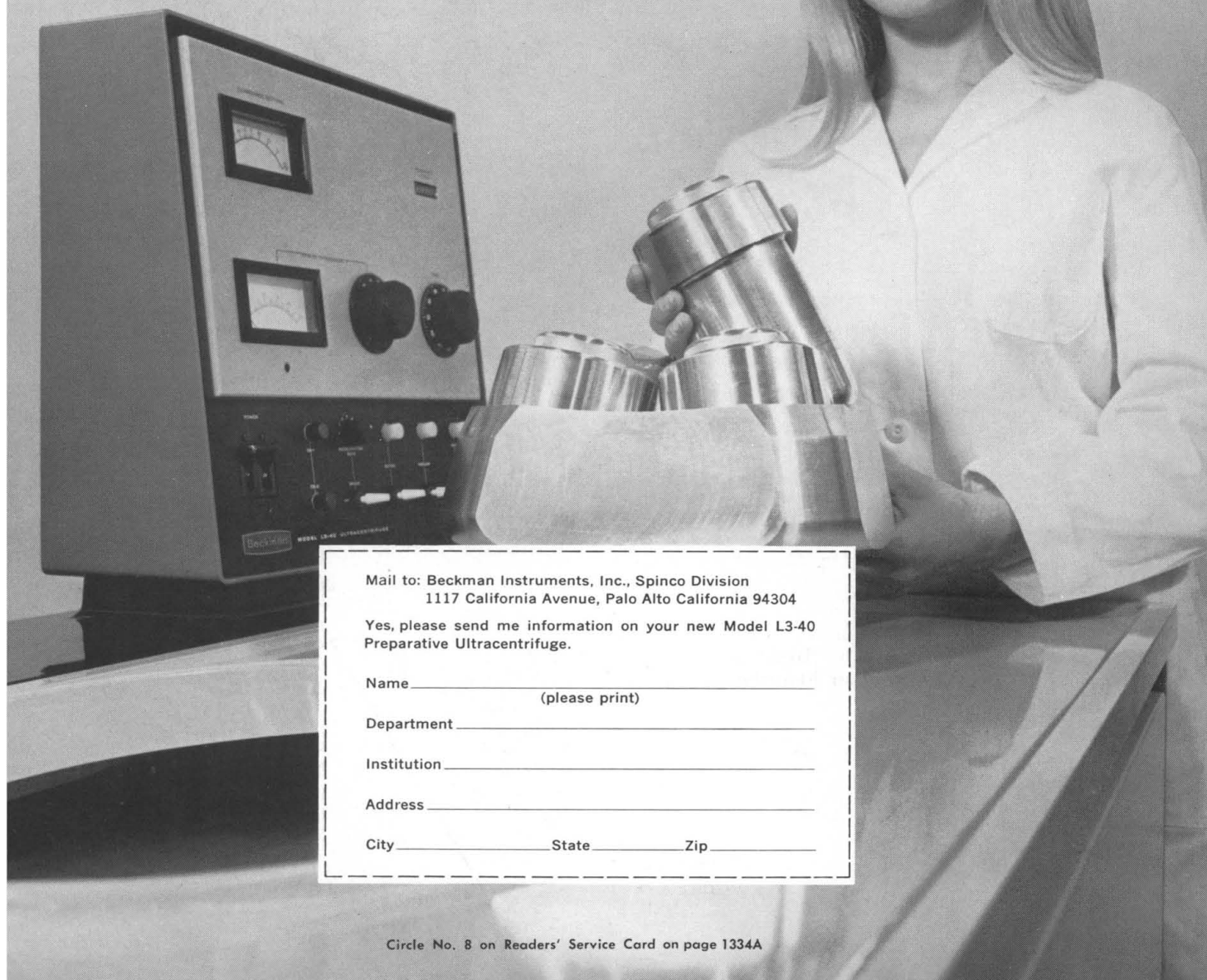
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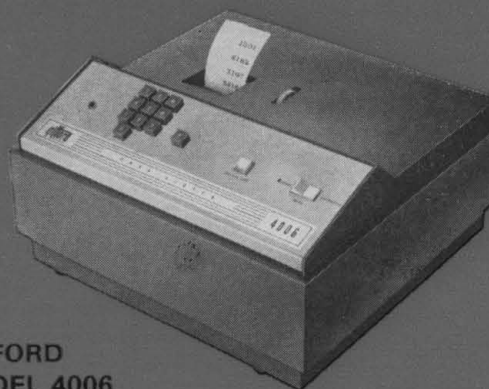
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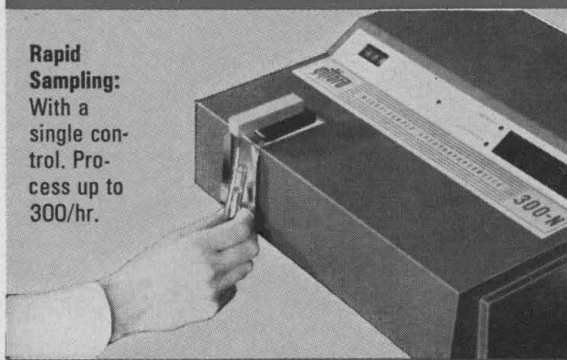
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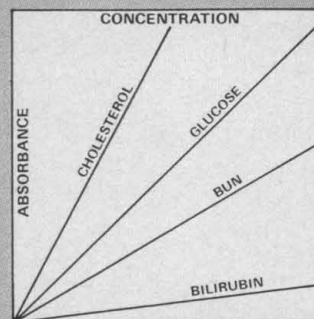
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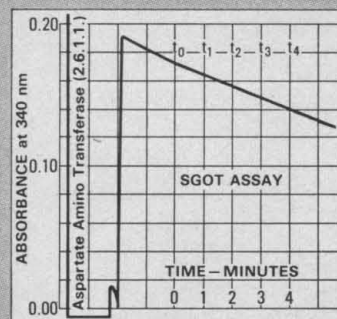
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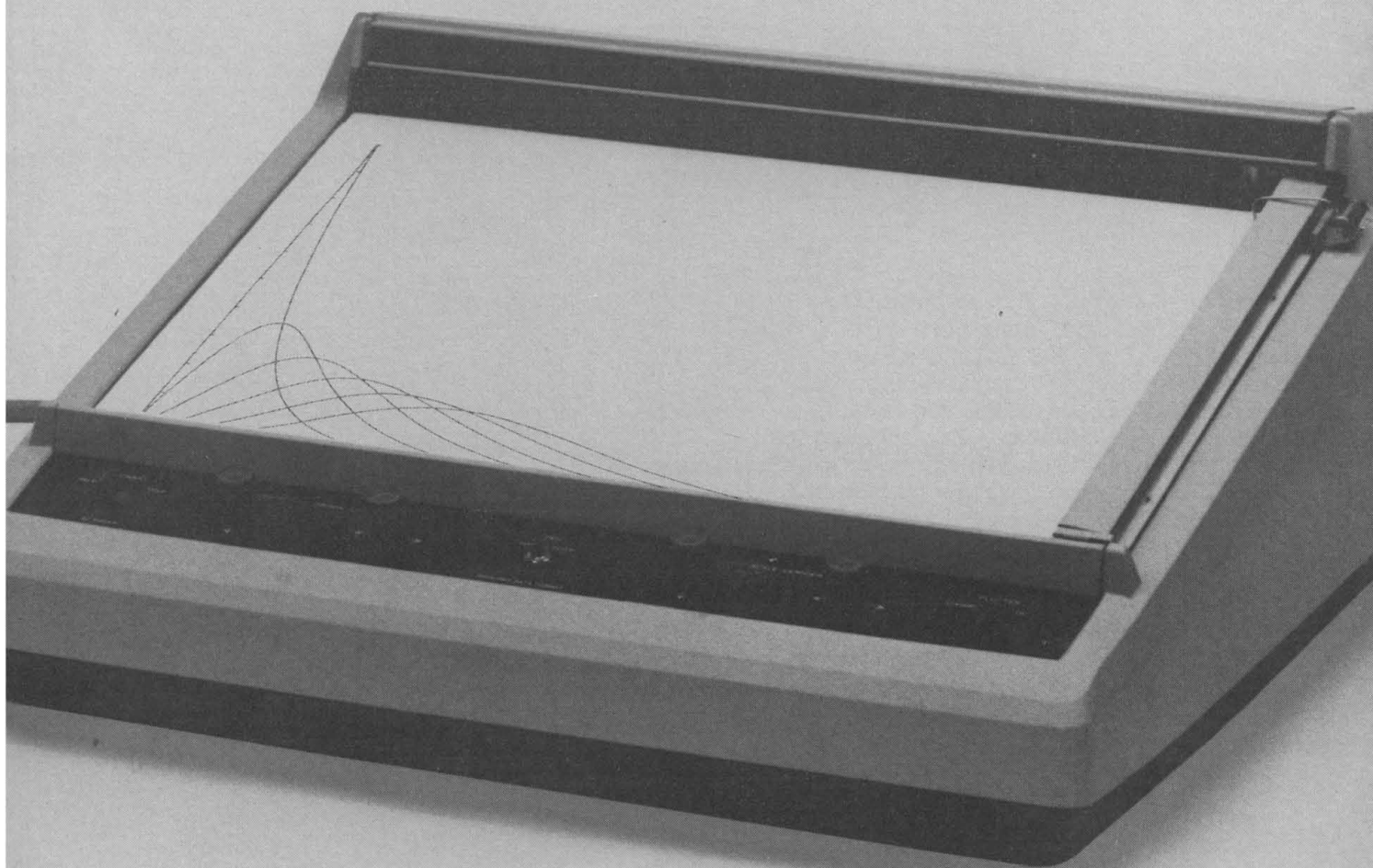
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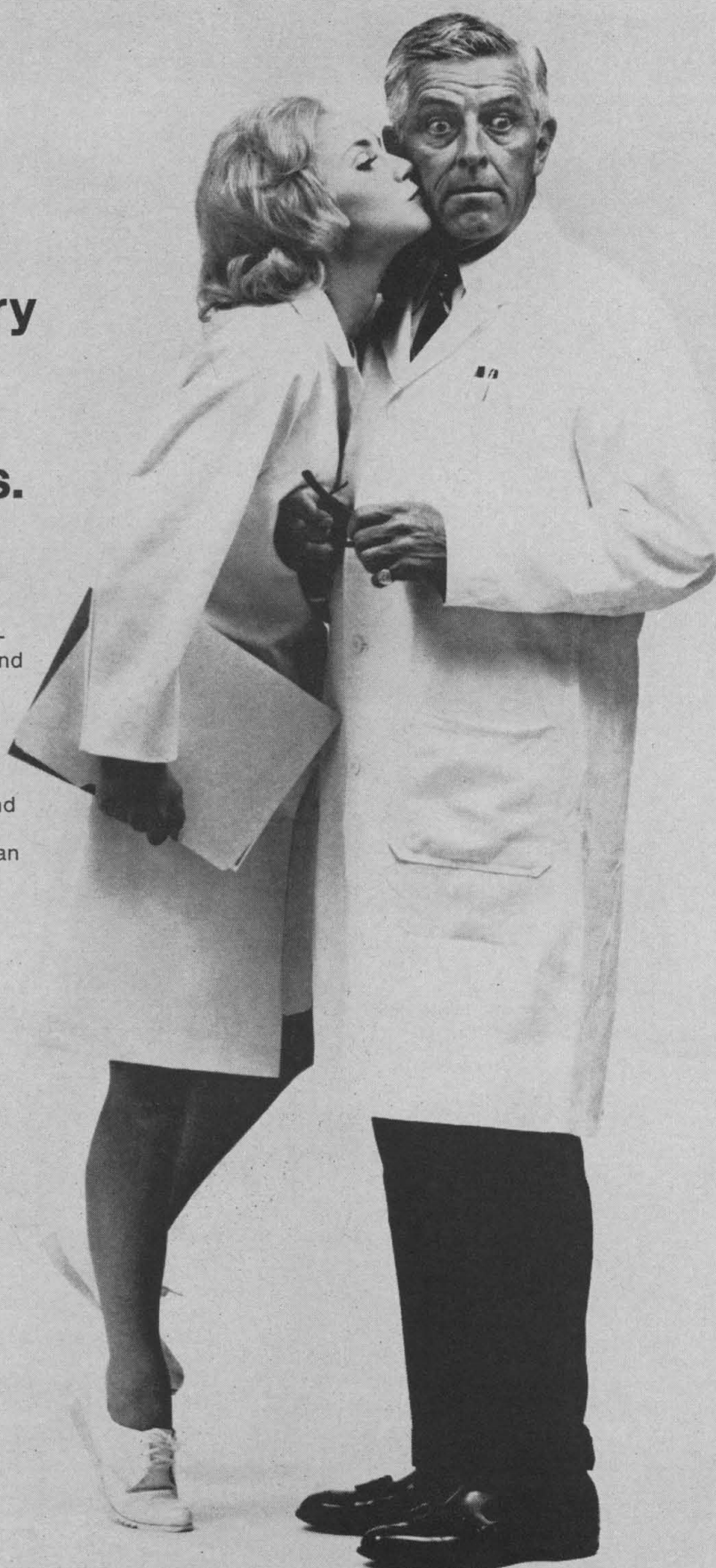
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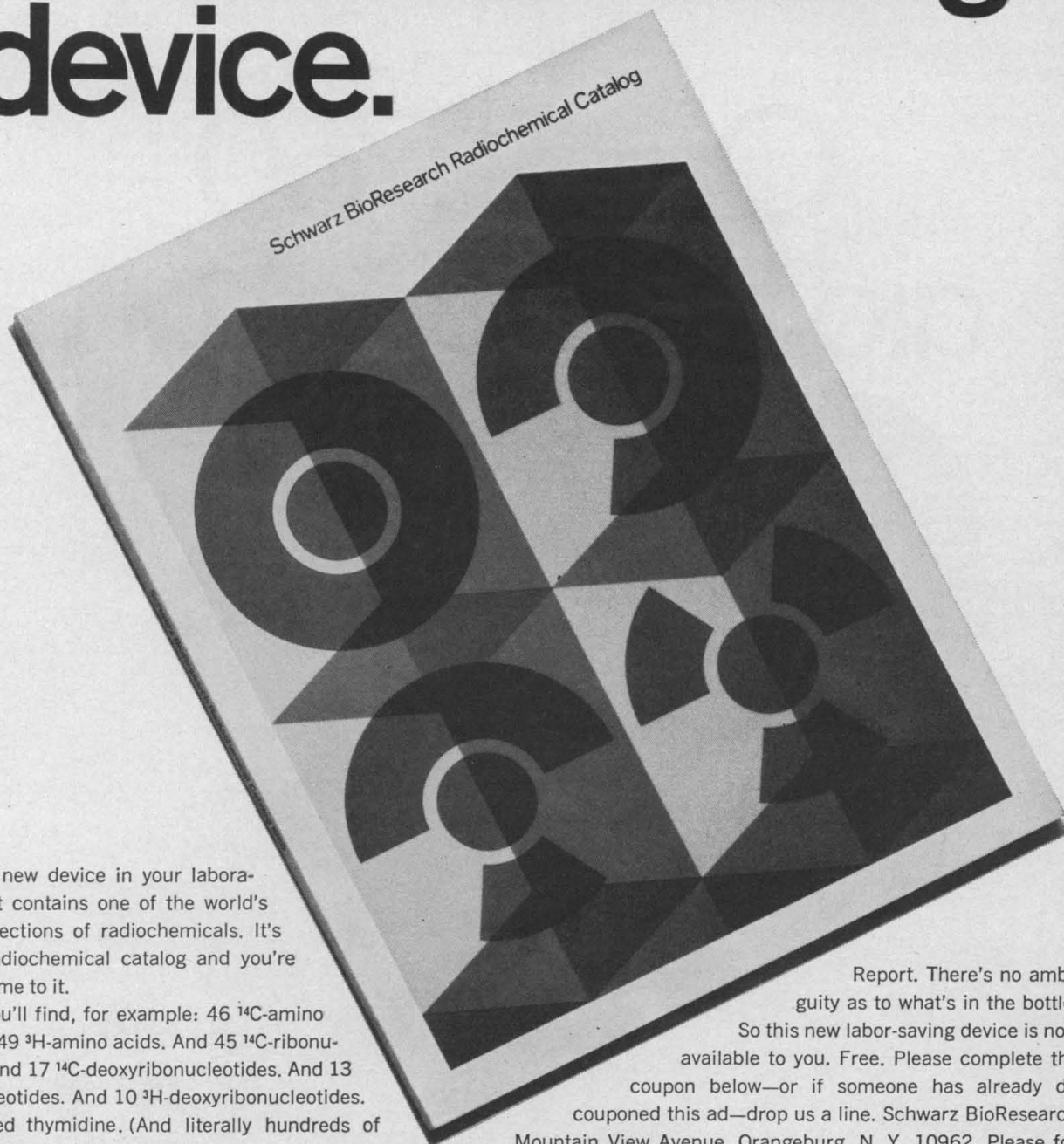
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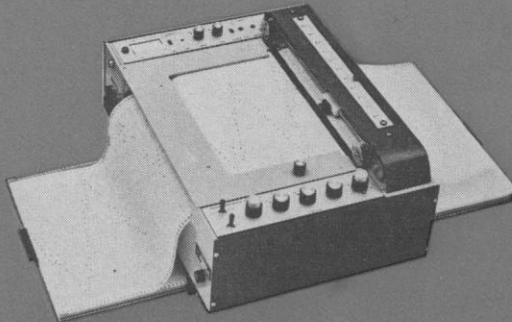
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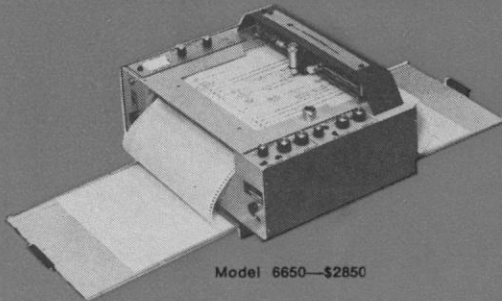
**jeolco** U.S.A. Inc. Electron Optics Division  
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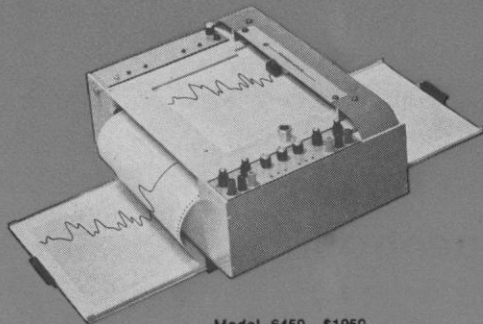
# Omnigraphic™ Plotters Continue to Offer More Features, Less Cost



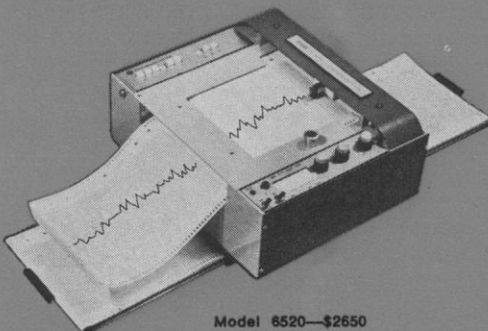
Model 6550—\$2850



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Model 6450—\$1950



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## High speed point plotting for the Nuclear Lab:

Here is the popular OMNIGRAPHIC™ point plotter designed for use with pulse height analyzers, digital oscilloscopes, DVM's, counters or scanners. Simply plug in the 6550 and you get:

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- ☐ Bi-directional stepping motor on each axis steps up to 18,000 increments/min.
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- ☐ Send for complete information on this and other computer plotters.

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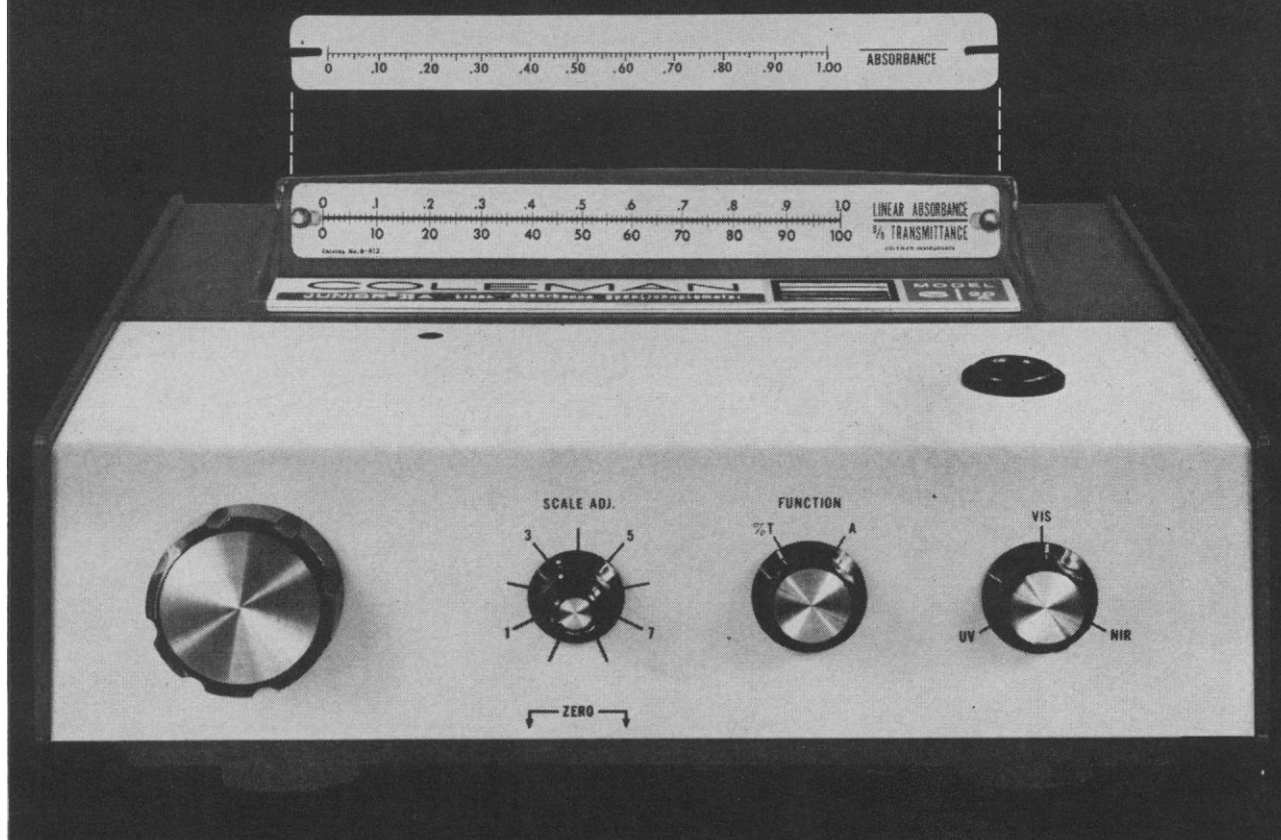
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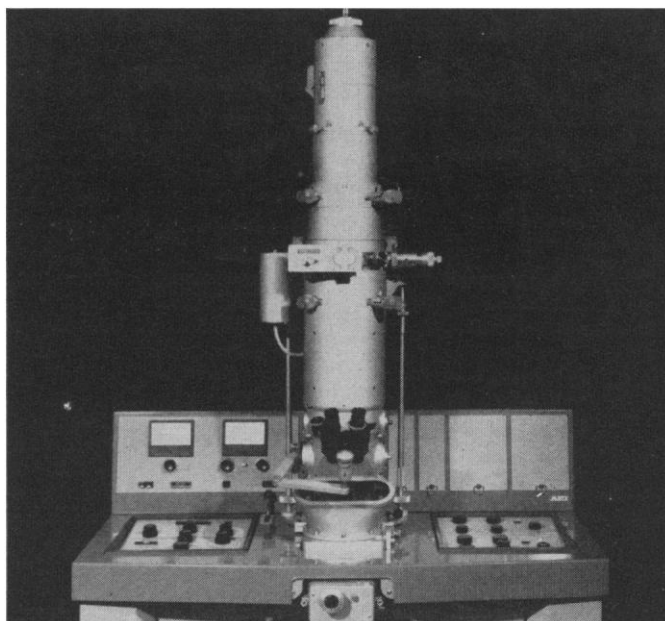
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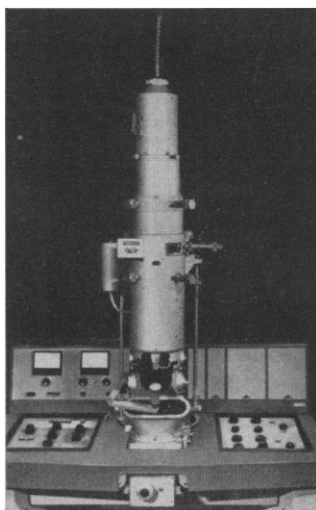
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## **The EM8: the electron microscope for scientists requiring ultra-high resolution.**

Resolution: 3Å, point-to-point, guaranteed. Multiple specimen holder: accepts 6 specimens at one loading. Magnification: 2,500 to 400,000 with a single control. Automated vacuum system: push-button controlled. Simplest ultimate performance microscope: minimum controls, virtual elimination of day-to-day alignment. Write for detailed literature on the EM8.

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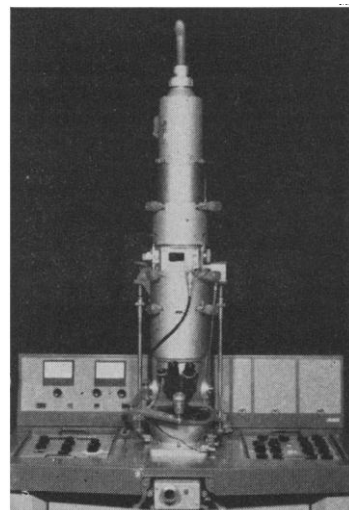


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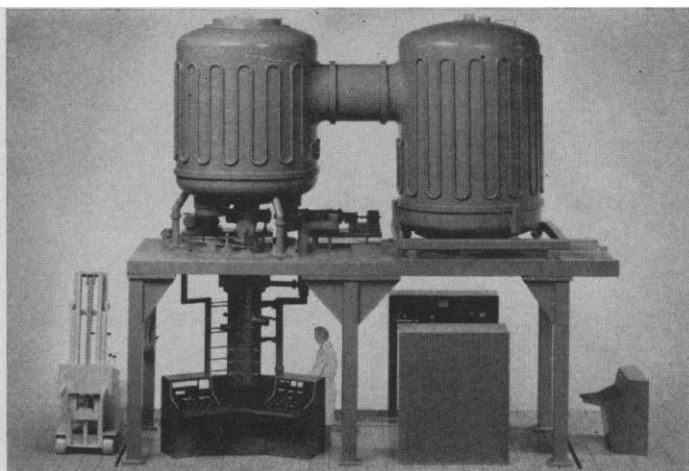
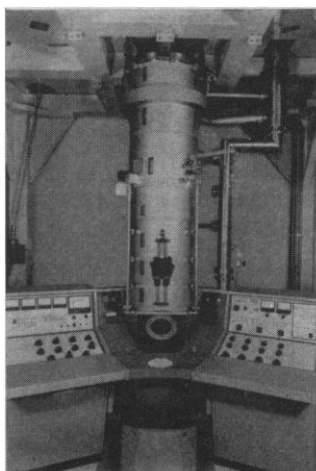


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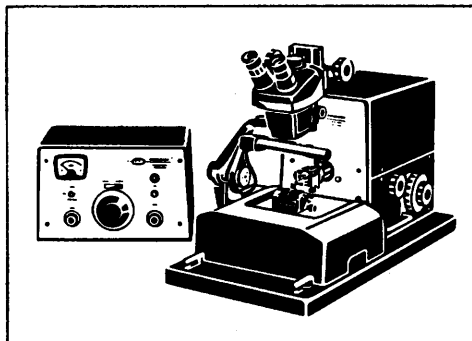
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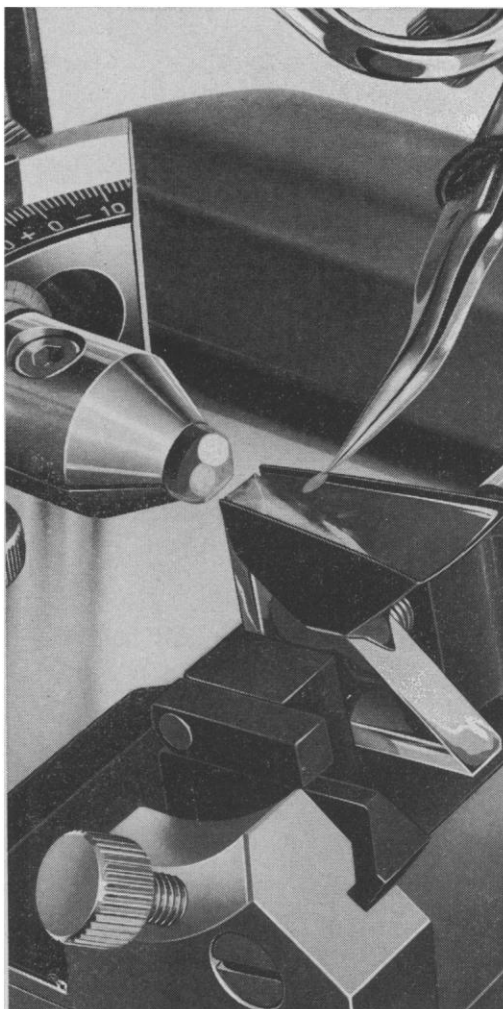


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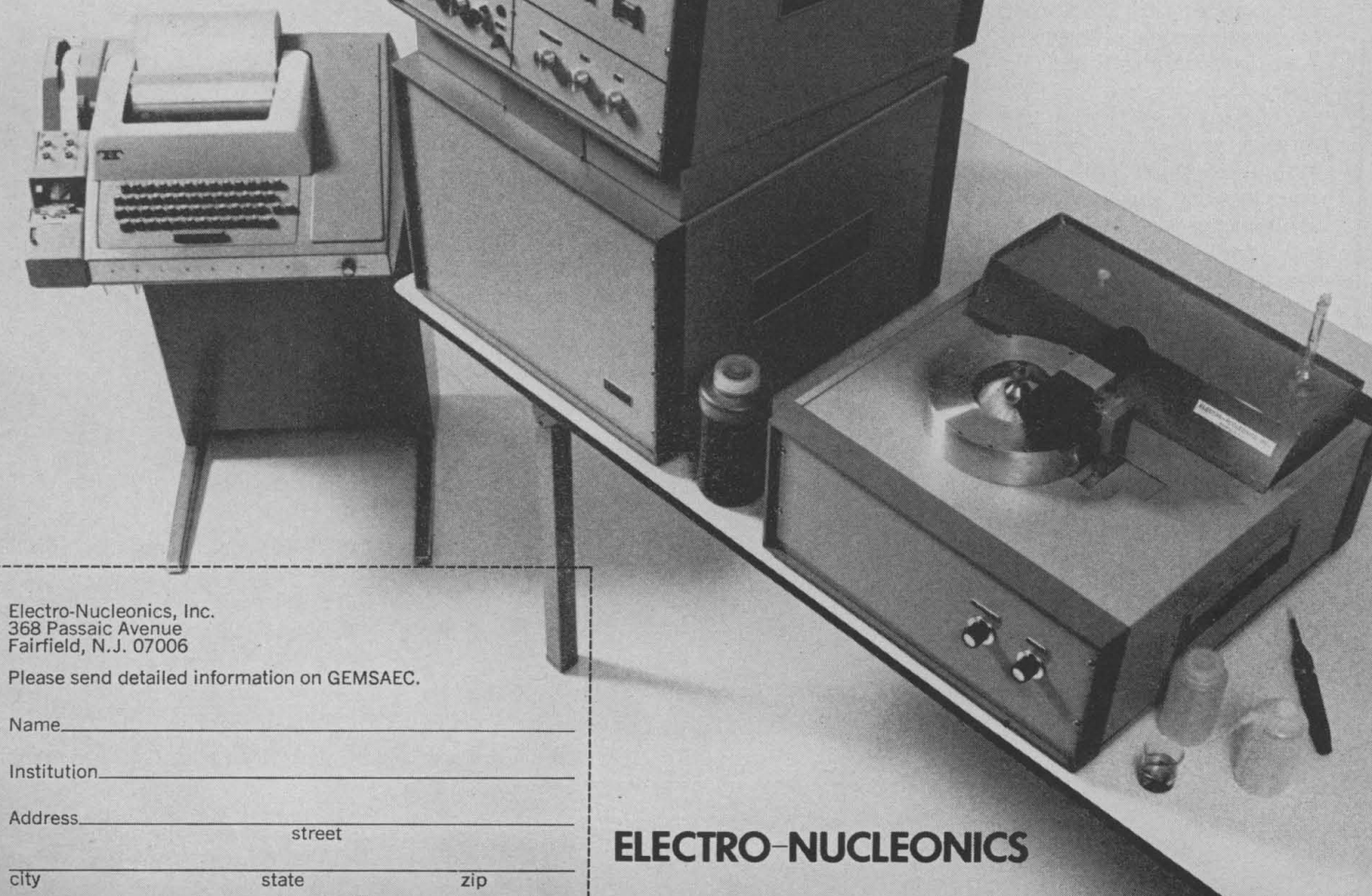
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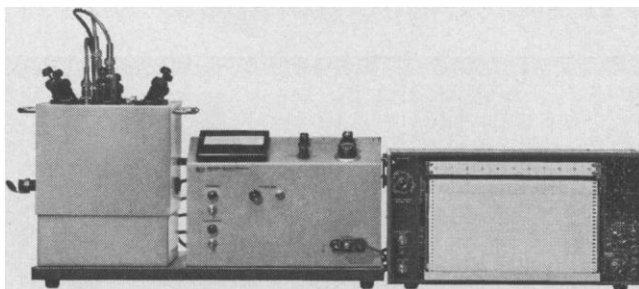
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**...and do away with stopwatches, bridge-balancing and note-taking**

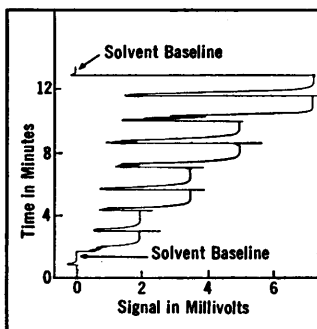
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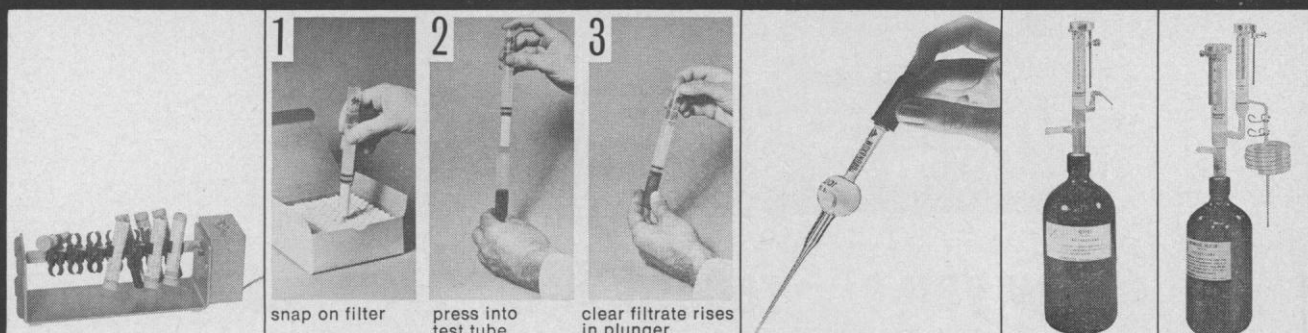
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2. STAT-FILTER®

3. GRUNBAUM PIPETS 4. REPIPETS® 5. DILUTORS

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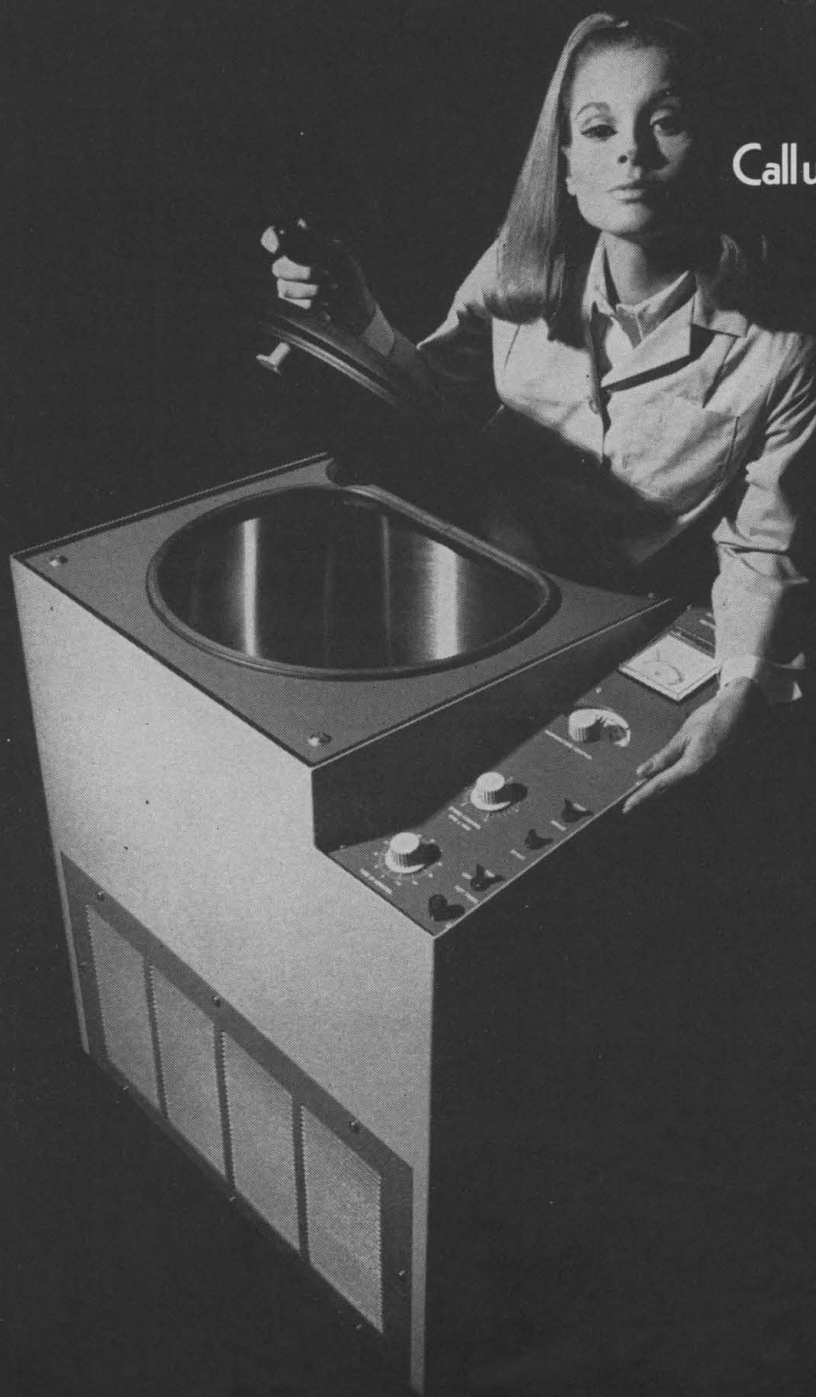
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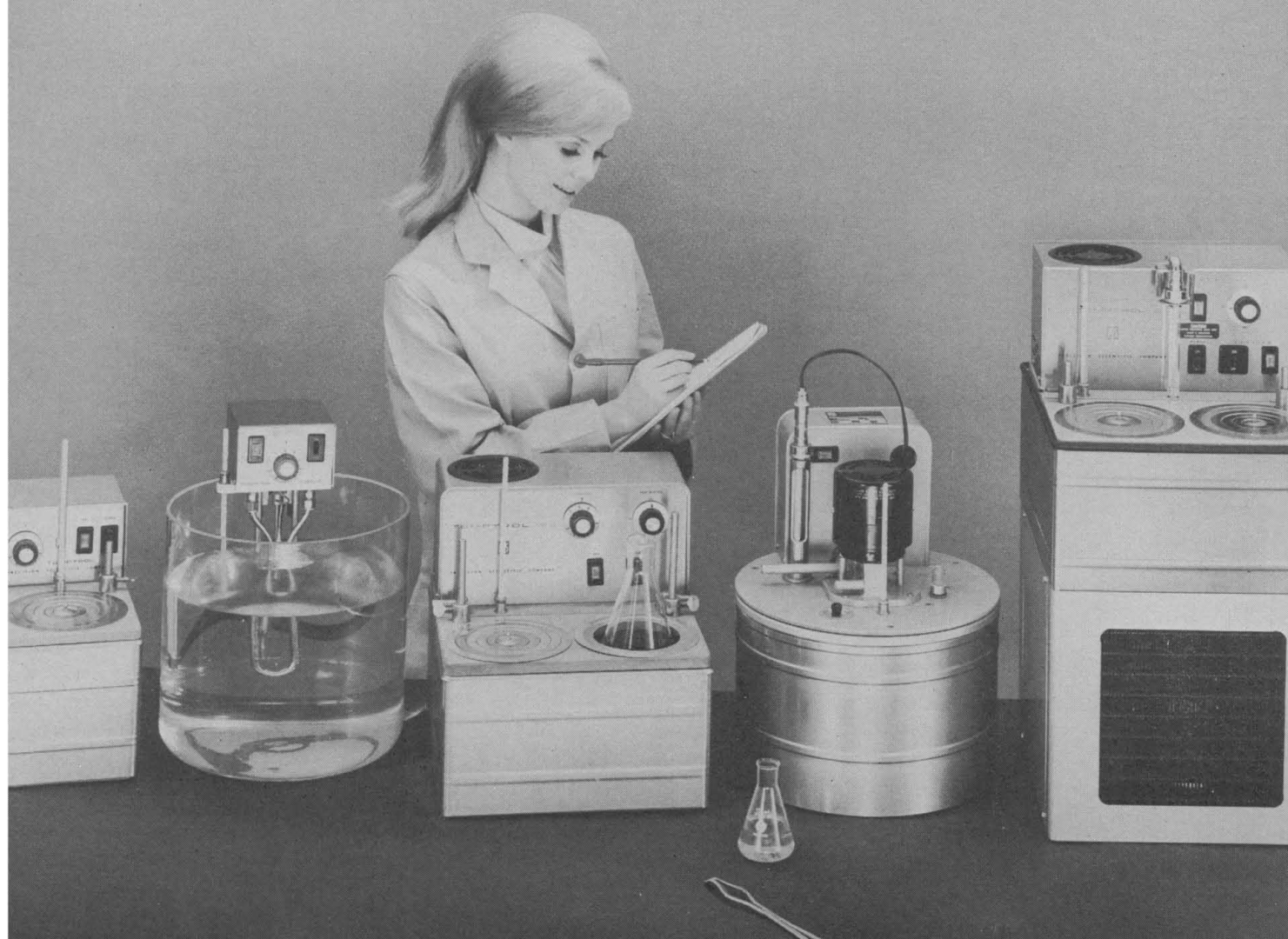
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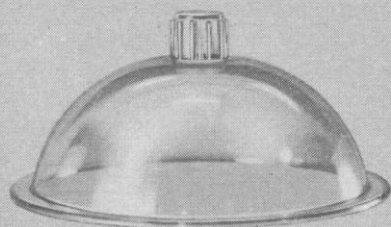
Reservoir capacity range is: 1.25, 2.25 and 2.75 gallons, plus the Lo-Temptrol which is a 15 gallon capacity unit that cools to  $-30^{\circ}\text{C}$ .

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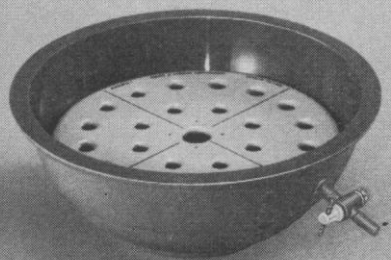
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## Electroluminescence Seen in 1907

H. C. Gatos in "Electronic materials and applications" (11 Apr., p. 137) states that "Electroluminescence was discovered in 1937, 10 years before the transistor." Electroluminescence in zinc sulfide was first observed by G. Destriau (1) in 1936 (2-4), not 1937. However, it has been known for a long time that electroluminescence in silicon carbide (also referred to by Gatos) had been seen as early as 1923 by Lossew (5). Furthermore, I recently reported (6) that similar observations on silicon carbide were made as long ago as 1907 by Round (7). Electroluminescence thus predates the transistor by 40 years, not a mere 10 years.

I would also like at this time to correct a misleading statement made in my reference 6. At the time Round published his results on silicon carbide, he was residing in New York City as stated. However, it has been pointed out to me (by P. C. Newman of Northampton, England) that Round was an English citizen and one of the pioneers of "wireless" in that country. Furthermore, in 1966 he was still alive and had attained the age of 85.

HENRY F. IVEY

Westinghouse Electric Corporation,  
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Pittsburgh, Pennsylvania 15235

### References

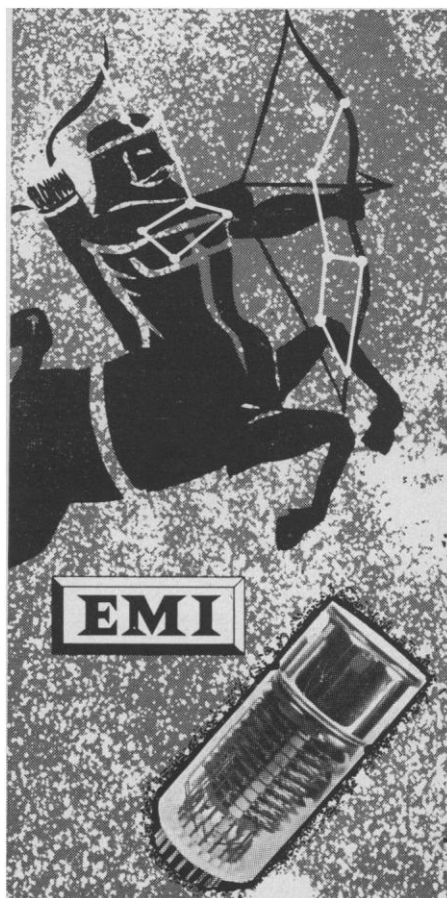
1. G. Destriau, *J. Chim. Phys.* **33**, 587 (1936), **34**, 117 (1937); *Trans. Faraday Soc.* **35**, 227 (1939).
2. — and H. F. Ivey, *Proc. IRE (Inst. Radio Engrs.)* **43**, 1911 (1955).
3. H. F. Ivey, *J. Electrochem. Soc.* **104**, 740 (1957).
4. —, *Electroluminescence and Related Effects* (Academic Press, New York, 1963).
5. O. W. Lossew, *Telegrafia i Telefonía*, No. 18, 61 (1923); *Wireless World* **15**, 93 (1924); *Phil. Mag.* **6**, 1024 (1928).
6. H. F. Ivey, *J. Electrochem. Soc.* **113**, 140C (1966); *IEEE Spectrum* (June 1966), p. 146.
7. H. J. Round, *Elec. World* **49**, 308 (1907).

## Relevance of Research to Students

In general, I find myself in strong agreement with Stephen J. Tonsor's speech of 1 April to the education committee of the National Association of Manufacturers which was endorsed by President Nixon (1). In particular, his proposal that the student exercise the choice in the placement of the funds supporting his or her education is the strongest possible reinforcement of diversification and, ultimately, relevance of an education.

However, I strongly disagree with

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on page 1334A



his general condemnation of research at universities. He contends that research leads to disengagement between students and faculty as if the only engagement is the classroom relationship. This is a mistake—both the implication that the only relevant engagement should be the classroom and, most important, that university faculty and administration should allow research to grow without ensuring a major and relevant relationship with students. The tragedy and mistake is that universities have allowed research to grow without demanding and ensuring a continuing student, and particularly undergraduate student, involvement. This involvement should take the form of part-time jobs—recognizing and forcing cognizance of the necessary so-called “inefficiency.” Indeed, part-time student help requires considerably more time and effort on the part of the faculty member, but this is just the so-called inefficiency that should, and must, be demanded. Undergraduate student employment in research at New Mexico Tech (60 percent of all undergraduate students) goes a long way toward achieving the student-faculty involvement that is so desperately needed at this time.

STIRLING A. COLGATE  
*New Mexico Institute of Mining and Technology, Socorro 87801*

#### Reference

1. For partial text, see *Chronicle of Higher Education* (1424 16th St., Washington, D.C., 5 May 1969), p. 3.

#### Misinterpretation

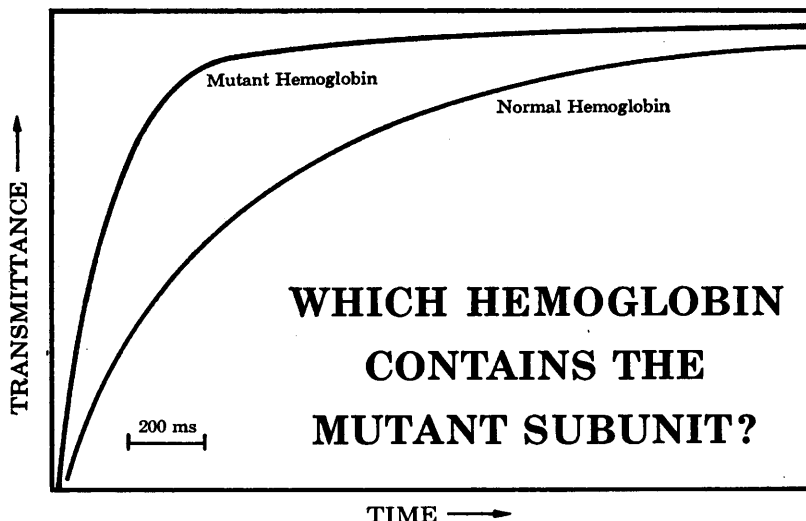
A policy of not replying to reviews is overridden in this case by unwillingness to let obviously false statements stand. In his review (9 May, p. 697) of my *Languages of Art*, Rudolph Arnheim writes: “This neatness entices Goodman to assert that a work of music is its score, just as he believes that a work of literature is its text.” I quote from page 210 of my book: “Thus in the different arts a work is differently localized. . . . In music, the work is the class of performances compliant with a character. In literature, the work is the character itself.”

The quality of the review may be judged from this sample.

NELSON GOODMAN  
*Department of Philosophy,  
 Harvard University,  
 Cambridge, Massachusetts 02138*

## CHEMICAL PROFILES

... drawn by Durrum

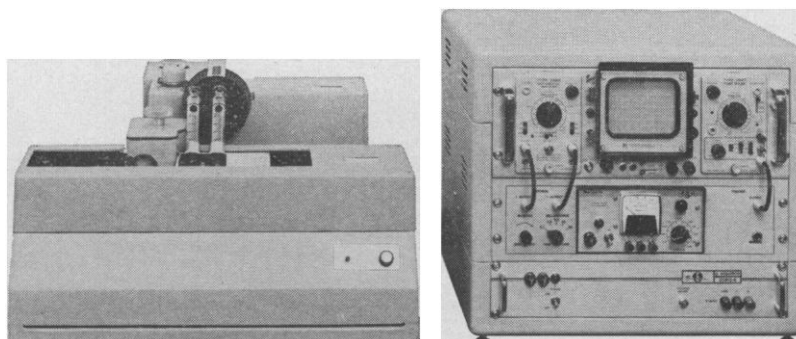


Even a minor molecular rearrangement can have a dramatic effect on chemical activity. These profiles\* recorded by a Durrum-Gibson Stopped-Flow Spectrophotometer reveal a 40-fold difference in azide-hemoglobin reaction rates. One reaction is with normal hemoglobin, the other with a mutant containing alpha-chain tyrosine residues in place of the usual proximal histidines.

Equilibrium constants would not have hinted at this difference; only kinetic tests with the Durrum-Gibson instrument permit the use of this new technique for classifying mutant types.

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\*AS REPORTED BY HENRY F. EPSTEIN AND LUBERT STRYER IN VOLUME 32 (1968) OF THE JOURNAL OF MOLECULAR BIOLOGY.



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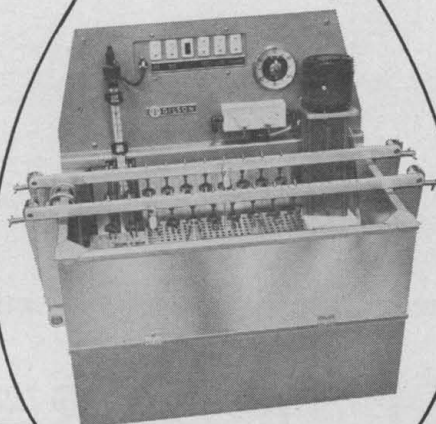
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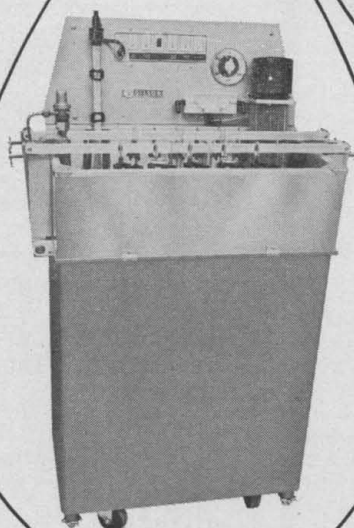
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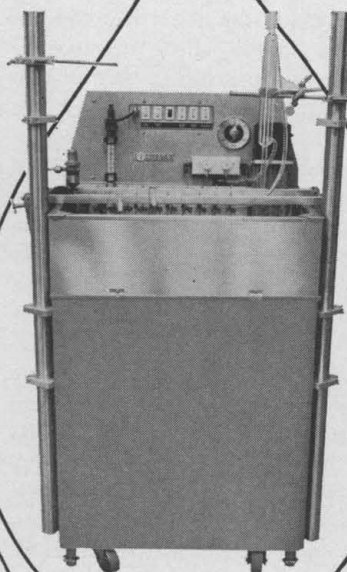
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## The Use of Arid Lands

The approximately 14 percent of the world's cropped lands that are under irrigation produce a fourth or more of the world's agricultural crops. As the food needs of a too rapidly growing population continue to increase, more and more of the arid and semiarid regions will be cultivated, for much of this land is capable of year-round use, and conditions are more favorable than in humid regions for the control of insects and disease and the advantageous timing of water application. One estimate is that by the year 2000 there will be twice the present 370 million acres under irrigation, even though the cost of new irrigation projects, which now averages almost \$400 per acre, is substantially higher than the cost of bringing new land in humid regions under cultivation.

The investment required means that irrigation agriculture can be economically successful only when combined with sophisticated farm technology. Yet too often, over the world, expensive water storage and distribution facilities have been uneconomically coupled with moderately primitive methods of farm operation.

These were some of the points made at the International Conference on Arid Lands in a Changing World which AAAS held in Tucson, Arizona, on 3 to 13 June. This was the second international arid lands conference held by the Association, and there were some significant differences between this one and the one held in 1955.

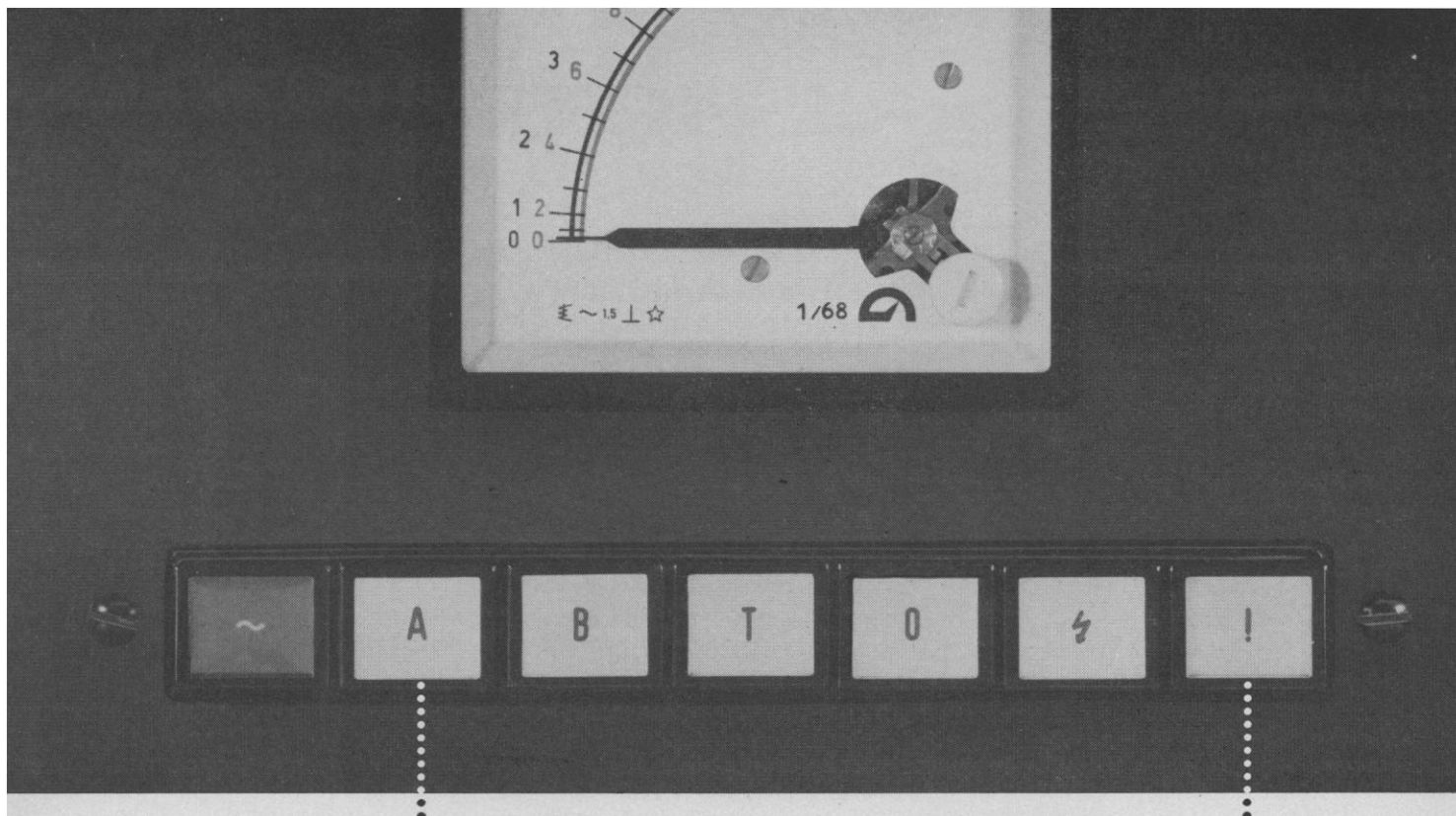
The participants, who came from every major arid area of the world, had a variety of technological advances to discuss—for example, remote sensing systems, desalting methods, and the new high-yield grains. Yet more significant than these developments was the greater attention paid to economic, to sociological, and especially to the management aspects of the complex problem of using a fragile environment continuously without destroying it. There were a few examples of long-enduring irrigation successes. But they were more than counterbalanced by reminders of how extensively man has unwittingly turned grassland and food-producing areas into wasteland and desert. The Sahara, for example, is still increasing by 40,000 acres a year.

A frequently expressed theme was the fact that agricultural improvement alone can do but little for the economic advance of many arid countries. One speaker estimated that a doubling by 1980 of the agricultural output of Iraq, without any increase in input—an implausible assumption—would raise per capita income from \$190 to \$220 a year. It was also reported that the economic effect of the High Aswan Dam and other projects in Egypt might be to increase per capita income from about \$130 to about \$142 a year, and that the irrigation canals were also responsible for a grave increase in schistosomiasis.

Other means than traditional agriculture with emphasis on grains and staples will be necessary if substantial increases in per capita income are to be achieved. Specialty products, industrial or other nonagricultural developments, and—as many speakers mentioned—increased tourism will be needed if most of the arid regions are ever to reach the stage of self-generating economic growth.

But traditional agriculture is the base from which these regions must start, and thus the need for wise land management was reemphasized. The arid lands experts were uncertain whether the pressure to exploit more of the arid lands would, quite literally, in the long run make the deserts bloom or produce more Saharas. In a larger sense they were illustrating, from the consequences of several millennia of irrigational history, that trying to control the environment is hazardous and insufficient. Man must also adapt to it.—DAEL WOLFLE



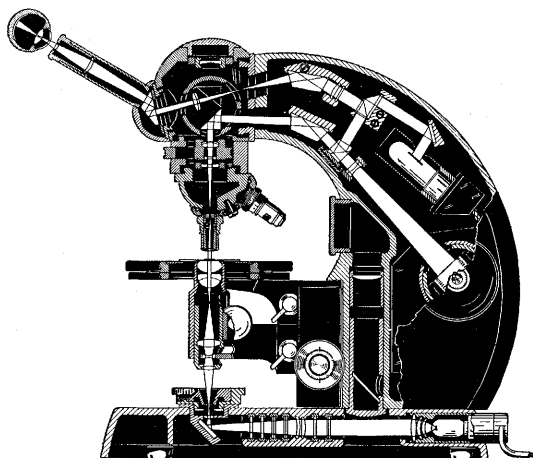


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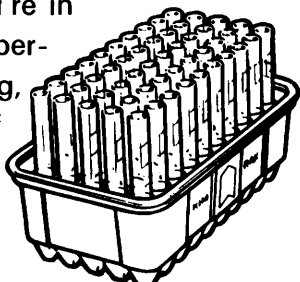
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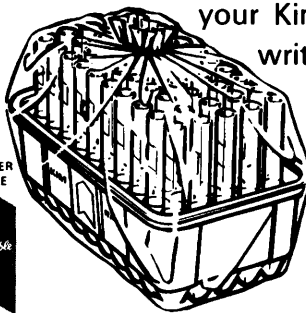
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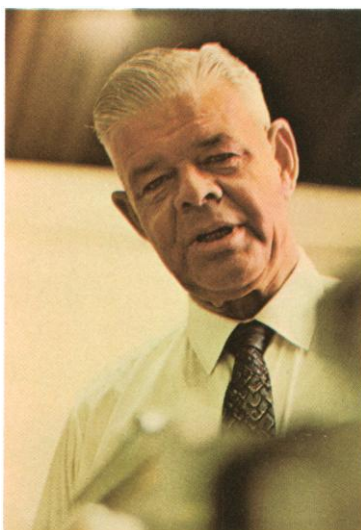
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the quality of the recorded information.

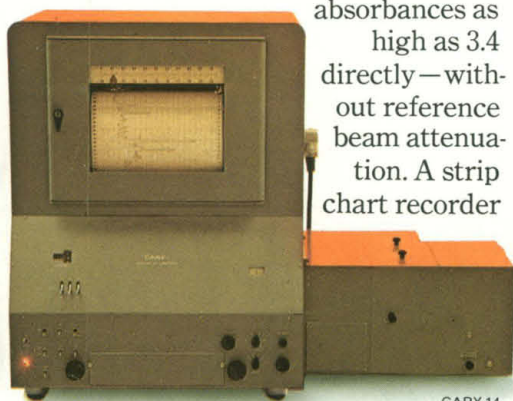
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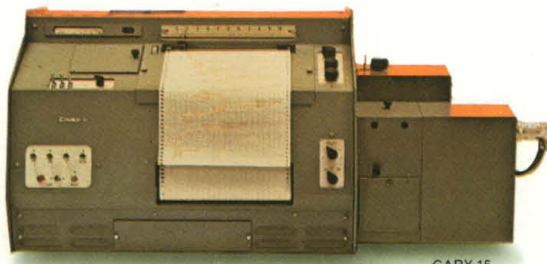
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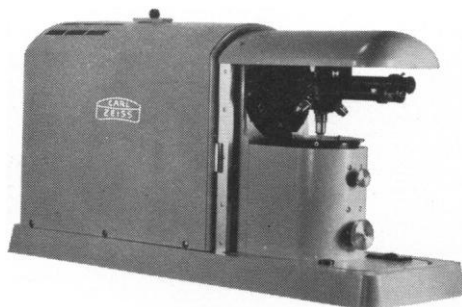
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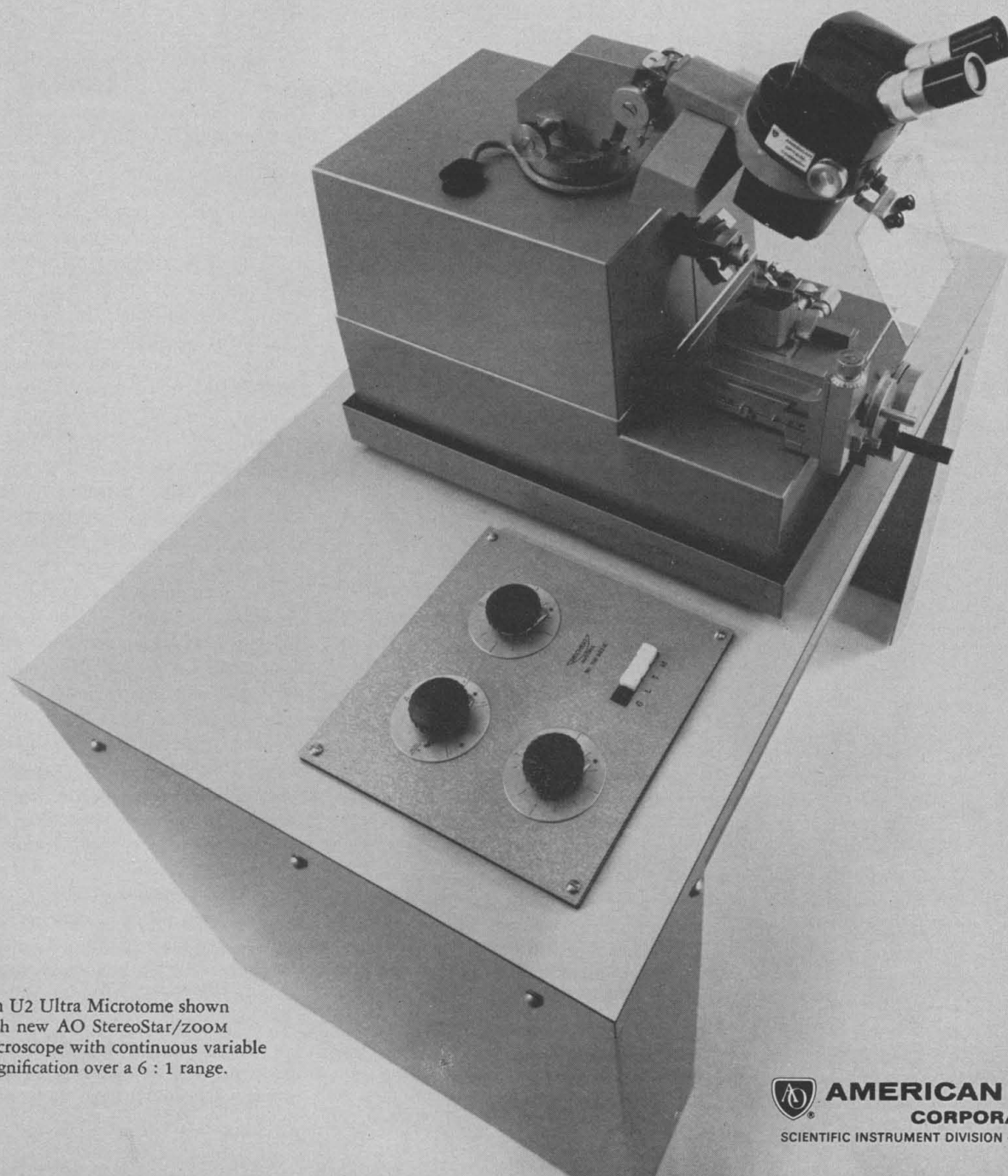
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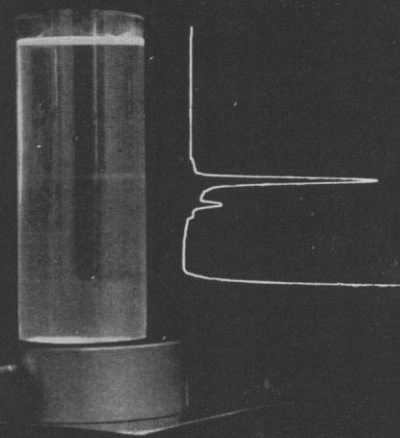


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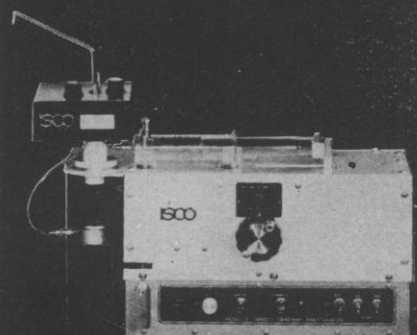


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cies significant loss of red cells into the tissues may occur with moderate thrombopenia in the absence of overt hemorrhage. An apparent interaction between neutropenia and platelet deficiency was pointed out by Flidner and Heit (University of Ulm).

A model relating events at the cellular level to the mortality rate in irradiated mammals was presented by Robinson (Brookhaven). The animal's  $LD_{50}$  was expressed in terms of five parameters: the  $n$  and  $D_0$  for stem cells, their original number, a mature-cells-per-stem-cell or proliferation factor, and a parameter for the animal's mature cell requirement. It was inferred that the shape of the animal dose-survival curve sets an upper limit on the possible interindividual variation of each of the five parameters, and in particular a relatively low limit for that of the stem-cell  $D_0$ . It was pointed out (Sinclair, Argonne; Patt, University of California) that additional refinements would be desirable, especially that of making the proliferation rate after exposure dose-dependent. The finding of "small colonies" in tissue culture by Sinclair, confirmed in studies with splenic colony formation units, indicates that this would be a more realistic assumption.

Sugahara (Kyoto) showed that physiological stresses such as hypoxia, exercise, and bleeding, which may or may not be related to changes in size of cell populations, increase resistance. The work of Schooley and of Stohlmann referred to previously, emphasizes the importance of mechanisms that control cell proliferation in the normal and stressed animal.

Microorganisms normally nonpathogenic can be quite pathogenic in the heavily irradiated animal, for example, the presence of pseudomonas is known to greatly decrease the  $LD_{50}$  of mice. Wild rodents, however, that would be expected to harbor a number of parasites, are among the most radioresistant of mammals. Van Bekkum (TNO, Rijswijk) showed that the  $LD_{50/30 \text{ days}}$  of pathogen-free guinea pigs is more than twice that of nonpathogen-free animals. The increase in resistance of gnotic animals may be related to the absence of actual infection (Wilson, Van Bekkum); to an increased rate of utilization of mature elements (Nakamura, Flidner); to difference in the metabolism of normal substances, for example, bile (Fry, Argonne); to the presence of different flora (several authors); to toxins; or to as yet poorly

defined additional factors. Wilson (Notre Dame) showed, using mono-contaminated, previously germ-free animals, that radioresistance may be primarily or secondarily related to the activities of intestinal microorganisms. Antibodies increased survival even in germ-free animals, perhaps because recovery is stimulated by them in some as yet undefined fashion.

"Recovery" in the intact mammal over a time period of days to weeks, undoubtedly including both repair of sublethal cellular damage and cell proliferation, was described by Casarett (University of Rochester). Split-dose experiments in the mammal show that recovery rates so determined are markedly dependent on a number of factors including species, strain, and size of conditioning dose. An exponential decay curve represents a rough approximation to much of the recovery data. The large differences in recovery rates among species do not correlate with factors such as body size, life span, or metabolic rate.

Kondo (University of Nagoya) differentiated inbred strains of mice on the basis of differences in original gene pool and on differences in natural and artificial selection through sister-brother inbreeding. His studies using ten inbred strains indicate that the variability in lethal dose among mice selected from a given strain was not distinguishable from that among mice from different strains.

Tazima (National Institute of Genetics, Nirsima) showed that two fractionated doses of 500 roentgens produced a greater effect than 1000 roentgens (single dose) with respect to mutation frequency in the silkworm. He suggested that a demonstrated pileup of cells in  $G_2$  might account for the differences. Sinclair (Argonne) indicated that there must also be a pileup in  $G_1$ , which might be even more likely to show a higher mutation frequency.

Bond (Brookhaven) showed that species differences in  $LD_{50}$  values for the gastrointestinal syndrome are considerably less than the variation in  $LD_{50}$  for the bone-marrow syndrome (a factor of less than 2 versus a factor of 10). At the high-dose levels involved, severe bone-marrow damage and resultant depletion of blood neutrophils is severe even at the early time associated with the G.I. syndrome. Irradiation of only the bowel or a large segment of the bowel requires higher doses to kill, and the survival time is longer. These findings show a signifi-

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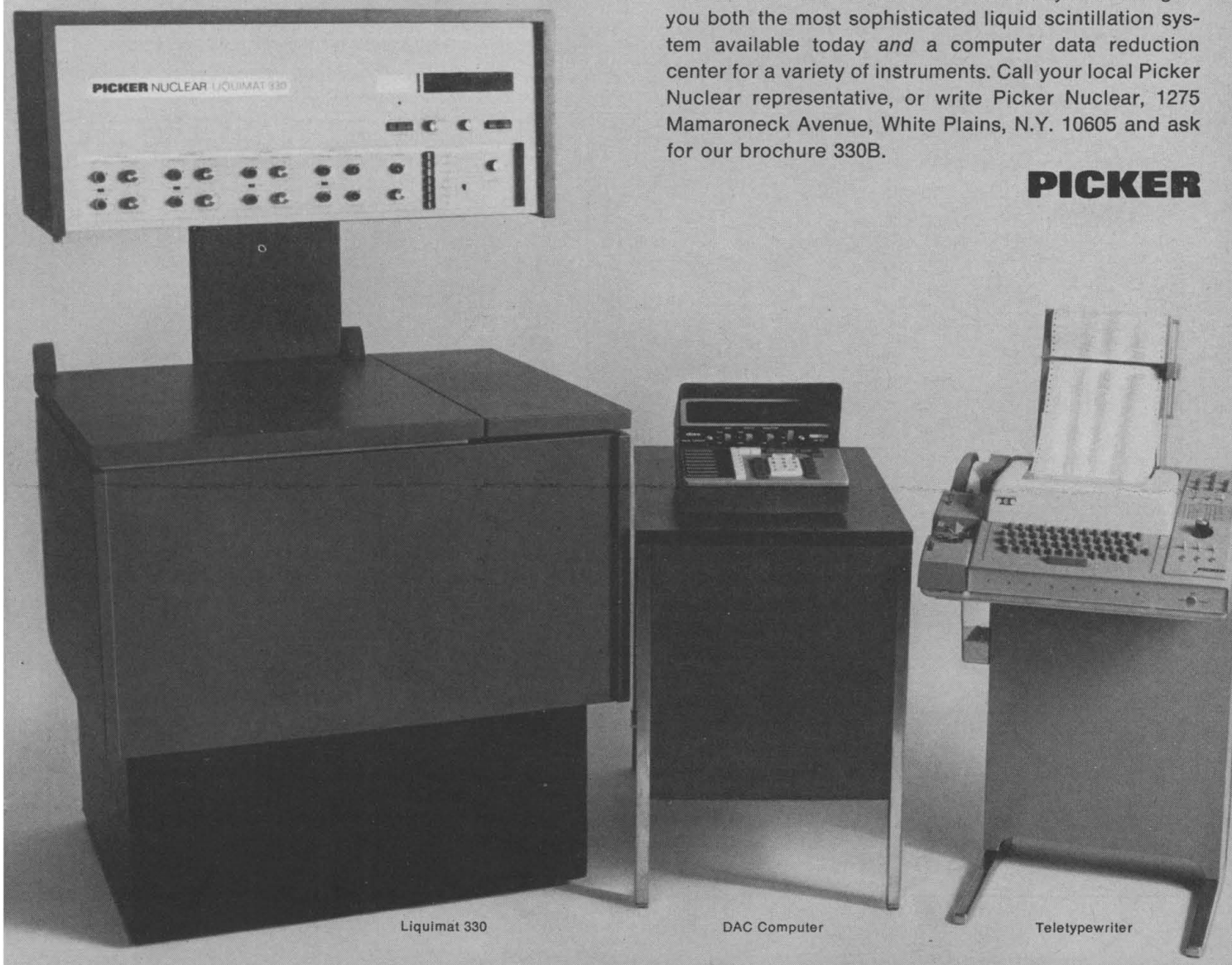
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Second thing. Although the DAC computer functions with the Liquimat 330 as a true on-line computer, it is easily and completely divorceable from the liquid scintillation counter. Accordingly, you can marry it to your other instruments that now just generate raw data. And this DAC computer is no toy. It is a full-fledged programmable, general-purpose computer with a substantial capability. As such, it can also be used by itself for polynomial computations, statistical analyses, curve-fitting, interpolation, and even as an everyday calculator.

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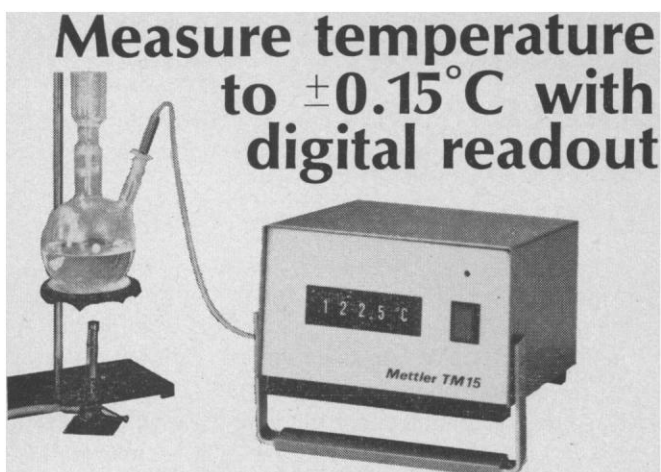


Liquimat 330

DAC Computer

Teletypewriter





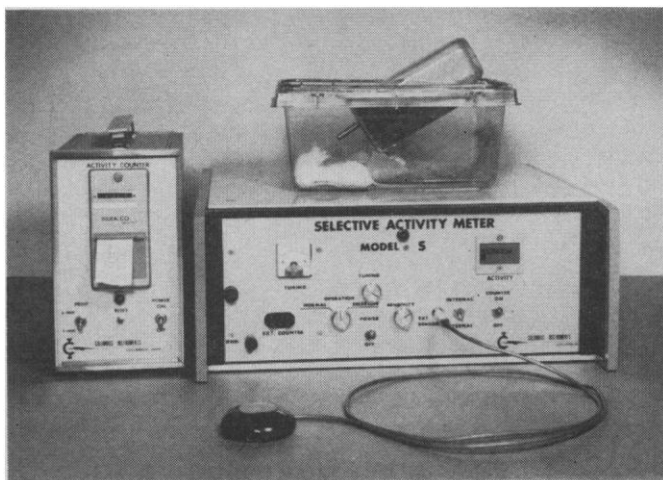
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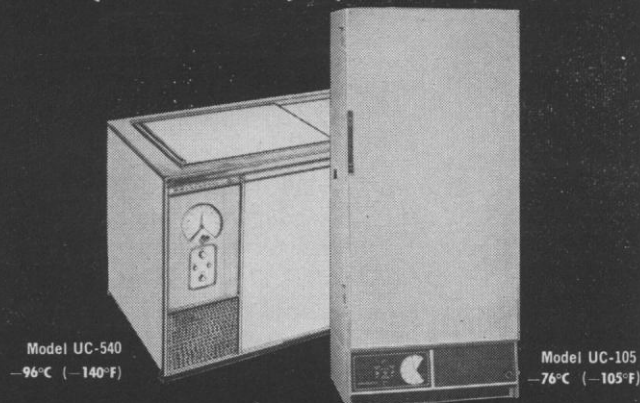
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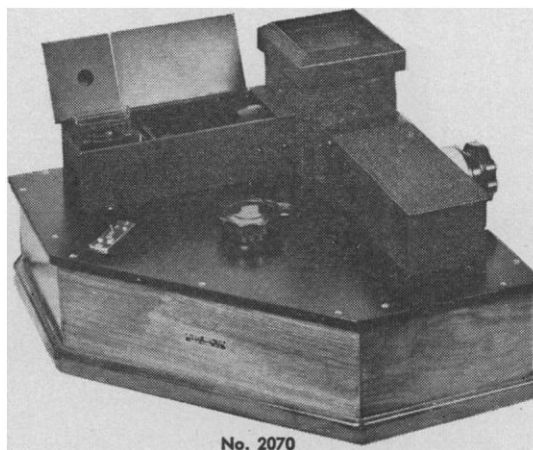
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20 JUNE 1969

cant contribution of neutropenia and infection to the G.I. syndromes seen with whole-body radiation.

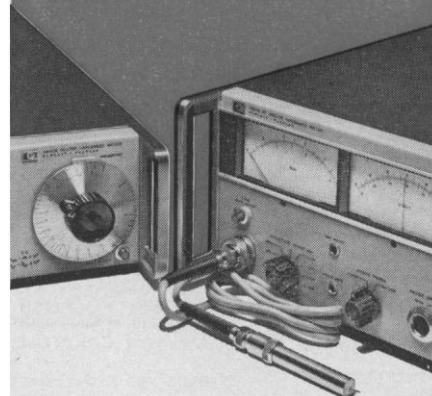
Lushbaugh (Oak Ridge Associated Universities) indicated that while changes in underlying cell populations probably are of cardinal importance in mortality among animals exposed to doses in the "hematopoietic death" range and somewhat above, additional factors assume importance as the dose is increased (above perhaps 1000 roentgens in most species). Direct damage to the small vessels and capillaries, become increasingly important. Thus, while the term "hematopoietic syndrome" may be appropriate, the terms "gut syndrome" and "central nervous system syndrome" may in a sense be misnomers. Damage to the principal cell populations presumably involved may not be the critical factor that determines mortality.

Matsuzawa (Aichi Cancer Center Research Institute) counted surviving crypt stem cells after exposure of mice to graded doses of radiation. He obtained a D<sub>0</sub> of 220 rads and an extrapolation number of 4.8. (Earlier estimates by Hornsey *et al.* and by Withers showed a similar broad "shoulder" but a lower D<sub>0</sub>). Fry (Argonne) studied the relationship between the LD<sub>50</sub> for the G.I. syndrome and the parameters of gastrointestinal epithelial cell proliferation in eight mammalian strains and species. Differences in radiosensitivity appeared to be related to the ratio of proliferating to functional cells; the transit time in proliferating and functional compartments; the cell cycle time; the relative rapidity of feedback mechanisms and cell turnover; and the time required for differentiation. That sensitivity and survival time depend on the kinetics of cell proliferation of gastrointestinal cells was indicated by the data of Wilson (Notre Dame), Matsuzawa (Aichi Cancer Center Research Institute) and Fliedner (University of Ulm). The transit time of cells from the crypts to the tips of the villi is prolonged in germ-free animals, and the time for death from the G.I. syndrome is delayed proportionately.

Lushbaugh (Oak Ridge Associated Universities) presented data of Casarett *et al.* (University of Rochester) showing that appreciable capillary damage in the villi probably is present at dose levels corresponding to the G.I. syndrome, which may be in part responsible for denudation of the villi. He also indicated that actual fluid loss from the body during the G.I. syndrome in

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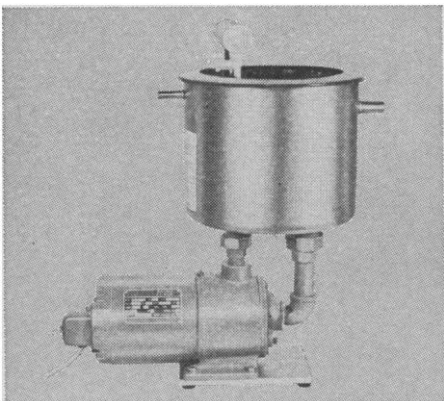
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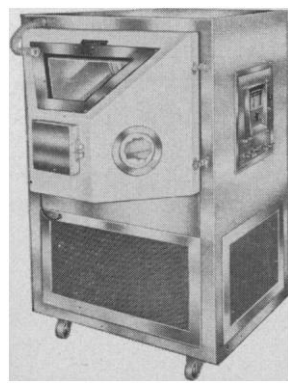


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rodents is minimal, but that loss of fluid into tissues (edema) may be an important factor. His data indicate that sodium loss (as determined by studies using radioactive sodium) may be minimal, at least prior to the time that the animal approaches the moribund stage. Hyodo-Taguchi and Egami showed a distinct increase in loss of sodium from irradiated goldfish suffering from gastrointestinal syndrome. Lushbaugh pointed out that such loss may well be from vessel damage particularly in the gills of the fish.

In summary of the conference, the problems involved in differential species radiosensitivity were brought into sharper focus, but a great deal of work needs to be done before the differences can be understood. Detailed work is required on differences in pool sizes, the kinetics of cell proliferation, and control mechanisms of cell proliferation in the different species. Physiological variables must be better defined, particularly the rate of utilization of mature functional cells in the irradiated versus normal individual. The possible role of the reticuloendothelial system deserves a great deal more attention, as do changes in blood vessels and the supporting matrix for proliferating tissues, particularly at dose levels high in the lethal range for the bone-marrow syndrome and above.

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Meister, director of planning, Hall of Science of the City of New York, Inc.; Henry Allen Moe, president emeritus, Guggenheim Memorial Foundation; DeWitt C. Reddick, School of Communication, University of Texas; and William P. Steven, vice president, *Chicago Sun Times/Chicago Daily News*.

To be eligible for the 1969 awards, the newspaper or magazine articles on the natural sciences and their engineering and technological applications must have appeared in print between 1 October 1968 and 30 September 1969, in publications within the United States.

A newspaper entry can be any of the following: a single story, a series of articles, or a group of three unrelated stories, articles, editorials, or columns.

The three awards will be presented on 27 December 1969 at the annual dinner of the National Association of Science Writers during the 1969 meeting of the AAAS in Boston.

Additional information and application forms may be obtained from Grayce A. Finger, Dept. E, AAAS, 1515 Massachusetts Ave., NW, Washington, D.C. 20005 (202-387-7171).

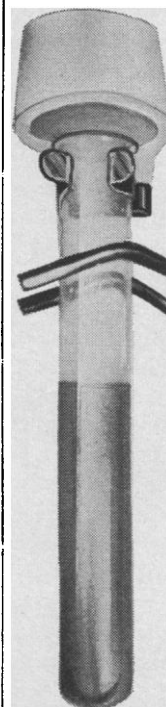
#### Courses

**Workshop in Genetic Chemistry**, Madison, Wis., 15–21 Aug. Will provide an introduction to the methodology of genetic chemistry for study of systems such as oxidative phosphorylation, membrane function, and enzymic catalysis. Enrollment is limited to 20 chemists who wish to explore the possibility for application of their skills and experience to problems in genetic chemistry. Applicants should describe their interests, list publications, and provide a brief curriculum vitae. Also request travel and per diem if it is needed. Deadline for applications: *15 July*. (Professor Robert M. Bock, Laboratory of Molecular Biology, University of Wisconsin, Madison 53706)

**International Seminar for Hydrology Professors**, Urbana, Ill., 13–25 July. Is intended to acquaint hydrology professors with new technological developments in hydrology, such as nuclear techniques, space applications, stochastic analysis, and systems simulation; to determine the current status of teaching and research in basic hydrology; to provide for discussion of teaching and research methods, techniques, and instrumentation; to ascertain gaps in knowledge and to determine research needs and anticipated research trends; and to discuss impact of hydrologic education on manpower, on relation with government agencies, on international cooperation, and on water resources development. (Professor V. T. Chow, Director, International Seminar for Hydrology Professors, 3118 Civil Engineering Building, University of Illinois, Urbana 61801)

**Technical and Industrial Communications**, Fort Collins, Colo., 20–25 July. Will emphasize the application of communication techniques in business, industry, and institutions of government and education. Current research and new applications, including computer science and communicology, will be discussed. The

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**Chemical Reaction Engineering**, Glen Arbor, Mich., 20-26 July. An advanced seminar on experimental method, data sources, modeling and technique in the design and analysis of reacting systems. *Fee*: \$375 (includes American plan accommodations at the Homestead Inn on Lake Michigan). (Dr. Robert E. C. Weaver, Department of Chemical Engineering, Tulane University, New Orleans, La. 70118)

**Biological Electron Microscopy**, Los Angeles, Calif., 2-13 September. For professional and laboratory personnel who desire knowledge and experience in tissue preparation and ultrathin sectioning for electron microscopy. *Fee*: \$250. Limited to 12 participants. (Dr. Robert F. Bills, Hancock Foundation, University of Southern California, Los Angeles 90007)

## National Meetings

### July

5-11. **Tri-Organizational Science and Clinical Rehabilitation Conf.**, 13th, Albany, N.Y. (J. Timmerman, 1520 Van Hoesen Rd., Castleton-on-Hudson, N.Y.)

6-10. **Forest Products Research Soc.**, 23rd, San Francisco, Calif. (K. E. Huddleston, The Society, 2801 Marshall Court, Madison, Wis. 53705)

7-18. **Conference on Environmental Effects on Antenna Performance**, Boulder, Colo. (P. Blacksmith, AFCRL (CRD), L. G. Hanscom Field, Bedford, Mass. 01730)

7-18. **Science for Clergymen**, Oak Ridge, Tenn. (Special Projects Office, Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge 37830)

8-11. **Nuclear and Space Radiation Effects**, University Park, Pa. (E. A. Burke, AFCRL (CRWH), Stop 30, L. G. Hanscom Field, Bedford, Mass. 01730)

9-12. **National Soc. of Professional Engineers**, Kansas City, Mo. (P. H. Robbins, The Society, 2029 K St., NW, Washington, D.C. 20006)

10-13. **American Therapeutic Soc.**, 70th, New York, N.Y. (R. T. Smith, The Society, 37 Narbrook Park, Narberth, Pa.)

11-12. **Programming Language Users Conf.**, Binghamton, N.Y. (J. A. Higgins, Computer Center, State Univ. of New York, Binghamton 13901)

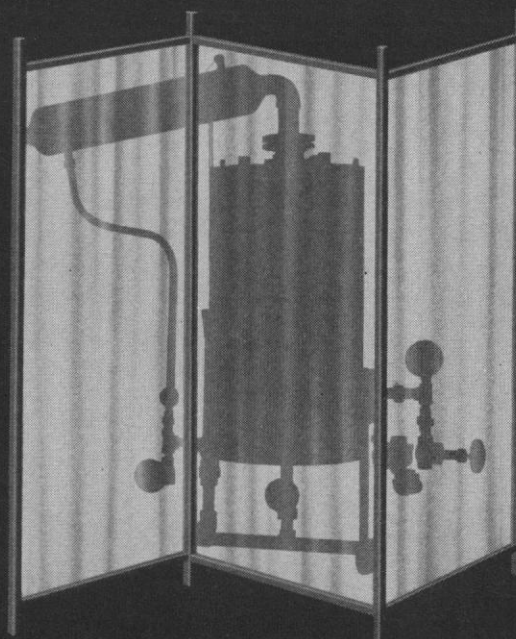
12-13. **Society for Surgery of the Alimentary Tract**, 10th, New York, N.Y. (J. V. Prohaska, The Society, 950 E. 59 St., Chicago, Ill. 60637)

12-13. **Society for Vascular Surgery**, New York, N.Y. (R. M. Nelson, Surgical Research Lab., Latter-Day Saints Hospital, Salt Lake City, Utah 84103)

13-16. **Physiology and Biochemistry of Muscle as a Food**, Madison, Wis. (E. J. Briskey, Muscle Biology Lab., College of Agricultural and Life Sciences, Univ. of Wisconsin, Madison 53706)

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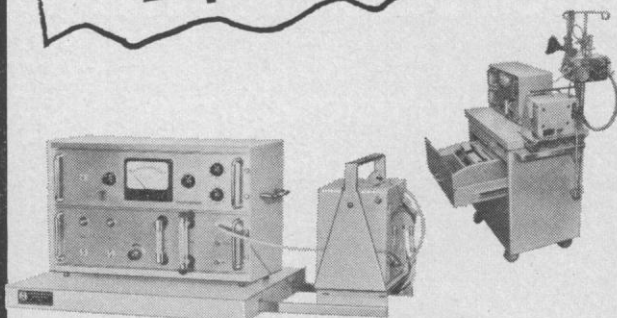
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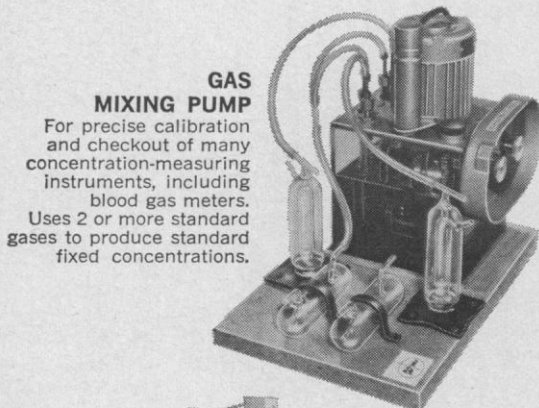


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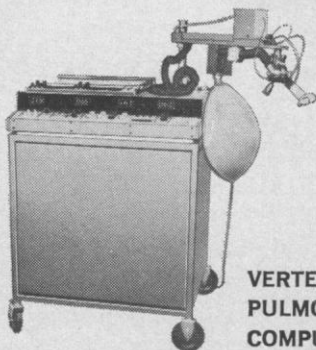
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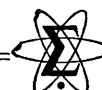
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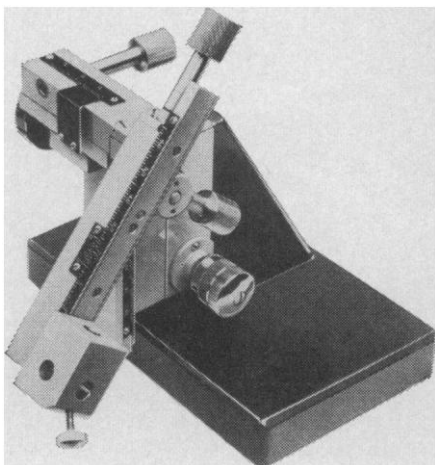




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13-17. American Medical Assoc., New York, N.Y. (W. E. Burmeister, The Association, 535 N. Dearborn St., Chicago, Ill.)

14-16. Sanitary Engineering Research, Development, and Design, 2nd natl. symp., Ithaca, N.Y. (A. W. Lawrence, 219 Hollister Hall, Cornell Univ., Ithaca 14850)

14-18. Symposium on Ecology as a Guide to Social Change, New Haven, Conn. (Z. W. White, Yale Univ., New Haven 06511)

14-18. Symposium on the Nature, Induction, and Utilization of Mutations in Plants, Pullman, Wash. (J. H. Kane, Div. of Technical Information, U.S. Atomic Energy Commission, Washington, D.C. 20545)

14-18. Persistence of Food Habits: Problem in the War on Hunger, Milwaukee, Wis. (Engineering Foundation Research Conf., Room 308, 345 E. 47 St., New York 10017)

16-18. Electron Probe Analysis Soc. of America, 4th, Pasadena, Calif. (A. A. Chodos, Geology Dept., California Inst. of Technology, Pasadena 91109)

18-19. Rocky Mountain Cancer Conf., Denver, Colo. (D. G. Derry, Colorado Medical Soc., 1809 E. 18th Ave., Denver 80218)

20-25. Association for the Advancement of Medical Instrumentation, Chicago, Ill. (J. J. Post, 19 Brook Rd., Needham Heights, Mass. 02194)

21. Group Representations in Mathematics and Physics, Seattle, Wash. (R. S. Paul, Battelle Memorial Inst., 4000 NE 41st St., Seattle 98105)

21-25. Transportation Systems Analysis, Milwaukee, Wis. (Engineering Foundation Research Conferences, Room 308, 345 E. 47 St., New York 10017)

23-25. Montana Radiological Soc. Symp., Glacier National Park. (C. H. Agnew, 1231 N. 29th St., Billings, Mont. 59101)

25-26. Linguistic Soc. of America, Urbana, Ill. (R. B. Lees, Dept. of Linguistics, Univ. of Illinois, Urbana 61801)

28-29. Society of Research Administrators, San Francisco, Calif. (K. Hartford, Biology Dept., Yale Univ., 102 Kline Biology Tower, New Haven, Conn. 06520)

28-30. Society of Research Administrators, 3rd annual, San Francisco, Calif. (K. Hartford, Yale Univ., 102 Kline Biology Tower, New Haven, Conn. 06520)

28-1. Instrumentation Science, research conf., Geneva, N.Y. (T. E. Tremellen, Education and Research Services, Instrument Soc. of America, 530 William Penn Pl., Pittsburgh, Pa. 15219)

28-1. Quality Engineering and Research, Milwaukee, Wis. (Engineering Foundation Research Conferences, Room 308, 345 E. 47 St., New York 10017)

## August

3-6. National Heat Transfer Conf., 11th, Minneapolis, Minn. (D. C. Kelly, American Inst. of Chemical Engineers, 345 E. 47 St., New York 10017)

3-7. Society for Cryobiology, 6th annual, Buffalo, N.Y. (R. E. Greco, 3175 Staley Rd., Grand Island, N.Y. 14072)

4-5. Aerospace Structures Design Conf., Seattle, Wash. (J. R. Fuller, Boeing Co., P.O. Box 707, Ortn. 6-8650, M/S 77-89, Renton, Wash. 98055)

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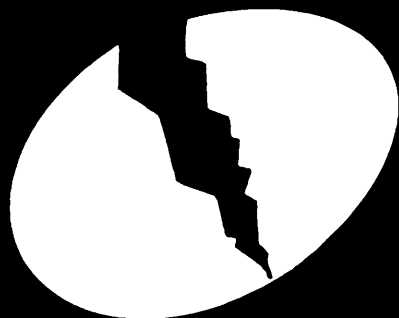
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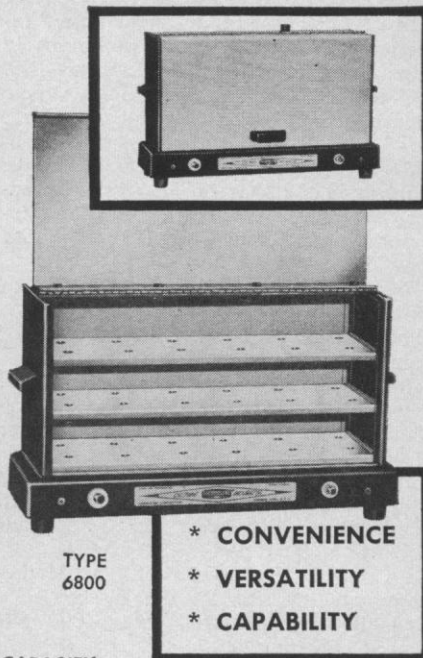
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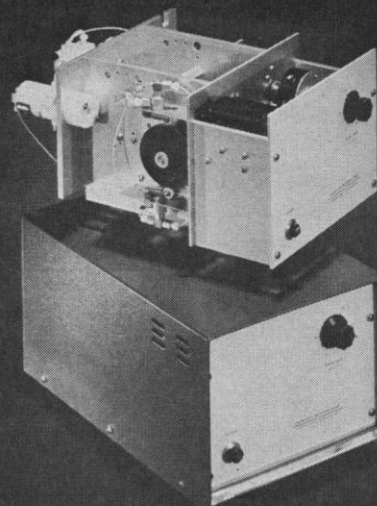
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4-6. **Deterioration and Preservation of Library Materials**, 34th annual conf., Chicago, Ill. (H. W. Winger, Graduate Library School, Univ. of Chicago, 1116 E. 59 St., Chicago 60637)

4-8. **Molecular Biology and Pathology**, 2nd conf., Saratoga Springs, N.Y. (K. T. Lee, Dept. of Pathology, Albany Medical College, Albany, N.Y. 12208)

5-8. **World Conf. on Records**, Salt Lake City, Utah. (S. E. Beesley, 1030 S. Orchard Dr., Bountiful, Utah 84010)

6-8. **Applications of X-Ray Analysis** Conf., Denver, Colo. (B. L. Henke, Div. of Metallurgy, Denver Research Inst., Denver 80210)

10-13. **Soil Conservation Soc. of America**, Fort Collins, Colo. (H. W. Pritchard, 7515 NE Ankeny Rd., Ankeny, Iowa 50021)

11-13. **Symposium on Crystal Growth**, Washington, D.C. (H. S. Peiser, Room B316, Bldg. 223, National Bureau of Standards, Washington, D.C. 20234)

11-14. **Society of Photo-Optical Instrumentation Engineers**, 14th annual technical symp., San Francisco, Calif. (H. L. Kasnitz, SPIE Symposium, P.O. Box 288, Redondo Beach, Calif. 90277)

12. **American Astronomical Soc.**, Albany, N.Y. (G. C. McVittie, Univ. of Illinois Observatory, Urbana 61801)

13-24. **Frontier Topics in Crystallography**, Stony Brook, L.I., N.Y. (E. H. Kone, American Inst. of Physics, 335 E. 45 St., New York 10017)

17-22. **Animal Behavior Soc.**, Burlington, Vt. (B. Dane, Tufts Univ., Medford, Mass.)

17-22. **American Inst. of Biological Science**, Burlington, Vt. (J. R. Olive, 3900 Wisconsin Ave., NW, Washington, D.C. 20016)

17-22. **American Soc. of Zoologists**, Burlington, Vt. (J. R. Shaver, Dept. of Zoology, Michigan State Univ., East Lansing 48823)

18-20. **Genetics Soc. of America**, Madison, Wis. (B. Wallace, Dept. of Genetics, Cornell Univ., Ithaca, N.Y. 14850)

18-21. **American Hospital Assoc.**, Chicago, Ill. (E. L. Crosby, 840 N. Lake Shore Dr., Chicago 60611)

18-22. **New England Assoc. of Chemistry Teachers**, 31st summer conf., Plymouth, N.H. (M. P. Olmsted, Publicity Chairman, NEACT, 9 Brookmont Dr., Wilbraham, Mass. 01095)

18-22. **American Soc. of Pharmacognosy**, 10th annual, Corvallis, Ore., with **Marine Biomedicinals Symp.** (P. Catalfomo, School of Pharmacy, Oregon State Univ., Corvallis 97331)

18-22. **American Phytopathological Soc.**, Spokane, Wash. (J. P. Fulton, Dept. of Plant Pathology, Univ. of Arkansas, Fayetteville 72701)

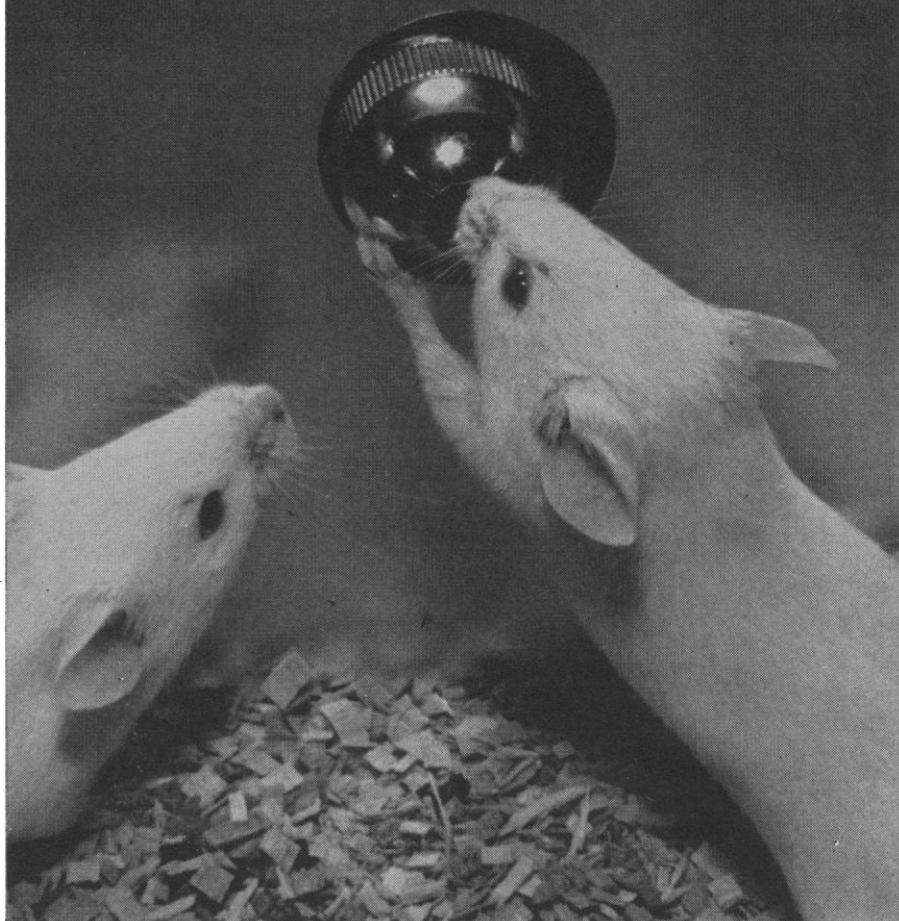
18-22. **National Goals in Water Pollution Control**, Santa Barbara, Calif. (F. A. Butrico, Coordinator of Environmental Sciences Programs, Battelle Memorial Inst., Columbus Laboratories, Washington, D.C.)

19. **Biometric Soc.**, western North American regional, Pullman, Wash. (J. S. Williams, Statistical Lab., Colorado State Univ., Fort Collins)

19-21. **Birch Symp.**, Durham, N.H. (R. R. Weyrick, Dept. of Forest Re-

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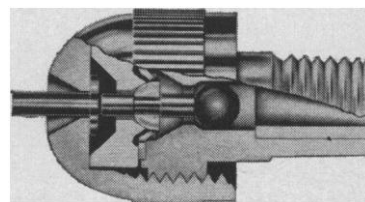


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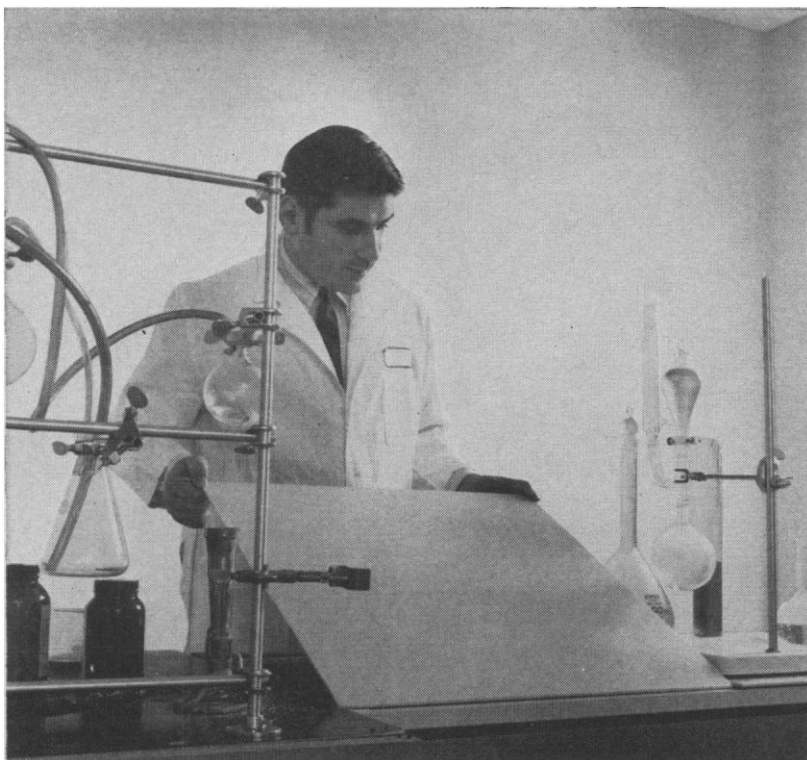
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19-22. **Biometric Soc.**, eastern North American regional, New York, N.Y. (D. G. Gosslee, P.O. Box 713, Oak Ridge, Tenn. 37830)

19-22. American Assoc. of **Clinical Chemists**, 21st natl. mtg., Denver, Colo. (J. Preston, P.O. Box 18323, Capitol Hill Station, Denver 80218)

19-22. Western **Electronic Show and Convention**, San Francisco, Calif. (D. W. Martin, WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005)

19-22. American Soc. for **Horticultural Science**, 44th annual, Pullman, Wash. (C. Blackwell, The Society, 615 Elm St., St. Joseph, Mich. 49085)

19-22. American **Statistical Assoc.**, 129th, New York, N.Y. (D. C. Riley, The Association, 810 18th St., NW, Washington, D.C. 20006)

19-23. American **Fern Soc.**, Seattle, Wash. (A. M. Evans, Dept. of Botany, Univ. of Tennessee, Knoxville 37916)

20-22. American Soc. of **Civil Engineers**, Hydraulics Conf., Logan, Utah. (ASCE Hydraulics Conf., % Utah Water Research Lab., Utah State Univ., Logan 84321)

21-23. American **Nature Study Soc.**, Pullman, Wash. (J. Geisler, Milewood Rd., Verbank, N.Y. 12585)

24-25. **Programming Languages Definition**, San Francisco, Calif. (J. A. Painter, IBM Corp., Research Lab., Dept. 978, Bldg. 025, Monterey and Cottle Rds., San Jose, Calif. 95114)

24-27. **Alaska Div., AAAS**, College. (V. Fisher, Inst. of Social, Economic and Government Research, Univ. of Alaska, College 99701)

24-27. **Defects in Electronic Materials for Devices**, Boston, Mass. (D. P. Sera-phim, IBM Components Div., Bldg. 300, Hopewell Junction, N.Y. 12533)

24-27. Conference on **Food-Drugs from the Sea**, Kingston, R.I. (G. F. Greene, Jr., % Professional Services, Abbott Labs., North Chicago, Ill. 60064)

24-29. **Gerontological Soc.**, Washington, D.C. (E. Kaskowitz, The Society, 660 S. Euclid St., St. Louis, Mo. 63110)

24-2. **Botanical Soc. of America**, Seattle, Wash. (R. C. Starr, Dept. of Botany, Indiana Univ., Bloomington 47401)

25-27. **Applied Mechanics Western Conf.**, Albuquerque, N.M. (A. B. Conlin, Jr., Technical Depts., 345 E. 47 St., New York 10017)

25-27. **Mathematical Assoc. of America**, Eugene, Ore. (A. B. Willcox, The Association, 1225 Connecticut Ave., NW, Washington, D.C. 20036)

25-28. **Chromosphere-Corona Transition**, Boulder, Colo. (J. W. Evans, Sacramento Peak Observatory, Sunspot, N.M. 88349)

26-28. Engineering Applications of **Electronic Phenomena Conf.**, Ithaca, N.Y. (H. J. Carlin, School of Electrical Engineering, Cornell Univ., Ithaca 14850)

26-29. **Electron Microscope Soc. of America**, St. Paul, Minn. (G. G. Cocks, Olin Hall, Cornell Univ., Ithaca, N.Y. 14850)

28-1. Society of **Petroleum Engineers**, Denver, Colo. (J. B. Alford, 6200 N. Central Expressway, Dallas, Tex. 75206)



31-4. American Psychological Assoc., Washington, D.C. (K. Goodall, The Society, 1200 17th St., NW, Washington, D.C. 20036)

31-4. Psychometric Soc., Washington, D.C. (W. B. Schrader, Educational Testing Service, Princeton, N.J. 08540)

31-6. Quantum Solids: Hydrogen and Helium, Aspen, Colo. (J. C. Raich, Colorado State Univ., Fort Collins 80521)

## International and Foreign Meetings

### August

4-7. International Conf. on Raman Spectroscopy, Ottawa, Ont., Canada. (J. A. Koningstein, Chemistry Dept., Carleton Univ., Ottawa)

4-9. International Rhinologic Soc., Mexico, D.F. (G. H. Drumheller, 1515 Pacific, Everett, Wash. 98201)

4-15. Vertebrate Evolution: Mechanism and Process, Istanbul, Turkey. (M. K. Hecht, Dept. of Biology, Queens College, Flushing, N.Y. 11367)

6-12. International Congr. of Crystallography, 8th, Buffalo, N.Y. (E. H. Kone, American Inst. of Physics, 335 E. 45 St., New York 10017)

10-14. International Conf. on Medical Physics, 2nd, Boston, Mass. (E. W. Webster, Dept. of Radiology, Massachusetts General Hospital, Boston 02114)

10-15. Chemotherapy, 6th intern. congr., Tokyo, Japan. (W. P. Boger, P.O. Box 265, Princeton, N.J. 08540)

11-15. International Conf. of Medical Physics, Boston, Mass. (W. T. Maloney, Suite 620, 6 Beacon St., Boston 02108)

12-15. International Photoconductivity Conf., 3rd, Palo Alto, Calif. (G. S. Picus, Hughes Research Labs., 3011 Malibu Canyon Rd., Malibu, Calif. 90265)

17-21. International Assoc. of Milk, Food and Environmental Sanitarians, Louisville, Ky. (H. L. Thomasson, Box 437, Shelbyville, Ind. 46176)

20-21. International Electronic Circuit Packaging Symp., San Francisco, Calif. (IECPS Papers Selection Committee, % WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005)

20-27. International Union of Pure and Applied Chemistry, 22nd, Sydney, Australia. (J. R. Price, Box 2249U, G.P.O. Melbourne, Australia 3001)

21-28. International Symp. on Statistical Ecology, New Haven, Conn. (G. P. Patil, Dept. of Statistics, 302 McAllister Bldg., Pennsylvania State Univ., University Park 16802)

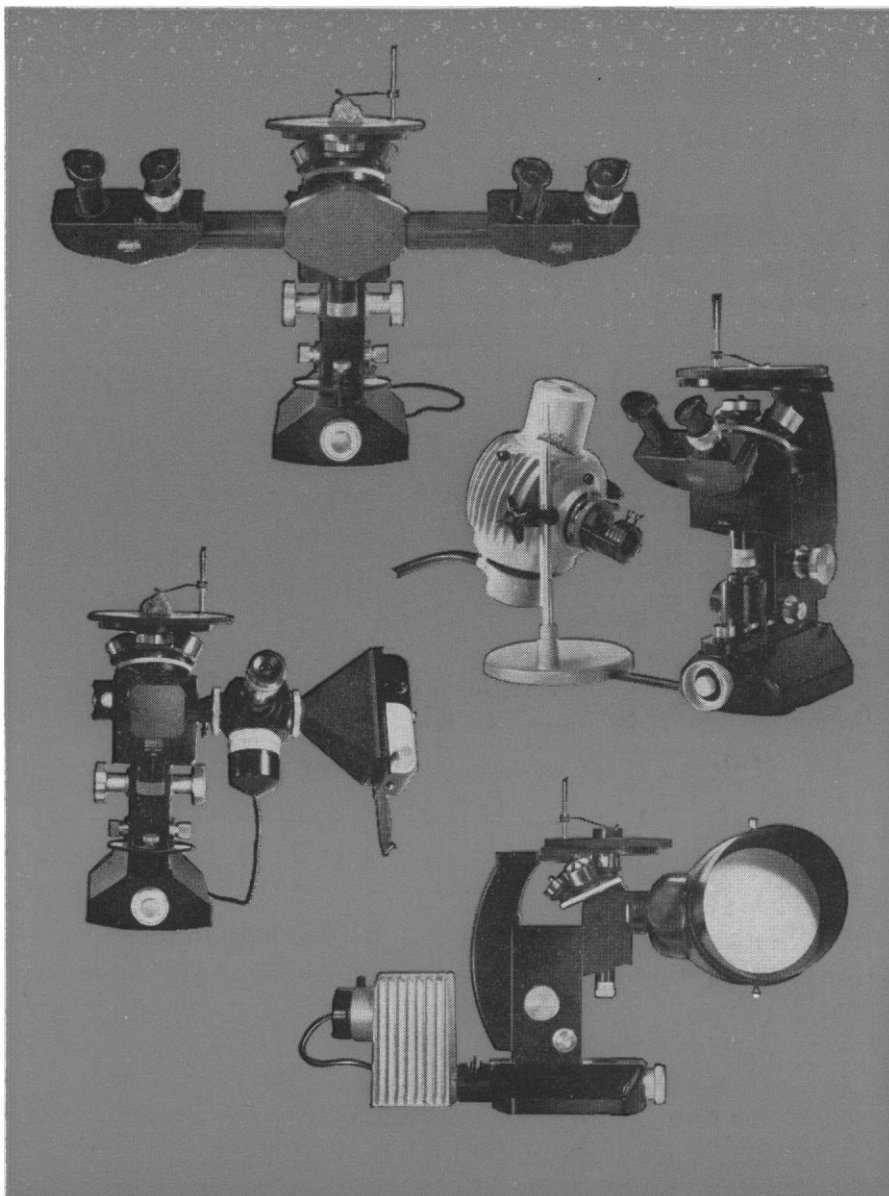
24-26. Laurentian Hormone Conf., Mont Tremblant, P.Q., Canada. (Laurentian Hormone Conf. Office, 222 Maple Ave., Shrewsbury, Mass. 01545)

24-28. Mobilizing Canada's Agricultural Resources, 49th, Saskatoon, Sask. (R. H. Burrage, 1969 AIC Convention Committee, Box 800, Sub. P.O. No. 6, Saskatoon)

24-29. Gerontology, 8th intern. congr., Washington, D.C. (N. W. Shock, 9650 Rockville Pike, Bethesda, Md. 20014)

25-29. International Conf. on Luminescence, Newark, Del. (F. Williams, Dept. of Physics, Univ. of Delaware, Newark 19711)

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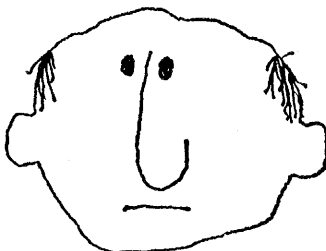
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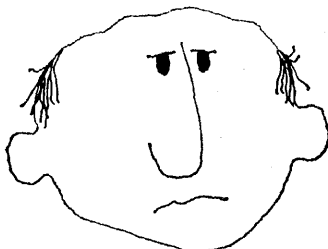
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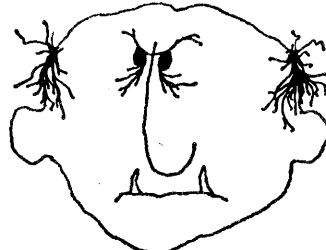
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## BOOKS RECEIVED

(Continued from page 1390)

**Biopathology of Pattern Alopecia.** Proceedings of an international symposium, Rapallo, Italy, 1967. Aldo Baccaredda-Boy, Giuseppe Moretti, and Johann Rudolf Frey, Eds. Karger, Basel, 1968 (U.S. distributor, Phiebig, White Plains, N.Y.). x + 222 pp., illus. \$14.15.

**Biology and Man.** George Gaylord Simpson. Harcourt, Brace and World, New York, 1969. xii + 180 pp. \$5.95.

**Boundary Value Problems of Mathematical Physics and Related Aspects of Function Theory.** Part 1. V. P. Il'in, Ed. Translated from the Russian edition (Leningrad, 1967). Consultants Bureau, New York, 1969. viii + 96 pp. Paper, \$15. Seminars in Mathematics, vol. 5.

**The Climatic Physiology of the Pig.** L. E. Mount. Williams and Wilkins, Baltimore, 1968. x + 274 pp., illus. \$14.50. Monographs of the Physiological Society, No. 18.

**Clinical Vitaminology.** Methods and Interpretation. Herman Baker and Oscar Frank. Interscience (Wiley), New York, 1969. xii + 244 pp., illus. \$13.95.

**Coal and Coal-Bearing Strata.** Based on the 13th Inter-University Geological Congress, Newcastle upon Tyne, England, 1965. Duncan Murchison and T. Stanley Westoll, Eds. Elsevier, New York, 1968. xii + 420 pp., illus. + 42 plates. \$28.50.

**Community Fact Book for Washington Heights, New York City. 1965-1966 and 1960-1961.** Jack Elinson, Paul W. Haberman, and Cyrille Gell. School of Public Health and Administrative Medicine, Columbia University, New York, 1968. vi + 102 pp., illus. Paper, \$5.

**Dosage Non Destructif de la Composante Minérale du Tissu Osseux par Densitométrie Radiographique.** W. Mouvet. Editions Arscia, Brussels; Librairie Maloine, Paris, 1968. 184 pp., illus. Paper, 360 F.B. Collection "Médico Monographies d'Angrégés."

**The Economic Effect of Declining Fertility in Less Developed Countries.** Gavin W. Jones. Population Council, New York, 1969. iv + 32 pp., illus. Paper.

**Effects of Pesticides on Fruit and Vegetable Physiology.** Subcommittee on Chemicals Affecting Fruit and Vegetable Physiology, Committee on Plant and Animal Pests, National Research Council. National Academy of Sciences, Washington, D.C., 1968. x + 90 pp. Paper, \$3.25. Principles of Plant and Animal Pest Control, vol. 6. NAS Publication 1698.

**Elektronische Bauelemente und Netzwerke I.** Physikalische Grundlagen der Bauelemente. H.-G. Unger and W. Schultz. Vieweg, Braunschweig, 1968. xvi + 208 pp., illus. Paper, DM 16.80. Uni-texte.

**Fetal Homeostasis.** Vol. 3, Proceedings of the Third Conference, Princeton, N.J., 1967. Ralph M. Wynn, Ed. Appleton-Century-Crofts, New York, 1968. xiv + 306 pp., illus. \$12.75.

**Fluidization Engineering.** Daizo Kunii and Octave Levenspiel. Wiley, New York, 1969. xxii + 538 pp., illus. \$14.95.

**The Fossil Flora of the Drywood Formation of Southwestern Missouri.** Philip W. Basson. University of Missouri Press,



Columbia, 1969. x + 174 pp., illus. \$4.50. University of Missouri Studies, vol. 44.

**Heredity and Environment in the Functional Psychoses.** Case Histories. Einar Kringlen. Universitetsforlaget, Boston, 1968. viii + 278 pp. Paper, \$8. Norwegian Monographs on Medical Science.

**Intracranial Aneurysms and Subarachnoid Hemorrhage.** A Cooperative Study. Adolph L. Sahs, George E. Perret, Herbert B. Locksley, and Hiro Nishioka, Eds. Lipincott, Philadelphia, 1969. xii + 302 pp., illus. \$10. Reprinted from the *Journal of Neurosurgery* 1966, vols. 24 and 25.

**An Introduction to Mathematical Logic.** Gerson B. Robison. Prentice-Hall, Englewood Cliffs, N.J., 1969. xii + 212 pp., illus. \$5.95.

**Lecture Notes on the Use of the Microscope.** R. Barer. Davis, Philadelphia, ed. 3, 1968. viii + 84 pp., illus. Paper, \$1.75.

**Linear Ferrite Devices for Microwave Applications.** Wilhelm H. von Aulock and Clifford E. Fay. Academic Press, New York, 1968. xiv + 226 pp., illus. \$12. Advances in Electronics and Electron Physics, Supplement 5.

**The Machining of Metals.** E. J. A. Armarego and R. H. Brown. Prentice-Hall, Englewood Cliffs, N.J., 1969. x + 438 pp., illus. \$13.95.

**The Motivated Working Adult.** Ray C. Hackman. American Management Association, New York, 1969. 208 pp., illus. \$13.

**The Nation's Water Resources.** The First National Assessment of the Water Resources Council. Water Resources Council, Washington, D.C., 1968 (available from the Superintendent of Documents, Washington, D.C.). xvi + 450 pp., illus. Paper, \$4.25.

**The Nation's Water Resources Summary Report.** The First National Assessment of the Water Resources Council. Water Resources Council, Washington, D.C., 1968 (available from the Superintendent of Documents, Washington, D.C.). xvi + 32 pp., illus. Paper, 65¢.

**Natural Proteinase Inhibitors.** Rosmarie Vogel, Ivar Trautschold, and Eugen Werle. Translated from the German edition (Stuttgart, 1966) by Express Translation Service. Academic Press, New York, 1968. xiv + 162 pp., illus. \$10.

**Organic Syntheses.** An Annual Publication of Satisfactory Methods for the Preparation of Organic Chemicals. Vol. 48, 1968. Peter Yates, Ed. Wiley, New York, 1969. x + 166 pp., illus. \$6.95.

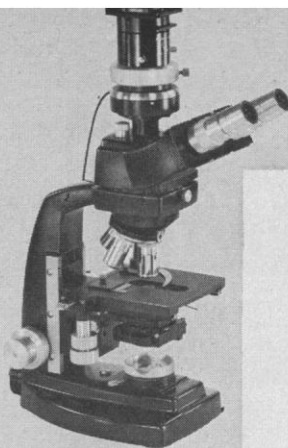
**Organozinc Coordination Chemistry.** J. Boersma and J. G. Noltes. International Lead Zinc Research Organization, New York, 1968. 120 pp., illus. Paper, \$2.

**A Pictorial Guide to the Identification of Fusarium Species According to the Taxonomic System of Snyder and Hansen.** T. A. Toussoun and Paul E. Nelson. Pennsylvania State University Press, University Park, 1968. 52 pp., illus. Spiral bound, \$5.95.

**Prague's 200 Days.** The Struggle for Democracy in Czechoslovakia. Harry Schwartz. Praeger, New York, 1969. x + 278 pp. \$5.95.

**Prenatal and Postnatal Mortality in Cattle.** Subcommittee on Prenatal and Postnatal Mortality in Bovines, Committee on Animal Health, National Research Council. National Academy of Sciences,

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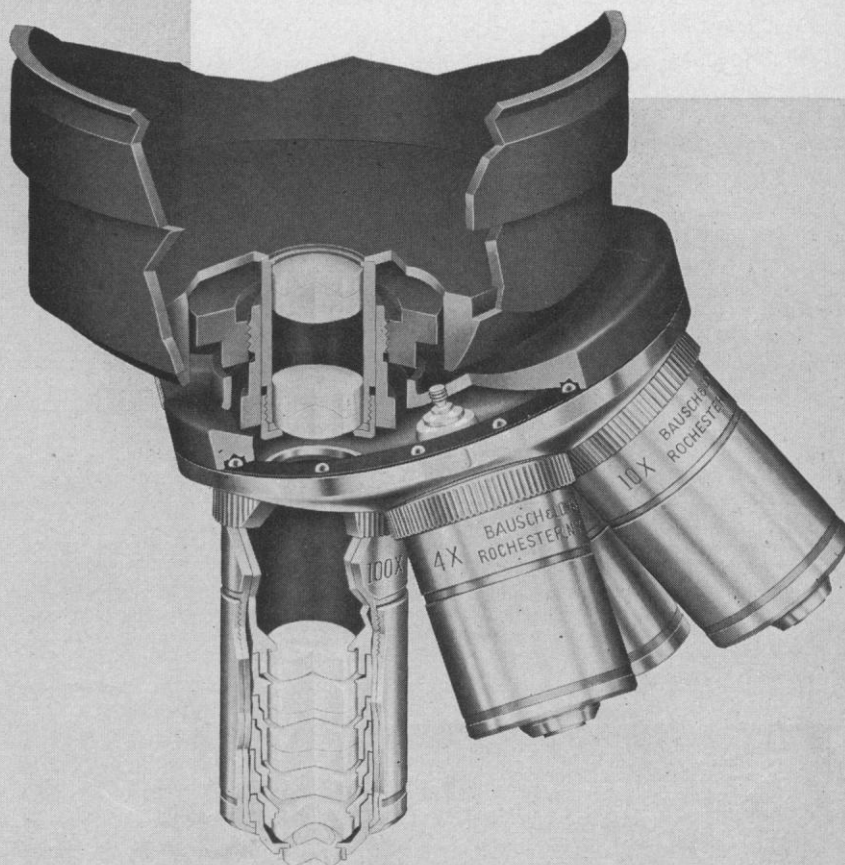


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Washington, D.C., 1968. vi + 130 pp. Paper, \$3.25. NAS Publication 1685.

**Principles of Demography.** Donald J. Bogue. Wiley, New York, 1969. xiv + 930 pp., illus. \$16.50.

**Psychological Problems in Mental Deficiency.** Seymour B. Sarason and John Doris, with chapters by Frances Kaplan and M. Michael Klaber. Harper and Row, New York, ed. 4, 1968. xii + 500 pp. \$9.95.

**A Revised Check-List of the Birds of the Maltese Islands.** C. De Lucca. Clascsey, Hampton, Middlesex, England, 1969. 96 pp. Paper, \$2.

**Science and Civic Life in the Italian Renaissance.** Eugenio Garin. Translated from the Italian by Peter Munz. Anchor (Doubleday), Garden City, N.Y., 1969. xxiv + 176 pp. Paper, \$1.25.

**The Science of Culture.** A Study of Man and Civilization. Leslie A. White. Farrar, Straus and Giroux, New York, 1969. xxxvi + 444 pp. Paper, \$2.85. Revised edition with a new preface by the author.

**Selected Bibliography on Algae.** No. 9. Nova Scotia Research Foundation, Halifax, 1968. xiv + 166 pp. Paper, \$5.

**Semantic Information Processing.** Marvin Minsky, Ed. MIT Press, Cambridge, 1968. viii + 440 pp., illus. \$15.

**Semiconductor Nuclear-Particle Detectors and Circuits.** Proceedings of a conference, Gatlinburg, Tenn., 1967. W. L. Brown, W. A. Higinbotham, G. L. Miller, and R. L. Chase, Eds. National Academy of Sciences, Washington, D.C., 1969. xviii + 798 pp., illus. \$25. Nuclear Science Series Report No. 44. NAS Publication 1593.

**Symposium on Radioecology.** Proceedings of the 2nd National Symposium, Ann Arbor, 1967. Daniel J. Nelson and Francis C. Evans *et al.*, Eds. U.S. Atomic Energy Commission, Oak Ridge, Tenn., 1969 (available from Clearinghouse for Federal Scientific and Technical Information, Springfield, Va.). xii + 774 pp., illus. Paper, \$3. CONF-670503, Biology and Medicine. TID-4500.

**The Talented Student.** A Validation of the Creativity-Intelligence Distinction. Michael A. Wallach and Cliff W. Wing, Jr. Holt, Rinehart and Winston, New York, 1969. xiv + 146 pp. Paper, \$3.95.

**Vertebrate Adaptations.** Readings from *Scientific American*. Introduction by Norman K. Wessells. Freeman, San Francisco, 1969. viii + 368 pp., illus. Cloth, \$10; paper, \$5.45.

**Violent Men.** An Inquiry into the Psychology of Violence. Hans Toch. Aldine, Chicago, 1969. xviii + 270 pp. \$7.50.

**Weather and Health.** An Introduction to Biometeorology. Helmut E. Landsberg. Anchor (Doubleday), Garden City, N.Y., 1969. xii + 148 pp., illus. Cloth, \$4.95; paper, \$1.25. Science Study Series.

**Wildlife in Danger.** James Fisher, Noel Simon, Jack Vincent, *et al.* Viking, New York, 1969. 368 pp., illus. \$12.95. Studio Book.

**William Whewell's Theory of Scientific Method.** Robert E. Butts, Ed. University of Pittsburgh Press, Pittsburgh, 1969. xii + 360 pp. \$8.95.

**The World as Teacher.** Harold Taylor. Doubleday, Garden City, N.Y., 1969. xii + 324 pp. \$6.95.