

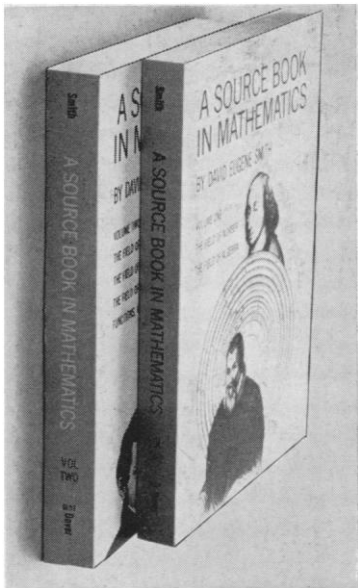
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Letters

Animal Research

As a member of the AAAS I object on moral grounds to those editorial policies which led to the publishing of the article "Effects of differential infantile handling upon weight gain and mortality in the rat and mouse" [*Science* 130, 629 (1959)] by V. H. Denenberg and G. G. Karas. Their experiments consisted of handling young rodents for various lengths of time and then starving the animals to death. The purpose of this procedure was to determine the stress effects of infantile handling on rats and mice.

In all experiments involving pain or death to animals, (i) the information to be obtained should be worth (in terms of human benefit or real increase in fundamental scientific knowledge) the suffering caused, and (ii) the same or more valuable information should not be obtainable, with a reasonable amount of extra effort, by more humane procedures. These two criteria are practically platitudes.

Since I am not a psychologist I shall not comment on the worth of the experiment. The second criterion given above was not observed and, indeed, the experiment was not only immoral but imprecise. Certainly competent biologists could have suggested tests (anatomical, physiological, biochemical, and so on) for estimating the effect of the stress on the animals that would have provided more precise and interesting data than the one crude fact—how long it took for the animals to starve to death. This more exact information would not have required killing the animals in so cruel and extended a fashion. Note well, it took over 9 days for some of the rats to die. If Denenberg and Karas were not capable of performing these more demanding tests, then they were obligated to ask capable biologists and chemists to assist them, and, of course, to share the authorship of their article.

Very often there is strong pressure exerted on scholars to publish. The editors of *Science* have a moral obligation to see that they do not encourage needlessly painful experimentation by their publishing policies.

R. B. KELMAN

Ossining, New York

The task of selecting an end point, or dependent variable, in research is always a critical one. At times it is a relatively simple matter since, for some problems, an appropriate end point has been established by theory and empirical findings. At other times it is difficult, for a variety of reasons, for an experi-

menter to arrive at a decision as to which variable or variables to measure. In selecting an end point it is generally agreed by investigators that certain criteria must be met. These criteria include *relevancy*, *sensitivity*, and *precision*. It is obvious that the measured variable must be relevant to the problem under investigation; it must be precise in the sense that it is repeatable; and it must be sensitive enough to detect differences induced by the experimental treatments, if such differences exist. Any variable which satisfies these demands is scientifically valid and may be used to study subhuman organisms. When research is conducted on human beings, other criteria in addition to those listed above must be met.

An end point which has been widely used with animals as a measure of resistance to stress has been survival time after the introduction of some stressor agent. One such stressor has been starvation, either by itself or in combination with other agents. Selye discusses various classes of stimuli including starvation, which act as stressors. The reader is referred to Selye and the other cited literature for further information and references (1). Thus, the biological literature definitely establishes that survival time following starvation is a *relevant* dependent variable.

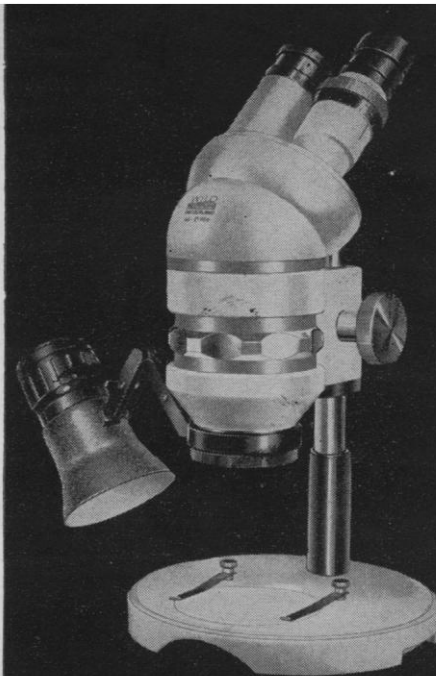
The precision of the survival-time end point has been attested to by the fact that different researchers, working independently, have been able to reproduce one another's results. As was indicated in our paper, Karas and I obtained the same general findings as did two other pairs of researchers. In addition, a partial replication of our data has established the repeatability of the phenomenon. Thus, the survival time measure is a *precise* end point.

The statistical analysis of our data found differences among the various groups well beyond the usually accepted level of significance. These statistical findings have held up in the partial replication. Thus, survival time is a *sensitive* end point.

Since the three criteria specified above have been met, it follows that our measure is scientifically valid and can be used to assess the effects of the experimental treatments.

It may still be argued that the technique is "crude" and that it does not provide "interesting data." With reference to the question of crudeness, it is pertinent to quote here a statement by Selye and Schenker (1), who exposed rats to a cold stress under starvation conditions and recorded survival time. In discussing the merits of their technique Selye and Schenker state that "the test is *specific* because it is based upon the preservation of life . . ."

(Continued on page 266)



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Editorial	Moment of Truth	267
Articles	A View of Genetics: <i>J. Lederberg</i>	269
	Human and Amphibian Neoplasms Compared: <i>W. R. Duryee</i> et al. Tumors in frogs and human beings are strikingly similar in cytological characteristics.	276
	Introducing Modern Medicine in a Navajo Community: <i>W. McDermott</i> et al. Physicians and anthropologists are cooperating in this study of changing patterns of culture and disease. The second of two parts.	280
Science in the News	Scientific Activity in Africa Growing; U.S. Education Aid Rising Slowly	287
Book Reviews	B. Wallace and Th. Dobzhansky, <i>Radiation, Genes, and Man</i> , reviewed by <i>B. Glass</i> ; other reviews	293
Reports	Enzymatic Basis of Mannose Toxicity in Honey Bees: <i>A. Sols</i> , <i>E. Cadenas</i> , <i>F. Alvarado</i>	297
	Identity of a Rust on <i>Ephedra</i> : <i>F. D. Kern</i> and <i>P. D. Keener</i>	298
	Cosmic Neutrino Radiation: <i>G. Marx</i> and <i>N. Menyhárd</i>	299
	Computer Analysis of Reflex Control and Organization: Respiratory Sinus Arrhythmia: <i>M. Clynes</i>	300
	Solid-Counting of Octadecane-1-H ³ : <i>M. Muramatsu</i> and <i>T. Sasaki</i>	302
	Electron Transfer and Absorption Spectra of Complexes: <i>S. Ainsworth</i> and <i>E. Rabinowitch</i>	303
Departments	Letters from <i>R. B. Kelman</i> and <i>V. H. Denenberg</i> ; <i>C. D. Holmes</i> , <i>G. W. Brier</i> , <i>D. B. Kline</i> ; <i>D. M. Gates</i>	263
	Pure Chemical Compounds; Forthcoming Events; New Products	304
Cover	The Massachusetts coast. Martha's Vineyard is at the lower left, and Chappaquiddick Island is at the right. Nantucket Sound is in the center, and Cape Cod and Massachu- setts Bay are in the background. [Photo by Laurence Lowry, from <i>This Sculptured Earth</i> , published by Columbia University Press; see page 294]	

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Moment of Truth

I once knew an agency whose top officer used a very effective method with his "governing" board. He placed every proposal he submitted on the agenda for three successive meetings. At the first meeting he would say: "Obviously we need not spend time at this meeting, debating this proposal; for today it is merely being recorded on our schedule for careful review at two later meetings." At the second, he would say: "I think it neither feasible nor necessary to devote any particular attention to this item at this meeting. It has been before you previously, and after all it does not come up for any definitive action until our next meeting." At the third and final meeting he would say: "Now gentlemen, this proposal has, as you all know, been before you for some time. The action requested today is the purely formal one of official approval, merely to complete the record on a proposal which has been before you twice previously, and which I am sure already has your carefully weighed consent. Do I hear a motion?"

I know another organization that prides itself on the many carefully scheduled steps which constitute the procedure for preliminary approval of any proposal for a new activity. By the time the proposal reaches the higher levels of responsibility, the number of examinations and successive interim approvals is so impressive that there is an almost overwhelming temptation to assume that the real decision has already been made.

I know another organization which approves "preliminary" studies of feasibility, of tentative design, of advance and small-scale laboratory testing of units to see whether they can be made to function—all of this aimed in the direction of some huge new venture. These beginning steps are taken in a rather carefree atmosphere of "Well, it won't cost too much to try out some ideas; and after all, we can decide later whether we really will undertake the huge venture." But presently the organization finds that, without ever facing the central decision, it has drifted into a position from which retreat is impossible.

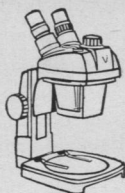
I hope it will not be too abrupt and curious a change of scene to recall what happens under the warm afternoon sun within the Plaza de Toros in Madrid, or Mexico City, or Linares, or Bogotá, or in many other Latin cities.

At each running of the bulls, after the haunting and foreboding pageantry of the entry; after the mad rush out through the gates of fear; after the grotesque ceremony of the picadores and the stylized precision of the banderilleros; after the exquisite skill and the frenetic bravado of the matador—then comes that quiet instant when best and man face each other in motionless challenge. Then is the moment when the bull's head goes down and the bright blade is poised. Then is the moment when courage and beauty and death confront one another, not in sham play, but in terrifying and noble reality.

If this honest and clear focus of decision can be achieved in the bull ring, is it too much to hope that, in the infinitely more significant contests which decide the great issues of support for science, we can make the preliminary steps serve, but not conceal or dominate? Is it too much to hope that there can be a cleanly recognized, an honestly recognized, moment when courage and wisdom and accepted responsibility confront the act of decision? Is it too much to hope that, in the administrative management of science and in the determining of the major lines of strategy, there occurs, from time to time, a moment of truth?—WARREN WEAVER, *Alfred P. Sloan Foundation, New York*



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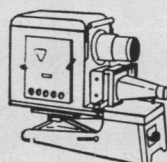
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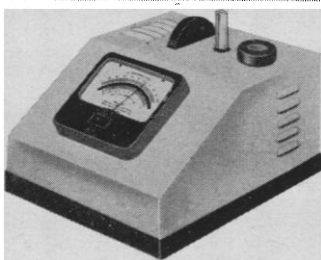
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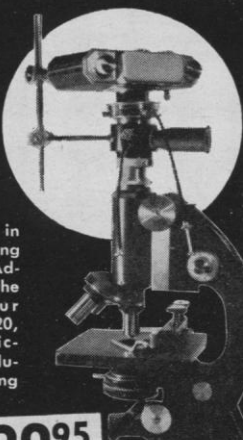


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Meetings

Pure Chemical Compounds

Augmented sources of certified pure substances, a clearinghouse of information about the availability of such materials, and intensified research on all aspects of the purity problem are urgently needed by science and industry. This situation was revealed at a conference on Chemical Compounds of Certified High Purity, held 22 and 23 June at the National Academy of Sciences in Washington. Approximately 35 prominent scientists participated in the conference, which was sponsored jointly by the National Science Foundation and the National Academy of Sciences-National Research Council. Frederick D. Rossini of the Carnegie Institute of Technology was chairman of the conference and also of the five-man organizing committee appointed by academy president Detlev Bronk.

Highly purified compounds are necessary as standards of measurement, in the calibration of instruments, and in the definitive determination of physical and chemical properties requisite for the compilation of "critical tables" of enduring value. In fact, in any type of physical or chemical research where experimental results are sensitive to small amounts of impurity, the availability of pure compounds is imperative. The preparation of such materials simply has not kept pace with the tremendous strides made in recent years in instrumentation and experimental techniques of measurement.

Many major classes of inorganic, organic, and metallo-organic compounds should be made available, including biologically important classes of compounds. Discussion ranged widely over the diverse types of pure substances required—from monoisotopic elements such as oxygen-17 to complex proteins such as insulin, and from single crystals and semiconductor materials to more prosaic compounds. It was also revealed that new criteria for determining purity are needed by biochemists, chemists, and physicists. The educators present agreed that a great increase in the availability of pure compounds speeds graduate research but also results in a certain loss from the standpoint of teaching, which must be remedied.

At the conclusion of the conference recommendations were made for the establishment of a center of information on existing sources of chemical compounds of certified high purity and for the establishment of a permanent central technical organization with responsibility for the identification, preparation, further purification, and certification of pure chemical compounds. It was

also recommended that the National Academy of Sciences-National Research Council, in cooperation with other national and international scientific groups, implement a program for improved communication among laboratories concerned with the pure-compounds problem and encourage research on all aspects of the purity of chemical compounds and on the analytical chemistry pertaining to this work.

A limited number of copies of a report on the conference has been prepared. These are available to persons concerned with the pure-compounds problem and may be requested from the Office of Critical Tables, National Academy of Sciences, 2101 Constitution Avenue, NW, Washington 25, D.C.

GUY WADDINGTON

National Academy of Sciences,
Washington, D.C.

Forthcoming Events

February

25-27. Cell Physiology of Neoplasia (14th annual symp. on fundamental cancer research), Houston, Tex. (Editorial Office, Univ. of Texas M. D. Anderson Hospital, Texas Medical Center, Houston 25.)

26. Highway Geology, 11th annual symp., Tallahassee, Fla. (W. F. Tanner, Geology Dept., Florida State Univ., Tallahassee.)

28-5. American College of Allergists, Miami Beach, Fla. (E. Bauers, 2160 Rand Tower, Minneapolis 2, Minn.)

29-3. American College of Surgeons, Boston, Mass. (H. P. Saunders, 40 E. Erie St., Chicago, Ill.)

29-4. Pittsburgh Conf. on Analytical Chemistry and Applied Spectroscopy, Pittsburgh, Pa. (L. P. Melnich, U.S. Steel Corp., Monroeville, Pa.)

March

2-4. Low and Medium Energy Nuclear Physics, colloquium, Grenoble, France. (F. Netter, C.E.N., Saclay, BP. No. 2, Gif-sur-Yvette, Seine et Oise, France.)

3-5. American Acad. of Forensic Sciences, Chicago, Ill. (W. J. R. Camp, AAFS, 1853 W. Polk St., Chicago 12.)

4-6. National Wildlife Federation, Dallas, Tex. (C. H. Callison, 232 Carroll St., NW, Washington 12.)

6-13. American Otorhinologic Soc. for Plastic Surgery, Miami Beach, Fla. (J. G. Gilbert, 75 Barberry Lane, Roslyn Heights, N.Y.)

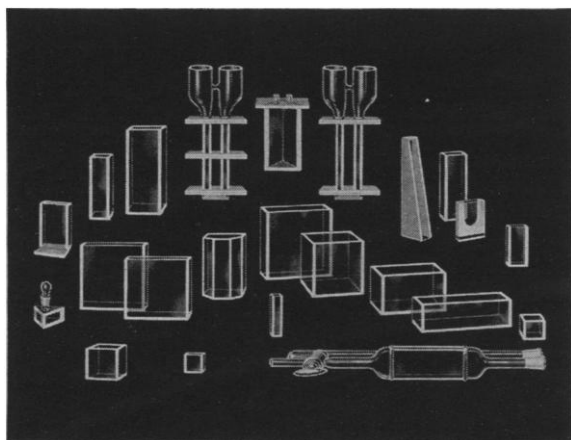
7-9. Wildlife Management Inst., Dallas, Tex. (C. R. Guterth, 709 Wire Bldg., Washington 5.)

7-11. American Soc. of Civil Engineers, New Orleans, La. (E. S. Kirkpatrick, ASCE, 33 W. 39 St., New York 18.)

10. Recent Developments in Poultry Nutrition (Assoc. of Vitamin Chemists), Chicago, Ill. (J. T. Sime, Director of Research, Evaporated Milk Assoc., 228 N. La Salle St., Chicago 1.)

10-11. Institute of the Aeronautical Sci-

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21, 523 (58).
Ibid, 20, 601 (58)

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ences—Flight Propulsion, Cleveland, Ohio. (S. P. Johnston, 2 E. 64 St., New York 21.)

13-14. American Otological Soc., Miami Beach, Fla. (L. R. Boies, University Hospital, Minneapolis 14.)

14-16. American Railway Engineering Assoc., annual conv., Chicago, Ill. (N. D. Howard, AREA, 59 E. Van Buren St., Chicago 5.)

14-17. Positive Health of Older People, forum, Miami Beach, Fla. (A. Mallach, National Health Council, 1790 Broadway, New York 19.)

14-18. National Assoc. of Corrosion Engineers, 16th annual, Dallas, Tex. (W. A. Mapler, NACE, 18263 W. McNichols Rd., Detroit 19, Mich.)

15-16. American Broncho-Esophango-

logical Assoc., Miami Beach, Fla. (F. J. Putney, 1712 Locust St., Philadelphia 3.)

15-21. Nondestructive Testing, 3rd intern. conf., Tokyo and Osaka, Japan. (S. Ishizaka, Scientific Attaché, Embassy of Japan, 2514 Massachusetts Ave., NW, Washington 8.)

17. Congress for Pharmacists, 2nd annual, Jamaica, N.Y. (Congress for Pharmacists, Public Relations Office, St. John's Univ., Jamaica 32.)

17-19. American Radium Soc., conf., San Juan, Puerto Rico. (ARS, 635 East Union, Pasadena, Calif.)

17-19. Blood Platelets, intern. symp. (by invitation only), Detroit, Mich. (Miss S. A. Johnson, Henry Ford Hospital, Detroit 2.)

17-20. International Assoc. for Dental Research, Chicago, Ill. (D. Y. Burrill, Northwestern Univ. Dental School, 311 E. Chicago Ave., Chicago 11.)

18-19. American Laryngological Assoc., Miami Beach, Fla. (L. Richards, Massachusetts Inst. of Technology, Cambridge.)

20-23. American Assoc. of Dental Schools, Chicago, Ill. (R. Sullen, 840 N. Lake Shore Drive, Chicago 11.)

20-26. American Cong. on Surveying and Mapping, Washington, D.C. (C. E. Palmer, American Soc. of Photogrammetry, 1515 Massachusetts Ave., NW, Washington 5.)

20-26. American Soc. of Photogrammetry, Washington, D.C. (C. E. Palmer, ASP, 1515 Massachusetts Ave., NW, Washington 5.)

21-24. American Acad. of General Practice, 12th annual, Philadelphia, Pa. (AAGP, Volker Blvd. at Brookside, Kansas City 12, Mo.)

21-24. Institute of Radio Engineers, natl. conv., New York, N.Y. (L. G. Cumming, IRE, 1 E. 79 St., New York 21.)

23-25. National Council on Alcoholism, annual, New York, N.Y. (M. Ross, American Psychiatric Assoc., 1700 18 St., NW, Washington 9.)

23-25. Optical Spectrometric Measurements of High Temperatures, symp., Chicago, Ill. (F. Brech, Laboratories for Applied Science, Univ. of Chicago, 6220 S. Drexel Ave., Chicago 37.)

24-25. Human Factors in Electronics, 1st annual symp. (IRE), New York, N.Y. (J. E. Karlin, Bell Telephone Laboratories, Murray Hill, N.J.)

24-26. American Assoc. for the History of Medicine, Charleston, S.C. (J. B. Blake, c/o Smithsonian Institution, Washington 25.)

24-26. Aviation Education, 4th natl. conf., Denver, Colo. (W. Kinkley, Superintendent of Schools, Aurora, Colo.)

26-27. American Psychosomatic Soc., 17th annual, Montreal, Canada. (E. D. Wittkower, APS, 265 Nassau Rd., Roosevelt, N.Y.)

28-31. Exploitation of Natural Animal Populations, symp., Durham, England. (E. D. Le Cren, British Ecological Soc., The Ferry House, Ambleside, Westmorland, England.)

29-31. American Power Conf., 22nd annual, Chicago, Ill. (R. A. Budenholzer, Mechanical Engineering Dept., Illinois Inst. of Technology, 3300 Federal St., Chicago 16.)

29-31. National Science Teachers Assoc., 8th annual conv., Kansas City, Mo. (Miss M. R. Broom, NSTA, National Education Assoc., 1201 16 St., NW, Washington 4.)

30-31. Adrenergic Mechanisms, Ciba Foundation symp. (by invitation only), London, England. (G. E. W. Wolstenholme, Ciba Foundation, 41 Portland Pl., London, W.1, England.)

31-1. Continuous Culture of Microorganisms, symp., London, England. (R. Elsworth, c/o Ministry of Supply, Microbiological Research Establishment, Porton, Salisbury, Wilts., England.)

31-2. American Gastroenterological Assoc., New Orleans, La. (W. Volwiler, Dept. of Medicine, Univ. of Washington, Seattle.)

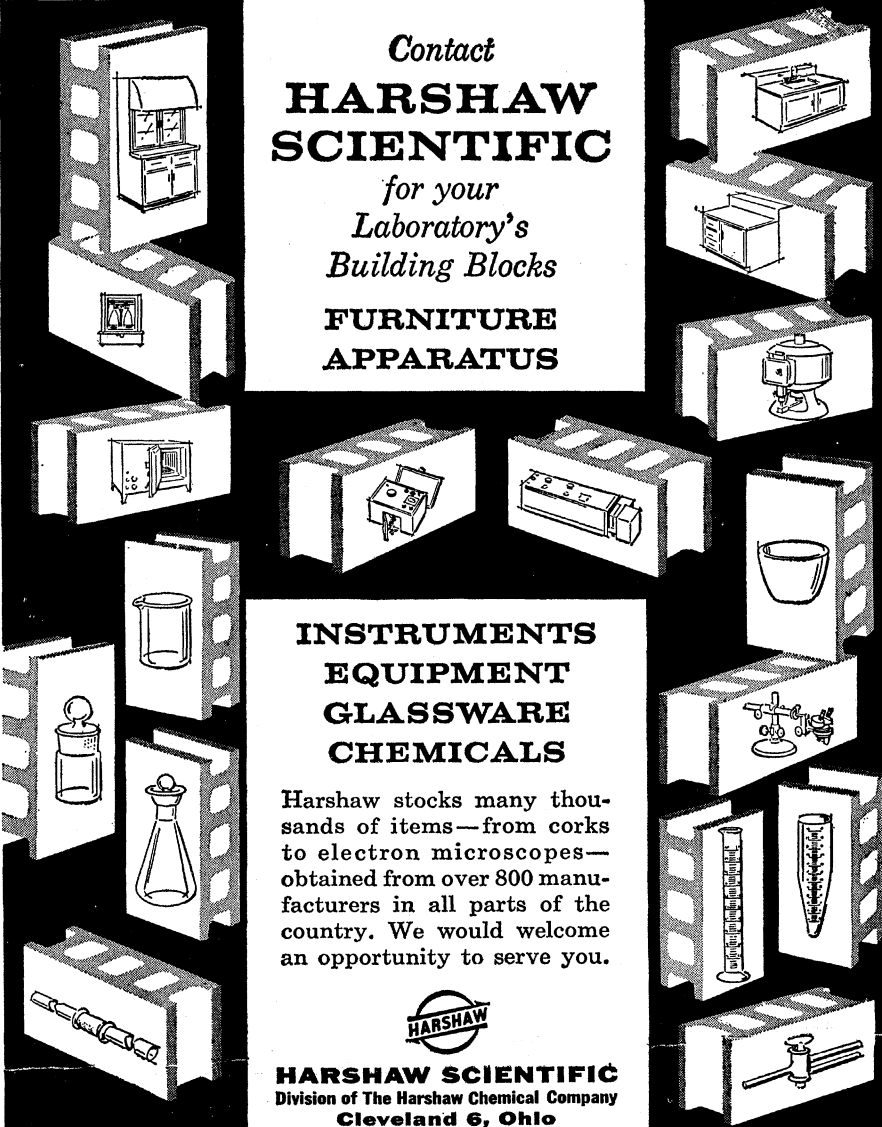
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