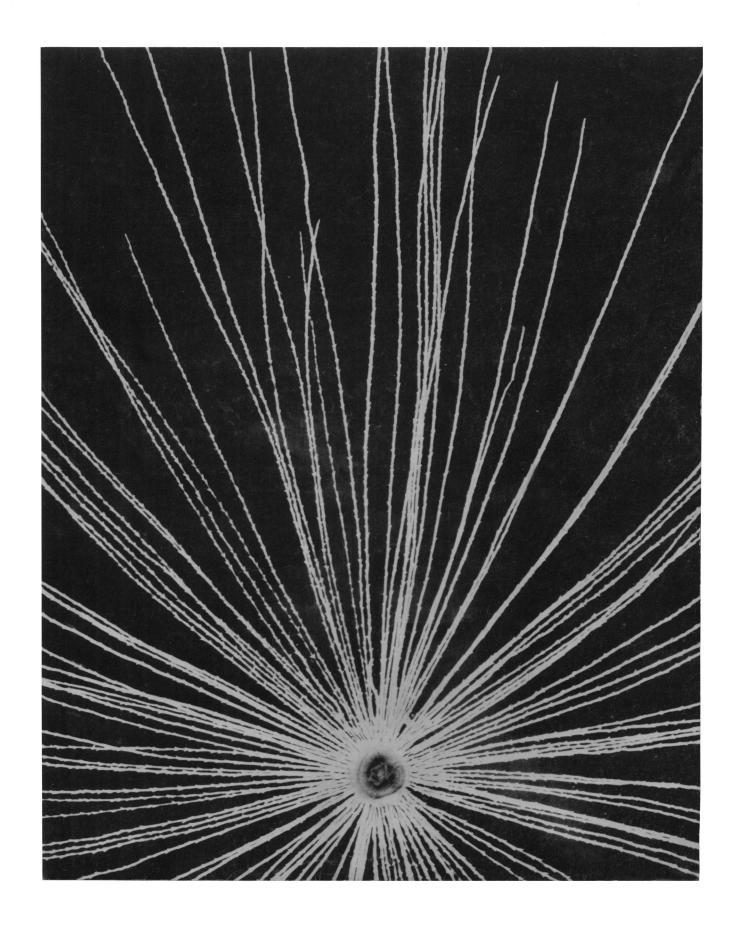


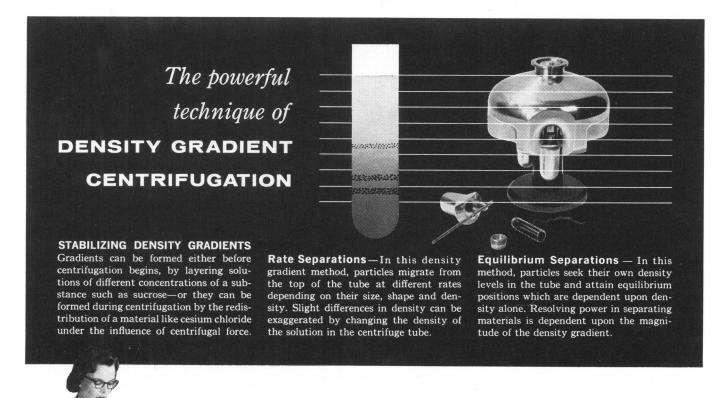
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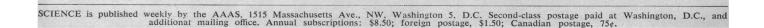


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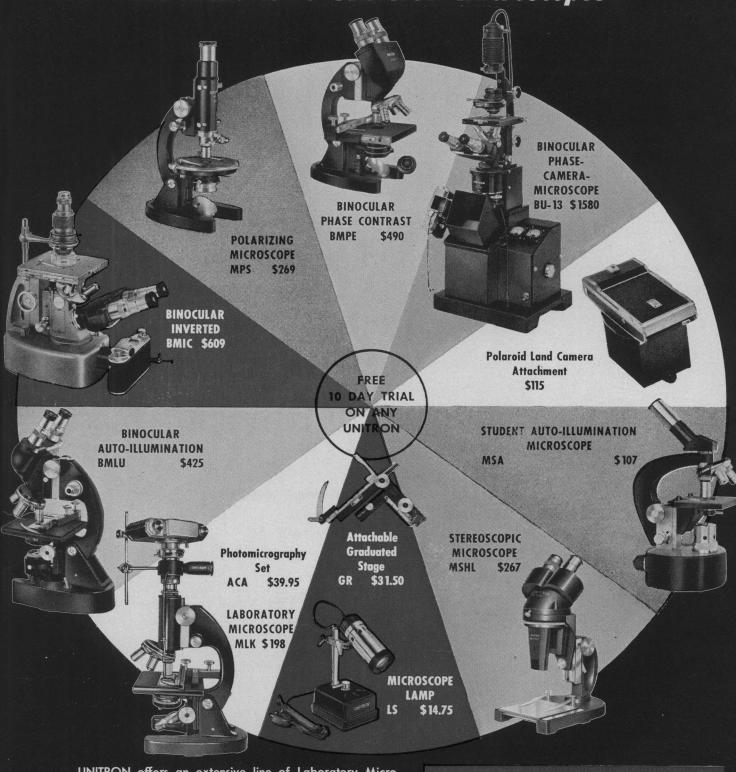
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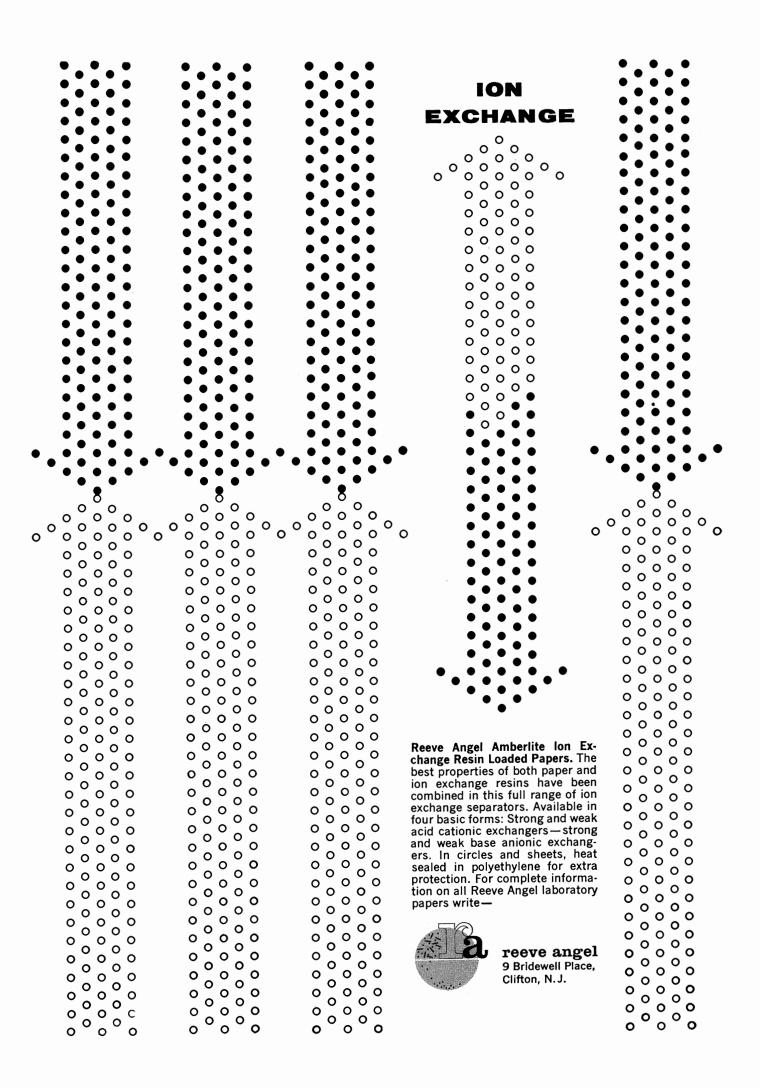
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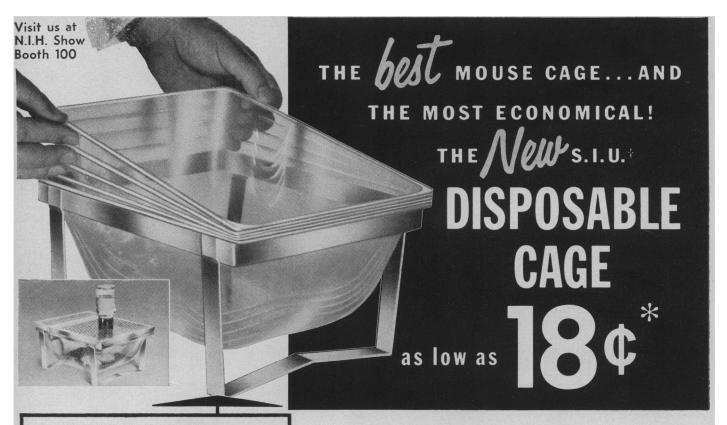
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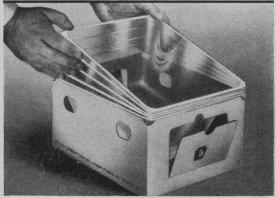


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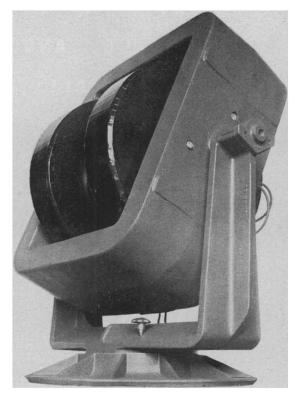
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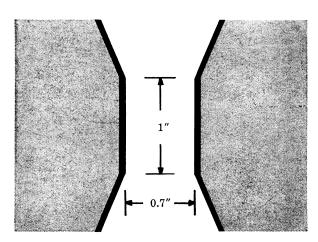
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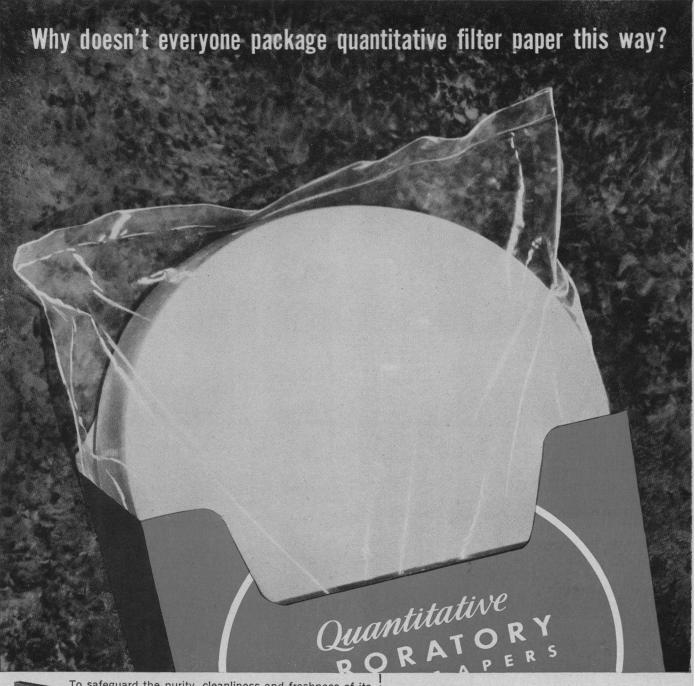
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758 SCIENCE, VOL. 134





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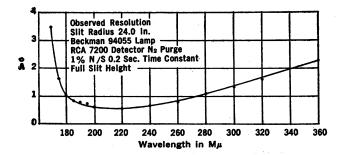
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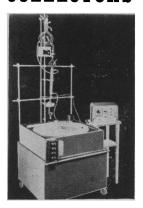
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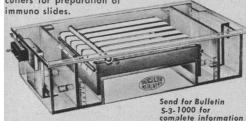
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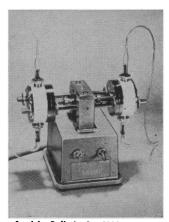


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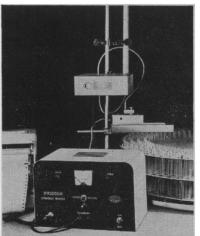
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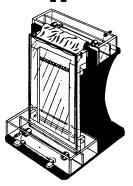


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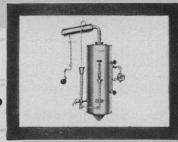
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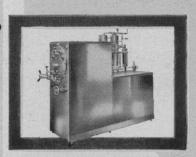


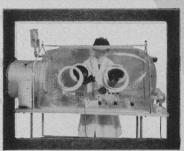
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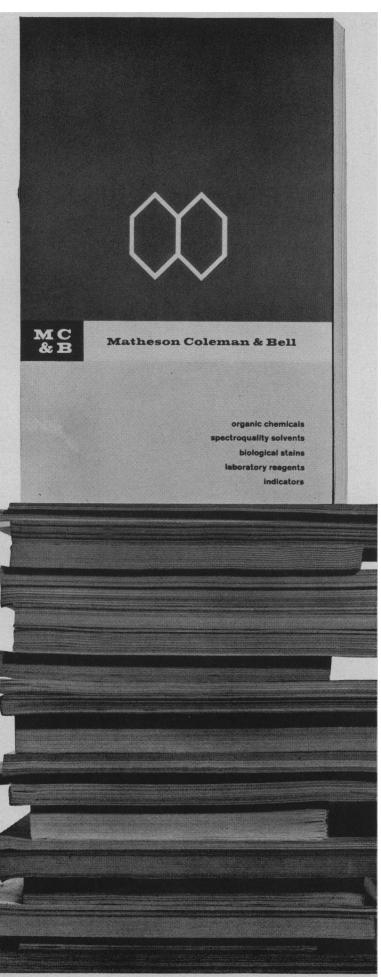
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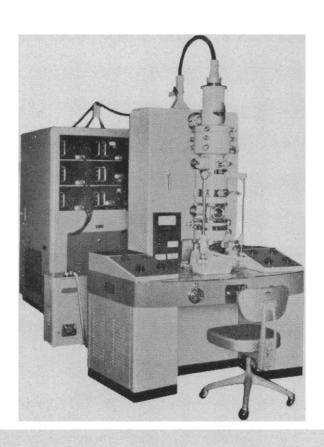
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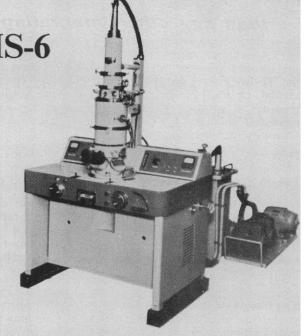
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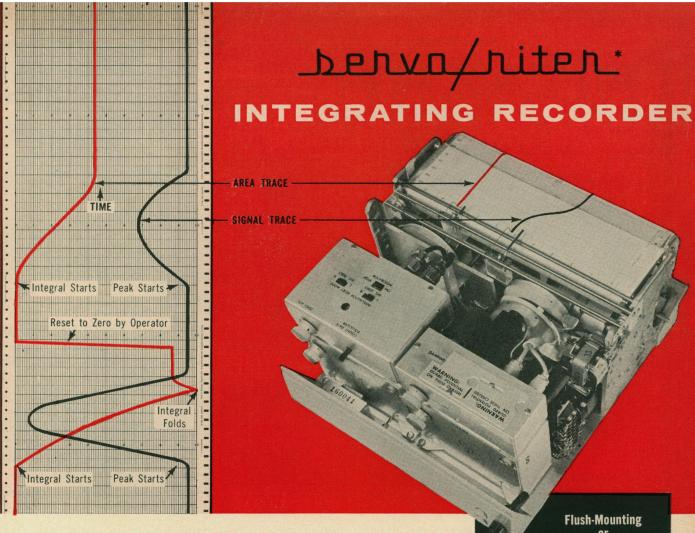


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Note that the integrating signal utilizes the full chart scale to provide faster, easier reading. Traverse of the full scale represents 1,000 counts. If the integral exceeds 1,000 counts, the integral "folds" and completes its excursion in the opposite direction. You may reset the pen to either margin between each peak or at the start of each integration for easier interpretation. The integrating circuit may be set to any assumed zero point in the span of the recorder signal.

The Integrator Recorder is offered with either portable or flush-mounting servo/riter recorders. Or, the Integrator Unit may be factory installed in your existing wide or dual chart servo/riter recorder. In fact, many flexible arrangements are possible . . . let TI's recorder engineers work with you on specific applications.



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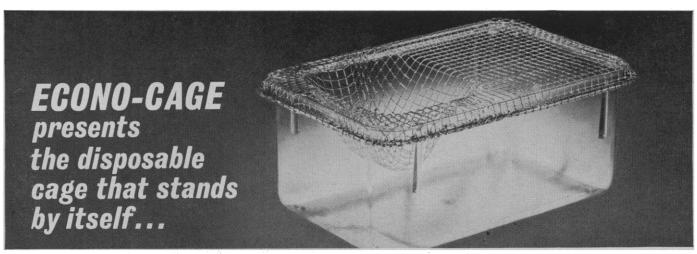
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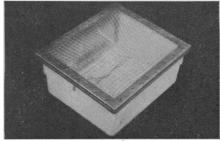
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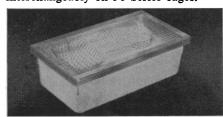
added to the line that stands by itself

The New Disposable Econo-Cage #21, Pictured Above, Brings To Animal Care A Rigid Plastic Disposable Cage That Spells Real Economy. It Stands By Itself Requiring No Expensive Supports That Prevent Full Visibility. Designed Primarily For Mice, The Cage Is 11½" X 7½" X 5" Deep. The Floor Area Of 84 Square Inches Will Adequately House Up To 12 Mice. All 20 Series Lids Fit The New Disposable Econo-Cage #21.



ECONO-CAGE #50 SERIES

The new 50 Series Econo-Cages and lids are designed for Hamsters or rats. Dimensions are 12% " X 14%" X 65%" deep with room for 11 adult Hamsters per cage. The cages are available in clear Acrylonitrile-Styrene Copolymer—Econo-Cage #53, Linear Polyethylene—Econo-Cage #54 and Polypropylene—Econo-Cage #55. All 50 Series lids fit interchangeably on 50 Series cages.



ECONO-CAGE #40 SERIES

Number 40 Series cages can be used interchangeably for Hamsters and/or rats. #43 is made of clear Acrilonitrile-Styrene-Copolymer, #44 of Linear Polyethylene and #45 of translucent Polypropylene. All 40 Series lids are standard

 $\frac{1}{2}$ " mesh designed for rat housing and fit interchangeably on all 40 Series cages. All 30 Series lids also fit all 40 Series cages but have the $\frac{5}{16}$ " for mice.



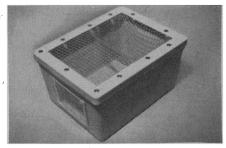
ECONO-CAGE #30 SERIES

Number 30 Series cages are designed as breeding and holding cages for mice. The over-all dimensions are 19" X 10½" X 5½" deep. Cage #32 is made of fiberglass, reinforced by plastic. Cage #33 is made of clear Acrylonitrile-Styrene Copolymer. Cage #34 is made of linear high density Polyethylene. Cage #35 is made of Polypropylene. All 30 Series lids are interchangeable on 30 Series cages.



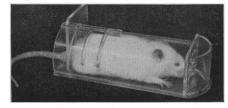
ECONO-CAGE #20 SERIES

Econo-Cages in the 20 Series are designed primarily for mice. Over-all dimensions of the cages are 11½" X 7½" X 5". This cage is used for housing animals during experimentation and also as a one-to-one and two-to-one breeding cage. The cages are available in Polystyrene - new disposable Econo-Cage #21, Fiberglass, reinforced plastic -Econo-Cage #22, clear Styrene-Acrylonitrile Copolymer - Econo-Cage #23, transculent Linear Polyethylene-Econo-Cage #24, autoclavable Polypropylene-Econo-Cage #25 and Polycarbonate Resin-Econo-Cage #27. All 20 Series lids are interchangeable on 20 Series cages.



GENERAL PURPOSE ECONO-CAGE #12

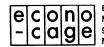
Over-all dimensions of the Econo-Cage general purpose unit are $11\frac{1}{2}$ " X 8" X 6" deep. This cage is designed especially for laboratories with changing animal use requirements. It can be used to house mice, Hamsters, rats and guinea pigs. Because of its versatility, it is ideal in teaching situations. The cage is available with or without windows. It is made of fiberglass reinforced polyester plastic. All #12 lids can be used on General Purpose Cage #12.



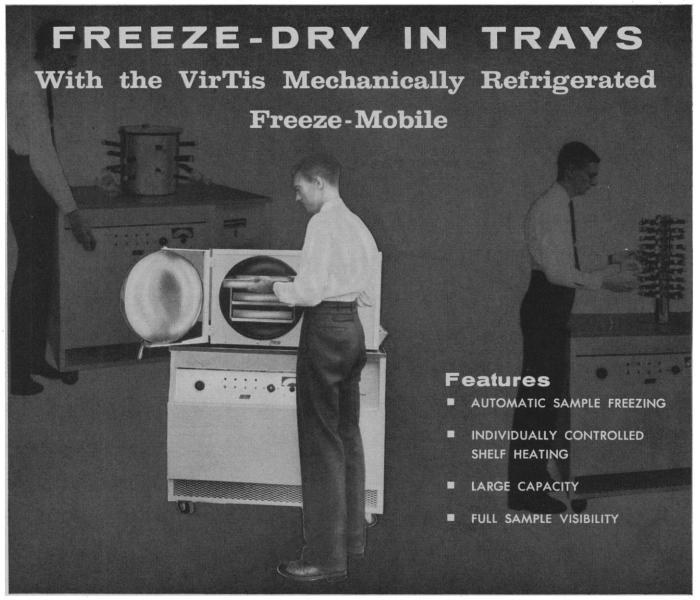
ECONO-RESTRAINING CAGES #90 SERIES

The small Restraining Cage #88 can be varied from 2" to 3½" in length and is 1¼" wide. Econo-Cage #90 can be varied from 4½" to 6" in length and is 2½" wide. Econo-Cage #91 can be varied from 5" to 7" in length and is 3" wide. All these units can be cleaned chemically or with hot water. They are not autoclayable.

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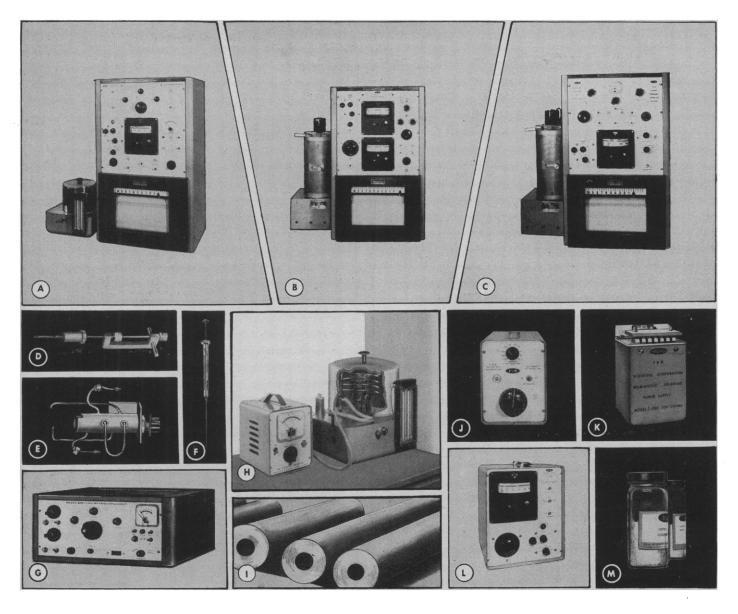
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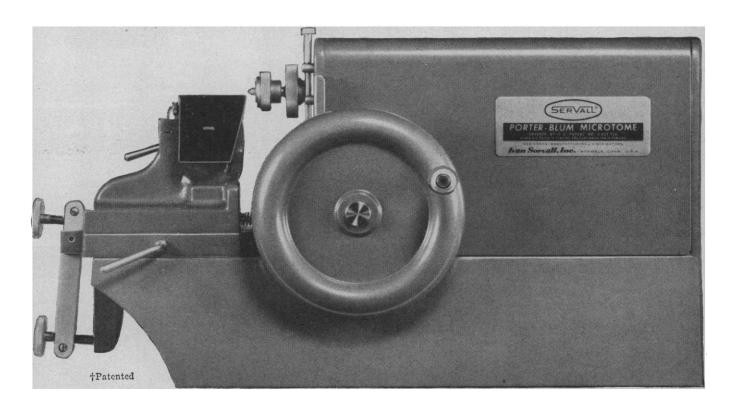
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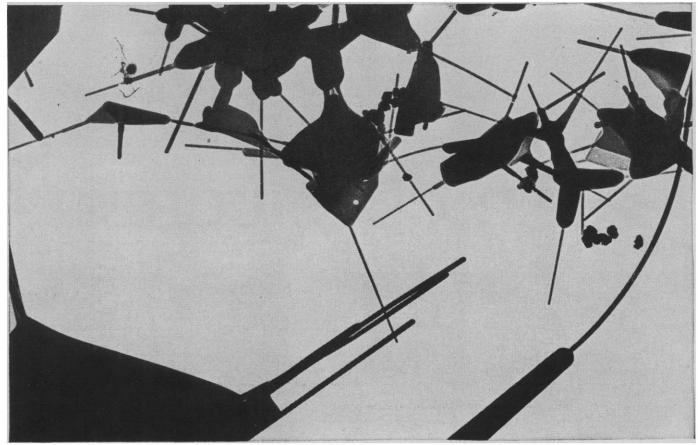
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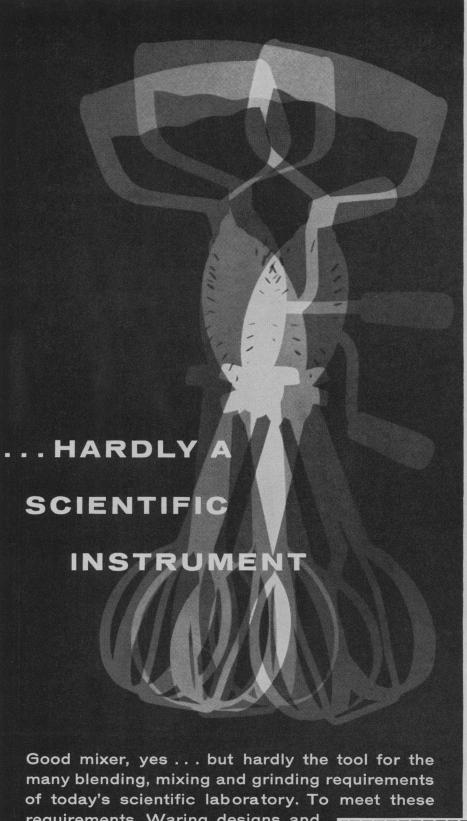
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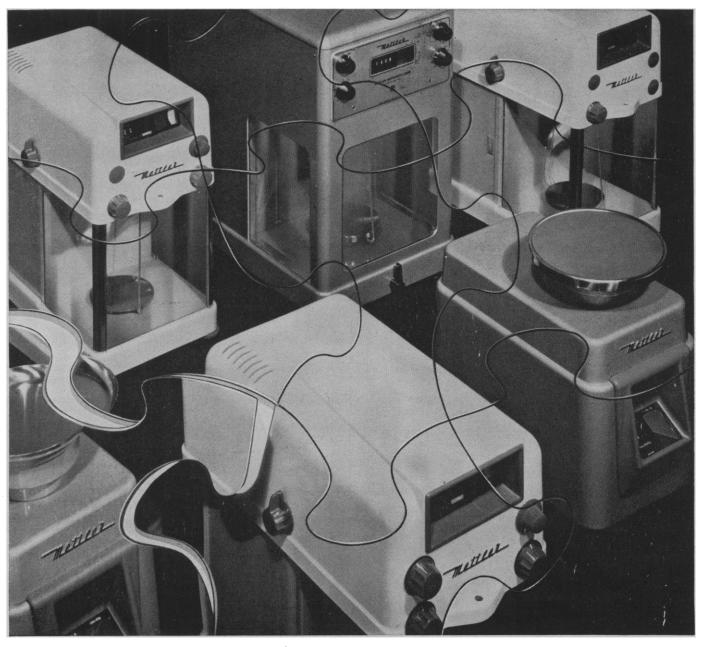
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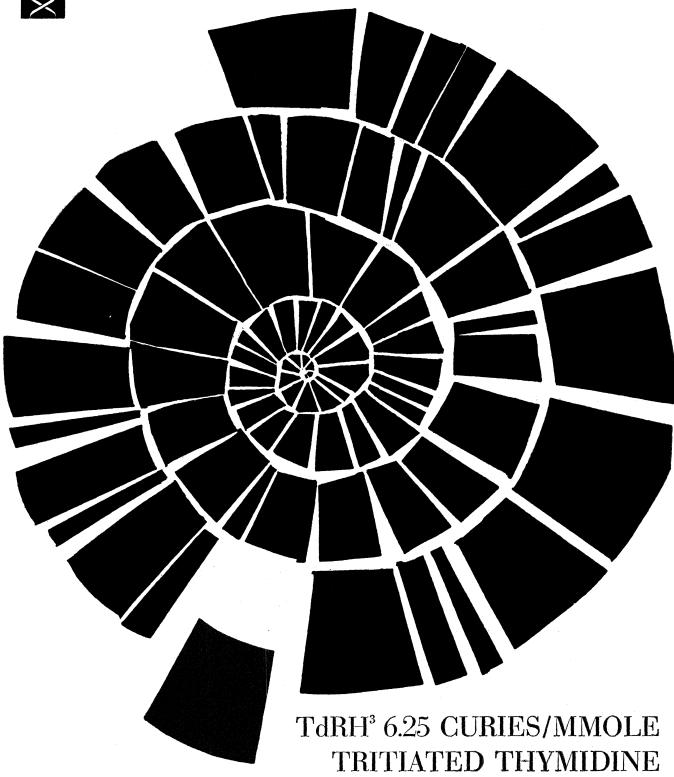
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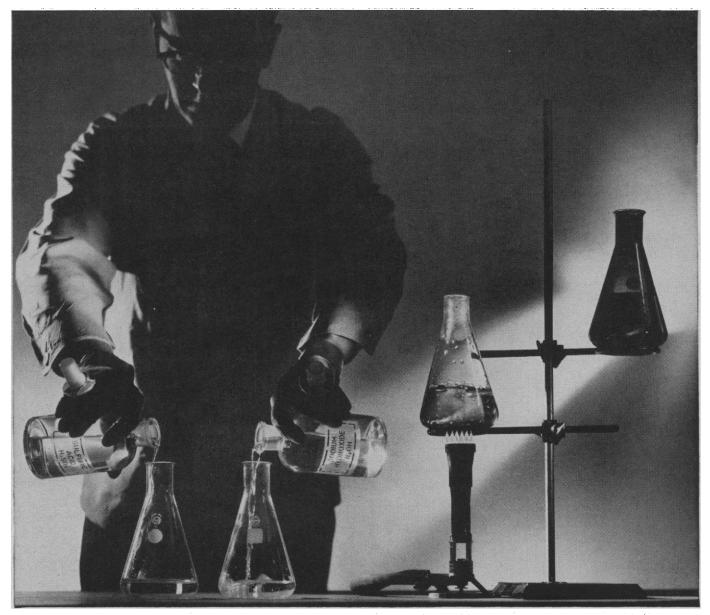
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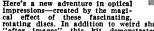


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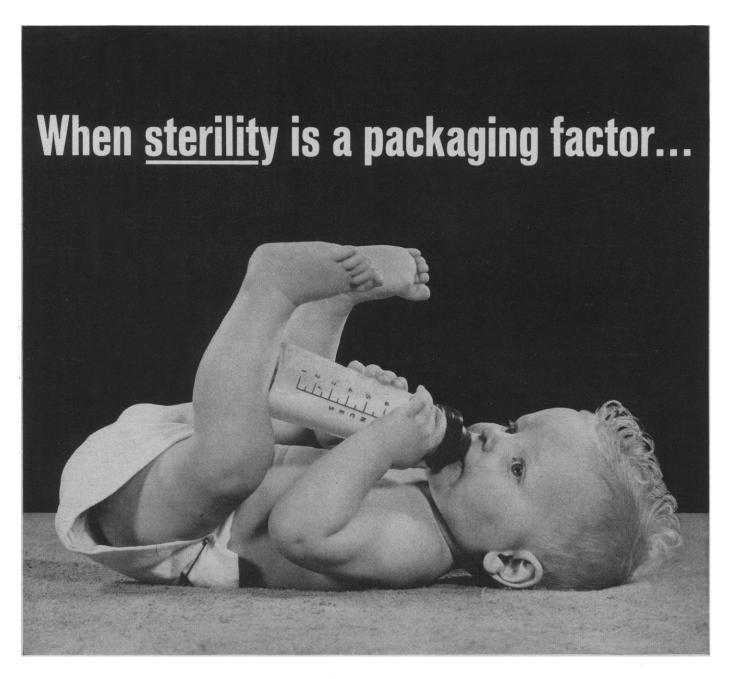
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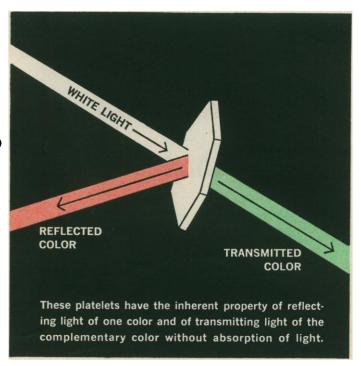
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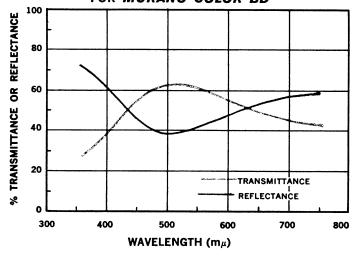
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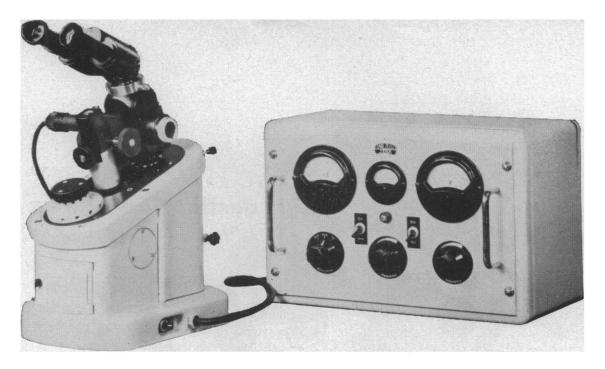
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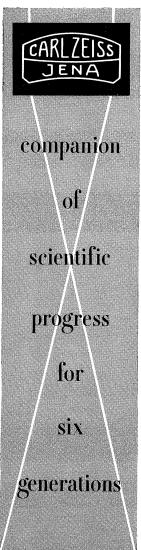
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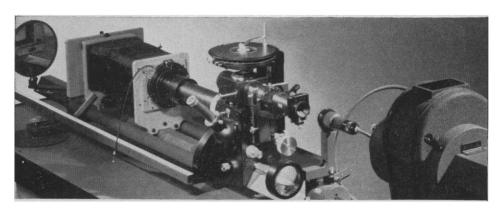




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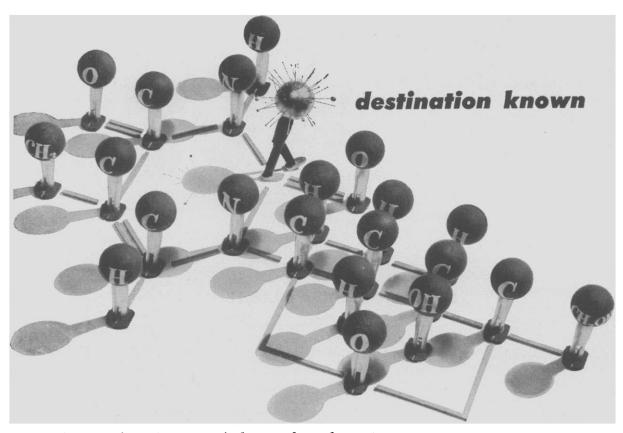
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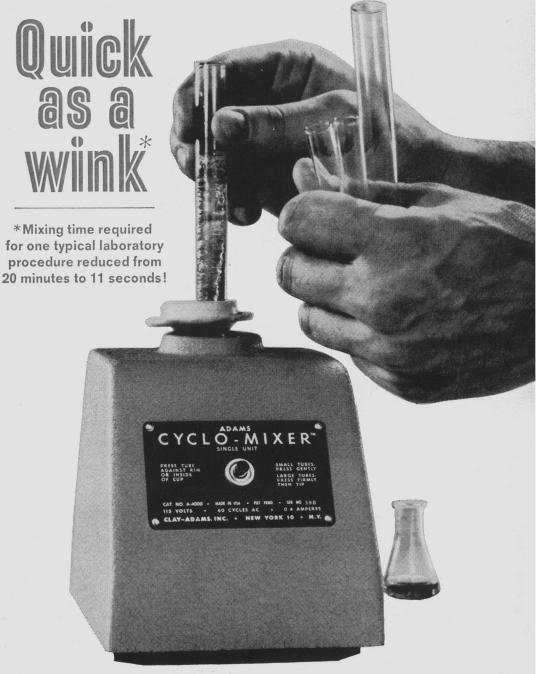
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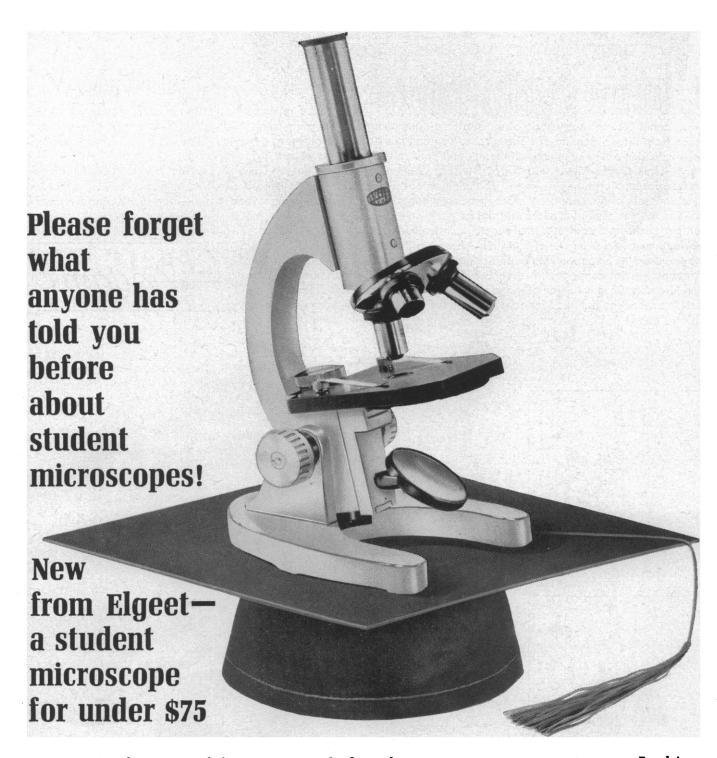


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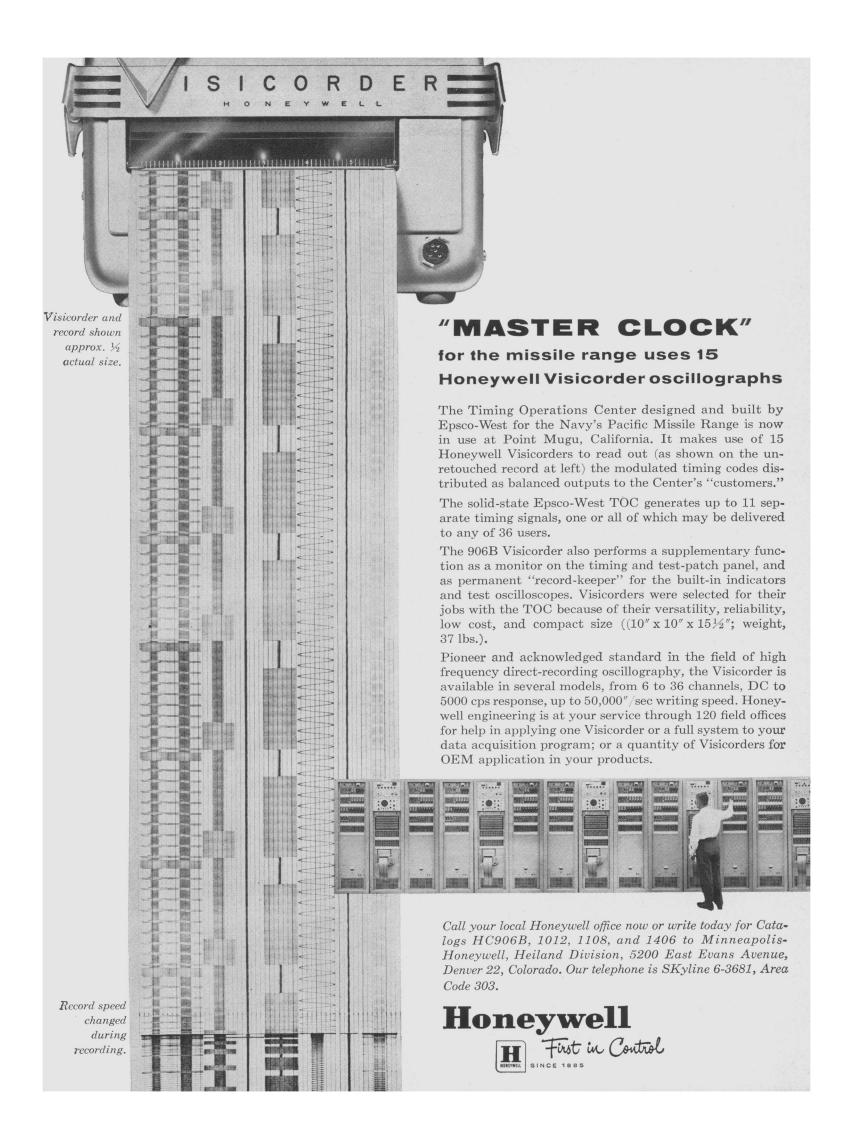
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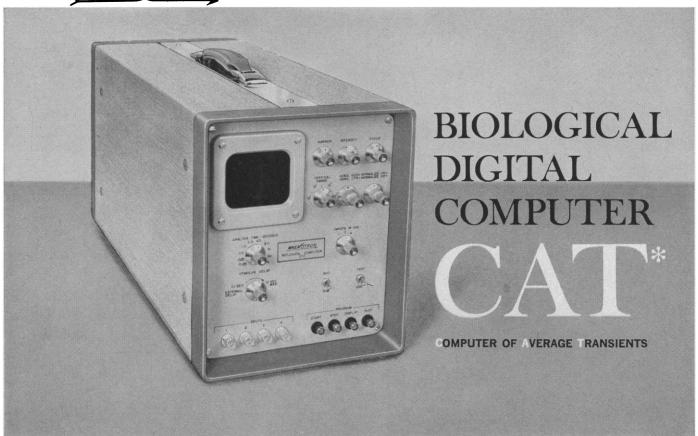
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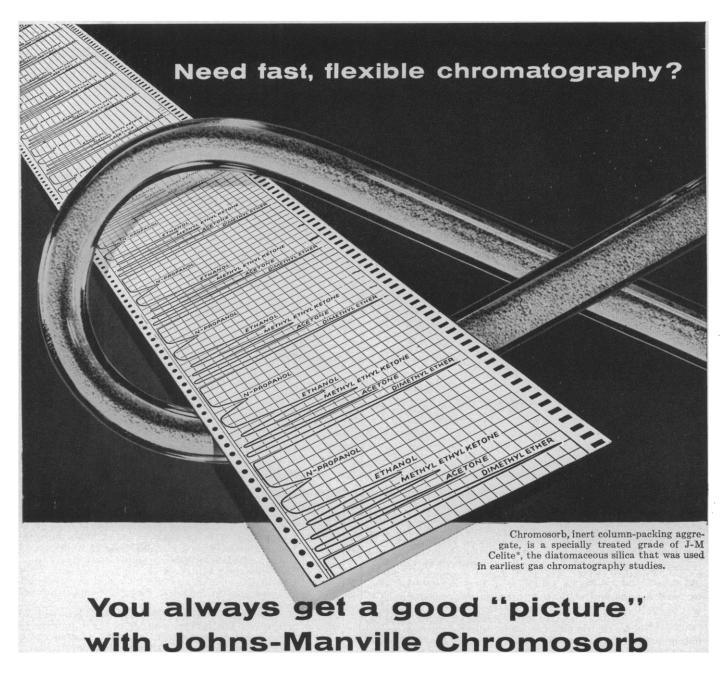
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Write for Bulletin S53

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tion of the center of gravity (population) will be on the perpendicular bisector of the base, varying with the distance of C from the base; but regardless of that distance, the point of minimum travel for the three to convene will be a fixed point, the center of the equilateral triangle of which AB is one side.

WALTER CROSBY EELLS 3700 Massachusetts Avenue, NW, Washington, D.C.

Choice of Discipline

The growing dichotomy in biology described by Barry Commoner [Science 133, 1745 (1961)], a plant physiologist, is even more evident to those of us in the traditional areas. Paralleling the need he presents for a defense of biology is a need for defense of the individual who has chosen to work in biology. What are you to answer, for example, when a fellow scientist challenges not the quality of your research but, rather, the quality of your whole research area?

Having worked in one of the more traditional parts (floristics) of a classical biological discipline (plant taxonomy), I have several times felt a need to defend my choice of this area against the pronouncements not only of those outside my particular discipline but even of those within it.

The only satisfactory answer I have found is this: that the goal of modern science is to achieve nothing less than a complete intellectual mastery of the universe. In terms of this goal, no one area of scientific research is of intrinsically greater value than another; and it follows, therefore, that in the evaluation of his chosen discipline the scientist is autonomous.

Tom S. Cooperrider Kent State University, Kent, Ohio

Food Additives

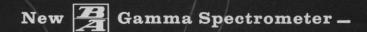
In their letter [Science 133, 947 (1961)] Levin and co-authors discuss the question of an advisory board on problems related to the Delaney clause in the Food Additives Amendment. This question has been of serious concern to all manufacturing groups concerned with chemicals that come in contact with food. The provisions of the amendment, without this clause, are

sufficient to enable the Food and Drug Administration to refuse registration to food additives that have been shown to cause cancer. Levin and co-authors stated that the "fact" should be considered that "the panel probably would be under heavy pressure from corporations who would want exemption now for additives for which there is some evidence of carcinogenic effect in animals." The reason for designating such an allegation as a "fact" is not stated. A comparable prediction would be that the panel would be under pressure by cancer investigators who want exclusion of additives for which there is a minimum of evidence of carcinogenic effect. Large sums have been made available by Congress for research in cancer because of the public fear of this disease. Investigators in the field of environmental cancer will inevitably be preoccupied with seeking indications of carcinogenic stimuli. Some of us feel that there has been a tendency to emphasize the danger from certain chemicals on the basis of equivocal scientific evidence, as we have previously noted

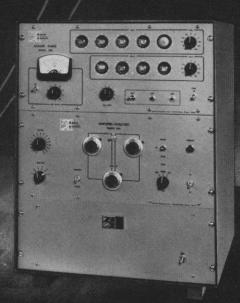
The second point made by the authors relates to the difficulty of predicting safety on the basis of expecting less than 100 responses in a population of 108. This question was discussed at length by Seevers (2) some years ago, who, without invoking elaborate statistical procedures, correctly pointed out the impossibility of guaranteeing absolute safety from chemicals. He stated: "no method ever has been, or ever can be, devised which will permit in advance an exact prediction of human hazard No competent pharmacologist, toxicologist or clinician will undertake to guarantee that no risk is present in making available a new chemical for widespread distribution . . . The degree of risk is calculated by balancing the toxicity of the chemical under conditions of use (its hazard) against its benefits to man."

Should production of tumors in animals under specialized experimental conditions by chemical stimuli be sufficient to cause the enduring label of "carcinogen" to be affixed to the chemicals? Estrogenic substances, examples of which are widely distributed in animal and plant materials (3), fall under the ban. Huggins, who reported the aggravating effect of a mixture of progesterone and estradiol on transplanted mammary fibroadenoma in rats (4), also has found that this mixture pre-

(Continued on page 869)



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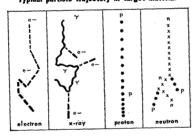
Accelerators in Biology

A regular reader of this series will not be surprised to learn that most of the nuclear particle accelerators which we sell to university and government laboratories are being used by physical scientists to explore the nature and structure of physical things.

Increasingly, however, the life scientist is making use of accelerators to learn more about the living cell and the effects of ionizing radiation on complex biological systems, including man. This type of study has obvious implications in general medical research, cancer therapy, space medicine and health physics.

Another area of application — one we might call biological engineering — involves the reduction of biological concepts to engineering practice. These uses of accelerators — to extend the shelf life of foods for indefinite storage, to deinfest cereals and grains or inhibit sprouting in fruits and vegetables and to sterilize drugs and pharmaceuticals—hold the promise of solving some of the most important human problems.

Typical particle trajectory in target material



Sterilizing with Electrons

The inactivation or "killing" of microorganisms by use of penetrating radiation from particle accelerators is a practical commercial application today. Production sterilization of sutures is being successfully carried out with High Voltage Engineering microwave linear accelerators by Ethicon, Inc., a division of Johnson and Johnson. Similar programs have been adopted by other organizations using Van de Graaffs and other types of accelerators. Radia-

tion sterilization facilities, available on a rental basis for pilot studies or production runs, are being operated by Electronized Chemicals Corporation at Burlington, Mass. and by High Voltage Engineering Corporation at Rockford, Ill. 70,000 curies of cobalt-60 or 250,000 curies of cesium-137. Moreover, the *utilization efficiency* of a directed and scanned electron beam is higher than that of divergent gamma-rays.

(4) The source of ionizing energy

TYPICAL ACCELERATORS AVAILABLE FOR STERILIZATION

Type Accelerator	Energy Range (Mev)	Power (kw)	Electron Penetration* (inches)	X-Ray Yield (r/min — 1 m)
Insulating Core Transformer	0.3-0.5	5	0.02-0.04	هوهنية فينهناه
Van de Graaff	1.0-4.0	4	0.13-0.54	5 x 10 ³
Microwave Linac	4.0-12.0	10	0.54-1.60	3 x 10 ⁴

*Uniform electron penetration in unit-density material.

Since all forms of ionizing energy are qualitatively similar in their ability to modify and destroy all forms of life, you may be interested to know the reasons for the choice of these machines — and their high-energy electron outputs — as the radiation source for sterilizing applications:

(1) The ionizing agent should be of the type which accelerates electrons within the absorber, without producing dissociation and degradation in the basic material. Protons, alpha particles, neutrons, and other heavy particles which produce dense columns of ionization are ruled out by this criterion.

(2) The ionizing energy should be capable of penetrating to an adequate depth within or through the absorber and should deliver an approximately uniform dose. Lack of adequate penetration effectively eliminates ultraviolet which is restricted to films of unit density material about 100 microns thick. The penetration of electrons increases directly with accelerating voltage, and installations can be designed to assure adequate irradiation in depth.

(3) The ionizing energy should be available in quantity and at a cost to process bulk quantities safely and economically. Although both x-rays and gamma-rays meet this requirement, the processing capability of high-energy electrons is usually safer and greater. For example 1 kilowatt of output electron energy is equivalent to the gamma-ray energy released by

should permit irradiation of the medium in any state, including solid, liquid and frozen. Irradiation in the dry state or frozen liquid state can often preserve normal properties of complex materials otherwise sensitive to radiation. This is accomplished most effectively and conveniently with high energy electron beams because of their intense localized output and correspondingly rapid product throughput.

(5) The ionizing energy actually absorbed in the medium must be capable of accurate application, measurement, shielding and control. The relative simplicity and accuracy of absorbed dose measurement and control for x-rays, gamma-rays and high-energy electrons is about the same. Shielding is accomplished more readily with electrons, however, because of their defined direction and range and inefficient x-ray production at low voltages.

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"A Mere Bagatelle"

A melancholy commentary on our times is that it seems unrealistic and somewhat old-fashioned to discuss international relations on ethical grounds. We have come to take it for granted that the law of the jungle prevails among nations. Nevertheless, nations large and small still attempt to justify their actions on the basis of moral principles: they appeal to the court of world opinion. Acts of national self-interest may be, for example, camouflaged as necessary to "preserve the peace" even though innocent bystanders may be hurt in the process.

Perhaps no course of action in the history of mankind, short of war itself, is more charged with ethical questions than the testing of nuclear weapons in the atmosphere. For any test of this kind puts radioactive materials into the stratosphere to come down upon earth as fallout over the ensuing months and years all over the world. It is true that the amount of fallout from all tests conducted before the present series was started amounts to only a small fraction of the natural background radiation to which everyone is at all times subjected. Furthermore, it is unlikely that the current series of tests by the Soviet Union will-even if a 100-megaton bomb is set off-produce much more fallout than all previous explosions combined. Although experimental evidence to show that such low levels of radiation are damaging is lacking, it is a sound assumption that some somatic and some genetic harm will result. The risk for any particular individual is small, but for the race as a whole, the probability of damage approaches certainty. As Mr. Tsarapkin has said, according to the Manchester Guardian Weekly, "The dangers of fallout are a mere bagatelle compared with the dangers of nuclear war." Quite true, but deplorably lacking in feeling. It is as though someone who is amputating your finger against your will should tell you that the loss of a finger is negligible compared with loss of the head.

Considerations of this kind and of world opinion were important factors in leading the Soviet Union, Great Britain, and the United States to suspend testing of all kinds nearly three years ago. They led the scientists and diplomats at Geneva to focus on the means of detecting and hence monitoring underground nuclear explosions, which produce no fallout. With the exception of the four small nuclear devices exploded by France, there have been no explosions in the atmosphere since the large series conducted by the Soviet Union in 1958. Fallout reached its peak in the spring of 1959 and steadily declined until the recent series was begun. It seemed not unreasonable to entertain the hope—despite increasing tensions over Berlin—that the voluntary suspensions of testing in the atmosphere by the major nuclear powers might persist indefinitely.

The new series of atmospheric tests by the Soviet Union rudely dashed these hopes. The resumption of atmospheric tests manifests a cynical disregard of world opinion about the undesirability of increasing the exposure of the human race to radiation. Morality aside, it paves the way for the resumption of tests by others anxious to keep their relative positions in the deadly race, and it opens the door to new nuclear powers. We can think of no more urgent matter for the United Nations to consider at its current session. We hope that Premier Khrushchev's blatant threats to annihilate the principal NATO powers in Europe and to vaporize the Acropolis will not deter the U.N. from condemning atmospheric testing. That such condemnation would be effective immediately is perhaps too much to hope for, but that it might have a long-term deterrent effect is a reasonable expectation. G.DuS.



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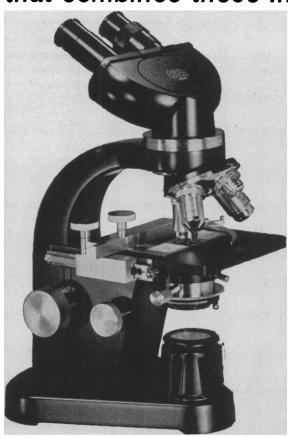


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22 SEPTEMBER 1961

Auditor's Report

At the end of 1960, the Association changed its method of handling the annual financial statement. In previous years the Association's own staff has prepared an "unofficial" balance sheet and record of financial transactions. Sometime later in the year, usually in May or June, the Association's auditor, G. P. Graham and Company, has prepared a separate account. In previous years the figures presented in the published statement similar to this one have been taken from the auditor's account.

All of the figures given in this report have been drawn from the financial statement prepared by the Association's accounting department. The auditor has reviewed that statement and has suggested that five of the many figures in the full and detailed account from which the present report is drawn should have been larger and five should have been smaller. Most of these discrepancies are due to the fact that income or expense items applicable to 1960 were not received until after the financial statement for the year had been completed. The cumulative effect of these ten changes would have been to increase the excess of income over expenditure by \$1524. This amount will be shown in the 1961 statement and annual report as an adjustment for prior years.

The discrepancies resulting from this change are not serious. The review by the auditor of the Association's financial accounts upon which the above report is based concluded with the statement: "In our opinion the accompanying statements present fairly the financial position of the American Association for the Advancement of Science as at 31 December 1960, and the results of its operations for the year ended on that date, and were prepared in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year. Respectfully submitted, G. P. Graham and Company, by G. R. Bowers."

DAEL WOLFLE

American Association for the Advancement of Science

Southwestern and Rocky Mountain Division

The Southwestern and Rocky Mountain Division of the American Association for the Advancement of Science held its 37th annual meeting in Tempe, Arizona, 16 to 20 April 1961. Meeting jointly with the division were the Arizona Academy of Science and District 3 of the Western Region of Beta Beta Beta.

At general sessions of the meetings Dael Wolfle, executive officer of the AAAS, gave the John Wesley Powell memorial lecture on "Developing talent"; P. C. Duisberg presented an illustrated discussion on the arid lands of South America; William H. Woodin presented his address as retiring president of the Arizona Academy of Science, on "A voyage to Galapagos"; and Alan T. Wager, retiring president of the Southwestern and Rocky Mountain Division, spoke on "Changing values in teacher training in the sciences."

There were special symposia of invited papers as follows: "Ecology of Ground Water in the Southwest" (under the sponsorship of the divisional committee on desert and arid zones research); "Improvement of Science Teaching" (sponsored by the divisional committee for improvement of science teaching); "Arizona's Popula-

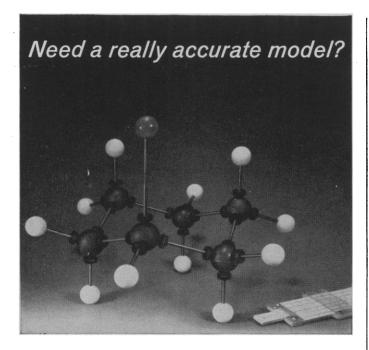


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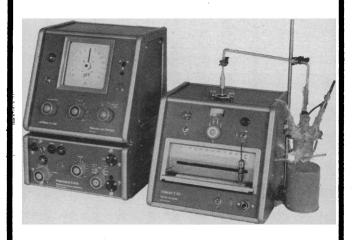


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tion Growth and Its Effect on Native Plants and Animals" (sponsored by the biological section of the Arizona Academy of Science); and "Pioneers in Southwestern Anthropology" (under the auspices of the Arizona Academy of Science's section on anthropology).

Sixteen undergraduate members of Beta Beta Beta presented papers on their projects of undergraduate research.

In joint meetings of sections of the Southwestern and Rocky Mountain Division and of corresponding sections of the Arizona Academy of Science, 115 individual research papers were presented.

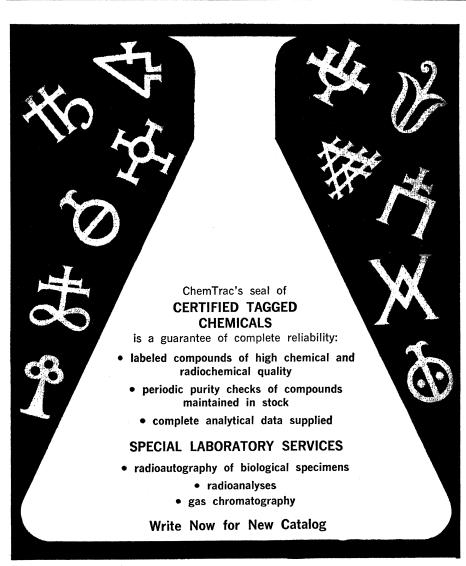
Newly elected officers of the divi-

sion are Anton H. Berkman (Texas Western College), president, and Terah L. Smiley (University of Arizona), member of the executive committee. Marlowe G. Anderson (New Mexico State University) will continue as secretary-treasurer and council representative.

The Southwestern and Rocky Mountain Division will meet jointly with the AAAS in Denver in December. According to present plans, the division will sponsor one of the major lectures at those meetings as its traditional John Wesley Powell memorial lecture.

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Meetings

Forthcoming Events

October

7-13. American Soc. of Oral Surgeons, 43rd annual, New York-Bermuda cruise, *M.S. Bergensfjord*. (D. C. Trexler, ASOS, 840 N. Lake Shore Drive, Chicago 11, Ill.)

9-12. Water Pollution Control Federation, 34th annual, Milwaukee, Wis. (R. E. Fuhrman, 4435 Wisconsin Ave., NW, Washington 16)

9-13. American Rocket Soc., space flight meeting, New York, N.Y. (ARS, 500 Fifth Ave., New York 36)

9-13. Luminescence of Inorganic and Organic Systems, intern. conf., New York, N.Y. (Miss G. M. Spruch, New York Univ., Washington Sq., New York 3)

10-12. Nuclear Reactor Chemistry, 2nd conf., and Analytical Chemistry in Nuclear Reactor Technology, 5th conf., Gatlinburg, Tenn. (Oak Ridge National Laboratory, Post Office Box X, Oak Ridge, Tenn.)

10-13. Administration of Research, 15th conf., San Juan, Puerto Rico. (G. F. Anton, Research Center, Univ. of Puerto Rico, Mayaguez, P.R.)

10-20. International Committee for Biological Control, Tunis. [P. Grison, Laboratoire de Biocenotique et de Lutte Biologique, La Miniere, par Versailles (S.-et.-0.), France]

11-13. Gaseous Electronics Conf., American Physical Soc., Schenectady, N.Y. (C. J. Gallagher, General Electric Research Laboratories, Schenectady, N.Y.)

11-14. Tau Beta Pi Assoc., Cincinnati, Ohio. (R. H. Nagel, Univ. of Tennessee, Knoxville)

11-14. Western Inst. on Epilepsy, 13th annual conf., San Antonio, Tex. (F. Risch, 3097 Manning Ave., Los Angeles, Calif.)

12–13. Congress of Neurological Surgeons, New York, N.Y. (E. Weiford, 4706 Broadway, Kansas City 12, Mo.)

12-29. Pacific Intern. Trade Fair, 2nd, technical meetings, Lima, Peru. (PITF, P.O. Box 4900, Lima)

14-20. International Congr. of Neurological Surgery, 2nd, Washington, D.C. (B. S. Ray, 525 E. 68 St., New York 21)

15. American College of Dentists, Philadelphia, Pa. (O. W. Brandhorst, 4236 Lindell Blvd., St. Louis, Mo.)

15-20. American Inst. of Electrical Engineers, fall general meeting, Detroit, Mich. (E. C. Day, AIEE, 33 W. 39 St., New York 18)

15-20. International Congr. of Allergolgy, 4th, New York, N.Y. (W. B. Sherman, 60 E. 58 St., New York 22)

15-21. Pan American Congr. of Endocrinology, 5th, Lima, Peru. (M. San Martin, Av. Central 325, San Isidoro, Lima)

16-17. Engineering Writing and Speech, natl. symp., East Lansing, Mich. (J. D. Chapline, Philco Corp., 3900 Welsh Rd., Willow Grove, Pa.)

16-17. Ionization of the Air, intern. conf., Philadelphia, Pa. (I. C. Kornblueh, American Inst. of Medical Climatology, 1618 Allengrove St., Philadelphia 24)

16-18. American Soc., of Safety Engineers, Chicago, Ill. (A. C. Blackman, 5 N. Wabash Ave., Chicago 2)

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16-18. Entomological Soc. of Canada and Entomological Soc. of Quebec, Quebec, Canada. (L. L. Reed, ESC, Neatby Bldg., Carling Ave., Ottawa, Canada)

16-18. Metallurgy of Beryllium, intern. conf., London, England. (Secretary, Inst. of Metals, 17 Belgrave Sq., London, S.W.1)

16-19. American Dental Assoc., Philadelphia, Pa. (H. Hillenbrand, 222 E. Superior St., Chicago 11, Ill.)
16-19. Vacuum Science and Technol-

16-19. Vacuum Science and Technology, 2nd intern. congr., Washington, D.C. (W. M. Welch, Intern. Organization for Vacuum Science and Technology, 1515 Sedgwick St., Chicago 10, Ill.)

16-20. American Ornithologists' Union, Washington, D.C. (H. G. Deignan, U.S. National Museum, Washington 25)

16-20. American Soc. of Civil Engineers, New York, N.Y. (W. H. Wisely, 33 W. 39 St., New York 18)

16-20. Symposium on the Programming and Utilization of Research Reactors, Vienna, Austria. (Intern. Atomic Energy Agency, Room 2249, United Nations, New York, N.Y.)

17-19. Japan Conf. of Radioisotopes, 4th, Tokyo. (R. Suga, Japan Atomic Industrial Forum, Inc., No. 1, 1-Chome, Shiba Tamura-cho, Minato-ku, Tokyo)

17-19. Lubrication Conf., 8th, jointly by American Soc. of Lubrication Engineers and American Soc. of Mathematical Engineers, Chicago, Ill. (R. L. Johnson, NASA, Lewis Research Center, 21000 Brookpark Rd., Cleveland 35, Ohio)

18-20. Design of Experiments in Army Research, Development, and Testing, 7th conf. (by invitation only), Fort Monmouth, N.J. (F. G. Dressel, Army Research Office (Durham), Box CM, Duke Station, Durham, N.C.)

18-20. Optical Soc. of America, Los Angeles, Calif. (Miss M. E. Warga, 1155 16 St., NW, Washington 6)

19-20. International Geophysics Assoc., 12th colloquium, Salzburg, Austria. (IGA, Freisaalgasse 31, Salzburg)

19-21. Indiana Acad, of Science, Terre Haute. (E. D. Weinberg, Dept. of Bacteriology, Indiana Univ., Bloomington)

20-21. Shallow Water Research Conf., Atlantic Coast, 1st natl., Baltimore, Md. (D. S. Gorsline, Oceanographic Inst., Florida State Univ., Tallahassee)

20-24. American Heart Assoc., annual, Miami Beach, Fla. (AHA, 44 E. 23 St., New York 10)

23-25. International Scientific Radio Union and Inst. of Radio Engineers, fall meeting, Austin, Tex. (Miss H. E. Hart, U.S.A. Natl. Committee URSI, 2101 Constitution Ave., NW, Washington 25)

23-25. Metallurgical Soc. of the American Inst. of Mining, Metallurgical and Petroleum Engineers, fall meeting, Detroit, Mich. (AIME, 29 W. 39 St., New York 18)

23-27. Metal Congr. and Exposition, 43rd natl., Detroit, Mich. (A. R. Putnam, American Soc. for Metals, Metals Park, Novelty, Ohio)

23-28. Congress of Chemical Engineering, 1st, San Juan, P.R. (R. Munoz, Apartado 47, Estación de Río Piedras, San Juan)

24-25. Shallow Water Research Conf., Gulf Coast, 1st natl., Tallahassee, Fla. (D. S. Gorsline, Oceanographic Inst., Florida State Univ., Tallahassee)

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24-26. Aerospace Nuclear Propulsion, intern. symp., Las Vegas, Nev. (P. M. Uthe, Lawrence Radiation Laboratory, Univ. of California, Box 808, Livermore)

24-27. American Dietetic Assoc., 44th annual, St. Louis, Mo. (Mrs. T. Pollen, ADA, 620 N. Michigan Ave., Chicago 11.

26-27. American Soc. of Tool and Manufacturing Engineers, Toronto, Canada. (A. Cervenka, Vanderbilt Blvd., Oakdale, L.I., N.Y.)

26-27. Instrumentation Facilities for Biomedical Research, symp., Omaha, Neb. (H. G. Beenken, Univ. of Nebraska College of Medicine, 42 and Dewey Ave., Omaha)

26-27. New Mexico Acad. of Science. Albuquerque. (K. G. Melgaard, P.O. Box 546, Mesilla Park, N.M.)

26-28. Professional Group on Electron Devices, annual meeting, Washington. D.C. (I. M. Ross, Technical Program Chairman, Room 2A-329, Bell Telephone 1.aboratories, Murray Hill, N.J.) 26-30. American Soc. for Aesthetics.

Detroit, Mich. (J. R. Johnson, Cleveland Museum of Art, Cleveland 6, Ohio)

27-28. Shallow Water Research Conf., Pacific Coast, 1st natl., Los Angeles, Calif. (D. S. Gorsline, Oceanographic Inst.. Florida State Univ., Tallahassee)

27-29. Association of Clinical Scientists, annual, Washington, D.C. (R. P. Mac-Fate, Secretary, ACS, 323 Northwood Rd., Riverside, III.)

28. American Mathematical Soc., 583rd meeting, Cambridge, Mass. (E. Pitcher, Lehigh Univ., Bethlehem, Pa.)

29-31. Photoelasticity, intern. symp., Chicago, Ill. (P. D. Flynn, Illinois Inst. of Technology, Chicago 16)

29-1. Marine Biology, intern. conf. (by invitation only), Princeton, N.J. (Mrs. E. Purcell, Interdisciplinary Conference Program, Rockefeller Center, Time & Life Bldg., New York 20)

30-1. American Oil Chemists Soc., Chicago, III. (W. O. Lundberg, Hormel Inst., Univ. of Minnesota, 801 16th Ave., NE, Austin)

30-1. Society of Rheology, annual, Madison, Wis. (J. D. Ferry, Univ. of Wisconsin, Madison)

31-2. Interscience Conf. on Antimicrobial Agents and Chemotherapy, 1st, American Soc. for Microbiology, New York, N.Y. (ASM, 19875 Mack Ave., Detroit 36, Mich.)

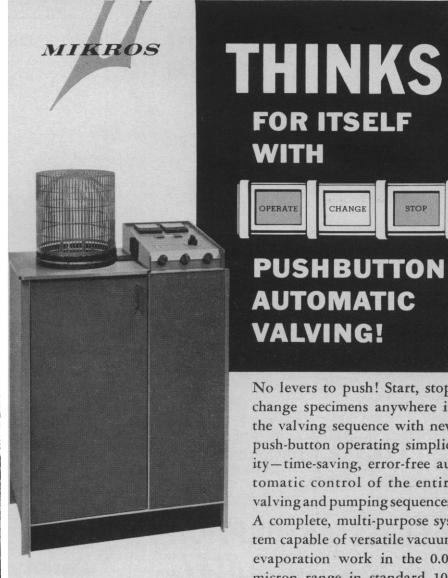
November

1. Rheumatic Fever, symp., New Haven, Conn. (E. A. Sillman, Connecticut Heart Assoc., 65 Wethersfield Ave., Hartford 14, Conn.)

1-3. Alkaline Pulping, 15th conf., Houston, Tex. (Technical Assoc. of the Pulp and Paper Industry, 360 Lexington Ave., New York 17)

1-3. Experimental Mechanics, 1st intern. congr., New York, N.Y. (Soc. for Experimental Stress Analysis, P.O. Box 168, Central Sq. Station, Cambridge 39, Mass.)

1-3. High Magnetic Fields, intern. conf., Cambridge, Mass. (H. H. Kolm, Lincoln Laboratory, Massachusetts Inst. of Technology, Lexington 73)
1-3. Transplantation, CIBA Foundation



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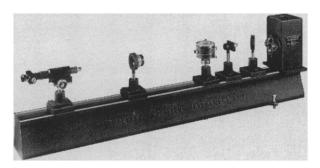
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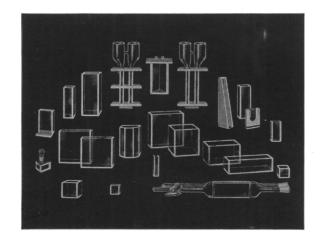


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symp. (by invitation), London, England. (CIBA Foundation, 41 Portland Pl., London, W.1)

1-4. American Soc. of Tropical Medicine and Hygiene, Washington, D.C. (R. B. Hill, 3575 St. Gaudens Rd., Miami 33, Fla.)

1-4. Society of Economic Geologists, Cincinnati, Ohio. (E. N. Cameron, Science Hall, Univ. of Wisconsin, Madison 8)

2-3. Cancer Chemotherapy, clinical symp., Washington, D.C. (T. P. Waalkes, Chemotherapy Natl. Service Center, NIH, Bethesda 14, Md.)

2-4. American Soc. for Cell Biology, 1st, Chicago, Ill. (H. Swift, Dept. of Zoology, Univ. of Chicago, Chicago 37)

2-4. Geochemical Soc., Cincinnati, Ohio. (F. R. Boyd, Jr., Geophysical Laboratory, 2801 Upton St., NW, Washington 8)

2-4. Geological Soc. of America, Cincinnati, Ohio. (F. Betz, Jr., GSA, 419 W. 117 St., New York 27)

2-4. Inter-Society Cytology Council, annual, Memphis, Tenn. (P. A. Younge, 1101 Beacon St., Brookline 46, Mass.)

2-4. National Assoc. of Geology Teachers, Cincinnati, Ohio. (D. J. Gare, Principia College, Elsah, Ill.)

2-4. Paleontological Soc., Cincinnati, Ohio. (H. B. Whittington, MCZ, Harvard Univ., Cambridge 38, Mass.)

2-4. Society for Industrial and Applied Mathematics, Washington, D.C. (Chairman, Program Committee, SIAM, P.O. Box 7541, Philadelphia 1, Pa.)

2-5. Mathematical Models in the Social and Behavioral Sciences, conf., Cambria, Calif. (F. Massarik or P. Ratoosh, Mathematical Models Conf., Graduate School of Business Administration, Univ. of California, Los Angeles 24)

3-4. Central Soc. for Clinical Research, Chicago Ill. (J. F. Hammarsten, Veterans Administration Hospital, 921 N.E. 13 St., Oklahoma City 4, Okla.)

4. Society for the Scientific Study of Sex, New York, N.Y. (H. G. Beigel, 138 E. 94 St., New York 28)

5-8. American Speech and Hearing Assoc., Chicago, Ill. (K. O. Johnson, 1001 Connecticut Ave., NW, Washington 6)

5-9. Society of Exploration Geophysicists, 31st annual intern., Denver, Colo. (C. C. Campbell, Box 1536, Tulsa 1, Okla.)

5-11. Stomatology of Peru, intern. congr., Lima, Peru. (A. Rojas, Avenue Pershing 155, San Isidro, Lima)

5-15. Japanese Chemical Engineers Soc., 25th anniversary congr., Tokyo and Kyoto, Japan. (Kagaku-Kogaku Kyokai, Shunichi Uchida, 609 Kojunsha Bldg. No. 4, 6-Chome, Ginza, Chou-Ku, Tokyo)

5-18. Latin American Phytotechnical Meeting, 5th, Buenos Aires, Argentina. (U. C. Garcia, Rivadavia 1439, Buenos Aires)

6-8. Association of Military Surgeons of the U.S., 68th annual, Washington, D.C. (R. E. Bitner, AMSUS, 1726 Eye St., NW, Washington 6)

6-8. Cell in Mitosis, 1st annual symp., Detroit, Mich. (L. Levine, Dept. of Biology, Life Sciences Research Center, Wayne State Univ., Detroit 2)

6-9. Atomic Industrial Forum-9th Hot Laboratories and Equipment Conf., Chicago, Ill. (O. J. Du Temple, American Nuclear Soc., 86 E. Randolph St., Chicago) 6-9. Southern Medical Assoc., Dallas, Tex. (R. F. Butts, 2601 Highland Ave., Birmingham 5, Ala.)

8. American Acad. of Arts and Sciences, Brookline, Mass. (J. L. Oncley, 280 Newton St., Brookline 46)

8-10. Nondestructive Testing in Electrical Engineering, conf., London, England. (Secretary, Institution of Electrical Enginees, London W.C.2)

8-11. Acoustical Soc. of America, Cincinnati, Ohio. (W. Waterfall, American Inst. of Physics, 335 E. 45 St., New York 17)

8-11. Institute of Management Sciences, San Francisco, Calif. (W. Smith, Inst. of Science & Technology, Univ. of Michigan, Ann Arbor)

8-11. Plasma Physics, American Physical Soc., 3rd annual, Colorado Springs, Colo. (F. Ribe, Los Alamos Scientific Laboratory, P.O. Box 1663, Los Alamos, N.M.)

9-10. Operations Research Soc. of America, 20th, San Francisco. Calif. (P. Stillson, 115 Grove Lane, Walnut Creek, Calif.)

9-11. Gerontological Soc., Pittsburgh, Pa. (R. W. Kleemeier, Washington Univ., Skinker and Lindell, St. Louis 30, Mo.)

9-12. Pacific Coast Fertility Soc., Palm Springs, Calif. (G. Smith, 909 Hyde St., San Francisco 9, Calif.)

9-20. Photography, Cinematography, and Optics, 3rd intern. biennial, Paris, France. (Comité Français des Expositions, 15 rue de Bellechasse, Paris 7)

12-17. Bahamas Conf. on Medical and Biological Problems in Space Flight, Nassau, Bahamas. (I. M. Wechsler, P.O. Box 1454, Nassau)

13-14. Exploding Wire Phenomenon, 2nd intern. conf., Boston, Mass. (W. G. Chace, Thermal Radiation Laboratory, CRZCM, Geophysics Research Directorate, Air Force Cambridge Research Laboratories, Bedford, Mass.)

13-16. Magnetism and Magnetic Materials, 7th annual intern. conf., Phoenix, Ariz. (P. B. Myers, Motorola, Inc., 5005 E. McDowell Rd., Phoenix 10)

13-17. American Public Health Assoc., 89th annual, New York, N.Y. (APHA, 1790 Broadway, New York)

13-17. Gulf and Caribbean Fisheries Inst., 14th annual, Miami Beach, Fla. (J. B. Higman, Marine Laboratory, Univ. of Miami, 1 Rickenbacker Causeway, Virginia Key, Miami 49)

13-18. European Conf. on the Control of Communicable Eye Diseases, Istanbul, Turkey. (World Health Organization, Palais des Nations, Geneva, Switzerland)

14-16. American Meteorological Soc., Tallahassee, Fla. (Executive Secretary, AMS, 45 Beacon St., Boston 8, Mass.)

14-17. Corrosion in Nuclear Technology, symp., Paris, France. (European Federation of Corrosion, Société de Chimie Industriells, 28 rue St. Dominique, Paris 7°)

14-18. Puerto Rico Medical Assoc., Santurce. (J. A. Sanchez, P.O. Box 9111, Santurce)

15-17. Eastern Analytical Symp., New York, N.Y. (A. Rekus, EAS, Research Dept., Baltimore Gas & Electric Co., Pratt St., Baltimore, Md.)

(See issue of 15 September for comprehensive list)

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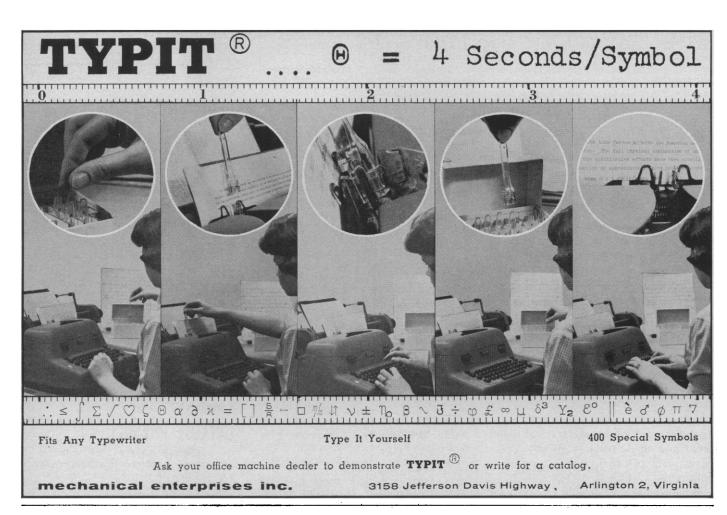
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uum pumping capacity is sufficient to pump down to operating pressure of 5×10^{-6} mm-Hg in 6 hr. Samples may be introduced so that operating conditions are attained within 15 min. The collector may be recovered within a few minutes after completion of a run, and a second run started on the same isotope within 15 min. (High-Voltage Engineering Corp., Burlington, Mass.)

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Impedance plotter covers the frequency range 0.1 to 1700 Mcy/sec. Used with a suitable oscillator, the instrument displays impedance as a trace on a Smith-chart-calibrated cathoderay tube. A separate x-y recorder can be added without affecting the cathoderay tube indication. (Alford Manufacturing Co., 299 Atlantic Ave., Boston, Mass.)

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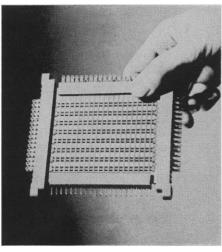


Fig. 1. Memory unit.



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Sterioscopic converter for closedcircuit television equipment permits conversion of existing television equipment to three-dimensional viewing. The converter, available in kit form, is entirely optical, requiring no electronic changes. The system consists of three devices. The first, fitting any 16-mm industrial television camera lens, provides the camera with two views of the scene. The second is a screen placed in front of the receiver screen. The third is a pair of glasses to be worn by the viewer, which is also available in clipon form. (Steriotronics Corp., 1717 N. Highland Ave., Los Angeles 28, Calif.)

Circle 7 on Readers' Service card

Voltage-to-digital converter features a conversion rate of $0.5~\mu sec$. Input voltage range of the instrument is 10 volts at an impedance of 250 ohms. An optional input impedance of 100 kohm is available. Accuracy is said to be ± 0.5 percent $\pm \frac{1}{2}$ least significant digit. Digital code output is parallel with maximum load of 5000 ohms. A visual display provides two binary-coded decimals. The instrument measures 6.5 by 6.25 by 3.5 in. (General Data Corp., 11602 9 St., Garden Grove, Calif.)

Circle 8 on Readers' Service card

Gas tester is a portable device for determining air contamination caused by trichloroethylene, perchloroethylene, and gasoline. Components of the tester are an aspirator and an indicator tube. Concentration of fumes is measured by the change in color produced when air is drawn into the tube by squeezing the aspirator bulb. (LKB Instruments Inc., 4840 Rugby Ave., NW, Washington 14, D.C.)

Circle 9 on Readers' Service card

Microwave signal generator for the 3-kMcy/sec band incorporates a microwave discriminator and high-gain d-c feedback amplifier to provide automatic frequency control of the klystron oscillator to ± 0.01 part per million. Frequency can be set with an accuracy said to be ± 0.05 percent. (Strand Laboratories, Inc., 294 Centre St., Newton 58, Mass.)

Circle 10 on Readers' Service card



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Stain-gage logger is a 200-channel instrument that scans strain data at the rate of five channels per second. Data are printed out and punched into paper tape. Either of two ranges, 0 to 5000 or 0 to $1000~\mu in./in.$ can be selected by a panel switch. An alarm system indicates when any given input exceeds a preset strain value for any channel. (Gilmore Industries, Inc., 13015 Woodland Ave., Cleveland, Ohio)

Circle 11 on Readers' Service card

Data input station (Fig. 2) will receive card, badge, variable, fixed, and remote data and will transmit the data to a central recording station where all data are recorded in computer-compatible language in punched paper tape.

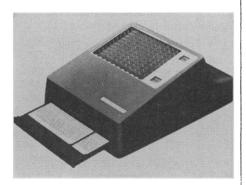


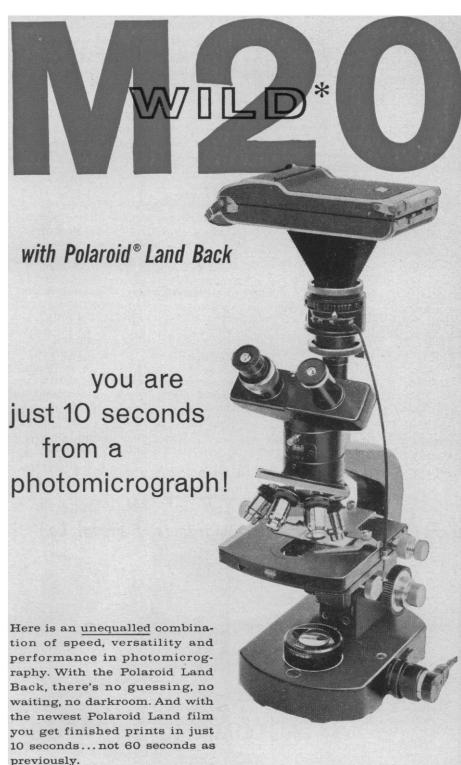
Fig. 2. Data input station.

The input station includes a reader capable of receiving up to 80 digits of prepunched card data and ten digits of prepunched badge data. The input station can be optionally equipped to receive digital data from external test equipment. Inserted data are checked automatically for consistency with message type. An error that is discovered must be acknowledged by the operator before the card can be removed. (Datex Corp., 1307 S. Myrtle Ave., Monrovia, Calif.)

Circle 12 on Readers' Service card

Moisture meter consists of two parts, a calibrated hygrometer and an oxidized aluminum container into the top of which the hygrometer fits. The sample to be tested is placed in the aluminum container, and the hygrometer is inserted into the top of the container and left there for approximately 20 min; at the end of this time the hygrometer will indicate the relative humidity of the sample. Absolute moisture of the sample may be determined by consulting a table of humidity equilibrium. (Abrax Instrument Corp., 179 Jamaica Ave., Jamaica 32, N.Y.)

Circle 13 on Readers' Service card



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Fig. 3. Digital voltmeter with transistorized operational amplifiers.

Digital voltmeter (Fig. 3) uses transistorized operational amplifiers to obtain high input impedance independent of null condition. The instrument covers the range 0 to 999.9 volts in three steps. Input impedance in the highest range is 10 megohms; in the intermediate range it is 1.0 megohm; and in the lowest range, 100 megohms minimum. Accuracy is said to be ±0.01 percent of full scale on all ranges. Average reading speed when no change of polarity occurs is 200 readings per second. Internal voltage reference is a Zener diode. Range selection is manual with decimal point location indicated in the digital display. (Electronic Associates, Inc., Long Branch, N.J.)

Circle 14 on Readers' Service card

Frequency standard is said to have long-term stability of 5 parts in 1010 per day and short-term stability over 1-sec intervals of 1 part in 1010. Two sinusoidal output signals of frequencies 1 Mcy and 100 kcy/sec are furnished. Source impedance and power level are said to be well suited for distribution over 50-ohm systems. Proportionally controlled double ovens are used to maintain crystal temperature constant within a few hundredths of a degree. Crystal dissipation level is kept constant at less than 0.25 μ w by automatic gain control. (Hewlett Packard Co., 1501 Page Mill Rd., Palo Alto, Calif.)

Circle 15 on Readers' Service card

Pressure pulse calibrator provides 3-msec rise time from atmospheric pressure to the calibration pressure that can be set from a few inches of water to 1000 lb/in.² The calibrating pressure is indicated on a Bourdon-tube gage. Various scales ranging from 0-15 to 0-1000 lb/in.² are available. Accuracy and linearity are said to be better than ±0.1 percent. The calibrator operates by dumping pressure from a calibration pressure flask into a small cavity at the active face of the trans-

ducer undergoing calibration by means of a back-seated poppet valve. A 1600-lb/in.² supply flask is included. (Atlantic Research Corp., Alexandria, Va.)

Circle 16 on Readers' Service card

Logic elements of the magnetic-core transistor type are designed as compact modules capable of performing the functions: Or, Inhibit, Branch, And, Transfer, Drive, Count, Complement. The elements operate at rates up to 250 kcy/sec. They are available with either positive or negative input/output pulse polarity. A single 12-volt power supply is required for their operation. Minimum one-to-zero ratio is 15:1; power requirement is 100 mw for full load and 25 µw for standby condition. Dimensions are 25/32 by 9/16 in. (DI/AN Controls, Inc., 944 Dorchester Ave., Boston 25, Mass.)

Circle 17 on Readers' Service card

Standby power system is designed for application where power interruption of even a single cycle will destroy intelligence sequences. The power system cuts in with zero switchover time when the a-c line drops below a preset level. When the line voltage returns to normal, the power supply first synchronizes itself with line frequency and then switches the load back to the line. When in the standby state, the device serves as a line voltage regulator holding voltage within ± 3 percent. Power outputs from 500 v amp to 3 kv amp are available. (Electro-Seal Corp., 938 North Ave., Des Plaines, Ill.)

Circle 18 on Readers' Service card

Respiration pump for producing artificial breathing in small animals is a piston pump with volume variable from 0 to 50 ml per stroke. A mechanically timed and operated valve controls airflow direction. Rate can be varied between 15 and 50 strokes per minute. (Phipps and Bird, Inc., 6th at Byrd St., Richmond 5, Va.)

Circle 19 on Readers' Service card

Charge amplifier, for use with quartz accelerometers, is a high-grain d-c voltage amplifier with a capacitive feedback path from the low-impedance output circuit to the very-high-impedance input circuit. The relationship of input charge to output voltage is determined solely by the feedback capacitance and is independent of the gain or other operating characteristics of the amplifier. Specifications of the instrument are as





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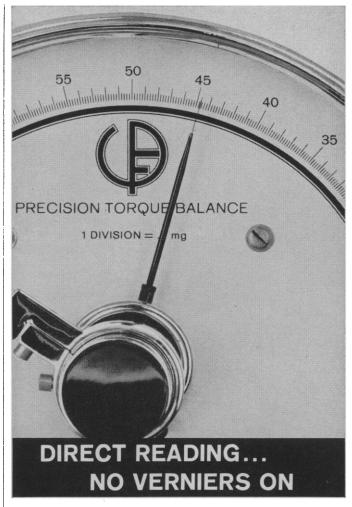
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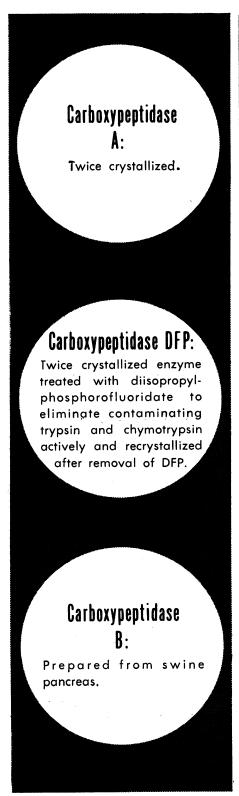
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Circle 20 on Readers' Service card

Ultraviolet photometer is designed for detection of the rise in enzyme content (serum glutamic-oxalacetic transaminase) of blood, said to indicate heart damage, hepatitis, and other conditions. The instrument is essentially an ultraviolet densitometer. Standard 13-by 100-mm test tubes are used to incubate the reaction mixture and also serve as photometer cells. Light weight and compactness are features of the instrument. (California Corporation for Biochemical Research, 3625 Medford St., Los Angeles 63, Calif.)

Circle 21 on Readers' Service card

Dissolved oxygen analyzer uses metallic thallium, which is extremely reactive to dissolved oxygen but inert to water. The reaction product, thallous hydroxide, increases the conductivity of the water. The analyzer consists of a mixed bed demineralizer cartridge and a packed column of pure thallium. Conductivity is measured before and after passage through the thallium column. The unit does not include a conductivity bridge. Several portable bridges available from the manufacturer can be used with the analyzer. (Industrial Instruments Inc., 89 Commerce Road, Cedar Grove, N.J.)

Circle 22 on Readers' Service card

Cathetometer has a range of 1 m. The instrument's micrometer head reads to 0.005 mm and its telescope level is said to be accurate to ± 1 sec. The main scale and vernier are made of Invar. The leveling bubble is illuminated and in the field of view so that the setting can be checked at the same moment a reading is being made. Overall height is 67 in. and weight is 280 lb. (Ealing Corp., 33 University Road, Cambridge 38, Mass.)

Circle 23 on Readers' Service card



860 SCIENCE, VOL. 134

Differential thermometer is said to be capable of measuring temperatures precisely to 0.001°C. Designed for use in measuring temperature fluctuations in calorimetry, change-of-state experiments, cryoscopy, and the like, the thermometer reads, directly in degrees centigrade, single-point or differential temperatures in the range from -60° to +300°C. (Fiske Associates, Inc., Bethel, Conn.)

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Arc-imaging furnace (Fig. 4) uses two opposing concave mirrors to capture radiant energy from an electric arc and focus it into an area 1/2 in. in diameter.

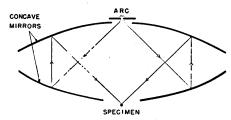


Fig. 4. Diagrammatic cross section of the "clam shell" optical system of the arcimaging furnace.

Temperatures greater than 3500°K are achieved. Shadowing losses are substantially reduced in the design of the furnace by locating the radiant-energy source and the specimen outside the reflecting system. Radiation enters the "clam-shell" reflecting chamber through a circular opening in the back of one of the mirrors and converges on a specimen outside an opening in the back of the second mirror. (Arthur D. Little, Inc., Acorn Park, Cambridge 40, Mass.)

Circle 25 on Readers' Service card

Microvoltmeter uses an automatically recharged nickel-cadmium battery to provide freedom from power-line coupling. The instrument has 15 ranges from $\pm 100 \, \mu v$ to $\pm 1000 \, v$ full scale. Input impedance is 100 megohms or greater on all except the microvolt ranges; in the latter, it is 10 megohms or greater. Accuracy is said to be ± 1 percent on all ranges. The meter is available in portable or rack-mounting form. (Dynamics Instrumentation Co., 583 Monterey Pass Road, Monterey Park, Calif.)

Circle 26 on Readers' Service card

Direct-writing recorder is an eightchannel instrument expressly designed for use with analog computers. Features of the recorder include static and dynamic accuracy said to be $\pm \frac{1}{2}$ percent, OFFERS YOU AN ELECTRONIC SQUARE WAVE

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addition to eight analog channels, two event channels are provided. The latter can be used to record time marks on the chart margin. (Brush Instruments, Division of Clevite Corp., 37 and Perkins Sts., Cleveland 14, Ohio)

Circle 27 on Readers' Service card

Storage oscilloscope combines a high-frequency oscilloscope and a storage instrument with selectable mode of operation. The oscilloscope makes use of the Memotron tube for both modes of operation. The tube contains a conventional

cathode ray-tube gun and deflection system. Behind the phosphor screen is a storage assembly which consists of two fine screens. This storage mesh is flooded with low velocity electrons by auxiliary guns. When the writing beam strikes the mesh, it causes secondary emission. The local positive charges that result cause the electrons in the storage screens to be attracted through to the phosphor screen. The bright trace which results is continuously displayed until the collector mesh potential is deliberately lowered below the critical value required for storage. Writing speed of the oscilloscope is 10° in./sec, and bandpass is 10 Mcy/sec. (Hughes Aircraft Co., P.O. Box 90904 Airport Station, Los Angeles 45, Calif.)

Circle 28 on Readers' Service card

Servo driven voltmeter has an input impedance of 100 megohms on ranges from 3 mv to 1 v and of 10 megohms on ranges from 3 to 300 v. Accuracy is said to be ± 0.15 percent on 11 selectable scales. Servo gain is automatically adjusted for each scale by the range switch. Double regulated Zener reference eliminates reference cell replacement. Indication is provided by a knife-edge pointer on a 14-in. scale. (Houston Instrument Corp., P.O. Box 22234, Houston 27, Tex.)

Circle 29 on Readers' Service card

Machine operation monitor is applicable to any machine or process in which off-normal conditions can be described in terms of a change in frequency or amplitude of signals developed during normal operation. Two data channels are provided, each with two limit levels. The channels may be excited by two separate transducers or by two characteristics of a signal from a single pickup. Frequency range is 2 cy to 10 kcy/sec. (Ray Data Corp., Columbus, Ohio)

Circle 30 on Readers' Service card

Flaw detector sends ultrasonic vibrations in a pulsed beam through the part to be inspected and detects echoes reflected back to the transducer by flaws. Reflected signals are amplified and presented as time (amplitude) signals on a cathode-ray viewing screen. Six choices of frequencies from 0.5 to 10 Mcy/sec are available for excitation. Pulse repetition rate is continuously variable from 25 to 3000 cy/sec. Barium titanate transducers are coupled to the object being tested by a synthetic membrane that fits tightly over the transducer.



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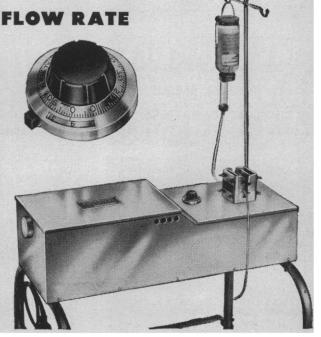
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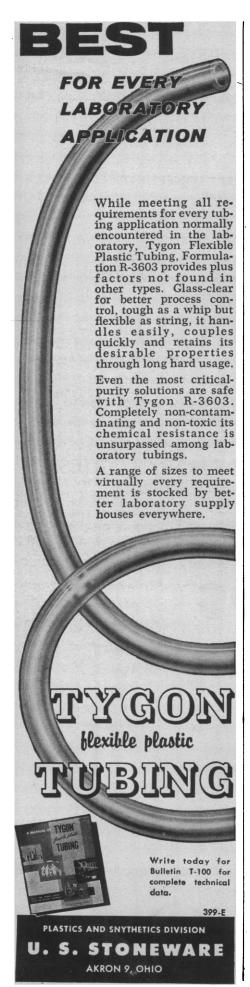
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Circle 31 on Readers' Service card

Variable delay line (Fig. 5) of the lumped-constant type features adjustable sliders designed so that they may pass one another and thus permit unrestricted individual settings. The model

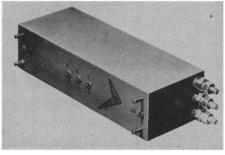


Fig. 5. Variable delay line.

VLR 15 has three adjustable taps with resolution of $0.025~\mu sec$. Maximum rise time of the network is $0.072~\mu sec$; delay is variable from 0 to $1.5~\mu sec$; maximum attenuation is 2 db. Thermal stability over the range -29° to $+60^{\circ}C$ is 50 parts per million per degree centigrade. This temperature range may be expanded to -55° to $+125^{\circ}C$. (Allen Avionics, Inc., 255 E. 2 St., Mineola, N.Y.)

Circle 32 on Readers' Service card

Switching-time test set is completely self-contained for measurement of diode recovery time, transistor delay, and rise, storage, and fall times. Switching times are measured in the range 2 to 500 sec. Included in the instrument are bias supplies, two pulse sources, a test jig, an oscilloscope, time marker bugs, and meter readout. The instrument utilizes a strobe or synchronous sampling technique. Matched 2-Mcy/sec crystals, one controlling the pulse generator and the other the sampler, are slightly offset in frequency and thus produce a sampling action through the pulse. Time conversion by this technique is 1:5000. Accuracy of time interval displayed by the meter is ± 5 percent of full scale, and accuracy of time-interval voltage output is ±3 percent of reading. Pulse repetition rate is 2 Mcy/sec. (Wiltron Co., 717 Loma Verde Ave., Palo Alto, Calif.)

Circle 33 on Readers' Service card

Information retrieval machine stores 32,000 standard-size magazine pages on a single reel of microfilm and searches the microfilm reels automatically at the rate of 6400 pages per minute. The machine is composed of a recording unit and a retrieval unit. The recording unit photographs files of documents along with a description of each document's contents coded in the form of opaque spots. The retrieval unit searches for the documents desired and presents the selected documents for viewing or printing. Requests for information are fed into the machine by punched cards; up to six requests can be handled simultaneously. (FMA, Inc., 142 Nevada St., El Segundo, Calif.)

Circle 34 on Readers' Service card

Chart integrator computes the area under a strip-chart curve. Count rate ranges from 1 to 30,000 are available. According to the manufacturer, no zero drift or change in range will take place over a wide temperature range. Accuracy is said to be ± 0.1 percent of full scale. The integrating device is directly connected to the recording pen of the recorder. (Disc Instruments, Inc., 3014-B S. Halliday, Santa Ana, Calif.)

Circle 35 on Readers' Service card

pH Meter is an automatic self-balancing instrument with digital readout. The instrument is line operated and is not affected by line fluctuations up to 10 percent, according to the manufacturer. A millivolt scale is provided for redox reactions. An external recorder can be plugged in for continuous monitoring. Accuracy is said to be ± 0.02 pH units over the full range of 0 to 14.00 pH units; temperature compensation is provided. (Polarad Electronics Corp., 43–20 34 St., Long Island City 1, N.Y.)

Circle 36 on Readers' Service card

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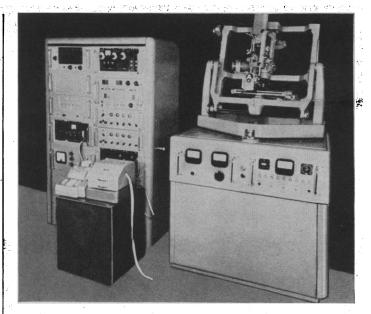
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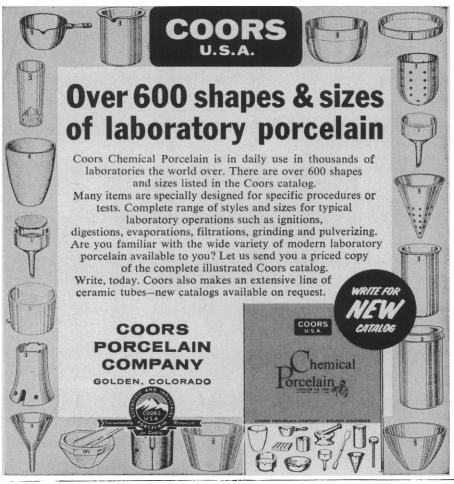
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JOSHUA STERN

National Bureau of Standards

Letters

(Continued from page 798)

vents hydrocarbon-induced mammary cancer in rats (5). Selenium, an old-time offender (6), has now emerged as an essential trace element, a deficiency of which causes serious problems in certain farm animals (7). Scientific, rather than legal, interpretations would seem to be the greatest need in the field of food additives. These interpretations should be made by those who will evaluate not only the risk of environmental cancer but also the need for chemicals in maintaining the food supply.

THOMAS H. JUKES American Cyanamid Company,

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References

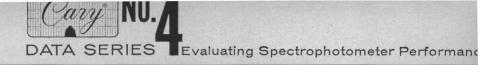
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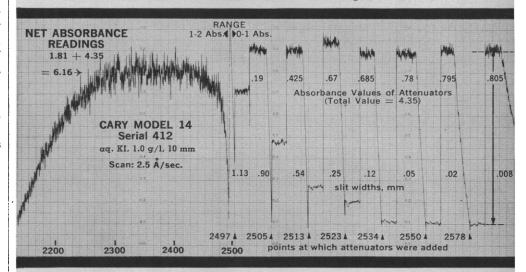
Loyalty Oath: Another Viewpoint

Within recent years, the faculties of a number of American universities have voiced varying degrees of disgust, distaste, and dislike of the disclaimer affidavit required of U.S.-subsidized fellowship students. Some have established the policy of refusing to accept fellowship students who are subject to such an oath. Indeed, the precedent which seems to have been set by some of our most influential universities has led to the general assumption that those which accept students under such qualifications are betraying the ideal of academic freedom. As a teacher, I too vigorously cherish my right of academic freedom. Yet, there is a question as to whether the loyalty oath falls, at least in this case, within the scope of academic freedom. Personal freedom and national allegiance should certainly be compatible. If so, where does the problem lie?

There seem to be two basic objections to the requirement as it now stands, the first of which is felt by



Radiant energy of wavelengths other than those defined by the indicated wavelength and slit width.



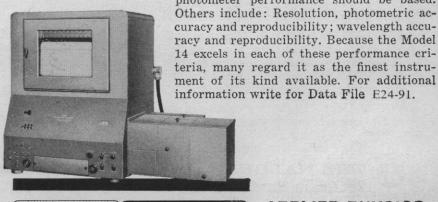
Stray light of Cary Model 14 is less than 0.0001% over much of range, 0.1%

even at range limits. When spectrophotometers are operated close to the limits of their wavelength range, measurements are restricted by a combination of weak radiation from the source and/ or poor detector sensitivity. In any spectral range, similar problems may be caused by absorbing solvents or use of the differential technique. Under these conditions, stray light lowers performance because it contributes a disproportionate amount to the total energy being measured. Also, the important advantages offered by high absorbance measurements-reduced errors due to contamination of cell windows, uncertainties in path length, etc.-can only be had if stray light is minimized.

For these reasons, the Cary Model 14 has been designed with a double monochromator so that stray light is extremely low. Measurements with excellent accuracy can be made over the entire spectral range of the instrument.

The spectrum illustrates one of the performance tests used in the manufacture of the Cary Model 14. A sample with sharp cut-off was scanned slowly toward shorter wavelengths, where its transmission is negligible. Calibrated optical attenuators were added, at the points indicated, to the reference beam to extend the absorbance range. A false plateau or peak is found above 6.0 absorbance (.0001%T). It is caused by stray light, which amounts to less than 1 ppm.

Stray light is just one of several important criteria on which spectrophotometer performance should be based.





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practically all college teachers. One is the fact that prospective students take such an oath, while an equal demand is not made of numerous other groups and individuals who receive assistance from the same source. There is no basic difference in the intent of grants for student aid and the intent of grants which contribute to the solution of research problems, yet recipients of research grants need take no such pledge. In this respect, and perhaps only in this respect, is the government unfair for discriminating against these

fellowship students by making such a requirement.

Too, there is a real question whether the requirement actually serves its intended purpose. For those citizens without integrity, an affirmative answer presents no problems. In the face of this, does the requirement make a real contribution?

In spite of these objections, is a university justified in refusing to accept students who have been granted assistance with such strings attached? Should the institution accept other support from

a government which exacts a duty of this type? If integrity is to be maintained at the 100-percent level, all grants and assistance from the same source should be refused. Most of the schools which refuse to accept the students in question have no intention of boycotting the more substantial sums for research grants which their scientists receive.

Then, too, does the individual student have any rights in this matter? Are his own decisions less important than those of the university? The vast majority of faculty members, including those who oppose the loyalty oath, would be most vehement in insisting that students must be allowed to make their own decisions, insofar as possible. Yet, by declaration, those which will not accept "loyalty oath" students would deny them the opportunity of making their own choice.

But perhaps the most important problem, however, has little to do with whether it is morally right for the government to require the oath. Rather, does the university have a right to interfere with the making of a contract between the individual and his country? Should the university comment on either the validity or the desirability of such a compact? Certainly, no student or teacher need accept money or assistance of any sort under such a "stigma" if he is opposed. Since no decision or demand is required of the university, why should it concern itself with the contents of the contract?

However, the great bulk of objections from the academic world seem to lie in a generalized and rather nebulous feeling that individuals should not sign such a contract because it violates the freedom of thought or choice of an individual. This raises the question as to whether the constraints imposed by any kind of pledge or avowal of faith are unjust. Is it wrong to pay respect to the flag of one's country or declare faith in God? Should one refuse to enter one of the armed services or accept a job with the federal government because of the necessity for swearing allegiance? What about the pledge of intent when joining a professional or honorary society?

To take the oath is indeed a small price, if indeed it is a price, to pay for assistance. There should be no reason for aversion to repeating such an oath under any conditions or at any time that it is required.

We need have no concern that the loyalty oath presents an excessive de-



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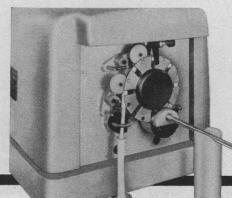
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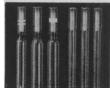
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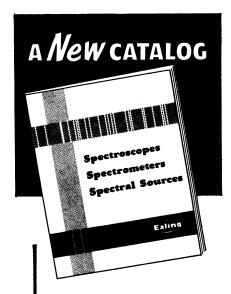
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mand or hardship on any individual or university. It does not. At the same time, it sets aside college students as exceptions to the rule and, in this respect, is unfair.

In spite of the mild furor to the contrary, there is nothing basically wrong with the requirement as it stands, or contrary to our American way of life. However, unless it is applied in an undiscriminating manner, it should be abandoned. Let us hope that our legislators see fit either to make this requirement uniformly applicable, or to disqualify it completely.

FRANK W. WOODS School of Forestry, Duke University, Durham, North Carolina

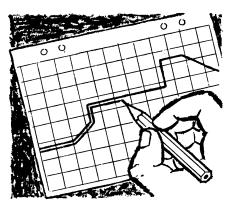
Soviet Commitment to Lysenkoism

From time to time, Soviet press releases relating to the status of Trofim D. Lysenko and his beliefs are republished in the United States, with homegrown "interpretations" frequently extended to predictions about all of Soviet agriculture, the economy of the U.S.S.R., and even international relations. In these conjectural pieces the ignorance of the authors about communism shines through more clearly than the scientific milieu for Soviet biology.

While traveling with the Comparative Education Society in the U.S.S.R. for 5 weeks in 1958, I made the following observations.

1) Young Soviet biologists have been thoroughly steeped in the assumptions of Michurin and Lysenko—a kind of neo-Neo-Lamarckism. They seem to be proud of a view which "opposes the 'Western' gene concept," and they cite the DNA's as evidence to *support* Lysenkoism. It is impossible to discuss in a brief space the level of their sophistication.

2) Academician Lysenko is, and has been, without interruption, a very important figure in the Communist Party and in Communist biological science for 20 years, and during that time his outlook upon the inheritance of acquired adaptations has been thoroughly embedded in every biology textbook and reference book to be seen, besides appearing frequently in books on philosophy and natural science in general. Lysenko is one of the eight editors of a five-volume encyclopedia of agriculture, and his 600-page Agrobiologia was revised in 1952. [For additional



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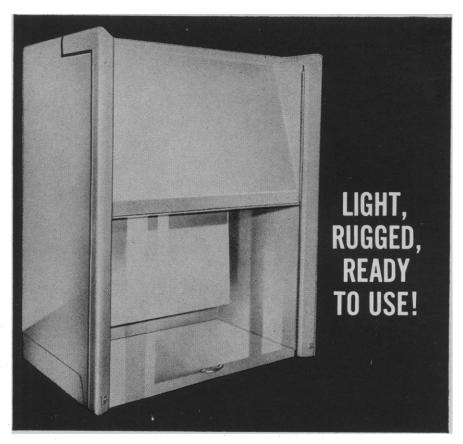
observations along these lines, see Ohio J. Sci. 61, No. 3, 147 (1961).] Lysenko's views harmonize perfectly with all aspects of Communist philosophy; to remove his ideas would leave a void which the gene theory could fill only lamely, if at all.

3) Application of Lysenko's ideas has produced results, much in the way that Burbank's methods have, and techniques based on these ideas are used today in the mass cultivation of unusual roses in Arizona. Where there are results, irrespective of questions of theory, there is a certain gain: greater energy is expended to test to its limits the potential adaptability of the germ plasm in environmental situations not normally encountered by a given plant or animal. Lysenko's initial success with millet—a grain considered to be of no small importance in the war years—has been followed by other successes, and his latest attempts, in which as director of the Institute of Heredity in Moscow, he is seeking to improve milk production, appear to follow the previous pattern. That V. P. Dubinin and a cluster of old-guard geneticists are "conducting a critical review of Lysenko's work," to quote a Soviet university professor, should be viewed in the perspective of the general climate of satisfaction with Lysenko's achievements; Dubinin is available, yes, but he is needed and prepared to replace Lysenko about as much as the Greenback Party is needed and prepared to take over Congress and the White House.

4) Most puzzling to us who follow the development of genetics is the co-existence of Mendelism and Lysenkoism in the U.S.S.R., yet this is perhaps the most significant observation of all in dispelling conjectures that Soviet biologists are about to embrace modern genetics. For example, one of the two colored plates in the 532-page, 1956 college textbook *Obschaya Biologia* (Everyday Biology) illustrates the familiar 1:21:1 ratio of red, pink, and white F₂ flowers, with this qualification: "... but Soviet scientists have improved upon this."

One naturally asks to what extent rejecting the gene concept affects plant and animal breeding and other areas of knowledge. As regards the latter, in the fields of education, psychology, and medicine, inheritance is ignored. Aptitude tests are unusable; deafness, mental disorders, and low intellectual capacity are attributed, respectively, to accidents, birth trauma, and laziness.

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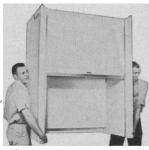
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animal breeding, one must first fully comprehend the Communist maxim, "Truth is absolute, but not final"; after this, one can realize that the Lysenkoist view, in the U.S.S.R., can be made to cover the situation in agriculture. If hybrid corn is being used, it is safe to say that a way has been found to explain the results in Lysenkoist terms, and the same hedging maxim allows for change if, for some reason, the gene has to be "recognized" to correct a desperate situation in agricultural production.

What has escaped most writers on the subject of Lysenkoism is the depth of the Soviet commitment to environmentalism.

LINCOLN PETTIT Department of Natural Science, Michigan State University, East Lansing

Fluoridation of Water Supplies

Leo Levine, in a recent letter [Science 133, 1674 (1961)], deduced from the recent political reverses on fluoridation of water supplies that the relationship between the scientific community and the public at large is growing more attenuated and unsatisfactory.

It is difficult to see how such a con-

clusion can be drawn from the particular issue which he describes. There are many prominent scientists who disagree entirely with fluoridation, though not because there is no evidence that in controlled circumstances and for certain young children there is a benefit to be gained thereby. The reason is that from a purely scientific point of view the evidence is entirely inconclusive regarding the deleterious effects that may occur over long periods of time in parts of the body other than the teeth of young children. This doubt has been thoroughly aired during the various political campaigns on fluoridation, and it is a most legitimate doubt to which a good answer has never been given.

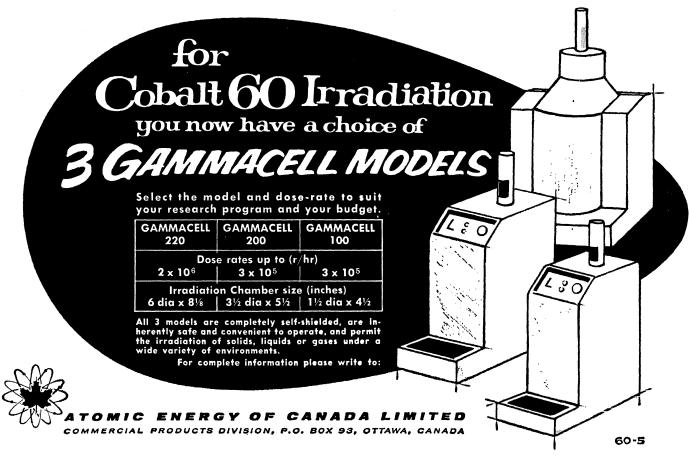
It is difficult to see how the public can be blamed for being concerned about this question, and it is the fault of the scientific community itself that it has not come to grips with so basic an issue. The greatest danger that faces the scientific community in its dealings with the public is to assume a holier-than-thou attitude in which it is presumed that what is stated by the scientific community to be good for the public is thereby holy writ. I think, in general, our citizens are much more intelligent than they are given credit for being,

and it is particularly true that the recent unfortunate episodes regarding food additives, such as the famous cranberry scare of several years ago, have left the public with the feeling that there is a great deal of experimentation going on by industry and by the scientific community at their expense.

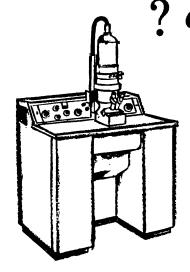
The groups who have opposed fluoridation include, of course, a number of fanatics, but their success or failure is largely tied to the correctness of the stand that they take, and I think it is important for all scientifically trained people to recognize that one should be very cautious and conservative in recommending the use of drugs and medicines for the public. We have too many incidents of side effects coming up when drugs have been used, which are well known to all people, and I do not think that the issue is a political one at all, as Levine indicates.

RALPH LANDAU 2 Park Avenue, New York

Fluorides may reduce tooth decay, but little information has been offered on their possible long-term effects on flowers, skin, laundry, or highballs. Nor have alternative methods of fluoride application been discussed in the many local campaigns for mass medication.



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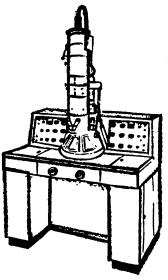
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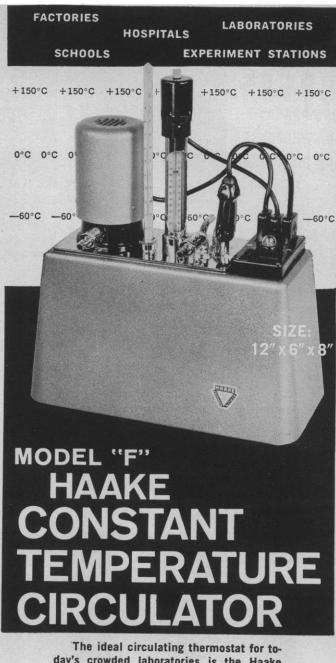
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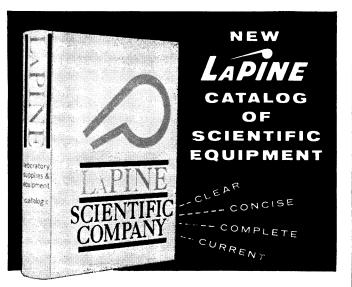
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Hence, thinking citizens apply the scientific method and reject the syllogism that, since children who have drunk fluoridated water develop fewer cavities, everyone (and everything) must drink such water-and also bathe, irrigate, and flush with it. Involved here is not, as Leo Levine claims, a lack of communication between "science" and "public," but a lamentable lack of scientific procedure on the part of wouldbe scientists.

Perhaps fluoride actually does more good to young teeth than harm to old bones. But must such medication be applied only through drinking water? Even so, must it be all water? Are individual home dispensers, similar to water softeners, impractical? Would fluoridation of water only in school buildings be inadequate? Why not add fluorides to milk, like vitamin D, or to table salt, like iodine?

Until these alternatives are demonstrated to be impractical, and adulteration of the public water supplies is demonstrated to be the only feasible method of reducing dental caries, yet to cause no degradation of the many other uses of the water, mass fluoridation deserves scientific skepticism and continual democratic defeat.

ARNOLD COURT

3 Havnes Road. Saxonville, Massachusetts

A recent letter on fluoridation of water supplies expressed concern regarding the unpopularity of this measure by voters in towns of high socioeconomic and educational levels. In recent years, fluoridation proposals, when placed on the local ballot, have suffered overwhelming rejection and have divided hundreds of communities into militant factions.

Why has fluoridation been one of the most unpopular health measures of the century? Political and public opinion surveys have revealed that many individuals do not know the meaning of fluoridation, and in many instances ignorance and fear have been used to defeat such a scientific measure ("Conceptions and misconceptions regarding fluoridation" was the subject of my M.S. thesis at Bowling Green State University, 1961). These studies have shown that many (over 50 percent) proponents did not know the meaning of fluoridation or confused it with water purification (chlorination), even in high socioeconomic groups.

Unless an educational campaign is skillfully conducted well in advance of the vote, these uninformed proponents may be changed into the semi-informed, fearful opponents. Although fluoridation has been endorsed by many medical and dental associations, the final outcome has very often been determined by referendum where "a little knowledge can be a very dangerous thing." Should the safety and efficacy of such a public health measure be decided by qualified professionals, or should its fate be determined via the popular vote?

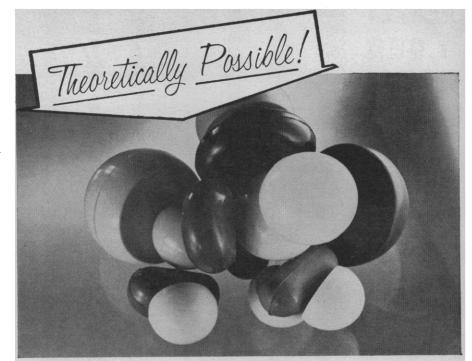
JULIE DARE BOYD

Rossford, Ohio

I was very much interested in the letter by Leo Levine, primarily because I have been an opponent of fluoridation and perhaps can offer some insight as to why fluoridation is continually defeated. Incidentally, we have just managed to defeat fluoridation at Allentown, Pa., by a ratio of 5.5 to 1, which is to my knowledge the most resounding defeat fluoridation has yet suffered.

I agree wholeheartedly with Levine that the fluoridation issue does afford an insight into the question of communication between the scientific community and the public. Or perhaps it would be better to say that fluoridation offers a chance to evaluate the communication between some portions of the scientific community and the public, for the reason that we are able to defeat fluoridation so easily is that not all the evidence is on the fluoridation side. It is true, of course, that the Public Health Service and the American Dental Association are on the side of fluoridation, but that does not mean that there are not very reputable and capable scientists who are opposed to fluoridation and who have produced evidence indicating that fluoridation is a potentially harmful practice. The voter in a fluoridation election, therefore, is put in the position of choosing between two branches of scientific thought. He is not making a choice between science and non-science, as Levine implies.

There is also another factor that enters the picture, and that is the scientist's ego. The scientist likes to feel that he is the master of the public's destiny in certain areas, and the average person can sense that egotistic drive if given half a chance. In the case of fluoridation, the question of scientific ego cannot be disregarded. Would it not be a wonderful thing for science if the addition of a single chemical could overnight cure tooth decay? The potential benefit of such an event to the standing



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of science and to the standing of certain scientists is so great that there is ample drive to continue the fluoridation campaign in the face of increasingly severe defeats at the hands of the voters and in the face of an increasing body of evidence indicating that fluoridation may not be safe. I think the voters sense this egotistic drive of the men in white coats to tamper with their water.

There is another factor. Could it not be that science is becoming equated in the public mind with artificiality and chemicalization of our environment, and that the people want the pendulum to swing back to our more natural existence of previous years? The great bulk of scientific advances add some chemical pollutant to either our soil, our food, our water, or our air. Almost every time there is a new breakthrough we find a new toxic residue to cope with. I spend 8 hours a day trying to convince people of the truth of those ideas, and I find that as the years go by it becomes easier and easier to do that.

ROBERT RODALE Prevention, Emmaus, Pennsylvania

As Levine points out, the controversy over water fluoridation has been an excellent example of failure of communication. The failure, however, is two-way. Not only have the scientists been unable to communicate to a part of the public, as the nature of many of the arguments used against fluoridation indicates, but the scientists themselves seem completely unaware of the existence of quite weighty arguments against fluoridation of community water supplies. Although I myself favor such fluoridation, I do not regard it as a simple open-and-shut case, and I would like to make an effort to remedy a failure of communication by presenting what I think is a strong argument on the other side.

In a sizable minority of American families, perhaps 25 percent, drinking water is obtained from a bottle kept chilled in the icebox. If the community water supply is not fluoridated, it would be a simple matter to add a little fluorine compound to this bottle. In any community in which there is a sizable number of people who wish to drink fluoridated water, it should be easy to arrange with druggists to keep dilute solutions in stock for this purpose. Thus, in a community in which the water supply is not fluoridated, it is quite possible for families to obtain the advantages of fluoridation for themselves. If the water is fluoridated at the waterworks, however, it is quite difficult to "unfluoridate"

If there are in a community some people who wish to have their water fluoridated, and some who do not, then both can have their desire if the community water supply is left unfluoridated, although the ones who want fluoridation will be put to some inconvenience. If the water is fluoridated, on the other, some people will be deprived of their freedom to choose in this field. We may disagree with the people who object to fluoridation of their water, but is there any reason why we should deprive them of their freedom of choice in the matter?

It seems to me that this is a respectable argument, although not necessarily conclusive. On the other side, fluoridation at a central plant is certainly cheaper and more convenient. Personally, I would prefer to spend a little bit more to preserve freedom of choice, but obviously there can be two opinions here. The argument which leads me to favor fluoridation concerns the fact that "home fluoridation" would, of necessity, be carried out by the parents while the principal beneficiaries would be the children. The question is thus analogical to the old legal problem of whether a Christian Scientist should be compelled to provide conventional medical care

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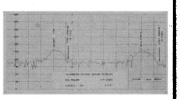
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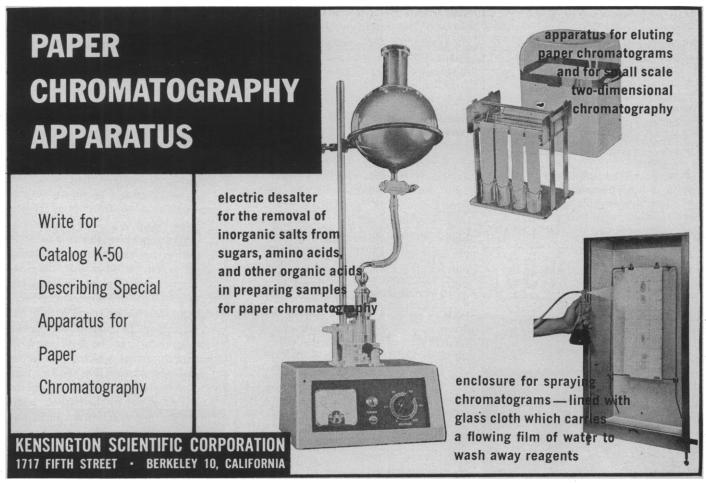


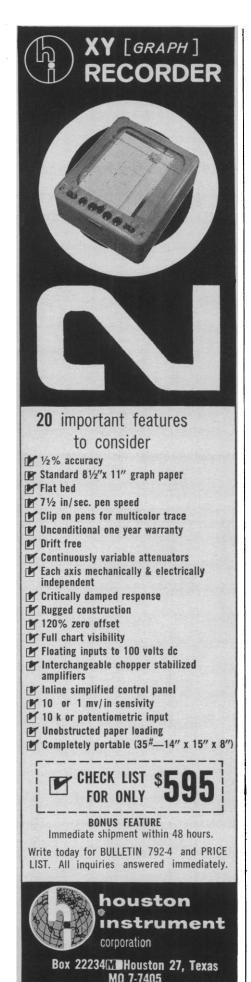


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for his children. I would say "yes," but I do not regard the problem as an easy one. Perhaps the "trend of voting on this issue in towns of the highest socioeconomic and educational levels" represents not a victory of "antiscience" but a simple difference of opinion on a difficult problem of public policy.

GORDON TULLOCK University of South Carolina, Columbia

Experimental Design

The arguments of Cronbach and Gleser (1) and Loewe (2) would have been fairly clear if they had made careful distinctions between individual characteristics, population characteristics, and estimates of population characteristics.

Lowe is apparently treating the "graded-response" curve as if it were the sample mean value of E as a function of D, since he refers to "test curves for individuals." Most statisticians would consider the "graded response" curve to be the expected value of E as a function of D.

At any rate, Loewe's first conclusion, that the quantal-response curve (at a single E level) cannot replace the graded-response curve, is quite obvious. If his second conclusion amounts to suggesting an analysis in which the graded-response data is converted to quantal-response data for each of several values of E_0 (that is, dichotomies), then I agree. These values should be spaced uniformly, unless there is some information about the type of distribution (which is true less often than the normal distribution is used). As for the dosage levels, there should be only one dose for each individual, and dosage levels should be repeated on a second individual only rarely, if at all. Testing many items at exactly the same level is vestigial experimental design: probit analysis is passé, and some form of stochastic approximation (3) should be used for sequential design of response experiments.

Cronbach and Gleser have overlooked the main practical reason for quantal experimentation: a two-valued scale is cheapest. It requires hardly any effort to detect a dead animal, or a metal plate with a hole in it. It would take a great deal more effort to measure some functional impairment in a poisoned animal, or to measure some characteristic of a projectile's remains after it had penetrated a plate of armor.



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Also, the reason for one dose per individual is not simply because there may be variation in time of the individual's responses, but because this variation may not be of the same nature as the inter-individual variation. For example, a small initial dose of poison may repeatedly permit animals to withstand second doses which would have originally been fatal.

DAVID ROTHMAN Systems Laboratories Division, Electronic Specialty Company, Los Angeles, California

- 1. L. J. Cronbach and G. C. Gleser, Science
- L. J. Cronbach and G. C. Gleser, Science 133, 1924 (1961).
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 A. Dvoretzky, "On stochastic approximation," in Berkeley Symposium on Mathematical Statistics and Probability, Proceedings of the Third Symposium, J. Neyman, Ed. (Univ. of California, Press Berkeley, 1956), vol. 1. of California Press, Berkeley, 1956), vol. 1,

"Hospitalism"

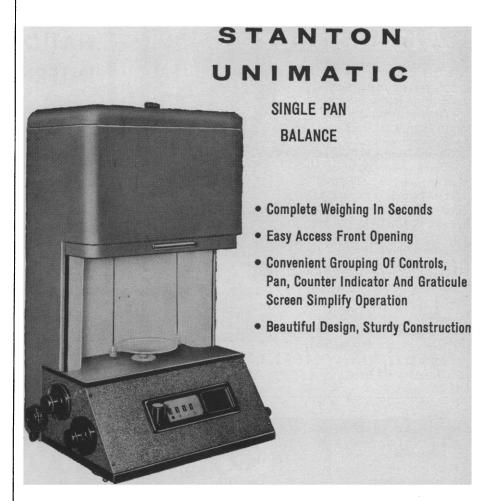
King [Science 133, 1642 (1961)] has urged that those readers interested in the discussion concerning the effects of environmental factors upon intelligence [G. Allen, Science 133, 378 (1961); H. Knobloch and B. Pasamanick, Science 133, 379 (1961)] read the work of Spitz on the effects of "hospitalism" [R. A. Spitz, in Psychoanalytic Study of the Child (International Universities Press, New York, 1946), vol. 1, pp. 53-74]. King states that Spitz's report is "carefully documented and lucid." I think it only fair to inform the interested reader that Spitz's work has been critically reviewed by Pinneau [Psychol. Bull. 52, 429 (1955)], who concluded that, because of methodological and other inadequacies, "the results of Spitz's studies cannot be accepted as scientific evidence supporting the hypothesis that institutional infants develop psychological disorders as a result of being separated from their mothers" (p. 448).

VICTOR H. DENENBERG Department of Psychology, Purdue University, Lafayette, Indiana

Age Factor in Hilo Disaster

The report by Lachman, Tatsuoka, and Bonk Science 133, 1405 (1961)] is a significant contribution, particularly since it illustrates one way in which the scientific community can be of service in the world of practical affairs.





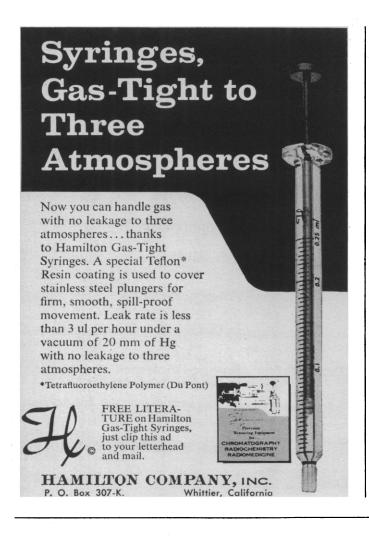
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In this case the authors have done a creditable job of investigating subjects' experiences before, during, and after the recent disaster which occurred when a tidal wave struck the city of Hilo, Hawaii. Of considerable importance are the findings which point out the differences between those who evacuated and those who did not when the warning sirens were sounded. This information should clearly be of great value in minimizing the loss of human lives in similar circumstances in the future.

Since I have been interested in the psychological aspects of aging, I was concerned about the age of those who did not evacuate, thinking that perhaps they might have been somewhat older than those who did. Lachman *et al.* present the age data (their Table 1), but only in terms of the number of subjects in the sample who were between the ages of 18 and 27, 28 and 37, and so on, and no mention was made of this variable in the text of the article. In order to get some idea, I computed

Table 1. Chi-square analysis, based on age data given by Lachman *et al.* $x^2 = 11.34$; df = 5; p < .05.

Item	Nonevacuees	Evacuees
	Age, 18-27 years	
o	29	30
\boldsymbol{E}	35.5	23.4
O- E	6.5	6.6
$(O-E)^2$	42.25	43.56
$(O-E)^2/E$	1.19	1.86
_	Age, 28-37 years	
.0	41	35
E	45.7	30.2
O-E	4.7	4.8
$(O-E)^2$	22.09	23.02
$(O-E)^2/E$	0.48	0.76
_	Age, 38-47 years	
0	45	32
E	46.3	30.6
<i>O-E</i>	1.3	1.4
$(O-E)^2$	1.69	1.96
$(O-E)^2/E$	0.36	0.06
	Age, 48-57 years	
0	45	19
E	38.6	25.5
<i>O-E</i>	6.4	6.5
$(O-E)^2$	40.96	42.25
$(O-E)^2/E$	1.06	1.66
0	Age, 58–67 years	•
O E	25 19.9	8
O-E	5.1	13.1 5.1
$(O-E)^2$	26.01	26.01
$(O-E)^2/E$	1.31	1.99
, , , -	Age, 68 years and ove	
0	12	, 6
\boldsymbol{E}	10.8	7.2
O-E	1.2	1.2
$(O-E)^2$	2.64	2.64
$(O-E)^2/E$	0.24	0.37

a crude average age for the nonevacuees and evacuees by simply assuming that each subject's age was at the midpoint of the category as the data were presented—that is, 22.5, 32.5, and so on. These crude average ages were 46.8 and 39.3 for the nonevacuees and the evacuees, respectively. Intrigued by the possibility of a difference, I then carried out a chi-square analysis (although with all of the data available, the more powerful t test would be more appropriate) and found a chi-square of 11.34, which, with 5 degrees of freedom, is significant at the .05 level of confidence (Table 1).

Thus, it would appear (pending crossvalidation) that the age variable, in addition to the variables described by Lachman et al., is one factor which accounts for the fact that some of the people did not evacuate. The reasons for this are not clear, but one might suspect that since older individuals are more likely to be infirm, they might have been less able to evacuate; also, psychological characteristics such as rigidity and confusion in response to novel stimuli may have contributed, since these characteristics, it is sometimes felt, are more common in older groups.

I do, however, wish to make it clear that age would be but one factor. It would not account for the fact that many individuals between 18 and 47 did not evacuate, or that some people over 68 did evacuate. Lachman et al. have indicated several other factors as provocative possibilities.

DAVID G. McDonald Department of Psychiatry and Neurology, School of Medicine, Washington University, St. Louis, Missouri

The mean ages for the evacuees and nonevacuees are 39.8 and 44.7 years, respectively. The difference between means is statistically significant (CR = 2.98, p < .01) and should have been reported. We agree with McDonald that the age factor is difficult to interpret, since an analysis of the data broken down by age groups did not reveal any consistent trends. The Hilo alert failed to produce an effort, on the part of the agencies responsible, to evacuate the aged, infirm, or disabled. This may have contributed to the age-evacuation relationship.

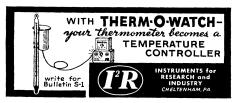
ROY LACHMAN

Johns Hopkins Hospital, Baltimore, Maryland

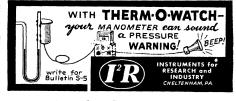


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Humoral Regulation of Breathing

The concepts presented by Armstrong et al. in their article "The humoral regulation of breathing" (1) should not be allowed to go unchallenged. In ten pages of computation and speculation the authors claim evidence that control of respiration is mediated via peripheral chemoreceptors sensitive to humoral changes in both arterial and venous blood. The venous receptors are supposed to be located in the pulmonary artery. The respiratory center is viewed by the authors as merely a "computing mechanism" to respond to afferent neural stimulation.

It is likely that the authors may find some disagreement with their contention that the brain serves only as a computer. The specific existence of osmoreceptors and thermal receptors has long been known (2). That the respiratory center may respond directly to chemical stimulation has also been shown. Comroe in 1943 demonstrated a ventilatory response to injection of CO2-bicarbonate mixtures directly into certain localized areas of the brain stem of the cat (3). Loeschke more recently has infused solutions into the cerebrospinal fluid to demonstrate also a central chemoreceptor response (4). To divorce the brain from its time-honored role of sensitivity to humoral changes and relegate it to the chore of computation seems scarcely justified.

The correlation between the magnitude of ventilation and venous blood Pco2 and H+ under a variety of conditions (for example, CO2 breathing and exercise) is well known. The authors' extensive mathematical gymnastics do nothing to pinpoint the site of action of the chemical stimuli. One cannot know whether venous Pco2 and H+ serve as stimuli to an as yet unlocated pulmonary artery chemoreceptor, or whether these chemical parameters only reflect the actual operating conditions within the chemosensitive cells of the respiratory center. It is not surprising that a crude mathematical correlation between ventilatory response and H+-Pco2 of mixed venous blood can be demonstrated. If it were possible to isolate the venous outflow from the respiratory center itself, a far better mathematical fit might well be obtained.

Perhaps it would be more appropriate to devote future efforts to demonstration of the physiologic existence of these elusive venous chemoreceptors, before assigning to them such an all-important role in the regulation of respiration.

ALBERT ROOS

THOMAS F. HORNBEIN

Laboratory of Thoracic Physiology, Washington University School of Medicine, St. Louis, Missouri

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- H. H. Loeschke and H. P. Koepchen, Arch. ges. Physiol. Pflüger's 266, 628 (1958).

We agree with the opening statement in the above letter—the concepts in our article should not go unchallenged. Several aspects of the presentation are admittedly controversial and, therefore, subject to challenge.

The paper was prepared with two objectives in mind: first, and primarily, to discuss some consequences of postulating a mixed venous chemoreceptor with functions similar to those of known arterial chemoreceptors. Having done this, such a variety of respiratory responses could be accounted for that several obvious questions arose: What is

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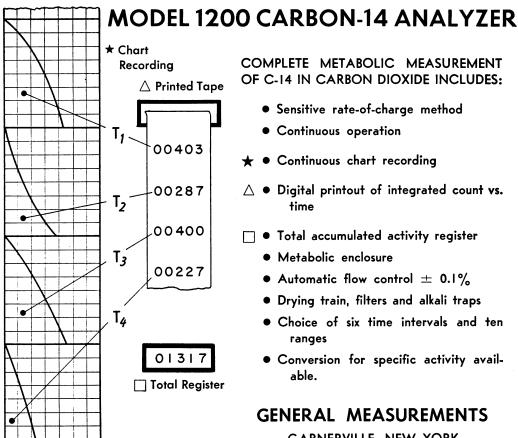
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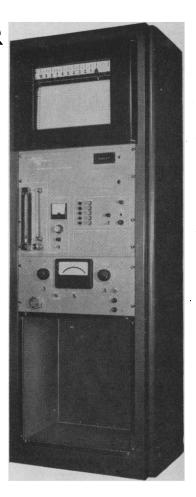


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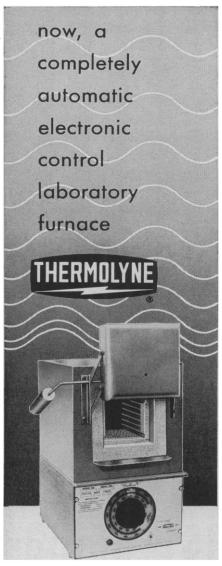
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the function of the respiratory center; is it analogous to a computer, or to a transducer, or does it have both sensory and integrative functions? Does arterial blood contain enough "information" for the body to regulate breathing and maintain arterial homeostasis? Are the efforts to wring out of arterial blood the data necessary to account for the hyperpnea of exercise a manifestation of laudable perseverance, or do these efforts represent a reluctance to abandon familiar concepts?

The second objective, then, was to raise these questions in public. Although we cannot answer these questions, in approaching them it seems helpful to put classic teaching into syllogistic form:

- 1) There is a respiratory center.
- 2) A respiratory response regularly follows the administration of many substances—inhalation of CO₂, intravenous injection of acids, and so forth. (At this point haven't many of us made the following inference that over the years has acquired the weight of a deduction?)
- 3) Therefore, the observed respiratory response is produced because the administered agent has stimulated the respiratory center.

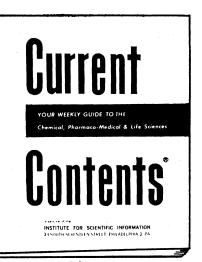
In another argument, the second premise becomes:

2) A positive respiratory response often follows the introduction of certain substances into the respiratory center (or the cerebral spaces).

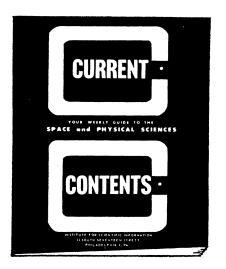
While it certainly follows that the central nervous system is chemosensitive to such substances, this is no proof that there is a chemoreceptor in the brain; it may only mean that the integrative action of the central nervous system has been disturbed by the procedure.

An interesting point is raised in Roos and Hornbein's third paragraph, where they imply that "operating conditions within the chemosensitive cells of the respiratory center" and "the composition of venous outflow from the respiratory center" are sufficiently altered by exercise to account for the observed hyperpnea. This may be, but we are unaware of supporting data. If the composition of blood draining the respiratory center can be assumed to parallel that of internal jugular blood, the possibility seems unlikely. In contrast to the venous drainage from most regions, the composition of internal jugular blood remains essentially stable at rest and during even severe exercise [J. H. Mitchell et al., J. Clin. Invest. 37, 1693 (1958)].

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For the convenience of readers who do not have our original article at hand, we point out that the respiratory center was not characterized as "merely" a computer, and it was not "relegated to the chore of computation." It was described as analogous to a computer; we assumed that readers would share our respect for computations done by the central nervous system. Neither was the mixed venous chemoreceptor mechanism "supposed to be located in the pulmonary artery." The glomus pulmonale (which is in the pulmonary artery) was described to show that the anatomic structure necessary for the concept exists; whether or not it is a chemoreceptor, we do not know. The equations and numbers in our article were derived by operations of arithmetic and elementary algebra, not from "extensive mathematical gymnastics." Nor were they intended to "pinpoint" the site of any action. The most extensively discussed equation (Equation 5) was used, primarily, to summarize much of our concept quantitatively-much as the second paragraph of the "Summary" does with words.

Finally, we are aware of the consequences of iconoclasm and those that often attend discussion of bits of indirect evidence which, when taken together, trend to support an unproved hypothesis. Since existing theory of respiratory regulation seems to have reached an impasse, a new approach, however challenging it may be, seemed, and continues to seem, appropriate.

BRUCE W. ARMSTRONG HOLCOMBE H. HURT RICHARD W. BLIDE JOHN M. WORKMAN

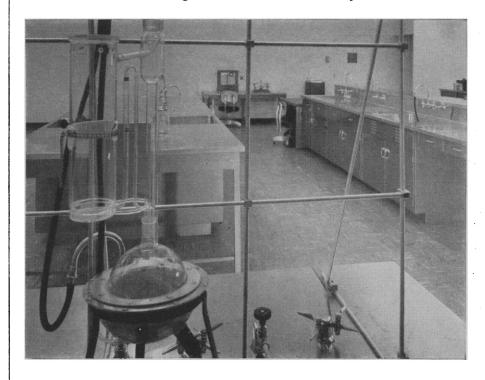
Cardio-Pulmonary Laboratory, University of Maryland School of Medicine, and University Hospital, Baltimore

Academic Biology in Europe

William V. Consolazio's article on the "Dilemma of academic biology in Europe" [Science 133, 1892 (1961)] painted a picture in the biological field which is in sharp contrast to what I had observed in Europe in the field of chemistry. I had the opportunity of working for a year in a European laboratory and was able to visit a number of university as well as industrial establishments. Most of the laboratories were conducting a vigorous program of fundamental research and on a larger



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scale than is usual in the United States. The equipment was up to U.S. standards, but the working facilities, in terms of space and assistants, were superior to what is found in most laboratories in our country. I believe that our effort is greater in applied research. I concur with Consolazio in his observations concerning the organization of the Research Institutes and the stifling effect it has on the younger members.

It may be that the difference in the status of academic biology and chemistry in Europe merely reflects what

people there believe is most important. Certainly we can see similar situations around us in the United States. Europe and America have a great deal to learn from each other, not only in the field of chemistry but in many other areas as well.

ELI PERRY

Bayou Shore Apartments, Galveston, Texas

I was fortunate enough to be able to spend 2 years at one of the excellent biological laboratories of the United States with the aid of a Na-

GLASSWARE

tional Science Foundation fellowship. I am most grateful for that opportunity and, therefore, feel obliged to say a few words on the recent article "Dilemma of academic biology in Europe." As Consolazio says, he is able to report only first approximations in his survey of the organization and the needs of European biology, and I find that, although I agree with some of his main points, I have quite a different impression of several others, especially as far as Germany goes.

I certainly agree with Consolazio that, at least as far as German academic biology is concerned, these reforms are needed: The training of students, who are to become the biologists of the future, needs to be broadened in several fields, for example in biochemistry and genetics. The capability of the universities could be greatly improved by adding professorships and departments. Also, it would be an improvement to have the responsibilities and privileges in each department shared by several members instead of having them borne entirely by one director, as they are now. But in spite of these deficiencies, I would say, in disagreement with the author, that adherence to tradition has not been the major cause of the decline in biological science in Europe. My view is that the two world wars are by far the most important cause. They, especially World War II, interrupted both research and academic teaching, and caused the economic ruin of Europe. This, and in some countries the loss of outstanding scientists and interruption of correspondence with the outside world, had two main results: the loss of scientific offspring, and the lack of facilities for research. After the last war, if first-rate scientists had been available and if the economic situation had allowed these people to have the facilities they needed, then there would be no reason to believe that European universities would not have changed, built new laboratories, created more chairs, and so on. As economic conditions improve, I believe this will become evident for all of Europe.

Fortunately, in Germany, with the much appreciated aid of members of the Western nations, especially the United States, much of the economic stress has been overcome and a modest, but increasing, proportion of our taxes is now being spent on improving the biological laboratories of the universities. The laboratory I returned



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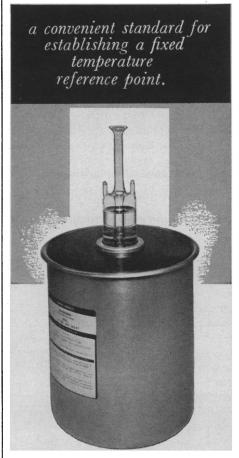


to from my stay in the United States is exceedingly well equipped, and the library facilities also are good enough to keep anyone from intellectual starvation. In addition, my colleagues and I do not have any difficulties to complain of in supporting our families.

For a more country-wide example, the Wissenschaftsrat (committee for nation-wide coordination of research and higher learning) has made many recommendations, including the proposal to create 35 new professorships of genetics in universities, in their natural science departments and agricultural and medical schools. Several German states have already acted upon these recommendations. Unfortunately, the shortage of qualified scientists and teachers, due to the causes stated above, will not be overcome for some time. The help of the United States in training young German biologists has been and will be of great benefit in overcoming this deficiency. Already many of these United States-trained biologists have returned and seriously discuss the improvements in German biology that seem to be needed-improvements that incorporate both new developments and the best of traditional forms. As economic and scientific conditions improve in Europe, I feel that the problem of young scientists leaving their home countries for the United States and Canada, for example, will disappear.

Consolazio believes that language differences are a serious barrier to a flourishing biological development in Europe. I feel that this is overly pessimistic. Europeans, in contrast to Americans, are more or less forced to be familiar with more than one language. Although this does not lead to easy communication among all European biologists, there is hope that the present trend towards more intercommunication will become even greater. For example, for the past few years the universities of Poitier (France) and Marburg (Germany) have had a successful and regular interchange of their faculty members of all departments. This type of exchange between still independent universities has the advantage of broad communication and yet of retaining a variety of ideas and approaches to problems. I would even consider cultural differences between European peoples an asset, which furthers a multifaceted progress, and which one should by no means try to make too homogeneous overemphasizing internationaliza-

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tion in science. Such trends toward uniformity should even be considered in the otherwise valuable creation of strategically placed international institutes of advanced studies.

Summing up, then, I would say that neither barriers of any kind inside of Europe nor the organization of her universities is the primary factor that has caused European biology to lag behind, but rather the effects of the sad 20th-century history on this continent. As to the means for recovery, I am much more optimistic than Consolazio that with continuing economic improvement the deficiencies can be overcome by the reshaping of university organization that at the same time will keep the best of traditional forms.

HANS J. BECKER

Zoologisches Institut der Universität Marburg an der Lahn, Germany

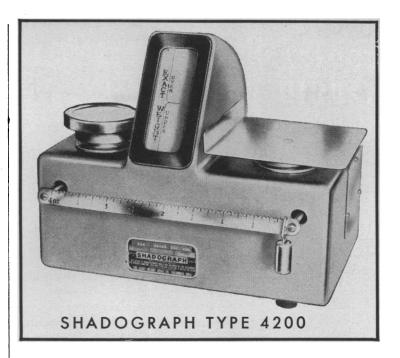
With respect to Perry's comments, my article limits itself to academic biology. I tried to make it clear that not everything was black. Even though I was generalizing, I nevertheless qualified my generalizations. In this instance, if I may quote from the article in discussion, I believe I can make my point clear: "There are pockets of scientific activity of very high quality in most of the other countries of Western Europe . . ."

With respect to Becker's points of issue, I have two comments to make. I am aware of plans not only in Germany but in other parts of Europe to right the existing situation, but more is needed than plans. In the second instance, I said nothing about language as a barrier to communication and to developments in science. I was talking about nationalism, and more specifically about citizenship as a qualification to hold appointments in the universities.

WILLIAM V. CONSOLAZIO
National Science Foundation,
Washington, D.C.

Mushroom Structure

You have committed a mistake in the explanation of the picture on the cover of the 26 May issue [Science 133 (1961)]. Your statement reads "... crowded knife blade gills of white support the umbrella-shaped pileus and bear spores..." The gills in Lepiota are free from the stipe and grow downward from the context of the pileus. The pileus is the supporting structure



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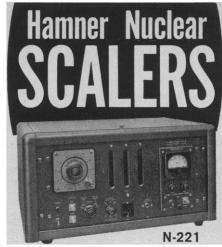
and holds the gills in position for spore discharge. The gills, by virtue of hanging free from all parts of the carpophore save the pileus, are in no position to support anything.

ALEXANDER H. SMITH Herbarium,
University of Michigan, Ann Arbor

Thyroxin Analogs in Tadpoles

The report by Frieden and Westmark [Science 133, 1487 (1961)] includes useful information on relative activity of thyroxin and its analogs in promoting certain metamorphic changes in tadpoles. The authors indicate that in the rat, according to oxygen uptake and goiter prevention tests, the various analogs used are from 0.1 to 10 times as effective as thyroxin. In the tadpole, when the hormones are administered by injection (insufficient detail given as to number and frequency of doses, and so forth), three of the analogs show 3 to 7 times the metamorphosis-promoting capacity of thyroxin, that is, within the same range of effect as for the rat, while the most active compound, 3,5,3'triiodothyronine, is 17 times as active, that is, outside the range of activity shown in the rat, but of the same order of magnitude. In contrast, when these hormones are administered by keeping the tadpole immersed in their solutions, these same analogs show up to 20 to 300 times as much metamorphosing activity as thyroxin.

Frieden and Westmark ascribe the very different relative activities to the "unique" route of administration, that is, immersion, and suggest that in part the tadpole response is "probably strongly influenced by relative rate of penetration." Regrettably they fail to remark that most, if not all, of the tadpole tests utilize the relatively insensitive system of the tail, involving either the measurement of tail shortening or of tail height reduction. In contrast, when the most sensitive system, the leg of the tadpole, is used as a test object in hypophysectomized (and thus functionally thyroidless) tadpoles, far less difference in relative activities of the compounds is noted [Kollros, in Comparative Endocrinology, A. Gorbman, Ed. (Wiley, New York, 1959), and Kollros and Race, Anat. Record 136, 224 (1960)]. Recent studies, using threshold doses of hormones to stimulate leg growth, have shown 3,5,3'triiodothyropropionic acid to be be-



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tween 10 and 50 times as active, at most, as thyroxin, rather than 290 times, as reported for tail reduction earlier [Roche et al., Biochim. et Biophys. Acta 20, 337 (1956)]. It should be emphasized that the extreme sensitivity shown in this reacting system cannot be ascribed to direct external stimulation by immersion, since the growth of the leg is characterized mainly by progressive changes in mass and by differentiation of the internal premuscle and muscle rudiments, and the precartilage, cartilage, and early bone of the skeleton. Metamorphic skin changes of the limb and of other regions as well are not evident in the animals treated with the lowest effective dosages. Exception should be taken, therefore, to the suggestion of Frieden and Westmark that immersion is likely to favor skin responses.

Since the immersion system provides the tadpole with a continuous and relatively unvarying hormone source, the possibility exists that internal and external hormone levels reach and maintain an equilibrium, as suggested by Moser [Rev. Suisse Zool. 57, suppl. 2, 1-144 (1950)], and that the differences in response between immersion and injection techniques result from the continuous, long-term, high-level stimulation to which the immersed animal is subjected, in contrast to the high-level but much briefer stimulus which the injected animal may receive. That equilibria are achieved is suggested by the studies which establish hormone thresholds for specific levels of limb response, that is, which show that successive stages of limb differentiation require progressively higher hormone concentrations to be realized [Kollros, Anat. Record 125, 624 (1956); Am. Zool. 1, 107 (1961)].

JERRY J. KOLLROS

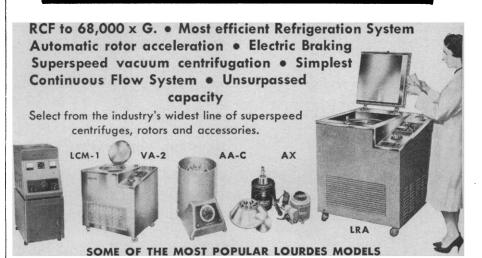
Department of Zoology, State University of Iowa, Iowa City

The comments of Kollros do not reveal any fundamental disagreement with the results summarized in our recent report in *Science* pointing out the fallacy of the alleged anomalous activity of thyroxin analogs in the tadpole. In this report we compared the results of a single injection with a single 48-hour immersion dose, using the typical criterion of tail reduction. This is essentially the measurement used by other workers, for example, Pitt-Rivers, Roche, Money *et al.*, in their reports of large ratios of analog to thyroxin activity. It seemed logical to us then

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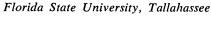
and now to compare the responses to immersion and injected doses, using a test similar to that used in these previous papers. But we clearly stated in our report (page 1489) that "Activity comparisons should also be made using other criteria, for example, limb eruption and growth (4)." [The "(4)" referred to experiments of Kollros.]

However, no adequately detailed data comparing analogs using the leg growth of the hypophysectomized tadpole or any other tadpole test have appeared in the references cited by Kollros, including the two symposium

papers [in Comparative Endocrinology (1959), and Am. Zool. 1, 107 (1961)] or in the abstract [which appeared in Anat. Record 136, 224 (1960)]. We are pleased to learn that recent studies by Kollros and associates, apparently also as yet unpublished, show 3,5,3'-triiodothyropropionic acid to be only 10 to 50 times as active as thyroxin. This supports our contention that the larger values reported earlier were unrealistic, possibly reflecting, at least in the tail reduction method using normal non-hypophysectomized tadpoles, the test route of immersion.

It was suggested that certain skin responses may be favored in immersion experiments, because of the proximity of sensitive skin areas to the expected sites of absorption, for example, gills and skin. But we did not offer this as an explanation for effects on the limb response. We continue to think that using an immersion rather than an injection test route introduces the important additional variable of the rate of penetration of a test compound from the solution into the animal. It is not yet proved that the immersion system provides the tadpole with a continuous and relatively unvarying hormone source, especially in view of the permeability parameter, the instability of many of the compounds of the thyroxin series, and their variable absorption on glass as emphasized in our report in Science.

EARL FRIEDEN
Department of Chemistry,
Florida State University, Tallahassae



Censorship and Propaganda

Regarding your editorial "The reluctant dragon" [Science 133, 1677 (1961)], I wish to point out that there are two sides to this question. As you indicated, censorship can be dangerous. On the other hand, propaganda can be dangerous, else the communist conspiracy would not spend so much time developing the technique.

I disagree with the implications of the editorial that imposing censorship on foreign propaganda is wrong in principle because censorship "is symbolic of fear and manifests a lack of faith in freedom and in the good sense and good judgment of American citizens." That Americans are not immune to the effects of propaganda is attested to by the number of communists that have been exposed within our government; also, by the communist-inspired student riots in May 1960 against the House Committee on Un-American Activities, in San Francisco.

We can continue to play the ostrich and ignore the dangers of the cold war, but to do so is to court disaster. Those who feel there is no danger have either neglected to study the record or have ignored its implications. Freedom, like health, isn't fully appreciated until it is lost.

WILLIAM C. HURT 1225 Martindale Drive, Fayetteville, North Carolina



SCIENCE, VOL. 134