SCIENCE

3 March 1967

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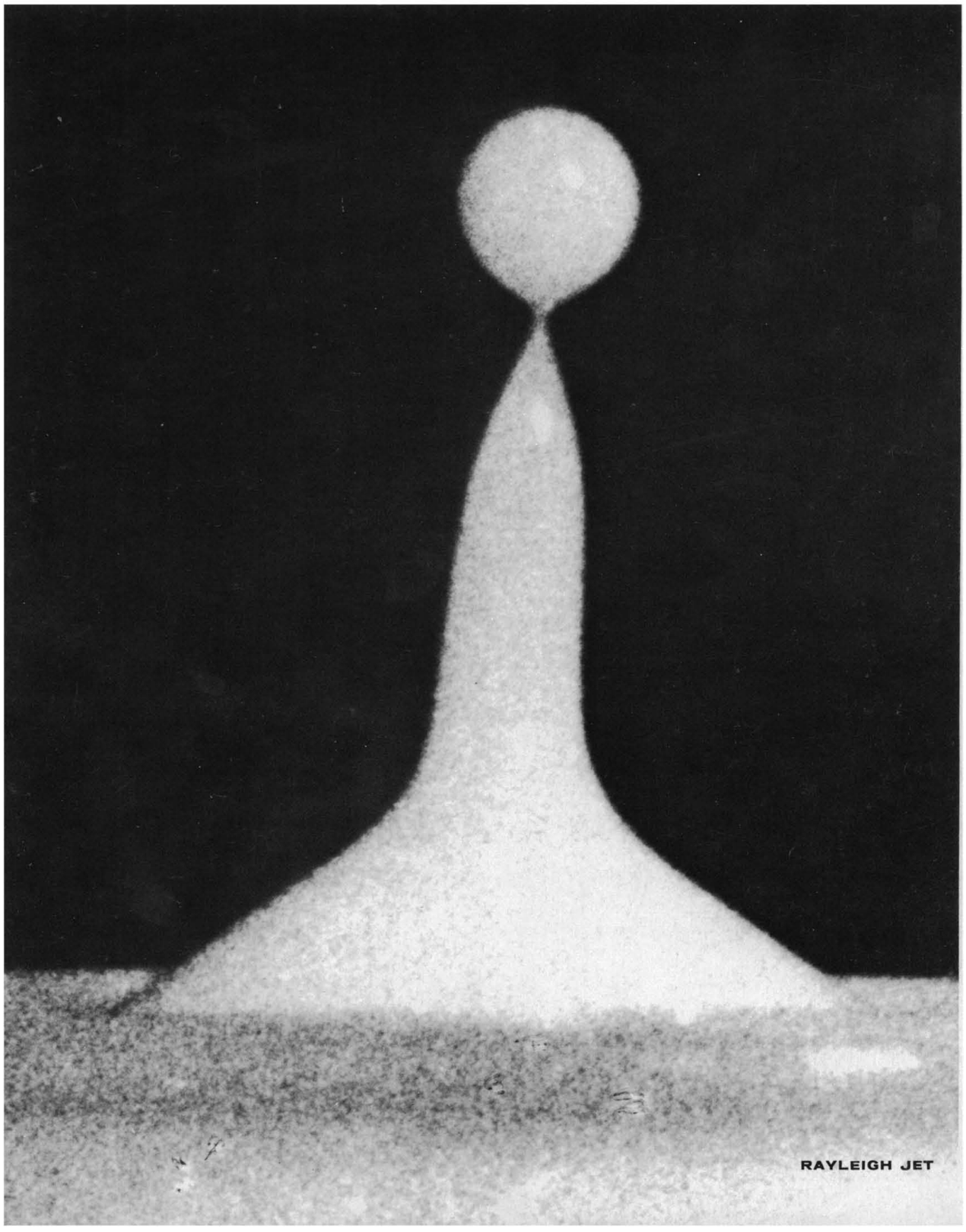
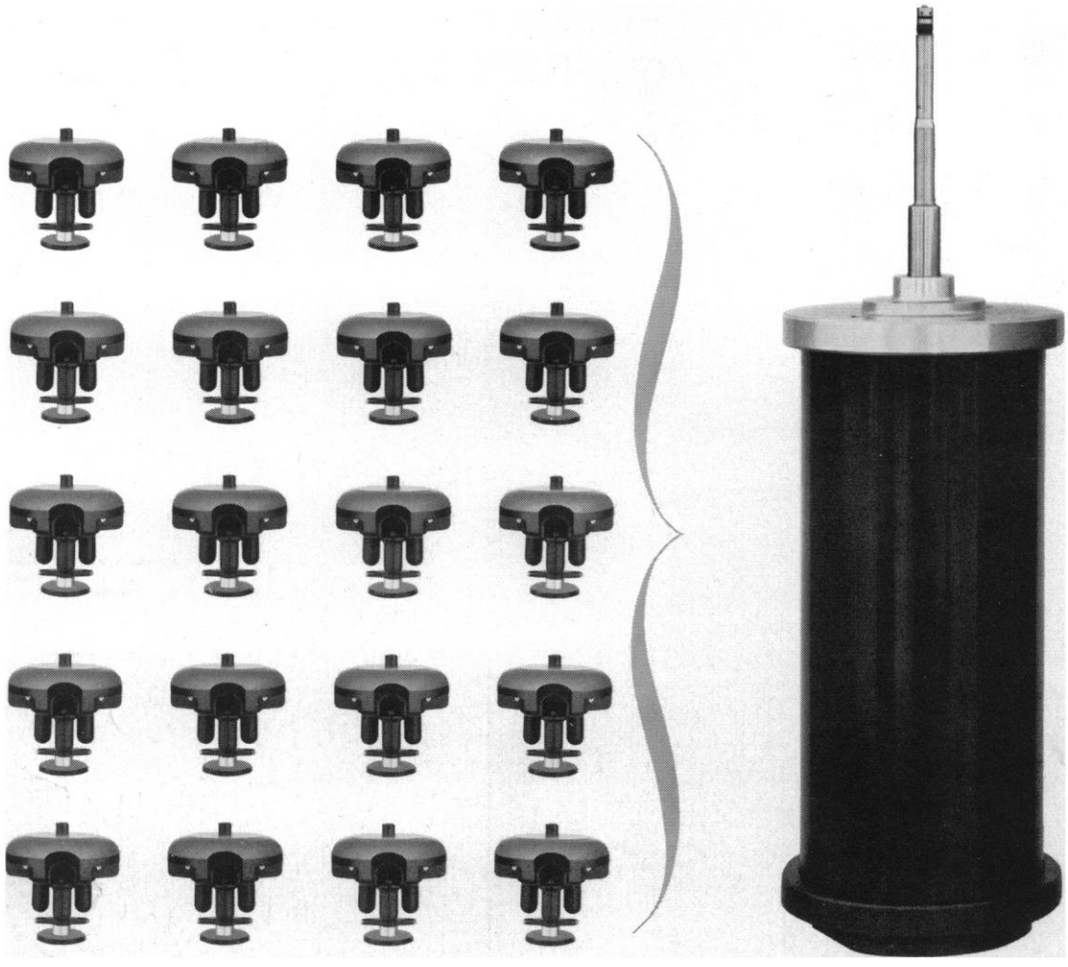
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE





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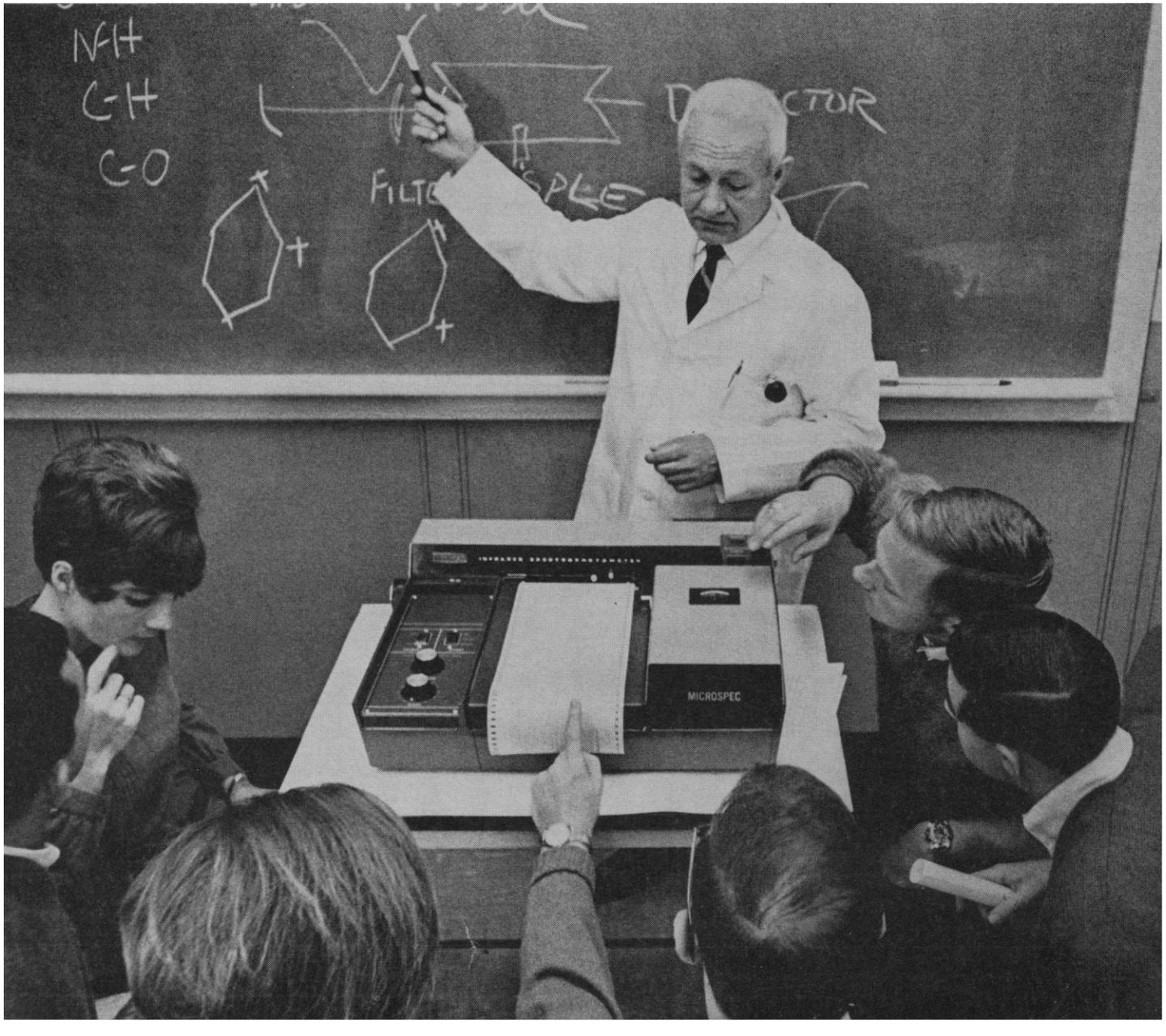

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SCIENCE

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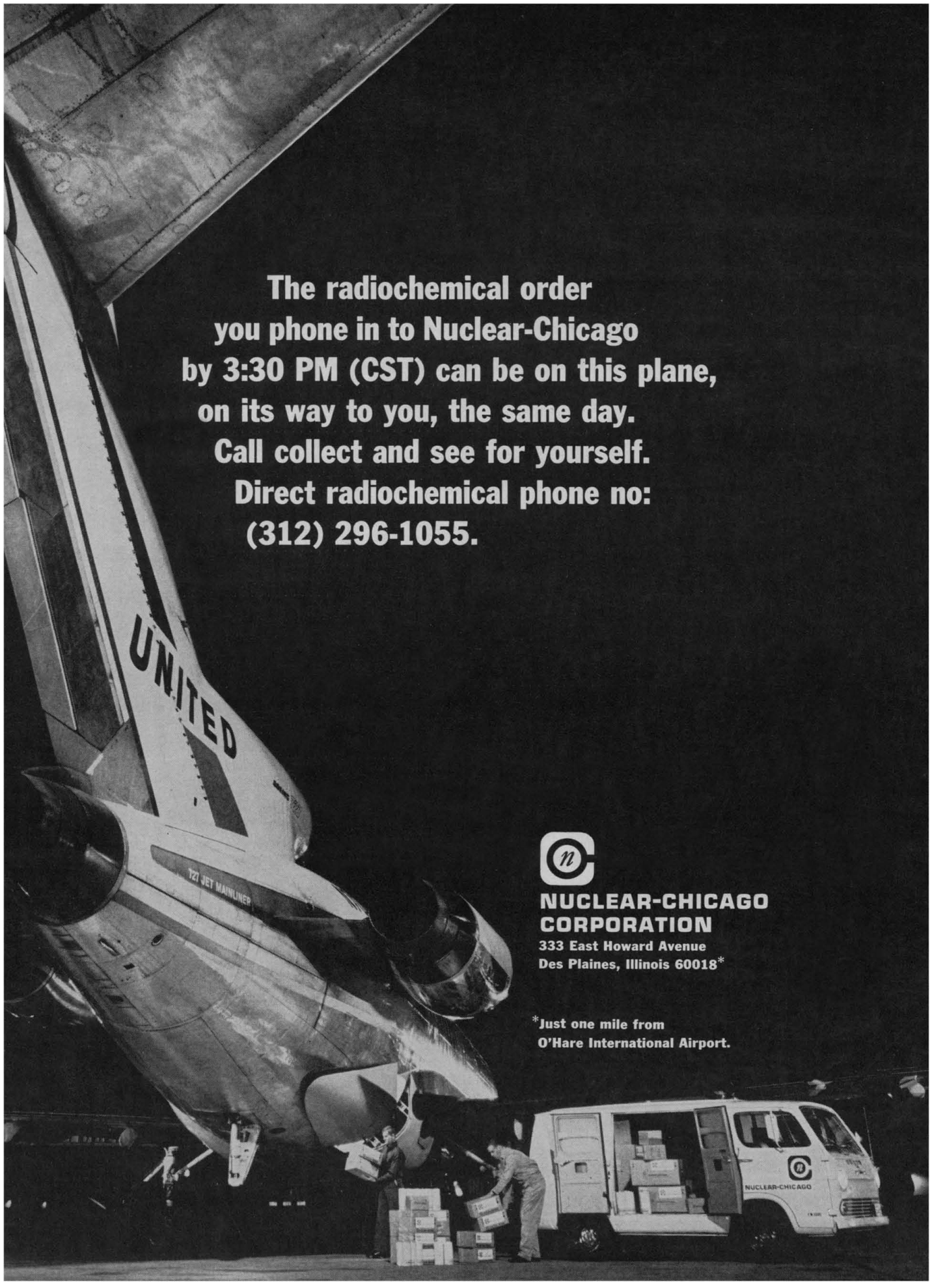
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

COVER

A jet thrown up from a liquid surface after a drop (3 millimeters in diameter) collided with the surface. The growth of an unstable wave on the jet causes a large drop to break away from the top of the jet. Photograph was taken 0.07 second after the original drop collided with the surface. See page 1112. [P. V. Hobbs and A. J. Kezweeny, Atmospheric Sciences, University of Washington, Seattle]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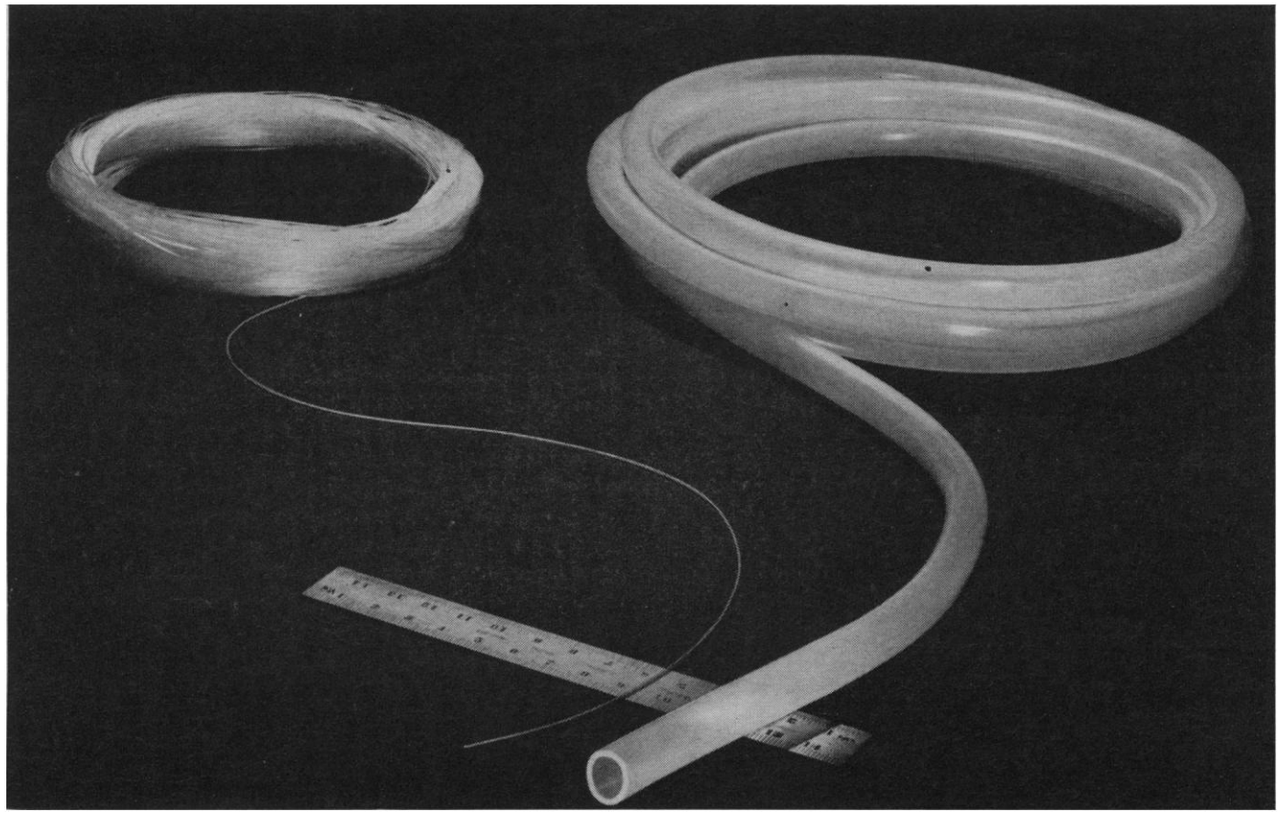

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our chances for finding out what it is by assuming that it is the same as that agreed upon by middle-class American liberals, not to mention what we do to the study of anthropology.

Therefore, I say we must keep these roles separate. We can condemn forms of warfare in Vietnam or anywhere else as much as we like but we must do this as middle-class American liberals or as humanitarians, or as theologians, or as whatever other class is applicable, but not as anthropologists, or at least not until we know a lot more about the limits of human nature than we do today. And when we do decide we know enough to say what offends human nature, we had better include the values and beliefs of some of the people we study in making our judgments, even if they are contrary to the precepts of Judeo-Christian ethics.

ARTHUR NIEHOFF
6214 Tally-Ho Lane,
Alexandria, Virginia

Ably Elucidated Precepts

My sincerest congratulations to Wolfle on his discernment of the necessity to admonish those intent on scholarly publication, whether for pedagogical purposes, for transmission of investigative disclosures, or for the establishment of standardized compendia of serviceable data, to refrain from the employment of glottologically superfluous or, in other words, unnecessarily verbose (i.e., insufficiently laconic) modes of exposition. His editorial (27 Jan., "Bad writing," p. 407) (q.v.) infused me with a profound desire to divest my expository compositions of all vestiges of pedantry and ambiguity, and I shall endeavor to adhere to the estimable precepts so ably elucidated therein.

LEONARD I. KINDLER
67-10 Groton Street,
Forest Hills, New York 11375

When Science is Palatable

René Dubos remarks (Editorial, 4 Nov., p. 595) that "Scientific problems should be presented to the general public from several points of view. . . . It is essential also that scientists discuss more thoroughly in public the implications of their findings. . . ." In the same issue J. P. Scott touches off a scathing review of Lorenz' *On Aggression* (p. 636) with the remark that it is "only 50 percent science." This raises the point: is it better to reach a wide public with a 50 percent product (provided the remainder is not anti-science) or to produce a refined, 100 percent product and not reach the public at all? Lorenz' success in communicating with nonprofessionals leads me to wonder if his manner of presenting a personal view of certain ideas and their implications may not be worth emulating. What Scott calls romanticism may be one of several necessary recipes for palatability. Let us face it: the public is uninterested in that which is unattractive, incomprehensible, or remote from their own lives; we cannot reach them by spouting formulae, however beautiful the formulae may seem to us. Scott describes Lorenz' books as "children's books," which they are not. So long as we equate nonscientists with children, we are not likely to be listened to in any case.

HOWARD E. EVANS
Museum of Comparative Zoology,
Harvard University,
Cambridge, Massachusetts 02138

Origins of the Lean and Hungry Effort

Bok and Kovach bewail the lack of drive in doctoral candidates (Letters, 4 Nov.; 23 Dec.) but the phenomenon is easily explained. It is the psychological effect of the business cycle. Bok graduated in 1930; Kovach then was 8 years old. The sudden collapse of the economic system, the unemployment, and the breadlines left their generation with the feeling that work is a privilege and sacred.

The young lads who are in their early 20's now have never known anything other than plenty. Work? There are hundreds of jobs available—nobody *they* know has ever been out of a job. And salaries always run to a car and a house and furniture to fill it. What are the oldsters worried about?

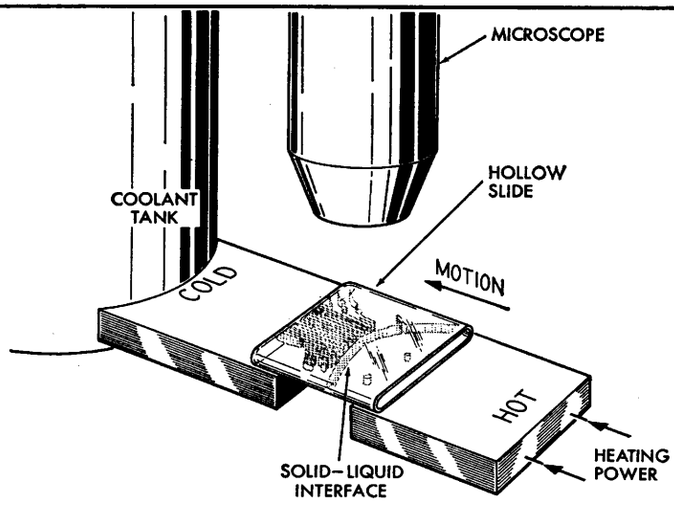
And *their* children, to whom nobody will ever talk about depressions, will be hit by want, deprivation, and penury in the middle 1980's, which will leave indelible mental scars and a driving attitude to work. Thus the Wheel of Life turns full cycle.

F. P. HUGHES
315 Poplar Street,
Hawkesbury, Ontario, Canada

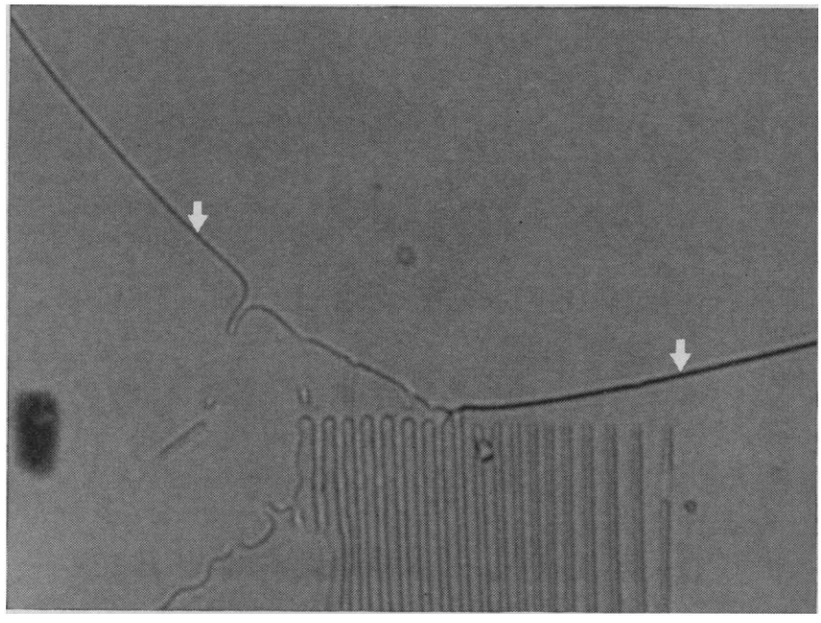
Report from

BELL LABORATORIES

Inside Solidifying Metals



Experimental setup in which photographs such as that below were taken. The glass slide or cell—containing a liquid which freezes like a metal—is placed between hot and cold blocks of brass. This produces a temperature difference along the slide. A solid-liquid interface then forms between the two blocks. By moving the slide toward the cold block at a constant rate, one can observe the steady growth of the crystal under the microscope.



Bell Laboratories' model (200x) permits physical simulation of a eutectic phase diagram for an alloy such as lead-tin. Diagram relates liquid proportions (horizontal scale) to temperature (vertical).

Two different liquids were put into a single slide . . . hexachloroethane on the left and carbon tetrabromide on the right. After a brief period, the liquids formed a graded mixture, from 100% of one at the left to 100% of the other at the right. The mixture was partially frozen, then photographed with the slide stationary. The solid-liquid interface (arrows) then showed the freezing point for every possible composition.

The "grid" under the solid-liquid interface is made up of alternate solid layers of the two chemicals (the eutectic region).

At Bell Telephone Laboratories, metallurgist Kenneth A. Jackson has devised transparent models of solidifying molten metals. With these models, we can now study what happens inside a metal as it freezes. This gives us a tool which promises to improve existing alloys and will perhaps help us find new and better ones.

The models are hollow microscope slides (diagram) containing such organic liquids as camphor or carbon tetrabromide. These compounds are among the few transparent substances whose molecules freeze without having to rotate into a specific orientation. Metal atoms act the same way, hence the similarity in freezing behavior.

Various modes of metal-crystal growth—planar, dendritic (tree-like branching) and cellular—have been studied in detail with this technique. Also, the solidification of alloys has been simulated (photo). To do this, liquids with freezing characteristics corresponding to those of two metals are mixed and cooled. With this procedure, Jackson and J. D. Hunt (now at the University of Oxford) observed, for the first time, the process by which the "equiaxed" zone forms in alloy castings. This is a zone of relatively small crystals, usually found in the center of an alloy casting. The new technique shows that the equiaxed zone results from "branches" melted from dendritic crystals. As the alloy cools, freezing begins at the outer surface, producing dendrites which project inward toward the hotter, liquid center. Branches, melted from these growing dendrites, are carried to the center of the casting to form the crystals of the equiaxed zone.

Until now, the only methods for studying metal freezing were laborious . . . cutting, polishing and etching, for instance. The new technique is not only simpler but also reveals hitherto unknown details of crystal growth.

Bell Telephone Laboratories
Research and Development Unit of the Bell System

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J. Robert Oppenheimer

When J. Robert Oppenheimer's laboratory at Los Alamos engineered the first atomic bomb, it made warfare inescapably a civilian as well as a military affair. From that time on, the notion that civilians could leave the unpleasantness of war to the soldiers was obsolete. But the bomb made equally though less obviously obsolete the isolation of the world of science and the intellect from that of politics and practical affairs. It was the genius of Oppenheimer that he not only symbolized both these changes but had the moral courage to act accordingly.

No one could have predicted this from his early scholarly career, when he began to organize in America theoretical research in basic physics, applying and extending the lessons he had learned as a graduate student in Cambridge, Göttingen, Leyden, and Zurich. Then his interests outside mathematics and physics ran more to music and Sanskrit poetry than to public affairs. Only a little later he was called to administer at Los Alamos one of the greatest engineering enterprises in history. On the basis of that feat, and of his imaginative understanding of the effect of new weapons on the world power system, he became an adviser to high political authority on military strategy, international relations, and government organization. Later, in private life, he extended his interests in the social sciences and humanities, both in his work as director of the Institute for Advanced Study and as a board member of organizations like the Social Science Research Council and the Twentieth Century Fund.

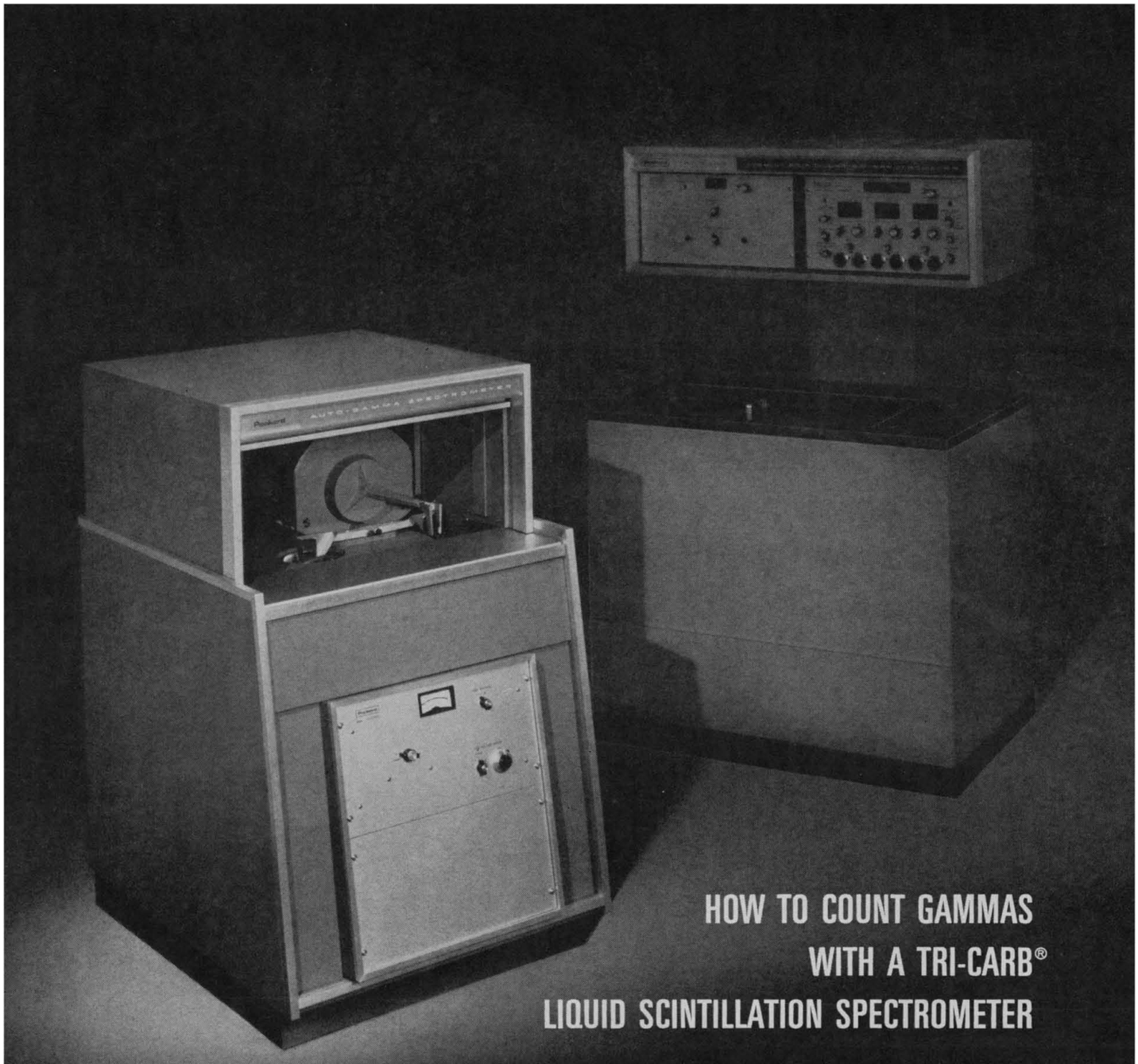
The great tragedy of his life was the decision by the Atomic Energy Commission in 1954 that he was no longer to be trusted as an official adviser with secret information. To most of his associates in public life who had known the full record, the decision was a tragic error. On the record, it was clearly motivated less by the specific offenses which he had committed than by his failure to give enthusiastic support to a crash program for an H-bomb, a sin of omission in which he was joined by many of the leading scientists who had made a success of the Manhattan Project.

When he remarked after Hiroshima that scientists at last had known sin, he summed up the new moral and political dilemmas of the age. The new powers that science had conceived and engineering had delivered had destroyed the innocence and the sense of freedom of the scientist. Henceforth the scientist could never profess a lack of responsibility for the fate of society; yet, whenever he responded to the call to political action, he would have to deal with problems that far transcended his specialized scientific competence.

Such dilemmas exist, of course, for society as a whole, and not merely for scientists. Can the United States maintain the tolerance and rational political processes of an earlier and more peaceful age, when progress seemed to be guaranteed by the advancement of science? Under the threat of war abroad and civil strife at home, national unity will depend not on our technological competence but on the political faith that science can be united with moral responsibility only through free inquiry and rational discussion.

Robert Oppenheimer's life was a symbol of some of the tragic dilemmas of the age. But it became a triumph of sensitivity and courage, through the union of intellectual power and moral concern that must be the foundation of both free science and a just society.

—DON K. PRICE, *Harvard University*.



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vitamin E may represent a state of excessive synthesis of catabolic and redundant enzymes which is repressed by vitamin E and inhibited by ethionine. If the hereditary muscular dystrophies are caused by a mutation in a regulatory gene, the similarity of these disorders to vitamin-E deficiency and the ineffectiveness of alpha-tocopherol as a therapeutic agent are explained. Katzen described the nature of function of the multiple forms of mammalian glucose-ATP-6-phosphotransferase (hexokinase). The total rat liver activity is now resolved into four distinct forms. The four enzymes have been separated and partially purified. Although they differ from each other, each distinct hexokinase is uniform in its properties from tissue to tissue, even though present in differing proportions depending upon the tissue source, animal age, and nutritional factors. A fifth type of hexokinase, apparently unique to sperm, was also described. On the basis of a correlation between the tissue distribution of the multiple forms of hexokinase and the tissues' insulin sensitivities, a hypothesis for the significance of the isoenzymes to the mechanism of action of insulin was outlined. Riggs presented a theoretical paper on the topic: feedback —fundamental relationship or frame of mind? Feedback is one of the four fundamental ways in which variables can be related to each other. Riggs pointed out that there is urgent need for universal agreement about the precise meaning of the term "feedback."

Effects of a liver carcinogen and the actions of radiation were discussed by Harry V. Gelboin (National Cancer Institute) and Olga Greengard (Harvard Medical School). Gelboin reported on the effect of methylcholanthrene, phenobarbital, and aflatoxin on RNA polymerase of rat liver. In the absence and presence of ammonium sulfate, methylcholanthrene and phenobarbital administered in vivo stimulate and aflatoxin markedly decreases RNA polymerase activity in the nuclei of rat liver. Greengard reported a fifteen-fold increase in the activity of tyrosine transaminase by the in vivo synergistic action of glucagon and hydrocortisone. She found that irradiation, unlike actinomycin, inhibited the "cofactor-type" inductions of tryptophan pyrrolase and tyrosine transaminase, but did not block the "hormone-type" induction of these enzymes. Greengard also discussed the mechanisms of induction in animals.

As in previous years, the Special Symposium Lecture was delivered by Sir Hans A. Krebs (Oxford University, Oxford, England) who discussed the redox state of diphosphopyridine nucleotides in regulation of metabolic processes. Krebs pointed out that the ratio of lactate to pyruvate reflects the redox state of dinucleotides in the cytoplasm; the glutamate system indicates the position in the mitochondrial matrix and the beta-hydroxybutyrate system that in the mitochondrial crystae. In diabetes the decrease in the ratios of the two mitochondrial systems was contrasted to the increase in the ratio of the cytoplasmic system. However, in starvation all three systems moved in the same direction to approximately the same extent. The ratios were very much lower in the mitochondrial systems than those of the cytoplasm, differing by a factor of 100 in liver from fed or starved animals and by a factor of 20 in the liver of diabetic rats. Krebs pointed out that the fact that calculations for the glutamate and beta-hydroxybutyrate dehydrogenase systems led to the same values for the ratio of NAD to $NADH_2$ implied that the substrates of these two dehydrogenases were in equilibrium with the same NAD-$NADH_2$ pool.

Indiana University honored Sir Hans A. Krebs at the end of his lecture by awarding a citation of the President of the University. Krebs also received the highest award given by the State of Indiana when he was made a Sagamore of the Wabash. In appreciation of his contribution to this Symposium series over the past half decade, volume 5 of *Advances in Enzyme Regulation* is dedicated to Sir Hans A. Krebs.

The symposium was sponsored by Indiana University School of Medicine, the American Cancer Society Institutional Grant, Hoffman-LaRoche, Eli Lilly and Co., Merck Sharp & Dohme, The Upjohn Co., and the Wellcome Co. The full text of the papers, edited by George Weber, will be published in the spring of 1967 as volume 5 of *Advances in Enzyme Regulation* (Pergamon Press, New York and Oxford). Volumes 1 through 4 of this series of Conferences on Enzyme Regulation in Mammalian Systems were published in 1963 through 1966 and presented the proceedings of the previous four symposia.

GEORGE WEBER
Pharmacology Department,
Indiana University School of Medicine,
Indianapolis 46207

Forthcoming Events

March

13–14. **Astronautics**, symp., Ottawa, Ont., Canada. (The Secretary, Canadian Aeronautics and Space Inst., 77 Metcalfe St., Ottawa 4, Ont.)

13–14. State Univ. of New York, Downstate Medical Center, "Visiting Scholar Lecture Series," **Arnold J. Toynbee**, Brooklyn, N.Y. (Office of Public Relations, Downstate Med. Ctr., 450 Clarkson Ave., Brooklyn, N.Y. 11203)

13–15. 32nd North American **Wildlife and Natural Resources** Conf., San Francisco, Calif. (Wildlife Management Inst., 709 Wire Building, Washington, D.C. 20005)

13–17. International **Laboratory Apparatus** and Materials Exhibition, London, England. (U.T.P. Exhibitions Ltd., 3 Racquet Court, Fleet St., London E.C.4)

13–17. Use of **Plutonium as a Reactor Fuel**, intern. symp., Brussels, Belgium. (J. H. Kane, Div. of Technical Information, U.S. Atomic Energy Commission, Washington, D.C. 20545)

14–15. American **Astronautical** Soc. 5th Goddard Memorial Symp., "The Voyage to the Planets," Washington, D.C. (M. B. Lees, General Electric Co., Defense Programs Div., 777 14th St., NW, Washington, D.C. 20005)

14–15. **Space**, natl. mtg., Los Angeles, Calif. (D. P. Chandler, 3370 Miraloma Ave., Anaheim, Calif. 82803)

14–15. **Temperature Measurements** Soc., 5th conf., Los Angeles, Calif. (R. A. Finch, Conf. and Exhibit Chairman, Atomics International, P.O. Box 309, Canoga Park, Calif. 91304)

15–17. **Instrumentation for the Iron and Steel Industry**, Natl. Instrument Soc. of America, 17th conf., Pittsburgh, Pa. (F. J. Barchfeld, Jones & Laughlin Steel Corp., 900 Agnew Rd., Pittsburgh 15230)

15–17. New Jersey **Mosquito Extermination** Assoc., 54th annual mtg., Atlantic City, N.J. (D. M. Jobbins, Dept. of Entomology and Econ. Zoology, Rutgers—State Univ., New Brunswick, N.J.)

16–17. **Hypervelocity Techniques**, 5th symp., Denver, Colo. (A. A. Ezra, Research Inst., Univ. of Denver, Denver 80201)

16–18. **Geological** Soc. of America, Northeastern Sect., 2nd annual, Boston, Mass. (M. Prinz, Tufts Univ., Medford, Mass.)

16–18. **Texas Acad. of Science**, College Station, Tex. (W. E. Norris, Jr., Biology Dept., Southwest Tex. State Coll., San Marcos, Tex. 78666)

16–19. International Assoc. for **Dental Research**, 45th general mtg., Washington, D.C. (G. H. Rovelstadt, c/o Navy Dental School, Natl. Naval Medical Center, Bethesda, Md. 20014)

17–19. Fourth Intern. **Vacuum** Congress, Univ. of Manchester Inst. of Science and Technology, Manchester, England. (The Secretary, Joint British Committee for Vacuum Science and Technology, 47 Belgrave Sq., London, S.W.1, England)

17–21. National **Science Teachers** Assoc., conv., Detroit, Mich. (Executive Secretary, NSTA, 1201 16th St., NW, Washington, D.C. 20036)