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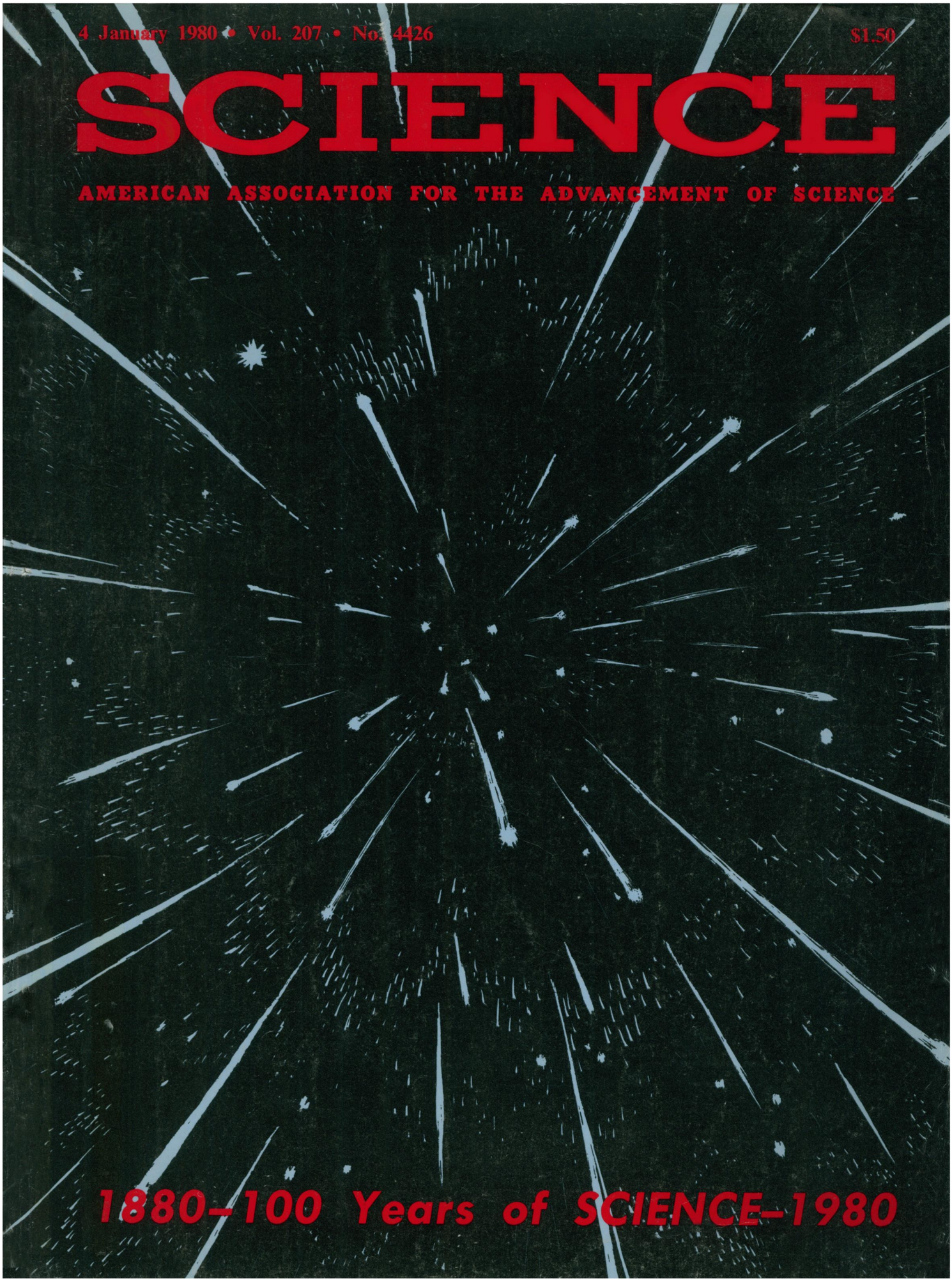

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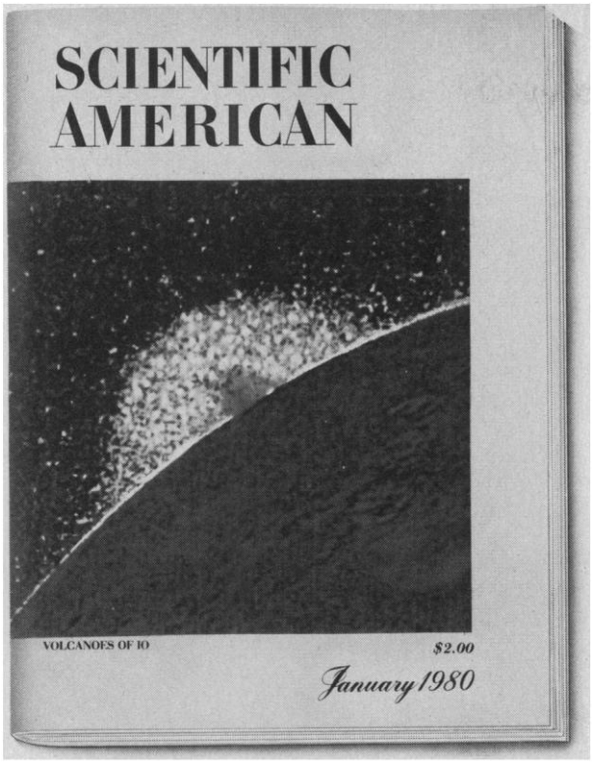

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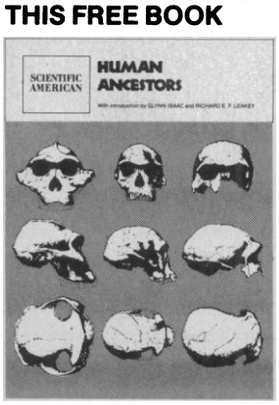

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ISSN 0036-8075

4 January 1980

Volume 207, No. 4426

SCIENCE

SCIENCE is published weekly on Friday, except the last week in December, by the American Association for the Advancement of Science, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. Second-class postage (publication No. 484460) paid at Washington, D.C., and at an additional entry. Now combined with **The Scientific Monthly®**. Domestic individual membership and subscription (51 issues): $34. Domestic institutional subscription (51 issues): $70. Foreign postage extra: Canada $12, other (surface mail) $15, air-surface via Amsterdam $40. First class, airmail, school-year, and student rates on request. Single copies $1.50 ($2 by mail); back issues $2.50 ($3 by mail); classroom rates on request. **Change of address:** allow 6 weeks, giving old and new addresses and seven-digit account number. **Postmaster:** Send Form 3579 to *Science*, 1515 Massachusetts Avenue, NW, Washington, D.C. 20005. *Science* is indexed in the *Reader's Guide to Periodical Literature* and in several specialized indexes.

COVER

The year 1980 marks the centennial for *Science*. *Science* had three birthdays before it achieved a record of continuous weekly publication. The first birthday was Saturday, 3 July 1880. Thomas A. Edison was owner and John Michels was editor. Publication ceased early in 1882. The second birthday was Friday, 9 February 1883. Alexander Graham Bell and Gardiner G. Hubbard organized an editorial company with Samuel H. Scudder as editor, and later N. D. C. Hodges. Publication ended in March 1894. The third birthday was 4 January 1895. James McKeen Cattell was editor and publisher. See pages 54A–54P. [Design, Richard Pellicci, New York]

LETTERS

Innovation

During hearings held jointly by four congressional committees on 31 October 1979, the Administration revealed the long-awaited report of its Domestic Policy Review on Innovation (News and Comment, 16 Nov. 1979, p. 800). This review has been of central interest to industry, and many key research leaders participated in its formulation. Numerous workshops on the topic have been conducted (with participants from government, industry, and academia) resulting in the primary recommendation that the government take immediate and effective steps to enhance innovation. To do so means to establish a national policy and to support it with sufficient financial resources to make a significant impact on a broad base of innovation in industry.

Financially, the Administration's recommendation would provide virtually no wherewithal to carry out a policy, even if such a cohesive plan had been developed. The addition of $20 million per year to the budget of the National Science Foundation (NSF) is a proper augmentation of NSF's traditional role of creating manpower and basic research. Beyond that, the recommendations give no major support to "centers for cooperative research and development," as were developed in Japan and many European countries during the 1950's under the financial aid and political pressure of the Marshall Plan. The contention here is that the nonexistence of such centers is a major reason for the relative decline in innovation in the United States.

This lack of innovation is centered in the spectrum of industries that manufacture consumer products (*1*). The weakness in this sector is best indicated by our trade balance in machinery and machine products, which represent 75 percent of our trade in manufactures. In 1978, the 20 most negative trade categories for machines amounted to a total loss of $34 billion—effectively equal to our loss in oil. If one ignores the trade in cars, trucks, and aircraft, then machines account for 60 percent of our manufactures trade. This trade is protected by not more than 6 percent of our nation's research and development (R & D) for manufactures (both federal and industrial). The conclusion is that not more than 5 percent of our nation's scientific manpower is being used in mechanical manufacturing. Except for isolated cases, this manpower is either too poorly trained

(the weakness is in academia) or too overworked to integrate new technological innovations, such as those available from the space program or from major centers in other countries.

Another unique feature of this 60 percent of our manufactures trade is that not more than 0.7 percent of the federal R & D expenditure for manufactures is being spent on new mechanical technology. The conclusion is that not more than 0.7 percent of our research effort is now being expended to produce new manpower in the manufacturing sector. Hence, while other countries are vigorously pursuing new and more efficient manufacturing technologies, our industrial base is not being refreshed by a sizable infusion of manufacturing technologists.

One portion of the manufacturing spectrum that is being considered here is light machinery (*2*) and the products of those systems. (The intelligent robot would be the highest level of this technology.) In 1978, we lost $11 billion in our trade in this area. The conclusions are

1) We are exporting our base for clean industry to other countries.

2) We are exporting jobs associated with these industries.

3) The pressure on our technological institutions to produce new manpower capable of creating competitive technology is substantially reduced.

4) We are losing a significant tax base (not less than $0.5 billion) and the associated multiplying effect of an important economic sector.

Other trade categories (for example, cars and trucks) are experiencing similar and growing intrusions into our home markets.

Part of the solution to the innovation deficit in the United States is the demonstrated effectiveness of cooperative research and technology centers such as the Production and Engineering Research Association in northern England, which serves 2000 companies with a staff of 350 and an annual budget of $15 million. Such a center represents a focus for fragmented industries that need help implementing new evolving technologies. Furthermore, when associated with a university, a center can enhance existing manpower in industry by means of specialized training programs or generate new manpower through sponsored research.

It may be argued that government should not participate in establishing such centers to help industry. In fact, it already supports 20 federally funded

4 January 1980, Volume 207, Number 4426 **SCIENCE**

Science Centennial

When the first issue of *Science* was printed, the United States had few universities worthy of the name. Of 330 so-called colleges and universities, 218 had fewer than 100 students, 88 had 100 to 200, 12 had 200 to 300, 6 had 300 to 500, and 6 had more than 500.* Graduate education was almost nonexistent. Those seeking advanced degrees studied in Europe. Faculties were small: most schools had fewer than ten professors. Only a small amount of research was conducted, and the *American Journal of Science* was the principal local vehicle for its publication.

The American Association for the Advancement of Science, then in its 32nd year, had a total membership of 1550, of whom probably no more than half were actually scientists. The Association served as an umbrella organization for the various disciplines. A few specialized groups, such as the American Chemical Society, were also beginning an independent existence.

But there were stirrings and ferment in the land. The United States had become relatively prosperous. Its people were energetic, and there were those who were determined to improve the national status in scientific matters. Nevertheless, the launching of a weekly magazine on 3 July 1880 was a courageous—even foolhardy—act. The principal financial backer was the controversial Thomas A. Edison. The editor was John Michels. The magazine was intended to be patterned after *Nature*.

Edison was a successful inventor whose flamboyance was offensive to some scientists. The magazine was not a financial success; Edison withdrew his support after about a year, and publication ceased soon thereafter. Rights to the magazine were purchased by Alexander Graham Bell and his father-in-law, Gardiner G. Hubbard. Publication was resumed on 9 February 1883 with Samuel H. Scudder as editor. The two sponsors were generous; the quality and content of the magazine were much improved, and many leading scientists contributed items to it. However, financial success was still elusive. During about a decade, a loss of $80,000 was sustained. Publication was suspended after the issue of 23 March 1894.

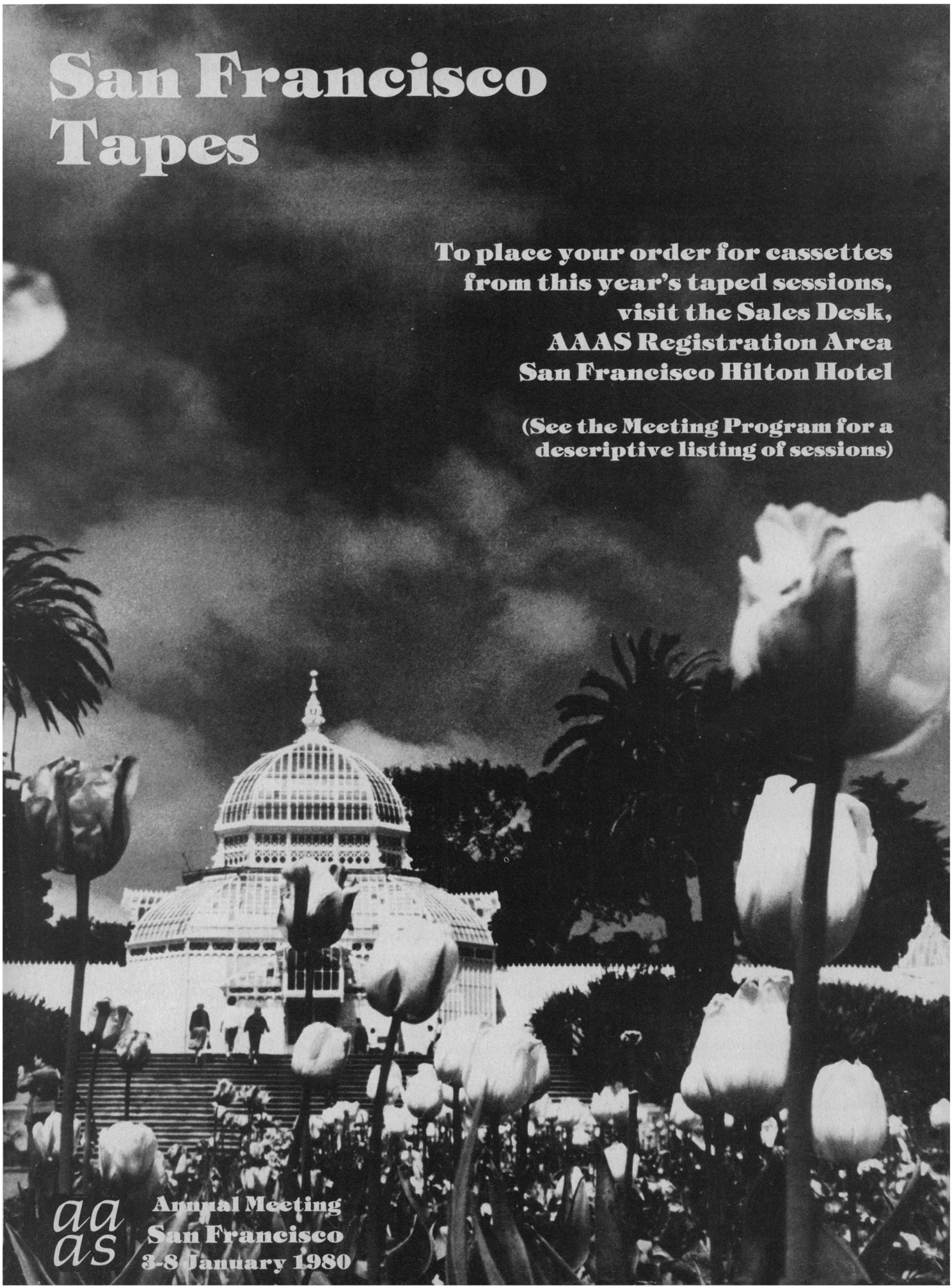
But better days lay ahead. Rights to the magazine were obtained by James McKeen Cattell, who was head of the psychology department at Columbia University. He created an editorial board that represented the various disciplines and included 18 leading scientists of the time, such as Simon Newcomb, mathematics; E. C. Pickering, astronomy; O. C. Marsh, paleontology; Henry F. Osborne, biology; and John Wesley Powell, anthropology.

Cattell, ably assisted by his wife, Josephine Owen Cattell, established a low-cost editorial office at their home north of New York. Publication of *Science* was resumed on 4 January 1895. In 1900 Cattell succeeded in obtaining the cooperation of the American Association for the Advancement of Science, which made *Science* its official journal.

The Cattells remained as owners and editors of the magazine until James Cattell's death in 1944. Ownership then passed to AAAS. Turbulent years followed until Dael Wolfle became chief executive of AAAS in 1954. Under his judicious guidance, sound editorial and financial policies were established, and *Science* prospered.

Examination of the material appearing in *Science* during the hundred years of its existence reveals a rich heritage. From time to time during 1980 we will reprint excerpts from this material. However, we are reluctant to engage in an excess of ancestor worship. Instead, it is our intention to honor the past contributors by examining the present and looking to the future, just as they did. Our principal observance of the centennial will occur on the hundredth anniversary of *Science* in the form of a special issue. This will contain about 25 articles, of which 5 will portray aspects of the history of the magazine. The major content will be devoted to surveys of the status and future of the sciences, applied sciences, and interactions of science and technology with societal problems.—PHILIP H. ABELSON

*H. A. Rowland, *Science* **2**, 242 (1883).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and by the modest 16 pages (out of a total of 407 pages of text) devoted to vertebrate brain in the final chapter on the "function of the blood-brain barrier." This is in no way a criticism of Bradbury, for his book is a balanced and clearly written account of the existing literature. It is, however, a reflection of the complexity of the system his book describes, of the conceptual and experimental approaches that have been adopted in the past, and, also, of the many problems that remain to be elucidated.

J. E. TREHERNE

Department of Zoology, University of Cambridge, Cambridge CB2 3EJ, England

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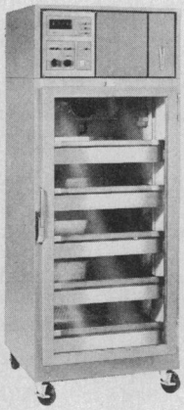

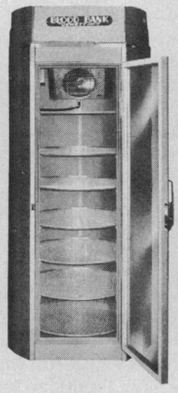

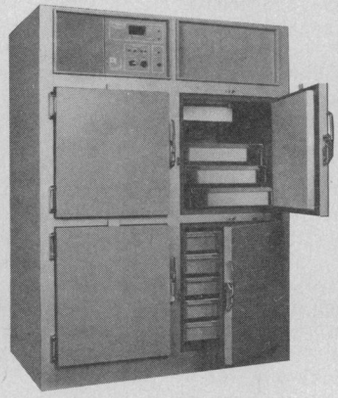

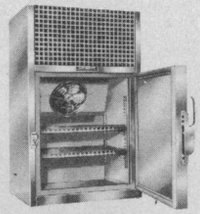

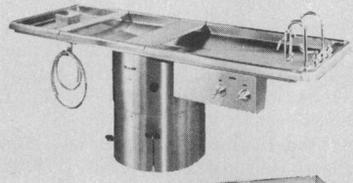

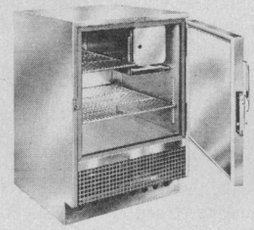

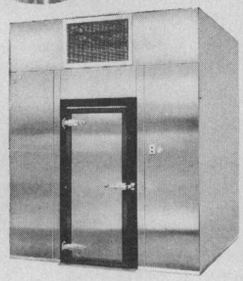

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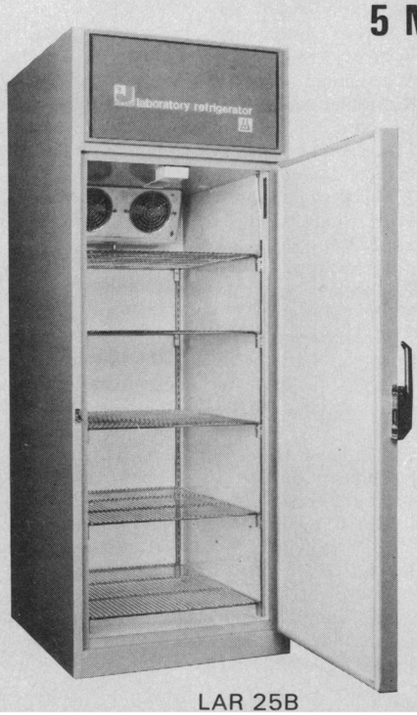

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- tangerine or blue exterior front with beige cabinet*
- white enamel interior
- adjustable and interchangeable stainless steel drawers and shelves
- illuminated interior
- uniform cabinet temperature (2° to 4° C)
- quick temperature recovery
- dual or single air circulation system

PHR 37B

All refrigerator models available with glass doors and for pass-thru operation.

*Also available with stainless steel interior and exterior finishes.

Freezers in similar sizes also available.

The Best of Both Worlds . . .

Individual Craftsmanship combined with Modern Technology

JEWETT
REFRIGERATOR
2 LETCHWORTH ST.
BUFFALO, N.Y. 14213