SCIENCE

29 March 1974

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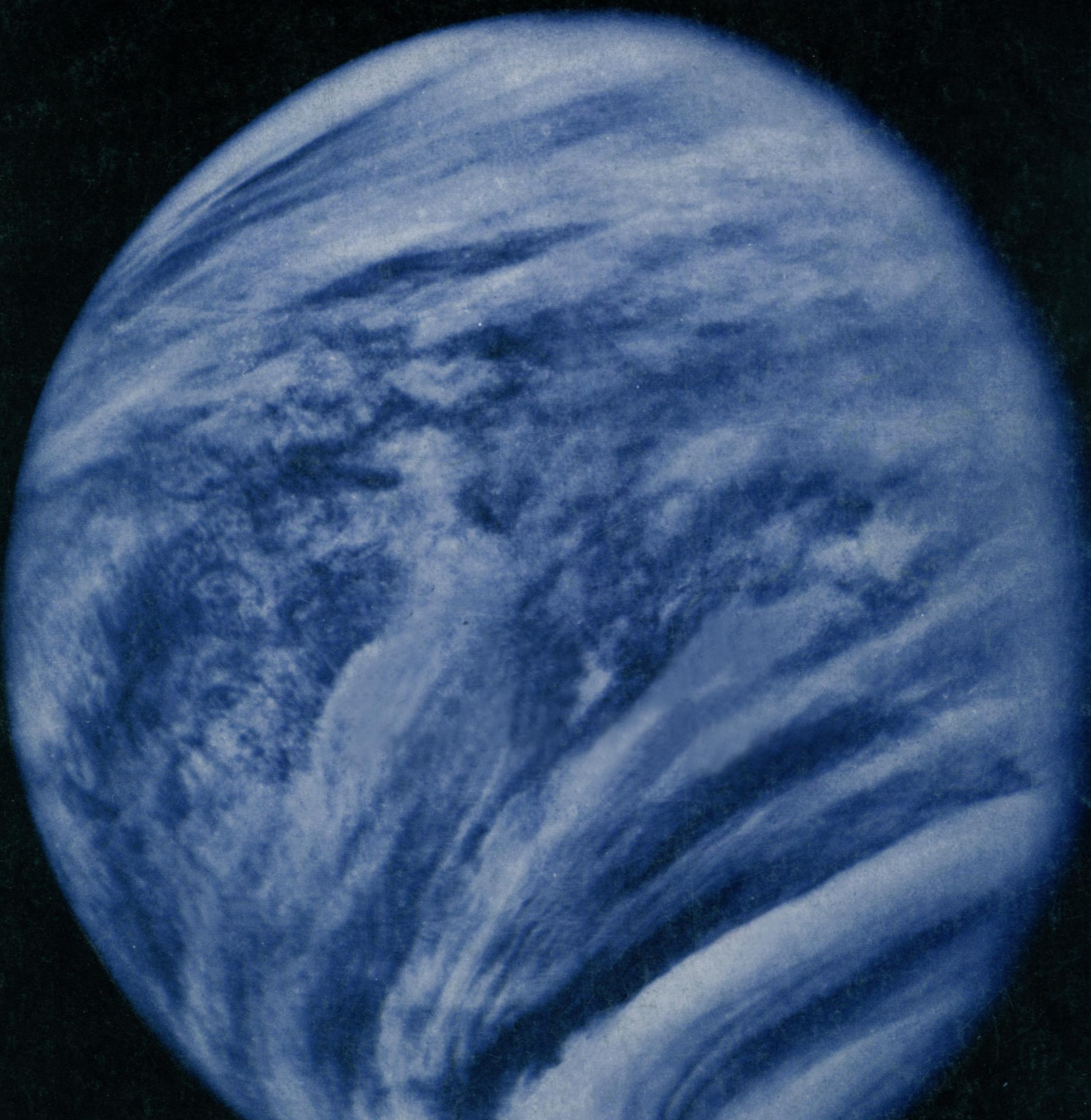

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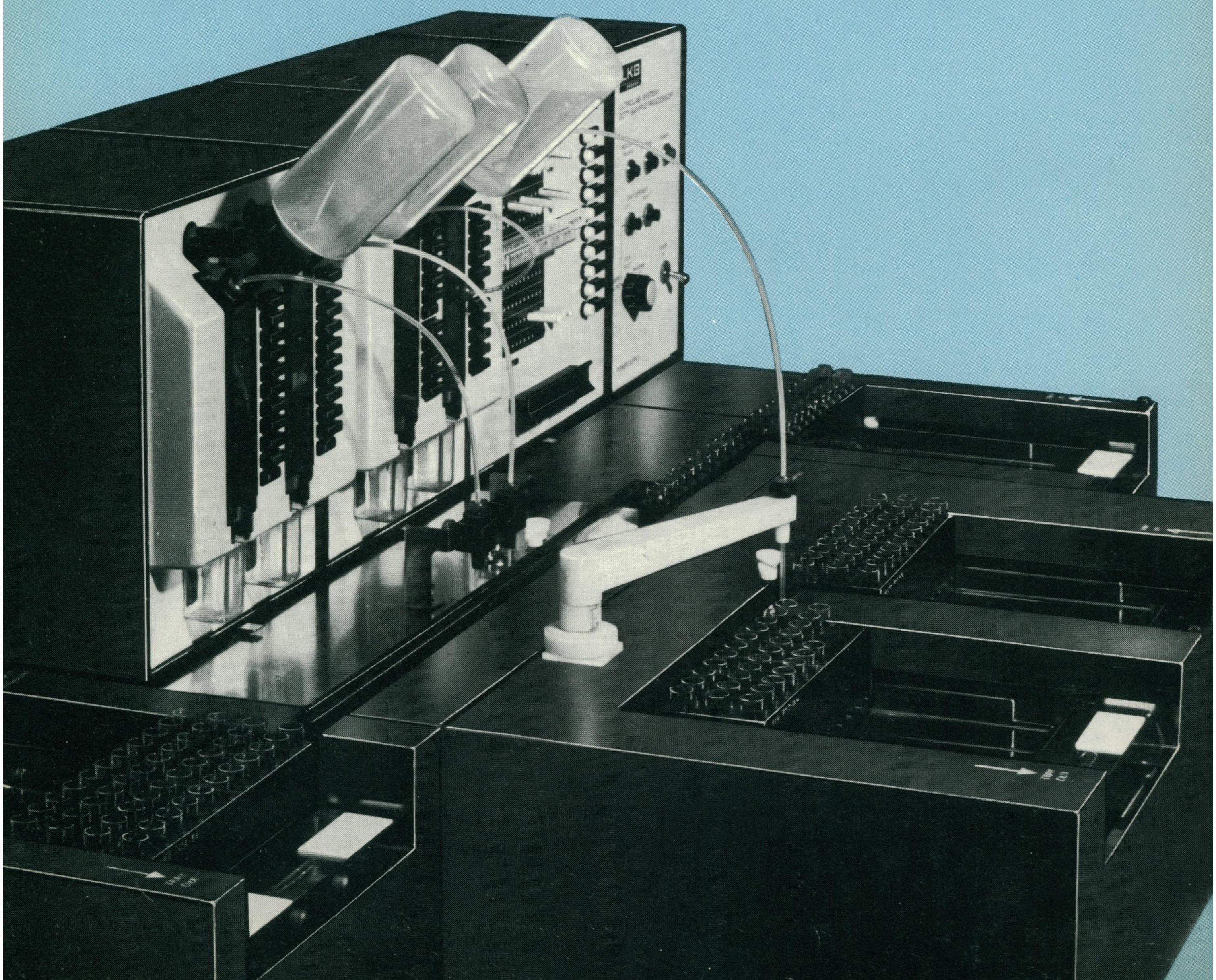

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Volume 183, No. 4131

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COVER

A view of Venus from 720,000 kilometers taken by the television cameras on Mariner 10 one day after encounter. Individual frames were computer-enhanced by the Image Processing Laboratory, Jet Propulsion Laboratory, then mosaicked and retouched at the Division of Astrogeology, U.S. Geological Survey in Flagstaff. The frames were taken in invisible ultraviolet light and are printed here in shades of blue. See page 1307.

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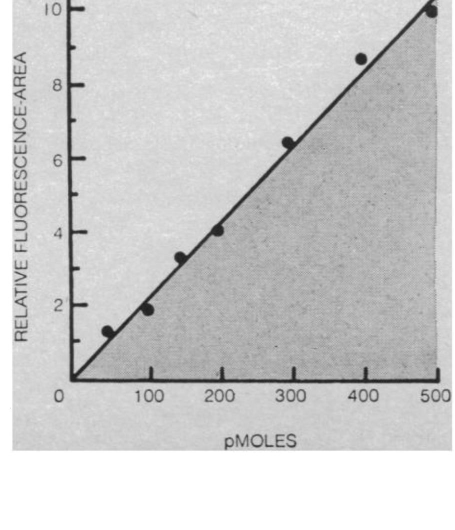

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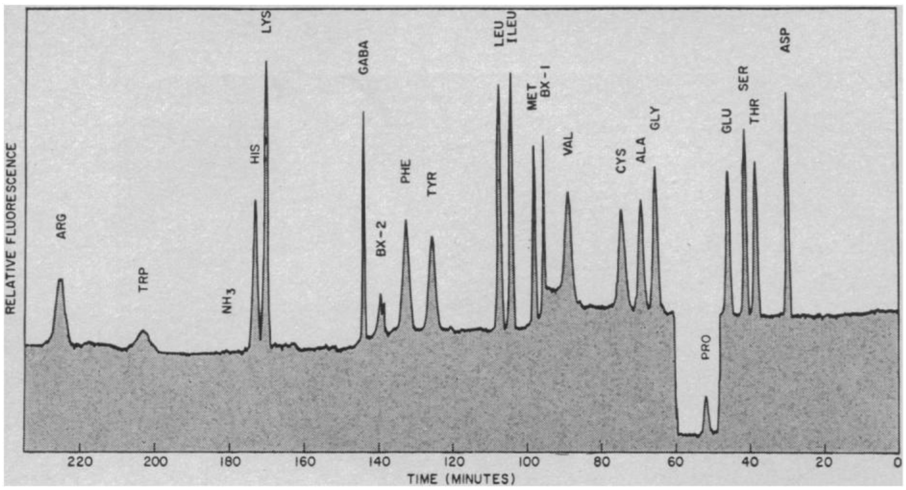

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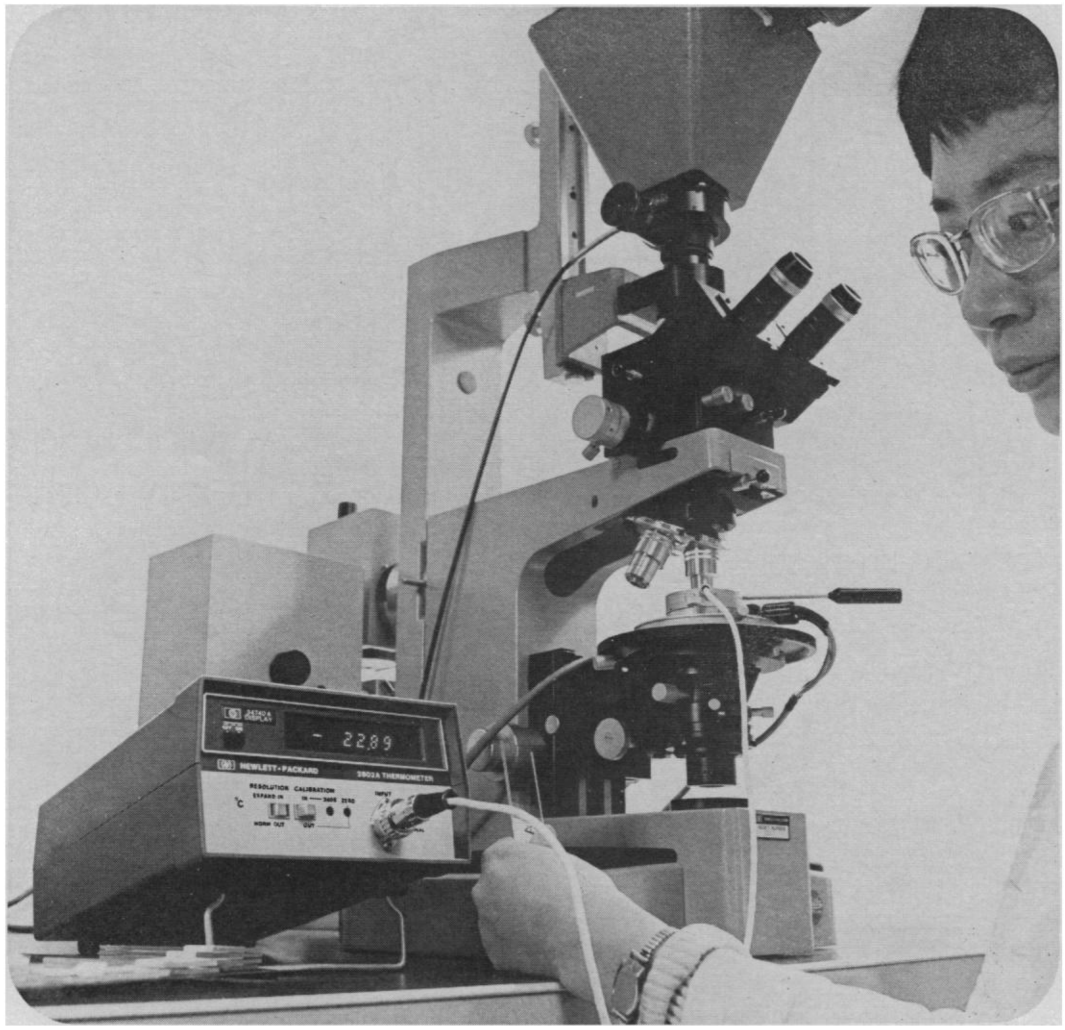

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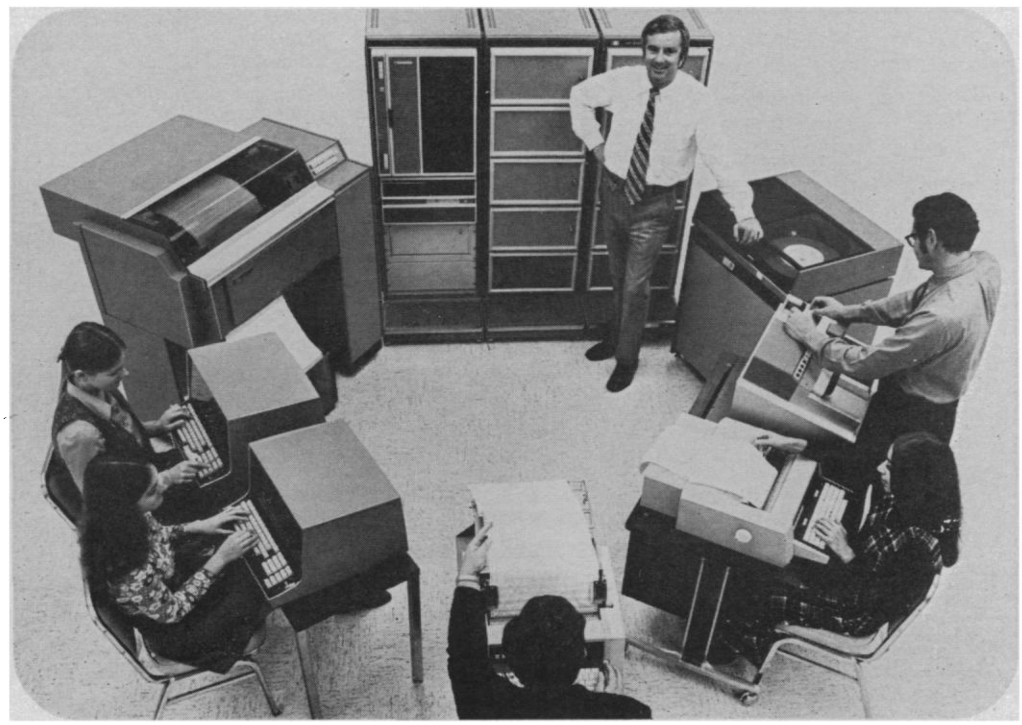

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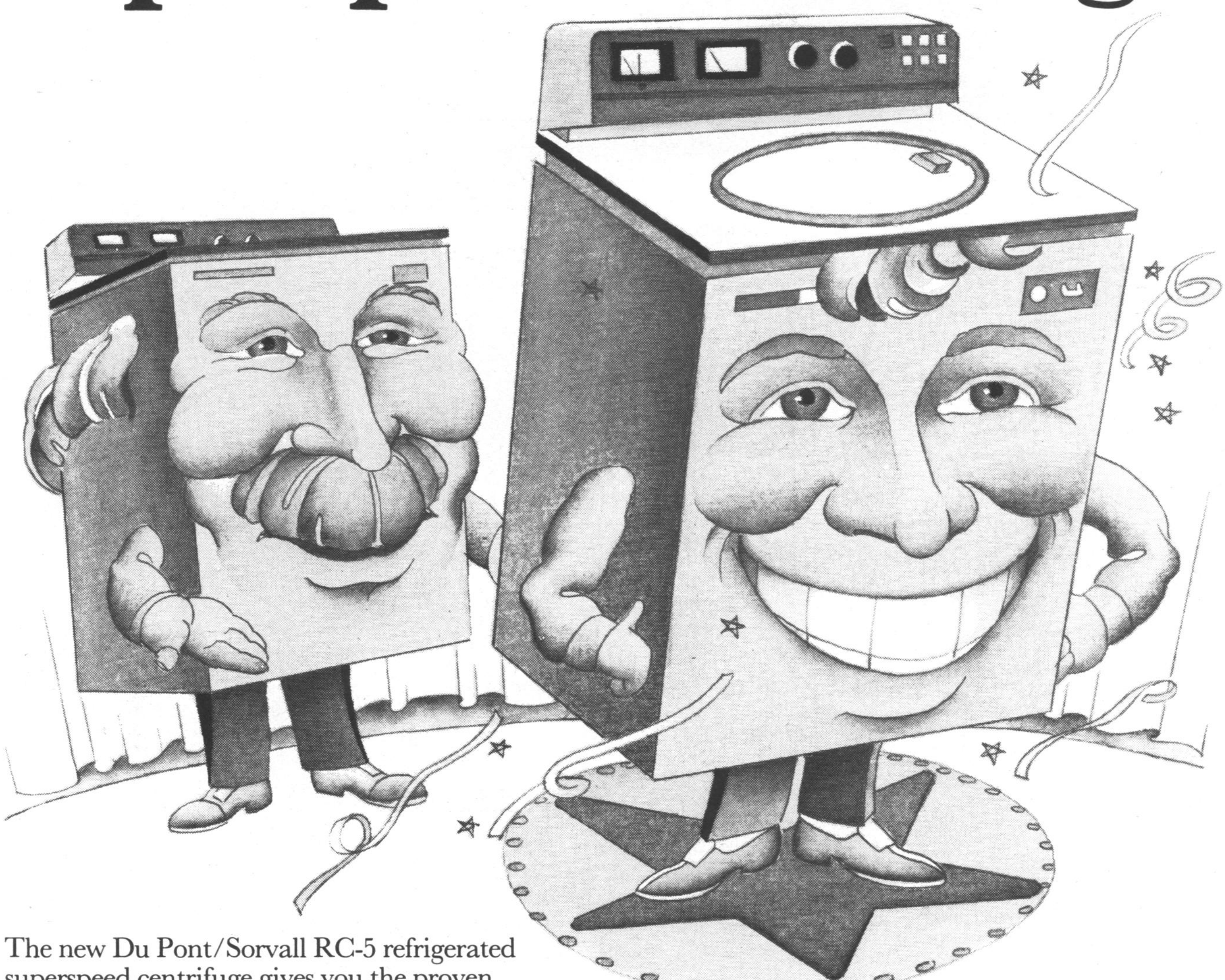

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dividuals have had similar experiences with the same journal. This practice raises serious questions concerning publishing ethics. Over and above the injustice to particular authors is the problem of journal credibility in general. Historians of science in particular must find this practice unsettling, since it raises questions as to which misinterpretations or mistaken nuances in an article are those of the author in question and which are those of an anonymous editorial assistant.

It is difficult for individuals to monitor such problems of publishing ethics or to alert the scientific community to this or similar problems of which it may be unaware. It would appear there is a real need for some scientific organization to establish a mechanism for the investigation of problems in the ethics of scientific communication.

ERNEST B. HOOK
Birth Defects Institute, New York State Department of Health, Albany 12208, and *Department of Pediatrics, Albany Medical College of Union University, Albany*

Rabies Shots

In his Research News report of 28 December 1973 (p. 1329), Thomas H. Maugh II writes that "individuals who have been exposed to rabies or whose jobs or hobbies open them to exposure (veterinarians and spelunkers, for example) normally require a series of 14 to 21 daily injections of rabies vaccine to produce immunity. . . ."

It is true that authorities urge "high-risk" individuals, such as animal handlers, to get preexposure rabies vaccinations. However, this initial series of injections involves only two to four shots spread out over 2 weeks to 6 months. Anyone who has had preexposure vaccinations and who possesses sufficient antibodies need only receive one to six injections if subsequently bitten by a known rabid animal. It is neither recommended nor necessary for anyone except unvaccinated persons who have been significantly exposed to rabies to have "14 to 21 daily injections."

The advisability of preexposure rabies vaccination has not been widely accepted by scientists and by others who work with animal species that could potentially expose them to rabies. Part of this reluctance is because of the misconception that the initial series involves 14 to 21 daily injections.

As Maugh states, the new Wistar vaccine will probably reduce the vaccine side effects and may someday allow even further reduction in the number of injections necessary both before and after exposure to rabies.

BRUCE MAX FELDMANN
University of California (Berkeley) Pet Clinic, Berkeley 94710

Definition of the Meter

It may be useful to follow up on my letter (29 June 1973, p. 1321) on the speed of light and its implications, or lack thereof, for the study of the solar system. The following passage is excerpted from a resolution adopted by the International Astronomical Union (IAU) at its General Assembly in 1973 (*1*).

> The International Astronomical Union . . . recommends that when the most precise value of the speed of propagation of electromagnetic radiation in vacuum is required, the value proposed by the Consultative Committee for the Definition of the Meter . . . , namely $c = 299\ 792\ 458$ meters per second, should be employed, . . . and that the International Committee of Weights and Measures *maintain this value in any redefinition of the meter* [italics mine].

The last phrase carries the clear implication that the meter is to be redefined as a specified number of light-seconds, thereby reducing it to a secondary unit. There has been some confusion over the motivation, even the propriety, of doing this. The lone negative vote cast among the IAU members present was due to concern over the "legislation of constants of nature."

Of course, there is nothing of the constant of nature about the meter or any measure related to it. It was originally defined, after all, as an arbitrary fraction of the circumference of a small planet whose primary astronomical importance consisted of its being the habitation of all known astronomers. Nothing could be more ad hoc. The present conventional definition is based on a transition wavelength of krypton, which may be more accessible, but is hardly an improvement in principle. At the time of its adoption, this definition seemed safe enough, but its freedom from ambiguity was only assumed. It apparently did not seem important that both the meter and the speed of light were measurable in principle, or that such measurements might be incompatible with the defined second.

Now, because of advances in laser technology and measurement technique, a new definition of the meter is required. It would be preferable to eliminate the problem by rethinking the fundamental concepts rather than simply adopting a new convention after the manner of the old concept.

The speed of light has recently been measured in at least three independent experiments in which different techniques were used. The internal consistency between these determinations is more than an order of magnitude better than the precision with which the conventional meter can be determined. The latter has nothing to do with measurement technique, but rather relates to an ambiguity in the actual krypton line. While it is possible to redefine the meter more sharply, this would only leave the same problem for a future time. The adoption of a conventional speed of light in vacuum, in combination with a defined second, implies a meter not subject to change in principle. It has the happy effect of throwing all of the uncertainty into one's knowledge of the actual length in meters of any physical distance, such as an electromagnetic wavelength, the length of a bar of platinum, or the distance to the moon. The uncertainty is purely one of measurement, not of definitions, and is thus much more satisfactory to an orderly mind.

The value for c recommended by the IAU is, of course, that which is most compatible with the current definition of the meter, so no discontinuity would be introduced by its adoption.

Some persons have interpreted my earlier letter as a call for the use of the light-second as the sole unit of distance. That was not my intent. While this unit should be regarded as the most fundamental one, as a result of the techniques now used for all high-precision measurement, it is inconvenient in some contexts. Secondary distance measures, such as the astronomical unit, the meter, and the angstrom, still have an important place in science.

J. DERRAL MULHOLLAND
Groupe de Recherches de Géodésie Spatiale, Observatoire de Meudon, Meudon 92190, France

References

1. *I.A.U. Trans.*, in press.

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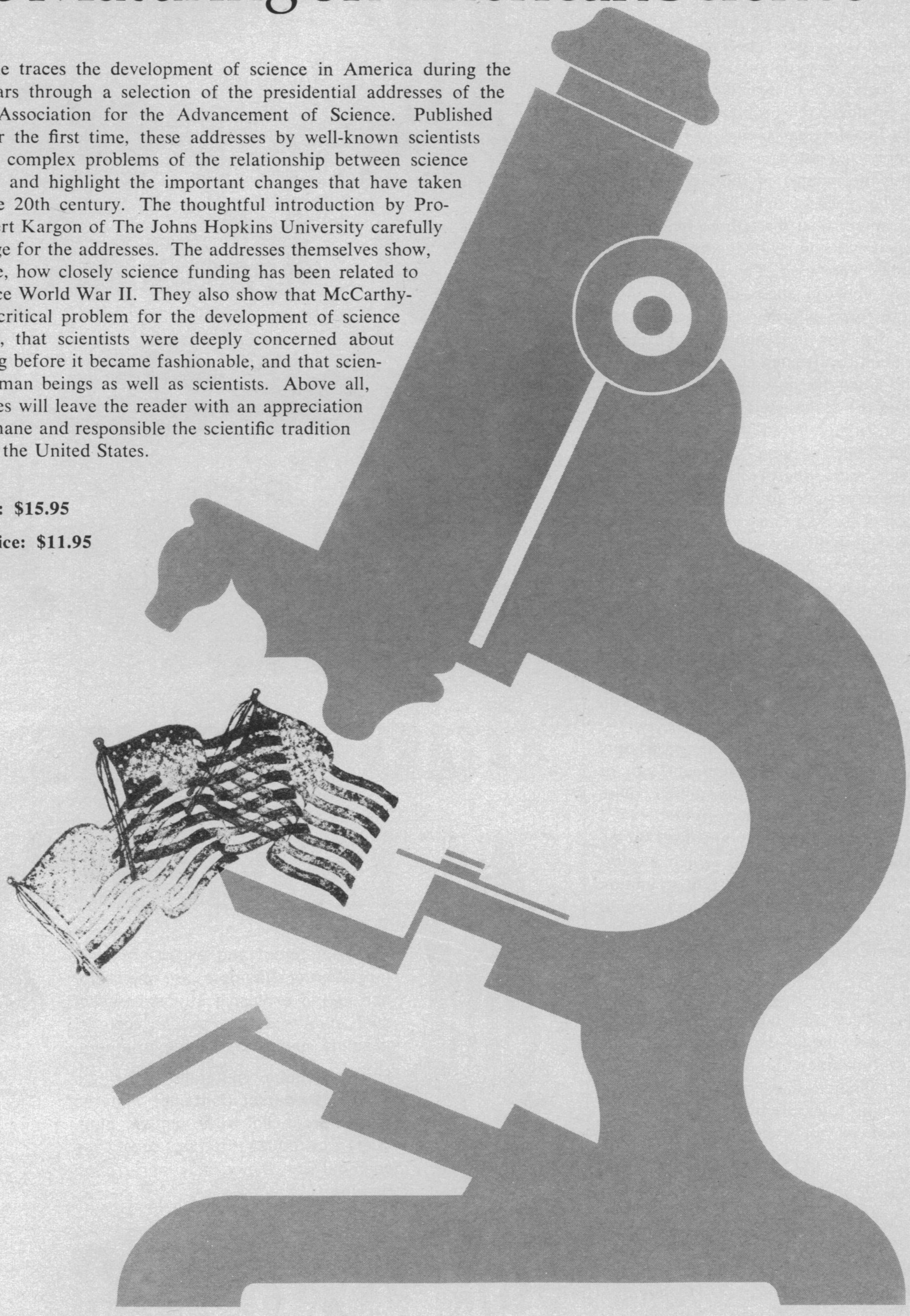

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Academic Science and Industry

The United States has entered an era in which its economy is strongly affected by the rest of the world. Increasing populations and affluence have led to many shortages and, in turn, to comparatively rapid, worldwide inflation. During the past year, prices of many important commodities have doubled. The profound effects of increases in worldwide prices of energy have not yet been fully manifested. Consequences for the United States may include a drop in standards of living, with those dependent on salaries or pensions particularly hard hit. In meeting these circumstances, the performance of the Administration and the Congress has not been impressive. There appears to be little foresight at a moment that cries for vision. But with today's comparative exclusion of scientists and engineers from government decision-making, we cannot expect judgment or imagination in technological matters.

The situation requires more than having a spokesman in government. It requires building a broad base of understanding of the need for long-term remedies, as against short-term nostrums. The academic community, which is the source of crucial talent and many ideas, has little influence now, nor is it likely to obtain decisive weight alone. If the academic community is to be effective, it must act in combination with others. An interesting possibility is high technology industry. Companies engaged in such activities are already heavily dependent on scientists and engineers, and many of these have achieved influential positions in their organizations. These leaders understand the potentialities of science and technology. They also understand the necessity for long-range planning and commitments to reaching goals.

At one time, industry was a prime supporter and defender of academic institutions. During the last two decades, however, while universities fell into dependence on government, industry and universities have been estranged. But academia now understands that it cannot count on government for sustained rational behavior. At the same time, industry needs a healthy university system. Already there are shortages of some kinds of engineers, and shortages of physical scientists are likely soon. Thus the climate is more favorable for a closer working arrangement.

Accordingly, a meeting held in New York on 8 March may have special significance. It was a dinner hosted by Frank Cary, chairman of the board of International Business Machines Corp. Among those attending were the presidents or chairmen of the boards of many of America's largest high technology companies, 13 Nobel laureates (mainly in physics), and some leaders in academic life. The immediate purpose was to honor the three physics Nobel laureates for 1973, but Cary emphasized that a prime reason was to initiate a dialogue between academic science and industry.

The principal talk was given by Patrick E. Haggerty, chairman of the board of Texas Instruments Inc. He began by acknowledging the debt that his and other companies owed to fundamental advances in solid-state physics. He further stated that "Only through a vastly improved knowledge of ourselves, our environment, and our universe are we likely to be able to attain and sustain an improved quality of life." A substantial part of Haggerty's talk was devoted to a call for a new science and technology advisory apparatus in the Executive Office of the President.

One short speech and one splendid dinner, although agreeable, are, by themselves, quickly forgotten. However, if anything is clear, it is that we cannot depend solely on the wisdom of politicians in the solution of long-range problems. We must find better ways. A closer cooperation of academic scientists and dynamic elements of industry could lead to effective actions.—PHILIP H. ABELSON

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