# Letters

## Brookhaven Accelerator Time

John Walsh (News and Comment, 6 Sept., p. 841) attributes to a senior visitor at the FNAL (Fermi National Accelerator Laboratory) a remark that is totally without foundation. We refer to the statement that the attitude at Brookhaven used to be, "Let the amateurs in during the summer, we'll do the real research the rest of the year." This was a comment about the presumed "competition between staff and visitors for time on the machine." The statistics (which include both Alternating Gradient Synchrotron and Cosmotron time) show that the vast majority of accelerator time at Brookhaven has been assigned to visitors for many years.

| Fiscal year | Machine time (%) | |
|---|---|---|
| | Staff | Visitors |
| 1963–1968 | $33 \pm 5$ | $67 \pm 5$ |
| 1969 | $10 \pm 2$ | $90 \pm 2$ |
| 1970 | $10 \pm 3$ | $90 \pm 3$ |
| 1971 | $13 \pm 2$ | $87 \pm 2$ |
| 1972 | $10 \pm 2$ | $90 \pm 2$ |
| 1973 | $18 \pm 2$ | $82 \pm 2$ |
| 1974 | $8 \pm 2$ | $92 \pm 2$ |

In fact, Brookhaven has led the way in providing centralized facilities for university research groups. Doing so has always been a primary (and publicly accepted) objective of the laboratory's program. While resources have never been such as to provide for every need of every user, this mode of operation has been so successful as to be universally adopted by other major high energy physics laboratories.

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## Hydrogen Storage in Metal Hydrides

The use of metal hydrides for hydrogen storage, discussed in a letter by Brattain and Gunsul (25 Oct., p. 302), has been the subject of a great deal of research in our laboratory and elsewhere (*1*). Such storage does indeed have advantages over the use of compressed gas or liquid hydrogen, both technically and economically.

Research has been under way at Brookhaven National Laboratory since 1965 on metal-hydrogen reactions, with the aim of developing improved storage media. Certain alloy-hydrogen systems have been discovered that appear quite promising, especially for stationary storage. An example is $FeTi\text{-}H_2$, which is under development as a component of a load-leveling system for electric utilities; it would store hydrogen produced electrolytically from off-peak power and later feed it to batteries of fuel cells to supply the peak load. Other, lighter metal-hydrogen systems are under development for automotive applications.

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### References

1. J. J. Reilly and R. H. Wiswall, Jr., *Inorg. Chem.* **6**, 2220 (1967); *ibid.* **7**, 2254 (1968); *ibid.* **9**, 1678 (1970); *ibid.* **13**, 218 (1974); in *Proceedings of the 7th Intersociety Energy Conversion Conference* (American Chemical Society, Washington, D.C., 1972); J. J. Reilly, K. C. Hoffman, G. Strickland, R. H. Wiswall, Jr., in *Proceedings of the 26th Power Sources Symposium* (PSC Publications Committee, Redbank, N.J., in press); F. J. Salzano, E. A. Cherniavsky, R. J. Isler, K. C. Hoffman, in *Proceedings of the Hydrogen Economy Miami Energy Conference* (Univ. of Miami Press, Coral Gables, Fla., 1974) (there are many other papers relating to hydrides in these proceedings); H. H. Van Mal, K. H. J. Buschow, A. R. Miedema, *J. Less Common Metals* **35**, 65 (1974).

Brattain and Gunsul comment on the capacity of rare earth intermetallics to absorb hydrogen and suggest that these materials might be the key to the storage problem involved in the use of hydrogen as a nonpolluting fuel for automobiles. The absorptive power of rare earth transition metal systems is indeed enormous—the per unit volume of hydrogen that can be retained by $LaNi_5$ (*1*) or $ErCo_3$ (*2*) at modest pressures (greater than 10 atmospheres) is roughly twice that of liquid hydrogen. The absorptive power of the elemental rare earths is even greater; Ho, for example, has a capacity to absorb hydrogen that is roughly 50 percent greater than that of $LaNi_5$ (*3*). However, these elements are devoid of interest for hydrogen storage because hydrogen release and uptake is a very slow process except at temperatures above 400°C. The truly remarkable feature of the rare earth intermetallics lies not in their capacity to absorb hydrogen but rather in the speed with which they take up or release hydrogen at temperatures below 100°C.

Despite the possible advantages of using rare earth intermetallics for hydrogen storage, the disadvantages are so formidable as to be virtually insurmountable. For example, to obtain the energy equivalent of 20 gallons of gasoline from hydrogen stored in an intermetallic, one needs 1 to 1.5 tons of $LaNi_5$ or $ErCo_3$. If obtainable at all, these materials at present would cost more than \$40 per pound, or \$80,000 for a single automobile. Hence the obstacles of weight and cost stand in the way of using rare earth intermetallics as hydrogen storage media in mobile vehicles. Metal hydrides, to be attractive for normal vehicular use, must be at least an order of magnitude lighter and an order of magnitude cheaper than the rare earth systems presently under consideration.

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### References

1. J. H. N. Van Vucht, F. A. Kuijpers, H. C. A. M. Bruning, *Philips Res. Rep.* **25**, 133 (1970).
2. T. Takeshita, W. E. Wallace, R. S. Craig, *Inorg. Chem.* **13**, 2283 (1974).
3. A. Pebler and W. E. Wallace, *J. Phys. Chem.* **66**, 148 (1962).

## Uniformity of References

It is a fairly common experience for an author of scientific papers to have his manuscript rejected. The next step, unless the author is completely discouraged, is to revise and resubmit the article, often to some other journal where a more kindly review is at least a possibility. Sometimes, if the author is convinced that his data are valid and his presentation is reasonable, no changes in the manuscript are necessary other than those required to suit the rules and format of the new journal. Usually such required changes are minimal, with one exception—almost always the style of the references must be drastically changed.

This is a plea for uniformity in the manner of presentation of references. Why should *Science*, the *American Journal of Physiology*, the *Proceedings of the Society for Experimental Biology and Medicine*, and so forth, each have a different format for references? If the journals that publish scientific articles would adopt a uniform reference system, the work of the secretaries who retype rejected manuscripts would be greatly reduced. Which uniform system to adopt could best be settled by a conference of journal editors such as one recently held by a group of editors of biochemical journals (*1*). We suggest the following features as desirable: (i) a consecutive series of reference numbers in the text rather than a listing of references alphabetically by author; (ii) inclusion of the full title of each article listed—often the most useful and informative part of the reference list; and (iii) uniformity of abbreviations of journal titles.

Perhaps it is too optimistic to expect such individualists as journal editors to adopt a uniform procedure, but we hope our suggestions will be given serious consideration.

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**References**

1. IUB [International Union of Biochemistry] Commission of Editors of Biochemical Journals, *Biochemistry* **12**, 4301 (1973).

## Hybrid Cell Proposed

Most present attempts to produce cheap protein are concerned with such organisms as algae and yeast, or with improved cereals, such as lysine-rich sorghums. Although these sources could be cheap, their nutritional value cannot be compared with that of animal protein.

As an alternative, I wish to propose the synthesis of a hybrid cell composed of Chlorella (a single-cell algae containing chlorophyll) and such animal cells as bone-marrow cells, liver cells, or others. Such a hybridization could perhaps be accomplished by means of deactivated Sendai viruses, by nuclear transplantation, or by other techniques. If the hybrid cell is viable, it could then be grown in culture. The resultant clones could then be screened for selection of those with the most desirable characteristics—speedy growth, retention of chlorophyll, high nutritional value, genetic stability, and an acceptable taste. Such a hybrid cell would, if realizable, obtain its energy cheaply through photosynthesis and yet have the high nutritional value of an animal cell. We might thus combine the value of meat and vegetable in one cell.

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## Cuban Science

In 1973, a small group from various colleges and universities in the United States visited Cuba at the invitation of the University of Havana. Three of us were scientists. What we saw of Cuban science was both exciting and depressing.

Cuban science is in a highly expansive period (*1*). In 1955, about 30 university degrees in science were granted (*2*). The December 1972 graduating class at the University of Havana included 450 students in the natural sciences, 557 in technology (engineering), 635 in medicine, and 230 in agriculture. This tremendous increase in scientific training is not due to any remuneration: scientists get no special privileges and, in fact, may be paid less than certain skilled workers. Instead, Cubans at all socioeconomic levels have come to realize that the development of science in their country is inextricably linked to their emergence from an underdeveloped economy.

The qualitative aspects of Cuban science are also worth noting. In many fields, including university teaching and medicine, women and blacks have achieved or are approaching proportional representation. In 1972, the Faculty of Science at the University of Havana had 205 male and 185 female professors, and 1493 male and 1496 female students. Serious thought and effort have gone into trying to avoid a total distinction in status between intellectual and manual labor. While putting a certain amount of resources into developing pure science, the Cubans have put most of their effort into linking science and technology to developmental needs.

For all their strides, the Cubans are seriously hampered by two problems, both of which are related to the U.S. blockade of Cuba. First, equipment in many teaching and some research laboratories is old, primitive, or makeshift. Second, and more important, there is a dearth of teaching materials and scientific information. Many of the texts used in biology, for example, were published in the United States before the 1959 revolution. Cubans find it difficult to get copies of U.S. journals and impossible to receive them on a regular basis. They also have difficulty getting some Western European and international scientific journals. Finally, Cubans often find it difficult to get their work published in Western journals. Although individual books and journals may be mailed to Cuba, official U.S. discouragement, travel restrictions, and various impediments on bulk shipments prevent any significant exchange (*3*).

The charters of the United Nations, UNESCO, and the World Health Organization call for the diffusion of developmental and technical information. It is ironic, then, that Cuba, one of the few Third World countries in a position to employ this information, is prevented from obtaining it. Conscientious scientists in the United States, who have traditionally supported freedom of dissemination of scientific information, are in a position to change this state of affairs, perhaps by initiating discussions of the situation with fellow scientists or by writing to the State Department. An end to the blockade of Cuba, which would allow meaningful exchange between the United States and Cuba, should be vigorously supported by us all.

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**References and Notes**

1. M. Roche, *Science* **169**, 344 (1970).
2. Statistics for 1955 were provided by the Faculty of Science, University of Havana.
3. Anyone interested in sending books or journals to Cuba can contact one of us. Although new editions are preferable, older books that are not badly out-of-date would be useful.