1600 species of Pteridophyta and Spermatophyta that are found in the Nasu area, with notes on locality, flowering, and fruit-bearing times, most of which are derived from the careful field notes of the Emperor. As far as I know, the vegetation of few localities in Japan, or anywhere else in the world, has been so closely observed and minutely recorded. The many color plates of plants in their natural surroundings and of sceneries in various seasons are excellent, both scientifically and artistically.

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Space Shuttle Costs

The letter from Ralph E. Lapp on space shuttle costs (3 Mar., p. 392) contains some factual errors and incorrect reasoning which make a difference of an order of magnitude in his estimate of the program cost. Lapp refers to cost data on past manned and unmanned space experiments, but not to the paper which proposes and explains the $100 per pound payload cost estimate for the shuttle (*1*). The latter estimate is based on 7 years' experience at the National Aeronautics and Space Administration (NASA) with airborne systems (*2*) and is modified to take into account the differences between aircraft and the shuttle (the causes of the previous high costs have also been examined to be sure they can be eliminated).

Lapp's argument is based on ". . . the extreme assumption that NASA's payload costs can be slashed to $2000 a pound. . . ." He adds $11 to $16 billion in development and operations costs to the resulting $40 billion for 20 million pounds in orbit. He gives no basis or justification for his "extreme assumption," which is an order of magnitude too high. Further, he reasons that payload construction costs must be brought down to about $100 per pound (a few times "the cost of gold") to justify more economical transportation systems, but he includes the transportation system and *not* the payload construction cost in his estimates of payload cost (he divides $11 billion by 20 million pounds). At $100 per pound, 20 million pounds would cost $2 billion, not $40 billion, over a period of 10 years.

Finally, NASA's claim is not that a payload can be "lifted from earth to orbit" for under $100 per pound, but that construction of a payload for a shuttle sortie mission would cost between $100 and $200 per pound (*1*). This cost makes it "meaningful to seek cheaper space transportation" (according to Lapp's own criterion). Detailed studies are currently being made at NASA to document more precisely the payload costs that can be realistically expected for the space shuttle, in the sortie, and also in other operational modes.

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References

1. M. Bader and N. H. Farlow, *Potential Reductions in Cost and Response Time for Shuttle-borne Space Experiments* (AIAA Paper No. 71-808, American Institute for Aeronautics and Astronautics, New York, 1971).
2. M. Bader and C. B. Wagoner, *Appl. Opt.* **9**, 265 (1970).

Animal Experiments

On 20 January 1971, the Council of Europe adopted Recommendation 621 on the use of live animals for experimental or industrial purposes. The Council of the International Union Against Cancer, at its meeting in Sydney, Australia, on 18 March 1972, unanimously adopted the following resolution in opposition to Recommendation 621.

The Council of the International Union Against Cancer deplores Recommendation 621 (1971) of the Council of Europe because scientists are always searching for the best method of arriving at reliable information without inflicting unnecessary suffering upon animals. The Council of the International Union Against Cancer believes that information provided by animal experimentation is an invaluable resource and loss of this avenue of research would be a very serious setback for the world scientific community. Furthermore, scientific achievement and the quality of training of medical and scientific personnel resulting from a judicious utilization of animals will be jeopardized should Recommendation 621 be implemented.

In consequence, the Council of the International Union Against Cancer urges its member organizations in each country holding membership of the Council of Europe to inform their government of the objectionable consequences of the application of Recommendation 621 (1971).

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