Letters

Glamourous Road to Space

Recently I received a memo from the National Aeronautics and Space Administration which was addressed to life scientists to solicit proposals for experiments to be conducted on upcoming space shots. I wish to protest against a system of research funding which permits one agency, NASA, to solicit extremely expensive, risky, and low-yield research at a time when other agencies, such as NIH, are having difficulty funding any new research projects in the basic sciences.

I am personally involved in two ways. First, for 10 years I have had a series of small grants to support my research and the research of about 30 students. Now, because of the critical shortage of funds, I foresee the possibility of this work being cut short, also the possibility that many young men, my students among them, will have little chance these days of being able to start productive research careers. Secondly, I have some personal knowledge of the type of project NASA is seeking to support in the projected series of Biosatellite missions since I had NASA support at one time and came to know something of the projects and the men involved. Each of the Biosatellite projects is enormously expensive, primarily because of the problems in developing life-support and data-telemetering systems. The engineering of these necessary but scientifically tangential systems can cost $1 million or more. Even when the scientific aspects of a study can be financed on a quite modest scale, the total cost can be quite immodest. I know also that there is an inevitable gimmicky aspect to these projects. The biological studies that are conducted in space can be simulated in a normal earth-bound laboratory; at least the same experimental variables are available for manipulation. Radiation in space can be readily simulated. Weightlessness cannot be sustained except in space, of course, but *increased* weight can be easily achieved in a centrifuge. Yet the scientists who would spend $1 million to determine the effects of decreased weight do not usually bother to install a simple centrifuge in their labs to determine whether increased weight has any effect upon the phenomena they study.

A space shot has glamour. The space scientist can have a "first" almost regardless of what he undertakes. His data are almost guaranteed publication because journals, too, play the glamour game. For myself, I have no intention of submitting a proposal for the Biosatellite program, even though my research could be easily extended to the program. There are more productive things to do with my limited funds and time. I shall miss out on the glamour, and have to risk papers being published on their merit, rather than finding automatic publication because they have the aura of the space age. I shall content myself with traditional research in one of the traditional basic sciences. Perhaps 10 or 20 or 50 young scientists could do likewise if it were possible to reallocate the funds that will probably serve primarily to give some scientist a little glamour.

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Amazonian Fauna in Danger

At a wildlife conference in Colombia some months ago biologists were greatly concerned over the rapid decimation of a number of Amazonian species. Many are involved: jungle cats, caiman crocodiles, big turtles, the unique New World monkeys, otters, peccaries, amphibians, and many tropical fishes. The native Indians who hunt the animals were reported to be penetrating deeper and deeper into the forest to secure their specimens which they sold daily to the honorary U.S. Consul at Leticia, Colombia, and he, in turn, shipped out great quantities of animals without any regard for their increasing scarcity.

A 1-percent tax on the very low local value of each shipment is collected on those exports which are declared at customs. The Colombian Ministry of Agriculture figures show that about 200,000 "skins" of vertebrate species are shipped from Leticia to Bogota and Barranquilla each year. Tiny monkeys are crowded into cages. One Colombian biologist states that even on the first leg of the journey to Bogota, a high percentage die *before* shipment to Miami. It was also reported that over 400 monkeys, mostly howlers, were killed in order that a medical research team from a U.S. university could study the aortas, and that this was apparently the only use made of their carcasses. These stories may have grown in the telling, but the conferees did point out that the fauna of Colombia was being decimated by the U.S., in spite of our own well-recognized principles of fish and game management. Why, they asked, should the U.S. encourage exploitation of South American fauna when it does not tolerate such careless harvest of its own? They viewed this as another case of "imperialism," of our taking advantage of their less industrialized society.

Several Colombian biologists suggested that hunting be completely stopped around Leticia until an inventory of numbers and careful ecological studies can be made by the fish and game personnel. In reply to this suggestion, a reporter for *El Tiempo* of Bogota stated that illegal traffic would then simply be diverted to competitive trading posts such as those at Manaos, Brazil, and Iquitos, Peru, where the trade is, if anything, worse than at Leticia. It would seem that the drain of fauna might be stopped if the countries of the Amazon basin were to act as a unit in sealing off the trade while the endangered species can still make a comeback.

In summary, my colleagues in Colombia suggested (i) adequate study of each of the endangered species and their ecology such as was given to the guanay cormorants on the bird islands off Peru; (ii) action by the republics of the Amazon basin, perhaps through the Organization of American States or the United Nations, to enforce a ban on the capture and sale of endangered species; and (iii) U.S. congressional legislation to forbid importation of endangered species similar to the Migratory Bird Treaty Act.

It is to be hoped that the plight, not only of the Colombian, but the entire Amazonian fauna will merit a large

place on the agenda of the forthcoming UNESCO meeting in Paris 4–13 September, where the major objective will be to seek a scientific basis for the rational use and conservation of the resources of the biosphere.

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Contracting Policies of Artificial Heart Program

In his letter "Bioengineering contracts slight universities" (28 June), Angelakos cites the example of some contracts awarded by the Artificial Heart Program of the National Heart Institute in his discussion of the desirability of developing bioengineering groups within the university framework. I would like to present some facts that bear on his assessment of the problem.

1) Angelakos mentions grants and contracts of the Artificial Heart Program; this program awards contracts only. Another part of the National Heart Institute awards grants, a number of which are to academic institutions in support of work in the artificial heart area. It is worth noting that academic institutions may pursue both the grant and contract route or may elect to eschew contracts; industrial organizations are not eligible to receive NIH grants, so their only route is the contract one. It is possible that this sort of self-selection may play a role in the interest in and distribution of contracts.

2) Angelakos mentions the possibility that one factor in the apparent lack of participation in such contracts by academic institutions may be the limited dissemination of appropriate information among universities. The mailing list of the Artificial Heart Program has on it the name of every medical school in the country, many of the engineering schools, departments, and institutes, as well as a large number of individuals at these academic institutions.

3) All proposals for contracts from industrial and academic organizations are subjected to exactly the same competitive review: In the first of the three-stage review every artificial heart contract proposal goes through before contract awards are made, a scientific and technical evaluation is made by an *ad hoc* group of knowledgeable experts, all of whom are from universities or government, and none of whom is ever from industry; this would imply, I believe, no anti-university bias in our review process.

4) It is not true that "less than 20 percent of the funds [in $3 million of contracts] went to university laboratories." Many of the contracts and funds awarded to industrial organizations involve the participation, either through subcontracts or consultations, of academic institutions. The list that Angelakos based his comments on did not contain such information, since its purpose was merely to list the identities of the principal contractors.

5) Of three contracts awarded for evaluation of physiologic effects of cardiac assist devices, it is true, as Angelakos points out, only one went to a university laboratory; in one of the others, however, a cardiovascular surgeon from a nearby eminent medical school plays a major role; in the other, a number of persons from the medical staff of the Artificial Heart Program Office have been participating very closely in the studies. What Angelakos did not mention, because it was not included in the list he based his reactions on, is that these three contracts are in addition to two others that were awarded 1 year earlier and are still in effect; one is to a medical school and the other to an industrial organization that has a very close working relationship with one of the leading academic hospitals in the country. Furthermore, all five of these contracts are operating according to protocols and plans developed by the Artificial Heart Program staff in consultation with a task force composed of academic, medical, and engineering people.

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Behavior: Questions of Influences

Perhaps a polemic book deserves a polemic review. At least the combination is not an unusual one: Witness E. W. Hansen's comments on Zing-Yang Kuo's controversial book *The Dynamics of Behavior Development* (5 April, p. 58).

Most of us would agree that the positions attributed to Kuo should be roundly criticized. Doubtless Kuo himself would concur. It is an unhappy fact that the major criticisms in the review were directed at positions that were not expressed, or implied, by the author.

In fairness to Kuo, it should be observed that his assumption that behavior development is a continuous process does not require that, as Hansen puts it, "everything that occurs at a given point in time is equally important in influencing everything that is to occur in the future." On the contrary, significant portions of the volume are concerned with factors that make for a loss of plasticity of behavior during ontogeny. Notwithstanding the assertions in the review, Kuo shows a clear appreciation of the selectivity and specificity of environmental effects upon behavior. The fact that Kuo reports several experiments on the specificity of early experience for later behavior scarcely indicates a "cop-out" on this issue.

Kuo does not claim, as Hansen says he does, that it will be possible "to control the evolution of the organism in the future 'independent of somatic changes . . . .' " Apparently this statement was taken from Kuo's discussion on page 203 of the issues involved in the evolution of behavior, not of the organism. For Kuo, there is a difference. Briefly, he argues that certain species-atypical behavior patterns (diet preferences, habitat selection, agonistic responses, and the like) can be established by controlling the environmental context in which the young animal is reared. And, "As long as the general nature of the new environmental context remains relatively unchanged, despite inevitable variations, we may expect that the newly induced behavior patterns, or behavioral neo-phenotypes of the group as a whole would be carried on from generation to generation" (p. 201). This is hardly a "mystical" process, especially in the light of Kuo's own experimental demonstrations of how contextual factors and the behaviors of the maternal animal play significant roles in the shaping of the responses of the young (see, for example, pp. 66–82).

Does the volume offer anything new? Remarkably, the review overlooked the fact that the book contains the reports of more than a score of previously unpublished experiments on the development of such diverse activities as appetite preferences, locomotion and flight patterns, fighting, sexual behaviors, vocalization, and song acquisition. Though the work covers a 40-year span, it is neither prosaic nor a "rehash." Included in this collection, for instance, is one of the few demonstrations of the