problem unreal by preventing the influence of the two classes of factors ever being separated. As they well know, it is normal scientific method in this cosmos of pervasive interactions to restrict the variables so that one thing can be studied at a time; indeed they give an example of this. If there is a continuum of effects the extreme cases are the most important, because simpler. To study positive developmental selection, stimulate mutations but keep the environment constant and observe what evolutionary changes occur, or examine corresponding situations in the past. And on the theoretical side it may one day be possible to predict the class of mutations which is capable of surviving developmental selection in a given species in a constant environment.

Other geneticists, mainly interested in negative developmental selection in microorganisms, have been surprised to discover that ideas vaguely taken for granted for some time have seldom been made explicit in the literature, and that their implications, being radical, have never been developed. [However, see J. Marquand Smith, *Theory of Evolution* (Penguin, Harmondsworth, 1959), for one of the first statements of these ideas in the literature on evolution reaching a wider audience.]

Developmental selection is of great importance, not only for evolutionary theory, but because it may hold clues to the nature of biological organization in general, at each level and in all species, which is the main problem of structural biology. The present condensed analysis is certainly imperfect; not only are the known facts inadequate, but even as a speculative theoretical statement it requires further development.

L. L. WHYTE
Wesleyan Center for Advanced Studies, Middletown, Connecticut

Grants and Scientific Freedom

Norman Kaplan's recent article on "Research overhead and the universities" [*Science* **132**, 400 (12 Aug. 1960)] is certainly timely. It seems to me, however, that he has skirted one of the major aspects of the problem.

He gives as one of the three major functions of a university the "extension of knowledge." Traditionally this extension is to be directed exclusively by the university and especially by the individual investigator. Any erosion of this freedom of direction constitutes external "control" and, if it is to be acceptable at all, must be compensated by some very real gain to the welfare of the public. Kaplan has, I think, recognized this in restricting his discussion

to "basic" research. Research which is not "basic" has no proper place on a university campus; if it is admitted at all it should be paid for in full; in fact, not only should the "donor" (purchaser) pay all overhead and administrative costs but he should recompense the university over and above these costs for permitting itself to be diverted from its proper function.

But leaving aside developmental research as an improper function, what about basic research? I would agree with Kaplan that in so far as the university is left in complete control of such research it has no right to expect inclusion of overhead costs. It seems to me, however, that the only way that a university can possibly be left in complete control of its research program is to have it accept only such funds as are without strings. The mere fact of having to spend money on predesignated programs, to make reports of such expenditures, and to be limited in the reallocation of funds constitutes a very real control. The university, in order to obtain such funds, is forced to choose as immediate research objectives not what are the most pressing intellectual and cultural objectives within the total framework of knowledge but, rather, the objectives which will bring the greatest price in the market place. Whether we wish it or not, the whole structure of present-day research financing is contrary to the traditional university function of untrammeled search for truth.

If I am right in this, and I think it is a view tacitly supported by the quotation from DuBridge which Kaplan cites with approval (p. 403), then all grant-sponsored research is "controlled" and should pay full overhead *plus* a subsidy in compensation for this control. Kaplan is wrong in wishing to eliminate such payments.

However, I think he is right in opening up the larger question of whether such research belongs properly in a university. Does not grant research belong more properly in private institutions outside the university framework? I suggest that although the universities have not come out and said so openly they have partly recognized this in setting up semiautonomous agencies which are segregated from the teaching function. The Space Research Institute of Johns Hopkins is a frankly externally oriented agency. The Brookhaven Laboratories constitute another. The Oriental Institute of the University of Chicago is a semiautonomous agency which is *not* externally oriented and as such, I suspect, gets very little financial support from the sources to which Kaplan was referring and expects very little in the way of agreed-upon "overhead" cuts.

I think that funds donated to a university for predesignated projects and programs, by whatever agency, should

be looked upon as constituting a purchase of partial control that should be paid for. I hope that someday someone, perhaps even the government, may recognize the need for truly "free" subsidy of the university's function of the pursuit of knowledge, or really *basic* research. When it does, and funds are given without strings, the university itself will decide what portion is to be allocated to overhead and the question Kaplan is discussing will cease to have pertinence. A note on National Science Foundation grants in the same issue of *Science* [**132**, 405 (1960)] suggests a welcome trend in this direction. Until this trend becomes more definite—that is, so long as Kaplan's question *is* pertinent—I believe the granting agencies are remiss in providing such niggardly funds for overhead.

PHILIP R. WHITE
Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine

I cannot agree with White's contention that all grant-supported research—whether basic or not—is, in effect, "controlled" research. There are significant variations among the granting agencies with respect to the elements of control listed by White. The National Institutes of Health, for example, allow the investigator considerable liberty in reallocating grant funds. Moreover, they extend scientific freedom quite explicitly. In the statement accompanying the notification of the grant award, they inform the investigator that he "is not required to follow the specific details of the project submitted for review, particularly if he finds promising leads that in his opinion are likely to be more productive than the project proposal itself." Not all granting agencies extend these kinds of freedom, to be sure. But I feel it would be unfair to classify all grant research as necessarily controlled.

However, White's main point is an extremely important one, and I would certainly agree that we would do well to re-examine the heavy emphasis on the project-grant system as the best possible mechanism for the support of basic research in the universities.

Despite the title of my article, I tried to make it clear that I do not consider overhead the major issue. I deliberately chose it as a central focus and made the rather drastic suggestion that all overhead payments for basic research in the universities be eliminated as a dramatic way of drawing attention to some of the larger questions involved. I also wanted to show that piecemeal decisions even on relatively trivial issues have consequences for the development of our national policies on the organization and support of scientific research. The drifting tendency toward full reimbursement would, as I indicated in the article, solve few of the basic long-range problems. Once institutionalized, this tendency could result in a situation favored by few and difficult to reverse.

It is precisely for this reason that I would disagree with White's suggestion that the university be recompensed over and above full costs for permitting itself to be diverted from its proper function. This, it seems to me, would "reward" the university for abdicating one of its major responsibilities. And in the present financial crisis this might prove all too tempting to far too many universities which have rarely appreciated fully the significance of the research function. If I understand White's argument, I find this a particularly precarious means of achieving the objective on which we are in complete agreement—namely, a truly "free" subsidy of really basic research.

I should like to see the overhead problem viewed in the context of such unanswered questions as these: Should we continue to rely on the universities as the major producers of basic research? What about those universities which are doing little to establish the conditions considered essential for the effective conduct of basic research? Should we consider encouraging the formation of many more independent research institutes (like the Jackson Memorial Laboratory or perhaps more generally modeled on the Max Planck Institutes) with the specific objective of pursuing basic research?

I might also note that the block grant, favored by many as a superior device for supporting research while providing greater freedom, would probably work out quite differently in independent institutes and in universities. The block grant may be more effective in the institute, where it would go directly to the people committed to, and involved in, research. A block grant to the president of the typical university, removed as he is usually from the research people and faced with conflicting departmental demands and rivalries only partly related to research criteria, may be far less effective than we might typically expect.

I hope I have not given the impression that I think I have some of the answers to the pressing issues raised in either White's letter or my article. As I continue my research in this area, especially through comparative analyses of research organization in different countries and in different institutional frameworks, I hope to find out more about the kinds of questions which must be asked long before any "final" answers can be sought. I appreciate this opportunity to comment on White's very stimulating letter.

NORMAN KAPLAN
Department of Sociology and Anthropology, Cornell University, Ithaca, New York