Letters

(Continued from page 996)

I suggest that if the Commission finally decides to have the symbols conform with the widely accepted stoichiometric relation between oxidant and reductant, it will suffice to state that they should be NAD^+ and NADH. By comparison with the currently used DPN^+ and DPNH the meanings will be well understood. Further comment of the sort injected into the 1961 report hardly can be regarded as germane to the principal subject of that report. One may also expect corrections of the errors in Appendix E.

W. MANSFIELD CLARK
Johns Hopkins University, Baltimore, Maryland

References

1. *Report of the Commission on Enzymes of the International Union of Biochemistry* (Pergamon Press, New York, 1961).
2. W. M. Clark, *Oxidation-Reduction Potentials of Organic Systems* (Williams and Wilkins, Baltimore, 1960).

The New Regulations Pertaining to Research Grants of the Public Health Service

During recent weeks, storms of criticism of the newly instituted regulations relating to the management of research grants of the National Institutes of Health (NIH), a division of the Public Health Service (PHS), have arisen among the staffs of many universities, institutes, and scientific societies, and among various individual scientists. Congressional Committees, the General Accounting Office, and the General Counsel of the Department of Health, Education and Welfare, recognizing the occasional lack of adequate responsibility by grantees of the PHS, have made demands that scientists not be treated as especially privileged citizens and that greater fiscal control should be exercised in the expenditure of the hundreds of millions of dollars awarded annually by the various agencies of Congress for the support of scientific research. It is important to note that the funds of the PHS are awarded on the basis of evaluations made by carefully selected scientists, who serve as consultants to the Surgeon General, and who carefully scrutinize each application for a grant, with respect to the objectives, the proposed means of

obtaining them, and the appropriate amount of money needed to support each application that is recommended for approval.

It is unfortunate that some members of the Congress and of the offices mentioned think that scientific research can operate productively when subjected to rigid fiscal controls, as can a variety of industrial or other operations supported by federal funds. It is only too easy for critics to characterize scientists working in areas of fundamental research, particularly in biological and medical fields, for whom "fiscal controls" are necessary—for their own good. Yet experienced investigators know full well that important discoveries simply cannot be made in an atmosphere of restrictive rules, regulations, and bureaucracy.

What has gone wrong? Perhaps it is to a considerable degree a result of unprecedented rapid growth in (i) the number of scientists being trained or supported by federal funds; (ii) the number and size of the grants; and (iii) the almost inevitable differences in opinion as to what constitutes essential freedom to do good research, as compared to what some apparently regard as unfettered license. In any case, although attainment of the desired degree of "fiscal control" can be insured by the development of severely restrictive regulations, the inevitable price to be paid is a reduced overall productivity of science in America. Consequently, the Congress ought to have the collective courage to question the wisdom of those "directives" of its committees and of other groups that have led to the establishment of restrictive regulations by unwilling but apprehensive agencies.

What are some of these newly made regulations that are regarded so unfavorably by scientists?

1) The requirement that grantee-investigators not be allowed to alter their objectives in a major way, except after permission has been recommended by a committee or granted by officials within the agency from which the funds were obtained.

2) The establishment of rules requiring that records be kept concerning the actual percentage of time that grant-supported scientists devote to a research project.

3) The interpretation that full-time employment with funds derived from a research grant should prohibit even a modest and sensible participation of scientists in such regularly scheduled

educational activities in an institution as are conducive to the scholarly development of the individual.

4) Restrictions upon freedom to shift funds within the several budgetary categories of a research grant, even when a grant has been morally committed for several years in advance, with those inevitable changes in orientation that develop and that require a maximal amount of flexibility in the management of research funds.

Let us consider then, each of the above-listed restrictive regulations, and some constructive suggestions for their modification.

1) Scientists reacted vigorously against a most objectionable earlier restriction that prevented any significant modification of an initially approved research objective by a qualified investigator. Their objections led the Surgeon General of the PHS to announce recently a change in this regulation whereby the alteration of research objectives is now limited to "changes in methodology, approach, or other aspects of the project that would expedite achievement of *its* (my italics) research objectives, including changes that grow logically out of the approved project and serve the best scientific strategy." This is a major step forward, but even this statement does not go far enough, for it does not permit an essential change in the orientation of a very competent and established investigator. All that is needed, in this new regulation, is to change the italicized word "*its*" to "*his.*" Such a modification would put the responsibility for quality and objectives where it should be, in the hands of the carefully selected investigator. Furthermore, it would have the very salutary strategic effect of not encouraging the submission of grant applications that are vague with respect to objectives and therefore difficult to evaluate. It would thus be recognized that precision in the delineation of a proposed investigation, although of great value to advisory committees concerned with evaluation, would not restrict an investigator to an area that new research could demonstrate to be unproductive.

2) Perhaps none of the new regulations has caused more irritation among scientists than has this one; not only is it unrealistic and unworkable, but it demands intellectual dishonesty. Good investigation cannot be done under the shadow of a time clock and effective scientists do not work a week of 37.5 or 40 hours. A regulation that requires that either "per cent of time" (or "per cent of effort") or "hours per week" be recorded asks for the impossible. Contributions to research cannot be estimated on the basis of the number of hours at either the bench or the desk, for equally important intellectual contributions actually may occur during conferences with scientific colleagues and students, and, even more, with time for reflection: in the library, while shaving, or in the quiet of one's bed! Let us realize, therefore, that neither time nor effort can be gauged as with clerks, and scientists should not be required to make outwardly plausible but actually untenable estimates of it.

3) There appear to be some curious differences between the kinds of dollars awarded by the PHS in support of research and training and how they may be used; these may be defensible in terms of bookkeeping and "fiscal control," but not in terms of attainment of intellectually desirable goals. Thus, as an example, a PHS research grant that fully supports a scientist permits him to give only an occasional *unscheduled* lecture, but a modest amount of scheduled teaching, desired by the individual for his own intellectual stimulation and growth, the respect of his peers, and the development of his career, is forbidden. On the other hand, the same man might be employed legally, and on a full-time basis, on a PHS-supported research training program and be so overburdened with teaching that time for productive research would be minimal or absent.

Clearly, a much more liberal interpretation is needed of what is reasonable in the way of modest and sensible participation in teaching that is desired by the theoretically full-time research worker, and of what actually is beneficial, not detrimental, to his research. To accomplish this requires only a common-sense definition of reasonableness—and what could be simpler than an *average* participation of up to perhaps 6 hours a week, rather than, let us say, up to 15 percent of his time and effort?

4) Some restrictions upon freedom to shift funds, within the various budgetary categories of a previously approved grant, would seem to be entirely warranted *if* scientists are not to be regarded as the best judges of sensible and productive ways to obtain desired objectives within the framework of the

total amount of money provided for the conduct of their own research. But if the scientists are not to be trusted, who is? As the new rules now stand, it can be predicted that a rapidly expanding army of bureaucratic officials will be drafted to rule upon the multitudinous and laboriously documented appeals for budgetary readjustments that are certain to be presented continually by grantee scientists throughout America. Who can evaluate and rule upon these appeals? Presumably former scientists who, for a variety of reasons, become involved in the regulation of science rather than in contributing to it creatively. Will not the amount of money relegated to the salaries of this new bureaucracy, as well as the amount of time spent by scientists who ought to be working or thinking, be far more wastefully expended than that to be spent, presumably unwisely, each year by a small percentage of less severely controlled grantees? If the fear is that some institutions will use research funds to rehabilitate physical facilities (or in some other *wasteful* manner), presumably with a view to the better accomplishment of the research, will this not be controlled adequately by the well-known activities of the General Accounting Office, which scrutinizes the records of expenditures by institutions and has the power (and exercises it) to enforce restitution? If undue travel by scientists for conferences and the exchange of ideas is a legitimate and really fearful problem, a restriction on alterations of this aspect of research budgets perhaps is defensible. It would seem, however, that in all other categories the best way to foster scientific progress is to delegate authority to the principal investigator (and his administrative associates in an institution) to expend the allocated research funds with maximal freedom. The investigator, as an applicant, has already been judged to be highly qualified for the conduct of research; a reasonable sum of money has already been granted with which to gain the desired objectives, and maximal attainment will occur only with minimal bureaucratic interference in the guise of attaining fiscal responsibility.

In conclusion, it is suggested that the objectives of the Congress to further scientific research and the training of new scientists, as well as the best means of attaining these ends for the public good, hitherto attained with remarkable success by such disbursing

agencies as the National Institutes of Health and the National Science Foundation, need further consideration—carefully and promptly. For this purpose, it has been suggested by others that the National Academy of Sciences be invited to arbitrate in the present controversy. What could be more appropriate in this case?

Specifically, there is need (i) to reduce the present limitations upon modifications of research objectives; (ii) to abolish the keeping of records by research workers of "time and effort"; (iii) to liberalize the interpretation of "full-time" and to permit scientists entirely paid from research grants to participate to a modest degree in teaching; and (iv) to remove restrictions upon the transfer of funds between the different categories of a budget set up to permit an initially desirable research objective to be attained.

It is unthinkable that the errors of a very small proportion of the grantees of the Public Health Service and of other federal agencies should be so exaggerated that, in purging them, serious and lasting harm be done to the progress of science. The people of the world probably have received more permanent benefit from unimpeded scientific research and development than from almost any other application of American intelligence, ingenuity, enterprise, and public money (*1*).

ARNOLD D. WELCH

Yale University,
New Haven 11, Connecticut

Note

1. The substance of this letter, by the chairman of the Department of Pharmacology, Yale University School of Medicine, has received the approval, as well as the constructive criticism, of the other chairmen of the departments and the dean of the School of Medicine, and the provost of Yale University.

Intelligence and Genetic Trends

From time to time students of evolution have urged that adverse changes are probably taking place in the collective pool of human genes and that practical measures may be needed to counter the trend. For geneticists such assertions raise questions, to which there are no simple answers, about their individual and collective responsibilities for the genetic future of man. Some of the more perplexing of these questions do not appear to have been discussed in print.

In his recent book, *Animal Species*