Government and the Freedom of Science

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THE vast growth of the support of scientific research by Government has given the Government great powers over the careers of scientific investigators. On the whole, these powers have been used thoughtfully and with restraint by enlightened administrators who have worked in close collaboration with the scientists themselves. However, a serious threat to the freedom of the individual and to certain basic rights has arisen lately. Research grants for unclassified research by men of high competence and generally unchallenged integrity have been withheld, or abruptly revoked, because of unspecified allegations of supposedly subversive activities. Therefore all scientists must welcome both the recent request from Sherman Adams, Assistant to the President, to Detlev W. Bronk, that the National Academy of Sciences take the problem under consideration, and Bronk's prompt acceptance of this responsibility on behalf of the Academy (*1*).

The issues involved are grave; they have aroused widespread concern among the members of the scientific community of the United States. Yet there has been little public discussion of the issues and apparently no attempt at explicit formulation of principles. We may have confidence that the National Academy Committee (*2*) that is to deal with the problem will face the issues wisely and forthrightly. Yet committees like this one can operate effectively only on the basis of informed and thoughtful opinion diffused generally among American citizens, especially those of the scientific world. As one of these citizens, I have set down the following considerations, formulated gradually during many months of study and discussion with colleagues (*3*). Certainly I claim no special wisdom or insight. Whatever may be of value in this discussion is only a reaffirmation of principles long formulated and long honored but apparently often forgotten in the stress of the atmosphere of crisis in which we live today.

We must first be explicit with regard to where most of the trouble has occurred. More than one Government agency has been involved in actions of the type I am discussing; but the most numerous and most serious incidents have been related to research supported by the U.S. Public Health Service. During the last decade, the Public Health Service has established a splendid record of achievement in its program of research grants and fellowships, which have been administered with wisdom, and with respect and understanding for the conditions required by scientific men to achieve the best that is in them. In the early spring of 1954, however, reports began to circulate that grants for open, unclassified research were being revoked or denied, on grounds apparently political and unconnected with the competence or integrity of the investigators involved. A statement of the policy involved was made by Oveta Culp Hobby, Secretary of the Department of Health, Education, and Welfare, on 28 April 1954. This was published at the time in several newspapers and has since been circulated by the Federation of American Scientists. The most relevant paragraphs follow.

> We do not require security or loyalty investigations in connection with the award of research grants. When, however, information of a substantial nature reflecting on loyalty of an individual is brought to our attention, it becomes our duty to give it more serious consideration. In those instances where it is established to the satisfaction of this Department that the individual has engaged or is engaging in subversive activities or that there is serious question of his loyalty to the United States, it is the practice of the Department to deny support.
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> If the subject is an applicant, the grant is not awarded. If the subject is an investigator responsible for a grant-supported project or is the recipient of salary from the grant, the grant is terminated unless the sponsoring institution desires to appoint an acceptable substitute.
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> The Public Health Service supports a large segment of medical and related research through more than 2,000 grants which involve some 14,000 persons each year. Although this practice has been followed since June, 1952, fewer than 30 persons have been denied support.

We may note that the policy, for which Secretary Hobby has taken responsibility in this statement, was not initiated by her, for its beginning in June 1952 antedates the present Administration in Washington. This point is mentioned to emphasize that the issues I am discussing may be considered apart from party politics.

The actions described in Secretary Hobby's statement had already aroused deep concern among scientists. For instance, on 15 April 1954, the American Society of Biological Chemists adopted a resolution strongly protesting such actions and requesting the National Academy of Sciences to investigate the situation. Similar action was later taken by the American Physiological Society (*4*) and by other scientific societies and groups. These protests and the vigorous action of the authorities of the National Academy in pursuing the problem have certainly played a major part in bringing about the inquiry that the National Academy Committee has been asked to undertake.

Secretary Hobby's announcement is not a statement of what might happen; it is a statement of what has happened and what is continuing to happen. It was acknowledged in the statement itself that nearly 30 investigators had been affected by this ruling. Others—I do not know how many—have been affected since. In

some cases the action taken involves the refusal to award or to renew a grant, on grounds unconnected with the scientific qualifications of the investigator or with his personal integrity and character, as such terms are commonly understood by ordinary men. In other cases the action has been more drastic: it has involved the sudden revocation of a grant already awarded and approved, sometimes in the midst of a 3- or 5-year term of support. Action has been taken suddenly, perhaps with a month's notice, after which all funds were cut off. Explanation for the action has been refused, but a double blow has been dealt the investigator involved. First, he has been deprived of funds vital to his research, often on extraordinarily short notice. Second, the action could be taken by some as implying something dubious, possibly something sinister, concerning the investigator's past. These implications are there; they are intangible; nothing is revealed; no opportunity is given to the investigator to know the nature of the implied charges or to offer any reply. The revocation of funds, under such circumstances, can threaten his future career and make other agencies reluctant to support his work. If he is in a position that lacks tenure, it may even threaten the loss of his job. It may be said that the careful avoidance of publicity that has been maintained in these matters is a protection for the individual involved. However, when the investigator turns to another agency to seek support, the fact that a grant has been revoked or denied must almost inevitably appear, and the potential threat to his future career will arise in acute form.

It should be reiterated here that the research for which these men have been granted funds is not secret in any way. No threat to national security is involved in their pursuing their work openly. They are charged with no offense against the law. The action taken against them has often involved the breaking of a moral agreement, if not a legal contract, by the supporting agency. The action is taken outside the security system and outside the law, in a no man's land of undefined accusations and vague suspicions.

A fundamental distinction between open and classified research must be emphasized. Virtually all of us acknowledge the necessity of a security system whenever secret work is involved. In the present troubled state of the world—a condition which is neither peace nor war and which has no earlier parallel in the experience of most of us—some such system is indeed a somber necessity. The rigorous requirements of security inevitably involve at times the barring of highly qualified individuals from access to secret information, if there is any reason for substantial doubt concerning their loyalty or discretion. On occasion the decision must be taken to deny the individual such access, even though in fact he may be completely loyal and trustworthy. If the system is wisely administered, such cases should be rare.

The application of the rules is not simple; the value of employing an unusually gifted individual must be balanced against the risks involved in his employment; for every person is to some extent a security risk. The general principles, however, are clear, and they differ in at least one fundamental respect from the principles of the law. The assumption that an individual is innocent until proved guilty cannot be taken over directly into the security system. To work under that system is a privilege, not a right, and individuals may on occasion be rejected on suspicion, even if those suspicions are unfounded. We may grant these general principles underlying the operation of the security system, but at the same time we may raise grave questions regarding the wisdom with which they have been applied in specific cases. Overzealous application of the rules, resulting in the exclusion of highly qualified individuals from service to their country for inadequate reasons, may in itself be one of the greatest of security risks.

Withholding unclassified research grants on the basis of undisclosed information, however, is a policy that raises totally different issues. It is, in effect, an intrusion of the security system into a realm that has nothing to do with security. Security considerations are a painful necessity; we accept them as having compelling force within the area where secrecy must prevail. They are irrelevant and dangerous when invoked outside that area.

Whether he operates under the security system or not, every person is subject to the law. If he has engaged in criminal subversive activities he is subject to trial and to punishment. Such activities, when they exist, are indeed frequently so cloaked in secrecy that it may be exceedingly difficult to obtain the evidence justifying a legal conviction, even when one may be convinced that the individual is actually guilty. Such criminal activities, however, must be sharply distinguished from expressions of opinion, no matter how repulsive the opinions may appear to most of us.

For the most part, the identity of the persons who have been denied support for unclassified research is unknown to me. I have learned the names of three or four of them, however, and they are men whom I know well. They are outstanding in their fields of research. They have made major contributions to our understanding of such subjects as the structures of biological macromolecules, immunological reactions, and metabolic processes. They are admired, respected, and trusted by their scientific associates. Some of them in the past may have upheld political views that seem to me foolish or ill-judged, but these are matters that they are free to decide for themselves. I do not know one among my scientific colleagues who would question the integrity or character of these men or who would doubt in any way their suitability to receive support for open and unclassified research.

The damage done directly to these men by the policies of the U.S. Public Health Service is a serious matter. The actions taken are regarded as frankly outrageous by many, including myself. However, I submit that the gravest damage done by these policies is not to the men whose grants are withheld. The few whose names are known to me stand high in the esteem

of their colleagues; both they and we deeply resent the imputations cast upon them. As yet I know of none of them who has not been able to obtain support for his research elsewhere. This may not be true of all; some indeed, I am sure, fear that their ability to get support elsewhere is threatened. All this is bad, but the worst effects are upon other persons who continue to be approved and to receive support. Each one can picture himself also among those that are in trouble; even though he, himself, is in no danger, he may become more guarded in his speech; some thoughts that come to him he may not speak to his colleagues as freely as before, hesitating now and then lest he may say something that might conceivably be used against him.

Two of my colleagues—men of great capacity, courage, and force of character—have told me they have found this attitude beginning to affect them. They granted that on rational grounds they had nothing to fear; they were clear in their consciences and in the eyes of the law; but they knew too well the obscure nature of the grounds on which support had been denied to others; they feared for the younger people working in their departments, whose future could be imperiled by the denial of support, and they became more cautious because of this anxiety. Such fears are destructive. The struggle to guarantee to all men the right to speak their minds on controversial issues without fear of reprisals has gone on for centuries. That right is always in jeopardy and it must be constantly and actively maintained. It is certainly vital for scientific workers, to whom independent thinking is a basic necessity in their work.

These fears are supported by indications that information from anonymous accusers is being used as a ground for disqualifying individuals from holding grants from the Government. The actions taken have been so carefully cloaked in secrecy that it is nearly impossible for a private individual to know what has been done. However, evidence from anonymous accusers, not speaking under oath, was employed against John P. Peters in the hearing that led to his removal as a special consultant to the Public Health Service. In the words of an editorial in the *Washington Post and Times Herald* on 29 Nov. 1954 (*5*), the work of Peters "involved no access to confidential or strategic information." Several eminent men—Charles W. Seymour, former. president of Yale, Charles E. Clark, judge of the Second Circuit Court of Appeals, and C. N. H. Long, former dean of the Yale Medical School—testified under oath on Peters' behalf. Yet the verdict given upheld the anonymous hostile informants, the identity of all but one of whom was unknown even to the board that passed on the case.

The case of Peters is still under consideration by the Supreme Court, and it would be impertinent to express an opinion in advance concerning what the verdict should be. Let us tentatively make the assumption that the Supreme Court will hold that Government has been acting within its rights in removing Peters from his position. I would still hold that Government, even if it has these powers, should refrain from exercising them except for grave reasons of national security. If a man has access to secret and vital information or if he is in a position in which he might endanger national security by sabotage during a crisis, then accusations against him from any source must be carefully weighed. They must be weighed with caution—a skillfully worded anonymous accusation, framed by a clever Communist agent, could be a powerful weapon in disqualifying a loyal and gifted scientist from serving his country in a sensitive position. Nevertheless, when national security is involved, such warnings cannot be disregarded. If a man working under the security system is removed from his post because of anonymous charges made against him, this need not imply guilt of any sort; it merely means that there is considered to be a risk in his employment in a sensitive post, a risk that the responsible authorities do not feel justified in taking.

For a man who operates outside the security system, however, the usual standards of our law and our society should prevail. If such a man is trusted and respected by his colleagues and neighbors, if they testify to his integrity, anonymous accusations should be ruled out of consideration in relation to his fitness to receive a grant for open research. It is a dirty business to make such accusations or to lend an ear to them when they are made; they poison the straightforward trust in dealings between men, which is the normal basis on which scientists, like most other people, carry on their work together. To strike at this basis of trust is to sow suspicion and hostility, to weaken the coherence of our society, and thereby to damage the national security itself.

The policies attacked here violate a long tradition—a tradition deeply rooted in English and American law—extending far beyond the confines of the law as such. This tradition insists upon the right of the individual, if an accusation is lodged against him, to know the nature of the accusation and the identity of the accuser. One might attempt to evade the issue here by saying that there is no accusation—that the Government is free to grant or withhold funds as it pleases; that the receiving of funds for scientific research is a privilege, not a right, and that this privilege may be withdrawn at any time by the granting authority at its own discretion. We may admit that technically there is much truth in this. The Government may set the terms upon which it bestows these funds; if the proposed recipient disapproves the terms, he is free to refuse the proffered funds until the terms are altered. But our Government exists to serve the people, and it is my conviction that the people are not best served by offering money for basic scientific research on such terms as this. It is not enough, of course, for the scientists to be convinced of this fact; the ultimate decision is in the hands of the American people and many will not accept the point of view expounded here unless it is fully and carefully explained to them.

It is a matter of profound regret to me that the

policies that are here attacked have been formulated and applied by the U.S. Public Health Service, which has performed magnificent service during the years since the war in the support of fundamental research in the United States. Its policies have, in general, been admirable. Its administrators have shown an enlightened outlook in promoting fundamental research; and, apart from the lamentable issues here discussed, they have shown an admirable solicitude for the freedom of the investigator. The laboratory with which I have been associated for many years has received generous and understanding support from the Public Health Service, which has made possible a long series of researches with which I am proud to have been associated. All this I am happy to acknowledge. However, the recently developed policy of the U.S. Public Health Service with which I am concerned here, while ostensibly designed to oppose subversion, appears to me to be itself subversive—subversive of the traditional liberties of the individual and of his right to be judged by due process of law or by something analogous to due process in matters that do not lie strictly within the domain of the law.

Many will say that the issues involved are not as grave as I depict them; that very few people are being hurt; that these disturbances will pass; and that we may endanger the whole structure of Government support of science by challenging the procedures now being adopted. I reject such arguments. Certainly I do not share the fears of the alarmists who believe that our society is rapidly becoming totalitarian; the fact that articles like this one can be published and freely discussed is good disproof of such ideas. Yet the trend toward totalitarian procedures is present in the arbitrary actions that I have discussed; and the time for resistance is now, not later. The men who are enforcing the decisions I oppose are certainly not ruthless autocrats—they are probably conscientious administrators, worried about maintaining the flow of Government funds for science and fearful lest congressional investigators should charge some recipient of a Government grant with being a subversive character. All this is human and understandable, but I believe that it shows a dangerous timidity on the part of certain administrators and that it has done great harm. Even if only a few of our colleagues are hurt—whether it is one person or many—I believe that we should stand up and protest on their behalf. In any case the threat is not to a few persons only; it is to all of us; for no one knows whether or not he will be the next victim, and whether or not he will find his own support cut away and his own future in jeopardy.

Inevitably the decision concerning proper action in this grave situation is not easy for most scientists. Because I am not a department head, and because I derive my research support from other agencies that have maintained the tradition of freedom, I feel that I can speak more openly than many of my colleagues. I can say only that the withholding of research grants for unclassified research on grounds unconnected with the scientific competence and integrity of the investigator is abhorrent to me. Under the circumstances I shall neither ask for nor accept funds from any Government agency that denies support to others for unclassified research for reasons unconnected with scientific competence or personal integrity. If I do receive funds for research and I learn subsequently that the granting agency has adopted such a policy toward other individuals, I shall stop using such funds and shall return the unexpended balance to the agency that awarded them to me.

I state this as a personal policy without urging that my colleagues join me in it. I know many whose personal convictions are essentially identical with mine but who feel precluded from taking similar action because of their responsibility for obtaining funds for their departments and especially for the younger workers whose careers would be imperiled if funds were cut off. For myself, however, I can say only that I see great danger in the present situation. Having freedom to speak and holding the convictions that I do, I feel that I cannot keep silent in the face of a policy which I believe to be a threat both to the freedom of science and to the basis of the social order in which most of us believe.

Immensely powerful forces are transforming our society and the status of science and scientists within our society. For a vigorous modern nation, a flourishing science is a condition for national strength and even for survival. Scientists are urgently needed, and the pressure grows increasingly strong to consider the scientist as the servant of the state. Insofar as he operates under the security system, or in any case in which he serves as an adviser to Government, the scientist is indeed a servant of the state. It is imperative, however, to preserve, in spite of the portentous growth of the power of the state, the tradition of free scientific inquiry by persons who in their work owe no allegiance except to the spirit of inquiry, the desire to understand, and the sense of beauty in discerning patterns of order amid the chaotic multiplicity of phenomena. It is the independent, unfettered investigators who have made the great germinal discoveries, and if we do not provide the conditions in which such men can flourish, we shall lose leadership in science. Yet in our world of today such scientists, like others who work on problems of a more applied type, must receive much of the support for their work from Government. It is one of the great problems of our time to maintain a Federal Government that has at its disposal immense material resources and immense power, and still to insure that the power is used with due respect for the integrity of the individual and for his personal freedom. It is, I think, one of the great American achievements of the past generation that we have largely succeeded, during a period of profound social change, in combining these almost incompatible objectives. I believe that we can and must succeed in doing this in the field of Government support of sci-

ence. To succeed requires incessant vigilance to prevent undue encroachments on personal freedom and a patient determination that scientists and Government administrators cooperate and understand one another to make the system work.

References and Notes

1. *Science* **121**, 7A (11 Feb. 1955).
2. *Science* **121**, 490 (8 Apr. 1955).
3. A draft of this paper was sent to Oveta Culp Hobby, Secretary of the Department of Health, Education, and Welfare, on 23 Dec. 1954. The letter of acknowledgment stated that the problems discussed in the paper were being considered. On 27 Jan. 1955 I again wrote to Secretary Hobby asking whether the paper contained any misstatements about the U.S. Public Health Service. The reply mentioned none but stated that the problem was still under study. I then decided to submit the paper for publication, after revising the opening statement to take account of recent events and adding two paragraphs related to the use of anonymous informers—J. T. E.
4. *Science* **120**, 1010 (17 Dec. 1954).
5. Reprinted in *Science* **120**, 1009 (17 Dec. 1954).

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Abstracts of Papers Presented at the Annual Meeting

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Localized Ultraviolet Irradiation of Parts of Chromosomes and of Cytoplasm in Dividing Cells

William Bloom, Raymond E. Zirkle, Robert B. Uretz, *University of Chicago*

Localized irradiation of small parts of chromosomes of mesothelial cells of newt (*Triturus viridescens*) with heterochromatic ultraviolet light produces a localized change of refractive index of the chromosomes, as is seen by phase-contrast microscopy in the living cells. The "pale" areas do not stain with ordinary nuclear stains or with the Feulgen method after fixation. Irradiation of equal amounts of cytoplasm during metaphase causes a collapse of the spindle and a subsequent "false anaphase" in which whole chromosomes aggregate in two clumps of random number. These clumps move apart and cytokinesis follows. Irradiation of cytoplasm during early prophase apparently inhibits development of the spindle but "false anaphase" nevertheless takes place.

We are testing the relative effectiveness of different wavelengths in producing these effects.

Progress in the Theory of Superconductivity

John Bardeen, *University of Illinois*

Considerable progress in understanding superconductivity has been made from both phenomenological and atomistic approaches, although difficulties remain. Magnetic properties can be accounted for by a model in which the ad hoc assumption is made that the electrons form a condensed superconducting state such that a finite energy $\varepsilon \sim kT_c$ is required to excite an electron. Otherwise, excited electrons in the superconducting phase are assumed to be similar to those of the normal phase.

The theory does not lead to the London equations but to phenomenological equations similar to those suggested by Pippard. The current density at a point is determined by the field in a region of $\sim 10^{-4}$ cm surrounding the point. A dependence of penetration depth on mean free path, as observed by Pippard, is a consequence of the theory. It has not yet been possible to derive this model from first principles.

Recently, Pines and Bardeen have shown why, as is indicated experimentally by the isotope effect, electron-lattice interactions are more important than Coulomb interactions in the normal-superconducting transition. This justifies the approach of Fröhlich and of Bardeen. The criterion for superconductivity is essentially that electron-lattice interactions be so large that they cannot be treated by perturbation theory. Satisfactory mathematical methods for treating such large interactions are lacking. It may be hoped that future developments will bridge the gap.

A Mono-acetyl Derivative of Chymotrypsin

Arnold Kent Balls, *Purdue University*

The question of the constitution of the active center of a hydrolytic enzyme has not yet received a satisfactory answer in any given case. One promising approach, however, appears to have been with chymotrypsin, whose inhibition by halogen phosphate esters results from the introduction of a single phosphoryl group into the enzyme molecule. For several reasons it seems likely that this group becomes attached to a part of the active center. The active center also appears to be clearly involved in the acetylation of chymotrypsin by *p*-nitrophenyl acetate, for the reaction occurs prior to a slow enzymatic decomposition of this substrate and consists in the transfer of one acetyl group to the enzyme molecule [Hartley and Kilby, *Biochem. J.* 56, 288 (1954)].

While also studying this reaction, we have observed that it did not occur with chymotrypsinogen or with inactivated chymotrypsin. The acetylated protein was, moreover, inactive toward ordinary substrates. Chymotrypsin acetylated with ortho-, para-, or 2,4 dinitrophenyl acetate showed an unexpected stability in acid solution. By taking advantage of this property, it was possible to isolate the acetylated protein in apparently rather pure form. No rapid liberation of acid occurred when chymotrypsin reacted with a nitrophenyl acetate, but rapid liberation of acid did occur when a solution of the isolated protein was made slightly alkaline. The acetylated protein yielded one equivalent of a hydroxamic acid when treated with hydroxylamine at *p*H 6.5; thus the new substance appears to be unusually reactive. Reversion to chymotrypsin occurred rapidly in alkaline solutions. In a slightly acid