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Chernick, Cedric L.; Ad Hoc Committee on Government-University Relationships in Support of Science; Committee on Science, Engineering, and Public Policy; National Academy of Sciences; National Academy of Engineering; Institute of Medicine

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WHO GIVES BEST?

An Examination of the Grant and Contract Policies of Industry, Foundations, and Voluntary Organizations, and a Comparison with Federal Government Practices

A Background Paper Prepared by

AU1 Cedric L. Chernick

for

The Ad Hoc Committee on Government-University Relationships
in Support of Science

OR2

NAS Committee on Science, Engineering, and Public Policy

OR1

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National Academy of Engineering
Institute of Medicine

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Every restraint and requirement originates in somebody's demand for it.

Herbert Kaufman "Red Tape, its Origins, Uses, and Abuses" (The Brookings Institution, Washington,D.C., 1977), p.29.

INTRODUCTION

This paper will examine the existing relationships among universities, private foundations and voluntary organizations, as they relate to the provision of financial support for research and development in the sciences. Primary emphasis will be given to support for basic research. First, the nature of the relationships will be reviewed; then the expectations of the parties; then the terms and conditions pertaining to the use of the funds; then the reporting requirements; and, then, the audit experiences. Finally, these experiences will be compared with those encountered with federal funding sources. The information and opinions included in this paper are those of the author based on his experiences, reinforced with conversations with other individuals knowledgeable of prevailing circumstances. Where possible, reference will be made to published sources.

Both industry and foundations provide funds to universities in what might be termed a "philanthropic" mode. That is, they provide funds which are somewhat unrestricted as to their use and, in fact, at the discretion of the institution they may end up being used for the support of scientific research. This paper will, however, restrict itself to support which is akin to that obtained in the form of grants or contracts from the federal government for the funding of specific research and development endeavors.

For the purpose of clarity, the following definitions will be used for this paper:

"University" A not-for-profit institution of higher education which grants degrees and whose faculty are encouraged to conduct original research.

"Agency" A branch of the federal government which awards grants or contracts for the conduct of research and development.

"Sponsor" Any non-government organization which awards grants or contracts for the conduct of research and development. When used, "sponsor" will include, foundations, voluntary agencies, and industry.

"Foundation" A not-for-profit entity established as a mechanism for making grants for scientific, educational, religious, or charitable purposes. The donor(s) may suggest the general areas in which the funds are to be disbursed; the trustees, directors, or their equivalents have the final responsibility for actual grant approval. Foundations frequently have specific purposes which are either dictated by the terms of their creation, or which are determined from time to time by their governing bodies. Among their grants are those for assistance to universities to support of work which advances the purposes of the foundation.

"Voluntary Organizations" Those organizations which collect funds from the general public for the support of the organization's mission. The funding of research in universities, in the field of the organization's interest, is generally considered as one mission.

"Award" The transfer of funds for the support of research and development, by grant, contract, or other formal mechanism.

THE NATURE OF THE RELATIONSHIPS

Private Foundations.

In 1978 the Internal Revenue Service estimated that there were 28,000 entities registered to operate as private, grant-making foundations. Foundations come in a variety of types and sizes. In 1979, the last year for which data is available, the Foundation Center reported data on 3,363 of these foundations.[1] Of that group, only 1.7 percent had assets over $100 million and over 70 percent had assets under $5 million. The foundations not included in the data are undoubtedly almost all likely to be in the under $5 million category, and probably not very active in making grants for scientific R & D. There are four basic types of foundation: national (e.g. Ford, Rockefeller, MacArthur, Carnegie), special interest (e.g. Robert Woods Johnson [health], Joseph P. Kennedy [mental retardation]), corporate (e.g. Exxon, Amoco, Allstate, Xerox, General Motors), community (e.g. the Community Trusts of New York, Chicago, and Cleveland).

Analysis of the available data shows that universities and colleges received the largest percentage of the grant dollars of private foundations in 1979, about 36 percent of the total. There is clearly a symbiotic relationship between universities and foundations. This relationship should result in funding mechanisms which allow both parties to carry out their individual missions in a mutually supportive manner.

The interests of voluntary organizations tend to be "disease" or "organ" specific, such as the American Cancer Society or the American Heart Association. The voluntary agencies collect funds from the public primarily to advance the treatment and cure of diseases. In order to fulfill this part of their missions, the agencies sponsor basic research, usually in universities and their associated hospitals. Because the universities are, therefore, helping the agencies to carry out agency functions, both parties have an incentive to facilitate the transfer of funds to the institutions.

Industry.

Industrial support for scientific research in universities may, for convenience, be considered as that provided for the purchase of a specific expertise or service. However, the motives of industry in supporting university research are generally quite different from those of government agencies and other sponsors in the areas we have circumscribed for this study. Often, someone within the corporation has identified the need for a specific project to be done. The first step may be a determination as to whether the project could be done in-house, or whether it should be done outside. Sometimes, there is no choice available because of a desire for access to a specific, unique piece of equipment, or access to a particular faculty member, or because of a need to obtain unbiased data for licensing procedures. This last need, particularly in the later stages of drug testing, involves access to a patient population. Because of the size of population needed, because of the nature of the protocols, and because of the value of having doctors who are trained in making observations, drug companies rely heavily on teaching hospitals for these studies.

The nature of the university-industry relationship, therefore, tends to be much more one of a buyer and a seller. Except where the university has a unique facility or individual, industry does not have the same mutuality of interest in reaching agreement on terms and conditions for providing funds. While all of the sponsors can negotiate by suggesting they will take their work elsewhere, industry is the only one that can, in many cases, "threaten" to do the project itself if agreement is not reached. (In some isolated instances, the government can also do this, but nowhere near to the extent or as easily as industry can.)

The industry-university relationship also shows considerable variation depending on the positions taken by different universities. These can range from aggressively seeking to sell R & D services to industry, to regarding any ties with industry, other than when industry is operating in a philanthropic mode, with a sense of uneasiness over the university's ability to avoid compromising certain of its basic principles.

Even when not operating in a philanthropic mode, industry will occasionally support basic research in universities when it recognizes that the research is of a nature that could lead to fundamental knowledge which would benefit it. One interesting example of such support is that offered by the Pharmaceutical Manufacturers Association Foundation (PMFA). Voluntary contributions are collected from member companies and the income is used to support research and training in areas vital to the industry as a whole. Formed in 1965, the PMFA awarded over $1.1 million in grants in 1981.[2]

EXPECTATIONS OF THE PARTIES

Level of Support

The magnitude of the support for scientific R & D in universities from the various sectors is shown in the following table:

Table I

University Expenditures for Research & Development - By Source[3]
(Percentages)

Year	Federal	Industry	University	Other
1953	54.1	7.5	28.2	10.2
1960	62.7	6.2	23.0	8.0
1970	70.6	2.6	19.7	7.1
1980	67.7	3.9	21.7	6.7

The data for government support is given to provide information as to the relative amounts of support received from the various sources. While the levels of support indicate that the foundation and industrial support may be relatively small, those sources are, nevertheless, tremendously important. Various reasons can be put forward for the importance of these funding sources. Perhaps the main advantage is the fact that they represent an alternative to the federal government. They may be the only funding source for certain programs, because work is proposed in an area which is considered politically sensitive, or because work is proposed in an area which is outside the areas of interest of the federal agencies. Often, foundations are willing to take chances on projects which may or may not be successful, whereas federal agencies feel that they need "successes" to justify future congressional appropriations. Another reason is that non-federal agencies may be able to provide funds for needs which can't be reimbursed under government regulations; for example, certain kinds of foreign travel. The importance may come from the flexibility certain sponsors can provide in allowing the reprogramming funds to follow paths which may not have been identified, or even known, when the original proposal was submitted.

Identification of Sponsors & The Application Process

The processes whereby non-federal entities and universities identify mutual interests and reach agreement on the provision of R & D support to the universities are many and varied, ranging from the formal solicitation of proposals open to all, to informal invitations involving one-on-one action of representatives of

the parties involved. Generally, through program announcements or annual reports, universities can ascertain the fields of interests of sponsors.

As has already been suggested, industrial support of specific R & D projects is much more of a marketplace transaction. Because of a desire not to disclose their "secrets", industrial sponsors generally do not make public disclosures of the fields in which they are seeking to sponsor university research. While there may be occasions in which universitites bring unsolicited ideas to industry, based on a knowledge of the general areas in which the company has a position, the more usual course is for the initiative to come from the sponsor. One of the problems which exists with the initiative coming from the institution is lack of information as to who would be the appropriate industrial contact person. Where funds do come as a result of a university initiative, there is often an existing relationship between the university and the industrial sponsor. This relationship can be that of a faculty member being a consultant to the company, or a recent graduate may be working for the company, or a senior officer may be on a university committee or even on its board of trustees.

The more usual circumstance with industry is that it has identified, perhaps through the literature, or a presentation at a professional meeting, faculty who may be able and willing to undertake specific research of interest to the company. Other sources of information include recruiters who visit campuses, company representatives who visit campuses seeking patent opportunities, or the reverse side of the relationships cited in the previous paragraph. Occasionally, patent management firms and the like act as "brokers" in bringing together interested parties. There is a price that is paid for the secrecy. Industry has to rely on its ability to identify the appropriate sources to do its work, and sacrifices the opportunity to choose from among a variety of options which might be available in an open competition.

The fact that industry's prime concern is generally in having a piece of work completed and, in this mode, it is less concerned about the interests of the university, may create a problem. When considering the expectations of the parties, it may be difficult to identify the parties where the industrial grant for a specific piece of research results from an on-going consulting agreement between the sponsor and the investigator. In general, the parties are recognized as being the agency or sponsor on the one hand, and the university on the other hand. When the parties tend to become the individual faculty members and their industrial counterparts, an arrangement arises which may create a significant potential for a real or perceived conflict between the investigator's obligations to the institutiton and those to the industrial sponsor. The conflict could range from the use of institutional resources without authorization or reimbursement; the use of materials and services paid for by another sponsor; the failure to recover funds to cover the investigator's time, perhaps because the investigator already has a consulting agreement with the sponsor which pays for his or her time; or because the investigator has a financial interest in the company providing the research support. Although these situations have existed for many years and have been handled appropriately without elaborate rules and regulations, recent events have caused many institutions to reexamine their positions. The level of concern is such that the State of California Fair Political Practices Commission has recently extended to faculty at the University of California rules on conflict-of-interest which are similar to those which govern other state officials. Any university scientist who expects to receive research funds from a private company will have to disclose whether or not he or she has a financial interest in the firm. If the individual does have such an interest, an independent panel within the university will have to determine whether or not the funding can be accepted and, if it can be, under what cirumstances. Elsewhere, the recent resignation of a tenure appointment by a faculty member because of the potential

for conflict involving a relationship with a company in which the faculty member had an interest, may only be the first of such cases.

The voluntary organizations and the major foundations, which generally have professional administrative staff responsible for grants and contracts, tend to be more structured than industry in their processes. In part, the need for structure derives from the large volume of applications which they tend to receive, and the fact that their review processes may involve group meetings, and hence scheduling considerations. Even if the scientific review process does not introduce scheduling questions, the fact that Boards of Trustees (or Directors) have to approve awards, means that deadlines geared to their meeting dates are inevitable. Their application processes sometimes involve pre-application discussions or the submission of a short letter of inquiry, either of which might result in an invitation to submit a more complete application, or which might bring a polite but definite indication of disinterest! Although solicited applications tend to be the exception rather than the rule, some of the larger foundations and voluntary agencies do take the lead in trying to influence the research which is being done in certain areas, perhaps to open up a field which is not yet receiving federal support, or to try to mitigate the effects of sudden changes in federal programs. While solicited applications for specific research may be more usual in social science and social welfare programs, they are also encountered occasionally in engineering, and biological and physical sciences R & D programs.

The Review Process

When potential sponsors receive unsolicited proposals or multiple applications in response to solictations, decisions have to be made as to which applications will be funded. The most common and tested mechanism is the use of peer review, whereby experts in the field evaluate the proposals and rank order them in terms of scientific merit. For this process, the agency staff need not be experts in the fields of the applications, but need only be familiar enough with them to be able to assign them to the appropriate reviewers. In such a role, the staff can certainly influence the outcome of reviews by choice of reviewers, but they have a diminished influence on the final determination. The applicant can feel somewhat protected from arbitrary and capricious action by the fact that the work will be evaluated by peers. When the fund/no-fund decision is basically in the hands of one program officer, the applicant has the advantage that only one person has to be "sold" on the value ot the proposal, yet there is the disadvantage that one is relying on one person only and the application stands or falls on the action of one person who may dislike an application for non-technical reasons.

In industry, as has already been noted, the decision as to the exact nature of the work to be funded, and who will do it, is often made up front. Perhaps made by an individual scientist in the company, or by a group of scientists. To the extent that peer review ot proposals takes place it is generally by company staff, or by individuals who have appointments as consultants to the company.

TERMS AND CONDITIONS

Scope

After a general introduction, some of the more important terms and conditions which have been cause for concern will be highlighted in their order of importance. At one time or another, for one institution or another, there will have been single grant or contract clauses which may have caused more problems than those covered below, but the ones selected have been those most often encountered as causing difficulties.

The terms and conditions imposed by foundations were quite liberal prior to the passage of the 1969 Tax Act. That Act imposed on private foundations a need to be

somewhat more specific in telling grantees how to handle the funds they were to receive. The number of foundations, voluntary organizations, and industrial concerns supporting university R & D is well over one thousand, and the number of universities receiving such support approaches one thousand, although one hundred major research universities may well account for over 80 percent of the R & D support dollars received. Each grantor and grantee is attempting to negotiate the terms and conditions most favorable to itself. As a result there are innumerable different individual terms and conditions applicable to the funding of university R & D. The results of a survey of the grant award and administration policies, conducted in 1978, are included in Appendix A. While these results are neither current nor comprehensive, they do illustrate the wide range of positions taken by sponsors.

Freedom of Publication

From the institutional point of view perhaps the most difficult question to be faced is the one of freedom to publish. Except in times of war when the national interest was to be protected, universities have jealously guarded their right to disclose openly the results of any and all research done on their campuses. After all, the main purposes of universities in society are to discover, teach, and freely disseminate knowledge. Delays in disclosure of newly acquired knowledge to accommodate filing for patent protection, or to coordinate the integration of results of multi-institutional studies, have been accepted as long as there was a time certain after which the results could be published, whether or not the events for which the delay was requested had transpired. Acceptable delays are generally of the order of weeks or, at the most, months. The remaining terms which will be discussed have all resulted in compromises of one kind or another, but the basic tenet of freedom to publish is one that all institutions appear to regard as inviolate. A further problem regarding publication freedom arises when faculty have access to proprietary data which they are not at liberty to disclose to students or colleagues, or to use in publications. Particularly in situations in which materials are used in research where the investigator does not know the nature of the material, or may not disclose the nature of the material, the freedom to publish may be hollow, as few, if any, reputable journals would publish a study "on compound XY-123" or involving a "circuit enclosed in a black box."

Patent Rights

The question as to who should own the patent rights to work done on campus when external funds support the research or development effort is not a new one, although the potential size of royalties from biotechnology seem to have brought the matter to a sharper focus. Each institution develops its own policy and decides what it will and will not accept. Some schools are quite sophisticated and have in-house patent and licensing staff. Others rely on patent management companies and share with them a portion of the royalties and licensing fees. While the patent question does not seem to be a major question with non-profit sponsors it is with industry. The arrangements which are reached vary from industry insisting on rights to all patents, particularly if the company has a background position in the field, to arrangements in which the university holds the patent rights, but gives the sponsor the first right on a license which may be exclusive or nonexclusive. An interesting recent arrangement is one where the sponsor has the rights, but the university has march-in rights if the sponsor does not develop the patented items in a reasonable time period. At least one voluntary agency of some size has a rather strict patent policy; grantees are expected to assign patents to the agency, with the inventor receiving a nonexclusive, irrevocable, royalty-free assignable license.

Indirect Costs

Perhaps the matter of indirect costs and whether or not they will be paid at the full rate is one that creates most problems within the academy. (The "full rate" means the indirect cost rate negotiated with the federal government for use with awards made by its agencies. The rate is negotiated based on cost principles set forth in Office of Management and Budget Circular A-21.)[4] While faculty feel that in matters relating to freedom of dissemination of results and patents their interests and those of the institution are coincidental, for many the feeling is that in attempting to recover appropriate indirect costs the institution is diverting funds that would otherwise go to the support of their research. This is not the place to attempt to explain the intricacies of how indirect costs are calculated. Suffice to say that such costs are real, that government regulations require that they be allocated to all institutional activities regardless of the source of funds, and that anytime an institution accepts funding for a program and does not recover the full indirect costs, it is sharing from its own funds the amount of the foregone indirect costs. Many faculty regard this as bookkeeping sleight-of-hand. It is not. Real dollars are involved, and universities should consider budgeting for this cost sharing so that the actual amount is known and conscious decisions are made concerning what is an acceptable level for it, and which areas of the institution are receiving this "hidden" addition to their budgets.

It is somewhat surprising that in some instances industrial sponsors have been known to question the need for institutions to recover their full costs when performing sponsored research. This posture may lie in the attitude that what industry is buying is essentially an agreed upon service for a fixed price. While an institution is not generally expected to use its own funds to complete a piece of research if the funds made available by the industrial sponsor are insufficient, the institution sometimes is not expected to return excess funds if the sponsor's needs have been satisfactorily met by the expenditure of less than the agreed upon amount. Very often, industrial representatives enter into negotiations knowing how much they wish to spend to get a job done, and they may show very little interest in the fine points of the budget. If the work can be done for the anticipated cost, and that amount allows the institution to recover full indirect costs, there may be no problem. If the price, including full indirect cost recovery is too high, then the option may be to reduce the indirect cost or have the work taken to an institution which either has a lower rate or is willing to compromise. Institutions vary in their positions with respect to indirect cost recovery from industry, and the nature of the arrangements into which they will enter. Some schools prefer to enter into agreements whereby they are reimbursed for the costs they incur and, if they received any advanced payment, to return any funds not utilized in completing the project. Under agreements of this type full direct and indirect cost recovery seems reasonable. Other institutions may make a trade-off which involves the equity in patent rights as a consideration in determining an appropriate indirect cost rate.

While all organizations which sponsor research, and all awardees, want to maximize the effectiveness of the limited funds they have available to them, foundations and voluntary organizations seem to be particularly concerned with this objective. The feeling is that the institutions are approaching them for support of a project which the institution wants to do, and they are merely providing some level of assistance. Many of them take the attitude that indirect cost would be incurred by institutions anyway and, therefore, they see no reason why they should contribute toward paying them. Some will agree to pay what they consider the incremen-

tal costs the university incurs by having their project on campus, but incremental costs are hard to determine. Who is to say which project required the hiring of extra support staff, or increasing computer capacity? There is a long history of discussion and negotiation with the federal government which has resulted in what is considered to be a reasonably equitable way of apportioning indirect costs among functions, including those supporting R & D. Certain sponsors, for their own reasons, choose not to use the accepted practice. One institutions experience covering 59 private foundations and voluntary agencies reveals the following:

IDC Rate (per cent of total costs)	Percent Using Rate
0	42
10 or less	36
20 Or less	20
More than 20	2

In noting these rates, it should be realized that the average federal rate for the top one hundred institutions, in terms of level of support, is over 47 per cent of total costs.

Work Scope and Budget

Here again the variety of options and experiences makes it difficult to offer any generalizations. Industry clearly has the most restraints with respect to work scope, which is not surprising in view of the previously stated buyer-seller relationship. On the other hand, industry seems to be the least concerned about rebudgeting, once the "bottom line" dollar amount is agreed. The experience with foundations and voluntary agencies runs the gamut from total freedom with respect to both work scope and budget, to constraints which make some costs totally unallowable. Examples of some unallowable costs are: construction, building alteration and renovation, books and journals, academic year salaries for faculty, and indirect costs. Other typical constraints may be that up to 10 percent of any line item may be rebudgeted, without prior approval, or that items such as foreign travel or major equipment purchases must be approved in advance. While there is more flexibility with respect to scope of work, it is generally expected that any "substantive" change in work scope will either be submitted for prior approval or, at least, that the sponsor will be advised of the change.

Reporting

All sponsors require that reports of the results of the work that they support be submitted. In some instances submission of publications which arise from the work is sufficient to satisfy this reporting requirement. In multi-year funding arrangements the submission of interim reports may be required, and subsequent funds may only be released after such reports have been submitted. Principal investigators occasionally have difficulty in generating enough enthusiasm for preparing the reports, as there may be little overt evidence that they serve any valuable purpose. Lack of any kind of scientific feedback from the sponsor often creates the impression that receipt of the report is merely a technicality required to close the grant file.

While financial reports are always required by other sponsors, they are not always required by industry. The difference may be whether the award is on a cost-reimbursement basis, or in the nature of a fixed-price arrangement. There is some evidence that financial reports are studied, as questions will be raised concerning expenditures which do not conform to the sponsor's policies. Also, sponsors may require that unspent funds be handled in a specific manner. In some

cases the funds must be returned, in others the award period may be extended to permit the funds to be expended for the original purpose, or the grantor may allow the funds to be used in furtherance of the general purpose for which the funds were awarded.

In the case of private foundations the reporting requirements are generally based on the 1969 Tax Act, which requires that the awarded funds be spent for the purpose for which they were awarded and that they not be spent for influencing legislation or intervention in political campaigns. In fact, the Act requires that the grantor establish procedures "...to obtain full and complete reports from the grantee on how the funds are spent...."

Audit Experience

While non-federal sponsors seem to have no published requirements relating to audit, some do "reserve the right to inspect the financial records relating to grant expenditures." Extended discussions with representatives of both grantors and grantees reveal that on-site audits rarely occur. Two kinds of audit activity may be visible to the grantee. As already stated, audits may be conducted of expenditure reports to insure that funds have been spent in accordance with the approved budget, or within the flexibility granted by the award terms and conditions. The other type will be an inquiry from the public accounting firm, auditing the grantor, asking to verify the amounts awarded and paid as of the close of the grantor's fiscal year. The author's inquiries at institutions, which involved individuals with over a hundred person-years of experience, suggest that there have not been any detailed audits of project-support grants for research. The few audits that have occurred have been to verify that a matching grant has been earned, or have involved major construction projects.

The concensus appears to be that audits of university expenditures by sponsors are just not cost-beneficial. All institutions have annual audits conducted by either a public accounting firm, or by the state, or by both. Despite the fact that universities rely primarily on outside support for their R & D activities, these activities account for a small proportion of their total expenditures. For the universities in the U. S. (and here the term university does not include four-year colleges) research expenditures average a little less than 20 percent of their total expenditures.[5] Thus, the universities' own funds form by far the largest fraction of the monies that could be misused. Universities establish internal procedures to safeguard funds and to monitor for the allowability of expenditures within their own rules. In many areas sponsors do not specify particular terms and conditions with respect to allowability of costs, rather they ask that their funds be treated according to the institution's own practices. Non-government funding sources rely on the integrity of the universities' own systems to protect their funds. This is undoubtedly one of the reasons for grants being made to institutions, rather than to individual faculty members.

Other Conditions

The two other conditions which have caused some problems relate to ownership of equipment purchased wholly, or in part, with outside funds, and reimbursement for time spent on sponsored research during the academic year by faculty.

The matter of ownership of equipment is generally resolved by agreement that the title to the equipment rests with the institution, but that it is expected that if the investigator is permitted by the sponsor to transfer the award to another institution, then the equipment bought under that award may also be transferred. An internal institutional problem often occurs when the faculty member changes

institution after the award period is over, and wishes to take along equipment purchased under the award. Technically, the equipment does belong to the institution, and there is no legal obligation to permit it to be taken. In practice, what happens may well depend on whether or not the institution is going to continue the program or has other continuing use for the equipment in question. One solution which has merit is for the two universities involved to agree on a price for the sale of the equipment. In some cases, the disposition of equipment in this way may not be straightforward, as the equipment may be regarded as state property, or the disposition of university assets may require the approval of its governing body.

Certain grantors feel that universities by appointing faculty undertake the obligation to pay their academic year salaries. As has been indicated previously, they also feel that they are helping to provide funds for something the university wants to do anyway. Under these circumstances they see no obligation to pay academic year salaries. However, in many institutions the faculty are committed to rendering a specified amount of non-research service to the institution. The only way they can reduce the amount of this service is to have an outside sponsor reimburse the university for additional time spent on research, this is usually known as "released" time. When sponsors will not pay for released time, universities have to make their own determinations as to whether or not they will accept support under these conditions and release the faculty invoved from their institutional obligations in order to carry out the research.

As was implied at the beginning of this section, there are many terms and conditions, other than those cited above, which constrain the use of award funds. These would include such things as limiting travel, requiring prior approval for purchases of equipment costing more than a certain amount, restricting the use of consultants, and the like. However, unlike those cited above, the others generally fall into the category of being annoying or inconvenient, and will not be considered further in this paper.

COMPARISONS WITH THE FEDERAL PROCESS

Scope

Following the order used in the previous sections, the relationships with non-federal sponsors will be compared with those extant in the university-government relationship.

At this point it might be as well to consider the motives of the various groups which fund academic R & D. The federal government has a mandate to support and encourage the conduct of broad scientific and technological training and research to advance the interests of the country as a whole. A recent report from the U. S. General Accounting Office[5] states that science and technology "...require substantial attention from the national Government of a country that is as scientifically and technologically sophisticated as the United States." There appears to be general agreement among the branches of government about the fact that the major role in the support of basic R & D will continue to rest with the federal government. The differences of opinion relate to the size of the government role

Non-government sponsors have no such broad mandate, each having its own particular area or areas of interest. The fact that the private sector may offer an alternative to the government for any given project is primarily due to the large number of sponsors, rather than any broad interest on the part of any one of them.

Level of Support

The levels for both government and other support sources have already been given. Clearly, in total dollars the government support far outweighs any other source, and the health of the university R & D establishment is dependent on the government support level. Few university research groups exist solely on non-federal funds, many exist solely on federal funds. Investigators are primarily looking for long-term, steady levels of support. Federal funds usually provide the underpinnings for their research groups because, at least in the past, there is generally some guarantee of a fixed period of support, with every expectation that the support will be renewed if there is evidence of satisfactory progress. Support from non-federal sources is frequently of a one-shot nature and, thus, is used as a supplement for the federal "base", rather than as the main support for a research group.

Identification of Sponsors

As tax funds are involved, the federal agencies are much more open in their publicizing the availability of funds, and the areas in which funds will be made available. Information on grant possibilities may be obtained from general brochures and individual program announcements published by the agencies, from the Catalog of Federal Domestic Assistance,[6] from agency annual reports, from budget proposals to Congress, and from informal contacts with agency staff. The government also solicits proposals for specific research which it wishes to have done. When there is a specific request of this type, the funding is usually provided in the form of a contract rather than a grant, with an identified, deliverable product. Information concerning such opportunities is usually made available in the form of a Request for Proposal (RFP). Universities make their interests known to agencies and are placed on bidders' lists, from which they receive RFP's which may be of interest. The publication Commerce Business Daily[7] carries lists of RFP's, as do a variety of commercially produced publications and services. This openness makes dealing with the government much easier than dealing with any other sponsor, as far as identification of opportunity is concerned.

The Application Process

Again, dealing with the federal agencies is much more of a regularized process than dealing with most other potential sponsors. The mechanics of the application process are well-defined. There is little or no problem in ascertaining what to submit, to whom, and when. Many agencies have available application kits which contain instructions and all of the forms necessary for the submission of an application. Often, anouncements and brochures provide the names of agency officials responsible for given programs and agency telephone directories and organization charts are publicly available.

The Review Process

Peer review is used by many of the agencies, although the nature of the review process may differ. The National Institutes of Health, for example, use formally appointed committees which make the initial determination as to the scientific merit of an application. These groups meet regularly and discuss the merits of the various applications assigned to them. The names of the members of these committees are publicly available. If the proposal is in a given scientific area, then the applicant will have a good chance of knowing in advance which committee will review the application. Shortly after the application is received by NIH, the applicant is informed of the committee to which the application has been assigned. Some agencies do not use panels which convene regularly, but may send applications to ad hoc reviewers chosen by agency program staff. The names of

these reviewers are not generally known to the applicant. By judicious choice of reviewers, program staff could influence the outcome of the review. However, if this is done it is not a widespread practice, judging from the few public complaints heard.

Some non-federal sponsors also use forms of peer review. One drawback is that it can be a time-consuming process. Applicants are informed of the results of their applications anywhere from six months to a year after they are submitted. However, despite many studies and hearings, peer review is still regarded as the most appropriate way to handle the evaluation of applications. Surprisingly, the cost to the agency or sponsor is not as large as might be thought. For NIH the cost is a little less than 0.5 percent of the total expended on NIH Research and Training grants.[8] (It might be worth noting that the low cost is due in no small part to the willingness of reviewers to provide their services for a fee of $100 per meeting day, a fee which has been unchanged for over 10 years, and which is far less than the reviewers would normally receive for a day of such work. Of course, the time spent in actual meetings is only a fraction of the time needed to review proposals. Even with limits on the numbers of pages in a proposal, a conscientious reviewer will spend many hours studying perhaps as many as 30 applications for any given meeting.)

The recent report of the National Commission on Research which concerned itself with the review process provides an excellent overview for those desiring further information.[9]

Terms and Conditions

General The federal government deals with institutions in a much more bureaucratic way than any other sponsor. While it may have taken its original model from the experience of foundations, it has built onto the base all kinds of restrictions. It must be admitted that some of these were attempts to forestall the repetition of identified abuses. However, abuses identified at a small number of places have resulted in the imposition of across-the-board restrictions. Anyone involved in the administration of federal awards finds a plethora of regulations with which it is necessary to become familiar. At the generic level there are several Circulars issued by the Office of Management and Budget which regulate all federal awards, then each separate agency will have its own policy and procedures manual, and, often, individual programs will also have their own rules. While some of the variations among agencies arise from the legislation which authorizes a program or which appropriates funds for it, many of the differences arise from agency interpretations of legislation. For example, some agencies will accept a blanket assurance that the applicant institution is in compliance with certain regulations, while others require that an assurance be submitted with each application for funds. At large research universities special staff are assigned to keep up with the miriad of changes and proposed changes published daily in the Federal Register. Commercial publications abound to assist administrators in keeping up to date. Besides the direct regulations, there are those which are the result of legislation to achieve social goals, but which impinge on universities by virtue of their accepting federal funds -- affirmative action, occupational health and safety rules, age discrimination, unemployment compensation -- to name a few.

The fact that the major research universities receive almost three-quarters of their research support from the federal government has special significance. It means that their attitudes toward the terms and conditions under which they accep grants and contracts tend to be molded by the federal experience. True, there ar

government clauses which are compromises and which would not be accepted if one had the choice, but these kinds of clauses are "acceptable" if the choice is otherwise to forego the award. In dealing with other sponsors a good negotiator while attempting to secure the most advantageous terms will, nevertheless, use what has been accepted from the government as a fall-back position. Similarly, accounting systems, purchasing systems, travel policies, and the like are geared to dealing with the large volume of federal business. While having all support conform to the same rules and regulations would be of considerable administrative convenience, universities would not accept standardization if it removed current flexibilities. The fact that "private" money allows deviations from standard federal, or even state, regulations is often one of its most valuable properties.

Although the government may have multifarious reasons for funding university programs, the money often comes in restricted packages which require the separation of expenditures for things which cannnot logically be separated. For example, faculty may be asked to differentiate between effort expended on teaching and that expended on research, when the two are contemporaneous. Often the rules and regulations are more concerned with form rather than with substance, or are more appropriate to procurement in a commercial environment. The one positive note is that, by and large, the same rules and regulations apply to all government support. Individually, and collectively through Washington-based associations, universities over the years have negotiated terms and conditions for support which are felt to be consistent with academic freedom and insitutional autonomy.

Freedom of Publication By and large, and after long years of negotiation, the government has recognized and respected the universities' position with respect to the open dissemination of the results of work done on campuses. In these matters the universities are not being obstructionist. To give up the right to open dissemination of the results of work done on campus would be to deny one of the basic reasons for a university's existence. If work needs to be done which must be done in secret, then it should be done outside the university setting. The recent concerns in areas of cryptographic research and a possible movement toward stricter interpretation of the Arms Control Export Act, which could require prior agency approval for the release of unclassified information which might have military significance, have prompted the National Academy of Sciences to review the whole question of free exchange of scientific information. The fact that the recent increases in funds for scientific R & D are in the budgets of the defense agencies lends an urgency to the resolution of this matter.

Patent Rights The government position with respect to patent rights has been clarified and modified by the passage of the Patent and Trademark Amendments Act of 1980, Public Law 96-517, also known as the Bayh-Dole Bill. After considerable effort on the part of institutional representatives, the government agreed that universities would retain patent and licensing rights to inventions made during the course of federally sponsored R & D. There are certain minor limitations and exceptions, but basically the Act provides arrangements which the universities would find acceptable from all sponsors.

Indirect Costs With respect to research support programs, at least for the past 15 years, the government has generally been willing to pay the full indirect cost. In this respect the difference from other sponsors is beneficial. (The current NIH proposal to pay only 90 per cent of the negotiated rate is an ominous sign.) One might make the case that the government should not be discriminated against and that, if the institutions are willing to accept less than the full rate from some sponsors, they should do so from all. On the other hand, one of the largest

single components of the indirect cost rates is the departmental administration category, which accounts for about 30 per cent of the total. It is this category which includes a large part of the cost of compliance with the federal rules and regulations as they apply to grant management, including the cost of complying with some of the rules designed to achieve the governments social goals. It is not surprising if the universities feel put upon when they are criticized by Congress because indirect costs are so high, since one reason for the high rates is compliance with Congressionally mandated rules in such areas as environmental protection, occupational health and safety, equal employment opportunity, animal welfare, and the like. Personnel costs are also inflated because of regulations pertaining to Social Security benefits, unemployment compensation,and the raising of the retiremnt age. It is interesting that one does not find the same Congressional concern over the substantially higher indirect cost rates charged by industrial contractors. Not only are they paid full costs, they also receive additional sums for independent R & D -- funds provided, ostensibly to allow companies to maintain their R & D capabilities.

Work Scope and Budget The federal government fits into the pattern of other sponsors in that in some instances work scopes may be changed without prior approval, and in some instances they may not. Budget changes are a somewhat different matter. Government-wide regulations may require the agency to approve all, or some, budget changes in advance. Certain agencies have alleviated the delays such prior approval requirements may cause by delegating approval authority to universities. Universities must meet certain criteria and establish certain procedures before they can obtain prior approval authority, but the approach appears to have had advantages for all parties.

Reporting The federal requirements for substantive and fiscal reports parallel the most stringent ones of other sponsors. Regular reports are required during the course of the work, and after its conclusion. Under some federal contracts the reporting requirements become onerous. Presumably, regular reports are necessary when there is the possibility, under a cost-reimbursement contract, that the specified work will not be completed on time, or within cost, or both. However, the frequency of reports required under some contracts suggest that the sponsoring agency wishes to micromanage the project.

Audit The biggest difference between federal and non-federal support is evident in the matter of audit. Each university is assigned a federal agency as its cognizant auditor. For most universities this is the Department of Health and Human Services. The cognizant audit agency is responsible for the audit of direct cost expenditures and the audit and negotiation of indirect cost rates. The extent of the audit is such that some institutions have full-time federal auditors resident on their campuses. Each year's direct costs are subject to audit, although the audits may not be conducted each year, and books may have to remain open for two, three, or more years. Although standard sampling techniques are used, an audit of an institution with annual direct cost expenditures of around $30 million may take several person-weeks of effort from the federal auditors and a like amount of time from the institution's own staff. Considering the fact that institutions spend annually about $4.6 billion of federal funds on R & D, the amounts actually recovered by such audits hardly justify the cost. Many of the identified costs which auditors recommend for disallowance each year are actually costs which have been expended for the funded projects but for which the record keeping is technically defective.

In the case of contracts, as opposed to grants, a fraction of the payment due from the federal government may be withheld, pending an audit of expenditures at the completion of the project.

It should be recognized that very few instances of misuse of federal funds resulting in personal benefit to investigators have been uncovered. While there may be cases where institutions have benefited from improper record keeping, the monies have not benefited employees or stockholders, they have been used for legitimate university R & D purposes. The argument could be made that it is the deterrent effect of the audits which minimizes the amounts identified as being improperly expended. This deterrence could be achieved by random choice of universities for audit, for example, which would significantly reduce the cost. As has been pointed out, the non-federal sponsors manage to rely on the internal controls of each university to safeguard their funds. There is some evidence that the federal government is moving in a direction to reduce its auditing of university expenditures and concentrate its efforts on entitlement programs where the opportunity for misuse of funds is greater. Rather than being audited by federal auditors, the universities would be required to arrange for an audit of their expenditures by an outside party. While universities are generally grateful for the opportunity to reduce the number of audits, by having their state auditors or chartered accountants also conduct an audit for the government, there is some apprehension as to the specifications the government will set forth for the scope of such audits. If a for-profit audit firm does an audit of the scope of the current federal audits, then the cost is likely to be much higher than the cost of a similar audit done by federal auditors. If the scope can be tailored to be integrated with the annual audits presently done for universities then there should be overall cost savings. Either way, the costs of the audits will be transferred from the government to the universities. While the universities will be able to include the audit costs in their indirect cost calculations, the fact that full indirect costs are rarely recovered means the universities will have to bear part of the burden of the audit costs. The increased indirect cost rates, brought about by government fiat, will cause further criticisms of the universities for their "inflated" indirect cost rates!

In the matter of indirect cost rates the necessity for audit is more evident. Despite efforts to codify the accounting rules through OMB Circular A-21, there are still enough areas open to varying interpretations that negotiation of what is acceptable and what is not acceptable have to take place. The exposure that institutions seem to face is that methods of accounting for costs which are accepted one year by one auditor may not be accepted in a future year, even without a change in the ground rules or in the individual doing the audit. A proposal has been made for a reversion to the method whereby a standard indirect cost rate is established for all universities. While this proposal has some attractive features, it does not take into account the substantial differences among universities. These differences involve such matters as whether the university is public or private, the ratio of research effort to teaching effort, the ratio of high-cost to low-cost research, (some research involves laboratories with energy-devouring equipment while other work needs only paper and pencil), geographic location, age of buildings, and type of energy used for heating and cooling. Despite these differences, the proposal warrants more attention than it is currently receiving. Perhaps, as with individual income taxes, some standard rates, which allow for the cited differences, could be developed and offered as an option to those universities which would prefer not to face the uncertainty and cost of annual negotiations. However, care would have to be taken to protect those universities which choose to use a negotiated rate. Agency program officers

have been known to persuade faculty that their universities were compromising their chances of being funded by asking for reimbursements for costs which were legitimately allowable, but which the program officer felt were inappropriate.

However, even in the area of indirect costs there are built-in safeguards against institutional manipulation. As has been stated, indirect costs are allocated among all university activities. For the general categories this results in allocations to the government which may average about 20 cents on the dollar. In these times of tight budgets there is little advantage to a university to load an extra dollar onto indirect costs when it can only recover 20 cents. In fact, the universities have a clear incentive is to reduce indirect costs wherever possible.

Cost Sharing While private sources may not be willing to pay the full cost of a program, they do not add to the cost by requiring that records be kept to attest to the fact that the university is sharing in the cost. The government does require the maintenance of such records to document a minimum level of cost-sharing, generally about one per cent. Considering the fact that universities themselves account for about 20 per cent of their total annual R & D expenditures, the documentation of a one per cent sharing on the federal expenditures would appear to be nothing more than a waste of time and effort which the research establishment can ill afford.

NEW RELATIONSHIPS WITH INDUSTRY

Recent research advances made in the biological sciences in universities have had an enormous impact on the university/industry interface. Industry suddenly found the universities possessing a technology with significant potential for application in ventures likely to be highly profitable in a relatively short space of time. Meanwhile, industry itself had neither the know-how nor the trained staff to exploit the opportunities presented. Some university faculty decided to exploit the technology by forming their own companies, and some entered into joint ventures with established companies. Some companies determined that what could happen once could happen again and decided to prepare by finding faculty who might be supported, and who might also train their own staff. As a result of these developments, a series of new types of university/industry connections have been forged. This paper will not attempt to produce an exhaustive list of such arrangements --- the list would be out of date before it was printed, things are moving so fast--- but an attempt will be made to document the range of relationships.

Some words of caution are in order. First, university/industry relationships have existed for many years, in field such as agriculture, mining, electronics, computing, and health sciences. Second, although the kinds of arrangements to be described are highly visible, only a limited number of schools are currently involved. Third, most of the arrangements are characterized by the fact that funds are given for the support of the work of identified individuals. Finally, although the dollar amounts may seem, at first sight, to be high, they still represent only a small percentage of the total university R & D expenditures.

Table II highlights some of the arrangements which universities have entered into with industrial sponsors. This table does not include the centers and cooperative programs resulting from the support received from the NSF University/Industry programs(q.v.).

Table II
Recent University-Industry Major Agreements

Participants	Year	Amount (millions)	Period (years)	Field	Conditions of Interest
Harvard/Monsanto	1974	$23	12	Basic cell research related to tumors	Monsanto receives patent rights.
MIT/Exxon	1980	$8	10	Combustion	MIT holds patents, Exxon receives royalty-free, non-exclusive licenses.
Mass.General Hosp. (Harvard Med.)/ Hoechst A. G.[16]	1981	$50-70	10	Molecular Biology	Hoechst gets exclusive, world-wide licenses.
Harvard Med.School/ E. I. du Pont de Nemours	1981	$6	5	Department of Genetics	Other sponsors may fund projects in the dept. du Pont gets licenses for arising from work it has supported.
Washington Univ./ Mallinkrodt	1981	$3.9	3	Hybridomas	As cell-lines may not be patentable, hybridomas developed will be withheld from Mallinkrodt's competitors.
Rockefeller Univ./ Monsanto	1982	$4	5	Plant Molecular Bio.	Monsanto gets patent rights, but Rockefeller has march-in rights if patents not being developed in reasonable time.
Washington Univ./ Monsanto	1982	$23.5	5	Proteins & peptides which regulate cell functions	Joint Washington/ Monsanto advisory group selects projects from proposals submitted by faculty-at-large. Monsanto receives option of exclusive licenses.
Yale/Celanese	1982	$1.1	3	Structure & function of enzymes and the genes that direct their synthesis.	Celanese has option for exclusive licenses. Budget includes $50,000 per year for a "research opportunities fund."

Of the companies set up with faculty participation perhaps the outstanding example is Genentech, a company founded to explore the commercial possibilities of gene splicing. Founded in 1976 as a partnership between two individuals, each of whom put up $500, when the company went public in October 1980 its market value at the close of the first day of trading in the stock was $529 million. At that time it did not even have a product on the market! This example, while not typical is also not unique. The stakes are clearly high in biotechnology, and there are many willing to take the risks.

Another instance of a new form of support is the Whitehead Institute for Biomedical Research. In this instance the funds come from an individual donor, but some of the problems raised would exist no matter what the funding source was, and it is, therefore, appropriate for mention to be made here. Associated with MIT, and headed by one of its faculty, the Whitehead Institute will have a staff of about 200. Its senior research staff will have joint Whithead-MIT appointments, and they will teach and direct graduate students, as well as doing Institute research. The Institute will focus its attention on developmental biology, pursuing basic research on the processes of cell fertilization, division, and differentiation. The relationship has all the classical problems to face --- conflict-of-interest for staff, outside influence over faculty appointments, ownership and licensing of patents, and the effect on faculty morale in general when a class of faculty appears to have "superstar" status. The academic world will watch with critical interest how these difficulties are handled. If an acceptable model is found, others may want to follow suit --- if they can find a donor willing to put up something approaching the $125 million Whitehead promised!

At Stanford University another experiment in university-industry interaction is taking shape. That is the establishment of the Center for Integrated Systems. The construction of a building to house the Center is being funded by 17 microelectronic firms who are putting up $12 million. A unique part of this arrangement is that the sponsoring companies will be permitted to have members of their own staff on site full-time. Thus, the companies will have access to graduate students and the latest faculty research. It will be interesting to see how the collaborative effort works when it involves competitors.

A somewhat more neutral cooperation among companies in one industry is represented by the Council for Chemical Research. The Council was incorporated in December 1980 with the expressed purpose of improving the "...common purpose and bond between the industries and research universities." The Council has both academic and industrial members. It is mentioned here because one of its functions is to "...promote and support new, significant and continuing sources of funding for research universities in order to enhance basic research....in the chemical sciences and engineering." One of the funding mechanisms initiated is a voluntary contribution formula for industry based on the numbers of BS/MS and PhD chemists and chemical engineers employed. Universities, in turn, will receive grants based on the number of like graduates in like fields.

Both universities and industry are sharpening their focus on the part that each can play in enhancing their interaction for mutual benefit. Now, more than at any other time, experiments are being conducted aimed at devising new mechanisms for these relationships, mechanisms that try to take into account the unique qualities that each partner can bring to the relationship.

At the same time, it should be recognized that both the federal and local governments can benefit from enhanced industry/university relationships. This

fact has not been lost on the federal government. Through the National Science Foundation, Industry/University Cooperative Research Program, established in 1978, the government has sought to encourage collaborations between university and industrial researchers. The university cost of the collaborative projects has been borne mainly through grants from NSF, while industry received the "encoragement" of grants which covered up to 50 percent of its costs. It is noteworthy that these arrangements pre-dated the interest stirred up by the biotechnology advances. Under the same general program NSF has also established specialized research centers involving industry. The centers cover such diverse fields as polymer processing, robotics, welding sciences, and computer-aided graphics. The total annual NSF support for these Programs has been around $5 million.

The Economic Recovery Tax Act of 1981 (Public Law 97-34) includes certain tax incentives to promote increased industrial R & D expenditures. While the main features would seem to favor the work being done in-house (only 65% of contracted-out costs qualify toward the expense level), there is a generous charitable deduction allowed for the donation of new equipment to universities.

At the state level, actions in North Carolina, Oregon, and California, among others, have demonstrated that legislators understand that science and technology are crucial to the economic well-being of their regions.

SUMMARY

An attempt has been made to detail the types of relationships which exist among universities, as grantees, on the one hand, and industry, foundations, and voluntary organizations, as grantors, on the other hand. The reasons for these relationships and how they come into being have been explored. The levels of funding have been given, and the ways in which funds are solicited and awarded have been described. Attention has been drawn to the rules and regulations which govern the use of funds once awarded, and the difficulties which may be encountered in safeguarding the interests of all parties. These relationships have been contrasted with the relationship which exists between universities and the federal government. Finally, some of the newest industry-university arrangemnents have been described.

Perhaps one final word of caution is in order. The paper has dealt primarily with the funding of specific, relatively well-defined research projects. The new industrial relationships may be providing broader forms of support, and the federal government has supported centers within universities for many years. While the federal centers represent a small fraction of the total R & D support, and many of the usual expenditure restrictions still apply they, nevertheless, do often allow considerable flexibility in the work scope of the center, and could serve as a model for alternate funding mechanisms.

In the main body of this paper the author has tried to provide factual material, any biases which have crept in by his choice of material to present are unintended. What follows are purely personal opinions and the reader who chooses to continue should be guided by this warning!

SOME THOUGHTS AND AFTERTHOUGHTS

Universities were founded as centers for teaching and the advancement of knowledge. Research is their lifeblood and contributes substantially to creating the intellectual atmosphere of the campus. However, particularly in the physical and biological sciences, and engineering, the cost of conducting most kinds of research has grown far beyond the abilities of universities to provide the necessary monies from their own resources. The experience of World War II, which introduced government to large-scale expenditures in support of scientific R & D, led to the government becoming the senior patron of university research. The universities were ready to accept the largess and grew to accommodate the generosity of the government. In fact, over the years, the universities grew to the point that now most of the large research universities would face serious financial problems were government support of research to terminate or be drastically reduced.

Non-federal support of scientific R & D has remained as a more or less constant fraction of the total university R & D expenditure and, despite government efforts to encourage increases, the level will hardly change significantly. Private foundations are mainly funded with "old" money and the size of their endowments is fairly stable. As of the end of 1979 the Foundation Center had data on the dates of the establishment of 3,323 foundations. Of these, over 92 percent had been founded before 1970 and almost 95 percent of those with assets over $100 million were founded before 1960. With inflation continually erroding the earning power of their assets, it is unrealistic to look to foundations for increased R & D support, unless they either alter their interests to give a larger fraction of their grants for this purpose, or they disburse their endowments. To increase current giving by utilizing principal would be foolhardy and contrary to the long-term interests of both the foundations and their grantees.

While industry might in its own self-interest provide some increase in the amount it spends "purchasing" R & D from universities, a 100 percent increase in industrial support would barely cover a 10 percent cut in federal support. If only basic research is considered the picture is more bleak. It would take a 200 percent increase in the level of industrial support to cover a 10 percent decrease in federal support. Clearly, then, the support of university research -- particularly of basic research -- will continue to be a government function.

At this point a slight digression is in order to offer strong support for the recent plea made by Allen Bromley, who was President of the American Association for the Advancement of Science at the time, a plea that funding level for research be separated from those for development. The manner in which development overshadows reseach and even how applied research overshadows basic research can be noted from the following tables, which use estimated data for 1981:

Table III

Type of Expenditure	Percent of Total
All R & D	100
All research	34.8
Basic research	12.7
Applied research	22.1
Development	65.2

Table IV
Distribution of University R & D Expenditures
(dollars in millions)

	Total	Spent by Universities	Universities as percent of total
All R & D	69,065	6,300	9.1
All Research	24,062	5,975	24.8
Basic Research	8,772	4,300	49.0
Applied Research	15,290	1,675	11.0
Development	45,003	325	0.7

In fact, although the dividing line is a fuzzy one, it is clear from the tables that the interest of the universitites is best served not only by separating research from development, but also by separating basic research from applied research.

Recognizing that the support of university research is primarily a function of the government leads to the question "how healthy is the relationship?" Of course, that is the fundamental question being investigated by the Academy. It is a question that is continually being studied from a variety of viewpoints. However, each examination appears to start with the assumption that the basic relationship is valid, and recommendations are for slight adjustments or minor changes. This attitude may be correct, perhaps those doing the studies have examined and rejected more radical changes, perhaps they have recognized the political problems inherent in sweeping changes of the ways in which universities do business with the government. One might question whether it may not be time to ask the question, "If the government is going to invest some $4 billion dollars a year in university research how can these funds best be used?" Clearly, there are some funds which have to be spent to achieve the missions of agencies or specific congressional mandates. However, apart from these funds, there are considerable sums available with some flexibility as to how they are to be used. Considering what is at stake, the scientific community appears to have minimal input into the distribution of funds among fields or among agencies. Budgets seem to grow at more or less the pace necessary to maintain the status quo. Perhaps the workings of the High Energy Physics Advisory Panel of the Department of Energy would serve as a good example of a mechanism which would permit more input by scientists. Possibly some amount of each agencies budget could be set aside for block grants to universities to be used for the support of research, with the size of such grants based on past performance. These grants could be made to departments within an institution, or made to an institution for support of work in a particular field --- a form of revenue sharing.

One of the problems which we currently face is how to encourage the best of our college graduates to undertake academic careers in basic scinces. Maybe it is time to admit that while everyone must be afforded equal opportunities to participate in the system, at a certain point consideration of the quality of performance becomes overriding. Of course quality is what peer review is all about. However, as funds become tight, and as the desire to continue to support current awardees remains strong, the amounts available for new investigators diminish. Grantsmanship dictates that investigators play safe, and propose research that reviewers will accept as feasible, and innovation and creativity are sacrificed. Perhaps certain universities, or departments, could be selected as

the leaders in a field, and anyone receiving an appointment as an assistant professor at those institutions would automatically receive a starter research grant without having to submit a research protocol for peer review. After all, th selection process for tenure-track assistant professorships at quality research universitites is itself a peer review process. To avoid universities making appointments because they know such awards would be forthcoming, they could either be matching grants, or they could prohibit the use of the funds for academic year salaries. At the end of a given time, the use to which the funds have been put would be evaluated by a peer review group. If the research performed is deemed worthy, a further grant would be made. This system would put the funding mechanis on the basis of actual achievements, rather than on the promise of something which may or may not come to pass. It would be an investment in quality principal investigators, rather than specific research proposals. The selection process fo faculty at quality research universities is a peer review system, particularly where such process is to a tenure-track position.

For the current funding mode, peer review is certainly the best available mechanis for awarding the available research dollars. Nevertheless, the system has at leas one major flaw, the amount of time and effort expended by applicants and reviewers on those applications which are not funded. This non-productive time is multiplie when the same application is submitted to several potential sponsors. If the peer review system is truly independent of the reviewers, then perhaps the results from one review of one application could be used by several agencies and sponsors to make their own evaluations, and rank order the application among those that particular source has received. If this kind of multi-purpose review is not considered appropriate, are we admitting to playing a form of Russian roulette with the peer review process?

Previously there has been allusion to the fact that many principal investigators have research programs for which the total support cannot be garnered from one source. Particularly in the case of the federal government, the division of support means an administrative burden in apportioning costs among those providing the support. It is frustrating to have an auditor question the purchase of animal feed because there weren't any animals charged to the grant. When it is explained that the project is partially supported by another source, then strict apportionment of costs is demanded. Recognition of such circumstances should be the rule for research accounting, and allowable direct costs should not have to be apportioned.

One of the continuing problems with university fiscal accounting has been the charges for the effort expended on sponsored research by faculty, including the effort expended on the administration of research, which may be charged to the indirect cost category "Indirect Departmental Expense." Again, it is suggested that the option of using some form of standard charge be offered. It would not seem unreasonable to suggest that a faculty member must devote a certain amount of effort to a project in order to be considered its principal investigator. In fact requiring this would eliminate the practice of senior investigators lending their names and reputations to applications which are, in fact, the applications of their junior colleagues. Having established a percentage figure for the effort, the universities could apply for and receive the standard percentage of the investigator's salary for each grant on which he or she is accepted as the principal investigator, without keeping any records other than an annual certification that at least that amount of time was expended on the project. In addition, for any grant on which a person is the principal investigator, the universities should be allowed to charge a standard percentage of the faculty member's time to the

appropriate indirect cost category. Presumably, these percentages could be set so that, on the average, universities would recover about the same percentage of such salaries as they do now. If the universities would "discount" this figure somewhat to allow for the reduction in accounting costs, then the government agencies, by showing a cost saving, might have some encouragement to agree to experiment with the proposal. As a fall-out, disharmony which now is created among faculty and their administrations by program officers encouraging faculty to reduce the amount of their released time would be eliminated. The problem of state universities having to recover for all released time might be overcome if they accept the averaging concept. Even so, the experiment should allow for universities to select the standard charge option, or to continue to maintain the records necessary to document the expenditure of the effort.

The foregoing are a few ideas arising from personal observations over a dozen or so years in university research administration. No doubt some of them are flawed but, if they encorage readers to take a fresh look at some long-standing problems, then some useful purpose will have been served.

From "Government Contracts and Grants for Research. A Guide for Colleges and Universities"
by Reagan Scurlock.
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	Types of Grants			Eligibility			Application				Award			Cost Sharing Required		Pay't. Schedule	Indirect Cost Allowed		Title to Equipment			Patent Rights			No-Cost Extension On Request		If PI Transfers May Grant Be Transferred		Close Out Requirements		
							Prescribed Application Form		Deadlines																						
	Research	Training	Fellowships	Educational Institutions	Nonprofit Organizations	Individual Faculty Members	Yes	No	Yes	No	Range of Support	Earliest Activation Date After Award	Normal Grant Period	Yes	No		Yes	No	Sponsor	Grantee		Sponsor	Grantee	Negotiable	Yes	No	Yes	No	Fiscal	Technical	Patent
ABBOTT LABORATORIES	x			x	x	x		x		x	500 10K	v	v		x	N						x					x		x	x	x
AMERICAN CANCER SOCIETY	x	x	x	x		x	x		11 1 4 1		500 112K	v	v		x		25% IDC			x				x	x		x		x	x	x
AMERICAN CHEMICAL SOCIETY PETROLEUM RESEARCH FUND	x			x	x		x			x	12K M	9 1	2 3 years		x	AN	$500 DA			x					x		x		x	x	
AMERICAN DIABETES ASSOCIATION	x					x	x		3 1		3.5K		1 yr		x	AN				x		x			x		x		x		
AMERICAN HEART ASSOCIATION	x			x			x		9 1		14K A	7 1	v		x	Q	10% IDC			x					x		x		x	x	
AMERICAN LUNG ASSOCIATION	x	x	x	x		x	x		12 1		10 25K	7 1	1 3 years		x	7 1 1 1	15% IDC					x nil			x		x		x	x	x
AMERICAN PARENTS' FOUNDATION	x			x	x		x		2 1 9 1		4 200 61		1 yr		x	2 1 1 1	20% IDC		x N				x		x		x		x	x	x
AMERICAN UROLOGICAL SOCIETY		x				x	x		10 1		15K	7 1	2 yrs			mo.		x					x		x			x		x	
ARTHRITIS FOUNDATION	x			x	x		x		9 2			v	1 yr		x		8% IDC			x				x	x			x	x	x	
COMMONWEALTH FUND	x			x				x		x	5-100 K	1			x	AN	N			x			x		x						
COUNCIL ON LEGAL EDUCATION FOR PROFESSIONAL RESPONSIBILITY				x	x		x				35K A	2 5 mo	2 yrs						x				x		x				x	x	x
DAMON RUNYON CANCER RESEARCH FUND	x			x			x		3 15 9 15		20K A	1 mo.	1 2 yrs		x		5% IDC			x		x			x		x		x	x	x
CAMILLE AND HENRY DREYFUS FOUNDATION	x			x	x			x	4 1 9 1		10K	1 mo	1 yr				N									x		x	x		
EASTER SEAL RESEARCH FOUNDATION	x			x	x		x		3 1 8 1		1-10K	1 mo	1 3 yrs	x		AN	15% IDC			x			x		x		x		x	x	x
EPILEPSY FOUNDATION OF AMERICA	x	x	x			x	x		4 15		12K M	1 1	1 yr		x	MO		x							x		x		x	x	
EXXON EDUCATION FOUNDATION	x	x		x			x		3 1 6 1 9 1 12 1			1 mo	1 2 yrs		x	SA		x	x							x				x	x	
FIGHT FOR SIGHT, INC.	x		x	x	x	x	x		3 1		3 8 5K A	v	6 mo 1 yr		x			x		x			x		x		x				x	x	
FORD FOUNDATION	x	x	x	x	x	x		x		x			1 3 yrs		x	Q	10-15% IDC			x			x		x		x		x	x	
ANNA FULLER FUND	x		x	x			x		1 1 3 1 6 1		10K M	1 mo	1 yr		x	AN				x				x	x		x		x	x	
THE GRANT FOUNDATION, INC.	x	x		x	x			LTR 1st		x		v	1 4 yrs		x															x	x	
JOHN A. HARTFORD FOUNDATION	x			x	x		LTR 1st			x	20-172K	1 2 mo.	1 3 yrs	x		SA	20% IDC			x				x				x		x	x	x
THE ROBERT WOOD JOHNSON FOUNDATION		x		x	x			x		x		v	v	N		AN	N			x				x		x				x	x	
KELLOGG FOUNDATION	x			x									x		x	N		x										x		x	x	
LALOR FOUNDATION	x			x		x			1 15		15K M		1 yr		x	1/3 start 1/3 6 mo.	8% IDC			x				x				x		x	x	x
JOHN AND MARY MARKLE FOUNDATION	x	x		x	x			x		x					x	Q	N			x			x		x					x	x	x
MILBANK MEMORIAL FOUNDATION	x			x	x			x			15K																					

	Types of Grants: Research	Types of Grants: Training	Types of Grants: Fellowships	Eligibility: Educational Institution	Eligibility: Non-Profit Organizations	Eligibility: Individual Faculty Members	Application: Prescribed Application Form Yes	Application: Prescribed Application Form No	Application: Deadlines Yes	Application: Deadlines No	Award: Range of Support	Award: Earliest Activation Date After Award	Award: Normal Grant Period	Cost Sharing Required Yes	Cost Sharing Required No	Pay't Schedule	Indirect Cost Allowed Yes	Indirect Cost Allowed No	Title to Equipment: Sponsor	Title to Equipment: Grantee	Title to Equipment	Patent Rights: Sponsor	Patent Rights: Grantee	Patent Rights: Negotiable	No-Cost Extension On Request Yes	No-Cost Extension On Request No	If PI Transfers May Grant Be Transferred Yes	If PI Transfers May Grant Be Transferred No	Close-Out Requirements: Fiscal	Close-Out Requirements: Technical	Close-Out Requirements: Patent
MILBANK MEMORIAL FOUNDATION	x			x	x			x			15K					N	N								x				x	x	
MOTT FOUNDATION				x									x	x		N		x										x	x	x	
MUSCULAR DYSTROPHY ASSOCIATION OF AMERICA	x		x			x	x		4-30 12-31		10K 20K	6 mo	1 yr.		x		8% IDC		x						x		x		x	x	
NATIONAL DAIRY COUNCIL	x			x	x		x		4-1		10 40K	1-1	1 yr.				10% IDC						x		x		x		x	x	
NATIONAL FOUNDATION	x			x			LTR 1st		1-1 8-1 10-1		1-100K	1	1-2 yrs		x	SA	10% IDC			x			x		x				x	x	
NATIONAL MULTIPLE SCLEROSIS SOCIETY	x		x	x	x		x		2-15 8-15			7-1 1-1	1-3 yrs		x	Q	20% IDC			x		N			x		x		x	x	x
NUTRITION FOUNDATION	x			x	x	x	x		8-1 2-1		1-40 K	1-6 mo.	1-3 yrs		x	7-1 1-1				x			x		x		x		x	x	x
JAMES PICKER FOUNDATION	x		x			x	x		9-15		4K M	2 mo	1 yr		x			x		x			x		x		x		x	x	
POPULATION COUNCIL	x	x	x	x	x		x		1-4 7-10/15		75K	1	1-7 yrs.				10% IDC			x		x			x				x	x	x
RESEARCH CORPORATION	x	x	x	x	x		LTR 1st			x	1-5(4) K	1	1 yr	X for EQPT		AN		x		x			x		x		x		x	x	
RESEARCH FUND OF AMERICAN OTOLOGICAL SOCIETY	x			x	x	x	x		1-15		10K	7-1				Q	10% IDC			x			x		x				x	x	x
ROCKEFELLER FOUNDATION	x	x	x	x	x	x		x		x								x		x			x				x		x	x	x
RUSSELL SAGE FOUNDATION	x	x	x	x	x			x		x	1-300 K	1	1-4 yrs		x	Q	15% IDC		x						x		x		x	x	x
SEEING EYE	x		x	x	x		x		2-15 8-15			1 mo	1 yr		x	12-1 6-1	15% IDC								x		x		x	x	x
ALFRED P. SLOAN FOUNDATION	x	x	x	x	x			x		x	1K to 1M	1	1-3 yrs.		x	N	15% IDC			x					x		x		x	x	x
CANCER FOUNDATION	x		x	x	x	x		x				1 mo	3 yrs		x	AN		x		x			x		x				x	x	x
UNITED CEREBRAL PALSY RESEARCH AND EDUCATION FOUNDATION	x	x	x	x		x	x		4-15 9-15		1300 60K	1-1 7-1	2 mo-3 yrs.		x	Q	15% IDC			x					x		x		x	x	
WARNER LAMBERT ASSOCIATION	x			x				x		x	6-42K				x	N	N			x		x			x		x		x	x	x

V — Varies
N — Negotiable
A — Average
Q — Quarterly
M — Maximum
I — Immediately

AN — Annually
MO — Monthly
SA — Semi-Annual
DA — Department Allowance

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