61. J. Shine and L. Dalgarno, *Proc. Natl. Acad. Sci. U.S.A.* **72**, 4734 (1975); J. A. Steitz, in (*1*), pp. 479–496.
62. W. Herr, N. M. Chapman, H. F. Noller, *J. Mol. Biol.* **130**, 433 (1979).
63. M. Santer and S. Shane, *J. Bacteriol.* **130**, 900 (1977).
64. J. Ofengand, R. Liou, J. Kohut, I. Schwartz, R. A. Zimmermann, *Biochemistry* **18**, 4322 (1979); J. B. Prince, S. S. Hixson, R. A. Zimmerman, *J. Biol. Chem.* **254**, 4745 (1979).
65. J. B. Prince, B. H. Taylor, J. Ofengand, R. A. Zimmermann, unpublished.
66. Summarized in M. Shimizu and G. R. Craven [*Eur. J. Biochem.* **61**, 307 (1976)].
67. M. Nomura, S. Mizushima, M. Ozaki, P. Traub, C. V. Lowry, *Cold Spring Harbor Symp. Quant. Biol.* **34**, 49 (1969).
68. S. Pestka, *Methods Enzymol.* **30**, 462 (1974); L. P. Gavrilova and A. S. Spirin, *ibid.*, p. 452.
69. A. H. Knoll and E. S. Barghorn, *Science* **198**, 396 (1977).
70. R. Gupta and C. R. Woese, *Current Microbiol.* **4**, 245 (1980).
71. C. R. Woese and G. E. Fox, *J. Mol. Evol.* **10**, 1 (1977).
72. Recently, R. Brimacombe [*Biochem. Int.* **1**, 162 (1980)] and C. Ehresmann *et al.* (personal communication) have proposed secondary structure models for 16*S* RNA which have many features in common with our model.
73. Supported by NIH grant GM 17129 (to H.F.N.) and NASA grant NSG 7044 (to C.R.W.). We thank our co-workers J. Brosius, N. M. Chapman, N. Crawford, R. Gupta, R. R. Gutell, W. Herr, J. J. Hogan, J. Kop. A. M. Kopylov, and D. A. Stahl for their contributions to this work. We also thank R. A. Garrett for stimulating discussions.

Indirect Costs of Federally Supported Research

Kenneth T. Brown

Summary. Indirect costs of federally supported research have increased steadily and dramatically since the current indirect cost policy became effective in 1966. The amount of research supported by any given level of federal funding has thus been markedly reduced, and this has become a critical factor limiting research support in the United States. The current policy has had multiple adverse effects that threaten the health of both the federal research program and the universities in which most of the research is conducted. This article examines the background and nature of the current policy, describes its consequences, and proposes simplifying modifications.

In federally supported research a distinction is drawn between direct costs, which cover the expenses of a specific research project, and indirect costs, which are allocated to research organizations to defray research expenses broadly described as overhead. This article concerns indirect costs at U.S. universities and colleges, which will be lumped for convenience under the term universities. As I will document in this article, indirect costs have increased steadily and markedly since 1966, when the current indirect cost policy became effective. This is the case even when indirect costs are expressed as a percentage of total research costs. The amount of research that can be supported with any total level of federal funding has thus been seriously reduced, and this has become a major factor limiting the support of research in this country.

The importance of this matter is incalculable but may be assessed partly by considering the groups affected. Of course, U.S. taxpayers must pay the higher indirect costs. Also affected are all beneficiaries of research, who constitute an even larger group that is worldwide in distribution, especially in research fields such as human health. But three groups are affected with special force in their daily work. One is the federal granting agencies, who have the duty of supporting as much high-quality research as they can. Another is administrators of universities where the research is performed, for whom a major concern must be the fiscal soundness of their institutions. A third group is the scientists who conduct the research, and who often depend largely on federal funds to pursue the research careers for which they have been trained. All three of these groups may be expected to favor the optimal support of research. But that goal is being compromised by the high indirect costs that now pertain at many universities, whose administrators are thus placed at odds with both the granting agencies and their own research faculties.

This situation cries out for all parties to pull together toward common goals. Research should be optimally supported, with smooth working relations between all of the main groups involved, and without imposing unnecessary financial or administrative burdens on the universities. Attainment of these goals requires that all parties have a clear and shared understanding of the problem. This is not currently the case, partly because many relevant facts are not readily available, and partly because partisan viewpoints have obscured some of the issues. Thus in the first part of this article I will describe the history of indirect costs, including a budgetary analysis of the extramural research program of the National Institutes of Health (NIH); this is one of the largest federally funded research programs and the one for which I have the best information (*1*). I will next attempt to identify the most critical aspects of this issue and the major problems that have arisen under the current indirect cost policy. Finally, I will propose modifications of the policy that I believe to be in the best interest of all parties, and suggest steps to expedite the desired modifications.

Background

The early history. Unless otherwise indicated, all indirect cost rates in this article have been calculated by expressing indirect costs as a percentage of total direct costs. Before 1955, an indirect cost rate of 8 percent was applied uniformly to NIH research grants at all educational institutions (*2*). From 1955 to 1963 the indirect cost rate became 15 percent; from 1963 to 1966 it was 20 percent of allowable direct costs, which amounted to about 16 percent of total direct costs (*3*). In 1966, apparently in response to strong representations by universities to the Bureau of the Budget, which is now the Office of Management

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Table 1. NIH funds awarded in research grants to U.S. universities and colleges during fiscal years 1966 through 1979. Total costs, direct costs, and indirect costs are in millions of dollars. Direct costs are also given as a percentage of total costs.

Costs	Fiscal year													
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Total	431	487	516	524	505	569	676	681	886	929	1236	1150	1322	1580
Direct	378	414	431	432	411	458	537	528	686	709	922	859	981	1158
Indirect	53	73	85	92	94	111	139	153	200	220	314	291	341	422
Direct as a percentage of total	87.7	85.0	83.6	82.5	81.4	80.5	79.4	77.5	77.5	76.3	74.6	74.7	74.2	73.3

and Budget (OMB), a major policy change became effective that has extended to the present time (*4*). Under this policy the indirect cost rates of each university are frequently renegotiated, usually on an annual basis. The vast majority of universities conduct these negotiations with the Department of Health and Human Services (DHHS) or the Department of Defense, following policies set by OMB, an arm of the Executive Office.

The growing concern. By 1976 the rising indirect cost rates had aroused sufficient concern in Congress that a joint conference of the House and Senate Appropriations Committees called for bringing the "spiraling indirect cost rates under control" (*5*). I am informed by John Lordan, chief of the Financial Management Branch of OMB, that this congressional concern was the major reason for the 1979 revision of OMB circular A-21, a set of more specific regulations designed to close loopholes and prevent abuses (*6*).

Although federal granting agencies and grantee scientists are much affected by indirect cost rates, they had little or no voice in indirect cost policies until very recently. Hence these two groups have been almost completely disenfranchised in an issue of great import to their work. In this situation it was probably inevitable that the rising indirect cost rates would require these groups to become better informed about indirect costs and to demand a voice in the matter. My own involvement resulted from activities in both groups. Like other researchers with whom I have discussed this subject, I have long had the impression that rising indirect cost rates have been eroding funds available for the direct costs of research. My concern grew especially during the past 3 years, while serving on the National Advisory Eye Council (NAEC), the policy-making body of the National Eye Institute (NEI) that makes final decisions on all NEI research grants. By October 1979 several members of the NAEC had become disturbed by the effects of rising indirect costs on research supported by the NEI. Having no mandate in this matter, but feeling that the issue was becoming too important to ignore, the NAEC adopted and forwarded to Donald Fredrickson, director of NIH, a resolution requesting that the matter be studied at the NIH level. Although NIH also has no mandate for controlling indirect costs, it seemed an appropriate level for studying indirect costs as they influence a major federal granting agency. Fredrickson attended the next meeting of the NAEC, in February 1980, for an extensive discussion of the issue. In response to this and other inputs, and agreeing with the concerns expressed, he made indirect costs the sole topic at the May 1980 meeting of his NIH director's advisory committee (*7*). Indirect costs have thus been identified by NIH as a major concern at this time.

Indirect Costs of NIH Grants

Effects of increased indirect costs on NIH research funding. Table 1 shows data on NIH grants to U.S. educational institutions. The period covered is fiscal 1966, the last year before the current policy became effective, through fiscal 1979, the most recent year for which data were complete at the time of compilation. This table covers all types of research grants awarded by NIH, including regular research grants (RO-1's), program project grants, clinical research center awards, research career development awards, and biomedical research support grants. Among these types of grants, the same indirect cost rate applies to regular research grants and program project grants. Special rates, usually lower, are negotiated for clinical research centers, while research career development awards include a fixed 8 percent for indirect costs and biomedical research support grants carry no indirect costs. Because the entire mix of research grants is used, indirect costs reported here are conservatively low; the effect is significant but not great, since grants carrying lower indirect cost rates than regular research grants accounted for only 28 percent of NIH's total funding for extramural research in fiscal 1979.

Table 1 shows that from 1966 through 1979, annual indirect costs of NIH grants increased from $53 million to $422 million, a factor of 8.0, while direct costs increased from $378 million to $1158 million, a factor of 3.1. The percentage of total costs awarded for indirect costs increased steadily over this period. Of course, this caused a corresponding steady decline in the percentage of total funds devoted to direct costs, as shown in Table 1, the decline being from 87.7 percent in 1966 to 73.3 percent in 1979. Although the portion of total costs that was available for direct costs dropped only 14.4 percent, funds for direct costs were seriously reduced. In fiscal 1979 the funds available for direct costs were $1158 million. But if the same percentage of total costs that was available for direct costs in 1966 had still been available in 1979, direct cost funds in 1979 would have been $1386 million. In other words, by 1979 the direct cost funds for that fiscal year had been reduced by $228 million because the percentage of total funds devoted to indirect costs had increased over a 13-year period. This is a noteworthy result, especially since it represents the reduction of direct cost funding for only 1 year and only one federal granting agency.

In this article an "overall" indirect cost rate refers to the annual indirect cost rate pertaining to NIH's entire research grant program; such rates are readily obtained from data in Table 1. Figure 1 shows that this overall indirect cost rate grew steadily from 14.0 percent in 1966 to 36.4 percent in 1979; the rate itself thus increased by a factor of 2.6.

Since questions are sometimes raised about the conclusion that rising indirect costs reduce funds for direct costs, the basis for that conclusion will be made explicit. Each institute at NIH annually requests an appropriation for grant-supported research that is a single line item including both direct and indirect costs. From the funds appropriated for that purpose by Congress, the prevailing overall indirect cost rate determines the

percentage that must be devoted to indirect costs. The effects of a rising overall indirect cost rate would be most evident in a period of constant annual appropriations for grant-supported research, during which the additional funds required for indirect costs would correspondingly reduce the funds available for direct costs.

While a rising indirect cost rate will always have an adverse effect on direct cost funding, this effect is less obvious during a period of rapidly rising total budgets. For example, Table 1 shows that total research appropriations rose so rapidly from 1966 to 1979 that direct cost funds increased by a factor of 3.1. It might appear on that basis that research is now so much better supported that there is little cause for concern. That point is examined in Fig. 2 by plotting NIH's indirect and direct cost funds in "constant" 1966 dollars, using deflator factors from the biomedical R & D price index developed by NIH. Results in these constant dollars show that indirect cost funds increased from $53 million in 1966 to $186 million in 1979, a real gain of $133 million to a value that was 3.5 times the 1966 level of funding. By comparison, direct costs increased from $378 million to $512 million over the same period, a real gain of $134 million to a value that was only 1.35 times the 1966 funding level. In other words, direct cost funding in constant dollars increased only 35 percent over that 13-year period.

Differences between universities. Until very recently, universities were permitted to negotiate indirect cost rates on a variety of "bases," such as a percentage of salaries and wages or a percentage of total direct costs less specified items. Because of these various bases for negotiated rates, it has become common practice to express indirect costs as a percentage of total direct costs, especially when comparing indirect cost rates between institutions. Under the 1979 revision of OMB circular A-21, all indirect cost rates must now be negotiated on a well-specified "modified total direct cost base" (*6*).

Even when the basis for computation is uniform, differences between indirect cost rates of various universities are difficult to interpret, for reasons described later. But these differences are so large that they are an important aspect of the situation, and they will be presented from that standpoint. Data were obtained on the growth of indirect cost rates at the 20 NIH grantee institutions awarded the most funds for research during fiscal 1979. Table 2 lists these

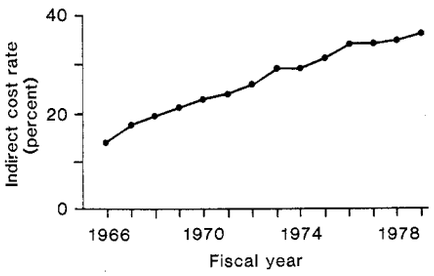

Fig. 1. Growth of the overall indirect cost rate that covers NIH research grants to U.S. universities and colleges. For each fiscal year from 1966 through 1979, the indirect cost rate was obtained from Table 1 by expressing indirect costs as a percentage of direct costs.

institutions, their research support for direct costs in fiscal 1979, and their indirect cost rates in fiscal 1979. Among these institutions the greatest increase was registered by Yeshiva University, whose indirect cost rate rose from 17.1 percent in 1966 to 63.8 percent in 1979, a factor of 3.7. The top half of Fig. 3 shows results for Yeshiva and two other private institutions. By 1979 the indirect cost rate at Harvard University had grown to 49.4 percent; at that institution slightly more than half the direct costs awarded in fiscal 1979 were to Harvard Medical School, for which the indirect cost rate had risen to 59.5 percent. At the Massachusetts Institute of Technology (MIT) the indirect cost rate rose steadily and more slowly to 39.9 percent. All of the other ten private institutions of Table 2 showed patterns that are well represented by the three illustrated, aside from New York University, where the indirect cost rate had risen to only 35.7 percent by fiscal 1979.

Figure 3 also shows data for three

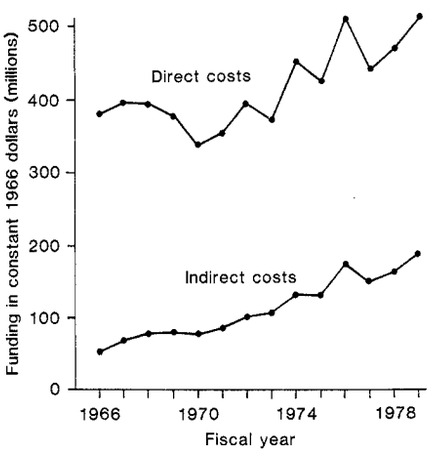

Fig. 2. Growth of direct and indirect costs of NIH research grant awards, expressed in constant 1966 dollars. Results were computed from data in Table 1, using the fiscal year biomedical R & D price index developed by NIH.

public universities. Among these the most rapid increase was at the University of Michigan, where the indirect cost rate reached 47.6 percent in fiscal 1979, a value similar to that of Harvard University. A slower growth rate was shown by the University of Wisconsin at Madison. Still slower and very similar growth rates occurred at the Universities of Washington and Minnesota, which are not illustrated. The University of California negotiates indirect cost rates that apply uniformly to all its campuses; when indirect costs are expressed as a percentage of total direct costs, only very slight differences appear between campuses. Annual indirect cost rates have thus been averaged for the three campuses that appear in Table 2, and these average values are shown in Fig. 3 for the University of California, which exhibited the least increase of indirect cost rates over the period shown.

Figure 3 demonstrates that indirect cost rates have grown at widely different rates among both private and public institutions that receive major research support from NIH. By 1979 this had resulted in a large spread of indirect cost rates between institutions. Why are the differences so great, and are they justified? It has recently become evident that some institutions assign as many costs as possible to the "direct" category, while other institutions assign many of the same costs to the "indirect" category (*7, 8*). Although the reasons for this are not clear, they may involve different institutional strategies. Costs assigned to the direct category can be allocated to specific grants for accurate cost accounting; also, the institution's indirect cost rate can thus be held down. On the other hand, assignment of as many costs as possible to the indirect category will reduce direct costs, the only ones that receive peer review on grant applications to NIH, thus enhancing the possibility that grants will be approved without significant cuts of their direct costs. Regardless of the underlying reasons for such dissimilar policies, they must contribute to a significant but indeterminate extent to the observed differences of indirect cost rates between various institutions.

In summary, because of widely differing treatments of indirect costs among universities, the indirect cost rates of different universities are not comparable. Much attention has been devoted recently to university accountability in expending federal research funds (*5–9*). Within that subject, it would seem a matter of public interest and university responsibility that indirect cost rates

should at least have a well-defined significance, so that any major differences between universities could be interpreted clearly. Instead, accounting practices are permitted and conducted under the current indirect cost policy that undercut this basic aspect of accountability.

Some Critical Aspects of Current Policy

In this section I will analyze some aspects of indirect costs that are not entirely budgetary in nature. I will attempt to do this in a nonpartisan way, with the aim of furthering the best interests of all parties. To the extent that it is not possible to be truly nonpartisan, the views expressed will be primarily those of a university faculty member who is concerned about the continued health of both the federal program of research support and the university system in which much of that work is conducted. Since the faculty viewpoint has been most notably lacking in determination of indirect cost policies to date, it seems in greatest need of representation.

Differences between direct and indirect costs. A document circulated by a university administrator at the May 1980 meeting at NIH stressed the following statement: "The only difference between direct and indirect costs is the precision with which the costs can be specifically identified with a given activity." This view is misleading, and dangerously so, since it could be used to justify further increases of indirect costs by inappropriately associating them with direct costs. In fact, direct and indirect costs differ in several substantive respects that merit close attention.

First, the mechanisms for approving direct and indirect costs of NIH grants are entirely different (*10*). A stringent peer review evaluates not only the scientific merits of each grant proposal but also the direct cost budget. Every major item of direct costs must be justified in the grant proposal, and whenever the justification is deemed insufficient, selective cuts may be made during a three-step review process. Following the initial review by a study section, there is another review by the council of the awarding institute, and staff of the awarding institute may initiate budget cuts either before or after the action of the council. None of these budgetary reviews is perfunctory; in fact, significant cuts of direct costs are commonly made at each stage of review, although it is unlikely that a given grant would be cut at all three stages. By contrast, there is no similar prior review to evaluate the justification of an item that is added to the indirect costs of a university. Instead, there is a largely ad hoc review that normally occurs during the renegotiation for a new indirect cost rate. More important, the primary goal of that review is to determine whether the type of item that has been added falls within federal indirect cost regulations. Aside from rare and obvious instances, I am informed that federal audit agencies find it impractical to determine whether added indirect costs are justified by being required as part of an efficient operation.

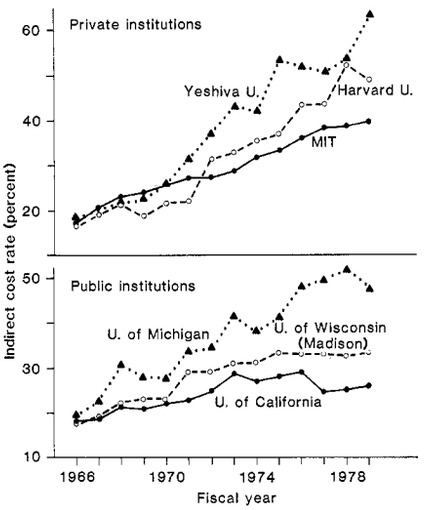

Fig. 3. Growth of indirect cost rates for six sample institutions drawn from the 20 institutions that received the highest research grant awards from NIH during fiscal 1979. For each fiscal year at each institution, indirect costs were divided by total direct costs to obtain the indirect cost rate.

A second difference, closely related to the first, concerns incentives to minimize the costs of research. For direct costs each investigator has a strong incentive to keep the proposed budget as low as possible, since unduly expensive projects invite particularly close scrutiny. There is no similar incentive to minimize indirect costs, since only direct costs are considered in the three-step evaluation of grant budgets. Put another way, there is no evaluative step at which an exceptionally high indirect cost rate reduces the probability that grant proposals from that university will be funded. Under these conditions, there is inadequate incentive for universities to be cost-efficient with respect to indirect costs of grant-supported research. In fact, the present system would almost seem to encourage inefficiency. For example, if a university wishes to hire an additional administrator whose salary is chargeable to indirect costs, it is necessary at most to support that salary from nongrant sources during the first year. Thereafter the salary becomes part of the ongoing indirect costs that may be used to negotiate a higher indirect cost rate in all successive years. A university may thus pyramid its administrative costs of research, since they are not subject to effective limitations and are paid for almost entirely by outside funds. Under these conditions, which are similar to those that promote bureaucracy in government, one expects administration to expand until it becomes cumbersome and unnecessarily expensive.

Third, while indirect costs are well protected against inflation, direct costs are not. The overall indirect cost rate is always a percentage of direct costs and it is renegotiated frequently on the basis of indirect costs incurred by the universities. Direct costs do not have this protection. Also, direct cost funds are adversely affected by a rising overall indirect cost rate, as already described. This means that direct cost funds are not only inadequately protected against inflation, they can even suffer from the very protections against inflation that are enjoyed by indirect costs. These unequal treatments were established in 1966, before inflation became a dominant factor in the U.S. economy.

Finally, when direct cost funds are expressed in constant dollars, they will be reduced by any one of several conditions. These include reduction of the total research budget, inflation, or an increase of the indirect cost rate. On the other hand, direct cost funds can show a real increase only when there is a congressional increase of the NIH budget for extramural research, provided that this increase exceeds any concomitant effects of an increased overall indirect cost rate and that it also exceeds inflationary effects on direct costs. Although these conditions have been met in some past years, it appears highly unlikely that they will be met in the foreseeable future. And whenever the funds for direct costs actually do rise, indirect cost funds rise proportionately. This situation seems fairly summarized by saying that indirect costs continue to be in a no-lose position, while direct costs are now in a no-win situation. In the near future of direct costs, the best that can realistically be hoped for is maintenance of the status quo. But even that seems a forlorn hope in the face of leveling federal budgets, continued inflation, and continued vulnerability to increased indirect cost rates. In short, it appears that a critical point has been reached in the federal funding of research.

The reality of indirect costs. Some well-placed and highly respected univer-

sity administrators identify the primary problem of indirect costs as failure of the faculty to understand them and to recognize them as "real" costs. This attitude, which surfaced at the May 1980 meeting at NIH (*7*), requires examination. It is ironic because the faculty, which has been disenfranchised in this issue and disadvantaged by high indirect cost rates, is thus identified as the source of the problem. Like all meritorious obfuscatory statements, this one contains enough truth to be seductively credible. Faculty are indeed poorly informed in this issue, partly because their daily duties are along quite different lines. When they do ask questions, they commonly report university indirect cost policies to be obscured by a cloudy curtain that is difficult to penetrate (*7*). To whatever extent that occurs, failure of the faculty to be informed about indirect costs cannot be blamed on the faculty itself. More important, indirect costs are obviously real; hence this is not the issue, but only a readily destroyed straw man. The true concern of faculty is a healthy skepticism about whether current indirect cost rates are fully justified. Unless university policies in this matter are openly available, faculty suspicions will inevitably persist and intensify.

Is reimbursement of indirect costs necessary? This question is still raised occasionally by critics of indirect costs, using mainly a historical justification. Prior to World War II, most research at universities was supported by the universities themselves, including both direct and indirect costs. Against that background, postwar federal support for direct costs of research seems to have been regarded initially as a pure boon and welcomed with open arms, with little concern for its attendant indirect costs. But as federally supported research increased markedly toward its present level, the total amount of research at universities simply became too great for the indirect costs to be borne mainly by the universities themselves. Reimbursement of some major portion of indirect costs is thus a necessary aspect of a desirably high level of federally supported research.

The extent of indirect costs reimbursed. Although indirect costs are real and must be largely reimbursed, a remaining question concerns the extent to which they can appropriately be charged to research grants. In this connection a distinction must be drawn between contract research and faculty-initiated research grants. Contract research is initiated by a federal agency that requires solution of a specific problem, for which bids are solicited. In effect, a fee is offered for services, both being agreed on in advance; it seems entirely justified that the full costs of such research should be reimbursed, and this is current policy. The concern here is grant research that begins with a research proposal developed by a faculty member. The research is rarely of such immediate interest to a federal agency that the proposed work would have been solicited by that agency, but it may be supported under an enlightened and highly desirable program for the long-term support of basic research. This federal support confers major benefits to both the faculty and the university, because research is one of the main ways in which faculty careers and university reputations are built. Hence universities should continue to share costs of this type of research, although their funds must be spread more thinly over a larger research program than in the past.

The mutual benefit of faculty-initiated research to the government and the universities was clearly recognized when statutory cost-sharing was initiated in 1965 with insertion of the following provision in pertinent congressional appropriation acts (*2*): "None of the funds provided herein shall be used to pay any recipient of a grant for the conduct of a research project an amount equal to as much as the entire cost of such project." At least one appropriation act is more explicit (*11*). The Independent Offices–Housing and Urban Development Act, which applies to the National Science Foundation (NSF), the National Aeronautics and Space Administration, and the Environmental Protection Agency, states that aside from government-solicited proposals, "the extent of cost sharing by the recipient shall reflect the mutuality of interest of the grantee or contractor and the Government in the research."

While establishing the principle and rationale of cost-sharing, these statutes leave the question of how much cost-sharing should be required to the various federal agencies. A minimum of 1 percent of the total project costs is required on NSF-supported research projects (*11*). For grantees under DHHS, specific institutional cost-sharing agreements are required. The office that handles this matter for DHHS indicates that universities typically cover about 5 percent of total project costs.

Are the current levels of cost-sharing too high or too low? A document of the National Association of College and University Business Officers argues that cost-sharing should be abolished as a matter of principle (*2*). The wisdom of this view must be questioned, mainly because it denies university benefits from federally supported research and the financial responsibilities that the universities should thereby assume. This attitude can only do further damage to the government-university partnership, which is already badly strained (*9*). Also, this view advocates removing one of the small remaining protections that universities have against overdependence on federal funds.

On the other hand, one hears scattered reports from faculty that federal research funds are avidly sought by the universi-

Table 2. The 20 NIH grantee institutions that received the highest research grant funding for direct costs during fiscal 1979, the amounts awarded that year for direct costs, and the indirect cost rates for that year (expressed as a percentage of total direct costs).

Institution	Direct costs ($ million)	Indirect cost rate (%)
Columbia University	28.4	39.1
Cornell University	18.4	39.3
Duke University	19.8	43.5
Harvard University	29.1	49.4
Johns Hopkins University	34.3	43.0
Massachusetts Institute of Technology	15.5	39.9
New York University	16.6	35.7
Stanford University	25.7	49.5
University of California, Los Angeles	29.4	25.4
University of California, San Diego	20.8	27.2
University of California, San Francisco	38.2	24.4
University of Chicago	19.5	40.4
University of Michigan	16.6	47.6
University of Minnesota	24.7	27.7
University of Pennsylvania	29.2	43.0
University of Washington	30.7	28.6
University of Wisconsin, Madison	26.0	33.1
Washington University, St. Louis	24.0	47.3
Yale University	28.3	43.6
Yeshiva University	19.5	63.8

ties, with faculty sometimes being cast in the unwelcome role of fund-raisers. While this attitude of university officials is difficult to document, for a variety of reasons, these reports are too persistent and widespread to be ignored. In any case where this attitude is held by university officials, one must wonder whether federal research funds are not unnecessarily advantageous to the university, with the level of cost-sharing less than it could and should be.

Estelle Ramey put the above point clearly in the context of faculty perceptions (*7*). She stated that university administrators urge faculty to get as many grants from the federal government as possible in order to help the institution. The perception of faculty is that the university benefits and indeed profits from this course. She also noted, however, that when faculty express concern about high indirect cost rates, administrators respond that the rates are not high enough and that research grants are financial burdens that increase costs to the university.

Increasing indirect cost rates. I have concentrated on the policy within which indirect cost rates have increased so markedly and on problems resulting from the policy itself. Within the framework of that policy, many factors have undoubtedly operated to increase indirect cost rates, some of which have been identified (*2, 8, 12*). Analysis of this complex subject is beyond the scope of the present article, but certain points should be noted. The much-cited increased fuel bills are undoubtedly important, particularly in certain regions and in recent years. Also, the increased costs of grant administration have been especially significant for many years. While the current indirect cost policy generates concern that lowered efficiency of research administration may be an important hidden element, the universities cannot avoid a large part of these increased administrative costs.

It is widely believed that burgeoning federal regulations have been an important cause of the increased costs of research administration (*8*). Universities are now required, by at least 59 different federal laws and regulations, to carry out a large variety of federally mandated social programs in areas such as fair employment practices and public safety (*13*). While the worthiness of these programs is not at issue here, much of their cost to the universities is in the demonstration of compliance. This is required under the threat of withdrawing all federal grant support, so these indirect costs are unavoidable. This amounts to the forced robbery of Peter to pay Paul, since the indirect costs required for those programs are taken largely from funds that could have been used for direct costs of research. One question raised is whether research funds should be used to pay for federally mandated social programs. Also, use of the purse strings to make universities serve as instruments of national policy, which has been described convincingly by Senator Moynihan, is an ominous trend (*14*). Both problems could be avoided if the social programs and scientific research were funded independently. While a workable mechanism to accomplish this might be difficult to devise, it is a goal that seems worthy of the best efforts.

Problems for Universities

Although objecting to the accompanying regulations, many university officials defend the basic structure of the current indirect cost policy and continue to pursue further increases of the indirect cost rate. In following that course they tacitly assume that the current policy continues to be advantageous to the universities. When regarded from a larger view, their course of action can only be justified on the assumption that the current indirect cost policy confers net benefits to the universities that will continue to outweigh the disadvantages of that policy to the federal program of research support. The validity of these assumptions must be questioned, particularly on considering the disadvantages of the current policy to the universities themselves.

First, university administrators are now in an almost continuous adversary relationship with federal agencies in renegotiating indirect cost rates and assuring "accountability" in the use of indirect cost funds. This involves unhealthy strains and is expensive to both universities and taxpayers. The 1979 revision of OMB circular A-21 is causing further stress and the new regulations have been strongly protested (*7, 9, 12, 15*). While OMB seems to expect that indirect costs will be reduced by these tightened regulations, some university administrators believe that indirect costs will increase because of the higher costs of accounting. Both types of effects will undoubtedly occur, and the net result is in doubt. If the net result is an increase of indirect costs, we will have a vicious circle in which high indirect cost rates have resulted in regulations that will further increase indirect costs.

Second, university administrators are in an adversary relationship with their own faculty, since high indirect costs are contrary to important faculty interests. This corrodes the working atmosphere within universities. The problem is particularly severe if, as sometimes reported, either direct or subtle pressures are brought to bear on faculty to seek federal research support that is largely for the financial advantage of the university.

Third, universities are placed in undesirable competition with each other. Since few universities are content to be disadvantaged in relation to their competitors, the high indirect cost rates of certain universities beget jealousies and contribute to the upward spiral of indirect cost rates.

Fourth, some wise university administrators have long been perturbed by the specter of undue dependence on federal funds. Those fears are now being realized. Required compliance with multiplying federal programs and regulations is a clear illustration of how federal support funds carry significant federal controls that are deleterious to university functions.

Since rising indirect cost rates create progressively severe problems, they could ultimately lead to disastrous effects both for federally supported research and for the universities. If the purposes of federal research support became sufficiently undermined by rising indirect cost rates, the value of the entire research support program could be questioned; the beginnings of such a reaction have already been noted (*16*). In that event, especially if combined with severe budgetary stringency, the entire program would be threatened. If federally supported research were drastically reduced or abolished, with the universities having become critically dependent on indirect cost funds, the universities would likewise be endangered. While alarmism should always be avoided, these concerns seem healthy and realistic. In short, there is a real danger that rising indirect cost rates could kill the goose that lays the golden eggs.

Actions Proposed

Modification of indirect cost policy. It is proposed that uniform indirect cost rates should be reestablished; each rate should be a percentage of the total direct costs, applied uniformly to all universities, and subject to alteration only under exceptionally compelling circumstances. This would represent a return to the

much simpler system used through fiscal 1966, but with an important difference, namely that indirect cost data compiled by the universities and now available to federal agencies could provide an objective basis for setting uniform indirect cost rates. For NIH the most important uniform rate would apply to RO-1's and program project grants. These types of grants currently carry the same indirect cost rate at any given institution, and they account for about 72 percent of the funds expended by NIH for extramural research. Lower indirect cost rates would be expected to continue for certain other types of grants, such as research career development awards, and it is proposed that these lower special rates would also apply uniformly at all institutions.

This proposal would eliminate or reduce many of the serious problems that have developed under the current policy. The frequent renegotiation of indirect cost rates by each university would be abolished. The need for demonstrating accountability in connection with indirect costs would also be abolished, rendering unnecessary the detailed requirements of A-21. Instead, each university would receive an indirect cost rate that was deemed reasonable, and the resulting funds could be spent in any manner desired. By eliminating frequent renegotiations and formal accountability requirements, administrative indirect costs would be reduced significantly, permitting reduction of the indirect cost rate. Competition between universities on indirect cost rates would be abolished by this proposal, and uniform indirect cost rates would be more easily justified to faculty members. If the uniform rates were such that grant funds were not unnecessarily attractive to the universities, there would likewise be less temptation to regard the faculty as fund-raisers. Taken together, the effects just described should greatly improve the working efficiency and the quality of university life, particularly for university administrators. Taxpayers should also be especially benefited by reduction of the small armies of accountants now required on both the government and university sides of indirect cost issues.

Uniform indirect cost rates would likewise provide a strong incentive for universities to strive for optimal efficiency with respect to indirect costs of grant-supported research. Since all universities would receive comparable compensation for indirect costs, efficiency would become greatly to their benefit. Instead of universities competing with each other for higher indirect cost rates, they would compete in the efficiency of using federal indirect cost funds, which would seem a healthy change.

Another effect of this proposal is that universities would quickly place as many of their research costs as possible under direct costs because it would be to their benefit to do so. Such a policy has already been in effect for many years at the University of California, where it has worked well and has contributed to this institution's relatively low indirect cost rate. For institutions that do not already follow this policy, their grant applications would provide a more complete account of the funds requested for the proposed research. More of the research costs could thus be scrutinized and would become subject to cuts if deemed unjustified. In other words, the peer review system could operate more effectively. With as many research costs as possible being put in the direct category, the kinds of research costs remaining in the indirect category would become reduced and much more uniform than at present. An important basis for the current large differences between indirect cost rates at various universities would thus be removed. It is also noteworthy that these ends would be accomplished by providing universities with incentives to take steps deemed desirable, rather than by mandatory regulations that must be enforced.

While this proposal has been given in its simplest form, it is recognized that modifications may be required. For example, since fuel costs vary with climate, regional differences between indirect cost rates may prove necessary on that basis. Such regional rates would not seem to compromise the advantages of the proposal. Even a regional indirect cost rate might not be entirely equitable to all the universities that it covered. But complete equity is also not attainable under the current policy, and it is not clear that equity between universities would be reduced under this proposal. As recently as 1979, the General Accounting Office (GAO), an investigative arm of Congress, recommended that indirect costs not be controlled by a uniform ceiling on the indirect cost rate (*8*). The reason cited was a perceived decrease of equity between universities. Unfortunately, there was no indication that this GAO report weighed the advantages of a uniform indirect cost rate that have been described in this article. Even if uniform indirect cost rates did result in some reduction of equity between universities, that would seem a small price to pay for the many advantages that may be foreseen.

In this proposal the uniform indirect cost rates would be stabilized by being renegotiated only under compelling conditions, which would have to be demonstrated by the universities. Both direct and indirect cost funds would then rise or fall together, depending on the total federal research budget, both types of research costs being equally protected against inflation. The main stumbling block might be the indirect costs of still further government regulations. Hence that problem would have to be brought under control to avoid unduly frequent revision of the uniform indirect cost rates.

While the principle of cost-sharing is sound, the present mechanism of cost-sharing is needlessly complex. Current policies permit universities to recover fully the indirect costs of grant-supported research. A separate mechanism is then used, at least by DHHS, to negotiate for universities to pay a portion of both the direct and indirect costs of grant-supported research. In other words, the universities take in federal funds with one hand and pay out with the other. This procedure for cost-sharing is expensive in effort and funds for both the government and the universities. It would seem much more efficient to establish uniform indirect cost rates that fully cover indirect costs, and then reduce those rates appropriately to provide for cost-sharing.

Expediting the desired modifications of policy. University administrators are well placed and well organized to exert political influence in furtherance of their perceived interests on indirect costs. By contrast, there is no group that similarly represents direct costs at the necessary political levels. This imbalance is reflected by the current indirect cost policy and the problems that have arisen under that policy.

In correcting that imbalance, it appears that the only group that could appropriately represent direct costs is the university research faculty. This is based on the belief that neither taxpayers nor beneficiaries of research would become sufficiently aroused and organized on such a technical matter, while federal granting agencies are not in a good position to take a political stance. Research faculty are seldom inclined, by either disposition or training, to become politically involved. Also, many faculty are understandably reluctant to take a position contrary to that of their own administrators, on whom they must depend for

the advancement of their work and careers. It appears, however, that the indirect cost issue is one that the faculty can no longer afford to ignore. Also, faculty interests may not be contrary to the long-term interests of their administrators and universities. In addition to their own needs and responsibilities in the matter, faculty may thus have a unique opportunity to exert beneficial effects on behalf of all parties to this issue.

In taking that opportunity, it will be necessary for faculty to become better informed and to develop well-defined goals concerning indirect costs. It is hoped that this article will be helpful toward those ends. In advancing their opinions, faculty should have a role in the indirect cost policies of their own universities. Recently some significant steps have been taken in that direction at the University of California, which has a well-established policy of faculty participation in university governance. A meaningful dialogue on this issue should be beneficial to faculty and administrators alike at all universities.

If significant changes of indirect cost policy are to be made, it will probably also be necessary for faculty to represent their views to OMB and to appropriate members of Congress. This could be done by individual communications and through the scientific societies. The latter mechanism might be particularly effective, provided there were sufficient safeguards to ensure that the expressed views of scientific societies adequately represented the views of the membership. It would be a happy outcome if university administrators could be convinced of the need for changing the indirect cost policy along the same lines desired by the faculty. Based on my own contacts with university administrators, such an outcome is not entirely implausible. In that event the universities could represent a cohesive and united interest that would greatly improve the probability of effecting the requisite modifications of federal policy.

Concluding Remarks

The present policy of frequently renegotiated indirect cost rates, in effect since 1966, has been the framework within which indirect cost rates for federally supported research have risen rapidly. This trend has undermined the basic purposes of federally supported research by limiting funds available to support the direct costs of research. It has thus had marked adverse effects on the interests of federal granting agencies, research scientists, and beneficiaries of federally supported research, while being costly to U.S. taxpayers. The universities have also been seriously affected by expensive and burdensome procedures that impair their functions. Although many university administrators continue to defend the current indirect cost policy, it imposes great strains on them. The only group that strongly defends the current system is thus in a position to gain greatly if much of their time and energies could be freed for more fruitful endeavors.

Although increased costs of fuel and research administration have contributed to the higher indirect cost rates, the indirect cost policy is itself flawed and is the basis for many of the problems that have developed. The upward trend of indirect cost rates is now so well established and so firmly based on the indirect cost policy, that this trend must be expected to continue unabated unless it is checked by positive measures. In fact, the indirect cost rate is now increasing alarmingly at certain universities. The adverse effects of the current policy have already become severe; if allowed to continue, they could become disastrous for both the federal program of research support and for the universities.

Following analysis of the situation, this article proposes simplifying modifications of federal policy that appear to represent the long-term best interests of all parties. Since it now seems certain that corrective modifications of policy will be required at some time, the logic of haste is compelling in the interest of early relief from present problems and the optimal advantage in averting more serious ones. But further decisions should be made only with close attention to the views of all concerned parties. In particular, research faculty, who are intimately affected by indirect cost policies, have had little or no voice in this matter and should assume a strong role in future deliberations of this issue.

References and Notes

1. Data on the NIH extramural research program were provided through the assistance of W. F. Raub, associate director of NIH for extramural research and training. The data were compiled by J. A. Brackett and C. W. Casey in the Statistics and Analysis Branch of the NIH Division of Research Grants.
2. "Indirect costs in universities," *Administrative Service/Supplement* (National Association of College and University Business Officers, Washington, D.C., October 1976), issue 4:5:1.
3. T. J. Kennedy, Jr., J. F. Sherman, R. W. Lamont-Havers, *Science* **175**, 599 (1972).
4. Bureau of the Budget circular A-74, "Participation in the costs of research supported by federal grants," 13 December 1965.
5. *Congressional Record—House*, 3 August 1976, p. 8269.
6. Office of Management and Budget circular A-21, "Cost principles for educational institutions," *Fed. Regist.* **44** (No. 45), 12368 (6 March 1979).
7. Proceedings of the 40th Meeting of the Advisory Committee to the Director, NIH, 13–14 May 1980. Published by the Office of the Director, NIH, December 1980.
8. "Indirect costs of health research—How they are computed, what actions are needed." Published by U.S. General Accounting Office, Report HRD-79-67, 27 July 1979.
9. National Commission on Research, "Accountability: Restoring the quality of the partnership," *Science* **207**, 1177 (1980).
10. The grant approval mechanism varies between agencies and is somewhat different, for example, at the NSF.
11. Newsletter of the National Association of College and University Business Officers, April 1980.
12. S. Mac Lane, *Science* **210**, 158 (1980).
13. P. H. Abelson, *ibid.* **208**, 353 (1980); C. Van Alstyne and S. L. Coldren, *The Costs of Implementing Federally Mandated Social Programs at Colleges and Universities* (American Council on Education, Washington, D.C., 1976).
14. D. P. Moynihan, *Harper's* **261**, 31 (December 1980).
15. A. B. Giamatti, *Science* **210**, 984 (1980).
16. N. Wade, *ibid.*, p. 33.

17. In preparing this article I have consulted with many persons, mainly government officials, university administrators, and research faculty. These consultants, all of whom reviewed this article prior to its final revision, have been extremely helpful but bear no responsibilty for the opinions that I have expressed. They include J. Krevans, R. Littlejohn, J. Lordan, S. Mac Lane, R. N. Meader, A. Pelavin, J. Perpich, E. Ramey, W. F. Raub, T. Rolinson, and S. Selby.