RESEARCH MANAGEMENT REVIEW

The Journal of the
National Council of University Research Administrators

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Editor's Preface

The "Winds of War" in the Middle East may have calmed but peace has not broken out for the university community. Indirect costs, always a potential source of contention between principal investigators, research administrators, institutional fiscal officers, and funding agencies, have attracted media attention as never before witnessed. Congressman Dingell's hearings have drawn international notice to inappropriate and in some instances unallowable indirect cost recovery for federally sponsored research at some major research universities, particularly Stanford University. Within minutes, it seemed, all Washington eyes were focused on allowable versus appropriate expenditures, the complexity of the A-21 reimbursement system, and the overall credibility of research universities as stewards of the taxpayers' dollars. Overhead has never been so "sensationalized."

This issue contains three articles that cover topics of how research universities came about, how they can function more effectively, and how they might exercise institutional responsibility when students are used as research subjects. Some brief comments about each manuscript follow.

Not surprisingly, indirect costs lead the list of areas for recommendations in the article by Stanley and Sellers, "Making Things Better: A Summary of Past Recommendations for Improving the Management of Federally Sponsored Academic Research." Although they don't cover the universe of studies in research administration, their review is substantively comprehensive. Thoughtful and serious study of ways to streamline bureaucratic procedures and allow for fair and equitable recovery of university-funded research expenditures in support of sponsored research, while preserving accountability for the taxpayers' dollars, has regularly occurred. Unfortunately, most studies' recommendations are seldom implemented; the authors make several suggestions about how to increase the possibility of implementation.

Smith, Cutting, and Riggs make a compelling case for the need to monitor the involvement of students in research projects. Most research administration offices include or are closely associated with research risk management including the institutional review board (IRB) that oversees human subjects research. While readers may not agree with all of the authors' suggestions for controls to avoid problems relating to the use of students as subjects, the issues are well articulated and merit our serious consideration in the context of our institutional human subjects policies.

In Streharsky's fine review, the evolution of the university research mission offers a reassuring and revitalizing occasion as the various traditional parties to the partnership grapple with an erosion of public confidence in the performance of the nation's research universities. Streharsky is able to keep an ambitious topic under control and readable. Newcomers to research administration as well as the more experienced, who may benefit from a refresher course in how research universities came about, will be reenergized by the strength of support this manuscript offers.

RMR is fortunate to be able to reproduce in "Reports and Observations" the statement made by Wayne Kennedy on "Indirect Costs of Federally Funded Research at Colleges and Universities" presented May 14, 1991, before the Subcommittee on Labor, Health and Human Services, and Education, Committee on Appropriations, U.S. House of Representatives. Kennedy succinctly and briefly describes the major attributes generating the variations in indirect cost rates at universities: facilities costs, cost recovery policies, and costing differences between direct versus indirect assignments. The statement is exceptionally lucid and provides some explanatory language that research administrators may well find helpful for their campus and community. The editor is grateful to Kennedy for allowing the statement to be reprinted.

Also in "Reports and Observations" is a brief comment on the containment of legal costs in technology transfer. Legal fees can escalate rapidly beyond the likely return of an institution's technology transfer investment. Here are a few suggestions that, while not new or inherently profound, may keep some new operations from making potentially expensive missteps. Seeking the assistance and guidance of other research administrators and well-established technology transfer practitioners is still the best advice we can offer.

RMR continues to be interested in receiving manuscripts of potential interest to the general community of researchers and research administrators. Authors are encouraged to contact the Editor with questions about topical content and review procedures.

Mary Ellen Sheridan
Editor
June, 1991

Making Things Better: A Summary of Past Recommendations for Improving the Management of Federally Sponsored Academic Research

D. Anne Stanley and William Sellers

Abstract. Various commissions, studies, panels, and groups have suggested ways to improve the management of federally sponsored academic research in the United States. This paper categorizes and tabulates the recommendations made in all readily identifiable reports issued since 1980. Accompanying tables show which recommendations have been made by which groups, how many times a given recommendation was made, and which categories of recommendations are addressed most often. The paper finds that, despite some progress, most frequently reiterated recommendations have not been formally or widely implemented. The authors suggest that this is because recommending groups generally do not have authority to act on their own recommendations and because implementation of recommendations frequently depends on consensus among a broader group of stakeholders than is comprised by the recommending group. Moreover, broad consensus often is lacking because of different perspectives on fundamental principles of research administration. The authors conclude that recommending groups need to more actively follow through on their recommendations by working to obtain the consensus needed for change. In addition, there is need for redoubled efforts to articulate and promote agreement on fundamental principles of research administration. Finally, the analysis of past recommendations revives ideas for action and provides a base line against which to measure progress.

D. Anne Stanley *is Senior* Program Officer, Government-University-Industry Research Roundtable, National Academies *of* Sciences *and Engineering* and Institute of Medicine, 2101 *Constitution Avenue, N.W, NAS 340, Washington, D.C. 20418. William Sellers is Contract* and Grant *Officer* in the Research Administration Office, *Office* of the President, University *of California, 300 Lakeside Drive,* GWB 406A, *Oakland, CA* 94612-3550. (Both authors are staff to members of the Steering Committee of the Federal Demonstration Project.)

INTRODUCTION

Numerous studies have examined the government-university partnership and have recommended ways to reduce friction in the administration of federally sponsored research. Many of the recommendations have been unheeded. A few have been implemented, at least partially, and some have become the basis for demonstrations carried out under the Florida and Federal Demonstration Projects, both known by the acronym FDP. The FDP is a cooperative activity among several federal agencies and grantee organizations[1, 2]

In the summer of 1990, the FDP Steering Committee (Committee) took stock of the status of the Demonstration Project. As it did so, the Committee identified two reasons for the success of the FDP. First, the FDP grew out of a perceived need to solve specific problems (e.g., unnecessary prior approval requirements in the federal cost principles). Second, a conscious choice was made to begin by tackling those problems most amenable to change. A significant element in defining a problem as tractable lay in consensus on the appropriateness of the proposed change.

The FDP Steering Committee also looked to the future. As it began defining areas for new demonstrations, the questions facing the Committee included: Who is to say what problems should be addressed? How can a list of pressing problems be developed? How can items on such a list be ranked? To assist the Committee in answering these questions, the authors surveyed the recommendations of many studies of the administration of federally sponsored academic research.

The results of the survey are of interest beyond the FDP because many organizations share the FDP's interest in streamlining the management of research. The analysis of past recommendations revives ideas for action, provides a base line against which to measure progress, and illustrates the importance of consensus as a precondition for implementation of change.

METHODOLOGY

Building on the work done for the FDP Steering Committee, the authors reviewed an extensive bibliography maintained by the Government-University-Industry Research Roundtable and selected for examination all studies and reports since 1980 that address the administration of federally sponsored academic research. The focus of the review was on recommendations resulting from formal studies, workshops, and committee, commission, and task force deliberations. Articles, books,

and papers issued by individuals were eliminated. Recommendations addressing levels of research funding and recommendations specific to one discipline were also eliminated. The selected recommendations were categorized under various issue areas. Although some recommendations fit in more than one category, recommendations are listed only once. The findings were analyzed in terms of how many times each recommendation was made and in terms of the number of recommendations in each category.

SUMMARY OF FINDINGS

Table Formats. Table 1, Sources Reviewed, lists all surveyed studies that contain recommendations regarding administration of federally sponsored academic research. Preceding the citation of each study is a source code used later (in table 2) to correlate recommendations with the reports that make them.

Table 2, Summary of Past Recommendations, lists the recommendations by category and indicates, in the fourteen columns to the right of the list of recommendations, which study(ies) proffer each recommendation. An X is used to indicate that a particular study made a particular recommendation. When a recommending body issued more than one report in the same year, the recommendations contained therein are grouped under the same source code.

Table 3, Tabulation of Findings, lists the categories the recommendations are grouped under and indicates the number of recommendations made within each category in two different ways. The first number (the number under the column No. of Recs./Cat.) represents the number of different recommendations within the category. The second number (the number under the column No. of Xs/Cat.) represents the total number of times those recommendations are made. The categories are ranked by the total number of times recommendations in that issue area are made.

Table 1
Sources Reviewed

Source Codes	Sources (in chron. order)
OMB	Office of Management and Budget, Executive Office of the President, Managing Federal Assistance *in* the 1980s: A Report to the Congress of the United States Pursuant to the Federal Grant *and Cooperatiue* Agreement Act of 1977, Pub. L. 95-224 (Washington, **D.C.:** March 1980).

Table 1 (continued)

Source Codes	Sources (in chron. order)
PTN	University of California Management Group, Partnership *Between* Universities *and the* Federal Government: Response to a Study of Federal Assistance Management Pursuant to the Federal Grant and Cooperative Agreement Act of 1977, Pub. L. 95-224 (Oakland, CA: The University of California, January 1980).
NCR	National Commission on Research: Funding Mechanisms: Balancing Objectives and Resources *in* University Research (Washington, D.C.: May 1980). Accountability: Restoring *the* Quality of the Partnership (Washington, D.C.: March 1980). Review Processes: Assessing *the* Quality of Research Proposals (Washington, D.C.: May 1980).
SLN	Sloan Commission on Government and Higher Education, Sloan Foundation, "Federal Support for Academic Research:' A Program for Renewed Partnership (Cambridge, MA: Ballinger, 1980).
NSF1	National Science Foundation, Advisory Council, Task Group #7, Accountability in Research (Washington, D.C.: 1981).
GRC	Grace Commission, Task Force Report on Research and Development, President's Private Sector Survey on Cost Control, Submitted to the Subcommittee for Consideration at its Meeting (Washington, D.C.: December 8, 1983).
GRS	Ad Hoc Committee on Government-University Relationships in Support of Science, National Academy of Sciences, National Academy of Engineering, Institute of Medicine, Strengthening *the* Government-University Partnership *in* Science (Washington, D.C.: National Academy Press, 1983).
GAO	General Accounting Office: Audits of Federal Programs: Reasons for the Disparity Between *Costs* Questioned by Auditors and Amounts Agencies Disallow, Report to the Chairman, Legislation and National Security Subcommittee, Committee on Government Operations, House of Representatives (Washington, D.C.: 1984). Assuring Reasonableness *of Rising Indirect Costs on NIH Research* Grants - *A Difficult Problem* (Washington, D.C.: 1984).
CSP	Committee on Science, Engineering, and Public Policy, National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, Report of the Workshop on the Effort *Reporting Requirements of OMB Circular A-21* (Washington, D.C.: National Academy Press, 1984).

Table 1 (continued)

Source Codes	Sources (in chron. order)
BAH	Government-University-Industry Research Roundtable, Reducing Bureaucratic Accretion *in* Government *and* University Procedures *for* Sponsored Research: New Approaches in Process *and* Additional Areas *for* Attention, Proceedings of a Hearing, June 5, 1985 (Washington, D.C.: National Academy Press, 1985).
WH	White House Science Council, Panel on the Health of U.S. Colleges and Universities, A Renewed Partnership, (Washington, D.C.: Office of Science and Technology Policy, Executive Office of the President, February 1986).
FDP	Florida Demonstration Project, Interagency Working Group, *Continuation of* Florida Demonstration Project Activities, Memorandum to the Chairman of the Florida Demonstration Project Assessment Committee (Washington, D.C.: August 1987).
AAU	Ad Hoc Committee on Indirect Costs, Association of American Universities, *Indirect Costs Associated with Federal Support* of *Research on University Campuses: Some Suggestions for Change* (Washington, D.C.: December 1988).
NSF2	National Science Foundation, Report of the Merit *Review Task* Force (Washington, D.C.: 1990).

Table 2
Summary of Past Recommendations

Recommendations	Sources (in chron. order)													
	1980				1981	1983		1984		1985	1986	1987	1988	1990
	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Policy Development Process														
Agreement on fundamental principles & issues of govt.-univ. relationship	X	X	X				X					X		
Create an independent forum to guide evolution of govt.-univ. relationship		X	X				X							
Recognize that assistance (vs. procurement) is the most appropriate mode of supporting research			X				X							
Representatives of all affected parties to accept responsibility for familiarizing themselves with A-21 & A-110 and for reaching consensus on the changes needed							X							
Revise A-21 & A-110 in light of fundamental principles		X	X				X							
Experiment with and implement new grant administration procedures						X								
Definition of Accountability														
Principles to be applied for insuring accountability should be initiated by the government and adopted after dialogue with appropriate interuniversity bodies					X									

	Sources (in chron. order)														
		1980			1981	1983			1984	1985	1986	1987	1988	1990
Recommendations	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Universities to recognize govt. has legitimate interest in maintaining accountability		X	X											
Define accountability as pre-award review of proposed res. & budget, pre-award approval of instl. bus. systems, during or post-perf. review of res. progress/conduct, and audit assurance that funds spent were for the approp. program of research										X				
Consistent Policy Implementation														
Improve training of res. admin. with emphasis on fundamental principles.	X		X											X
Develop core set of terms for govt. funding of research		X	X		X					X		X		
Develop system for coordinating OMB policy dev. & agency grant regs.	X													
Congress to give OMB statutory auth. to enforce greater uniformity	X									X				
Standardize/simplify proposal format							X			X		X		
Proposals														
Simplify noncompeting continuation funding												X		X
Make noncompeting continuations automatic			X											
Limit proposal length										X				X
Simplify budgets in individual investigator proposals														X

	Sources (in chron. order)													
		1980			1981	1983		1984		1985	1986	1987	1988	1990
Recommendations	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Incr. oral communication betw. scientific and progr. officers and prospective proposers										X				
Permit PIs to submit only one proposal when parts of their program are supported by more than one agency										X				
Review Processes														
Have internal and external examination of review systems periodically for effectiveness & equity; funding agencies to initiate retrospective studies on how effective review processes are			X		X		X							X
Experiment to refine review processes; modify legislative & admin. restrictions on such experimentation			X											
Funding agencies to make explicit the nature of the underlying sci. & policy considerations used in arriving at funding decisions			X											
More emphasis on PI's previous work; make such assessments a matter of record							X			X	X			X
Merit review should emphasize importance of proposed work and its feasibility														X
Have award decision more closely linked to career stage of PI										X				

Recommendations	Sources (in chron. order)														
	1980				1981	1983		1984		1985	1986	1987	1988	1990
	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Funding Mechanisms														
Test different funding mechanisms (e.g., lump-sum grants, "grants-in-aid")			X			X	X			X				
Establish new modes of support for individual investigators (e.g., starter grants, strategic grants)														X
Regularly review profile of supported investigators to determine if balance among modes of support is appropriate														X
Expanded Grantee Authority														
Agencies to delegate more budget & management auth. to universities		X	X							X		X		
Increase flexibility of PIs to manage project funds			X							X		X		
Allow pre-award costs, no-cost extensions, and carry-forward			X							X	X	X		
Establish a minimum prior approval system for all research grantees												X		
Relatedness														
Allow relatedness among different PIs to be determined intramurally							X							
Allow related projects to be aggregated for admin. purposes		X	X							X		X		

Recommendations	Sources (in chron. order)													
	1980				1981	1983		1984		1985	1986	1987	1988	1990
	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Experiment with lead grantor concept modeled on NSF's master grant concept					X									
Research Support Continuity														
Extend the use of basic/master agreements or block grants											X			
Increase use of multiyear awards; incr. avg. awd. length from 3 to 5 years			X			X				X				
Longer grants and easier renewal processes when quality of research is clear and obvious					X									
Congress to adopt a 2-yr. approp. cycle for funding basic research			X											
Introduce incentives for agencies to provide more timely award notices			X											
Cushion the impact of terminating large awards (e.g., forward-funding)			X											
Provide research capacity support at a certain basic level across schools			X	X										
Equipment														
Raise definition of equip. threshold										X		X		
Technical Reporting														
Limit frequency and length of technical reports										X				

	Sources (in chron. order)														
		1980			1981	1983		1984		1985	1986	1987	1988	1990
Recommendations	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Permit PIs to submit a single tech. report when parts of their program are supported by more than one agency										X				
Financial Issues														
Simplify financial reporting												X		
Reexamine whether cost sharing serves useful purpose					X									
Eliminate statutory cost sharing &/or documentation reqs.			X				X			X	X			
Use single letter of credit federal-wide at each institution												X		
Audit Issues														
Develop systems for adjudicating policy interpretations made by auditors & fin. managers		X												
Allow funding agencies to comment on draft audit findings			X											
Have program officers comment on reasonableness of personnel costs		X	X											
Transfer respon. for financial oversight of fed. awds. to acad. inst. to a new Office of Inspector General attached to the National Science Bd.				X										

	Sources (in chron. order)														
	1980				1981	1983		1984		1985	1986	1987	1988	1990	
Recommendations	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2	
Change frequency of fed. audit of direct & indirect costs from annually to every 2-3 years, w/opt. interim audits in unusual circumstances							X								
Allow PIs to use up to 10% of project funds on a fully discretionary basis											X				
Improve procedures program officers use for questioning initially disallowed costs								X							
Eliminate or constrain use of reaudits, certifications, and corrective action plans to allow questioned costs								X							
Review and improve audit resolution procedures								X							
Provide Congress more complete and uniform audit resolution data								X							
Socioeconomic Issues															
Allow institution-wide annual reps. and certs.										X					
Eliminate micromanagement of an institution's health, safety, and insurance programs												X			
Universities should redouble their efforts to maintain higher ethical standards							X								

Recommendations	Sources (in chron. order)													
	1980				1981	1983		1984		1985	1986	1987	1988	1990
	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Continuing examination of questions related to freedom of scientific investigation vs. regulation to protect society from possible ill-effects of research					X									
Univ. Business Systems														
Self-regulatory principles and practices should be initiated by universities and adopted after dialogue with federal agencies					X									
Incorporate features in A-21 and A-110 that facilitate & encourage effective mgmt. and control against abuse							X			X				
Focus accountability on the total business mgmt. system of the institution						X				X				
Develop uniform process to certify grantee financial and administrative systems												X		
Universities should not impose unnecessary bureaucratic controls on PIs												X		
Effort Reporting														
Replace PARs with cert. that direct charges were fair and reasonable			X				X		X					
Replace PARs with monitored workload system (incl. nonprofessionals)		X												
Replace PARs with simpler, less costly, and more valid method of acctg. for perf.							X							

	Sources (in chron. order)														
		1980			1981	1983		1984		1985	1986	1987	1988	1990
Recommendations	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Eliminate faculty effort reporting											X			
Formulate code of ethics, enforce it, minimize detail for auditing					X									
Indirect Costs														
Allow fixed, standard, or threshold rates in lieu of documented negotiated rates for certain admin. costs						X	X	X	X		X		X	
Agencies to adopt NIH method of reimbursing indirect costs — proposals should include only direct costs			X		X									
Agencies to adopt NSF method of incl. indirect cost in project budget											X			
Split indirect cost rate into two additive rates: one for facilities/equip. (incl. O&M and depreciation or equiv.); one for all other components													X	
Govt. to reaffirm & accept the averaging principle for idc.: tends to produce one rate per campus													X	
Raise the cut-off for using the short form to $10 million						X	X						X	
Charge more costs directly													X	
Have greater uniformity in what is included in the base													X	

	Sources (in chron. order)													
		1980			1981	1983		1984		1985	1986	1987	1988	1990
Recommendations	OMB	PTN	NCR	SLN	NSF1	GRC	GRS	GAO	CSP	BAH	WH	FDP	AAU	NSF2
Greater consistency in negotiating rates among cognizant agencies and their geographic field offices													X	
More effective appeal process													X	
More flexible rules for use allowances													X	
Govt. not to tamper with gen. accepted acctg. principles in attempt to meet budget targets													X	
Find ways for faculty to become more aware of univ. financial processes									X				X	
Universities to consider new techniques to hold down cost; govt. to be more aware of cost impact of regs. on univ.													X	
Joint univ.-govt. approach to develop incentives to control indirect costs							X							
Greater use of multiple-year rate agreements							X						X	
Govt. & univ. to agree on rationale and methods for determining, allocating, and sharing costs of research							X		X					

Table 3
Tabulation of Findings
(ranked by No. of X&at.)

Category	No. of Recs./Cat.	No. of XslCat.
Indirect Costs	17	28
Policy Development Process	6	15
Consistent Policy Implementation	5	14
Expanded Grantee Authority	4	12
Review Processes	6	12
Audit Issues	10	11
Research Support Continuity	7	10
Proposals	6	8
Financial Issues	4	7
Effort Reporting	5	7
University Business Systems	5	7
Funding Mechanisms	3	6
Relatedness	3	6
Definition of Accountability	3	4
Socioeconomic Issues	4	4
Equipment	1	2
Technical Reporting		2
Total	91	155

Results of Anulysis. Several categories of recommendations stand out as ongoing problem areas as indicated by the total number of times the studies address issues in those categories (see table 3, the No. of Xs/Cat.).

The indirect costs category tops the list. Eight studies over nine years address this area and make a total of twenty-eight recommendations. Among the seventeen different recommendations, few are repeated frequently. The main exception is the recommendation to allow fixed, standard, or threshold rates in lieu of documented negotiated rates for various administrative costs. This recommendation is made more times (six) than any other recommendation in this or any other area of concern. The other, more minor, exception is the recommendation to raise the cut-off for using the short form for indirect cost calculation (made three times). Eleven of the recommendations are offered only once. Thus, the indirect cost area stands out as particularly fraught with friction but largely lacking consensus on specific recommendations for change.

In contrast, other frequently addressed issue areas reveal notable consensus on directions for change, as indicated by the fact that several specific recommendations are reiterated frequently. While the category "policy development process" comprises only six different recommendations, those recommendations recur so frequently that this issue area has been addressed a total of fifteen times. The recommendation made most often (five times) is to work toward agreement, among the partners in the research enterprise, on the fundamental principles and issues of the government-university relationship. Recommended three times each are the creation of an independent forum to guide the evolution of the government-university relationship and the revision of Office of Management and Budget (OMB) Circulars A-21 and A-110 in light of mutual understanding of accountability, effectiveness, the nature of research, the purposes of the government-university research partnership, and other relevant fundamental principles. Moreover, all the recommendations in this area are closely related, which reinforces the sense of urgency behind the need to improve the policy development process.

Another issue area that stands out is "consistent policy implementation." In total, this area is addressed fourteen times. Of the five different recommendations, one is offered five times: develop a core set of terms and conditions for government funding of research. Two are urged three times each: standardize and simplify formats for research proposals, and improve the training of research administrators with emphasis on fundamental principles.

There are a total of twelve recommendations related to expanding the authority of universities and principal investigators to manage awarded funds, making this another prime subject of recommendations for improvements in research administration. While only four different recommendations are made in this issue area, most of them recur often. Recommendations made four times include the following: delegating more budget and management authority to universities; and allowing universities, without prior federal approval, to incur pre-award costs at their own risk, to carry-forward unspent funds from one project period to another, and to extend final project periods if it is at no cost to the research sponsor. Another recommendation is made three times: increase the flexibility that principal investigators have in managing research project funds.

Recommendations related to the area of "review processes" also were made a total of twelve times. Of six different recommendations, two were made four times each: examination of review systems for effectiveness and equity, and placing more emphasis on principal investigator's previous work.

Like the indirect cost area, "audit issues" and "research support continuity" received a lot of attention (they were addressed eleven and ten times respectively), with little consensus on specific recommendations. Of the ten different recommendations in the audit area, none were repeated as frequently as three times. Of the seven different recommendations concerning continuity of research support, the only recommendation made as many as three times was that to increase the use of multi-year awards.

Although some issue areas are not subject to extensive attention, the recommendations most often span close to a decade of concern. These recurring individual recommendations fall in categories that, as a whole, do not stand out as highly problematic. For example, elimination of cost sharing and/or requirements to document cost sharing is high on the list of frequently offered recommendations. Four reports spanning seven years urge this change. However, the recommendation falls in a category, financial issues, that, in total, is addressed only seven times. Other repeatedly urged specific suggestions include the following: allowing related research projects to be aggregated for administrative purposes (recommended four times); testing different funding mechanisms, e.g., lump-sum grants (also recommended four times); and replacing Personnel Activity Reporting with certification that direct charges are fair and reasonable (recommended three times).

DISCUSSION

There has been some progress in accordance with some of the recommendations for change. The Government-University-Industry Research Roundtable and the Federal Demonstration Project are forums for guiding the government-university research relationship (recommended three times). Also, the FDP provides a means to experiment with new grant administration procedures (recommended once).

Most of the recommendations in the "expanded grantee authority" category were tested under the Florida phase of the FDP. The delegation of budget and management authority (recommended four times) led to increased flexibility of principal investigators to manage project funds (recommended three times), and pre-award costs, no-cost extensions, and carry-forward were allowed without prior federal approval (recommended four times). The success of those demonstrations resulted in two decisions. First, the expanded authorities for grants were extended to participants in the Federal Demonstration Project. Second, all federal agencies that sponsor research were given permission to use the new procedures for all grantees.

FDP participants operate under a set of terms and conditions for government funding of research that is the beginning of a core set of terms and conditions (recommended five times), and a condition of participation in the FDP is that universities remove from their business systems unnecessary bureaucratic controls on investigators (recommended once). The on-going FDP demonstration of a different standard for documentation and allocation of research costs holds promise for addressing concerns about administration of closely related research projects. (This issue issue area, although not the specific change, was subject to six recommendations.) The FDP is also demonstrating a model for a streamlined process for noncompeting renewals (recommended two times). A proposed demonstration to simplify financial reporting is under review (recommended once).

Additional developments at least partially address other recommendations contained in the reviewed reports. The 1986 changes to OMB Circular A-21 set a fixed rate for salaries and fringe benefits associated with departmental administrative expenses. By excluding the departmental administrative activities of faculty and others from cost-based reimbursement, this change reduced faculty effort reporting. (The general issue of effort reporting was the subject of recommendations seven times, and the recommendation for fixed or threshold rates in lieu of documented or negotiated rates for various administrative costs was made six times.) The National Science Foundation (NSF) method of including indirect costs in project budgets has been more widely adopted (recommended once). The 1990 report of the NSF merit review task force is evidence of a serious internal examination of ways to improve the efficiency and effectiveness of review processes (recommended four times). In recent years the National Institutes of Health have moved to increased the duration of support under their research grants (recommended three times). The Total Business System Review initiative from the office of Naval Research is a step toward focusing accountability on the business management systems of universities (recommended two times). Also, headlines about the Baltimore case notwithstanding, many universities are redoubling efforts to maintain higher ethical standards (recommended once).

Nonetheless, much of this progress is tenuous and uneven. Few changes have been incorporated into the regulations and circulars that govern research administration, and few have been adopted by the full universe of federal agencies that sponsor academic research or the universities that perform the research.

Moreover, there is a marked absence of progress on several of the most frequently made recommendations, including those to agree on

fundamental principles and issues of the government-university relationship (recommended five times), eliminate statutory cost sharing and documentation requirements (recommended four times), revise OMB Circulars A-21 and A-110 in light of fundamental principles (recommended three times), raise the cut-off for using the short form for indirect cost calculation to $10 million (recommended three times), and improve the training of research administrators with emphasis on fundamental principles (recommended three times).

CONCLUSION

A remarkably wide array of recommendations has been made over the past decade in studies addressing problems in the administration of federally sponsored research. Analysis of those recommendations shows that some issue areas have been the subject of considerable attention and are areas of continuing tension in the government-university research partnership. Of particular note in this regard are the following: indirect costs, the policy development process, consistent policy implementation, expansion of grantee authority, review processes, audit, and continuity of research support. This finding should be viewed with some caution, however. The level of aggregation used to categorize the recommendations, the lack of objective criteria on which to base the categories, and the overlap among some categories mean that the results of the tabulations are, to some extent, subjective.

Analysis also shows that, despite some action, most frequently made recommendations still are not formally or widely inplemented. This leads to the conclusion that thoughtfully considered recommendations issued by high-level commissions, study groups, and sophisticated analysts are not sufficient to cause improvement in the administration of federally sponsored research. Recommending groups generally do not have authority to act on their own recommendations, and implementation of recommendations commonly depends on consensus among a broader group of stakeholders than is comprised by the recommending group. Moreover, the required consensus often is lacking because the various stakeholders have different perspectives on the fundamental principles of research administration.

In the absence of follow-through by the recommending groups, action largely has been left to coincidental concurrence of views between the recommending groups and the organizations or agencies that have the power to act. Some, albeit still inconclusive, action has also occurred through the FDP, which has undertaken the time-consuming and

sometimes painful process of bringing stakeholders together to reach the consensus required to jointly design and test new procedures for research administration.

The authors suggest that recommending groups might have more impact if, instead of disbanding when their reports are issued, they remain intact and worked toward acceptance of their recommendations by the organizations / agencies that do have authority to act. The ongoing discussions between the U.S. Office of Management and Budget and representatives of the Association of American Universities (AAU) concerning the 1988 AAU report on indirect costs is a salutary example.

However, proposed solutions to problems in research administration often uncover fundamental disagreements about the princples of research support and administration - principles ranging from the proper bases for accountability, to the appropriate degree of delegation of oversight, to the proper balance between standardization and flexibility. Formal implementation of tested innovations in research administration, such as the expanded grantee authorities demonstrated under the FDP, and even the testing of more controversial changes in procedures for research administration, hinge on broad consensus on such principles. Thus, the authors suggest that efforts to test and implement specific recommendations need to be accompanied by explicit attention to the principles embodied by the current and the proposed new procedures.

In addition, the path for more effective and efficient research administration would be smoothed if agreement on fundamental principles could be achieved by directly addressing the question: What are the appropriate principles of research support and administration?

While this review points to issue areas that need attention and to specific recommendations that might be acted on, the results also raise the question: Who has identified the issues and made the recommendations? The nature of the recommendations and the frequency with which they recur reflect the composition of the recommending groups and the primary concerns of those groups. The perspectives of principal investigators and agency program managers are not as strongly evident as the perspectives of university and government administrators.

Although the findings in this analysis need to be supplemented with recommendations from groups with additional perspectives, the findings can be used by the FDP and other groups to identify potential action items and to set priorities among them.

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Use of Students as Research Subjects: Institutional Responsibility

Deborah L. Smith, JoAnn C. Cutting,

and Robert O, Riggs

Abstract. This paper focuses on responsibilities of institutions of higher education regarding the use of university students as human subjects in university research projects. A brief history of research involving humans is followed by an explanation of the use of students in university research projects and a summary of institutional responsibility to students and to the public. The authors conclude with suggestions that institutions incorporate controls into research policies in order to avoid problems relating to the use of students as subjects in research projects.

INTRODUCTION

The relationship between universities and students is a complex one which has been reviewed from a variety of perspectives. However, one aspect of the university-student relationship has not been adequately addressed: the use of university students as human subjects in university research projects. In providing a brief history of research involving humans, this paper notes that the fundamental principles of respect for persons, beneficence, and justice must be considered when conducting research using human subjects. The student's vulnerability as a research subject makes it particularly important for universities to consider these principles before approving the use of students as research subjects. Self-regulation of the use of students as research subjects will convey university commitment toward fulfilling its responsibilities to students and to the public and also may help universities avoid additional outside regulation.

Deborah L. Smith *is* Director of Project Administration, Office of Research Affairs, The University of Tennessee, *Suite* 220, 847 Monroe Avenue, Memphis, TN 38163. JoAnn C. Cutting is Assistant General Counsel *and* Assistant Professor at the University of Tennessee. Robert 0. Riggs *is* Regents Professor of Higher Education, Memphis State University, Ball Education Building, Memphis, TN 38152.

RESEARCH INVOLVING HUMANS - A BRIEF HISTORY

Concern regarding the use of human subjects in research dates back to the experiments performed on prisoners in concentration camps during World War II. Because many of these experiments involved cruel and inhumane treatment, many of the doctors involved in such atrocities were tried for war crimes. The resulting Nuremberg Code of 1947[1] outlined principles which must be observed when using humans in medical experiments. These principles included (1) "voluntary consent," (2) necessity of the experiment for the good of humanity, (3) prior animal or other research to indicate that "anticipated results will justify the performance of the experiment," (4) avoidance of "all unnecessary physical and mental suffering and injury," (5) ban of experiments expected to result in the death or disablement of subjects unless "the experimental physicians also serve as subjects," (6) involvement of no greater risk than benefit, (7) adequate care and treatment of subjects, (8) conduct of research by only highly skilled and qualified investigators, (9) discontinuation of experiments at subjects' will, and (10) discontinuation of experiments which result in indications of "injury, disability, or death to the experimental subject".[2]

The Declaration of Helsinki, written by the World Medical Association in 1964, then revised in 1975, provided recommendations similar to the Nuremberg Code for the conduct of biomedical research involving human subjects. Again, the concepts of voluntarism, risk/benefit ratio, and prior animal or related experiments were embraced.' In addition, this document recommended that an independent physician obtain informed consent from the subjects in cases where a dependent relationship exists between the subject and the investigator.[2]

As the U.S. federal government became involved in scientific and medical research, it began to promulgate rules governing the use of human subjects in such research. In 1953, the U.S. Public Health Service (PHS) instituted rules necessitating prior review of research involving human subjects in its own intramural research activities; similar rules were extended to extramural research projects funded by the PHS in 1966.' This latter application coincided with a resurgence in public concern regarding the safety of subjects of scientific research[3,4]; the regulations also coincided with concerns for the appropriate use of public funds to support such research.[5]

Exactly what does the term "human subject" mean? The definition published in the U.S. Code of Federal Regulations (U.S. 1987,46 CFR 102F) is the following:

> "Human subject" means a living individual about whom an investigator (whether professional or student) conducting research obtains (I) data through intervention or interaction with the individual, or (2) identifiable private information.

Note that this definition includes not only medical research conducted by physicians but also other research activities involving interactions with individuals or the use of private information, e.g., private student or patient records or sociological surveys regarding students' sexual habits. Mention should be made here that any private use of student records for research purposes are protected under federal regulations ("Buckley Amendment," U.S.C., 1982, Title 20, Section 1232G, Public Law 93-380, 88 Stat. 484, Section 513).

The U.S. Food and Drug Administration (FDA) definition (applicable to studies of investigational drugs or devices) is as follows:

> "Human Subject" means an individual who is or becomes a participant in research, either as a recipient of the test article or as a control. A subject may be either a healthy human or a patient.[6]

Both the FDA (21 CFR 50,56) and the U.S. Department of Health and Human Services (HHS) (45 CFR 46) now have established guidelines for the use of human subjects in research. HHS regulations apply to research using human subjects in any research activity supported by funding from the HHS. FDA regulations "apply to research involving products [novel drugs and medical devices] regulated by the FDA, "regardless of source of funding for the research activity. Research involving both HHS-funded research and FDA-regulated products must comply with both sets of regulations[7] Both agencies require review of the applicable project by an institutional review board (IRB). In addition, state or local regulations or university policies may be more stringent and may require IRB review of all research projects involving human subjects.[8]

What is an IRB and what does it do? Federal regulations state that the purpose of institutional review boards - which have the authority to approve, disapprove, or require modifications in research - is to ensure that (1) risks "are minimized," (2) risks "are reasonable in relation to anticipated benefits," (3) the "selection of subjects is equitable," (4) the "informed consent" of subjects or their legal representatives is documented, (5) adequate safety provisions are provided, (6) privacy and confidentiality

safeguards are included, and **(7)** "the rights and welfare of subjects who are members of a particularly vulnerable group" are protected.7

In 1979, the National Council for the Protection of Human Subjects of Biomedical and Behavioral Research published The Belmont Report: Ethical Principles **for the** Protection of Human Subjects **of Research** (U.S. PHS, 1986), which covered "Boundaries between Practice and Research," "Basic Ethical Principles," and "Applications," including "Informed Consent," "Assessment of Risks and Benefits," and 'Selection of Subject." [9]

All of the codes outlined in this historical review include three fundamental principles to be considered in the conduct of research using human subjects: (1) respect for persons, (2) beneficence, and (3) justice. The first of these principles, respect for persons, involves the autonomy of individuals to consent to participate in the research activities and protection of individuals with a diminished capacity for autonomy (e.g., the mentally ill, prisoners).[2] This would include the writing of consent forms in language which the research participant can understand - an item of recent concern in IRB literature.[10]

The second principle, beneficence, involves doing no harm (based on the Hippocratic oath) and ensuring that the benefits of the research outweigh the possible risks. Since even determining what may be harmful can sometimes involve risk, the latter of these two points (assessing and justifying the risk/benefit ratio) merits the bulk of consideration[9]

The third principle, justice, requires that persons be treated fairly. With regard to medical and other scientific research activities, justice requires giving adequate consideration in the selection of subjects for participation so that no particular class of people is more likely to be selected than others and so that a representative sample of individuals likely to benefit from the research is included in the study population.[2]

The application of these three principles may not always be practical or necessary; however, investigators and institutions should give careful consideration to these principles before undertaking research involving human subjects and, in particular, before approving the use of students as human subjects in research.

USE OF STUDENTS AS HUMAN SUBJECTS

Just where does the use of students as human subjects in research projects come into play? In comprehensive university settings, students may be used as participants in social science or educational research projects conducted by either faculty members or by other students. In university health science centers, students may also be involved in medical research as "healthy volunteers" in evaluations of investigational

drugs. For Phase I studies of investigational drugs, for example, healthy volunteers are used in pharmacological trials "to determine toxicity, metabolism absorption and elimination,. . . preferred route of administration, and safe dosage range.""

Why are students used as research participants? Since a limited number of subjects are available for research projects, investigators sometimes must work diligently to obtain the numbers of subjects necessary for the validity of a project. At the same time, investigators must minimize costs so that the cost/benefit ratio of the project will be maintained. Therefore, they seek subjects who are the most readily accessible. In the case of physicians, their own patients or patients in nearby hospitals fall into this category.[3] In the case of university investigators, students may serve as readily accessible subjects. Additionally, the use of students facilitates the conduct of follow-up tests which are often required, especially in medical research. Thus, for projects such as the Phase I evaluations of investigational drugs mentioned previously, the student body may be a very good source of healthy volunteers.

The use of students as human subjects in research projects has raised considerable question; in fact, some universities have instituted policies which limit the use of students in such projects or provide strict guidelines for their participation.[3] Many institutions, however, have no such policies in place.

Why are students vulnerable as research subjects? Christakis[12] indicated that their desire to please the investigators, combined with their own interest in the research activity under consideration, places students in positions of questionable autonomy with regard to informed consent. Peer pressure may also be applicable when students are asked to participate in studies conducted by other students. Kobasic[3] stated that, "The university IRB should take special care to protect the medical student from undue coercion and excessive health risks" when he or she is a possible research subject. Another concern is whether students are unduly influenced by incentive payments or the award of extra credit to participants in such studies.

UNIVERSITY RESPONSIBILITY TO STUDENTS AND TO THE PUBLIC

The relationship between the university and the student has undergone vast changes over the past few decades and, despite "judicial reluctance to interfere",[13] the courts have been called upon to provide the ultimate definition of that relationship. In the majority of these cases, the courts

have formulated conclusions based upon either contract theory or constitutional law,[14] and distinctions have been made between public and private institutions in the application of these laws.[15]

The relationship between the university and the student regarding the use of students as research subjects, however, may be better addressed through university self-regulation. By exercising two areas of responsibility - the university's fiduciary responsibility to serve the best interests of its students and the public and the university's ethical responsibility to maintain its institutional integrity - universities would comply with the three fundamental principles of conducting research using human subjects. Action on this issue also may help universities avoid additional external regulation.

Contract Theory and Constitutional Law

Although educational institutions generally deny any specific contractual academic obligations to students, contract theory may be applicable if the aspect of the university-student relationship in question involves matters addressed in a valid contract signed by both parties. In such disputes, "the first legal source to consult is usually the contract terms."[16] Examples of valid contracts would include granting of degrees upon completion of specified requirements and payment of fees. However, Kaplan[16] further indicated that "courts have applied the contract theory to postsecondary institutions in a deferential manner," allowing institutions to change contractual terms as necessary to fulfill their responsibility to adequately educate students.

Constitutional law generally guarantees individual freedom and limits the powers of governments over individuals. Any state statute or institutional regulation or practice which violates a student's constitutional rights "will be subject to invalidation by the courts."[16] Specific constitutional provisions often at issue in student-university conflicts include the following: freedom of speech, press, etc. (generally protected by the first amendment to the U.S. Constitution); freedom from unreasonable search and seizure (the fourth amendment); freedom from double jeopardy and self-incrimination and a guarantee of due process (fifth amendment); sovereign immunity of state institutions (eleventh amendment); and guarantees of due process and equal protection under the law (fourteenth amendment).[16]

Although all institutions of higher education may be subject to both contract theory and constitutional law, application of constitutional law to conflicts between students and institutions is more likely in the case of public institutions; contractual theory generally is more likely to be relied upon in dealing with private institutions. However, it may

well be that neither of these theories adequately addresses the relationship between universities and students with regard to student participation in university research activities.

Fiduciary and Ethical Responsibility

What, then, is the university's responsibility with regard to the use of students as participants in scientific research? Two areas of responsibility are suggested: (1) a fiduciary responsibility to serve the best interests of the student and the public and (2) an ethical responsibility to maintain the integrity of the institution and to avoid additional external regulations.

Black's Law Dictionary gives the following definition of "fiduciary": [17]

> . . . a person holding the character of a trustee, or a character analogous to that of a trustee, in respect to the trust and confidence involved in it and the scrupulous good faith and candor which it requires. A person having this duty, created by his undertaking, to act primarily for another's benefit in matters connected with such undertaking?7

This dictionary further indicates that "[a] 'fiduciary relation' arises whenever confidence is reposed on one side and domination and influence result on the other. . .."

Seavey expressed the opinion that professors and administrators in educational institutions have a fiduciary responsibility to the students.[18] Levine indicated that after human subjects have signed a consent form to participate in medical research, the institution is in a fiduciary position with regard to the subjects. Levine further stressed that "investigators must be aware of their motivations and take care not to subjugate the subject's will to their own."[2] Kobasic agreed that institutions and IRBs have a fiduciary responsibility to human research subjects.[3]

Another aspect of the university's responsibility to students involves the university's duty to instill ethical principles and to set an example of professional ethics.[19, 2o] In its Statement on Professional Ethics, the American Association of University Professors indicated that "a teacher. . . [should avoid] any exploitation of students for his private advantage. . . "[21] Dill expressed the view that faculty members should serve as models for students,[22] and Baumgarten stated that, among other responsibilities, teachers have a responsibility to teach values.[23]

The same principle of fiduciary responsibility is applicable to the university's relationship to the public since the public places its trust - and, in the case of public institutions, considerable funding - in the university and depends upon it for the education of students and the conduct of research. As Seavey suggested, application of the fiduciary

concept to the university-student relationship could eliminate distinctions in the application of constitutional theories to situations involving private versus public institutions.'*

In fulfilling their fiduciary responsibility to students and to the public, universities also meet the requirements of the first two principles of the codes of ethics listed earlier in this paper: respect for persons and beneficence. The former principle involves the autonomy of the subjects of research to give informed consent. As Silverman indicated, "The quality of consent is often influenced by the social relationship of the principals. . . [and] self-interest can make the [investigator] very persuasive." [1] The second principle involves adequately assessing the risk/ benefit ratio of the study. In making this assessment, university investigators must keep in mind their fiduciary roles in placing the students' best interest before their own. Robertson indicated that peer pressure has sometimes forced investigators "to pursue knowledge at the expense of the subject"4

The fiduciary responsibility of the university to the community-at-large and to the scientific community specifically involves the third principle cited in the codes: justice, which includes equitable selection of subjects for research activity. Random selection of subjects representative of the study population likely to benefit from the research is necessary for valid scientific investigations;[2] the use of students, who are not so representative, may bias the data.[13] Universities may want to take a close look at the use of students in research with regard to this third principle since university students may be of a "particular class." This would be especially applicable to medical and other health sciences institutions, as well as other schools with stringent admission selection criteria. Of course, the point could be argued that this principle would not be applicable in studies such as bioavailability studies using healthy volunteers.

A university's ethical responsibility to maintain the integrity of the institution and to avoid additional external regulations also addresses the relationship between universities and students with regard to using students as research subjects. In maintaining the integrity of the institution, universities would do well to look to the theory of professionalism. Even in the days of Plato, it was known that "no craft or profession should seek its own advantage but should benefit those who are subject to it."[24] Striven indicated that ethics is often taken for granted until problems arise;[25] Ylvisaker and Farago echoed that sentiment with regard to professional ethics.[26,27] The Council on Scientific Affairs and the Council on Ethical and Judicial Affairs of

the American Medical Association recommended protection against even "the appearance of impropriety?

Schurr, however, indicated that the definition of professionalism is changing:

> Their [professional academics] purpose is not so much to glorify truth and promote knowledge as to receive economic support, advance their several specialties, and satisfy their interests. . . . These days one does not become a professional by "making a profession," but by being paid to exercise a special competence, thereby satisfying one's own interest in the public interest.[29]

Schurr further stated that as public scrutiny continues, institutions must police themselves or the public will do it for them. Farago echoed this concern and stated that professionals are sometimes tempted to "act selfishly" rather than in the best interests of others. He suggested self-regulation by institutions in order to prevent external regulations which, he indicated, are designed "to keep the system honest. . . ."[27] Silverman' suggested that the codes listed earlier in this paper evolved because scientific and medical investigators "could not be relied on" to self-regulate.

In order to avoid additional external controls in this age of "growing sophistication of consumers"[26] universities would be wise to address the subject of the use of students as participants in research projects and to take steps to ensure the protection of these subjects.[29] Kobasic also expressed concern that investigators might put their own interests above those of their subjects and indicated that although self-regulation will not guarantee ethical conduct, it should reduce the likelihood of abuse.[3]

CONCLUSION AND RECOMMENDATIONS

In view of the growing public concern about institutional accountability and considering the institution's own integrity and institutional responsibility to both students and the public, institutions of higher education would be wise to incorporate into their research policies controls governing the use of students as human subjects in research projects. Such controls might include the following:

1. A statement specifying the types of projects in which the use of students as human subjects might be permitted and encouraging investigators to give careful consideration to the need to use students as human subjects in research projects.

2. A requirement that all projects which involve the use of students as human subjects in research be reviewed by the IRB regardless of funding and that such projects be reviewed by a special board (or subcommittee of the IRB) to ensure that students are not coerced into participating in such projects and that the students' best interests are safeguarded during the project.
3. Procedures to withhold approval of projects involving the use of students as research subjects unless the protocol indicates that an independent physician or, in the case of nonmedical studies, an independent faculty member will obtain informed consent from the university students involved.
4. Inclusion of a university student as a regular member of the IRB.

In addition, institutions may want to consider incorporating into their standard IRB guidelines or application materials a special section on use of students as human subjects. This would ensure that all investigators who submit protocols to the IRB for review have access to information relevant to the use of students as human subjects in research.

Institutions of higher education can never be completely free from public scrutiny or from the potential of litigation. However, institutions which follow the recommendations in this article can be certain they have given careful consideration to their research policies as they relate to the use of students as research subjects and should be able to avoid many of the problems which might otherwise arise. Such procedures will not only discourage or lessen the need for external controls but will also serve as persuasive evidence that the institution is exercising diligence in meeting its responsibilities to its students and to the public.

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Evolution of the University Research Mission in the United States

Charmaine Judy Streharsky

Abstract. This paper describes the evolution of the university research mission from the era of Napoleon until 1990. The infancies of the front-running research universities are described, as well as the maturation and growth of governmental and industrial support for university research. Recommendations of various groups calling for university involvement to aid U.S. world leadership in research and education are highlighted. The article speaks to the importance of decentralization in university research and the key roles universities play in recommending and implementing national science, research, and education policies. All associated with the university enterprise are encouraged to help their institutions serve as leaders in matters of public safety, human rights compliances, and ethical issues. Direct involvement of U.S. universities in national science, research, and education policies also is prescribed. Such involvement is seen as obligatory in pursuit of the tripartite university mission of education, research, and public service.

HISTORICAL FRAMEWORK AND THE FRONT-RUNNERS

> We are like dwarves upon the shoulders of giants, and so able to see more and farther than the ancients.
>
> (Bernard of Chartres, quoted in "John of Salisbury," Metalogicon)

According to many researchers of ancient history, centers of scholarship and learning date from the ancient civilizations of the

Charmaine Judy Streharsky is Director of Research Services and Sponsored Programs at the University of Akron, Akron, OH 44325-2102.

Middle East, Greece, Rome, Africa, and South America. However, the institutional grandmothers of American research universities were probably an unintentional gift of the conquests of Napoleon.

The Kingdom of Prussia suffered military and political collapse triggered by Napoleon's victories in 1806. In Prussia's efforts to rebuild, Prussia captured its entire educational system under national control under the Ministry of the Interior.4 The University of Berlin was established in 1809 and merged with the Royal Academy the same year to create a center of learning unlike that known before. This university was hampered by no religious or philosophical constraints. Its professors were seen as teachers and scholars. Its mission was free inquiry and the search for truth, and its subsequent dissemination (teaching) was secondary. Great success was experienced by this university, filled with this heady freedom, in securing world-renowned scholars to join the faculty. The reborn Bonn University followed suit, and this German research university model became widely imitated in Europe, the Americas, and Asia.[4]

Visiting scholars as well as graduate students were welcomed from around the globe to the German universities. Between 1820 and 1920, perhaps 9,000 scholars studied at German universities, with most receiving advanced doctoral schooling.[9] Many of these scholars returned to their home countries, of course. Therefore, not only was the German model admired and imitated from afar, but those from the United States educated at German universities who returned to positions in American academe, brought their personal experiences to bear and further influenced their own colleges and universities toward the German research university model. German research universities enjoyed their world-wide premier reputation until the creation of the Nazi state. Tragically, the squelching of academic freedoms of free inquiry and expression, accompanied by elimination of "non-Aryan" scholars in the institutions and then subsequent destruction caused by war, wrought havoc upon the German universities.[4]

From the American colonial establishment of the first college (Harvard) in 1636 through the pre-Civil War years, U.S. colleges and fledgling universities concentrated their efforts on teaching. Although there were some notable exceptions, the achievement of most students was perhaps more comparable to that of English preparatory school graduates rather than to English university graduates of the time.[9] This no doubt slowed faculty research growth. It is graduate education which both supports and benefits most from faculty research. As American students eventually became better prepared as they entered college, the graduate education and faculty research efforts began to feed one another.

PostCivil War urbanization, expanding settlement, and industrialization forces created the demands for advanced scientific and technical training and knowledge by both businesses and government at all levels.[9] The Morrill Act of 1862 created opportunities for endowment funds created by the sale of lands by states to establish and maintain at least one college in each state. These land-grant colleges were created for teaching, but "without excluding other scientific and classical studies."23 This left the door open for research to be supported by the land-grant colleges as well. In 1887 the Hatch Act created the government-funded agricultural experiment stations at land-grant institutions, which further strengthened their research missions.7

Although scholarly research continued to increase, in the late 1860s the stated primary mission of the colleges was still teaching. In 1868-69 President Andrew White of Cornell and President Charles Eliot of Harvard urged continued emphasis on teaching. The deepening faculty interest in scientific research and experimentation was viewed by some college administrators with alarm. Even the president of German-modeled Johns Hopkins University spoke in 1876 of the obligation to teach, but only freedom to investigate.[2,10]

From the 1880s on, the research mission of U.S. colleges received increasing attention. For example, by 1880 Harvard had established the earliest research sabbaticals, which released a few faculty members from teaching at half-pay every seventh year to pursue their own scholarly research.[6] These were rare prizes, however, until the 1910-20 period, when eligibility was extended to all Harvard faculty.

Harvard was perhaps the first to receive a major incentive grant in support of research. In 1880 a private individual offered Harvard a grant of $115,000, with the stipulation that Harvard had to first raise $75,000 for endowment to cover operating expenses of what was named the Jefferson Physical Laboratory.[6] By 1888 California and Chicago universities had created astronomical observatories through like funding schemes. The pattern for what we now refer to as "challenge" matching grants was formed in the United States.

The mood was changing at some institutions as well, as in 1893 the University of Chicago President William Harper outlined the scholarly research and publication mission of his institution. He proposed to make the work of giving instruction secondary to that of faculty scholarly research!8 Early in the 1900s a few key research institutions, such as the Carnegie Institution, were created. However, universities remained the principal home of all research endeavors.

As research grew, doctoral programs expanded as well. Johns Hopkins awarded the highest number of doctoral degrees in the 1880s and 1890s.

However, by the early 1900s Harvard, Columbia and Chicago took the lead in number of doctoral degrees granted.[10]

Concern regarding comparative value of doctoral degrees granted by differing institutions was one cause for the creation in 1900 of the Association of American Universities, with twelve original members. Desire for other common standards brought formation of other accreditation-minded organizations. [18] Various philanthropic foundations which supported higher education began demanding certain standards in order for the universities to qualify for their financial support. This requirement benefitted universities by strengthening graduate education, and thereby aiding the research programs as well.

At the beginning of this century, a number of changes were made to promote research. There was concerted effort to lower faculty teaching loads to accommodate research.[6] Graduate student research fellowships were established with university funds, well before graduate teaching fellowships were established.[10] By 1900 eleven colleges and universities permitted sabbaticals for scholarly research purposes[10] By the period 1900-1920, the leading research institutions were creating budgeted accounts to be used by research faculty for expenses such as materials and supplies and support personnel. In an AAUP survey of 1921, nine universities were found to have specific revolving university grant research funds.[6] In addition, private contributions were sought from the community and alumni to supplement such accounts.

The years between the Spanish-American War and World War I saw the growth of “progressivism." An element of this was a deep sense of public obligation and social conscience, which brought American universities to the service ideal.[17] This further defined the tripartite university mission of the colleges and universities of teaching, research, and public service, which is viable today.

The University of Chicago, which was established as a “service” university, saw as part of service an obligation for an active research mission.[6] Chicago had a profound influence as a model for comprehensive universities. While it improved its research mission, it also expanded the traditional academic year to four full quarters, including a summer session. This allowed students to progress more rapidly, with the opportunity for a student to complete a bachelor’s program in three years; in addition, graduate research and education activities could remain active year-around. Faculty research publications were considered as important as teaching. The University of Chicago became the first truly comprehensive university, granting all degrees from associate through doctoral. Liberal education curricula became more professionally oriented, and professional programs included more

liberal education requirements. Major and minor fields for students were created, which allowed both interdisciplinary educational opportunities as well as greater focus in some fields, depending upon how they were used.[18]

Chicago also established academic departments, which provided a context for peer review of research activities as well as administrative structure.[10] The University of Chicago progressed rapidly as a research and service university, at one point aided by "robbing" over half of the academic staff of the financially troubled and dissension-ridden sister research institution, Clark University.[18]

In the 1890s the "bureaucratization" of universities had taken a form which would serve as a model of university administration through today. The universities of Chicago, Columbia, and Harvard created formal administrative structures, which gave deans great importance. Typewriters and typists became commonplace and institutional files mushroomed. College presidents early in the 20th century were urged to obtain special administrative training for their positions.[24] This administrative structure and formalized institutional record-keeping allowed easier research partnerships to develop between universities and government and universities and industry in research grant relationships.

Other research universities blossomed, such as the University of Wisconsin and Johns Hopkins University. In 1916 the University of Wisconsin president called for every Wisconsin faculty member to earn scholarly recognition and engage in productive work in research.[10] By 1920 the sixteen recognized research universities in the United States included University of California, Illinois, Michigan, Minnesota, Wisconsin, Caltech, Chicago, Columbia, Cornell, Harvard, Johns Hopkins, MIT, Pennsylvania, Princeton, Stanford, and Yale.[6] By any current measure, all of these remain strong research universities. By 1930 the U.S. Department of Education in its surveys of universities began seeking separate data on organized university research activities.[7] Organized internally and externally sponsored research activities at universities were no longer extraordinary.

By 1915 the American Association of University Professors (AAUP) had been established. This professionalization and banding together of faculty across university lines and disciplines aided the research mission as well. Principles of academic freedom and of tenure were defined, which protected free research inquiry from the probing of governing authorities and religious factions.[18] AAUP's direct support of freedom of inquiry and the university tripartite mission of research, teaching, and public service were reiterated in its 1940 Statement of Principles.' The search for truth (via research) and its free exposition

(publishing and teaching) were considered to be for the common good and therefore essential elements of true public service. When the United States entered the World War II era, comprehensive research universities were firmly established, and research was a vital element of their mission.[8]

GOVERNMENTAL RESEARCH SUPPORT

Government grants of money and equipment are not recent innovations. When Queen Isabella gave the regal nod to Christopher Columbus circa 1492, she was in fact awarding a government grant for a research expedition. However, government research grant support has increased dramatically in the United States over the past fifty years.

Prior to World War II, state support of university research seemed more significant than federal. In the early 1900s the progressive and public service-oriented University of Wisconsin had a tremendously strong relationship of mutual aid with the State of Wisconsin. Wisconsin faculty directed their research heavily toward the solution of state problems.[18]

But state support can be restrictive. Today, for instance, only three of the 200 universities in the Commonwealth of Pennsylvania's postsecondary system are assigned a research mission by the state.[19] Furthermore, states can subtly manipulate research activities of the universities through approvals or disapprovals of graduate curricula. State control through requisite approval of graduate programs, justified as a worthy effort to avoid duplication of programs at universities within the same state, can enhance or curtail that university's and department's resources for research as well.[19] But sponsors desire to place their funds where they see the greatest chance of success, and doctoral students support faculty research. Therefore, state governments and their boards, appointed to oversee university educational programs, have a profound influence over university research as well.

By the early 1900s through the 192Os, U.S. universities felt the monetary pinch in trying to support research on their campuses. Need was critical for larger, stable sources of research funding for multi-year periods. Costs for science research equipment and facilities increased dramatically, lockstep with the growing sophistication of science.[6] Competition among universities in the research arena caused demand, and therefore salaries, of faculty scientists to rise. The National Research Council in 1920 conducted a survey of scientific research funding in the United States.[6] It found that reliable research funding via endowment or long-term planned budgetary appropriation was sketchy

at best among the sixteen universities surveyed. The drive for government research support was on.

Naturally the Great Depression of the early 1930s had an adverse effect on universities and research, along with virtually all other institutions in the United States at the time. However, during and after World War II, real effort was made at the federal level to advance U.S. scientific and technological research along with science education. Understandably the emphasis was on national prosperity and security.

Broad and long-term federal support of basic and applied research was given high priority. In 1950 the largest federal expenditures for research were associated with Atomic Energy Commission research, individual small projects in natural science, applied large Defense projects, agricultural experiment station research, and Public Health for a total for those entities of $140 million.[7] In various fits and starts, many federal agencies had awarded research grants with the blessing of Congress. However, the Department of Defense (and most especially the Office of Naval Research) became the primary grantor agency of federal support for university basic scientific research until the establishment of the National Science Foundation (NSF) in 1950.[5]

The National Science Foundation Act of 1950 set the stage for meaningful coordinated grant support of scientific research and education. The NSF was established after five years of argument over the degree of its autonomy. Proponents, including former director of the Office of Scientific Research and Development Vannevar Bush, wanted the National Science Board to control the selection of the NSF director. They lost, and President Harry S. Truman prevailed as the selection of the NSF director was given to the President, with the federal executive Office of Management and Budget playing a major role at NSF in setting its annual budget request to Congress.[14]

In 1955 NSF moved toward funding bigger science with the growth of new centers for astronomy and for atmospheric sciences. In 1957-58 the Soviet Union's success with Sputnik I, which extended human contact to outer space, sent shockwaves through the U.S. scientific and political communities. This underscored the need of the United States to improve science education and basic research to remain a world leader.'4 Heavier federal investment in research and development and science education followed. No doubt the strong proposal peer review systems of the National Science Foundation and the National Institutes of Health gave the cream of scientific proposals the best chance to rise to the top of the federal agencies' funding priorities.

In 1968 an amendment of the NSF Act expanded its mission to the support of applied research and the social sciences. In 1979 engineering

was elevated in importance to a separate NSF directorate, recognizing the increasing value of engineering research!“ Although there was a leveling off of NSF proportionate support of research and science education in the early 198Os, at about $1 billion, in 1988 President Ronald Reagan proposed doubling the NSF budget within five years. As of 1990, forty years after its creation, the NSF annual budget exceeded $2 billion for the first time.‘4

Robert Rosenzweig, as President of the Association of American Universities, in 1987 described research universities from the period 1947-87. During this period the number of research universities grew to approximately 100. He described them as becoming larger, more complex, more competitive for money and people, more in need of capital, more involved in politics and policymaking, and more dependent on government support.[16] Roger Geiger noted the evolution of distinct organized research units within universities, which expanded markedly during this period from observatories and museums into university research institutes of specific focus. These organized research units often possessed a higher degree of autonomy than was traditionally afforded university academic departments, and this may have been a contributing cause to U.S. research growth in key areas.[7]

As government support, particularly federal, grew, government regulations affecting universities and research proliferated. The United States became increasingly concerned about public health. Between 1965 and 1980, Congress passed more than thirty laws aimed at coping with public health risks, whether for occupation, consumer products, transportation, or environment.[16] By 1990, to be eligible to receive federal funds, research universities had to comply with a myriad of government regulations, including such matters as rights of human subjects in research, recombinant DNA and biohazard management, lobbying, hazardous waste disposal and environmental standards, radiation safety, cost principles and audit requirements, scientific misconduct, equal employment and affirmative action, animal care and use, nondelinquency on federal debts, and drug-free workplace. The benefits of federal aid were uplifting, but the burdens of institutional compliance became the ballast.

INDUSTRIAL RESEARCH SUPPORT AND UNIVERSITY-INDUSTRY PARTNERSHIPS

Industry relies upon universities to prepare the educated, skilled, and professional workers it needs. Beyond this, industry has come to rely increasingly upon universities for both basic and applied research which is beyond its capacity or willingness to perform in-house.

In 1984 at its annual meeting, the National Brick Manufacturers Association deplored the absence of any university in the United States that provided courses and special facilities for ceramics research. Ohio State University stepped smartly into the breach and created such a program.‘7 Of such happenings were some happy university-industry affairs, if not marriages, made. For major industrial and manufacturing centers with a single focus (such as the rubber industry), the universities in closest proximity often develop complementary educational programs and research concentrations. However, it was not until the World War II era that industrial research awards to universities for basic and applied research became commonplace.

Government's wishes "for the people" include its desire that industry bring the fruits of university research to the public through new products. Thus government has always been supportive of university-industry exchanges. However, as we moved into the 1960s and 197Os, and the financial demands upon its coffers for research dollars increased, the government's interest in cooperation became keener. In 1978 Dr. Martin Cooper, at the time Director of the Division of Strategic Planning and Analysis of the National Science Foundation, spoke to the Society of Research Administrators of the increasing government reexamination of research priorities, and the recognized need for greater cooperation between academia and industry.[3] Government wished to move some of its burden to industry. Government saw it was not easy for many companies to take the pure scientists' information and quickly transform it into usable products. One government remedy was to cause the two to work together so that it would be clear where one endeavor ended, the other must pick up. The result was a series of incentive programs by federal and state governments. These offered modest funding to university and industry to become willing and resource-contributing partners in research *and development* efforts. Some, such as government base-grant-funded research centers with industrial involvement as a prerequisite of funding, continue to the present.

Because of the divergent philosophical and operations bases of universities and industry, they do not easily work together. Universities are nonprofit institutions. They are deeply rooted in the principles of academic freedom, which not only upholds freedom of inquiry, but also the privilege and obligation to share the resulting information through publication, international scholarly exchange, and teaching. Universities customarily do not "assign" personnel, at least not faculty, to research projects; the topic of research and sponsors is generally left to each faculty investigator's choice.

Industries on the other hand have their foremost obligation to their stockholders. Profit is mandatory to their mission. Therefore their research and development efforts for new products are almost always steeped in secrecy in order for them to gain as much advantage as possible over competitors. Their desire is to move decisively and pull out all stops to meet their schedules. Therefore, although university and industry scientists and engineers may delight in discussing one another's work and mutual interests, it is nonetheless difficult for the two *institutions* to work together comfortably. Compromise and patience are essential. As a crude indication of the level of interest and difficulties experienced in universities and industries working together, one may look at the 20th Anniversary Issue of the . Journal of the Society of Research *Administrators.* For the period 1968-88, two articles were listed on the topic of university-government cooperation; one article was indexed dealing with university-foundation relations; and *thirty-five* were listed on the topic of university-industry cooperation! [20]

As universities concentrated their efforts in recent years upon full-blown university-industry cooperation and attempts at technology transfer of university patentable inventions to industry, some encouraged their faculty researchers to join or form outside "spin-off' companies to commercialize promising technologies invented by those faculty researchers. In some cases, universities took equity interest in the companies. As a principal in the company, the faculty member stood to gain monetarily, as well as prestigiously with the exciting possibility that his or her new inventions would be brought to the marketplace. These were powerful incentives for the researcher to work with those with development and marketing skills in the small companies as well. The hope was that all would profit, including the faculty researcher, the university (through equity and/or royalty interest and the glory of being the origin of yet another remarkable new product), and the public.

However, faculty researchers who wished to retain their academic ties in addition to their commercial interests became a problem. To whom did they owe their allegiance? Could they impartially evaluate scientific results that might conflict with business profits, such as the results of clinical drug trials? Even when individual motives and ethics were pristine, the research results and subsequent recommendations could be questioned because there was no "arms-length" relationship. By stepping inside the company, the researcher stood to lose credibility as an independent scientist.

Now federal conflict-of-interest regulations are being thrashed out which no doubt will have an impact upon such arrangements. And many universities are pulling back from such *intimate* university-industry

relationships in recognition that they may impair pursuit of the mission of the university. In a journal article regarding potential conflict between freedom of inquiry and government policy, this writer recommended that we not yield to temptation or pressure to do that which does not fit comfortably within our personal and institutional ethical frameworks. As responsible citizens we should make our feelings known to the public policymakers. This seems good advice in the relationships between universities and private industry as well, and in our dealings with the agencies creating and enforcing the laws and policies which regulate that relationship.

UNIVERSITY ROLE IN EDUCATION POLICY

The United States faces severe challenges ahead to remain a world leader. International competition is stronger and likely to increase in trade, science, engineering, and economics. We will need all the basic research strengths we can achieve, a technically competent and educated populace, creative industrial managers, and supportive macroeconomic policies, according to a National Science Board 1988 report.[12]

In the meantime, we have serious concerns regarding the quality of U.S. public education. This writer heard discouraging comments made by a senior federal science advisor, who offered the opinion that the only hope for the United States to fill its needs in the next twenty years for a scientifically and technologically literate workforce was through attracting qualified individuals from foreign countries. He felt the we had essentially "lost" one generation of U.S.-born scientists and engineers through a combination of poor K-12 education practices along with unmitigated societal problems which have affected our young people's values, including the work ethic. He also pointed out that our incentive system does not encourage or reward advanced, and especially doctoral, education of our most talented citizens.

A National Governors' Association report of 1988 made some similar observations and some sweeping recommendations. It suggested anti-trust restrictions to permit expansion of joint ventures." Human resource needs were outlined with recommendations to increase the quality and quantity of U.S. teachers for kindergarten through high school by (1) increasing student aid; (2) allowing certification of engineers, physicists, and mathematicians with minimal additional course work for teacher certification; (3) enhancing math and science magnet secondary schools supported by university staff and advice; (4) increasing involvement of the business community; (5) acquiring greater corporate support by increasing university co-op programs,

adding adjunct faculty from industry into university programs, and increasing corporate donations to universities. Greater investment in research and development was suggested, along with greater commercialization of research findings and more federal and state government partnerships to support them as well."

The Task Force on Women, Minorities, and Handicapped in Science and Technology in a September 1988 report recommended a comprehensive program to assist the nation's human resource needs and to increase the participation of women, minorities, and handicapped persons in science and engineering. They recommended that universities set quantitative goals for recruiting, retaining, graduating, and *hiring* scientists and engineers from under-represented groups. And, interestingly, they recommended a massive media campaign to be undertaken with the assistance of the U.S. entertainment industry to encourage youth and the general public to acquire an appropriate level of science and engineering education.[22]

Looking at the challenges and problems and the recommendations presented here, it becomes clear that universities can and must assist in virtually every area. In education, the university's role is clear. Universities must do a better job than ever before of educating thinkers, planners, writers, scientists, engineers, technicians, economists, geographers, linguists, physicians, and all others who require postsecondary education, while involving all able people, including minorities and handicapped persons. We need participation of all of our citizens to solve the problems we face. Universities must do a better job of training *and retraining* competent school teachers, as well as training enough qualified scholar-teachers to become the next generation of university professors. And universities are appropriate locations for all types of adult education and for retraining adults in technical and professional fields. *Universities must be wise and persistent advisors us well in setting national education policy*.

The research mission of universities is more important than ever before. University research can investigate and proffer solutions for many of the problems we face, including the multitude of known, sobering environmental problems; energy shortages; hunger; distribution problems; disease; socioeconomic problems of all types; and other subordinate problems which, if solved, would make our collective lives better. We would do well to encourage university faculty to remember the value to society of their research scholarship amid the many other responsibilities they face.

Dr. John Sink of West Virginia University pointed out that decentralization of research in universities, as opposed to research

centered in a few national labs, fosters growth in research. We should be cautious to maintain this decentralization and individual inquiry so that avenues of inquiry are not missed through groupthink. Although scientific exchange is inivigorating, independent research avoids potential lockstep thinking. Decentralization also encourages healthy scholarly competition. Sink points out that in the current scheme of research funding, the number of top research universities is diminishing.[19] Federal research awards tend to go to these few universities. Scientists, engineers, and administrators should speak out so that federal research support is diffused sufficiently to support many independent researchers.

On the other hand, complementary to this, is the recommendation that the university's role should include helping to set and achieve national goals and increased cooperation between the university and other sectors in order to meet those goals.[15] Universities are obliged to participate in setting national science *policy*. A robust university research program in the United States would be one aided by the focus of *a* national science *policy*, which would allocate resources primarily (but not exclusively) to a manageable number of broad areas of research, and this coupled with decentralized research at *a* variety of institutions with *a* multitude of *scientists and their research teams addressing their best thinking to elements* of *the broad focus areas set by the national policy*. Collective wisdom brought to bear on a limited number of areas seems to possess the greatest chance of success.

CONCLUSION

As universities struggle to carry out their diverse responsibilities, they should attempt to do so as model institutional world citizens. Traditionally universities have railed against conformity and regulation, and leaned toward free thinking, rugged independence, and disdain for compliance. However, this desire for independence should not extend to universities not complying in matters critical to public health and safety or equal opportunity. Otherwise universities risk losing their enviable reputations as centers of highest-order thought and principle.

Dr. Robert Rosenzweig in a 1987 address to research administrators explained that life is longer and healthier for us in the United States than for any generation before us. However, in part because of the very scientific advances we have produced, the general public now has a higher awareness and greater knowledge than ever before of public health risk and feels more threatened by it than ever in the past. He solicited the help of research administrators to bring an informed and

objective assessment of university responsibilities in law and in good sense and in recognition of university vulnerability in the prevailing political and social climate.[16]

Universities should serve as exemplary leaders. It behooves all of us associated with academia to work as change agents, if necessary, within the universities to influence faculty and administrators to support and comply with federal regulations, especially those dealing with health and safety issues and rights of citizens. If university researchers believe that current or proposed regulations do not or will not accomplish the desired public benefit, they should devote the time and patience necessary to make their voices heard and educate the key agencies and legislators. University help is vitally needed to enlighten such administrators and lawmakers so that they may create rules that we can all live by and that will have the greatest chances of success.

Finally, universities who will play such an important role in the future of our nation and the world should not lose sight of their admirable research, teaching, and public service mission. On the cover of the National Science Foundation Annual Report of 1989 is a fine quote for consideration by us and by the university teacher-scholar-citizens as they teach, inquire, and serve the public:[13]

> Bear in mind that the wonderful things that you learn in your schools are the work of many generations. . . . All this is put into your hands as your inheritance in order that you may receive it, honor it, add to it, and one day faithfully hand it on to your children.
>
> -Albert Einstein

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Reports/Observations

Indirect Costs of Federally Funded Research at Colleges and Universities

(Statement by V. Wayne Kennedy, Vice Chancellor-Administration, University of California, San Diego, Before the Subcommittee on Labor, Health and Human Services, and Education, Committee on Appropriations, U.S. House of Representatives, May 14, 1991)

Mr. Chairman and Members of the Committee:

I am pleased to appear before you today to discuss the "indirect costs" associated with federally funded research at colleges and universities. My name is V. Wayne Kennedy and I am the Vice Chancellor for Administration at the University of California, San Diego. Although UCSD is not well known by the general public, and perhaps even by members of this committee, UCSD consistently ranks among the top ten university recipients of federal research and development funds. In fulfilling this research responsibility to the nation, we recognize UCSD's responsibility to prudently manage the federal funds provided by the citizens of this country.

President Shapiro [Princeton University] has made an eloquent statement about the benefits this nation derives from the partnership between the federal government and universities in conducting research and development. Indeed, some economists assert that future technological innovations are the principal way the United States will be able to compete economically with other nations that possess skilled labor forces and lower wage rates. Indirect costs may be the least understood aspect of this magnificent partnership. I have been deeply involved in indirect costs for the past thirty years, both in my current capacity and at the University of Maryland.

Perhaps the most perplexing aspect of indirect costs is the wide variation in indirect cost rates among colleges and universities. This

is best exemplified by the thirty-five-point spread in indirect cost rates among the top ten university recipients of federal research funds in fiscal year 1989. Among those ten universities, the lowest indirect cost rate is 39 percent and the highest rate is 74 percent. Everyone I know has the same question: Why is there such a wide range of rates? I will attempt to answer that question in these remarks.

There are more than 3,000 institutions of higher education in the United States. Approximately 100 of these are what we have come to call research universities, and I will restrict my remarks to those institutions. Despite their similarities, and there are many, there is tremendous diversity in the institutional characteristics that shape those universities and their financial practices. The age of an institution, its geographic location, whether it is public or private, the diversity of its funding sources for research, differences in traditions, and other factors influence a university's financial policies and practices. And these differences manifest themselves in indirect cost rates. The three major reasons for differences in indirect cost rates are: (1) facilities costs; (2) cost recovery policies; and (3) decisions about allocating expenses as either "direct" or "indirect" research costs. Each of these elements is affected by the institutional characteristics I have mentioned.

FACILITIES COSTS

All studies of the differences in indirect cost rates point to facilities as a major factor. A 1987 study of fourteen colleges and universities by the Council on Governmental Relations found that facilities costs alone resulted in up to a twenty-seven-point difference in the indirect cost rates of the institutions studied.

OMB Circular A-21 permits universities to be reimbursed by the federal government for the use of facilities in federally funded projects. Such reimbursement can be made under either of two basic methods. The choice of method produces large differences in the amount of facilities reimbursement claimed per year. Under the annual use allowance method, 2 percent of the value of buildings and improvements and 6.67 percent of the value of equipment may be claimed each year for as long as the assets remain in use. This allowance results in a fifty-year depreciation for buildings and fifteen years for equipment. As an alternative, assets can be depreciated over their estimated useful life. Under the depreciation method, assets can be separated into components, and each component may be depreciated over its estimated useful life. For example, the structure of a building may have a useful life in excess of twenty-five years, while the mechanical systems may have a useful

life of only fifteen years. The depreciation method produces a higher indirect cost rate but requires the expenditure of a considerable amount of time and money to implement. There is also disagreement between federal agencies and universities about the conversion of assets from one method to another. This controversy has convinced most universities to continue to employ a use allowance.

Another variable is the amount of direct federal funding a university receives for facilities. You may recall that in the 1960s and 1970s the federal government had active programs to fund research facilities. During the 1980s and at present the government provides minimal funding for facilities which, in turn, has resulted in more borrowing by universities. This has increased the facilities component of indirect costs.

A related factor affecting the cost of facilities is the cost of money. Interest expense varies widely among universities, not only because of the number of facilities financed, but also because of financial terms and interest rates. For example, facilities built in the early 1980s carry a considerably higher interest cost than facilities built in the late 1980s and early 1990s. Furthermore, financing options available to public universities are often less costly than those available to private universities because of federally mandated limits on the amount of tax exempt borrowing. State universities may also finance facilities through their state governments, which may produce lower interest rates than are available to private institutions.

Utilities rates and consumption levels are also markedly different around the country. Electricity, for example, costs nearly four times as much in California as in Washington. Research facilities costs also vary because of a school's mix of research disciplines. Life and health sciences facilities are more expensive to build and consume more utilities than mathematics and social sciences facilities.

I believe that the facilities costs at universities will continue to rise as buildings constructed in the 1960s and 1970s become obsolete and need replacement or renovation for the science of the 1990s and beyond. I also believe the government must be willing to pay for its use of these facilities in a manner that ensures the availability of buildings and equipment to do the nation's research.

COST RECOVERY POLICIES

Let me now turn to the issue of cost recovery policies. All research universities share in the cost of federally sponsored research. The degree to which an institution shares in the cost has an important effect on the differences in indirect cost rates. Cost sharing by research universities

can be done in a "direct" manner. For example, faculty effort devoted to federally sponsored research may be paid by the university. Cost sharing can also be accomplished in an "indirect" manner as, for example, when the university accepts a lower-than-calculated indirect cost rate. The reasons for different levels of cost sharing vary. Pressure from researchers to keep direct and indirect costs low for competitive reasons is frequently a major factor. Institutional policy or requirements of state government concerning the distribution of recovered indirect costs is another.

State universities on average propose and collect less indirect costs than private universities. Justification for greater recovery of appropriate costs, in many cases, requires special studies. The cost to prepare such documentation may not bring a return in recovery to the institution that warrants the up-front expense. Not all state governments allow the recovered funds to flow back to the universities. In those cases, the university has little incentive to conduct special studies that might result in greater indirect cost recovery.

COSTING DIFFERENCES - DIRECT VERSUS INDIRECT

Finally, I would like to address the matter of cost differences. Some types of costs are generally considered to be "direct costs," and others are generally regarded as "indirect costs." The ability to identify and assign direct costs to a specific project varies, not only between universities, but also between departments at the same university.

For example, one department may operate a clerical support pool, which is shared by *all activities* in the department, such as research, teaching, student support and administration. Job requests are funneled through the supervisor, are assigned, and completed roughly in the sequence in which they are received. It would be difficult to quantify the pool's effort in support of each separate departmental activity at year end. Therefore, this support cost would best be treated as an indirect cost. In another department, clerical support staff are separately retained for each of the department's specific activities. In this department, it is quite easy to identify and therefore charge the support cost directly to the activity which is benefitted.

Another example would be building rental costs for off-campus space dedicated 100 percent to research. This cost is easily identified and would be treated as a direct cost. Contrast this situation with a building on campus that may be used for both teaching and research. The research portion of this expense would be included as part of the indirect

cost rate. Equipment is another example. Project-specific equipment is direct charged, while university-acquired general use equipment, such as an autoclave, is likely to be indirect costed.

Operations and maintenance costs are also often found in both categories. The operations and maintenance indirect cost component represents basic levels of services such as electricity, water, and cleaning. Other services, such as special hazardous waste handling, are easily direct charged.

In conclusion, the differences in indirect cost rates and the reasons for these differences do not reflect arbitrary decisions but rather real differences among institutions: differences related to their facilities, organizational procedures, and budgeting. The A-21 cost principles recognize these institutional differences by providing alternatives for the treatment of various components of cost.

Recent reports have advocated changes in the cost principles that would serve to narrow the differences among institutional indirect cost rates. Changes, such as a threshold rate for administrative costs, a separate rate for facilities, and more direct charging of research costs, deserve serious consideration and would go a long way toward a better understanding of indirect costs. In my judgment, the cost principles have served both the government and universities well. They do need to be reviewed and modified, but certainly not abandoned.

Thank you for the opportunity to speak to you today. I would be pleased to respond to any questions you may have.

Wayne V. Kennedy
Vice Chancellor-Administration
University of California, San Diego
Q-057
La Jolla, CA 92093

CONTAINMENT OF LEGAL COSTS IN TECH TRANSFER

As many have observed, technology transfer programs are a vital part of the new economic equation. The time, energy and fiscal resources required for success in technology transfer activity are substantial! Research services staff who lack experience in this area should seek outside consultation before initiating major technological transfer activities. Such activities require maintaining a high energy level, keeping business contacts current, attending conferences, interacting with national and state government committees, and networking with corporate contacts to facilitate technological transfer activities. Another major consideration in technological transfer is cost containment of legal fees.

Legal fees can pose a formidable barrier to the effective implementation of technology transfer activities. The university, therefore, must be willing to provide the financial resources for the development of an appropriate program. A substantial allocation of funds is necessary for legal fees incurred for patenting and licensing activities. Filing costs for each patent averages $10,000 to $15,000. Depending upon the number of patents filed per year, the cost can be astronomical. On the other hand, income derived from various patents and licenses can provide incentives for research services staff to aggressively pursue technology transfer activities. If funds are refunneled to appropriate department heads and deans, there will be an incentive for staying on top of technological developments in their fields and serving as technological experts to research services staff.

Two major models exist for supporting technology transfer activities: (1) A university can enlist the services of a national corporation such as Research Corporation or AIM. These corporations decide what activities are patentable and licensable and they pay all of the legal fees and filing costs. The charge for this service is a certain proportion of the royalties derived. Thus, it is prudent for these corporations to do a certain amount of screening prior to filing. Such a model costs the university less initially; however, when a patent derives substantial income, the university receives less. Some state legislatures prohibit the exporting of patenting and licensing to outside corporations by their public universities. (2) A university has in-house staff to decide what

activities will be patented and licensed. These are usually scientists with either a law degree or some law background and many times have extensive patent experience. Other experts on campus, and off-campus legal counsel, may also be called upon. After the decision is made to pursue a patent, outside attorneys are enlisted to file patent licenses.

This model can cause substantial cost over-runs for a university. In order to contain the costs on legal activities, the following suggestions are offered: (I) Before engaging a firm for patenting and licensing activities, a cost estimate for each activity should be prepared. For example, have the firm put in writing that it will execute a patent for $10,000 and that any excesses will be covered by the legal firm. Some smaller firms may reduce the fees and produce more work. One drawback of a fixed price procedure is that there may be little incentive for quality. If inadequate up-front work results, it may be necessary to employ another firm. (2) Make sure that your firm knows that you are interested in doing business with other firms. A no-bid contract with a firm does little to keep prices down. Competition is essential. (3) As much of the routine work as possible should be done in-house before farming out the work for patents. Patent attorneys should train research services staff as much as possible to prepare correspondence, documents and other routine tasks. Farming out only those activities that must be executed by the patent attorneys will cut down substantially on your legal costs. (4) Keep excellent records, periodically checking to see that your record for charges corresponds with what the attorneys charge. If bills become excessive, they should be brought to the attention of the attorneys. (5) Approach any type of litigation from a cost/benefit analysis. Industrial concerns have powerful legal departments. If it is necessary for a university to pursue a copyright or a patent infringement, the university's general counsel must know what the budget is and help monitor the legal cost. (6) Agreement must be made in writing regarding who will pay advertising and marketing costs, which can be substantial.

Adequate resources earmarked for legal activities provide the university with a conceptual stability that is prerequisite to building a quality technology transfer program. If insufficient resources are provided, the university may find itself relinquishing numerous patent rights, foregoing the income that might be derived from them.

John S. Wodnarski
Associate Vice President, Research and Graduate Studies
The University of Akron
Akron, OH 44325-2102

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