RESEARCH MANAGEMENT REVIEW

The Journal of the
National Council of University Research Administrators

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Editor's Preface

This issue features articles addressing issues of interest to research administrators as they operate in their intramural environments, particularly those at smaller or mid-level funding institutions, and research administrators as they function with their faculty constituencies and the public. Ironically the two articles which incorporate university research policies and practices in a context of public perception and service, also draw attention to some conflicts of perception of the process of academic research. Universities' proactive technology transfer efforts have been integrated with the national mandate to achieve an international "competitive edge!' The public perception of the value of academic research is more positively viewed in this economic framework (although some would say this dilutes the intrinsic and necessary commitment to "basic" research by academicians.) But, that same public becomes skeptical of scientific and technical ethics as instances of scientific misconduct appear to be increasing or at least have the attention of the media more frequently.

Don Baldwin's article reviewing "Academia's New Role in Technology Transfer and Economic Development" achieves an excellent balance between depth and breadth and between the external environment and the internal (campus) response. Readers who are interested in the topic, but not well informed about technology transfer and economic development issues will be expertly enlightened. The pros and cons of two basic operating models for technology transfer in the university community are evaluated. Baldwin's closing comments about incentives and income distribution policies deserve further thoughtful assessment. Clearly the passage of PL 96-517 motivated most recently-constituted university technology transfer programs. Sufficient time has now passed to evaluate the institutional incentives encouraging university researchers to initiate the technology transfer process. Are institutions altering their incentives, royalty sharing mechanisms, etc? What is the impact of faculty involvement in spin-off companies? Is collaborative research being done differently in highly "transferable" areas?

Charmaine Streharsky's article poses in a more editorial format the need for institutional principles or initiatives for ethical conduct of research. The topic is most certainly timely as institutions formalize their policies addressing scientific misconduct in an area of public ambiguity about "good" research. The author raises serious questions, particularly those issues of student involvement and a discipline's training standard for acceptable and publishable data. The most complex dilemma may be that postulated value judgement that ranks the merit of the research by the accuracy of the conclusions drawn by the researcher.

Shifting to the intramural research administration contributions: John Mishler's carefully crafted article covers the variables affecting acquisition of sponsored funds at the small to mid-level college or university. He reviews the subject well, with a thoughtful analysis of operational mechanisms and some consequences. Program development is a key research administrative function at most institutions. Mishler's literature review, drawing from a variety of theoretical and applied resources e.g. "Journal of Higher Education," "Research in Higher Education," as well as the more familiar "SRA Journal" and "Grants" magazine, generates practical information that will be informative to many readers independent of the size of their institutions.

With this issue, a new section "Reports/Observations" is added. This section will feature contributions of brief, current topical reports from contributors. Contributions on issues of interest to research administrators but not in formats or contexts meeting the traditional standards for articles (original research, critical analysis of the literature of the topic, theoretical conceptualizations and practical applications, etc.) would be published in this section. "Reports/Observations" will consider for publication contributions which may have been previously published in internal institutional materials, or publications of very limited distribution in the research administration community, talks/presentations at regional meetings, or position papers/addresses from senior university administrators and other research policy analysts that would bring new insight or direction to the general research administration community. Gene Schuler's report on "Technology Transfer Concerns" draws attention to concerns about the relationship within the Tax Reform Act of bonding authority with university licensing commitments in research agreements, timing deposits of microorganisms, and export information regulations.

"RMR" continues to solicit manuscripts on topics of interest to professional research administrators. Authors deliberating about the potential for publication of a topic are encouraged to consult the editor.

Mary Ellen Sheridan
Editor
October, 1988

Academia's New Role in Technology Transfer and Economic Development

Donald R. Baldwin

Abstract. One of America's most demanding challenges is to restore its competitive position in the global marketplace. Slowed productivity growth and increased competition from foreign producers has led to serious trade deficits, a decline in real earnings and a stagnant standard of living. Changes in federal policies and new federal programs intended to improve American competitiveness in the world markets have spurred increased interest in university developed technologies and the technology transfer programs that attempt to move these technologies from the campus into commercial application. This article identifies some of the key trends and outlines the new role research universities are playing in the national economy.

INTRODUCTION

There is an exciting new phenomenon on the American academic scene, particularly among the research universities. It is commonly referred to as technology transfer and is increasingly the subject of attention by academic institutions, industrial corporations, state governments and the federal government. Rapid development of this technology transfer concept and the refinement of effective models to achieve it are important to the U.S. competitive position in the world marketplace and to consumers who seek high quality products at reasonable prices.

Technology transfer, per se, is not new to universities but a new dimension has been added. Their traditional methods of transferring the results of research include the education of students, publication

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of books and articles and the presentation of papers at scientific meetings. Those methods continue and are largely unaffected by another form of technology transfer that is at the heart of the new phenomenon mentioned above. For purposes of this article, technology transfer refers to converting research results into commercial products or processes covered by patents and/or license agreements. Before probing this new phenomenon, it is useful to note the primary reasons American universities have not historically participated in this commercialization form of technology transfer and to describe the changes that prompt them to do so now.

HISTORICAL PERSPECTIVE AND KEY CHANGES

The Russian launching of Sputnik spawned a vigorous U.S. commitment to science and technology. The federal government itself took a leading role and, during the 1960s and 197Os, allocated ever increasing sums of money to support basic research by the country's universities. In those years, there was lots of money, the application procedures were easy and the post-award administrative requirements were not onerous for the faculty investigator or the grantee institution.

Given these circumstances, longstanding university-industry research collaborations diminished, in part because industry funds were not needed to support university research and in part because industry's rights to the results were clouded by actual or potential commingling with federal research funds. In this separation between the academic and industrial research communities, a critical bridge was lost for the expeditious transfer of new technologies from the laboratory to the marketplace.

During the 1970s and into the early 1980s, core technologies produced by universities were largely ignored by American companies and were commercialized by foreign firms, especially Japanese. American technological preeminence in the world marketplace began to erode. The economic seriousness of these trends came into sharp focus during the late 1970s and led to a series of steps designed to revive and strengthen university-industry interactions. Government, industry and academia began to form new partnerships designed to focus on research with apparent commercial promise and to expedite transfer of the results into commercial products.

Defining the "proper" and most productive role for each of the three parties - government, industry and university - in these partnerships proved difficult. Many models have been tried and the experimentation continues even now. Along the way, there have been numerous conferences and workshops bringing together the sharpest minds in the country to consider the serious policy issues involved. Typical was a national conference[r] held in 1982 in which Frank Press, President of the National Academy of Science, provided key policy insights while discussing the importance of the national economy of having university-developed core technologies effectively exploited through university-industry relationships. In concluding his remarks, Press said, "The opportunities are incredible. If realized, they will enrich us all. Although we live in difficult times we are still the richest country in the world. In our science and technology we have the key to assuring our future." But he also noted that "The federal government has to make difficult choices."

While there remains some fuzziness about the best methods and mechanisms, it is clear that to regain market share and eliminate the balance of payments problem, American industry must improve its ability to compete with Japan, Germany, France and other countries, both in the U.S. markets and abroad. One important step toward that end will be industry's rapid incorporation of new technological advances from the nation's universities into their products and manufacturing techniques. This basic message was amplified in a recent booklet published by the Council on Research and Technology (CORETECH) setting forth its agenda for 1988 and beyond based on a year of deliberating how the critical process from the discovery of a new idea to commercialization can be strengthened. CORETECH has emerged as a key player in these matters. Established in early 1987 to develop and implement national public policies that encourage research and development and hence, U.S. competitiveness, it represents a broad cross-section of the American research community and has corporate, university, research institute, and association members.

In a summary statement about its policy recommendations, CORETECH says "We strongly advocate safeguarding and expanding our basic research base, and, at the same time, we urge that all actors in the R & D process emphasize technology transfer, commercialization, and advanced manufacturing technologies." This conveys the national mood and fabric that encourages - indeed mandates - the new university emphasis on technology transfer.

NEW FEDERAL POLICES ON PATENTS, TECHNICAL DATA AND SOFTWARE

Starting about 1980, federal encouragement of technology transfer by universities was dramatically increased, especially by adoption of a federal patent policy. This policy, which allows universities to retain ownership of patents based on federally funded research, has greatly increased the number of university-developed technologies being made available for commercialization. The clarity of title rights and the ability to profit from patents encourages universities to be more aggressive in identifying inventions and in licensing them to industry.

Prior to 1980, the U.S. did not have a uniform government-wide patent policy. Federal agencies were allowed to formulate their own policies - twenty-six in all - and these varied greatly. From the university perspective, the most favorable was what is now the Department of Health and Human Services (DHHS). That agency entered into Institutional Patent Agreements with universities allowing them to retain title to, and pursue commercialization of, inventions arising from DHHS supported research. The next most favorable policy was that of the National Science Foundation (NSF), under which the NSF would, on a case by case basis, allow the grantee institution to retain title. Least favorable was the Department of Energy (DOE) policy, which retained invention rights to the DOE. Other agencies fell somewhere on the spectrum between the DHHS and the DOE extremes.

It is clear from the GAO report and other recent studies that the passage of PL 96-517 motivated many universities across the country to implement new or more vigorous technology transfer programs. While this uniform government patent policy is widely recognized as the cornerstone for action, other factors strengthened this stimulus. As mentioned earlier, the U.S. competitive position in the world marketplace had eroded and there was growing evidence that this was due, in part, to the commercialization of US. developed technologies by foreign countries. The government, industry and academic communities recognized that the U.S. competitive position would be enhanced by strengthening university-industry linkages to more quickly identify the commercial applications of university developed technologies and to hasten the flow of those technologies from the laboratory to the marketplace. Further, by 1980, many states had taken a keen interest in economic development. They soon saw the important role that universities play in economic development and the relevance of strong university-industry linkages to fostering technology transfer and creating new jobs. It is also pertinent that in the early 1980s many public and private universities were having severe financial problems and were very attentive to new funding sources. The realization that a technology transfer program might be one such source required little imagination.

These circumstances did not encourage university faculty and administrators to commit either attention or resources to vigorous technology transfer programs. Further, prospective industrial licensees were generally skeptical of technologies based on federally funded research. They feared that the title or license granted them by the university would be clouded by government rights, thus diminishing their ability to fully exploit the technology and realize its potential value.

This context changed dramatically when the Congress enacted Public Law 96-517, The Patent and Trademark Amendments of 1980, giving universities the right to retain title to federally funded inventions they developed. The original Act was improved when Congress subsequently amended it in 1984 through Public Law 98-620 to extend its coverage and remove or ease some of its restrictions. A recent study by the U.S. General Accounting Office[3] (GAO) indicates that these laws have had a significant positive impact on universities and small businesses. University administrators surveyed indicated that PL 96-517 had stimulated business sponsorship of university research, which grew 74% from $277 million in 1980 to $482 million in 1985. These administrators also noted that the PL 98-620 amendments, removing licensing restrictions, have made businesses even mare willing to license and exploit university technologies

OTHER FEDERAL ACTIONS

In addition to the new federal patent policy, the federal government has taken a number of other steps since 1980 that also foster university-industry relations and encourage technology transfer. Four NSF programs are especially pertinent. They are: Industry/University Cooperative Research Centers; Engineering Research Centers; Science and Technology Centers; and Presidential Young Investigators.

Anti-trust laws were relaxed to allow firms to form collaborative research ventures to solve technological problems common to their industry. The Justice Department now sanctions such cooperative research with the understanding that cooperation will end and competition resume as soon as research is turned into product. According to a report published in May 1987 by the California Department of Commerce: forty such research consortia have been formed and more are being planned. Some involve one or more universities in addition to multiple companies. The University of Washington Center for Process Analytical Chemistry (CPAC) is one such consortium. The feasibility of CPAC was confirmed with assistance of a planning grant from the NSF. The Center was implemented in 1984 with about twenty chemical company sponsors and backing of a five year grant from NSF's Industry/University Cooperative Research Centers Program. By its fourth anniversary in 1988, CPAC had ten additional sponsors, a heavily used computer based communications network, an impressive list of scientific publications and a growing volume of invention disclosures - precisely the desired results.

Federal tax laws were also amended to provide R & D and incentives. For example, 1981 legislation provided corporations with an R & D tax credit for five years and a modified version of it has been continued. The tax credit provisions encourage corporations to donate research equipment to universities and to provide funding for university-based research. These tax incentives have stimulated many university-industry interactions that would not have occurred without them.

Changes in the U.S. Patent and Trademark Office (PTO) are also relevant. Recent automation has streamlined the operation and reduced the average time of patent issuance. Further, the number of Patent Depository Libraries was expanded by seven in 1985 to 60 nationally. Even more significant, patents now enjoy stricter enforcement under federal intellectual property laws. With increasing consistency, courts are sympathetic to patent holders place the burden of proof on the alleged infringer. The great efficiencies in the PTO and the more supportive attitudes in the courts encourage inventors to seek patent protection and the patents received are of greater value because infringement is discouraged.

As indicated above, the academic community is quite pleased with the federal policy covering patentable inventions, and it is having the anticipated positive impacts. However, the absence of a federal policy for technical data and computer software paralleling that for patentable inventions is a substantial disincentive blocking the effective commercialization of many university developed technologies. Technical data and software is now covered by two separate sets of federal rules implemented in the Spring of 1987, one applicable to civilian agency research awards to universities and the other to DOD awards. Both fail to recognize that university technical data and software is generally developed over many years with funding from many sources. Thus, the rules contain provisions which impede rather than facilitate the commercialization of computer software and other unpatented inventions, but there are hopeful signs for improvement. Key among them is an April 10, 1987 Presidential Executive Order, "Facilitating Technology Transfer," mandating the development by September 1988 of a single uniform policy, and language within the Order clearly indicates the intent that universities would be able to commercialize software and other technical data they develop in research supported by federal awards.

STATE INVOLVEMENT

Coincident with the new patent policy and other federal initiatives noted above, states have increased support for small business and higher education in the realization that both are vital to a healthy growing economy.

State economic development programs have shifted from an emphasis on attracting existing firms from out-of-state toward growing and nurturing local businesses. This shift was heavily influenced by the studies by David Birch[5] indicating that the majority of new jobs are created by small businesses: firms with fewer than twenty employees accounted for 66% of all new jobs between 1969 and 1976; companies less than five years old created 80% of all U.S. jobs during the same period; and the Fortune 500 companies created virtually no new jobs in the last decade (1970s). These studies have had substantial influence on state and local level economic development programs and have generated increased interest in growing and nurturing new companies. This, in turn, influences the focus of university technology transfer efforts. In addition to licensing existing businesses, serious consideration is now given to forming new start-up business to commercialize technology opportunities to be located within the university's own state or region.

The economic relevance of scientific research is also recognized. In a 1985 National Governors' Conference address, Governor Bruce Babbitt of Arizona, referring to the importance of new technology to business growth, said, "The application of scientific knowledge is the basis for economic expansion and diversification, the key to formation of new businesses and the competitive survival of old ones." Many other governors apparently share this view.

An article in Inc. magazine: which ranked states on the bases of new jobs and fast growth companies, indicated that the leaders - Alabama, Florida, Texas, Arkansas, North Carolina and South Carolina - were pouring unprecedented sums into public education and vocational/technical education. Ohio has established the Thomas Edison Program to link academic research with commercial technology ventures. Indiana has established a $135 million fund to invest as seed capital in high technology start-ups in thirteen discipline areas. Iowa has allocated $18 million for a biotechnology center that combines the resources of its research universities and local industry to expedite conversion of new technologies to products.

Pennsylvania has programs called the Ben Franklin Partnership and the Pennsylvania Technical Assistance Program (PENNTAP) that stimulate economic growth and support technology utilization within the state. Michigan invests some of its state pension funds as venture capital in new businesses and established the Strategic Fund which contributes to bank loans to businesses that would not qualify for conventional loans. All of these programs targeted to supporting local business development and these are typical of programs in other states.

States now see the importance of higher education centers not only as the source of skilled and knowledgeable individuals, but as the major stimulant in the formation of new businesses that can compete on the basis of technological advantages. The top areas for entrepreneurial activity and new venture investment have been Silicon Valley in the San Francisco Bay area and Route I28 around Boston. It is generally agreed that the presence of several excellent universities in those areas has fueled their successes. After many years in the making, strong economic growth is now occurring in the Research Triangle Park area of North Carolina based on the contributions of Duke, the University of North Carolina and North Carolina State University.

In the Puget Sound region around Seattle, strong growth in the biotechnology community is fueled largely by world class researchers and new technologies at the University of Washington and the Fred Hutchinson Cancer Research Center. In the Salt Lake City area, new business growth is spurred by the research capability and aggressive technology investment attitude at the University of Utah. Michigan has strategically targeted increased support of higher education as a way to boost economic development and, even in the midst of depression in its auto and steel industries, has increased its support of higher education. David Osborne[7] reported the Pennsylvania's Ben Franklin Partnership, started in 1983, has funded nearly 1500 projects involving 2500 companies, helped start 5 private seed capital firms and gave grants to 27 incubators for a total expenditure of about $90 million. The Commonwealth's universities have been key players in this enterprise.

A recent article in Fortune magazine[s] underscored the importance of higher education centers for job seekers in the 1990s. It said "Go where there are large concentrations of brains, plus cultural amenities that attract bright and creative people - the most promising spots of all seem likely to be near prestigious, research-oriented universities -." This recognition of the importance of higher education to job formation and economic growth was also confirmed by Zumeta and Stephens[9] and is now routinely factored into state strategies.

A CONCRETE EXAMPLE

Discussion of new university-based technology transfer programs may be abstract to those not directly involved. The experience at The University of Washington (UW) serves as a concrete example. Its response to the early 1980s fabric of circumstances seems to be typical of that of many universities across the country - both public and private. In the Fall of 1981, the UW Provost appointed a task force of senior faculty members and administrators to consider all issues related to technology transfer and to recommend whatever policies, procedures and organizational changes were deemed appropriate to assure an effective program consistent with the new federal patent policy, national objectives and the UW's own mission. The task force analyzed policies from selected other universities, took testimony from faculty throughout the campus and interviewed local industrial leaders. The effort took approximately nine months and eventually led to four major recommendations. They were:

- Revise the patent policy to explicitly reflect a positive attitude toward transfer of research results to the private sector and include incentives to encourage that transfer.
- Adopt a copyright policy as a companion to the patent policy so that the two policies together cover all tangible and intellectual properties.
- Establish an Office of Technology Transfer to administer the patent and copyright policies, coordinate university-industry interactions and give greater visibility to technology transfer functions.
- Adopt a policy concerning employee involvement with commercial enterprise to clearly encourage appropriate involvements and to provide uniform guidelines.

As consultation with the Faculty Senate, the Provost and the President accepted all four recommendations and moved to implement them. Early in 1983, the Office of Technology Transfer (OTT) was established and a revised patent policy and new copyright policy were adopted. Policy concerning employee involvement with commercial enterprise was taken up later and adopted in 1985. The early results of the UW's new program are shown in Table 1. This demonstrates that dramatic results are possible. The scope and timing of results vary from one institution to another depending upon the volume and type of research and the resources committed to the technology transfer program but the GAO report mentioned earlier and a large body anecdotal information indicate that the UW approach and experience are somewhat typical of research universities across the country.

Table 1

University of Washington
Office of Technology Transfer
Selected Activity Indicators

	Fiscal Years - ending June 30				
	1984	1985	1986	1987	1988
Disclosures:					
Invention Disclosures	33	47	62	70	82
Pool of Identified Inventions	90	137	167	228	298
License Agreements:					
New Licenses Signed	1	11	16	20	17
Total Licenses in Effect	28	37	50	67	90
Total Options-to-License in Effect	7	4	7	8	12
Licenses Producing Income	12	11	21	32	42
Income:					
Royalty and License Fees	$35k	$76k	$360k	$397k	$789k
Sale of Biological Materials*	6k	20k	17k	141k	53k
TOTAL INCOME	$41k	$96k	$377k	$538k	$842k
University-Industry Interactions:					
Research Agreements with Industrial Sponsors					
Number	312	379	419	424	522
Value	$7m	$12m	$11m	$15m	$19m

*Approximate annual figures; not reported separately until FY87.

TRENDS IN THE ACADEMIC COMMUNITY

As noted, the last five years have seen substantial growth in the number and scope of university based technology transfer programs. This has fostered increased activity in professional organizations that serve the needs of those who work in technology transfer offices. The growing interest in technology transfer and the urgent need for training in this new field is reflected in increasing membership in the Society of University Patent Administrators (SUPA) and the Licensing Executive Society (LES). Both organizations are attempting to meet member needs through new or expanded services. A journal and member directory were recently implemented by SUPA and both SUPA and LES have increased their sponsorship of meetings and offerings of conferences, workshops and educational materials.

Other organizations have expanded their charters to embrace technology transfer. For example, all regional and national meetings of the Society of Research Administrators (SRA) and the National Council of University Research Administrators (NCURA) now include major sessions and workshops on technology transfer.[10] The NCURA has published a major series on intellectual property[11] and its 1988 Workshop Program includes two workshops on technology transfer. Further, the National Association of College and University Attorneys (NACUA) has recognized the need to acquaint its members with the legal elements of the topic. NACUA's annual meetings now include multiple sessions on technology transfer while only five years ago the topic was not even mentioned in the Program.

OPERATING MODELS

How is technology transfer addressed on campus? While there are many variations, the two basic approaches to handling patents, licensing and industrial liaison activities are the in-house office and the outside agent models. There are pros and cons for each approach and the "right choice" is generally related to the particular circumstances of a given university. Assuming that it is adequately staffed with competent and experienced people, the in-house model will be more responsive to the institution's needs. The price of that responsiveness may be very high to hire patent attorneys, market analysts, industrial liaison experts and the staff to support them. In a new program, such investment is relatively high risk since there's no guarantee that the investment will eventually be recovered by successful patenting and licensing activity. Even if it is recovered, the recovery cycle is likely to be five years or more because it generally takes that long to complete the process from invention disclosure to significant sales of licensed products.

Given the large up front investment and the high risk of that investment, many universities choose the outside agent model. It assures immediate availability of the required legal, marketing and business expertise needed; it avoids the need for substantial up front money to cover evaluation of inventions patenting and market analysis costs pending much later recovery of those costs through fees/royalties; and it avoids the very real risk that the up front expenses will never be fully recovered. What the university gives up in this model is some degree of responsiveness to its peculiar needs and some share of the income which must be allocated to the agent(s). In general, it may be prudent for most universities to start with an outside agent type program and gradually move toward an in-house model as the program matures, experience is gained and income increases and becomes more predictable.

Some universities try to have the best of both approaches by using a combination of the two basic models. The University of Washington may be typical of those in this group. The UW's Office of Technology Transfer (OTT) administers the patent, invention and copyright policy and coordinates research interactions with industry. The OTT has reserved to itself the right to undertake any and all patenting and licensing functions it chooses. However, compared to the UW's $290 million in research funding and 80+ invention disclosures per year, the OTT is modestly staffed - 2.5 full time equivalent (FTE) professionals and 2.5 FTE support staff - and relies heavily on a patenting and licensing agent. This approach is designed to assure responsiveness to the UW's technology transfer needs and goals, while limiting its investment and risk. The UW's fee/royalty income has grown from $30,000 in 1983 to over $800,000 in 1988.

Stanford University and the Massachusetts Institute of Technology (MIT) are frequently cited as successful examples of the in-house model. Their annual fee/royalty income is in the $3-6 million range. That level of income is within the reach of only a few other universities in the country. Stanford and MIT have very large, highly prestigious research programs. They also have an entrepreneurial culture among their faculty through extensive, long standing linkages with industrial research sponsors, licensees and collaborators. Finally, they have made heavy up-front investments in their technology transfer programs. Any university attempting to develop or evaluate its own technology transfer program must be realistic about setting the goals and, most particularly, must be realistic about the time frame over which these goals will be achieved.

PATENTING AND LICENSING AGENTS

There are many national scope patenting and licensing agents available to assist universities with technology transfer. The major advantages in using such an organization are the depth of experience and the considerable resources that they can provide to achieve commercialization of a technology. The primary disadvantage is the diluted attention due to the number of institutions that the organization serves.

Perhaps the best known among the national scope agents is Research Corporation (RC). RC moved its headquarters from New York to Tucson in 1983 to better serve the geographical diversity of its clientele of over 300 colleges, universities and other research organizations. It has evaluated over 16,000 technologies since its inception in 1912 and is currently managing 1600 patents and 400 active technologies, about 200 of which are licensed, RC takes responsibility for patent protection on those technologies that it accepts for administration.

RC recently created Research Corporation Technologies (RCT) a wholly owned, not-for-profit corporation to be responsible for RC's technology transfer program. RCT included two new initiatives in its revised program, an incentive payment of up to $5,000 upon acceptance of a technology and investment in developmental research to add value to promising technologies. Other new approaches are also being tried as RCT strives to make its services more responsive to the needs of academic clients.

In addition to licensing agents that have a national multi-institution scope, many universities work with agents that have a limited scope focused on the university alone or a certain geographical region. The Wisconsin Alumni Research Foundation and The Washington Research Foundation are examples of such agents.

The Wisconsin Alumni Research Foundation (WARF) was created in 1925 to "develop the inventions of Wisconsin scientists and scholars and to support further research at the University of Wisconsin" with the majority of license royalties received. In the sixty years since its founding, WARF has granted over $150 million to the University, while building up a multi-million dollar endowment from 2400 disclosures, yielding 450 patents and 200 licenses on approximately 100 of the technologies. Total net income from patents is over $30 million through 1987. It is noteworthy that the majority of WARF's income has come not from inventions, but from investments that were created from the flow of license royalties on a few very valuable patents.

The Washington Research Foundation (WRF) in Seattle is a relatively new organization, having started its operations in 1982. The WRF was created to "help Washington State's universities and research institutes protect and license technology and know-how resulting from their research!' The WRF also operates a Biological Materials Distribution Center (BMDC) to make life science research materials, developed by its clients, available to scientists in other universities and industrial research laboratories.

In just six years, WRF has generated over $l,OOO,OOO of licensing and BMDC income. During that time, WRF evaluated over 250 invention disclosures and is administering about 80, including nearly 40 license agreements. Due largely to its location in Seattle and limited resources, most of WRF's disclosures to date have come from the University of Washington. However, it is reaching out now to serve other universities and research centers consistent with its state-wide charter.

Irrespective of the operating model used, the flow of significant technologies is the cornerstone for any technology transfer program. Given that technology stream, it is crucial to have highly motivated, skilled people securing patent protection and developing marketing plans for the technologies, whether by an agent or within the university's own technology transfer office. Of equal importance but outside the direct control of the technology transfer office or agent, is enlightened management oversight by top administration of the university. That oversight must recognize the long time frame required for the technology transfer to succeed - generally about ten years if starting from scratch.

INCENTIVES AND INCOME DISTRIBUTION POLICIES

Technology transfer programs must include meaningful incentives and rewards for inventors. These will differ from one institution to another, but one that will be common in all is the fee/royalty distribution formula. Most academic practitioners of technology transfer have concluded that the formula should be fairly generous toward the inventor and the inventor's department. Successful programs allocate I/3 to I/2 of the fee/royalty income to the inventor.

That income is a well earned reward. The inventor must prepare and submit the invention disclosure and, subsequently, assist university administrators and/or patenting/licensing agents understand the invention and its possible applications. Further assistance from the inventor is typically required when the patent attorney is drafting the patent application and/or responding to Office Actions from the U.S.

Patent and Trademark Office. Still other assistance is routinely required when the university or its agent begins to interact with prospective licensees and this frequently continues even after a license has been consummated in order to impart critical "know-how" from the inventor to the licensee. Generous incentives help to encourage inventors to participate in the technology transfer program and to assist the university, the patent attorney and the licensee in the ways that are necessary to maximize the speed and the ultimate success of the transfer.

Other incentives or rewards include: a variety of support services that can be offered by the university's technology transfer office or its agent; additional industrial research funds spawned by technology transfer initiatives; academic promotions and salary increases as technology transfer activities are increasingly recognized in academic reward systems; and favorable publicity related to new inventions, the issuance of patents, the execution of license agreements, etc. Particularly in new programs, it is important for the institution to gain the active involvement and strong support of deans and department chairs. They must carry positive messages about the program to their faculty and actively encourage faculty participation for the program to succeed.

CONCLUSION

The new university role outlined in this article is just one dimension of the very complex topic of economic competitiveness. The role is still evolving and will be for a long time. Universities are clearly groping for a better understanding of their proper role in strengthening U.S. economic competitiveness. They are experimenting with a wide variety of technology transfer programs, university/industry linkages and university/state government linkages to discover which are most effective for a given university within its unique state or regional setting. The range and boldness of these experimental efforts is encouraging but difficult to evaluate because of the long period required to conceive, implement and refine such programs, and because of the relative absence of agreed upon evaluation criterion. Nevertheless, those who are involved must press ahead to the best of their ability and share their experiences for the benefit of others. The evolution of this new role for universities in economic development is one of the most interesting to occur in the academic community in many years and may be one of the most important too, given its potential contribution to the well being of the country and its citizens.

REFERENCES

1 "Partners in the Research Enterprise: A National Conference on University-Corporate Relations in Science and Technology," held December 14-16, 1982. Proceedings were edited by Thomas W. Langfitt, Sheldon Hackney, Alfred I? Fishman and Albert V. Glowasky and published by University of Pennsylvania Press, 1983.

2 National Research and Development Policies for 1988 and Beyond: The CORETECH Agenda, 1988.

3 "Patent Policy - Recent Changes in Federal Law Considered Beneficial," United States General Accounting Office Report #GAO/RCED-87-44, April 1987.

4 California Department of Commerce Office of Economic Research, "Technology Transfer: The California Experience," May 1987.

5 Birch, David, "Interview - Why Things Aren't As Bad As They Seem" Inc., Volume 3, Number 9, September 1981, pp. 41-44.

6 "Growing Places", Inc., Volume 8, Number 10, October 1986, pp. 57-66.

7 Osborne, David, "The New Role Models," Inc., Volume 9, Number 10, 1987, October 1987, pp. 78-90.

8 "The Economy of the 1990s: Where to Live - And Prosper," Fortune, 2 February 1987, pp. 52-56.

9 Zumeta, William and Stephens, Dean, "Increasing Higher Education's Contribution to Economic Development in Washington," report to the State Senate Education Committee, December 1986.

10 "The Private Sector/University Technology Alliance. . . Making It Work," held September, 1984. Proceedings edited by Earl J. Freise and published by NCURA, January, 1986.

11 Intellectual Property Series, National Council of University Research Administrators, 1984.

Enhancing the Prospects for Acquisition of Sponsored Funds at Small to Mid-Level Colleges and Universities: A Guide for Program Development

John M. Mishler

Abstract. The current literature is replete with data addressing some, but not all of the myriad of institutional factors and components required to implement transitional programs, even though a paucity of information exists on the total process of change. This present monograph is directed toward assembling the relevant data which bear on this overall theme. As a means to implement institutional change, this corpus of information has been purposefully constructed as a specific guide for program development. The sequence of information offered, therefore, parallels the pyramid model of organization and is presented in order of priority.

INTRODUCTION

The ability of a small to mid-level college or university to implement the transition from a predominately teaching-oriented mission to one in which a focused emphasis is placed on acquisition of sponsored research, will be determined by successful responses to and solutions of a host of complex variables; namely, institutional commitment, long-range strategic planning objectives, financial resources and incentives, appropriate administrative and faculty infrastructures, suitable research environment and faculty development and research grant programs. These many and multifaceted variables, when understood and addressed

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in toto, provide the foundation and formula for transition; lack of attention to this overall symbiotic relationship will inexorably weaken, if not subvert, the process of change.

The organizational model, for modification of current practices among small to mid-level institutions of higher education, is an inverted pyramid; the dominant and major force for transition resides in the governing body and chief executive officer concomitant with authority to create suitable infrastructures and reallocate resources. The other variables necessary to induce change play a less pervasive role and should not be construed as minor components; their influence is a function of specific directives issued by higher authorities.

INSTITUTIONAL COMMITMENT AND TARGETED BUDGET ALLOCATIONS

institutional Commitment

The major dynamic force, to modify an institution’s commitment to research in general, and sponsored research in particular, resides in and is shared jointly between the governing body (e.g., Board of Curators, Regents, Trustees, etc.)’ and chief executive officer (e.g., Chancellor, President, etc.).[2,3,4] The absence of such a force allows progress toward establishing research as a priority to be negligible [2,5,6] or nonexistent. A commitment to fostering adaptation must be further shared between leadership provided by the chief executive officer and campus-at-large, e.g., leadership is most effective in small colleges or universities when the aspirations of both parallel each other in a setting permeated by mission and purpose.[2] In any transitional scheme, faculty play a most fundamental and pivotal role; their commitment to and participation in the total process of change will ultimately determine its final outcome.

Long-Range Strategic Planning Objectives - Definition of Mission and Purpose

In higher education, ability to resolve issues affecting financial resources, student recruitment and retention and stabilization of academic programs, determines the overall viability of an institution. In small college or university environments, certain institutional characteristics are associated with the capacity to successfully treat such issues; namely, commitment to mission and purpose, utilization of innovative and creative approaches to problem-solving and ability to be effective, as well as efficient.[2] In formulating a long-range strategic plan to implement transition to a research-oriented institution, these characteristics are paramount to the process of change. This plan should ideally be composed of two vital and interrelated components: (a) an immediate set of priorities to be enacted; and (b) defined goals to be achieved on a long-term basis. Contrary to the previously cited inverted pyramid model of organization, immediate priorities should be identified and addressed by a committee composed of appropriate administrators and faculty and subsequently, to the governing body and chief executive officer, as a "White Paper",[3, 7] This document should place focused priorities and responsibilities on three levels:7

- Level One (Institution-wide)

  At this tier, provision of the following resources would be crucial: (a) campus-wide pool of graduate research assistants; (b) adequate laboratory space; (c) state-of-the-art equipment; (d) funds to modernize laboratory facilities; (e) monies to implement faculty research grant programs; and (f) support from non-academic components, e.g., computing services;

- Level Two (Academic Unit)

  This tier should employ suitable mechanisms to: (a) create research-oriented faculty development programs, e.g., enhancement of salaries, reduction of teaching workloads, reward system based on a "goal-setting procedure" between a supervisor and his/her faculty and a supervisor and his/her dean or director, etc.; (b) identify area(s) or center(s) of excellence; and (c) improve management and data systems; and

- Level Three (Faculty)

  Faculty should be encouraged to: (a) enhance their research and scholarship skills; and (b) cooperate in academic unit area(s) or center(s) of excellence.

The substance underlying these three levels and relevant literature addressing these issues, will be presented in subsequent sections of this monograph. As stated previously, two vital and interrelated components comprise the long-range strategic plan to induce change. The second component relates to long-term goal-setting, and this constitutes a major responsibility placed on the governing body and chief executive officer. The language surrounding goal-setting must be specific and the charge succinct, e.g., beginning in 1984, "the university will double its sponsored research funding by 199O."[1]

The degree and manner in which these two vital components successfully interact, will ultimately determine the fate of any transitional scheme.

Financial Resources and Incentives

The complete and comprehensive enactment of long-range strategic planning is predicated primarily on the capacity to develop financial resources and incentives to support Level One (Institution-wide) responsibilities. The ability to create these required financial tools is, to some measure, a direct reflection of the sophistication of an institution's management practices. As a precursor to developing adequate financial resources and incentives, therefore, initial attention must be focused on utilizing prudent management systems. An improvement in the management practices of small colleges or universities has been shown to occur when Management Information Systems are combined in tandem with the technique of Management by Objectives.[8] By definition, Management Information Systems deal with the central issue of data management, e.g., financial resources and costs, institutional research, forecasting, etc.[6, 8, 9] The provision of these types of data, in turn, assist the decision-making process and facilitate appropriate and timely outcomes. The technique of Management by Objectives affords an institution the luxury of planning more adequately on a short- and long-term basis.* In regard to the ultimate scheme, the Management Information Systems/Management by Objects tandem[8] would be combined with an internal budget planning process.[10] In reality, it is the latter management technique which can create financial resources and incentives to support Level One responsibilities set forth in the long-range strategic plan. In terms of internal budget recycling schemes, monies to implement these responsibilities could be provided by: (a) revolving accounts maintained by the chief executive and/or chief academic officer (e.g., Provost, Vice President for Academic Affairs, etc.);[10] (b) utilizing recovery of indirect costs on external grants and contracts as a basis for allocating additional incentive monies, [11, 12, 13] and the procedural mechanics thereof;[6,14] (c) matching concepts (e.g., internal to internal and internal to external);[10] and (d) private donations.[10, 4]

The overall costs, to implement Level One objectives, will vary from institution-to-institution, depending on the present state and need to construct or renovate facilities, purchase state-of-the-art equipment and establish faculty research grant programs. In terms of expediency, development of the latter programs, if defined and dealt with correctly, may yield positive results in a minimum of time. The willingness of an institution to adopt clear and explicit policies, which state that award of a faculty research grant is also an obligation to submit a more comprehensive proposal to an external agency, can intensify internal to external grantsmanship transitional processes;[1] costs associated with such a directed program are estimated to be some $500 per FTE faculty? The expenditures required to support faculty research grant programs may, however, range from $1,000 to more than $600,000;[1, 5, 15, 16] these funds may have to be borne entirely during initial stages, by internal revolving accounts and/or private donations.[16] In the event of a successful transition from internal to external grantsmanship, funds recovered from the indirect cost category of external grants and contracts,[16] may be utilized to offset further institutional obligations, while still maintaining constant program support.

A creative and innovative approach to using internal funds, integrated within the framework of sound management systems, will immeasurably support Level One objectives contained within the long range strategic plan.

ADMINISTRATIVE AND FACULTY COMMITMENT - STRUCTURE AND SUPPORT SERVICES

Administrative Structure

In the overall management scheme, one critical element is required for all central support activities related to internal and external research endeavors; namely, an administrative research unit (e.g., Office of Research Administration, Office of Sponsored Programs, etc.).[5] In some small to mid-level colleges or universities, the administrative research unit is housed within, or directly associated with, a graduate studies program,[4] while in other institutions, this unit is a separate entity altogether.[1, 3, 4] The organizational control of this unit varies from institution-to-institution; [5, 16, 4] this authority is exercised by the chief academic officer, while in other circumstances, responsibility lies with the chief executive officer, graduate dean, vice president for research, finance or development officer.

In the implementation of long-range strategic plan objectives, and regardless of organizational location or mechanism of control, the administrative research unit must be charged with creation and implementation of suitable support and service activities related to all research obligations.5 In the internal arena, this unit should bear major responsibility for policies affecting disbursement of faculty research grants and awards,[l, 5, 12] and such other services to support campus-wide functions, e.g., animal facilities, biological/chemical/radiation safety programs, etc.[4, 5] In regard to external functions, this unit must be efficiently organized and staffed to comply with all regulations affecting the pre-award and post-award accounting procedures associated with sponsored research.[4, 5]

Faculty Structure

The faculty, of any small to mid-level college or university, are the most crucial element on which to subsequently construct a change in the mission and purpose of an institution. As previously cited, their commitment to and participation in the formulation of a White Paper, and creation of objectives contained therein, initiate the formal long-range strategic planning process. In the transitional phase, and continuing thereafter, their direct involvement in generation and oversight of institution-wide research policies and definition of appropriate goals is paramount. In the latter context, many institutions have established a faculty research body (e.g., Faculty Research Council, University Research Board, etc.),[1, 4, 17] normally constituted with senior faculty who possess sound research or scholarly interests. A portion of these faculty may be elected from the campus-at-large and a segment appointed by either the chief executive or chief academic officer,[4] or total membership is appointed.[1, 18] In the final selection of a faculty research body, general representation of all disciplines must be considered, i.e., humanities, natural and physical sciences and social sciences!, [4] The charge given to a faculty research body may range from providing the chief executive officer with sound counsel relevant to the overall climate for research to issues involving support services.[4] One of the more germane functions, however, relates to review and recommended approval of projects submitted for support under internal faculty research grant programs.[1, 16, 17, 18] This latter duty is ideally performed in cooperation with the administrative research unit.[1, 16, 17]

Support Services

In the long-range strategic planning process, a defined set of institutional support services and their subsequent short-term implementation, is most vital for transition. As related to mission and purpose, these support mechanisms must be innovative and effective, as well as efficient. In small to mid-level college or university environments, some of the more creative approaches involve:

- Faculty Research Grant Programs

  As normally defined, faculty research grant programs are short-term (up to three years), project-oriented endeavors financed wholly or in part, by institutional contributions.[5, 16] The intended purpose of such programs may vary from the support of young, inexperienced investigators to funding new, radical and sometimes, esoteric proposals.[4, 15, 16] The transition to a more research-oriented institution, where acquisition of sponsored funds is a major goal may, however, necessitate the need to restrict these grants to those faculty intending to apply for external support following completion of internal projects.[1] The policies required to affect this type of latter departure from normal procedures for awarding faculty research grants, should be formulated in a cooperative fashion between the administrative research unit and faculty research body? The elimination of entitlement programs (i.e., no restrictions), and their replacement by a competitive investment process (i.e., defined priorities) has been a successful model for enhancement of sponsored research.[1]

Faculty research grant programs should have defined priorities and expectations, but in addition, possess a degree of flexibility to respond to institutional characteristics and circumstances. An institution, for example, may choose to adopt a minor grant program ($2,000 to $4,000 per award),[5] or initiate both minor and major ($12,000 to $40,000 per award) programs combined with faculty travel grants ($200 to $600 per award).[1] In a combined minor and major grant program, faculty can be assisted in the latter category by comments received from appropriate external peer referees? The capacity to implement a faculty research grant program, corresponding to the prevailing institutional environment will, however, depend on financial resources allocated under Level One obligations;

- Enhancing Grant Preparation Skills

The ability of faculty to prepare, submit and understand the procedures needed to successfully compete for sponsored funds, can be facilitated by a variety of institutional-based mechanisms. One such procedure, involves creation of grant development seminars,[5] in which appropriate and experienced persons, either from the administrative research unit[19] or housed within an academic unit,[5, 20] can individually assist faculty in the total preparation process. As a further aid to faculty, review of proposals, prior to final submission, may be performed by the faculty research body and external referees.[6] Individualized systems of this type, greatly alleviate the mystery and uncertainties faced by faculty attempting to formulate and prepare external proposals.

Previous experience with sponsored programs is not the sole decisional prerequisite to insure faculty participation in external grant activity,[21] even though confidence to enter into such endeavors can be influenced by previous exposure gained in graduate school or as a post-doctoral research assistant.[21] It appears that grant development seminars benefit faculty in the early stages of their careers; faculty devoid of previous experience with sponsored programs, submit initial proposals later in their careers;[21]

- Dissemination of Sponsored Program Information

The relevant and timely provision of information concerning available sources of sponsored funding, in some circumstances, is directly related to the number of proposals submitted by faculty.[21] There appear to be two modes for dissemination of such information: (a) non-direct; and (b) direct. The first mode includes, but is not limited to, bulk mailing of brochures, pamplets and newsletters, use of bulletin boards (e.g., electronic systems), etc[5] This mode may be unsuited to serve an audience requiring targeted and specific particulars. The direct mode, on the other hand, is a coordinated effort designed to provide two-way communication, i.e., from the sponsoring agency to relevant faculty or from faculty to appropriate funding bodies. This direct mode can be implemented by creating an information-exchange committee (e.g., Faculty Research Liaison Group, Grants Coordinators, Research Coordinators Council, etc.).[3, 22] This committee is composed of faculty and/or administrators, appointed by their respective academic units, and charged with providing two-way communication between their constituencies and the administrative research unit. In some instances, the direct mode may be combined with an nondirect mode; bulk mailings are provided to targeted academic unit representatives on the information-exchange committee. The nondirect and direct modes can be passive instruments, i.e., information on sponsored programs is furnished by an agency to the institution. The creation of institution~[23] or nation-wide databases, e.g., Illinois Researcher Information System (IRIS) or Sponsored Program Information Network (SPIN),[5] however, provide the information-exchange committee and administrative research unit with a most powerful tool - the capacity to actively initiate funding searches directed toward specific faculty interests. The utilization of databases can reduce the reluctance and frustration experienced by faculty in their search for sources of sponsored funding.

In developing appropriate systems to disseminate information, the ideal mode would incorporate nondirect and direct techniques in combination with databases; and

- Interdisciplinary Research

The institutional support and encouragement of interdisciplinary research, i.e., combination of expertise, methods and knowledge of two or more disciplines coalesced around immediate and/or long-term common goals,[5, 4] can foster acquisition of sponsored funds;[24] absence of such a commitment undermines the principle of mission.[3]

Interdisciplinary research, for example, may take the form of specific programs entirely housed within an academic department and/or unit, or between academic units or by the creation of centers or institutes.[5] In this overall context, the administrative research unit can perform a vital role in securing sponsored funds. This role involves a new administrative function; a person specifically employed to broker the placement of sponsored research among academic units possessing a common feature, e.g., interdisciplinary research program in health sciences.[24] In small to mid-level institutions who do not have a health sciences component, the brokering function may be applied against other interdisciplinary research programs (including centers or institutes), especially those in the creative arts, humanities or social sciences. An additional initiative to consider, is the creation of an academic development office within the administrative research unit.[6] This new office would concentrate on solicitation of sponsored funds from private foundations.

SPONSORED RESEARCH AND INSTITUTIONAL CHARACTERISTICS

A long-range strategic plan addresses the structure and responsibilities required to implement change. The ability to acquire, nurture and sustain sponsored programs is, on the other hand, related to additional institutional factors influencing the environment for research.[25] These factors have been the subject of numerous reports; the underlying purpose has been to postulate their affect on receipt of sponsored funds. The conclusions drawn, however, must be placed in the context of analyses utilized and sample populations investigated, i.e., individual versus institutional variables, private versus public institutions, highly supported versus lesser funded institutions, differences among disciplines, undergraduate graduate programs and survey size (e.g., 100 research institutions versus 500 U.S. colleges and universities). These caveats notwithstanding, there appears to be a high degree of consensus and correlation between sponsored programs and such factors as previous history of external support and present funding levels,[26, 31] number and/or quality of publications [28, 29, 32, 33, 34] and graduate (doctoral) education. [26, 30, 27, 31, 35] Additional factors have been identified, albeit with a less pervasive influence; namely, existence of an administrative research unit,[27] institutional size, level of internal resources and number of full-time faculty[26] and location in a metropolitan area.[27] The role played by either quality ratings (measures of institutional quality based on program ratings) or institutional research funds, as factors affecting sponsored expenditures, remains controversial. In regard to the former, some reports have indicated a positive influence,[30, 31] while others discounted this assertion.[28, 29] The use of institutional research funds has gained some support,[27, 35] even though evidence to the contrary exists.[28, 29]

The capacity to induce change, as provided for in a long-range strategic plan, allows a small to mid-level institution, the opportunity to assess its strengths and weaknesses in the context of those factors affecting sponsored funds. Within the realm of possibility, ability to increase the number and/or quality of publications, enhance or create doctoral programs, raise the level of internal resources, research expenditures, full-time faculty and quality ratings and develop or improve an administrative research unit, are factors which can and should be addressed. The overall size of an institution, whether or not it possesses a past history of sponsored funds and its location, are constants and unlikely to change.

FACULTY DEVELOPMENT PROGRAMS: RESEARCH-ORIENTED

The various programs supporting faculty development, since their inception some two decades ago, have placed a major emphasis on improving the quality of college or university teaching.[36, 37] The success of such programs is multifaceted, even though several factors are paramount, i.e., strong institutional commitment[38] concomitant with defined policies, goals and incentives to reward appropriate faculty behavior,[36, 37] responsibilities shared between faculty and institution,[38] and relationship of quality to effectiveness.[38] In the implementation of a successful program,[36] the following features are necessary components and are presented in order of importance: (a) institutional grants and travel funds (including support for visiting scholars);

(b) instructional assistance practices; (c) emphasis on assessment (individualized professional and personal development plans); (d) traditional practices (faculty exchanges, sabbaticals and reduced teaching workloads); (e) workshops and seminars; and (f) publicity.

The creation of specific, research-oriented faculty development programs, can effectively draw upon the experiences gained from initial teaching-oriented plans, e.g., institutional grants and travel funds, emphasis on assessment, traditional practices and workshops and seminars.[39, 40, 41] The capacity to initiate research-oriented programs will, however, be predicated on an institution's need to consider additional factors, e.g., adequacy of sponsorship and resources to sustain productivity,[38] research-based merit salary structures and policies,[5, 42, 43] individualistic (selective liberal arts colleges) versus bureaucratic (research universities) faculty behaviors[44] and reputational standings.[45] In the setting of long-range strategic planning, research-oriented faculty development programs should be a Level Two (Academic Unit) responsibility; creation and implementation must be based on individual academic unit characteristics. In the adoption of such programs, academic units should consider defining work-related faculty behaviors within a system weighing their importance, determining the relationship between job performance behaviors and incentives and utilizing available data for decision-making purposes.[37, 46]

CONCLUSION

The various factors and components required to effectively implement transition from a predominately teaching-oriented institution to one in which sponsored research is emphasized, are generally known and recorded in literature; albeit, a database ranging from the theoretical to the applied. In this arena, however, there are certain constants, i.e., institutional commitment is paramount for change concomitant with a defined mission and purpose. In addition, appropriate administrative and faculty infrastructures are necessary ingredients for successful transition.

As a guide for program development in this area, the present monograph has been specifically constructed to identify each component in the transitional scheme, and apply relevant data against each conclusion drawn. This corpus of investigation is not intended to be all inclusive, but rather to serve as an instrument for change based on the collection of information presently at hand. Within certain limitations, more exact data bearing on many of the conclusions drawn in this monograph, are to be found in the literature cited. The references themselves have been carefully gleaned from a variety of sources, ranging from work in higher education to applied endeavors in the field of research administration. The ability to enact a program for transition should, therefore, be aided by the perspectives offered from this array of collected information.

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REFERENCES

1 Mishler, J.M., and J.D. Loesch, "The Directed Transition from Internal to External Grantsmanship," *Journal* of the *Society of* Research Administrators, XIX (1988), 23-30.

2 Peck, R.D., "Entrepreneurship as a Significant Factor in Successful Adaptation," Journal of Higher Education, 55 (1984) 269-285.

3 Pescatello, A.M., "Developing Support for Research at a Nonresearch University," *Grants* Magazine, 9 (1986), 219-223.

4 Woodrow, R.J., Management *for* Research *in* U.S. Universities, Washington, D.C.: National Association of College and University Business Officers, 1978.

5 Beasley, K.L., M.R. Dingerson, O.D. Hensley, L.G. Hess, and J.A. Rodman, The Administration *of* Sponsored Programs, London and San Francisco: Jossey-Bass Publishers, 1982.

6 Miller, B., "Research Development Techniques and Initiatives," Journal *of* the Society *of* Research Administrators, XVIII (1986), 29-36.

7 Mishler, J.M., "Institutional, Academic Unit and Faculty Objectives and Priorities to Enhance Campus-wide Sponsored Research," *Grants* Magazine, 10 (1987), 137-142.

8 Baldridge, J.V., "Impacts on College Administration: Management Information Systems and Management by Objective Systems," Research *in Higher Education,* 10 (1979), 263-282.

9 Mann, R.L., C.R. Thomas, R.C. Williams, and R.A. Wallhaus, An *Overview of Two Recent Surveys of Administrative Computer Operations in Higher Education,* Boulder, Colorado: National Center for Higher Education Management Systems at the Western Interstate Commission for Higher Education, 1975.

10 Lazier, G.G., and P.R. Althouse, "Developing Planning and Budgeting Strategies for Internal Recycling of Funds," *Research In Higher Education,* 18 (1983), 237-250.

11 Ellyson, E.J., R.E. Barr, and E.R. Bailey, “Formula-based Research Incentive Plans at Colleges and Universities,” Research in Higher Education, 17, (1982), 241-248.

12 Matchett, W.H. “The Recovery and Disposition of Indirect Costs at New Mexico State University,” Report Presented to the Council of Graduate Schools, Orlando, Florida, 1979.

13 Tepe, F.R., Jr., and A.C. Yates, “An Integrated Research Incentive Program:’ Report Presented to the Council of Graduate Schools, Orlando, Florida, 1979.

14 Muir, A.E., ‘Causal Modeling for Indirect Cost Management at Universities and Colleges,” Research in Higher Education , 12 (1980), 291-300.

15 Dingerson, M.R., “Internal Research Programs in Colleges and Universities,” Journal of Higher Education, 48 (1977), 283-293.

16 Dingerson, M.R., and M. Hill, “Comparative Policy and Practice for Internal Research Programs,” Journal of the Society of Research Administrators, XIV (1982), 27-32.

17 Mishler, J.M., and E.J. Ellyson, “Internal Grant Management. Results of a Pilot Study to Enhance the Quality of Proposals by Using External Peer Review,” Journal of the *Society* of Research Administrators, XVIII (1987), 17-23.

18 Leonard, F., A. Bain, and L.T Bowles, “Allocation of Biomedical Research and Support Grant Funds at the George Washington University Medical Center,” Journal of the *Society* of Research Administrators, XVI (1984), 45-48.

19 Lischwe, S., L. O’N. Manning, and J. Willimann, “Encouraging the Research Process: SIUE’S Experimental Grants Development Seminar for Faculty,” Journal of the *Society* of Research Administrators , XVIII (1987), *49-53*.

20 Mishler, J.M., “Unpublished Report,” 1988.

21 Harris, K., “Effect of Prior Experience on Decision to Submit Proposals,” Journal of the Society of Research Administrators, XVI (1985), *29-35*.

22 Mishler, J.M., “Recovery of Indirect Costs on Sponsored Programs: A Means to Create an Institutional Venture Capital Fund,” Grunts Magazine, in press.

23 Drew, J., and J. Norris, “Automating the Funding Search,” Journal of *the Society* of Research Administrators, SIV (1982), 27-32.

24 Mishler, J.M., “University - Pharmaceutical Industry Cooperation: Creation of a News Administrative Position to Broker the Placement of Clinical Trials,” Journal of the Society of Research Administrators, in press.

25 Harris, K., "Factors Associated with External Funding in Higher Education: A Review of Research," Journal of the *Society* of Research *Administrators,* XV (1984), 39-47.

26 McCoy, M., J. Krakower, and D. Makowski, "Financing at the Leading 100 Research Universities: A Study of Financial Dependency, Concentration, and Related Institutional Characteristics," *Research in Higher Education,* 16 (1982), 323-352.

27 Muffo, J.A., and R.L. Coccari, "Predictors of Outside Funding for Research Among AASCU Institutions," *Research in Higher Education,* 16 (1982), 71-80.

28 Muir, A.E., "The Determinants of Extramural Research Support to University and College Faculty," *Dissertation* Abstracts *International, 37* (1977), 3614A.

29 Muir, A.E., "Improving Success Probabilities of Faculty Requests for Extramural Research Support," *Research in Higher Education, 10 (1979),* 345-355.

30 Nozicka, *G., Federally Funded Research and Development at Universities and Colleges, A Distributional Analysis,* Washington, D.C.: Moshman Associates, Inc., 1978.

31 Wolfle, L.M., "Predictors of Outside Funding for Research Among AASCU Institutions: A Reanalysis," *Research in Higher Education,* 17 (1982), 99-104.

32 Liebert, R.J., "Research-Grant Getting and Productivity Among Scholars: Recent National Patterns of Competition and Favor," Journal *of Higher Education, 48* (1977), 164-190.

33 McAllister, RR., and D.A. Wagner, "Relationship Between R & D Expenditures and Publication Output for U.S. Colleges and Universities," *Research in Higher Education,* 15 (1981), 3-30.

34 Neumann, Y., "Predictors of Funding in Academic Fields," *Research in Higher Education, 9 (1978), 115-122.*

35 Ellyson, E.J., and J.P. Krueger, "Predicting Federal Research Funding at Colleges and Universities," *Research in Higher Education, 13* (1980), 131-136.

36 Centra, J.A., "Types of Faculty Development Programs," Journal of *Higher Education, 49* (1978), 151-162.

37 Fenker, R.M., "The Incentive Structure of a University," *Journal of Higher Education, 48 (1977), 453-471.*

38 Clark, S.M., M. Corcoran, and D.R. Lewis, "The Case for an Institutional Perspective on Faculty Development," *Journal of Higher Education, 57 (1986),* 176-194.

[39] McBurney, W.F., "Motivating Faculty to Do Research - What's in it for Them," Session Presented to the 21st Annual Meeting of the Society of Research Administrators, New Orleans, Louisiana, 1987.
[40] McBurney, W.F., "Faculty Incentives: Beyond the Pavlovian and the Pedestrian," Session Presented to the 29th Annual Meeting of the National Council of University Research Administrators, Washington, D.C., 1987.
[41] Youngers, J.A., "Research in the Teaching Institution: Faculty Development Programs," Session Presented to the 29th Annual Meeting of the National Council of University Research Administrators, Washington, D.C., 1987.
[42] Kasten, K.L., "'Tenure and Merit Pay as Rewards for Research, Teaching, and Service at a Research University," Journal of Higher Education, 55 (1984), 500-514.
[43] Neumann, Y., "Determinants of Faculty Salary in Prestigious Versus Less-Prestigious Departments: A Comparative Study of Academic Disciplines," Research *in* Higher Education, 10 (1979), 221-234.
[44] Ruscio, K.P., "The Distinctive Scholarship of the Selective Liberal Arts College," Journal of Higher Education, 58 (1987), 205-222.
[45] Davis, D.E., and H.S. Astin, "Reputational Standing in Academe," *Journal* of Higher Education, 58 (1987), 261-274.
[46] Drew, J.S., and A.O. Hughes, "Faculty Grants and Research Activity: How Academic Administrators May Objectify the Evaluation Process," Grunts Magazine, 9 (1986), 211-215.

Scientific Misconduct: A Call For Institutional Principles

Charmaine J. Streharsky

Abstract. Recent cases of scientific misconduct have been given great attention by the press and by federal agencies which fund scientific research in the United States. Public confidence in the results of research conducted by universities and research and development laboratories is being threatened by the disclosure of instances of ineptitude, plagiarism, and outright fraud at some of our most prestigious institutions.

Pressures (real or perceived) for consistent success in research, which promote an environment conducive to scientific misconduct, can be exerted subtly by university administrators, industry managers, governmental funding agencies, and journal editors among others.

Preventive and supportive actions could include: enunciation by institutional administrators of their recognition that luck may be an element in an individual or team being the first to make or publish a discovery, and that careful research which proves unsuccessful is nonetheless valuable; rewards given by research institutions and funding agencies for honesty in research conduct and reporting, and swift punishments meted out to those found guilty of scientific misconduct; open discussions with junior scientists, students, technicians, and staff regarding the importance of accurate reporting and cautions regarding blind loyalties; and routine publication by journals of questions raised by other researchers regarding replicability and validity of published research results.

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The investigation of the truth is in one way *hard, in* another *easy. An indication of this is found in the fact that no one is able to attain the* truth *adequately, while, on the other hand, we do not collectively fail,* but *everyone says* something true about *the* nature of things, and while individually *we contribute little or nothing of the truth, by the union of all u considerable amount* is amassed. Therefore, *since the truth seems to be like the* proverbial *door, which no one can fail -to hit, in this respect it must be easy, but the fact that we can have a whole truth and not the particular part we aim at shows the difficulty of it.*

ARISTOTLE (Wingo, 1974)[1]

INTRODUCTION

Instances of misconduct in science have been reported by the media and within the scientific community in recent years, spawning alarm regarding our reliance upon scientific results which may be flawed. Grave concern has been raised over instances of actual scientific fraud. The National Institutes of Health[2] and the National Science Foundation[3] have responded with requirements or proposed requirements that universities institute formal plans for review, reporting, and subsequent action regarding misconduct on scientific projects supported by their federal agencies.

Universities have a dual role in scientific inquiry. Much of the world's scientific research is conducted by faculty and employees of universities, and one of the universities' products is the result of that research. Their other primary product is the student trained within their walls. If either the research results are flawed, or the students are flawed in finding scientific misconduct acceptable, it seems the university itself is faced with a form of product liability.

It can be argued that certain intellectual and volitional powers can be developed through habituation (Wingo, 1974, p. 270).[1] Perfection is achieved through forming good habits in man's natural powers of reason and moral volition. In which directions have our collective characters been taking us? What can be done to encourage the habituation of honesty and integrity in science?

DISCUSSION

Several authors have expended considerable energy in researching this topic. Broad and Wade[4] and Kohn[6] (1986) researched cases of scientific misconduct from ancient times to very recent years and described them in their books. Cases of scientific misconduct in the recent past have been described in publications such as *Science*[6] and *Science and* Government Report7 For those with deeper interest in details of recent cases, the American Association for the Advancement of Science in Washington, DC will provide upon request an extensive bibliography relating to cases presented in a paper prepared by Patricia Woolf,[8] and reports on their workshops dealing with scientific misconduct issues.[9] Highly publicized cases of recent vintage include cardiovascular and other biomedical scientists who apparently falsified data while holding appointments at prestigious institutions of higher education.

Broad and Wade point out, however, that evidence has been presented that casts suspicion upon the studies conducted and reported by Hipparchus (second century B.C.), Ptolemy (second century A.D.), Galileo Galileo, Isaac Newton, Charles Darwin, Johann Bernoulli, John Dalton, Gregor Mendel, Admiral Peary, and a host of other scientists. Astronomer Hipparchus reportedly presented Babylonian data as his own, and Ptolemy has been accused of appropriating the work of Hipparchus, Galileo's colleagues doubted that he actually conducted some of his experiments and, when confronted, Galileo reported that they were conducted by "thought experiments." Newton in later editions of his work reportedly adjusted the correlation of a variable in his theory of gravitation in order to agree precisely with theory, according to reviewers some 250 years later. Certain historians believe Dalton published selectively only his "best" results which upheld his theory, and modern geneticists have concluded that Mendel must have hand selected data to make the best case. Darwin in his lifetime was involved in a storm of controversy over acknowledgment and lack of acknowledgment of the work of Edward Blyth. And Admiral Peary supposedly realized he was hundreds of miles away when he alleged that he had reached the geographic North Pole.[10]

These writers make a good point when they say that if history has been kind to scientists such as these, it is because their theories turned out to be correct. But for those concerned with honesty and morality, no distinction should be made between an Isaac Newton who lied but was right and another who lied but was wrong? These accusations and suspicions are mentioned to bring this matter into perspective. Those who cry that the reason for recent cases of scientific misconduct and fraud is the decay of present society's moral fiber should look more deeply into history. Similar problems have been encountered in other eras.

There are many types of scientific misconduct, ranging from errors of incompetence to out-and-out malicious frauds. Most cases fall somewhere in between. There may always be cases of scientific *incompetence* which occur now and then. The educational institution's responsibilities in those cases seem to be those of providing oversight and teaching correct scientific methods. Universities and other research-oriented institutions would be hard pressed to protect themselves against ever encountering an ill-intentioned, unprincipled, and perhaps mentally deranged individual who is engaged in scientific fraud and deception as a profession. The institution's obligations in that case should probably be to maintain institutional policies to provide suitable checks and balances, to encourage reporting of fraudulent conduct, and to stop that person from doing injury to society by whatever means are available to it. The more common cases are probably the gray areas of scientific misconduct, ranging from light mists to charcoals.

Most of us have learned at our parents' knees the value and desirability of measures of honesty, forthrightness, and integrity. Strict moral education of the individual is a distinct help, but it is tested once the real world is encountered by that individual. Scientists must possess a rather greater-than-average share of these traits given the nature of their work, which depends upon honesty so heavily. Kohn[6] points out that honesty depends not only on training and education, but ultimately on maturity and security; and that a creative scientist should have a high degree of emotional and psychological freedom coupled with organized precision. There are pressures, though, which a young scientist will encounter which perhaps were not expected.

The publish or perish pressures of academic life are well known. In addition, a young science student may quickly learn that the "average yield" really means the absolute best yield ever obtained, and that disastrous runs are never reported anywhere. It can become a fact of life that reading certain scientific reports is rather like reading ads for real estate; the reader is expected to look with a jaundiced eye for the true meaning. To the uninitiated, however, this can be and should be a traumatic experience.

What the student may encounter quickly are the day-to-day ethical decisions regarding reporting. Perhaps results are plotted and all fall cleanly along an obvious curve, except for one. One point is so displaced as to be almost off the chart. Clearly *something* is wrong. Whether or not that point is ever reported anywhere depends heavily upon (1) the accepted reporting methods within the field, and (2) the principal investigator's desire and preference. Herbert Nichols, Jr.'s book, *Science Blundering*[12] makes amusing and discomfiting reading. One wonders if all the aberrant cases had been reported and looked at with open minds, perhaps many scientific discoveries would have been made much sooner.

The definition of "misconduct" issued by the National Science Foundation defines it as (1) fabrication, falsification, plagiarism, or other serious deviation from accepted practices in proposing, carrying out, or reporting results from research; (2) material failure to comply with federal requirements for protection of researchers, human subjects, or the public or for ensuring the welfare of laboratory animals; or (3) failure to meet other material legal requirements governing research. These are certainly serious matters which should be outlawed at any institution. However, there seems to be a question of degree. The disregarding and failure to report an aberrant case, or the issue of a senior scientist failing to give proper credit to the contribution of a junior member, would probably not constitute any material failure. However, these are the steps which can lead us down a path we don't want to travel. The federal agencies do not address the fact that the very pressure exerted by them for researchers to produce outstanding results in short time spans can result in researchers taking shortcuts in order to obtain grant funding. Likewise, the call for more and more interdisciplinary research means that scientists must rely more on one another's word; they may not have the expertise necessary to check each other's work for accuracy.

PREVENTIVE AND SUPPORTIVE ACTIONS

As all of our aims are to prevent scientific misconduct and support scientific inquiry, perhaps more attention could be paid by institutions and individual administrators and researchers to some of the following points:

1) All of us should realize that the most tireless effort, greatest insight and perseverance, and keenest intellect are not always sufficient to result in being first with an important discovery; a certain element of luck and chance is always present to be an obvious winner; the work of those who paved the way or were close behind and who will continue to develop knowledge should be appreciated as well;

2) Careful research which proves unsuccessful should nonetheless be valued by an institution as it is always important to know what doesn't work as a step toward finding what does;

3) Institutions should recommend, support, and reward honest reporting by their faculty and students, and this fact should be communicated consistently by department heads, deans, program managers, and top administrators to scientists and students;

4) Those who engage in scientific misconduct should be punished

swiftly and appropriately once the facts have been established that punishment is merited; in all cases the "whistle-blower" if any should be protected from punitive action unless that person himself is guilty of willful misconduct. If inquiry proves an honest error has been made, all efforts should be made by the institution to make those facts known to protect the reputations of those involved and to foster an attitude of resuming business as usual;

5) Researchers and administrators alike should be cautioned about blindly loyal junior colleagues, technicians, and students who may be tempted to "help" the senior investigator by falsifying results; these individuals need occasional reminders that that type of help is no favor;

6) These matters should be discussed openly and repeatedly in institution-wide and college-wide meetings, in faculty departmental meetings, in classes, in student seminars, and in ordinary conversations with departmental secretaries and staffs. The institution's policies regarding these matters should be clearly enunciated and made known to all involved at all levels.

With the individual researchers, universities, and research labs doing their part to support honesty in research, it would seem that other entities could help as well. For example, editors of professional journals could be more willing to publish questions raised by other scientists about research results which were presented in their journals. Although the threat of suit always looms large in most our minds, it would seem that if journals treated these as more routine matters, that would be in the best interest of honesty in science. The practice of accepting papers for publication or presentation upon the submission of abstracts on research which may not yet have been completed seems unwise. Perhaps it would be better if editors insisted upon advance submission of a draft of the entire paper. Of course, this would slow down the dissemination of information somewhat, but on the other hand the temptation to "correct" the data so that they fit what was anticipated halfway through the research would be alleviated.

Funding agencies could insist upon full disclosure as well and reward those who report honestly and completely. Peer review of proposals should be maintained. When continuation or renewal funding is requested, the peer reviewer comments and questions should be passed on to the principal investigator for response and rebuttal in every case and considered by the agency's program officers.

Perhaps one step could be taken if a university insisted that its scientific reporting be complete and that its researchers include an explanation, such as:

"It is the policy of this institution that all actual data be reported. Cases which appear aberrant and outside the norm or the expected are nonetheless reported for the consideration of the reader, even though this may not be the customary reporting method in this field. The reader is cautioned to take this into account when making comparisons between reports of results."

One small step for the good of society; one giant leap against having to guess between the lines.

REFERENCES

[1] Wingo, G. Max. Philosophies of Education: An Introduction, Lexington, Massachusetts: D. C. Heath and Company, 1974.

[2] NIH Guide for Grunts and Contracts, v. 15, n. 11, July 18, 1986, Bethesda, Maryland: U.S. Dept. of Health and Human Services, 37 pp.

[3] National Science Foundation proposed regulations published February 10, 1987 (pp. 4158-4161) and July 1, 1987 (pp. 24466-24470) in the Federal Register, Washington, D.C.

[4] Broad, William & Wade, Nicholas. Betrayers of the Truth, New York: Simon and Schuster, 1982.

[5] Kohn, Alexander. False Prophets, New York: Basil Blackwell, Inc., 1986.

[6] Selected recent citations in *Science.*

"Harvard Researchers Retract Data in Immunology Paper," B. J. Culliton *234,* p. 1069, November 28, 1986.

"NIMH Review of Fraud Charges Moves Slowly," C. Holden 234, pp. 1488-1489, December 19, 1986.

"Integrity of Research Papers Questioned," B. J. Culliton 235, pp. 422-423, January 23, 1987.

"NIMH Finds Case of 'Serious Misconduct'," C. Holden 235, pp. 1566-1567, March 27, 1987.

"Prosecution Urged in Fraud Case," C. Norman *236,* p. 1057, May 29, 1987.

[7] Science and *Government Report, v.* XVI, n. 5, 6, 10, 11, 17, 18, 19 (1986); v. XVII, n. 5, 6, 8, 11, 15 (1987).

[8] Woolf, Patricia K., "Deception in Scientific Research," published in the Report on Workshop Number One, AAAS - ABA National Conference of Lawyers and Scientists "Project on Scientific Fraud and Abuse," AAAS, 1988.

[9] Final "Project on Scientific Fraud and Misconduct" Report to be published in 1989. Copies available from the AAAS Office of Public Sector Programs, 1333 H Street, NW, Washington, D.C. 20005. Tel. *202-326-6600.*

[10] Broad and Wade, supra, pp. 22-37, 226-27.
[11] *Ibid*, p. 213.
[12] Nichols, Herbert L. Jr. *Science Blundering: An Outsider's View*, Greenwich, Connecticut: North Castle, Inc., 1984.

Search Administration at Predominantly Undergraduate Institutions With A Small Volume of Sponsored Programs

Sharon K. Davis

Abstract. The role, structure, and function of the research and sponsored programs office at predominantly undergraduate institutions which have a small volume (five million dollars or less annually) of awards from external funding sources is reviewed in this article. The report also examines the methods these institutions employ to encourage research and sponsored activity. These predominantly undergraduate institutions recognize the value of research and sponsored programs.

INTRODUCTION

A predominantly undergraduate institution may be said to have a small volume of research and sponsored programs if it is awarded five million dollars or less annually by external funding sources. Such institutions have an interest in and a commitment to research programs, but there has been a dearth of information about the ways in which they seek and administer the necessary funds. This study reports data recently gathered concerning small sponsored program offices.

Historically, most funding for sponsored projects has been awarded to large research institutions - one can frequently see printed lists of the "top 100 research institutions" in the country! In recent years, however, a glimmer of hope has begun to appear for the predominantly undergraduate institution (WI). Abelson[2] recently commented on the 601 comprehensive universities in the United States which grant the majority of master's degrees and nearly half of all baccalaureate degrees. He reported that these universities have few or no Ph.D. programs, and that faculty have teaching responsibilities averaging 12 units each

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semester. Because of their heavy classroom commitment, it is understandable that relatively few PUI professors expend concentrated efforts on conducting research or directing sponsored projects.

Yet predominantly undergraduate universities recognize the value of funded research. In January, 1988, university presidents, vice presidents, and deans from 27 states participated in a conference on "Science Research in the Comprehensive University!' One of the speakers, Rep. George E. Brown, Jr.[3] of California made the following comments: "All parts of the educational system should not have identical roles, but research should not be confined to research universities. Research is an integral part of education." This view is important when it is recognized that predominantly undergraduate institutions grant about half of the baccalaureate degrees in this country. In addition, they play a vital role in educating minorities and economically disadvantaged individuals.

Federal agencies are beginning to recognize the capabilities of the predominantly undergraduate universities. The National Science Foundation has instituted programs such as Research in Undergraduate Institutions (RUI) and matching instrumentation grants, which are designed to help undergraduate science. A new trend may be seen as more federal agencies commit funds for projects and programs in predominantly teaching universities.

Few articles have been published which focus on the small sponsored programs office[4]. As new emphasis is placed on research at colleges and universities with a smaller dollar volume, it is important to understand the role, organizational structure, and function of the research and sponsored programs office. In addition, it is important to review the ways institutions encourage sponsored projects, and the institutional commitment to them.

This study reports the common factors and the diversity of sponsored programs at predominantly undergraduate institutions with a small volume of grants and contracts. The characteristics of trends at these universities are noted.

METHODOLOGY

In 1987, NCURA members at PUI were surveyed. Information wascollected regarding sponsored program offices at those colleges and universities which had an annual volume of five million dollars or less of sponsored programs activity. The survey was also designed to provide information regarding institutional support for research and sponsored programs, as well as incentives and rewards available faculty interested in research and scholarly activities. Surveys were distributed to 300 administrators (NCURA members). Of those returned, 78 met the criterion of representing institutions with five million dollars or less in awards from external sources.

RESPONDENT INSTITUTIONS

Enrollment at the institutions in this survey ranged from fewer than 1,500 to more than 13,500 full-time equivalent (FTE) students. Fifty-five percent of the respondent institutions had an FTE student enrollment of fewer than 7,500 students, as shown in Table 1. Most institutions had 400 or fewer faculty; only 27% had more than 400 faculty.

Table 1

Characteristics of Institutions with Small Research Volume

Number of FTE Students	Institutions Number	Institutions Percent	Number of Faculty	Institutions Number	Institutions Percent
o- 1,500	3	4	O-100	5	6
1,501-3,000	10	13	lOl- 200	14	18
3,001-4,500	5	6	201- 300	17	22
4,501-6,000	13	17	301- 400	15	19
6,001-7,500	12	15	401- 500	6	8
7,501-9,000	8	10	501- 600	7	9
9,001- 10,500	6	8	601- 700	2	3
10,501- 12,000	3	4	701- 800	2	6
12,001- 13,500	3	4	801- 900	2	3
13,401+	14	18	901+	3	4
			No response	2	3

These primarily undergraduate institutions contrast sharply with the institutions reported in a study by Shisler, Dingerson, and Eveslage.[6] Shisler et al reported a median faculty of 740; a median of 10,606 FTE students enrolled; and median of 11.5 million dollars in external funding. These differences seem to indicate that there is a much higher faculty:student ratio at PUI than was found in the Shisler et al.

ADMINISTRATIVE ORGANIZATION

Table 2 details the title of administrative unit of the research administrator. The largest group (26%) worked in a unit with “Research” in the title. The next group (14%) reported ‘Grants/Contracts”’ in their title, and 13% reported "Sponsored Program". These three groups include 69% of all survey respondents.

Table 2

Title of Administrative Unit of Research Administrator		
Office Title	Number of Institutions	Percent
Research	26	34
Grants/Contracts	14	18
Sponsored Programs	13	17
Development	4	5
Academic Affairs	8	10
Graduate	5	7
Administration	1	1
Other	6	8

Nearly three-quarters of the respondents reported to one of three administrative units - Provost (12%), Academic Affairs (34%), and Graduate School (26%). All responses are given in Table 3(a).

Table 3(b) lists the titles of people to whom the research administrator reports. Fifty-one percent of the respondents report to a Vice President and 26% to a Provost. These two account for 77% of all respondents. The remaining 23% report to a Dean (ll%), President (9%), or Vice Chancellor (3%).

Table 3

Title of Entitv to which Research Adminiırtrators Reports

(a) Title of Administrative Unit

Title	No. of Institutions	Percent
Provost	9	12
Academic Affairs	25	34
Graduate School	19	26
Admin. Service	3	
Advancement	3	4
Public Affairs	2	3
Other	10	14

(b) Title of Person

Title	No. of Institutions	Percent
Provost	9	26
President	3	9
Vice President	18	51
Vice Chancellor	1	3
Dean		11

The majority of respondents (62%) submitted fewer than 100 proposals per year to external agencies, as noted in Table 4(a), and most (62%) had fewer than 50 proposals funded per year. In reviewing the data regarding the number of proposals submitted, it is important to note several relevant factors. These include: availability of adequate research facilities and state-of-the-art equipment; teaching load; number of different course preparations; and whether individuals view their primary function as teaching, sponsored research, or a combination of teaching and sponsored research.

The majority of the institutions (60%) requested less than six million dollars per year. Fifty-three percent of the respondents received less than $1,500,000 per year, as shown in Table 4(b).

Table 4

Proposals Submitted and Grants/Contracts Awarded During Previous Year

(a) Volume of Proposals submitted to research office

Amount Requested	Number	Percent	Proposals Submitted	Number	Percent
$ 0- 2,000,000	16	21	o- 25	7	9
2,000,001- 4,000,000	21		26- 50	18	24
4,000,001- 6,000,OOO	9	12	51- 75	11	15
6,000,001- 8,000,OOO	6	8	76- 100	12	16
8,000,001- 10,000,000	8	10	101-125		8
10,000,001- 12,000,000	1	1	126- 150	7	9
12,000,001- 14,000,000	2	3	151-175	1	1
14,000,001+	9	12	176-200	5	7
			201+	8	11
			No response		

(b) Volume of grants/contracts awarded

Amount Awarded	Number	Percent	Grants/contract Submitted	Number	Percent
Less than 500,000	14	18	0- 25	23	30
$ 500,001- 1,000,000	14	18	26- 50	25	33
1,000,001- 1,500,000	13	17	51- 75	7	9
1,500,001- 2,000,OOO	6	8	76- 100	8	10
2,000,001- 2,500,OOO	5	6	101-125	7	9
2,500,001- 3,000,OOO	3	4	126- 150	4	5
3,000,001- 3,500,OOO	6	8	151-175	2	3
3,500,001- 4,000,000	5	7	176+	1	1
4,000,001- 4,500,000	5	7			
4,500,001- 5,000,OOO	6	8			
No response	1				

CHARACTERISTICS OF THE SPONSORED PROGRAMS OFFICE

The field of research administration is approximately 50 years old. Therefore, it may be assumed that primarily undergraduate institutions receiving modest amounts of external funds have had sponsored program offices established for a relatively short period of time. The data reported in Table 5 indicates that 74% of research offices have been in existence 14 or fewer years. Only 4 research offices have existed for more than 20 years.

Research offices at the respondent institutions have few staff members. Respondents were asked to indicate the number of professional and support-staff positions in the sponsored programs offices. As indicated in Table 6(a), results show that 44% of the respondents do not have a full-time professional manage the research office, while approximately one-third (32%) engage a professional person on a full-time basis. Another 20% employed between two and four individuals; one institution employed five professionals. It is significant that colleges and universities which responded to the survey seem reluctant to invest in employing professionals in the research office.

Institutions surveyed were somewhat more supportive of employing a secretary for the research office, as shown on Table 6(b). The respondents employed no secretary on 10% of the campuses; 47% employed one full-time secretary, and 18% employed two to four secretaries. The number of students employed in the sponsored programs office is also noted on Table 6(c). Many offices (41%) employ none, while 30%employ one student.

The budgets for the research administration offices vary greatly (see Table 7). Budgets ranged from less than $15,000 to more than $120,000. Most (56%) of these offices have a budget of $75,000 or less per year.

Table 5

Length of Time Research Office in Existence at the University

Years in Existence	Number	Percent
o- 2	12	16
3- 5	11	14
6- 8	9	12
9-11	17	22
12-14	8	10
15- 17		9
18-20	7	9
21-23	2	3
23+	2	3
No response	2	3

Table 6

Number of Staff in Research Office		
Number Employed	**Number of Institutions**	**Percent**
(a) Number of professionals		
0	34	44
0.50 FTE	2	3
1	25	32
2	11	14
4	32	43
5	1	1
(b) Number of secretaries		
0.50 FTE	85	106
1	47	60
2	12	15
3	3	4
4	3	4
(c) Number of students		
0	32	41
0.50 FTE	0	0
1	23	30
2	18	23
3	1	1
4 +	3	4

The sponsored programs office provides support services to faculty. As shown in Table 8, all offices (100%) assist faculty in preparing budgets for proposals. Many offices are also involved in providing assistance in proposal writing (94%), coordinating the institutional review of proposals (94%), and mailing proposals (91%). The sponsored programs office also provides notable support by holding grant writing workshops (87%), duplicating proposals for submission to agencies (85%), and providing telephone contact (80%) with sources of funding.

Table 7

Annual Operating Budget for Research Administration Office

Amount	Number of Institutions	Percent
$O- 15,000	14	18
15,001- 30,000	9	12
30,001- 45,000	7	9
45,001- 60,000	6	8
60,001- 75,000		9
75,001- 90,000	7	9
90,001- 105,000	4	5
105,001- 120,000	1	1
120,001+	16	21
No response	7	9

Table 8

Support Services to Faculty

Type of Service	Percent Yes	Percent No
Assist in proposal writing	94	6
Assist in preparing budgets	100	0
Recommend resources	71	30
Coordinate institutional review	94	6
Negotiate contracts	80	21
Duplicate proposals	85	15
Mail proposals	91	9
Hold workshops	87	13
Computerized grant information	56	44
Sponsor federal officer visit	60	40
Telephone	80	21

Table 9

Monetary Support of Faculty Research Activities by Institutions

Type of Support	Number of Institutions	Percent
Travel	63	81
Employ research assistants	54	70
Summer stipend	53	68
Equipment purchase		68
Released time from classes	44	56
Professional leave	36	46

FACULTY INCENTIVES AS INSTITUTIONAL SUPPORT FOR RESEARCH

The majority of research administrators surveyed reported that their institutions offered incentives to faculty for their research efforts. Of the administrators surveyed, 94% reported having university support specifically designated for faculty research and creative activity. Of this group, the activities funded to support faculty research included travel (81%), employment of research assistants (69%), summer stipends (68%), purchase of equipment (68%), assigned time for research - released time from classroom teaching (56%), and professional development leave (46%). These results are shown in Table 9.

Of the institutions surveyed, 41% reported having an affiliation with a university-related foundation. These foundations serve as sources of support for funding faculty research and creative activity.

INSTITUTIONAL SUPPORT OF SPONSORED PROGRAMS

The dollar amount institutions allocated to provide support for faculty ranged from less than $40,000 to more than $240,000, as outlined in Table 10. Some universities (27%) provided less than $40,000 to support faculty efforts, and many (53%) allocated less than $120,000.

Respondents reported their universities provided various other faculty incentives, including: publication of grant/contract awards (92%), internal grant program (86%), faculty travel to visit federal agencies (56%), and return of indirect cost money to dean or department (45%). Table 11 shows that approximately one-third of the institutions (36%) reported grantsmanship was considered during promotion/tenure deliberations. Some institutions (32%) reported that an awards dinner or reception was held for faculty; a notable number (21%) presented a Researcher of the Year Award.

Table 10

Amount of Funds Available to Support Faculty Research by Institutions

$ Amount	No. of Institutions	Percent
$ 1- 40,000	21	27
40,001- 80,000	13	17
80,001- 120,000		9
120,001- 160,000	7	9
160,001-200,000	5	6
200,001-240,000	2	3
240,000-	5	6
No response	18	23

Table 11

Faculty Incentives Provided by Institutions		
Type of Incentive	**Percent Yes**	**Percent No**
Publication of awards	92	8
Awards dinner ceremony	32	68
Researcher of the Year Award	21	80
Return of the indirect cost to PI		86
Return of the indirect cost to dean or department	: :	55
Promotion/tenure based on grantwriting	36	64
Merit pay for grantwriting	19	80
Faculty travel to visit federal agencies	56	44
Internal grant program	86	12
Monetary award	8	92

DISCUSSION AND CONCLUSIONS

This study reviewed sponsored program activity at institutions which have five million dollars or less in grants and contracts awarded annually. The study investigated the characteristics of sponsored programs offices, and institutional support of faculty as related to their research and scholarly activity.

The majority of the institutions had an FTE student enrollment of fewer than 7,500 students, and 400 or fewer faculty members. The majority of the respondent institutions submitted fewer than 100 proposals per year to external agencies, and had fewer than 50 proposals awarded year. Less than six million dollars was requested, and less than $1,500,000 was awarded.

The largest number of sponsored programs offices report to the Academic Affairs office, and the individual to whom the office reports typically has the title of Vice President. Most sponsored programs offices have been in existence on the campus for 14 years or fewer.

Research offices employ few individuals. Approximately one-third of the universities employ a professional person on a full-time basis; another 20% employ two to four professionals.

The sponsored programs office provides a variety of support services to faculty. These include assistance in proposal writing, budget development, duplicating and mailing proposals, and contact with agencies.

Institutions are providing support for research and scholarly activities in the form of financial assistance for faculty travel, summer stipends, purchase of equipment, assigned time for research, and research assistance. Institutions also provide incentives for faculty in the form of internal grant programs, visits to federal agencies, announcement of grant awards, hosting an awards banquet, and returning indirect cost money to deans or departments.

This appears to be an opportune time for predominantly undergraduate institutions to pursue increased external funding. The effort will, however, substantiate the need to increase resources allocated to the sponsored programs office.

The increase in external funds will require several years to achieve. An initial step must be the realization by faculty that externally supported research is important to the university. The ability to acquire external support should be considered in hiring as well as in tenure and promotion reviews. Support for faculty research efforts must be made known, and the incentives for faculty efforts must be well established.

BIBLIOGRAPHY

1 Chronicle of Higher Education, 1988.

[2] Abelson, Philip H., Science, Volume 239, No. 4841, February 12, 1988.

[3] Brown, George E., Jr., (Democrat Representative - California), speech at conference on 'Science Research in the Comprehensive University," Long Beach, Calif., California State University, January 1988.

[4] Kenny, James L., "Professional Research Administration at the Smaller University or College," Society *of Research Administration* Journal, Summer, *1978,* pp. 41-45.

[5] Shisler, Clifford L., Michael R. Dingerson, and Sonja Eveslage, "Research Administration Organizations, Practitioner, Characteristics and Tasks," *Society **of** Research Administration* Journal, Winter, 1987, pp. 5-11.

Technology Transfer Concerns

Three issues that concern individuals involved in technology transfer have not been particularly well published in the university community. The first involves the Tax Reform Act of 1986; the second, the deposit of microorganisms for a patent application; and the third, United States Government Export Restrictions.

TAX REFORM ACT & LICENSING

The Tax Reform Act of 1986, Public Law 99-514, includes a provision that specifically references cooperative research agreements. For a university (either state-operated or 501(c)(3) to secure tax-exempt bond financing, it must now certify that it does not engage in certain activities regarding cooperative research endeavors with nongovernmental entities, in particular with private industry. For example, the SUNY Research Foundation's certification reads:

> . . . hereby certifies that the Foundation currently requires that any license or other use of resulting technology by the sponsoring party be permitted only on the same terms as the Foundation would permit use by any non-sponsoring, unrelated party; that is, the Foundation requires that the sponsor pay a competitive price for its use of the technology. . . Further, the Foundation certifies that the price paid by the sponsoring party be determined at the time the technology is available for use rather than at an earlier time.

When requested to provide the references in the Statute that required the above certification, bond counsel for the State University of New York cited Section 141(B)(l) of the Act, "Private Business Use Test.,' There is not, however, explicit language regarding certification. It is an interpretation of the Act based upon "Legislative intent" and according to bond counsel will be universally accepted within the bonding community.

EFFECTS OF THE LAW

The effect of this certification is that a university is now prohibited from setting royalty rates, either actual or maximum, in an option or license provision of a research contract. These rates can only be set later, at the time the technology becomes available for use.

In our experience, approximately 15 percent of the companies we negotiated with wanted royalty rates set in the research contracts. By providing them with copies of the Tax Reform Act and explaining the situation, we have been able to prevent any problems from developing.

As far as competitive pricing is concerned, we determine through review that all our licenses are executed at a competitive rate; that is, the royalties we receive are what we would have received from any third party in the field.

TIMING DEPOSITS OF MICROORGANISMS

The second issue involves deposit of microorganisms to satisfy the enablement requirements of the U.S. Patent Law. In those cases where a narrative description of an invention in a patent application is not sufficient to describe the invention, the Patent Office will require an actual sample of the microorganism. Current Patent Law allows for filing of the patent application without the deposit of the biological material.

If the Patent Office determines a deposit is necessary, it can be made at any time the patent application is still pending - as ruled in 1985 by the U.S. Federal Circuit Court. (Previously in the U.S., the deposit had to be made prior to the filing of the patent application.) In order to file foreign patent applications, however, the microorganisms must still be deposited prior to the filing of the U.S. application.

EXPORTING INFORMATION

A third concern involves current U.S. regulations covering export of technology information. This is an area that is constantly changing, in that embargoed countries may change daily. Technology information is continuously being transformed as well through advances in science. A U.S. Bureau of Export administrator recommends following the news carefully. Those countries where the U.S. is imposing sanctions may be the newest additions to the current list of embargoed countries published by the U.S. Department of Commerce in the Federal Register.

Actively under review by the U.S. Department of Commerce is the area of biological materials. In particular, monoclonal antibodies are still being analyzed to determine if there should be any export restrictions on them. Restrictions already apply to the export of viruses, bacteria, and other infectious agents.

As more and more licensing is done with overseas companies, colleges and universities will have to address the issue. They will have to consider how to determine when technical information is being exported and take into account whether or not it is controlled information.

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