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NCURA

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EDITOR'S PREFACE

This issue of *Research Management Review* provides a diverse group of articles representing the broad scope of research administration. This issue is also my last as editor. As a result, the following individuals should be recognized for their tireless dedication to the *RMR*: Copy Editor Lee Carpenter, the past and present members of the Editorial Review Board, and past editor Robert Killoren. The new editor, William Sharp, will no doubt continue the tradition of quality that the *RMR* represents. Special thanks are due to the authors, for it is their articles that represent the heart and soul of the journal.

The first article, "Managing the University Patent Portfolio and Making it Attractive to Licensees: A Commonsense Approach," by Attorneys Todd E. Garabedian and Elizabeth A. Galletta, provides helpful and necessary suggestions for research administrators and technology transfer professionals that will maximize the value of intellectual property assets to universities and licensees. The value of intellectual property is of significant concern to many universities.

The second article, James J. Casey's "Making a Good Thing Even Better," examines the university-industry partnership, which has been largely successful for both sectors. NCURA, GUIRR and the Industrial Research Institute, Inc., are jointly engaged in a project to look at this partnership and ascertain ways it can be strengthened, particularly in the area of intellectual property.

Responsible Conduct in Research (RCR) is a critically important dimension in research administration because research and research results form the basis for advancing knowledge and life in the modern world. Timothy N. Atkinson's "Scientific Self-Regulation: A Brief Primer for Research Administrators" argues that research administrators and faculty must collaborate more effectively in managing the conduct of research. Universities cannot afford to have more negative publicity regarding the mismanagement of research.

The final article takes us across the Atlantic to the Emerald Isle, Ireland. Steve Jerrams and John Donovan from the Dublin Institute of Technology examine and discuss a number of contradictions at the heart of Research and Development (R&D) policy and implementation at Irish institutions of higher education. This article also illustrates an essential attribute of international research administration: the differences in administering research among different countries are often matched by the similarities. Research administrators across the globe must realize that they often face the same issues despite differing social, political, cultural, and educational structures.

The field of research administration is incredibly complex and is subject to constant change at the domestic and international levels. No doubt we will meet these challenges head on.

JAMES J. CASEY, JR., J.D.
EDITOR
CARDINAL STRITCH UNIVERSITY
MARCH 2005

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MANAGING THE UNIVERSITY PATENT PORTFOLIO AND MAKING IT ATTRACTIVE TO LICENSEES: A COMMONSENSE APPROACH

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ABSTRACT

Building an attractive patent and technology portfolio for potential licensees requires involvement and diligence by the technology transfer office and the inventors. Steps outlined in this article, such as proper treatment of IP to assure rights are not lost, preventing premature disclosures, assuring proper ownership and inventorship of inventions, and filing priority patent applications that meet the proper legal requirements for disclosure, should be taken to assure a full complement of rights are available to any potential licensee. Proper IP handling and management by the university and inventors will bring maximum value of IP assets to both the university and the licensee.

INTRODUCTION

Prior to 1980, Congress was concerned that the products of federally funded research were not moving into the public domain to an extent sufficient to benefit the public. This problem stemmed, in large part, to the ownership aspects of research results. At that time, the law provided that the products of federally funded research were owned by the U.S. government. Unfortunately, the government is not efficient in taking these products into the marketplace. To remedy this situation, in 1980 Congress passed the Bayh-Dole Act[1] which permitted universities and small businesses to acquire ownership of the inventions and products made using federally provided funds. To move these inventions and products into the marketplace, technology transfer offices were established at many universities for the express purpose of licensing their technology to the public. The basic idea was to license to companies the university inventions and discoveries made with federal funds in exchange for a royalty, and those companies would use those inventions and discoveries in their product development. Under these arrangements, the university receives a predictable royalty income, and the company adds valuable technology to its products, which, in turn, benefits the public. After more than twenty

years, the large number of licensing arrangements and new companies originating from research universities is a testament to the effectiveness of the Bayh-Dole Act.

To initially secure the university's rights in the technology, the technology transfer office will typically file some type of patent application, and then make it known that this technology is available for licensing. However, despite filing for patent protection, many potential licensees may be reluctant to license the technology due to improper treatment of the intellectual property by the university. In many cases, the IP is tainted in some way that makes it less desirable or unattractive for licensing. The taint is typically caused by legal misunderstandings by the inventors, the university, or the technology transfer office itself, and renders the technology less valuable to the potential licensee. The technology may still be licensed under appropriate circumstances, but the royalty stream enjoyed by the university is less than it would otherwise be if the technology were not tainted. Fortunately, these "self inflicted wounds" can be largely avoided by a thorough understanding of the legal and procedural aspects of the patent procurement process. This article discusses steps that the university, as licensor, can take to secure broad IP rights in an invention and make the invention as attractive as possible to potential licensees so that maximum revenue can be derived from the licensing arrangement.

ATTRIBUTES OF A DESIRABLE PORTFOLIO

From the point of view of a potential licensee, a technology or patent portfolio is most desirable if it (1) addresses technology that relates to the licensee's business, (2) has worldwide rights available, and (3) is free from encumbrances or problems that could limit the scope of protection. Obviously, item (1) depends on an evaluation of the portfolio from a technological perspective, and whether it makes sense from a business standpoint to acquire some type of rights in the technology. These considerations are outside the scope of this article. However, items (2) and (3) can be seriously affected by how the intellectual property (IP) is treated by the inventors and/or the technology transfer office shortly after it has been identified and developed. Proper care and handling of the IP from the beginning is crucial to maximizing its attractiveness to potential licensees, and hence its ultimate value in the marketplace.

One desirable feature of a licensable portfolio is its patent protection (or the potential for patent protection) throughout the world. The availability of worldwide patent rights is particularly important in technologies such as electronics, software, and biotechnology, where the marketplace is worldwide. Having the option of protecting the invention anywhere in the world offers flexibility to a potential licensee to choose countries or regions that best meet his business needs and increases the value of the invention. However, due to the nature of the patent laws in different parts of the world, the inventors or the university may limit the places protection may be sought by actions taken before a patent application is ever filed.

PREMATURE DISCLOSURES

Disclosures of the invention made prematurely and in the absence of any patent filings are generally the most common reason that patent rights in an invention cannot be pursued outside the United States. Under current U.S. Patent Laws, a patent may be applied for in the United States provided that no more than one year has passed since the invention was described in a printed publication anywhere in the world, or in public use or on sale in the United States.[2] This "grace period" gives the inventor one year from such disclosure to file a patent application in the United States. However, while the United States affords a one-year grace period, most other

countries in the world do not. Other countries have a so-called absolute novelty requirement where the invention must not have been disclosed at all, and any such disclosure acts as a complete bar to filing in those countries. Loss of patent rights outside the United States can drastically reduce the value of a portfolio, particularly in big markets such as Europe or Japan. Therefore, in order to secure worldwide rights in an invention, and thereby make it more desirable and valuable to potential licensees, it is crucial that the invention not be disclosed at all prior to the filing of a patent application.

Preventing premature or unintended disclosure of the invention requires a coordinated effort by the technology transfer office and the inventors to make sure the rights in the technology are secured *before* the invention is publicly disclosed. In a university context, loss of these rights most frequently occurs through disclosure of the invention in a publication or at a scientific meeting prior to having a patent application on file. The law considers a "publication" any information that is available to the public, and includes not only technical journal articles, but meeting abstracts, presentation handouts, and, most recently, poster presentations.[3] It is therefore essential that the inventors inform the technology transfer office before any of these types of disclosures are made so that a patent application can be filed to preserve worldwide rights. Similarly, the technology transfer office should implement a policy that faculty submit their manuscripts, posters, and abstracts to the technology transfer office for review prior to any type of public disclosure. Patent counsel should also be involved in reviewing these potential disclosures to advise the technology transfer office of the consequences of these publications, and procedures to avoid unintended loss in the rights to university technology. These steps can add considerable value to a patent portfolio by securing worldwide rights at a very early stage.

FULL UNIVERSITY OWNERSHIP OF THE TECHNOLOGY

Another problem that arises frequently is ownership of the technology or patent portfolio to be licensed. As a practical matter, a potential licensee of university technology will want assurances that the university has full ownership of the technology and full rights to license that technology to the potential licensee. If the ownership rights in the technology are in doubt, or if the university is not the exclusive owner of the technology, the potential licensee may press for contract terms that are less favorable to the university, or forgo the licensing opportunity entirely. Fortunately, the university can take steps to secure its full ownership in the technology.

First, the university should have in place a patent policy (or an employment agreement) that clearly indicates that the university owns worldwide rights to all inventions made at the university by all university personnel who are funded by the university, or who use university facilities or materials. University personnel should be broadly defined in the policy as including full- or part-time faculty, staff, students (both graduate and undergraduate), postdoctoral associates, non-academic employees, fellows, residents, outside consultants, appointees, or visitors. The university patent policy should also state that acceptance of the patent policy is a condition of employment or enrollment, and that all university personnel agree to assign their rights in any inventions to the university. All employees of the university should be provided with a copy of the policy. These steps should make it clear that the university is the owner of all inventions made by all personnel affiliated with the university. Recently, such policies were crucial to determining university ownership of important technology.[4]

Collaborations between inventors at different institutions often present ownership challenges. For example, investigators at one or more universities frequently form collaborations to work on a

specific project. While this type of interaction is beneficial and should be encouraged, ownership of the products of this research should be set out in an agreement between the universities prior to undertaking the project. For example, each of two collaborating universities could each own the technology jointly, and equally share any royalty that results from licensing the technology. Similarly, if the collaboration is between a university and a company, the technology could be jointly owned, and the university could grant an exclusive license to the company for use of its portion of the technology. Of course, other types of arrangements are possible; however, in all cases, the ownership aspects should be established at an early stage to avoid problems later.

The university should also make sure it is the assignee of the inventions described in any patent applications that are filed. In the United States, patents have the attributes of personal property, and are owned by the applicants, unless there is an assignment assigning those ownership rights to another entity.[5] Therefore, each patent application filed by the university should be covered by an assignment whereby all the inventors assign their rights in the invention to the university. Further, such assignments should be recorded at the U.S. Patent and Trademark Office (USPTO) so that the assignment is part of the public record, and the inventors listed on the assignment match those on the patent applications. These steps will provide assurance to a potential licensee that the university is the record owner and is the proper party to license the technology.

PRIOR ART REVIEW

Once the university becomes aware of technology that may be suitable for patenting, it is usually worthwhile to do a preliminary search of the patent and technical literature to determine what obstacles could impede procurement of a patent, and how those obstacles can be effectively addressed so that the technology has a reasonable chance of being licensed. If it turns out that the search reveals that the same technology was developed previously and cannot now be patented, the university can avoid the expense of securing IP rights in this technology and pursue something else. If, on the other hand, the technology appears novel, the university may wish to proceed with a patent application and offer it for licensing with some level of comfort that the technology is not expected to encounter too many problems during the patenting process.
The difficult task in these types of investigations is how much time, effort, and expense should be invested by the university in these types of investigations. The answer, of course, depends on the circumstances. For example, if the technology is very important to the university, more expense could be justified. We believe, however, at a minimum, a simple patent search to determine if a patent can even be filed is always worth the cost. If a potential licensee is identified and wishes to have a more comprehensive search undertaken, it can do so at its own expense.

INVENTORSHIP

Determining the proper inventors on a patent application is an important part of the patent procurement process. However, this determination is frequently not easy, particularly in an academic or collaboration context. Since the consequences of not properly identifying the inventors can result in a patent being found invalid or unenforceable, it is very important to rigorously determine exactly who the proper inventors are.

The most common belief among academics is that inventorship on a patent is analogous to authorship on a technical journal article. This belief is incorrect. Inventorship, unlike authorship, has specific legal criteria that must be met, and these criteria are best evaluated by patent counsel, and not the principal investigator of the research project. Under the patent laws, an inventor on a

provisional patent application is anyone who contributed to the *subject matter that is disclosed* in the provisional application.[6] In contrast, an inventor on a nonprovisional (e.g., a utility) application is anyone who contributed to the conception of the *claimed subject matter* in the application. Determining the proper inventors for a patent application is a highly fact-dependent inquiry and is further complicated by numerous judicial decisions that affect who can be an inventor. It is therefore advisable that IP counsel be engaged to properly determine the inventorship on patent assets that are to be licensed. This rigorous determination will increase the value of the portfolio to potential licensees because the risk of improper inventorship, and hence the chance of patent invalidity or unenforceability, is reduced.

SMALL AND LARGE ENTITIES

In 1982, Congress provided for a 50% discount on patent application and maintenance fees if the applicant was a so-called Small Entity. Small Entities were defined to include, among other things, non-profit organizations such as colleges and universities anywhere in the world, certain tax-exempt organizations, a nonprofit scientific or educational institution, or a nonprofit organization in another country, which, if it were located in the United States, would qualify as a nonprofit organization. However, in all these cases, to assert and maintain small entity status, the nonprofit organization must meet a further criterion that it

> ...[h]as not assigned, granted, conveyed, or licensed, and is under no obligation under contract or law to assign, grant, convey or license any rights in the invention to any person, concern, or organization that would not qualify as [a small entity].[7]

Thus, if a nonprofit organization, such as a university, licenses its patents to an entity that is not a Small Entity (for example, a large pharmaceutical manufacturer), prosecution and maintenance fees for that patent must be paid under the Large Entity fee schedule. Thus, it is important to determine if the licensee qualifies as a Small Entity or a Large Entity. Unfortunately, these determinations are not always easy. A U.S. court recently articulated the consequences of improperly claiming Small Entity status,[8] after a lower court found a particular licensed patent was unenforceable and expired due to improper claiming of Small Entity status and paying Small Entity maintenance fees. Claims of inequitable conduct before the USPTO were also alleged. It is therefore very important to investigate whether a potential licensee is a Large or Small Entity, and whether the Entity Status should be changed to reflect the licensing arrangement. As the above court decision makes clear, if Small Entity status is to be claimed, a thorough investigation into whether claiming such status is appropriate must be conducted. Failure to conduct such an investigation before making any claim for Small Entity status could form the basis of a lawsuit that could render the university's patent assets unenforceable.

Of particular concern is the situation where the university licenses its patents to a company. Companies provide particular challenges in determining Entity Status because for a company to qualify as a small entity, it must have 500 employees or fewer, including affiliates. The definitions of "employee" and "affiliate" are open to interpretation depending on the time of the year, the business cycle, and the other partnering arrangements the company may have. In general, any transactions involving licensing, conveyance, granting, or assignment of any patent assets owned by the university should be reported to a patent attorney so appropriate steps can be taken to review the transaction and determine if Small Entity status should be changed. Further, with respect to small business concerns, a thorough investigation of all affiliations and

relationships, including investor relationships and obligations, are required. Moreover, the issue of whether Small Entity status is proper must be continuously reviewed and any change in status promptly disclosed to the USPTO. It should be noted that if the applicant or patentee makes an improper attempt to claim small entity status with the intent to deceive, the USPTO will regard that attempt as fraud and expose the applicant or patentee to a variety of sanctions as well as placing the enforceability of the patent in jeopardy.

In many cases, the investigations described above could be costly and not provide a definitive solution with respect to small entity status. In addition, given the potentially severe consequences of improperly claiming small entity status in terms of claims of inequitable conduct and potential patent unenforceability, applicants or patentees should consider carefully whether to claim small entity status even though they may be entitled to do so. In certain situations, the university may wish to change the entity status to large entity and pay large entity fees. As the USPTO has noted:

> It should be appreciated that the costs incurred in appropriately conducting the initial and subsequent investigations may outweigh the benefit of claiming small entity status. For some applicants it may be desirable to file as a large entity ... rather than undertaking the appropriate investigations which may be both difficult and time consuming.[9]

In difficult circumstances, or where the determination of whether a licensee is a large or small entity in doubt, it is generally best to change the status designation to Large Entity to avoid potential problems.

THE U.S. PROVISIONAL PATENT APPLICATION

As mentioned above, to secure its rights in an invention, a university will generally file a provisional patent application in the United States to establish an early filing date and disclosure. The provisional application may be prepared and filed by outside patent counsel, or, in some cases (typically for cost reasons), the technology transfer office itself will prepare and file the provisional application. However, regardless of who prepares and files it, the provisional application must meet specific legal requirements set out in the patent laws with respect to the scope and content of the disclosure. In particular, the application must

> ...contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.[10]

Unfortunately, many provisional applications are filed hastily (often to avoid a public disclosure as discussed above), and the "application" consists of a draft manuscript, an abstract, poster slides, or, in some cases, a grant application, which frequently do not comply with these requirements, and/or disclose information that the university does not wish to disclose (e.g., financial information or collaborators). These types of hasty filings can have a serious impact on the IP rights of the technology. The legal effect of not properly disclosing the invention was recently brought to light in a case before the Court of Appeals for the Federal Circuit (CAFC),[11]

where a provisional patent application did not adequately support the invention as claimed in the nonprovisional application. Since the patented product was the subject of a commercial offer for sale more than 1 year before the nonprovisional patent application was filed, the issued patent was found invalid.

To make a patent portfolio as attractive as possible to potential licensees, it is important to have filed provisional applications that describe the invention adequately and meet the requirements of the patent laws. Preferably, this application will have been prepared by patent counsel in conjunction with meetings with the inventors so that the application fully complies with the legal requirements for disclosure, and can be relied on as a priority filing for subsequent applications that follow. As a general rule, all relevant data should be included in the provisional patent application. The provisional application is not required to have claims, but including at least one broad claim is generally desirable. The provisional application should also not include any information the university wishes to remain confidential, such as budgetary or financial information, or names of collaborators or partners.

THE U.S. UTILITY AND INTERNATIONAL PATENT APPLICATIONS

Within one year of filing the U.S. provisional application, the applicants have an opportunity to file a nonprovisional U.S. utility patent application and/or one or more foreign national or international patent applications.[12] While the provisional application acted largely as a "placeholder" and established a priority date, the nonprovisional utility and foreign/international applications are the applications that will in fact be examined by patent examining authorities.

Like the provisional application, the nonprovisional U.S. utility application must meet the disclosure requirements outlined above, as well as have claims directed to the various embodiments of the invention. If the provisional application was prepared with the above considerations in mind, it is generally not a difficult task to prepare or revise it as a nonprovisional utility application.

Prior to filing any nonprovisional utility application, the technology transfer office should check with the inventors to determine if any new data has been developed. Typically, the research process continues after the provisional application has been filed, and any new data generated since the filing of the provisional application should be included in the nonprovisional utility application. This updating process serves three important functions. First, adding new data to a provisional application secures IP rights to the data since it has not yet formed part of a patent application. Second, the new data can provide additional support for broad claims, which is always desirable from the point of view of a licensee. This point is especially important in fields such as biotechnology where the USPTO takes the position that this art is "unpredictable," and therefore many examples and large amounts of data are usually required to obtain claims having any useful breadth. Finally, the new data provides an opportunity to refine and clarify the invention described in the claims of the application, which will generally make the examination process proceed more smoothly. As mentioned above with respect to premature disclosures, the technology transfer office should communicate with the inventors so that new data can be gathered and included in the nonprovisional utility patent applications in advance of the one-year filing deadline.

The nonprovisional utility patent application process also requires that the inventors, technology transfer office, and anyone else involved with the preparation and/or filing of the application

submit relevant prior art to the Patent Office.[13] This "duty of disclosure" is imputed not only to the inventors, but to other laboratory personnel, support staff, and even those in the technology transfer office, and the consequences of not divulging known prior art include possible patent invalidity, unenforceability, or fraud. It is therefore very important to file a complete Information Disclosure Statement (IDS) divulging all of the prior art that the inventors or other parties are aware of. Filing an IDS will assure potential licensees that the university and the inventors are meeting their obligation to cite relevant prior art to the USPTO. A comprehensive IDS should be filed either with or shortly after filing the nonprovisional application. Moreover, any new and relevant prior art that was not included in the original IDS should be cited to the USPTO in one or more supplementary IDS as soon as possible.

In addition to an IDS, a signed Oath and Declaration must be filed along with the nonprovisional application. This is an important document in the application process because formal examination of the application by the examiner cannot proceed without having a signed Oath and Declaration on file with the USPTO. The signed Oath and Declaration must meet several legal criteria, including (1) identifying each inventor, his home address and country of citizenship, (2) stating that the person(s) making the oath or declaration believes the named inventor(s) are the original and first inventor(s) of the subject matter that is claimed, (3) stating that the person(s) making the oath or declaration has reviewed and understands the contents of the application, including the claims, and (4) stating that the person making the oath or declaration acknowledges the duty to disclose to the USPTO all information known to the person(s) to be material to patentability.[14]

Like the IDS, a signed Oath and Declaration should be filed either with or shortly after filing the nonprovisional application. Additionally, since the Oath and Declaration must be signed by each of the inventors, the technology transfer office should keep track of the whereabouts of each inventor so that the proper information can be supplied to the USPTO. During the course of prosecution, inventors (particularly graduate and postdoctoral students) will move, change jobs, etc., and it is important that the technology transfer office be able to locate these people if additional signatures are required. Having the signed Oath and Declaration on file, as well as current addresses for each of the inventors, will assure a potential licensee that the application file is in good order and that examination of the application can proceed.

In addition to the nonprovisional U.S. utility application, one or more foreign or international patent applications may be filed within one year of the provisional application filing date. While many options are available to the technology transfer office with respect to foreign filings, the most common approach is to file an international application under the Patent Cooperation Treaty (PCT). This type of application is advantageous because it covers many countries with a single application, and is relatively inexpensive to file. Preparation of the PCT application is also fairly efficient since the same document that is used for the U.S. utility filing can be used for the PCT filing, hence saving separate preparation costs. From the point of view of a potential licensee, having U.S. utility and PCT applications complete and properly on file provides assurance that all filing deadlines have been met and that the patent applications have a proper priority filing date.

CONCLUSION

Building a patent and technology portfolio that is attractive to potential licensees takes involvement and diligence by the technology transfer office and the inventors. The most important factor that is within the control of the university and the inventors is treating the IP properly to assure rights are not lost. Preventing premature disclosures, assuring proper

ownership and inventorship of the inventions, and filing priority patent applications that meet the proper legal requirements for disclosure are effective and easy steps that any technology transfer office can take to assure a full complement of rights are available to any potential licensee. If the technology meets a licensee's needs, and the university has treated it properly, the licensee will be confident knowing their investment has a good chance of success. Proper IP practices by the university and the inventors will bring maximum value of the IP assets to both the university and the licensee.

ENDNOTES

1. P.L. 96-517 (December 12, 1980).

2. 35 U.S.C §102(b) states that "A person shall be entitled to a patent unless ... (b) the invention was patented or described in a printed publication in this or a foreign country, or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States...."

3. *In re Carol F. Klopfenstein and John L. Brent Jr.*, Slip Op. No. 03-1583 (Fed. Cir., August 18, 2004).

4. *University of West Virginia v. VanVoorhies*, No. 00-1440,-1478 (Fed. Cir., January 30, 2002).

5. 35 USC §261.

6. 37 CFR § 1.45(c).

7. 37 CFR §1.27(a)(3).

8. *Ulead Systems, Inc. v. Lex Computer Management Corp.*, 351 F.3d 1120 (Fed. Cir., December 9, 2003).

9. Definition of Small Entities and Establishing Status as a Small Entity to Permit Payment of Small Entity Fees, 54 Fed. Reg. 54, 604 (2000).

10. 35 USC §112, First Paragraph.

11. *New Railhead Mfg., LLC v. Vermeer Mfg. Co.*, No. 02-1028 (Fed. Cir., July 30, 2002).

12. 35 USC §119(e).

13. 37 CFR §§ 1.97 and 1.98.

14. 37 CFR §1.63.

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MAKING A GOOD THING EVEN BETTER

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ABSTRACT

Partnerships between universities and companies are historical facts that provide demonstrable benefits to both parties. However, there are contentious areas, most notably intellectual property, technology transfer, and licensing. The successful aspects must be reinforced and the contentious areas must be minimized. This article addresses both the successful and problematic areas of the partnership and discusses the University-Industry Partnership ("Partnership"), a current initiative to improve this relationship.[1] With regard to the Partnership, the comments and observations contained herein represent the personal perspective of the author and not the formal position of the Partnership. The article concludes with discussion and conclusions about the Partnership and the overall relationship between academia and industry.

INTRODUCTION

Since its emergence after World War II, the field of research administration has been in a state of change. While change has been a constant, the past ten years have been particularly dynamic. This fact has forced colleges and universities to adapt quickly to the changing environment in research administration.

The following issues are among the most pressing:

A. Increasing competition for extramural funding.

B. Regulatory compliance by colleges, universities, hospitals and medical centers.

C. Financial cost accounting, compliance, and auditing.

D. The relative decline of federal R&D support coupled with the rise of corporate funding of R&D.

E. University-industry relationships.

This last issue is the subject of this article. Research partnerships between universities and their industrial sponsors are an important and generally productive relationship. Universities receive financial and non-financial support from their corporate sponsors; graduate and undergraduate students receive an excellent educational experience by working in industry, which prepares them for their professional careers. Universities develop better linkages with alumni in industry who will hopefully donate to their alma maters.

Industry also receives benefits from these partnerships. Their work is advanced through the employment of graduate and undergraduate students, they have access to facilities they may not otherwise have, and their own corporate agendas are advanced by completion of project deliverables.[2] It is perhaps quite accurate to say that students (as future employees) are the most consistent and real benefits of these relationships.

These partnerships also directly and/or indirectly benefit local, regional and national economies. Economic growth in the United States is necessarily tied to the growth and effective use of science and technology. The long-term dynamic growth of the American economy, and its place in the international economy, is tied to advances in science and technology. All Americans have a vested interest in this fact.[3]

This essay looks at the current state of university-industry partnerships, outlines a current attempt to improve these partnerships—The University/Industry Partnership ("Partnership")—and draws some conclusions and provides commentary on the Partnership and its potential impact on the overall relationship between academia and industry.[4]

THE CURRENT STATE OF THE PARTNERSHIP

Partnerships between universities and industry have been by and large a successful venture. These relationships often stretch back to the early part of the 20th century. The minutes of The Pennsylvania State University's University Research Council meeting of February 6, 1928 asked the following two quite familiar questions: "To what extent should the college enter into agreements with commercial concerns and under what conditions? What should be the institutional policy in reference to patent and patent rights?"[5]

The National Science Foundation has reported that prior to 1980 industry support of university research was rather constant. After 1980, growth became rather pronounced, rising from about $1 billion in 1989 to approximately $2.3 billion in 2000, and with an overall increase in science and engineering research of 150% between 1988 and 2000.[6]

There has been similar remarkable growth in total gross income for U.S. university and research institute patents as reported by the Association of University Technology Managers, rising from slightly less than $200 million in FY 1991 to $1.25 billion in FY 2000.[7]

Despite this success, the partnership is in a state of constant change and stress. As the first Partnership meeting indicated, the following external forces are having a major impact:

A. The research environment is changing in the United States and abroad. Economic conditions and government funding are forcing universities to look harder for private research funding.

B. Students and workforce supply and demand are central to the research enterprise. Changes in the pattern of this chain or pipeline are raising questions regarding whether the American public understands the importance and its economic effect. Are there enough Americans in science and engineering to "get the job done?"

C. Globalization is both a barrier and an opportunity. Foreign universities are increasingly able to compete with American universities in the R&D arena, even to the point that U.S. companies are doing business with foreign universities because of more favorable intellectual property rights.[8] Foreign students are also considered less expensive and their research leaders are U.S.-trained.

D. Local economic development pressures are forcing universities to become drivers of economic development. Universities are feeling pressure to link research to shorter-term immediate economic welfare and foster "entrepreneurial spirit" on campus and in the community.[9]

E. Stress in university-industry relationships is particularly due to the negotiation of research and intellectual property agreements. Contentious and draining negotiations often are the norm (the "hassle factor"). When the hassle factor becomes too great, trust diminishes, less industrial funding is invested in universities, and the relationship slowly dissipates. Unrealistic expectations often are at the root of this problem (financial gain for universities, work product for industry). Negotiating IP and related clauses remain the most significant bottlenecks to creating and maintaining harmonious partnerships.[10]

F. University and industry missions differ. This divergence leads to natural stress. The information technology sector maintains that universities should put all their IP in the public domain, while the pharmaceutical industry takes an opposing view. Some universities say they might be comfortable putting their IP in the public domain in some instances, but they cannot give away all their intellectual property rights.[11]

Academia and industry are being forced to deal with a variety of internal and external pressures. Pressure to compete for profit, market share, and prestige is coupled with the shifting tectonics of the industrial and university sectors. Globalization is putting pressure upon universities and industry to shake up their traditional ways of doing business. But how far can universities stray from their original missions?

This leads to a significant conclusion: while issues of intellectual property, licensing, and contract negotiation are among the most contentious issues, broader questions of culture, good faith, profit, education, economic policy and social policy are involved. At this point it is useful to point out why academia and industry collaborate.

WHY DO UNIVERSITIES AND INDUSTRY COLLABORATE?

Why academia and industry collaborate is essential to improving these relationships. These reasons include the following:[12]

- Universities provide industry with a *ready pool of graduate and undergraduate students.* Students receive essential workforce training that is not available in the classroom and may become permanent employees.

- *Technical opportunities* in industry exist for faculty and students that may not exist within the academic setting.

- *Materials* are available in industry for research and educational purposes that may not exist at academic institutions.

- Collaborations with industry provide *research funding* for universities. A steady stream of research money within universities is a necessary and, some lament, fact of life. Many universities rely on extramural funding.

- Collaborations with industry often advance the *university service mission*.

- Collaborations contribute to *local, regional and national economic development.*

- Collaborations between university and industry are often *novel to "high" technology* areas, in contrast to "low" technology areas (such as basic manufacturing).

- At some universities, collaboration with industry is part of their *internal reward structure*. Such structures provide a positive financial incentive for faculty, which is often essential for research development and retention of "star" faculty.

- *Universities often have infrastructure desired by industry*. For many companies, it is simply more cost-effective to contract out research to universities that have the research infrastructure rather than building from the ground up or renovating existing facilities.

- *Collaboration is encouraged by the federal government.* Whether through legislation such as the Bayh-Dole Act of 1980, or through specific grant programs such as the NSF-Partnerships for Innovation (PFI) program, the federal government explicitly or implicitly encourages such partnerships.

- *Industry outsourcing to universities*, to reduce the costs of doing business and increase profits.

As this list illustrates, this symbiotic relationship is mutually beneficial.

BARRIERS TO COLLABORATION

What barriers hinder collaboration? What causes these partnerships to be occasionally problematic? A focus group at the 2003 NCURA Annual Meeting identified the following:[13]

- *Communication* (or the lack thereof) is a major barrier to collaboration. Communication skills differ. Needs and expectations are often different and the failure to communicate them compounds the problem. University and industry representatives stereotype each

other. This also includes the lack of communication within organizations, where different offices within each organization must work together to get the partnership cemented.

- *Universities have mixed missions*, particularly when it comes to establishing start-up companies. The establishment of start-up companies with faculty at the center is, in some people's eyes, a significant departure from education, teaching, service and research.

- *Cultural differences* are a major barrier to collaboration. Not only is there the basic legal distinction between both entities, but there are also cultural differences that have nothing to do with this legal difference. Anyone who has spent a significant amount of time in contract negotiation knows this to be a reality of life.

- *Secrecy or public dissemination of knowledge* is a major difference between universities and industry. Universities desire to publish and disseminate the results of their work. Faculty demand and cherish the ability to publish. Companies are often more secretive about the results of research in the search for competitive advantage and ultimately profit.

- *Fear factor*. Both parties, through culture, prior experience, or stereotyping, often fear doing work with the other. Perhaps it is the fear of having to divulge information.

- *Universities overvalue the value of technology or the research they do*. This is often a comment made by industry, which feels that faculty often overvalue the work they do on projects. As with many aspects of this partnership, this varies on a case by case basis.

- *Lack of trust.* This is a significant barrier. This lack of trust occurs within universities and industry and often between these parties. This is particularly evident in areas of legal issues and contract negotiation and can be exacerbated by the departure of key personnel. This area emphasizes the need for personal, trusting relationships.

- *Financial risk for universities*. It is financially riskier for universities to work with industry than with government. The federal government in particular is seen as a stable source of research money. Obviously, however, budget cuts at the state and federal levels during periods of fiscal distress do not mean that government funding is entirely risk-free.

- *Faculty oversell projects*. Whether intentionally or inadvertently, faculty may oversell projects to their universities to secure institutional approval and funding.

- *Universities lack consistency*. By their very nature, universities are fluid organisms. Administration and faculty come and go, making long-term partnerships difficult. Agendas may change even if personnel are stable. Public universities are subject to the fiscal legislative process, and private universities have their own unique issues to a certain extent. Whether intentionally or inadvertently, universities can be inconsistent when it comes to industrial partnerships.

- *Exclusive relationships.* As in personal relationships, it is often the case that one party wants an exclusive relationship and the other does not. Some companies want an exclusive relationship and often universities and their faculty do not, or vice versa.

- *Conflicts of interest* often impede collaboration. At the present time universities are very much concerned with conflicts of interest (financial and otherwise). How can faculty do research if they are not free of potential conflicts? No company or university, no matter how much money is involved, wants to become embroiled in a controversy that will tarnish its reputation.

- *Too much specialization in contract negotiations*. It has been pointed out by industry that there is often too much specialization in contract negotiation, evidenced by a technology transfer office negotiating the intellectual property/licensing clauses and the sponsored program office negotiating the rest of the provisions. This can lead to unnecessary delay in finalizing research contracts. In fairness to universities, however, this sort of problem also exists in companies where different business units are responsible for different parts of a research or intellectual property agreement. This problem is compounded by personnel turnover, poor communication, and a shift in agendas.

These barriers often mix with each other, compounding the problem. It is apparent that barriers to collaboration arise from fundamental differences and are compounded by larger associated economic, political and social issues facing academia and industry. The university-industry relationship is complex indeed!

THE MAIN CONTENTIOUS ISSUES

While many partnerships occur smoothly without complication or conflict, certain contentious issues seem to regularly appear. These issues were significant enough to merit the convening of the Partnership. The most contentious issues are:

1. Communication between universities and industry in the performance of particular projects, including expectations and concerns.

2. Long delays in completing contract negotiations.

3. Negotiation of intellectual property and licensing terms, including ownership, revenue streams, and licensing to third parties.

4. Other legal provisions, particularly publication and international students as a result of immigration changes after September 11, 2001.

THE UNIVERSITY-INDUSTRY PARTNERSHIP

As a result of the aforementioned issues, the Partnership was established by the National Council of University Research Administrators (NCURA), the Government-University-Industry Research Roundtable (GUIRR), and the Industrial Research Institute (IRI). The title of the project is *Re-Engineering Intellectual Property Rights Agreements in Industry-University Collaborations*. Despite the title, and as shown below by the assignments of the project Teams, the scope of the Partnership is beyond IP Agreements.

NCURA, founded in 1959, is an organization of individuals with professional interests in the administration of sponsored programs (research, education, and training), primarily at colleges and universities. With 4,200 members nationally and internationally, NCURA serves its members

and advances the field of research administration through professional development and the sharing of knowledge, and by fostering community among members.

GUIRR is a unit of the non-profit, non-governmental National Academies. GUIRR was created in 1984 in response to the report of the National Commission on Research, which called for an institutionalized forum to facilitate dialog among the top leaders of government and non-government research organizations. The need to reduce growing tension between government and universities over procedures for administering federally sponsored research was a part of the original basis for the creation of GUIRR.[14] GUIRR's formal mission was revised in 1995 to "convene senior-most representatives from government, universities, and industry to define and explore critical issues related to the national and global science and technology agenda that are of shared interest; to frame the next critical question stemming from current debate and analysis; and to incubate activities of on-going value to the stakeholders. This forum will be designed to facilitate candid dialogue among participants, to foster self-implementing activities, and, where appropriate, to carry awareness of consequences to the wider public."[15]

The IRI is the foremost business association of leaders in research and development (R&D) working together to enhance the effectiveness of technological innovation in industry. Founded in 1938 through the National Research Council, the IRI is composed of senior executives from a diverse range of industries whose member companies are investing $70 billion annually in R&D worldwide. The IRI is the only cross-industry organization providing the R&D community with insights, solutions and best practices in innovation management developed through collaborative knowledge creation.

GUIRR and IRI have been involved in a dialog on the issue of university-industry research for 15 years prior to the convening of the Partnership. They have published the following:

A. "Simplified and Standardized Model Agreements for University-Industry Cooperative Research" (1988)[16]

B. "Intellectual Property Rights in Industry-Sponsored University Research: A Guide to Alternatives for Research Agreements" (1993)[17]

C. "Industry-University Research Collaboration: Report of a Workshop" (1995)

D. "Overcoming Barriers to Collaborative Research" (1999)[18]

MISSION OF THE UNIVERSITY-INDUSTRY PARTNERSHIP

The Partnership's mission is to explore current barriers to effective partnerships and seek solutions that will overcome the barriers so that partnerships can succeed. A direct outcome of this endeavor will be the development of, first, a set of principles upon which industry-university collaborations can be built and, second, the development of a nationally accepted array of contractual solutions regarding intellectual property rights.

COMPOSITION OF THE UNIVERSITY-INDUSTRY PARTNERSHIP

The Partnership is composed of leading individuals from academia, government, and industry. In addition to NCURA, GUIRR, and IRI leadership, the Partnership was initially composed of delegates from the following institutions; this list is changing as the needs of the project develop:

University Representatives: Bradley University; California Institute of Technology; Carnegie Mellon University; Georgia Institute of Technology; Massachusetts Institute of Technology; The Pennsylvania State University; Stanford University; University of California at Los Angeles; University of Nebraska-Lincoln; University of Texas at Austin; University of Washington; and the University of Wisconsin-Madison.

Government Representatives: National Institutes of Health; National Science Foundation; Office of the Assistant Secretary of Defense, Homeland Defense, Force Planning and Employment; Office of Science and Technology Policy; and the U.S. Department of Commerce.

Private Sector Representatives: Allon Therapeutics, Inc.; Corning Incorporated; Dow Chemical Company; Extrude Hone, Inc.; Flow International Corporation; Hewlett-Packard Company; IBM Global Services; Monsanto Corporation; National Center for Manufacturing Sciences; Venture Law Group; and II-VI, Inc.

ACTIVITIES OF THE UNIVERSITY-INDUSTRY PARTNERSHIP

The Partnership convened its first meeting in San Francisco on August 19–20, 2003. This first meeting was successful: 34 delegates began discussions on how industry and academia can work more productively together.

For more than a day, the delegates brainstormed through a set of questions that were shared with the entire Partnership. Partnership membership was divided into four working groups ("Teams") to develop a set of issues and barriers in industry/university collaborations and outline strategic principles and actions that may be used to overcome barriers and move to ideal collaborations. Team leaders were appointed to lead their respective teams through continuing conference calls. Since the initial meeting, the following activities have taken place:

- Teams met via conference calls to further develop and add to their principles and action topics, creating prioritized lists. These conference calls periodically continue.

- A focus group was convened at the November 2003 NCURA Annual Conference in Washington, D.C. to continue discussions and solicit feedback.

- February 2–3, 2004––Steering Team and Color Team Leaders meeting, Washington, D.C. A plan was formulated for moving Team strategic principles forward. This included a long-term vision covering a background document for decision and policymakers, a training document for practitioners, the development of best practices/demonstration partnerships to address contentious issues and brick walls, and a matrix of circumstances and options. This also included short-term points and assignments for the Teams to bring to the Second Partnership meeting.

- October 14-15, 2004—Second Partnership meeting to continue development and finalization of recommendations. Teams will present their draft documents/proposals and reform teams around the elements of the long-term strategic plan, which may require new participants and resources. After the meeting, new teams will shape draft documents and proposals into working and training tools that will be delivered at the National Summit, scheduled for fall 2005.

- Fall 2005—A National Summit in Washington, D.C. at the National Academies for national leaders of industry, university and government. This Summit will develop and endorse solutions for IP agreements that will foster the creation and commercialization of new knowledge and new technologies while appropriately protecting the interests of all parties.

TEAM ASSIGNMENTS

Teams have been working on a variety of assignments. These are the current assignments, keeping in mind that modifications may occur:[19]

Blue Team

Develop a continuing forum for demonstrations of solutions to difficult problems (identify the top ten contentious issues; develop a written proposal for a demonstration to address one of these issues; propose an organizational mechanism for the resolution of university-industry collaboration issues through demonstration projects). *Expected Outcome*: Demonstration partnership to address contentious issues/brick walls (an ongoing forum similar to the FDP).

Green Team

Develop portions of a working educational tool for practitioners, Part I of II (catalogue and explain common agreement types (e.g., consortiums, centers, clinical trials involved, federal funding involved) and known issues that come up in each; catalogue and explain issues that cross all agreement types (confidentiality, indemnification, non-disclosure). Red Team is assigned Part II of II. *Expected Outcome*: Educational training tool for practitioners, incorporating "wisdom" on circumstances and options (as opposed to static templates without explanation).

Red Team

Develop portions of a working educational tool for practitioners, Part II of II (develop an explanatory catalogue of well-known best practices; develop menu of solutions to identified issues, alongside explanations of tradeoffs among choices; identify known barriers; articulate matrix of non-issues). Green Team is assigned Part I of II. *Expected Outcome*: Educational training tool for practitioners, incorporating "wisdom" on circumstances and options (as opposed to static templates without explanation).

Black Team

Develop a high-level statement of principles that can serve as a "constitution" for university-industry collaborations generally and intellectual property agreements specifically (define the

respective missions of the two sectors; define the objectives and constraints relative to those missions; define the principles that would be consistent with all missions, objectives, and constraints so listed). This document will be the basis of a "sign on" effort later in project life. *Expected Outcome*: Background document for decision and policy makers (the "constitution").

CONCLUSION

Given that the Partnership has only been in existence for approximately one year, what can be said about it? One thing is clear: the Partnership is the most comprehensive attempt to date addressing the university-industry relationship. The current Team assignments reflect a comprehensive look at the entire relationship. Broad principles will be written and specific recommendations will be made. The project is broad, yet specific. There is much to commend, but much remains to be done. Honest discussion between representatives in a relaxed atmosphere has proven to be a positive benefit. Each has learned something from the other. Most of the past year has been spent talking and discussing, but the time for concrete action is now.

Addressing intellectual property and licensing within the broader context will result in improvement of these partnerships. Negotiations will be less time-consuming and less stressful. After all, research is paramount. The essential question must be asked: Can the parties compromise? Only time will tell.

As a participant in the Partnership from its inception, the author believes that there is no current downside to the project. The downside will come if the parties do not arrive at common broad principles and specific areas of agreement, and make a genuine attempt to correct the most vexing issues of this relationship. Much is at stake: money and prestige are just the tip of the iceberg.

Given the generally productive yet occasionally contentious nature of these partnerships, it should be clear that developing harmonious partnerships requires keeping those attributes that work and improving those that do not while at the same time adjusting for larger social, cultural and economic changes at the domestic and international levels. In such an environment, academia and industry in the United States must build a closer, trusting, working relationship.

This is not to argue, however, that change is going to require academia and industry to dispense with their fundamental attributes. Change can be accomplished within the larger context of stability and development of these partnerships IF both parties want it to occur.

The Partnership appears to be making headway in addressing fundamental problems and potential changes to this relationship, so the odds are good that the Partnership will produce more effective and efficient relationships. Individuals, institutions, and companies will benefit from these improved relationships. In the end, you will see more harmonious partnerships that will benefit all parties while having the ability to adjust to the changing world around them. The next year will be very interesting.

ENDNOTES

1. This article is largely reflective of comments made during a presentation at the 6th Annual Licensing Intellectual Property Seminar at the University of Dayton School of Law, Dayton, OH, March 16, 2004. With respect to the Bradley University NSF-PFI grant discussed herein, this

material is based upon work supported by the National Science Foundation under Grant No. EEC-0332714. Information pertaining to the University-Industry Partnership is the personal perspective of the author and does not represent the formal position of the Partnership. Special thanks are extended to Dr. Merrilea Mayo at GUIRR for reviewing a previous draft of this article. The original name of the University-Industry Partnership was "Industry/University Congress," but this was changed to the current title by the Partnership Steering Committee in June 2004 to better reflect the project.

2. For an excellent series of articles on the science and engineering workforce in the United States, particularly with reference to undergraduate and graduate students, *see Pan-Organizational Summit on the U.S. Science and Engineering Workforce: Meeting Summary* (National Academies Press, Washington, D.C., 2003).

3. See *Harnessing Science and Technology for America's Economic Future* (National Academies Press, Washington, D.C., 1999) for an insightful discussion of how America's economic future is tied to science and technology. For an excellent discussion of recent U.S. industrial performance in a changing world of economics and innovation, *see* National Research Council, Board on Science, Technology and Economic Policy, *Securing America's Industrial Strength* (National Academies Press, Washington, D.C., 1999).

4. For additional articles on the university-industry partnership, *see* Business-Higher Education Forum, "Working Together, Creating Knowledge: The University-Industry Research Collaboration Initiative" (American Council on Education, Washington, D.C., 2001); Berneman, L., "University-Industry Collaborations: Partners in Research Promoting Productivity and Economic Growth," *Research Management Review* 13(2), pp. 28–37 (Summer/Fall 2003); Dyer, B. J., "Can Universities Make Money on Start-Ups?," *Research Management Review* 13(2), pp. 23–27 (Summer/Fall 2003); Garabedian, T. E., "Recent Developments in Intellectual Property Law: Avoiding Traps in the Pursuit of University Research," *Research Management Review* 14(1), pp. 3–15 (Spring 2004); Garabedian, T. E., "Nontraditional Publications and Their Effect on Patentable Inventions," *Nature Biotechnology* 20(401) (April 2002); Government-University-Industry-Research Roundtable/Industrial Research Institute, "Simplified and Standardized Model Agreements for University-Industry Cooperative Research" (National Academies Press, Washington, D.C., 1988); Matsuura, J. H., "An Overview of Intellectual Property and Intangible Asset Valuation Models," *Research Management Review* 14(1), pp. 33–42 (Spring 2004); Severson, J. A., "Tectonics in the University-Industry Research Partnership," *Research Management Review* 13(2), pp. 12–22 (Summer/Fall 2003); Tellefsen, R., "Strategic State Planning for Technological Innovation: The Pennsylvania Ben Franklin Partnership," *Strategic Planning for University Research*, pp. 413–419 (1992); Thompson, T. B., "An Industry Perspective on Intellectual Property from Sponsored Research," *Research Management Review* 13(2), pp. 3–11 (Summer/Fall 2003). The *Research Management Review* is found online at http://www.ncura.edu/rmr/.

5. Killoren, R., and Butts, S., "Industry-University White Paper" (2003). This White Paper was created for the initial work of the Industry/University Congress that met in San Francisco in August 2003.

6. Academic Research and Development Expenditures: Fiscal Year 2000 (NSF 02-380), Table B-1, National Science Foundation (2002).

7. AUTM Licensing Survey: FY 2000, A Survey Summary of Technology Licensing (and Related) Performance for U.S. and Canadian Academic and Nonprofit Institutions, and Patent Management Firms, published by the Association of University Technology Managers (2001).

8. Dr. R. Stanley Williams, HP Fellow, Hewlett-Packard Laboratories, on behalf of the Hewlett-Packard Company, testified before Congress that U.S. companies are turning increasingly to foreign research universities offering more favorable intellectual property rights rather than work with U.S. universities (R. Stanley Williams, Testimony Before the Subcommittee on Science, Technology and Space of the Senate Committee on Commerce, Science, and Transportation, September 17, 2002). This is another form of labor outsourcing. Since the use of undergraduate and graduate students is central to most university-industry collaborations, this has startling implications for education in the U.S. Differences in intellectual property ownership models and litigation over IP ownership complicates and erodes this partnership. *See also* "A Relationship in Crisis: American Research Universities and Large Corporations," a draft document submitted for comment and criticism, authored by Dr. Williams. In this document he raises many of the same points and issues that he mentioned in his Senate testimony.

9. The federal government, through grant programs, encourages local and regional partnerships among universities, industry, and other local profit and nonprofit organizations. An excellent example is the Partnerships for Innovation Program (PFI) sponsored by the National Science Foundation (NSF). Bradley University received a three-year, $600,000 PFI grant to do the following: (1) leverage the region's substantial intellectual capital assets to create and nurture interdisciplinary, inter-institutional R&D partnerships leading to innovation and commercialization; (2) develop the region's substantial and underemployed human capital assets through innovative and aggressive educational and workforce development programs; and (3) develop a model for the management of intellectual property (IP) collaboratively developed within a partnership of diverse entities, and to link a portion of the IP-based revenue stream to Peoria NEXT programmatic initiatives (*Bradley University NSF-PFI proposal, Proposal Summary*). Partners with Bradley University are: Caterpillar, Inc., University of Illinois College of Medicine at Peoria (UICOM-P), U.S. Department of Agriculture National Center for Agricultural Utilization Research (NCAUR), Peoria Public Schools District 150, Illinois Central College, and OSF Saint Francis Hospital. Peoria NEXT is a not-for-profit corporation chartered under the laws of the state of Illinois and is comprised of the major institutional players in the Peoria area, including those mentioned as partners in the NSF-PFI grant. The *mission* of Peoria NEXT is to "create a healthier future for our regional community evidenced by increased economic growth and diversity, improved physical well-being, and the resultant social stability and opportunity" (http://www.peorianext.org/about.php). The *vision* of Peoria NEXT is: "By 2015, we will be the preferred Midwestern region in support of the culture of discovery, the creation of innovation and the implementation of commercialization in the areas of life science, material science, and engineering science" (http://www.peorianext.org/about.php).

10. Patents tend to be the most problematic in research and intellectual property agreements. It is also fair to ask whether the patent system in the United States is still operating optimally for the needs of science, technology and innovation in the 21st century. To this end, the National Academies are in the process of publishing a report that looks at the current status of the patent system, its performance, and how it can continue to reinvent itself. *See A Patent System for the 21st Century* (National Academies Press, Washington, D.C., 2004). The prepublication copy of this report indicates that the patent system is working well, but that stresses to the system threaten its functionability. The report makes the following recommendations for improving the patent

system: (1) preserve an open-ended, unitary, flexible patent system; (2) reinvigorate the non-obviousness standard; (3) institute an open review procedure; (4) strengthen USPTO capabilities; (5) shield some research uses of patented inventions from liability for infringement; (6) modify or remove the subjective elements of litigation; and (7) reduce redundancies and inconsistencies among national patent systems (*Ibid.*, pp. 4–6). For an excellent series of articles on patents in an economy that is based on the explosion of knowledge, *see* National Research Council, *Patents in the Knowledge-Based Economy* (National Academies Press, Washington, D.C., 2003).

11. Summary of First Industry/University Congress, October 2003.

12. NCURA/GUIRR/IRI Industry/University Congress Focus Group, NCURA Annual Meeting, Flip Chart Notes, November 3, 2003.

13. NCURA/GUIRR/IRI Industry/University Congress Focus Group, NCURA Annual Meeting, Flip Chart Notes, November 3, 2003.

14. Government-University-Industry Research Roundtable, *2000 Annual Report*, p. 19. The "Florida Demonstration Project" was initially conceived by GUIRR in 1986 to address streamlining the administration of federally sponsored research. Based upon success in Florida, the project was broadened into the Federal Demonstration Partnership (FDP), which now counts approximately 300 university and federal members, including Bradley University (Government-University-Industry Research Roundtable, *2002 Annual Report)*.

15. Government-University-Industry Research Roundtable, *2002 Annual Report*.

16. In the fall of 1989 GUIRR staff conducted a telephone survey of 70 university and industry users of this publication (known as the "model agreements"). This survey found that the model agreements had become accepted and valuable resources for negotiating university-industry research partnership agreements. The survey also found that intellectual property rights and licensing arrangements are two areas that deserved additional attention. *See Survey to Assess the Usefulness of Two Model Agreements for University-Industry Cooperative Research* (Government-University-Industry Research Roundtable and Industrial Research Institute, Washington, D.C., 1990), p. 12.

17. Nearly 12,000 copies of this report have been distributed with positive feedback. *See* GUIRR *1993 Annual Report*, p. 2. Richard F. Celeste, former Governor of Ohio, was Chair of GUIRR when this report was released.

18. This report was developed pursuant to a workshop held in Irvine, CA, March 23–24, 1998. See *Overcoming Barriers to Collaborative Research: Report of a Workshop* (National Academies Press, Washington, D.C., 1999).

19. See GUIRR/NCURA/IRI, GUIRR Council Meeting Update, February 3–4, 2004.

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SCIENTIFIC SELF-REGULATION: A BRIEF PRIMER FOR RESEARCH ADMINISTRATORS

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ABSTRACT

The National Academies of Science recently recommended a battery of guidelines for Academe to create an "environment" conducive to the responsible conduct of research. These guidelines affect the research administration field as a whole, as research administrators will be expected to assist in these changes. Research administrators, however, should consider their role in scientific self-regulation as they assist in environmental changes. Environmental changes take decidedly longer to achieve than a one-hour meeting or one-hour training session covering the definitions of scientific misconduct. It is time to move away from simple awareness training and discover new ways of collaborating with faculty to manage responsible conduct in research.

ROLE OF THE RESEARCH ADMINISTRATOR IN SCIENCE

The purpose of this article is to call attention to the literature concerning scientific self-regulation. Scientific self-regulation simply means scientists monitoring themselves to make sure the people in their profession are following rules and established norms. Research administrators are not expected to get involved with another profession's self-regulating activities, but most in the field believe they are involved by default because of federal regulations and auditing activities brought on by grants and institutional review board activities. This does not mean research administrators should act as peer reviewers for the soundness of science, it simply means the research administrator should probably be considered as a research variable in current research on scientific self-regulation. Research administrators seem to take pride in knowing they help with regulatory matters, but for an emerging profession like research administration, this needs some attention. With the National Academies recommendations, research administrators need to be

shown as a significant contributor affecting scientific self-regulation as well as the business-as-usual regulation.

Currently, the research administrator's role is viewed as a peripheral and largely clerical function. This involves making the campus aware of definitions of scientific misconduct, making sure the proper procedures are followed when an alleged incident occurs, and filing the paperwork. It is apparent that this peripheral role is all some of us want to perform, but if research administrators are to get involved in the actual prevention of scientific misconduct, and institutional climate changes, clearly a better understanding of the causes and effects of scientific misconduct is in order. The National Academy of Sciences recently recommended a battery of guidelines for Academe to create an "environment" conducive to responsible conduct of research. These guidelines affect the research administration field as a whole because research administrators will be expected to assist in these changes. Research administrators, however, should consider their role in scientific self-regulation as they assist in this environmental change.

RESEARCH ADMINISTRATOR: INSTITUTIONAL DEFINITIONS

Oliver Hensley (1986, p. 1) defined the research administrator or research support personnel (RSP) as those "who render assistance directly or indirectly to principal and co-investigators" and stated that "within the university research establishment, we can clearly identify four major types of persons with distinctive roles which are set by their purpose: (1) students, (2) researchers, (3) research support personnel (RSP), and (4) sponsors." Hensley offered thirteen functional classes of RSP, demonstrating that research administrators are an integral part of the university research culture and therefore should share the role of scientific self-regulation with the faculty whether this role is explicitly stated or not. Additionally, institutional environmental or climate changes can be brought about best by using the often neglected shared governance structure that exists within institutions of higher education.

The subject of scientific self-regulation is broad and growing and is primarily published in the area of Higher Education Administration and concerns faculty norms. An overview of the characteristics of scientific self-regulation is presented here to increase the research administrators' understanding of the professional self-regulation of science.

Research administrators typically view their role in science as a partnership between themselves and the faculty where the faculty members conduct research and the research administrators adhere to the regulatory requirements of the funding. When funding exists, it is difficult to separate the research administrator from the science because, by signature authority, the research administrator has a legal and ethical obligation to meet the goals of the project along with the faculty member. It is clear, therefore, that to affect institutional change, this role will have to be shared.

During the past decade, the self-regulation of science within this legal-scientific condition has primarily focused on the faculty. There has been an increase in the literature concerning self-regulation of science by promoting a culture, environment, or climate conducive to maintaining research integrity. Given that a culture conveys a body of norms or guidelines for behavior of that culture, it is necessary to understand the norms guiding the professoriate.

THE FUNCTIONAL CULTURE OF SCIENTIFIC PRACTICE

It will be helpful to research administrators to note that science as a profession was defined by Robert K. Merton's seminal work (1942) concerning the "norms of science" that guide the professional behavior of scientists. He identified four distinct "norms" of science: (1) universalism, which prescribes peer review and scientific merit as the guiding principle and denounces factors such as race, nationality, class, or personal qualities when it comes to deciding on merit; (2) communality, which prescribes that research findings must be published and the findings distributed for all the scientific community to scrutinize and, if found worthy, the originating scientist should receive the appropriate credit for that work; (3) disinterestedness, which prohibits a scientist from doing research to seek fame alone—science should be performed for the sake of disseminating new knowledge, and (4) organized skepticism, which prescribes that results of experiments should never be accepted without empirically and logically based methods. Scientists perhaps are able to self-regulate themselves and any deviations from these rules and guidelines are indeed self-correcting through the peer review of publications and a research design that promotes the reproducibility of results. Merton's analysis is functional when placed within its historical context because the grant system was just beginning to affect the university culture. The institutional and funding factors of science make it difficult for scientists to avoid intrusion into their work by administrators. Maybe a fifth norm for today's day and age, although not as elegant as Merton's vernacular, could be: (5) shared organizational leadership.

POTENTIAL CAUSES OF SCIENTIFIC MISCONDUCT

Edward J. Hackett (1994, p. 245) in a later work suggested three schools of thought concerning deviation from norms of science: (1) Individual psychopathology; (2) Anomie; and (3) Alienation. Hackett (*Ibid*., p. 246) maintains that individual psychopathology is the "least satisfying explanation of scientific misconduct," for two reasons: (1) because "the attribution of personality disorder…is vague and unmeasured, [and] (2) many of the characteristics that seem to underlie putatively defective scientific personalities also seem to characterize effective even eminent scientists." Anomie and Alienation are more satisfying because they exist within the cultural context of the norms of science as prescribed by Merton (1942). Anomie, according to Hackett (*Ibid*., p. 247), is a condition where "deviance may arise when great cultural value is placed on achieving an end, but the means for its achievement are unavailable to persons in certain positions." Wodarski's (1991) administrative and monetary changes mentioned previously are excellent suggestions for warding off a state of anomie.

Alienation, on the other hand, is "a separation of a worker from the work, the self, or other workers" (Hackett, 1994, p. 248). Fragmentation among faculty due to extreme specialization causes this condition. As a faculty member becomes highly specialized, a condition emerges that creates a dominant sense of alienation from the world and the institution. Again, Wodarski's research administrative interventions appear to be excellent preventive measures to a condition of alienation as well because of the high level of peer review and grant writing support.

In another study, John Braxton and Alan Bayer (1994) presented four general hypotheses: (1) "The higher the interprofessional status, the more favorable are that individual's attitudes toward taking action for scientific misconduct, (2) the greater the level of social cohesion in an academic department, the less favorable are the attitudes toward taking action for scientific misconduct, (3) the greater the institutional pressure for academic scientists to receive external grant support, the less favorable are individual academics' attitudes toward taking action for

scientific misconduct, and (4) professional solidarity constrains taking action against scientific impropriety." Braxton and Bayer (1994, pp. 351ff) found: (1) "Both departmental cohesion and professional solidarity exert the predicted influences on reputational harm"; (2) "As professional age increases, an individual's concern over harm to the university's and colleagues' reputations created for taking action for scientific wrongdoing decreases"; (3) "as professional solidarity increases, the tendency of an individual to endorse the use of informal and lenient sanctions for scientific improprieties also increases"; (4) "department chairpersons are less likely to endorse informal and lenient sanctions than are academics who are not department chairpersons"; (5) "cohesive departments buffer individuals from fear of being labeled a whistleblower"; (6) "professional age shields an individual from fear of being stigmatized as a whistleblower"; and (7) "as professional solidarity increases, the tendency of individuals to distance themselves from colleague misconduct increases." This article indicates exceptional opportunities for the research administrator to foster institutional relationships with scientists in order to uncover and report incidences of scientific misconduct and, better yet, prevent them from happening, particularly by partnering with deans and chairs.

SCIENTIFIC SELF-REGULATION IN THE LITERATURE

In recent years, John Braxton (1989, p. 423) hypothesized that "the greater the institutional administrative emphasis on research and scholarship, the greater the conformity to the norms of science." An "institutional" emphasis is a broad category and would perhaps involve factors such as resources, time, effort, and administrators. Braxton found that the institutional emphasis on research exhibited little or no influence on faculty conformity to the norms of science. According to Braxton, a combination of peer review and emphasis on publication is associated with a slight increase in faculty treating each other as peers. On the other hand, he found that combining rigorous scientific methodology with prohibiting science for fame causes faculty to fragment to some extent. This could be because the level of rigor on methodology is sometimes difficult to agree upon.

Support for the institutional role in science is also seen in the work of Edward J. Hackett (1990, p. 245), who contended that market and institutional forces are at play: "the culture of academic science is a blend of the cultures of science and academe, and the resulting cultural mix is further shaped through interaction with and accommodation to its clients, competitors and patrons." Hackett (*Ibid.*) further contends that the role of formal organization in science is governed by two perspectives: (1) resource dependence, and (2) new institutionalism or institutional theory. Resource dependence involves the exchange of goods and services such as grant mechanisms and contracts. Institutional theory emphasizes organizational behavior in response to a bombardment of transforming forces in society such as government, agencies, and elites. Cultural change occurs within these two contexts in both the public and private sectors. Because science depends on external funding for its survival, institutions and science exhibit some level of becoming more like the federal and state administrative structure. Research administration as a field evolved and changed along with "science" and with the influx of funding for science (Atkinson, 2002), so an unavoidable bond exists between the two fields. Self-regulation of science, therefore, involves a necessary partnership between the field of research administration and the scientists before realizing cultural and environmental modification.

CURRENT PRAGMATIC SOLUTIONS

John Wodarski (1991), a professional research administrator, focused his work on generating a "positive" research culture driven by strong institutional support. Wodarski implemented the following support mechanisms on his campus: (1) a catalogue of resources for identifying funding sources, (2) proposal critiques, (3) grant writing seminars, (4) small grants program, (5) redirecting indirect costs back to the investigator, (6) redirecting indirect costs into travel, and (7) set-aside funds for costs of publication and computer time. The strength of Wodarski's methods of directing funds into grant writing and proposal critiques and supporting research infrastructure assist faculty compliance with Merton's four norms of science. During the study period, Wodarski's campus experienced: (1) a 55% increase in external funds, (2) a 79% increase in funded programs, (3) an 82% increase in proposal dollar value, and (4) an overall 68% increase in proposal submissions. This is exemplary of research administration supporting and binding the science-administration partnership. Empirical data, however, are scarce concerning the effects of an increase in institutional support on faculty adherence to norms of science and the expected decrease in scientific misconduct. This article presents an excellent platform from which the research administrator can operate in helping to monitor the normative controls of science. Understanding how institutional support of this nature affects faculty self-regulation of science first involves an understanding of the underlying environmental factors involved in deviation from the prescribed norms.

THE MENTOR-TRAINEE FACTOR

Reybold (2001, p. 41), in studying graduate/mentor student culture, discussed "the role of academic culture [as a whole] in determining a personal model of ethical research in the practice of the professoriate." Some of Reybold's conclusions were: (1) There is a slim body of coursework in research ethics along with an expectation that students would glean ethical research practice from the professors; (2) disregard for compliance with institutional review board standards; (3) lack of a definition of ethical research; (4) concern about power issues in ethical decision making, where students witness "unethical" behavior but are in a poor position to do anything about it; and (5) that since institutions intensify their focus on rewarding research productivity, researchers become ambivalent toward ethical conduct. Reybold's article does not note the role of the research administrator in offering guidance, support, and training to graduate students in the regulations. That was not the purpose of the article. Again, this could be because the perception among many faculty is that the administration haphazardly hinders research rather than promotes it. Also, Reybold's article does not discuss many specific steps the professoriate should take to involve the administration.

CONCLUSION

It might seem obvious to note at this point that many opportunities exist to explore the role of the research administrator in scientific self-regulation. First, it is suggested that the normative structure of research administration in the scientific context should be better defined. Second, the role of the research administrator in science should be explored more empirically. Third, research administrators' attitudes and beliefs about scientific misconduct should be thoroughly assessed not only within the larger research university context but within some of the governmental structures as well. Fourth, attitudes and beliefs of executive administration toward research should be assessed in order to determine barriers to funding institutional infrastructure in order to initiate environmental changes. Fifth, but not finally, the normative structure of technology

transfer should be assessed to determine how this enterprise resists or facilitates adherence to Merton's norm of disinterestedness, which prohibits scientists from doing research to seek fame and fortune alone. Diagnosis and management of the scientific misconduct event is one thing, but prevention and culture building requires an altogether different set of skills. Hopefully, this small primer is a helpful step in the right direction toward meeting the goals of the latter.

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CONTRADICTIONS IN IRISH ACADEMIC RESEARCH

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ABSTRACT

The conditions that govern academic research vary greatly from country to country and research in the Republic of Ireland was and remains markedly different from that of its larger European neighbours and the United States. Despite the quality of its education system and the excellent reputation of its universities, until recently Ireland had relatively low levels of academic research. Pinnacles of excellence could be found in certain disciplines, but state funding was low and issues relating to industrial collaborations, international partnerships, commercialisation, and the exploitation of Intellectual Property (IP) rarely arose. Even today the Irish Government's spending on academic research, though only slightly less than the European average based on GNP, is dwarfed by the Research and Development (R&D) budgets of individual multinational companies. Nonetheless, rapid economic growth has led to a heightened awareness of the need for strategically planned research. The 'Lisbon Objective' proposes to make Europe "the most dynamic knowledge-driven economy in the world by 2010." Consequently, research is heavily influenced by this policy and so a range of unfamiliar problems are posed for managers of Irish academic research. Key to successful operational planning and growth is the need to reconcile a number of contradictions at the heart of R&D in Third Level Institutes.[1]

RECENT TRENDS IN IRISH ACADEMIC RESEARCH

There are seven universities and fourteen Institutes of Technology (IOTs) in the Republic of Ireland, serving a population of approximately four million. These statistics give only a superficial impression of a complex structure that has evolved over centuries. Four of the universities—University College Dublin, University College Cork, Galway and Maynooth—are in a federation under the heading 'National University of Ireland' (NUI), while the University of Dublin (Trinity College), Dublin City University, and the University of Limerick are autonomous bodies. Thirteen of the IOTs were formed from Regional Technical Colleges (RTCs) in the recent

past, while the Dublin Institute of Technology (DIT) was formally established in 1992 by amalgamating six technology colleges in the city. DIT is the largest Third Level Institute in the state with approximately 21,000 students, awards its own qualifications up to the Ph.D. level, and has a student intake that ranges from craft studies to postdoctoral research. A report in 1998[2] raised the prospect of DIT becoming a university, but this aspiration has been dampened by recommendations in a recent OECD publication.[3]

The Department of Education and Science (DES) is responsible for funding research initiatives for the IOTs, working through the Council of Directors of Institutes of Technology. The Council is jointly funded by the DES and the Institutes and enables directors to coordinate the work of the Institutes nationally and provides the resources needed for the respective management teams to discharge their duties towards their own institutions. Responsibility for funding in the universities is delegated by the DES to the Higher Education Authority (HEA). The universities are represented by the Council of Heads of Irish Universities (CHIU), which promotes the development of university education and research by formulating and pursuing collective policies and programmes.

Unsurprisingly, the level of research in the IOTs, currently at about 6% of the total budget for all higher education providers in Ireland, has been and still is low. However, an increasing awareness of the need for industry-related applied R&D is bringing about a change of ethos throughout the sector. DIT, though independent of the Council of Directors and CHIU, has enjoyed close working relations with industry throughout its existence. Consequently, until the late 1990s there were pockets of research, often of high quality, but not embedded in the culture of the Institute, nor was the research strategically or operationally planned.

In part, the contradictions in Irish academic research are universal and in part have evolved with the changing needs of industry, the economy, and the community, and are summarised below.

1. The paradox confronting the major funding bodies, which largely consist of industrial development agencies, is that they have both a responsibility for generating and commercialising indigenous IP while attempting to maintain the levels of research output and quality. This paradox is partially resolved by the establishment of two research councils—the Irish Research Council for Science, Engineering and Technology (IRCSET)[4] and the Irish Council for Humanities and Social Sciences (IRCHSS)[5]—whose purpose is to promote fundamental research. However, the budget of each organization is only a small part of the total Government Expenditure on Research and Development (GERD).

2. There is a disparity between the missions and policies of the universities and IOTs and the needs of the sectors of industry and commerce that are driving the 'knowledge-based economy.' The universities and IOTs have missions to support regional development. They also have an implied obligation to staff to allow them to retain currency in their disciplines via research and scholarship. A recent government report[6] has highlighted the disparity between industrial research requirements and the nature of research in Third Level Institutes. This disparity is in part irreconcilable due to academia's responsibility to staff and students.

3. A mismatch exists between the provision of research available in the universities and IOTs and the priorities of the major external funding bodies.

4. Inevitably, there is conflict between the aspirations of individual researchers and the strategies of Third Level Institutes and the goals and targets that emanate from them.

This text examines the issues raised and their impact on the research community and considers policies and actions for addressing the problems posed.

THE NATURE AND SCOPE OF THE MAJOR FUNDING BODIES

Ireland has achieved unprecedented economic growth in the last decade. A dramatic change has resulted from the benefits of European Union (EU) membership, strong ties with the U.S. economy, and high standards in education and government policy. The National Development Plan (NDP) 2000–2006[7] outlined a commitment to scientific research, technological development, and innovation. As a consequence, two research funding initiatives were established.

The largest of these was Science Foundation Ireland (SFI),[8] which was founded to support research in two disciplines aligned to research strength and long-term commercial potential. SFI is the state's largest funder of research with an initial fund of €646 million devoted to Biotechnology and Information and Communications Technology (ICT). Recently SFI has assumed responsibility for the Basic Research Grant Scheme and its derivative—the Research Frontiers Programme[9]—which provides project funding for broad-based basic research activity, though success rates are significantly below international norms. The requirement for R&D is succinctly described in SFI's 'vision':[10]

> Effective research and development require a combination of resources and talents to drive ideas forward rapidly. SFI will, within its strategic remit, seek out and support effective collaborations and partnerships with agencies, institutions and industry in Ireland and around the world that can best advance Ireland's research, technological and economic competitiveness.

The argument made is irrefutable, yet the narrow concentration of funding precludes many energetic and talented academics from a major source of R&D funds.

Along with this initiative, a Programme for Research in Third Level Institutes (PRTLI)[11] was established that provided €605 million in investment for research infrastructure. The initiative was funded at a similar level to SFI though part of the budget was realised from a private foundation.

Enterprise Ireland (EI),[12] an industrial development agency, previously supported academic research but now is increasingly focusing on industrially relevant research, though its Commercialisation Fund is open to academics to prove commercial concepts and develop products and services.

The European Union (EU) Framework initiatives[13] provide the opportunity to participate in large international projects in a wide range of disciplines with multiple European partners. The current framework (VI) makes significant funds available for integrated projects and networks of

excellence, whilst Framework VII is in the planning phase. The integrated projects are objective-driven multidisciplinary research topics that must have three or more international partners. Networks of excellence are intended to strengthen scientific and technological excellence in a particular research topic on a European scale, have at least six participants, and are thus designed specifically to overcome the fragmentation of European research. The large administrative role associated with managing an EU project is a disincentive to many applicants, while the rewards in being a minor participant are often seen as not worth the effort of engaging in the process. EU schemes would benefit from addressing these issues. Also, many proposals are ill defined at the writing stage due to a lack of clarity in the roles of individual partners and the planned interaction among them. Nonetheless, the EU frameworks offer a unique opportunity for Irish institutes to engage in high-calibre international research that they can ill-afford to squander.

The Irish Research Councils for Science and Technology and Humanities and Social Sciences (IRCSET and IRCHSS, respectively) offer competitive funding for a range of Third Level schemes, including postdoctoral and postgraduate fellowships and travel programmes. IRCHSS is the only significant provider of funding in the humanities and social sciences. The Technological Sector Research (TSR)[14] programme is in its fourth year and has three strands. The strands are not open to proposals from the universities. Strand I provides two-year stipends for postgraduate students in any discipline; Strand II is an enterprise development programme; and Strand III makes individual awards of up to €300,000 to projects designed to build core research strengths. New starts under the TSR scheme have decreased in the last two years.

Overall, some funding agencies have broad remits but negligible funds while the larger funders are narrowly focused either in commercial research or the two disciplines prioritised by government. The universities, with a tradition of research, more research-active staff, and well-established research management structures, are advantaged in the process of obtaining and exploiting research funds. However, in a knowledge-driven economy, DIT and the other IOTs are obligated to build and sustain high-quality research. The TSR schemes were envisaged to address this issue, but funding is precarious and historical inequalities endure. Research funding may not remain a political priority when the competing demands of other sectors of the education system resonate with the electorate, but government would be wise not to jeopardise economic growth by cutting back research.

Inadequate allocation of overheads seriously undermines Irish academia's ability to build sustainable research. At present there is no common policy on research overheads among the major funding bodies; some award no overhead, while others do. Likewise, some universities set a standard rate of overhead for research and consultancy but others do not. There is general agreement that ultimately only a full cost recovery (FCR) model will allow academic research to flourish, but Ireland is lagging behind the U.S. and major European research providers in planning its introduction.

ACADEMIC RESEARCH AND THE KNOWLEDGE-BASED ECONOMY

Though funding for research in Ireland has been at an unprecedented level in recent years, concern exists over the disparity in the amount of funding available for Biotech and ICT when compared with other disciplines. In particular, this view has been expressed by the Irish Research Scientists Association (IRSA).[15]

The necessary change in direction for Irish R&D has been set out in a number of reports. Downey[16] in particular articulates this change:

> With Ireland's traditional competitive advantages being rapidly eroded, a shift must be made from an economy characterised by foreign investment and importation of technology to a situation where research and innovation become important drivers of sustained international competitiveness.
>
> Development of the indigenous research capabilities required to enhance knowledge production, improve the quality and relevance of Irish graduates and translate new scientific and technological advances into marketable goods and services is a prerequisite to creating new competitive advantages.

Yet Third Level Institutes face problems associated with the limited funding base. Ideally, institutes should foster broad-based research that engages the majority of academic staff and consequently positively impacts teaching and learning. Additionally, the range of disciplines taught in the institutes and particularly in DIT requires that all aspects of scholarship are afforded equality with research; hence, music, fine art, architecture, etc., must offer parity of esteem and opportunity to all academics. Despite this obligation, external funding opportunities are concentrated in too narrow a set of disciplines focusing almost exclusively on commercially based research.

At DIT, research and scholarship seek to enrich Irish society and Ireland's intellectual capital. Staff and students are encouraged and expected to engage in knowledge generation and knowledge dissemination. Research and other scholarship are indispensable to Irish innovation across a broad spectrum of activities, including the development of consultancy and entrepreneurial activities. The Institute's Strategic Plan[17] sets out seven themes that are encapsulated in its Mission Statement. Three of these themes call for DIT to:

1. Have strong postgraduate and research arms.
2. Be closely allied and responsive to industry.
3. Be an entrepreneurial institution.

The plan thus recognises the inextricable link between industry and research, requiring a transformation of university-industry-government relations.[18] Accordingly, the Institute's Research and Scholarship Strategy, Industry Strategy, and Strategy for Teaching and Learning are compatible and the research ethos reflects close ties with and responsiveness to industry.

A recent report commissioned for SFI[19] indicates the difficulties in supporting industry. It points out that "expectations are high among government officials for stimulation of knowledge-driven economic and regional development from investments in basic research" and "universities and other third level institutions produce knowledge capital that can be used to encourage economic growth, benefit society and reinvest in academic knowledge production" (McFarlane and Granowitz, n.d., n.p.). However, the report's authors found a shortfall in fundamental resources for technology transfer in Third Level Institutes and state that investment is required to establish a robust technology transfer process. They further state that "the size and proximity of Irish third level institutions, their limited resources and the significant investment

that successful technology transfer requires are all factors that indicate that the institutes should network and pool their resources" (*Ibid.*).

The findings of the report indicate that if research in higher education institutes is to meet the needs of industry, more inter-institutional collaboration is required. Also, research carried out jointly with industry, where company employees are enrolled on part-time research programmes, will mitigate a lack of resources within the institutes and strengthen higher education's reputation with employers.

RELATING INSTITUTIONAL AND FUNDING BODY PRIORITIES

The academic strengths of Third Level Institutes must be harnessed to optimise research under the various initiatives. To do so, a range of institutional weaknesses must be addressed. Often the quality of proposal writing is low and rigorous internal evaluation of external funding applications is essential to safeguard the reputation of the host institute, evaluate impact on 'teaching and learning,' and ensure compliance with strategic planning. Periodic external reviews of research are a prerequisite for maintaining quality and relevance, yet Ireland does not have the same tradition of external research assessment that is found elsewhere in Europe. Similarly, personal development policies and career structures for researchers are less in evidence in Ireland. To redress existing deficiencies, buying-in of principal investigators of international standing may be necessary to build and maintain research in strategically important disciplines. It is also increasingly recognised that to provide higher education for any subject group, a range of complementary skills is required.[20,21] Each department within an institute will need to create the appropriate balance between 'teaching and learning,' research and scholarship that is essential for delivery of its programmes in a research-informed environment. The process must encompass the needs and academic specialisations of staff, the interests of students and the community, the quality of courses, and the rate of change of technology.

In the past, recruitment policies have not always been aligned with the requirements of a research-informed academic environment and must in the future have a central role in creating a match between staff skills and an institute's research and scholarship needs. Building competence in research and other scholarly activity poses a considerable challenge for Third Level education as is evidenced by a recent Forfás study.[22] The report from this study drew attention to the problems of encouraging, recruiting, and rewarding high-quality research staff:

> …there is a lack of career structure for professional researchers in academia that will make it hard for research groups to attract the best international applicants. There are few incentives for researchers to stay active in Ireland. Correcting this will become increasingly important if Ireland is to significantly increase its research capabilities by recruiting strong international researchers (Forfás, 2002, p. ii).

Self-fulfilment is an important motivation for participating in research, so not all academics will choose to engage in it. Those who do will have differing levels of commitment depending on personal choice, teaching, and administration loads and involvement in other forms of scholarship.

Harmonising departmental strategy and targets with those of an institute cannot be achieved by adopting a 'one size fits all' philosophy. The diversity of Ireland's Third Level provision should

be viewed as a unique asset and metrics should reflect this diversity. Though applied research and consultancy play an important role in driving a knowledge-based economy, the contribution made by pure or basic research should not be undervalued. As anywhere else, basic research provides industry with much needed, highly motivated graduates possessing research and problem-solving skills. However, Ireland is too small a state to disperse its research effort and funds widely and there are too many Third Level Institutes to allow duplication in research activity. Since there is no virtue in doing poor quality, unoriginal research, inter-institutional and international strategic alliances are essential. Hence, research activity will not be required from every lecturer in higher education, yet a system that gives parity of esteem and opportunity to all academics must be created. The system must carry the expectation that all teachers will be engaged in some form of scholarship. This will require a comprehensive overhaul of structures and conditions in Third Level Institutes and strategic planning in alignment with national, regional, and institutional needs.

As a consequence, Third Level providers should demand and play a greater part in influencing government policy on research. Difficult decisions with respect to prioritisation are called for; increasingly multidisciplinary research clusters will develop critical mass leading to pinnacles of excellence that operate across and blur traditional school and department boundaries. In this environment, though all teachers will be supported to engage in research and scholarship, only those with a proven track record and new appointments who exhibit potential to carry out cutting-edge research will be encouraged to acquire external competitive funding. Research disciplines that are not of great strategic importance to the state (e.g., materials science, an area in which Ireland does not have indigenous industries) should only be funded as part of international collaborations to which Irish researchers can make a real contribution.

Even so, government policy should be less narrowly focused on biotechnology and ICT. The key research initiatives that will fuel the next generation and long-term interests of Irish manufacturing industry and the economy should be determined and planned for.

Increased funding should be made available to allow Third Level Institutes to increase industry interaction, but the lack of a policy framework such as the Bayh-Dole Act in the United States will mean that conflicting views on translation of discoveries to commerce are not reconciled. Institute procedures for industry interaction must be less discouraging for academics and limited resources for innovation posts and technology transfer must be increased.

Timely reporting of discoveries from principal investigators is needed and the responsibility for reporting should lie with each institute, while funding agencies should assume ownership of the IP not exploited by institutions.

CONCLUSION

- The future of Irish academic research will depend on building multidisciplinary clusters of top researchers, working in high-quality facilities in niche disciplines.

- All research in Third Level Institutes must be subject to rigorous external periodic review. Recruitment policies must meet the needs of research-informed higher education that serves the knowledge-driven economy. Procedures, contracts, and career structures will need to change to create the required balance among teaching and learning, and research and industry interaction.

- International collaborations will be increasingly important, particularly in disciplines unrelated to Irish core industries. Every academic will not undertake research, but scholarship should be required from every academic.
- All higher education institutes will ultimately have to adopt a full cost recovery model for overhead if academic research is to be viable and sustainable.

- The government focus on research should be widened and an early start in identifying the next generation of research 'hot topics' should be made. A policy framework for research and industry interaction must be instigated, while greater funding of innovation and technology transfer is urgently required.

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Timothy N. Atkinson is a native of middle Tennessee and has been a member of NCURA since 1994. He is currently Director of Research and Sponsored Programs at the University of Arkansas for Medical Sciences with a FY04 grant portfolio exceeding $90 million and an IRB review load of approximately 1,500 active protocols. He is working on his Doctorate in Higher Education Administration (Ed.D.) at the University of Arkansas, Little Rock. He graduated from Tennessee Tech University with a B.S. in Biology in 1989 and started his career in the university research arena as a Research Assistant at Vanderbilt University where he sequenced long strands of DNA, purified proteins, and ran countless electrophoresis gels. He found his true niche in research administration in 1994 when he went to work at Meharry Medical College and learned how to review grants and coordinate the IRB under the direction of Peter J. Dolce, Ph.D. After leaving Meharry in 1996, he spent one year as a Research Administrator at Mississippi State University and traveled back and forth to Nashville on the weekends to complete his Master's in Higher Education Administration (M.Ed.) at Peabody at Vanderbilt University in 1997. In the same year, he moved his career to Arkansas.

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