Section III:

Redefining the Academy for the Public Good

Chapter 12

Ethical Conflicts and Public Responsibilities:

Commercialization in the Academy

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Abstract: The purpose of this study was to investigate ways that university technology commercialization may create ethical conflicts with social contract for science responsibilities. An analysis of 125 university licensing contracts with industry revealed substantial evidence of ethical conflicts undermining higher education's public good commitments and the norms of academic science.

In November of 1944, President Roosevelt wrote to his Director of Scientific Research and Development, Vannevar Bush, requesting his counsel on how peace-time science might be fostered in ways that mirrored the success of the industrial-scientific-government partnership of the war years. In his letter, Roosevelt (1944) wrote:

> There is…no reason why the lessons to be found in this experiment cannot be profitably employed in times of peace. The information, the techniques, and the research experience developed by the Office of Scientific Research and Development and by the thousands of scientists in the universities and in private industry, should be used in the days of peace ahead for the improvement of the national health, the creation of new enterprises bringing new jobs, and the betterment of the national standard of living.…New frontiers of the mind are before us, and if they are pioneered with

> the same vision, boldness, and drive with which we have waged this war we can create a fuller and more fruitful employment and a fuller and more fruitful life (p. 1).

More than a half century after Bush submitted his now famous reply, *Science: The Endless Frontier*, the American scientific enterprise continues to be one that emphasizes a triple-helix like partnership between government, universities, and industry (Etzkowitz & Leydesdorff, 1997) for the discovery and dissemination of knowledge for the public good. The social contract for science that has been in place for 60 years is sourced in the belief that higher education can be entrusted to engage in programs of basic inquiry unfettered by the entrapments of the marketplace. Furthermore, the social contract as manifested for institutions and their faculty rests on the foundational values of free and open access to information and research findings, the pursuit of truth wherever it may lead, and the unimpeded and transparent dissemination of these results (Merton, 1942).

Many important advances have emerged from the social contract. Federal research investment in universities have led to breakthroughs in radar, semiconductors, highway safety, crop production, and a myriad of human health advances, to name but a few. These important innovations occurred through incremental and paradigm shifting discoveries, aided by researcher access to data, replication/critique of findings, and a culture of altruism versus self-interest (Argyres & Liebeskind, 1998). In recent years, however, the forces of academic commercialization appear to be eroding the academic norms that undergird the social contract. Specifically, the free, open, and unfettered pursuit of truth and its dissemination is increasingly substituted by counter norms of secrecy, restrictions on the dissemination of new knowledge, and other self-interested behaviors (Anderson & Louis, 1994).

The roots of this change can be found in a variety of sources that took shape about 25 years ago. In 1980, out of concern that the United States was losing its economic competitiveness in the world, the federal government sought to incentivize institutional behavior by making it advantageous for higher education to privatize their most valued asset: the intellectual capital of the faculty. Specifically, universities could, for the first time, easily own the rights to technological innovations emerging from federally funded research. Having patents, federal policy makers felt, would stimulate industry to license more academic technologies, a key cog on the way to becoming a commercialized product for consumer consumption. This belief was borne out, given the enormous growth in academic patenting and industry licensing of academic-sourced technologies since 1980.

Prior to 1980, however, most academics and universities resisted efforts at privatizing knowledge ever since the first academic patent was obtained in 1917 by Frederick Cottrell, the University of California, Berkeley inventor of the breakthrough

smokestack anti-pollution device, the electrostatic precipitator. The view was that commoditizing academic research in a way that limited access undermined higher education's social responsibilities, especially in the arena of medical science, a field central to advancing public health. Cottrell himself even warned against direct university involvement in patenting and licensing, believing that:

> A danger was involved, especially should the experiment prove highly profitable to the university and lead to a general emulation of the plan. University trustees are continually seeking for funds and in direct proportion to the success of our experiment its repetition might be expected elsewhere…the danger this suggested was the possibility of growing commercialism and competition between institutions and an accompanying tendency for secrecy in scientific work (Cottrell, 1932, p. 222).

Unfortunately, the combined influence of the changed policy environment described above, the rise of highly lucrative opportunities in the new field of biotechnology, and resource contraction from traditional sources (such as through state subsidies of public higher education) overcame this resistance. Today, many universities and their faculty are becoming deeply involved in commercialization. All are hoping to realize a blockbuster financial success story, such as Gatorade (the University of Florida—$100 million in royalty revenues to date), Google (Stanford University—$694 million in stock), or Taxol (a cancer-fighting compound from Florida State University—$350 million in royalty revenues to date).

A growing range of scholarly work has been documenting the ways in which privatizing the intellectual commons (Argyres & Liebeskind, 1998) has been manifested and undermines the social contract (e.g., Bok, 2003; Slaughter & Rhoades, 2004). A subset of this work has focused on the ethical conflicts that academic commercialization can engender, such as data withholding, industry influence on faculty research, and financial conflicts of interest. Yet, what has been learned about these conflicts has largely emerged from self-report studies, analyses of institutional policy documents, or corporate linkage disclosures in leading academic journals. Although these kinds of studies have made a valuable contribution to knowledge, the nature of the topic makes it possible that controversial practices are underreported and/or suggests that what is stated in conflict of interest policy materials or disclosures may not align with actual practice. What is missing is research evidence on what universities and faculty actually do rather than what they say they do or feel on various ethical conflict issues.

The purpose of this study is to investigate ways in which universities may engage in practices that represent ethical conflicts with their public social contract for science responsibilities. Unlike previous research, this study was the first of

its kind to investigate on a national level what universities and faculty inventors actually do rather than what they say they do or what appears in policy statements. This was accomplished via a content analysis of contractual documents mined from Securities and Exchange Commission (SEC) materials of firms with linkages to universities. The analysis focused on four technology licensing practices with ethical implications affecting the social contract for science: transparency on licensing deal financials (i.e., full disclosure of financial terms), the awarding of exclusive licenses to single firms for technology development, university and faculty stock accepted in licensee companies, and the ceding of publication oversight rights to licensee companies. These investigations of interest led to the following research question: What licensing practices with social contract implications are manifested in contractual documents between universities and for-profit firms?

Conceptual Framework

Slaughter and Leslie (1997) argue that the forces of commercialization in higher education—or what they label academic capitalism—have been driven by changes in national policies guiding academic research and declines in state support for higher education. The combined effect of these forces, they suggest, has been to incite universities to become more entrepreneurial in an effort to generate sufficient revenues to support its labor and increasingly capital-intensive enterprise. One outcome of this movement toward entrepreneurialism has been the erosion of the traditional culture of academic science that undergirds the social contract.

Merton (1942) codified the ethos of the pre-entrepreneurial era with his description of four fundamental norms associated with the conduct of academic research. The first of these, *universalism*, captured the importance of recognizing that science should be evaluated on its merits and not on subjective criteria such as the reputation or social standing of the researcher. The blind review process of publication is perhaps the most apparent manifestation of this value set. The second norm, *communality*, articulated as a value that no person "owns" knowledge; it is shared openly and freely with all. Thus, an academic scientist should be willing to freely share her/his data and discoveries with others, all in the name of advancing knowledge. The third norm was *disinterestedness*. The intent of this value was that a researcher should conduct their work separate from personal motives. In other words, the academic scientist should selflessly pursue truth wherever it may lead in the name of advancing science and not as a means of personal gain. The last norm, *organized skepticism*, captured the importance of public and open critique of research findings, allowing others to attempt to replicate results and/or to build on the ideas. The most readily apparent manifestation of this norm is the process of presenting papers at academic conferences where others can openly question and

explore the merits, opportunities, and implications of new research findings.

While these four norms continue to be present in various forms today, others have suggested that there are new counter value sets in academic entrepreneurial science. Mitroff's (1974) study of the Apollo moon project offered a language to describe these "counter-norms." In contrast to universalism, for instance, he argued that the forces of *particularism* were also at work. Particularism, he suggested, led some to judge the quality of scientific work not on its own merits, but in part on the reputation of the individual or group presenting it. The fact that researchers with a known reputation tend to have enhanced chances at landing a major federal grant, for instance, is one high-profile example of particularism. A second counter-norm that Mitroff articulated was *solitariness*. In contrast with the belief that ideas and knowledge are universally shared and "owned" by all, solitariness suggested that scientists sometimes do seek to protect their findings jealously and not share their source data in order to safeguard a research stream and future credit. *Self-interestedness*, a third counter norm, this time in direct conflict with its traditional norm, disinterestedness, values the pursuit of new knowledge not for its own sake but to personally gain from such efforts in whatever form that might come—personal accolades, financial, and the like. Thus, particular streams of research might be pursued because it is perceived by the field to be more important, cutting edge, have potential financial gain opportunities, and/or lead to certain valued benefits like access to resources to built a larger and more complex lab. The final counter-norm, *organized dogmatism*, involves academic scientists promoting their own findings, theories, and innovations over those of others, and not for sound research-related reasons. Hence, this counter norm affirms that a researcher's key ally becomes their press agent who spins out regular releases to the popular press in the hopes of landing a feature story on their work and/or criticisms of their "competitors."

A growing body of literature has studied these forces and noted how they are manifested for academic faculty and their institutions in terms of a growing tolerance or ambivalence about conflicts of interest (Anderson & Louis, 1994; Slaughter, Campbell, Holleman, & Morgan, 2002). Campbell (1997) offers some useful examples such as faculty or institutional stock ownership in licensee companies, the powerful influence of corporate sponsors of research, faculty serving in company management posts while simultaneously serving as a researcher, and faculty and institutions placing profiting on intellectual property over the pursuit of research free of financial motives. Others have documented that some faculty are willing to accept company-imposed publication restrictions or delays, often so that patent protections for which they and an industry sponsor might ultimately benefit can be filed (Blumenthal et al., 1997). This practice has extended to pre-publication review or ghost writing by the contracting firm, especially for studies involving drug trials (Angell & Relman, 2002). Faculty also sometimes withhold data from

colleagues, primarily to preserve their scientific "lead" (Louis, Jones, & Campbell, 2002) or to increase the chance of obtaining needed resources to advance their research (Kenny, 1986). Furthermore, it is common for faculty to have consulting arrangements, board positions, or an equity stake in a company that licensed their technology (Boyd & Bero, 2000). Other researchers have reported growing scientific misconduct (Swazey, Louis, & Anderson, 1994), calling into question the legitimacy of published findings and in some cases, even serious breaches in human subject protections. In summary, the body of work on the growing adoption of the counter-norms for academic science would suggest that the conflict of interest issues that they can engender would also be evident in the contractual documents that universities make with licensee firms.

Methodology

Data for this study were drawn from an analysis of public company documents that must be disclosed as part of the normal course of a public, or soon to be public, firm's activities. The documents include initial public offering prospectuses (detailed company information required to inform potential investors), annual company reports, and of other support filings, all of which are available on-line through the SEC. Although there is no uniform approach or method by which companies describe their licensing activities, risk information that is reflected in a licensing deal (e.g., company dependency on another firm or university for an important technology) generally requires that they at least report the existence of a particular licensing deal, the parties and contract dates involved, the type of license (exclusive vs. non-exclusive), and basic terms (e.g., financial arrangements, length of term, etc.). Furthermore, a full licensing contract is often attached as an exhibit/appendix.

Procedures and Sample

A three-step process was used to mine SEC reported licensing-deal information for major U.S. universities. First, the names of all 151 Carnegie Doctoral Extensive universities were extracted from the 2000 Carnegie Classification database, since the vast majority of academic commercialization occurs within this classification of institution. Second, a specialized search engine, 10kWizard.com, was used to extract the data of interest. This search engine specializes in mining useful information embedded in SEC documents via the use of Boolean search terms and the extraction of blocks of text. Furthermore, there is a section of the search engine that targets SEC filing exhibits (i.e., attachments or appendices to primary documents). In previous tests of the 10kWizard search engine, it was clear that

filing exhibits are the most likely place to find detailed information on university-industry licensing deals, often including the actual licensing contract (Powers, 2003). Experimentation with the Boolean search capabilities revealed that searching these exhibits with the word "license" within ten words of a university name was a very effective way of selecting out university licensing contract information from other types of exhibits.

The second step of the procedure revealed 125 separate agreements between 52 universities and 83 companies between January 2000 and October 2005, the final sample used in this study. The universities and companies were geographically spread across the United States. The five-year timeframe was chosen to ensure that the sample included the most current licensing practices and was large enough to provide generalizable findings.

In step three, the data of interest was extracted from these 125 licensing deals. Information on the company involved, the nature of the filing, the date of the license, the industry code, the license type (exclusive vs. non exclusive), the inventor name, financial information (i.e., royalty and stock amounts), and publication restriction terms, if any, were downloaded into a separate spreadsheet for descriptive analysis (e.g., number and percentage of license types, days of allowable publication restriction, etc.). Blocks of textual language around the issues of interest were then downloaded in their entirety into a separate file for analysis and used to identify themes/concepts that emerged related to issues of ethical conflicts.

Data analysis

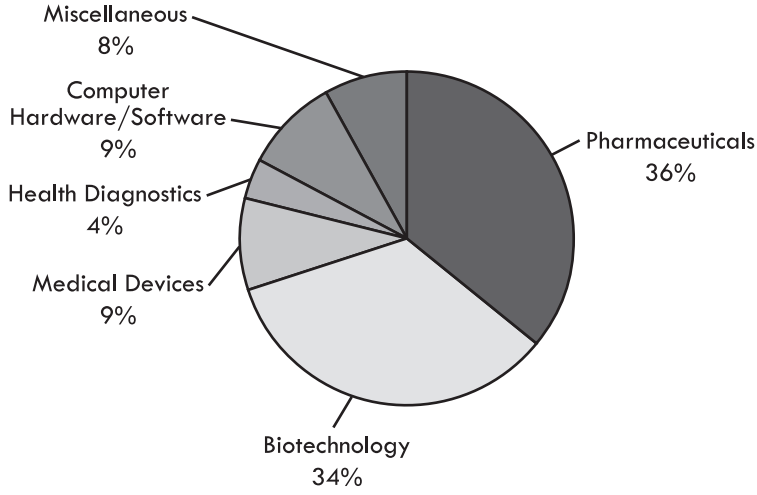
Following the data extraction, two forms of content analysis methodology were employed. Classical content analysis (Carney, 1972) was used to conduct numeric and word counts as well as frequency of theme or phrase occurrences. Theoretical content analysis (Marino, Castaldi, & Dollinger, 1989) was utilized to classify themes into categories. Thus, for instance, the number of licenses that were exclusive versus non-exclusive in nature, the number of licensing deals that involved stock equity to a university and/or the faculty inventor(s), and the number of times that financial information on stock ownership or royalty percentages was masked were investigated. Furthermore, language around the issues of interest, including on the topic of publication restrictions, were analyzed and grouped.

Results

As mentioned previously, 125 licensing contracts between a university and a for-profit firm were identified from SEC documents between January 2000 and October 2005. Fifty-two universities were represented in the sample, some with

only one licensing deal represented and others with more, the highest being 20. The median number of licensing deals per university was two, while the modal number of licensing deals per university was one (23 of 52). On the firm side, 83 companies were represented. The range of licensing deals with a university was between one and four, with a median and modal number of deals per firm of one (53 of 83), with a mean of 1.5 deals per firm. Figure 1 shows the breakdown of the nature of these licenses by industry of the licensee firm.

Figure 1. University Licensed Technologies by Industry Type



Approximately 1/3 of the licensed technologies were to the pharmaceutical industry, typically in the form of new chemical compounds that show medicinal promise for the treatment or prevention of disease. Another 1/3 were licensed to the biotechnology industry, broadly defined to capture new biologic products, living substances, and biological research with potential promise for improving health and health care. Medical devices, typically surgical or orthopedic devices/apparatuses, represented 9% of the total technologies, while health diagnostics, generally new instruments useful for the diagnosis of disease and genetic processes, made up 4% of the total. In sum, technologies with some direct connection to the health sciences fields made up over 80% of the licensed technologies in the sample. Given the lopsided financial support afforded to the health sciences in federal research funding, along with the fact that life science related patenting represents at least 40% of all patenting that emerges from higher education (National Science Board, 2004), it is not surprising that most licensed technologies in the sample came from the health science disciplines. The other 17% of technologies in the

sample were in the computer hardware and software arenas (9% of sample) as well as a variety of other miscellaneous fields (8%) such as manufacturing, chemicals, and business services.

As mentioned at the outset of this study, the focus of the research was to use content analysis methodology to investigate four technology licensing practices with potential ethical implications affecting the social contract for science: transparency on the financial terms of licensing deals, the awarding of exclusive licenses to single firms for technology development, the acceptance of university and faculty stock in licensee companies, and the ceding of publication oversight rights to licensee companies. The results of both the classic and theoretical content analyses are described in the sections that follow, each preceded by a brief discussion of the larger ethical context in which it is embedded.

Transparency in Licensing Activities

One of the historic bedrock values of academic science in support of the social contract has been transparency. In other words, researchers are to fully disclose findings as well their source data and methodologies so that others can then engage in replication activities and follow-up analyses. By doing so, good ideas are affirmed, mistakes or non-generalizable findings are revealed, and new extensions/applications are identified. Furthermore, academic researchers are expected to disclose potential conflicts of interest that might call into question the veracity of their findings. For example, the federal government requires principal investigator disclosure of significant financial interests[1] in a company in grant applications when it could affect the design, conduct, or reporting of research activities. Some academic journals require disclosure of company-funded research projects that are reported with the article at the time of publication. Efforts such as these help to affirm the integrity of the system and public confidence that resource investment in academic research is being handled responsibly.

Thus far, however, compliance reporting of potential financial conflicts of interest are self-evaluated and disclosed such that no independent confirmation is required. Furthermore, the requirement extends only to academic researchers and not their affiliate institutions, despite the fact that the latter may also fall prey to conflicts of interest. Hence, an investigation of financial transparency in academic licensing activity is a useful first independent assessment of both faculty and institutional financial involvements with licensee companies.

Of the 125 licensing agreements investigated for this study, 82 masked the royalty terms (66% of the total). In other words, there were clearly financial terms associated with licensing royalty arrangements, but none were disclosed or were simply edited out of the documents. Those that did disclose (N = 43) provided amounts ranging

from 2.5–10% of net sales and often with a set minimum of $5,000–100,000 per year; these figures could easily exceed the federal conflict of interest disclosure threshold of $10,000 per year, even with relatively modest sales or no sales at all. By law, universities must share a percentage of royalties with inventors, most commonly about 1/3 of the total received. Thus, it is clear that royalties are a potential source of financial conflict of interest for both universities and inventors.

In the case of the university or faculty inventor(s) receiving stock, it was clear that one or both received stock in 51 of the licenses. Of those 51 cases involving the transfer of stock, however, only 31 of them disclosed the terms with some degree of comprehensiveness (61%), the rest choosing to mask the arrangements. Of those that did disclose, it was clear that at least 12 of them would exceed the federal conflict of interest disclosure limit of either $10,000 in value or 5% ownership of a company, some many times over.

These combined findings indicate a considerable lack of transparency in university licensing regarding financial terms. On one level, this could be attributed to firms that may naturally wish not to disclose certain terms for business secrecy reasons. The SEC recognizes this fact by giving companies the ability to file a confidential treatment request on certain tightly prescribed financial and related information that could harm the company if it was disclosed in the marketplace. However, there was a critical mass of licensing deals in this sample in which full disclosure was made on royalty and/or stock elements (34% and 61% respectively). This finding suggests that some companies do not see disclosure of royalty and stock financials causing them material harm. By extension, then, it implies that the masking of key financial deal data may sometimes be driven by university desires for confidentiality rather than the firm's. Furthermore, it also suggests that if universities insisted on full financial disclosure in licensing deals, any firm resistance might be reduced or eliminated.

Licensing Exclusivity

Much commentary has been offered regarding the wisdom and efficacy of ceding broad rights to the development of a university-licensed technology to a single firm (e.g., Press & Washburn, 2000). These concerns have been especially acute around the licensing of basic technologies for which no clear application is evident. Some have argued, for example, that the patenting and exclusive licensing of gene sequences and stem cell lines to one company is not in the public interest, since it limits rather than enhances the potential development of broad-based applications in any number of health-oriented areas (Rai & Eisenberg, 2003). Technology transfer practitioners argue, however, that no company would ever risk licensing a basic technology with a very long, expensive, and risky incubation

period without exclusivity protections. Thus, universities and faculty are left in a quandary. Social contract for science obligations would suggest the need to make emergent technologies widely available so that the ideas can both advance science and be transformed into products of societal benefit. Yet, precisely because many of these technologies have unknown applications, companies are at times unwilling to license the technologies without at least some protection against others' easily producing a competitive product. Furthermore, if a university cannot license the technology, no revenues are realized to at least offset patenting costs.

An analysis of the study data revealed that 112 of the 125 licensing deals (90% of the total) were made exclusively with a single firm, and often with rights that extended worldwide. The rest were made either non-exclusively (i.e., other firms could have access to the technology) or, in four of the cases, co-exclusively (i.e., with one other firm). Careful reading of licensing documents, however, revealed that in about 1/2 of the cases in which a technology was licensed exclusively, the term was defined to delineate a particular "field of use," ostensibly to allow the technology to be licensed to another firm for a use not covered by the terms of the license. Yet, the definition used varied widely among the license contracts. For example, in one license deal, field of use was defined as "cancers of the gastro-intestinal track," while in another to "all human and veterinary applications." Clearly, this standard differed between the two licensing deals in terms of breadth of exclusivity. Furthermore, while most universities included language indicating their unimpeded right to conduct their own follow-up research using the technology,[2] relatively few clearly extended that right to academic researchers outside of their affiliate university. As a result, access to others' work—a central building block of academic research—appears in these cases to be possible at best only through complex and time-consuming material transfer agreements, likely with some degree of company oversight.

In many of the licenses, whether exclusive or non-exclusive, it was also clear that universities allowed a firm to do sublicensing (i.e., license the original technology to a third party). In this case, though, most appeared to do so with a higher value placed on its ability to generate more revenues for the university than for the purposes of seeing the technology reach the marketplace as quickly as possible for consumer benefit. This inference was drawn from the nature of university "reach through provision"[3] language that included generally tight prescriptions on the original licensee firm; specifically, these prescriptions pertained to revenue flows from third parties and university rights to royalties on new patents or products based on the original technology and subsequently licensed to or developed by a third party. Some have criticized this practice as impeding the pace of innovation, since it creates potential barriers to access and acts as a disincentive for third parties to sub-license a previously developed technology.

Stock Acceptance Practices

A central conflict of interest issue in university technology licensing involves the controversial practice of universities and faculty accepting stock in a licensee firm. Those that oppose the practice see it undermining disinterested inquiry when a faculty member stands to profit from the application of her/his research, which could potentially undermine the legitimacy of research findings surrounding that technology (Boyd & Bero, 2000). Others argue that accepting equity in lieu of up-front fees from typically cash-starved young firms shows institutional commitment to the partnership and creates mutual incentives for firm success (Bray & Lee, 2000).

As discussed under the transparency topic above, it was evident that 51 of 125 licenses (41% of the licenses) involved some form of stock equity for the university and often for the faculty inventor as well. For those that did disclose the amounts (31 of 51), the number of shares provided was quite varied, ranging from a low of 3,000 shares to a high of 800,000 shares. Furthermore, in at least eight of the cases, the amount of shares given equaled or surpassed a 5% company ownership stake. This proportion surpasses not only the federal government's threshold of a possible conflict of interest, but also a universally accepted norm for a controlling company interest. In addition, a number of the disclosed deals provided healthy stock options for the university and/or the inventor(s) in which either had a window of opportunity to purchase company shares at a pre-determined discounted rate. Evidence of whether or not this option was ever exercised would not be disclosed in these documents, unless those amounts led to an individual or the institution owning more than 5% of the company. However, it is quite common for persons to exercise such an option if they believe the stock to be a good investment.

Considering the fact that almost 1/2 of the licensing deals involved stock, it is clear that universities must view the practice as important and potentially lucrative, despite the risks that stock shares will fall in value or only appreciate over a very long period of time, as is especially true for the biotechnology sector. The concern, of course, is that this form of corporate entanglement may undermine the integrity of the research process. Recent research has shown, for instance, that some high profile breaches of human subjects protections have been attributable in part to the compromised integrity of researchers who had a financial stake in the company for whom the researcher is testing a new therapy (Thompson, 2000).

Firm Oversight of Publication

Previous research indicates that increased partnerships with industry can lead to company encroachment on the publication process (Blumenthal et al., 1997).

Although the extent of company control remains unclear, it is not uncommon for companies to expect a delay in publication to afford them time to consider patent applications prior to a technology being released into the public domain via academic publication (Cho, Shohara, Schissel, & Rennie, 2000). Given that the free exchange of ideas has been a bedrock value of academic science for advancing knowledge, impediments to this process are considered by many to be troubling at best and fundamentally wrong at worst.

The data mined from university licensing contracts revealed that 39 of 125 deals involved restrictions on publication. Restrictions were typically built around allowing a firm time to evaluate if an academic researcher's article/paper breached any confidentiality restriction built into the licensing contract and/or as a means of evaluating a new development from the original technology (i.e., right of first refusal on a new patent or license). Sixteen of the 39 deals allowed for a 30-day publication moratorium, while seven deals were set at 45 days, five at 60 days, and nine at 90 days. Of those contracts with predetermined moratoriums, the average number of delay days was 52, just under two months. Two of the 39 licensing deals also indicated a firm right to publication delay, but the number of days was masked. Within the set of 39 licensing contracts, the range of language and explicitness over the rights of each party varied. For example, some contract language simply stated a number of days of restriction and that all the university needed to do was notify the licensee of an impeding publication that would meet this timetable. Other contracts, however, made clear that the university must "submit for review and comment any impending publications" within a stated timeframe. Others included language that articulated what was allowable in publications, namely those that "were only for noncommercial educational and research purposes," with the implication that the company determined what met this standard. Still other contracts added closing clauses that affirmed final institutional authority on this matter.

It is important to note that 36 other licensing contracts explicitly made it clear that there were to be no restrictions on a faculty member's right to publication, and nearly as many as had noted some kind of allowable company restriction on publication. These universities appeared to have made clear that universities and their faculty researchers retained the full, unimpeded, and uninfluenced right to publish, irrespective of the source of funding or the possible desires of a company around secrecy and technology control.

The remaining 50 licensing deals in the dataset (40% of the entire sample), though, made no mention of restriction on publication. This could imply that companies were not afforded any rights in this regard. However, it could also mean that universities were not adequately proactive in asserting this important right for preserving the integrity of the academic research process. By extension, then, it may be that at least some of the universities involved in these deals are

ceding substantive rights to companies over the nature and pace of university research publication.

Discussion and Recommendations

The purpose of this study was to investigate ways in which universities may engage in practices that represent ethical conflicts with their public responsibilities and which may serve to undermine the social contract for science responsibilities. Using data mined from 125 licensing contracts between universities and firms, the extent and nature of four technology licensing practices with potential ethical implications were investigated. These practices included transparency on the financial terms of licensing deals, the use of exclusive licensing to single firms for technology development, university and faculty acceptance of stock in a licensee company, and publication oversight rights by licensee companies. The results indicated substantive deviation from the norms that have historically undergirded academic science, as evidenced by considerable non-transparency, barriers to access to university patented technologies by both follow-on researchers and non-licensee firms, university and faculty stock equity acceptance practices that may represent conflicts of interest, and a degree of company control of the academic publication process at some institutions. The individual and combined effects of these practices raise concerns for the discovery and dissemination of new knowledge for the public good and the integrity of the academic research process.

In light of these findings, four recommendations are warranted to preserve, if not rebuild, the integrity of academic research in support of the social contract for science. First, universities should consider a refinement of mission and purpose for technology commercialization that eliminates, or largely relegates low on the list, the importance of revenue generation. Few universities even enjoy substantial revenue flows and many have been losing money on their technology transfer programs for years (Campbell, Powers, Blumenthal, & Biles, 2004; Powers, 2005). In an era of high attention to economic development, a de-emphasis on revenues could be achieved by raising in importance the value of industry partnerships rather than technology commercialization per se. Universities have always been an important source of basic innovation for industry and have typically disseminated information through the open and public presentation of research at academic conferences and in scholarly publications. However, universities have also functioned more or less in an ivory tower fashion, such that linkages with business and industry for many faculty and universities are indirect and fleeting. The concern has often been that close ties to industry could influence academia to adopt an applied rather than a basic research model. However, this is largely an unfounded concern, given that basic R&D has remained around 70% of all academic R&D for decades (National

Science Board, 2004). A small but growing cadre of university technology transfer professionals has begun speaking to the need for a greater emphasis on partnerships with industry over revenue maximization as a way of best stimulating national innovation while also staying true to the social contract mission of higher education (Blumenstyk, 2004). Doing so can also help to rekindle the importance of openness and transparency, bedrock facilitators of the social contract for science.

Second, and in support of industry-university partnering, universities need to rethink exclusive licensing. In regard to basic technologies emerging from universities, serious consideration should be given to making them freely available or to licensing them on a non-exclusive basis. Stem cells and gene sequences are excellent case examples. Should a university be patenting and exclusively licensing these technologies (as some like the University of Wisconsin have done) when their applications are clearly broad but currently unclear? Given the potential impact on health care, multiple research teams and companies should have access to these technologies for research and development purposes for potentially broad applications, and via simplified processes such as streamlined material transfer agreements. Teams of university-industry scientists could then be more easily and broadly formed with each playing its respective role (academics examining broad application possibilities and industry investigating specific, targeted application work). As a company begins to "own" a particular application, more formalized agreements could then be established for the firm's profitable exploitation of the technology. However, the university should not let financial return considerations be a central driver of technology commercialization considerations, especially since few ever realize significant financial gains. An approach such as this helps to preserve the integrity of the academic science enterprise.

Third, government policy makers should become more actively involved in facilitating reforms. Thus, for example, federal financial conflict of interest guidelines should be established for faculty *and* institutions, such that universities are expected to disclose in the same manner as faculty investigators. While it may be that threshold points might be raised for universities, it should nevertheless be clear the extent to which institutions are financially entwined with their industry partners. Policy makers might also expect institutions to adopt a policy in which university and faculty stock in licensee companies are escrowed for a period of years so that it can be liquidated only at particular pre-arranged moments. Doing so allows stock ownership to continue, but removes some of the incentive for short-term thinking and influence that may taint either faculty or institutional judgment. In addition, policy makers ought to press universities to allow for certain prescribed activities that support their industry partnership mission. For example, faculty could apply for leaves of absence to work for a licensee company, even one they founded, and/or be allowed to use a sabbatical for this purpose.

Appropriately legitimizing these activities has the potential for speeding the processes of innovation, an important governmental goal. However, they must be evaluated in a way that does not compromise the core responsibilities of a faculty member: teaching, research, and service.

Lastly, careful attention to the encroaching controls of industry in the publication process is needed. Bok (2003) and Angell (2004) speak eloquently to the ways in which academe has allowed corporate influence to encroach the university. Especially worrisome is the way that major pharmaceutical companies are influencing the medical sciences and undermining higher education's integrity as an impartial source of accurate data on matters of human health and safety. Academic institutions need to assert their social responsibilities and remain as free from market forces as possible, especially as it regards their unimpeded right to publish research, even when it criticizes company-funded research.

Limitations and Opportunities for Future Research

While this study advances knowledge on the ethical conflicts of academic commercialization, it is not without limitations. First, the sample of companies chosen does not represent all of the licensing deals that are made with industry. For example, SEC rules allow some firm flexibility in defining the level of detail needed to make an adequate disclosure of investor risks. Thus, there were some licensing deals in the public domain that could not be used in this study because they lacked the details needed to be included in the analysis. In addition, many companies with university licenses are private and thus not bound by SEC reporting requirements. Although there is no reason to believe that universities would approach licensing with private companies differently than with public firms, surveys of universities or private companies regarding their licensing contracts and practices would be a valuable next research step. Second, the study was a cross-sectional investigation and did not explore how practices may be changing over time. Finally, a qualitative study in which university and industry licensing officers are engaged on issues raised in their own contracts would provide useful insights behind decision processes and orientations toward technology commercialization, something that could not be explored in this study.

Conclusion

In today's entrepreneurial climate for higher education, it is difficult to imagine a return to a pre-1980 period given the systemic changes and pressures confronting the industry. Nevertheless, this study offers a unique, evidentiary window into

what actually occurs with technology commercialization and not simply what professionals involved say occurs. Most importantly, it offers instructive insights into what might be done to stop—indeed reverse—the erosion in higher education's social contract obligations so that the public good can best be advanced in this developing arena of university activity.

Endnotes

1. Defined as when an investigator, including his or her spouse and dependent children, will receive anything of monetary value, typically including salaries, payment for services, consulting fees, stocks, bonds, stock options, patents, copyrights, royalties, or similar items, that could affect the design, conduct, or reporting of the research activities proposed. A significant interest is defined as exceeding $10,000 in any year or more than 5% ownership interest in any single entity.
2. The primary exception being as a function of the right of a company to first-refusal on new patent opportunities based on refinements of the original technology.
3. A reach-through provision is defined as property rights in products developed by the licensee or sub-licensee through the use of the transferred technology.

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