Technology Transfer and An Information View of Universities: A Conceptual Framework For Academic Freedom, Intellectual Property, Technology Transfer and the University Mission

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Abstract

In this Article, we provide a conceptual framework for technology transfer grounded in the fundamental purposes of a university -- the creation and dissemination of knowledge in the form of information. We describe how technology transfer activities shift the target audience for knowledge dissemination from traditional university target audiences to organizations with a predominantly economic purpose and different social norms. These shifts trigger a need to bridge differing behavioral expectations. Legal contracts and intellectual property rights can play a significant role in structuring relationships in such a non-traditional knowledge dissemination context. We analyze the role of formal technology transfer involving intellectual property licensing within this framework and provide a view of technology transfer that goes beyond an emphasis on ownership, control, and the quest for revenue and may reduce the tensions within a university between the concepts of academic freedom, intellectual property, technology transfer and the university's role in society.

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I. Introduction

The role of the modern American university has expanded in the two-and-a-half decades since the passage of the Bayh-Dole Act to include technology transfer utilizing intellectual property management and licensing (Mowery *et al.*, 2004, and references therein). As universities have gained experience with various approaches to technology transfer, there has been increasing debate about the role of technology transfer, its effect upon the research mission, and potential conflicts between academic freedom and the university's intellectual property management and technology transfer activities (Washburn, 2005). As in many discussions, the clarity of the debate hinges in part on linking the topics within an appropriate conceptual framework.

Discussing the appropriate relationship between intellectual property rights, academic freedom, and the mission of the university requires putting them on a common basis. Most often, the basis for discussion has been the rubric of ownership and control -- public versus private, commercial versus non-commercial. The very term "technology transfer" suggests that the focal point of the exercise is the transfer of either property or its control from one party to another rather than the underlying purposes for the transfer. We argue here that this superficial perspective on means is not the most fruitful approach. Focusing on who should control (or how much they should pay) without specifying in what context, to whom, and for what purpose technological information is disseminated does not provide an appropriate framework either for defining the role of and constraints on technology transfer or for university decision making about it. Solely examining the ownership/control perspective distracts attention from the ways in which dissemination of technology fits into the fundamental mission of the modern research university and,

perhaps surprisingly, is out of step with the way in which many commercial ventures view their interactions with universities (Jensen and Thursby, 2001; Mowery and Sampat, 2004; Cohen, Nelson and Walsh, 2002; Cohen and Levinthal, 1989; Cohen and Levinthal, 1990).

When technology transfer activities, such as the obtaining and management of intellectual property rights, are seen only as ancillary activities that are at best weakly connected with the everyday activities of the academy, the result is unnecessary tension between these efforts and other university activities. Factors that would enable both practitioners and academic decision makers to see relationships and choices more clearly are obscured. This confusion is evident in debates about the role of technology transfer offices as agents of central administration, and about the proper balance between the university's control of intellectual property rights arising out of the research enterprise and the rights and prerogatives of faculty in research and teaching matters as embodied in academic freedoms.

We argue in this Article that universities and their constituents should view their technology transfer activities more broadly and in alignment with core university missions -- the creation, validation, organization, and dissemination of knowledge in the form of information for the public good. This vision of technology transfer as fundamentally a dissemination, or teaching, function makes it possible to evaluate the relationship between technology transfer initiatives and other university activities consistently within the framework of other academic decision-making. It also enables one better to conceptualize the role of intellectual property in technology dissemination and helps to broaden the discourse about effective technology transfer beyond a stark choice

between exclusive rights and public domain publication. The technology dissemination perspective provides an alternative to viewing formal technology transfer as simply an uneasy balancing act between the evils of commercial co-optation and the realities of declining revenue.

II. Technology Transfer and Universities in an Information View

A. Difficulties with the Ownership/Control Paradigm

Historically, the focus in discussions of university technology transfer has been on the merit of providing ownership of patent rights to universities, and the role of exclusivity and control in commercial licensing and revenue generation by universities. The Bayh-Dole Act, permitting universities and other federal contractors to retain title to patents on their federally funded inventions, was motivated by a concern that government and industry were failing to bring government-funded inventions to market and that society was thus losing out on the benefits of its federal research investment (Stevens, 2004). The perception was that this failure was due in part to inadequate incentives for companies to develop embryonic university inventions into commercial products because commercial actors were reluctant to invest in commercializing an invention if they could not have exclusive rights to it[1] (Sampat, 2002; Kieff, 2001).

While there may have been some truth to this perception, recent empirical studies of technology transfer activities suggest that providing exclusive rights to commercial actors plays a relatively minor role in many successful technology transfer ventures (Jensen and Thursby, 2001; Mowery and Sampat, 2004; Cohen, Nelson and Walsh, 2002; Cohen and Levinthal, 1989; Cohen and Levinthal, 1990; Lemley, 2004; Hellmann, 2005). Indeed, many licenses for university inventions are non-exclusive, belying the idea that

exclusive rights always are needed to prompt investment; the type of access required will depend, of course, upon the industrial sector and the nature of the innovation, among other factors. Far more important than intellectual property rights, in many cases of successful technology transfer, is the opportunity for industrial scientists and engineers to learn from the university inventor through the inventor's personal involvement in the commercialization process (Thursby and Thursby 2006). Thus, from the point of view of the "recipients" of the technology, in many, if not most, cases, the process of technology transfer is more fundamentally a process of knowledge organization and dissemination than it is a sale of exclusive rights.

An exclusive emphasis in technology transfer on the transfer of patent rights often focuses the attention of university actors and others almost exclusively on the potential for revenue through exclusion either for themselves or to fund the university. This focus necessarily emphasizes the rare, but well-publicized "big winner" patents and gives the enterprise of technology transfer a certain "all-or-nothing" lottery flavor. Given the practical realities of technology transfer -- which include the level of effort required, the relatively small share of research funding that is provided by private industry and the fact that the overall financial returns on licensing of university intellectual property are small in most cases in comparison with their other sources of funding (Graff, *et al.*, 2001; Jensen and Thursby, 2001; Sampat, 2002; Thursby and Thursby, 2003) -- this concentration on the long shot is unfortunate. It can lead to neglect of the part that technology transfer can play on a day-to-day basis in promoting the university's core missions of information organization and dissemination. It can also distort the design and evaluation of

technology transfer activities and lead to conflicts with the university's core values and mission.

The dissemination of information and knowledge is a more appropriate starting point for a discussion involving university involvement with intellectual property rights. In an information/knowledge view, information creation, validation, organization, and dissemination are the core missions of a university. Creation, validation and organization of information into new knowledge lie at the heart of the *research* mission of the university; validation, organization and dissemination of knowledge in the form of new information define its *teaching* mission. The two necessarily overlap in the information paradigm of a university, which comprises the following steps:

i. Internalize available information as knowledge
ii. Construct research to extend knowledge
iii. Perform research creating new knowledge
iv. Validate / organize knowledge into new research and into new information
v. Disseminate information.

To evaluate the role of technology transfer -- in its various forms -- one must first inquire how it fits within these core university missions.

B. Technology Transfer and The University's Teaching Mission

While technology transfer is often viewed as an extension of the research enterprise of a university, it is important to remember that it is fundamentally a dissemination activity -- that is, a form of teaching. Indeed, universities and their faculty have always engaged in "technology transfer" through traditional dissemination activities such as classroom teaching, training graduate students, publishing, participating in research conferences, and so forth. The recognition that technology transfer is akin to teaching has the potential to broaden the debate about university technology transfer to

something more than a choice between publication into the public domain and intellectual property licensing focused on revenue.

A knowledge organization and dissemination paradigm also does a better job of describing the successful technology transfer experience, which often involves a much more complex relationship between faculty researchers and industrial actors than either simply "transferring" property ownership or publishing a scientific paper. The knowledge dissemination perspective is also useful in understanding both the motivations and the appropriate role of university faculty, who, on the one hand, often resist investing time in acquiring and licensing intellectual property rights but, on the other hand, sometimes devote significant efforts to entrepreneurial efforts to bring their inventions to market. Additionally, it provides a conceptual framework invoking traditional university norms for determining how to resolve conflicts that may arise involving academic freedom, the university's public mission, and faculty commercial interests.

A quick look at the broad range of activities normally associated with the university's knowledge dissemination and organization mission suggests that, to accomplish its social purpose of bridging the gap between laboratory and market, technology transfer may appropriately, and necessarily, take many forms. Intellectual property licensing is one option -- but only one -- for organizing and disseminating knowledge to industrial actors. Publication in research journals is also a means to disseminate knowledge to industrial actors, but it also may not always be effective. As with any teaching activity, the appropriate design of the "curriculum" and "teaching methodology" of technology transfer depends upon to whom one is disseminating information and for what purpose.

The primary traditional forms of university knowledge dissemination -- publication in academic journals, graduate research training, and classroom teaching -- are embedded in social contexts that are defined by social norms and practices that have evolved over hundreds of years. These traditional forms aim at educating individual students in the classroom, sharing knowledge with an academic peer group through publication and presentation, and training a population of graduate students by means that include classroom teaching, publication and presentation, and individual mentoring. Within these contexts, custom and shared experience establish the rules governing relations between teachers and students, researchers and their graduate students, and researchers and their colleagues. The efforts that go into organizing and disseminating knowledge are compensated by faculty salaries and by various informal, but no less important, mechanisms of reputation and satisfaction of the commonly shared preferences of those who choose academic professions.

Because these traditional means of disseminating knowledge are long-established they appear natural and obvious. The roles of the various players are clearly delineated by social norms and deviations from the norms are most often punished informally. When individuals learn in a standard context they know implicitly the permissions they have with respect to what they have learned and the compensation that is owed to their instructors. Where formal grievance procedures exist -- such as in cases of student cheating or faculty plagiarism -- they are based on well-understood principles and are rarely invoked. Formal contracts and legal rights play a minor role.

Students and teachers alike have expectations for classroom behavior, for the degree of individual attention and personal involvement that students may expect from

professors, and so forth. Though students are under contractual obligations to pay required fees, there is no detailed contract setting out exactly what students and faculty are expected to contribute to the learning experience. Yet, somehow, everyone knows how to behave.

Similarly, interactions between colleagues in academia are governed by detailed norms of reciprocity and the like, very few of which are set down in any written agreement. Publication norms are set within the various academic disciplines by peer review and unstated expectations. These unstated expectations define not only standards of quality, but also the detail with which research results are expected to be described, the standard for acknowledging those who contributed to the work (including such things as how the order of authors is determined), and the appropriate and inappropriate uses to be made of the information. Relationships between faculty advisors and their graduate students are similarly circumscribed by behavioral norms, including expectations of loyalty and expectations about at what point and to whom research results are properly disseminated outside of the research group.

When technology transfer is viewed as a form of teaching, it becomes immediately apparent that all the comfortable norms and widely shared expectations of appropriate behavior that characterize the traditional channels of university knowledge dissemination are absent. In these "cross-cultural" circumstances, it is perhaps not surprising, for example, that academic publications may be inadequate means to disseminate knowledge. Commercial entities may not have the "absorptive capacity" to glean commercially interesting information from hundreds of scientific articles, most of

which are not aimed at elucidating the commercial implications of their results (Cohen, and Levinthal, 1989; Cohen and Levinthal, 1990).

Indeed, even the traditional channels of knowledge dissemination do not rely exclusively on academic publication to organize and disseminate knowledge. Undergraduate education is based almost entirely on selecting and organizing knowledge that is already in the public domain and conveying it to students in a form that they can assimilate. Even the dissemination of knowledge within research peer groups is not confined to journal publication. Conference presentations, colloquia, and other more informal interactive contexts are crucial to propagating knowledge within a research community. Indeed, companies in research-intensive fields often encourage their researchers to participate in these activities, at least in part to increase the researchers' capacity to absorb the knowledge that is being disseminated in the traditional research communities.

Given that commercial enterprises and other organizations operating in an economic forum are a very different kind of target audience than the audiences for traditional university knowledge dissemination, it is not surprising that none of the well-established means for organizing and disseminating knowledge is entirely effective. In light of the recency of university efforts to address this target audience, it is also not surprising that university-industry relationships are currently structured in a variety of ways, none of which is entirely comfortable for either university or industry participants.

Continuing education, extension programs, distance learning, and so forth have all required that universities adapt their teaching approaches to the learning objectives and styles of non-traditional audiences. They have also been controversial, with different

universities making different choices about whether and to what extent to devote their energies to these educational activities. Formal technology transfer -- the dissemination of knowledge to industrial (or organizational) entities in a form that they can absorb and use -- poses similar, if more difficult, challenges.

Framing technology transfer as knowledge dissemination confronts universities with a number of questions, which we argue each university should address in an intentional manner when considering how to "design" a technology transfer effort. To what extent does the university wish to devote itself to this particular "teaching" mission? How does it interact with the other goals of the university? What university resources will be devoted to this activity and how will it be funded? How will the university mediate potential conflicts and exploit potential synergies between disseminating knowledge to industry and the traditional research and teaching missions? How should technology transfer be structured so as to best serve both the goal of bringing technology to the market and the university's broader public mission?

The technology dissemination perspective avoids two over-simplified and ultimately unhelpful caricatures -- one which views technology transfer as invariably a commercial corruption of academic values and another which views technology transfer naively as a source of "easy money" that can made without any impact on the university's primary activities. Neither of these caricatures is correct. Like any other program aimed at a non-traditional audience, technology transfer requires the development of programs, the commitment of university resources, and the involvement of university faculty. These programs can either complement the traditional university missions or detract from them and distort the university's priorities. If such programs are

to be integrated successfully, universities must consciously design them with standard university principles and practices in mind. Technology transfer programs require the same kind of conscious design that is necessary with traditional programs.

C. Structuring Technology Dissemination: Addressing the Lack of Common Norms

The dissemination of knowledge from academia to industry involves two groups that have widely different norms and expectations about how knowledge is created, organized, and disseminated and differing goals and values. In particular, the economic motives of traditional students are implicit and the compensation that universities receive for teaching is indirectly coupled with the economic aspirations of their students. Industrial recipients of university technology and innovation, on the other hand, have explicitly economic motivations for acquiring the knowledge and their willingness to invest resources in the activity are often directly dependent on their perceptions of possible commercial success for the industrial enterprise. University expectations for compensation from technology transfer often have been similarly anchored.

The lack of a well-worn structure for disseminating knowledge to industrial actors can lead to confusion and contention of various types. Technology transfer targets "teaching" to organizations whose reasons for learning are primarily economic in nature with a desire to embed the learning directly into goods and services within a competitive marketplace. Such teaching is not entirely foreign in the traditional university setting – consider the function of the professional schools -- but it clearly requires the development of a distinct methodology of information organization and dissemination. Just as universities seek to impart information to their professional students in a way that both

serves students' desires for economic success and imbues the educational process with certain public values, technology transfer must balance the demand by private companies for knowledge organized so as to maximize economic benefit to the company with the university's responsibilities to the public at large.

The very different operating contexts of corporations and universities and their differing purposes mean that assumptions on what the transfer of knowledge should entail and about what is important to the two sides may be vastly different. Commercial actors may expect (or at least wish) to be granted controls over the further dissemination of the technology or over the conduct of future research that may be unacceptable to academic researchers and inconsistent with university principles. An academic institution must balance its technology transfer activities with its responsibilities to its more traditional teaching and research constituencies and to the public in ways that would not arise in the commercial marketplace.

Because technology transfer involves dissemination of knowledge not to individuals, but to organizations, and because the social norms of the university and industry participants do not dictate a coherent course of interaction, one can expect that technology transfer -- even when viewed as primarily a structure for knowledge dissemination -- will differ from other teaching enterprises in the extent to which the relationships will need to be structured by formal agreements. It will not be enough just to send out a "tuition bill" to the industrial partner in technology transfer. Because there are no shared expectations about the terms under which knowledge is disseminated in technology transfer, formal contracts and other legal rights should be expected to play a larger role in substituting for missing social norms than they do in the more traditional

educational activities of a university. However, while the implementation of the teaching mission must be tailored to the commercial audience, the over-arching principles of knowledge dissemination for the public interest tempered by operational practicalities should guide the activity.

The "teaching" perspective may have a variety of implications for the conduct of the technology transfer enterprise. When technology transfer is viewed as part of the teaching mission of the university, the role of the technology transfer office as intermediary between university "teachers" and potential industry "students" takes on a rather different, and perhaps more normatively attractive, cast than the role of the technology transfer office as either fundraiser or marketing department. Acting as organizational intermediary between university faculty and students is, after all, a core function of university administration. Indeed, some issues that arise in the course of academic administration are not dissimilar to issues that confront the technology transfer effort: How should students be selected? Is it acceptable to provide preferences to those who will pay more? To those whose parents make larger donations to the alumni fund? To what extent should students as "consumers" of university education who "pay the bills" dictate the curriculum and to what extent should faculty, in their professional assessment of the university's broader public mission, determine the subject matter that is taught? To what degree can students influence the selection and retention of faculty? These questions are difficult, but they take on a less ominous tone in the standard education context partly because they are familiar and partly because well-established principles about the university's public mission and principles of academic freedom may be used to sort them out. The questions that come up in technology transfer may be even

more complicated because standard operating norms are lacking, but the same principles should apply.

The shift in emphasis away from the activity as one of solely an exchange of commercial ownership or control also suggests that the success of technology transfer offices must be measured – as it is for other educational endeavors – by something more than the generation of revenue. If the goal is not to maximize revenue, but to organize and disseminate knowledge in a form that will provide the most public and institutional benefit within the context of institutional mission, while still creating a sustainable infrastructure for dissemination and, if appropriate, compensating faculty and other university actors for their technology dissemination efforts, universities may well enter into contracts with different terms.

For example, many university and non-profit research institutions through their technology transfer offices utilize the Uniform Biological Material Transfer Agreement [UBMTA] or variants of it to create research accessibility for biological research tools for both academic and commercial research groups. The UBMTA places few restrictions on the use of the materials and has no grant back of rights or reach through provisions; the UBMTA format also recognizes that the cost of distribution is not zero, however, and makes provision for the transferring institution to charge to recover costs if it wishes to do so. We note, however, that commercial entities often try to obtain much more extensive restrictions in exchange for providing materials to university researchers. The associated difficulties in negotiation can lead to an erroneous appearance of universities impeding the exchange of materials.

Universities also continue to make software and other digital works available under various open source or source available licenses, some of the earliest examples of which are the Berkeley BSD and the MIT Licenses. Source available licensing in the fashion of the phred and phrap bioinformatic software licenses from the University of Washington addresses the issue of uniform and non discriminatory availability of research tools while recognizing that there are real costs to an institution and research group in organizing knowledge into information that may be utilized by others. While the licenses are free to academics, non-profit research institutions and others making their results readily available, a license fee for the software, differentiated by small and large business, is charged to commercial entities that do not wish to do so. Much of the fee is used to support the distribution activity. Like the UBMTA, all of these licenses support the activity of the institutions while addressing organization-to-organization issues such as the allocation of risk and attribution as to the source of information.

D. The Role of Intellectual Property in University Knowledge Dissemination

"Intellectual property" is a legal construct that regulates the dissemination and use of embodiments of knowledge (information). The primary context for the use and development of intellectual property rights has been that of commerce, corporations, and the marketplace where these rights arise out of doctrines such as fairness in competition and the role of government in promoting progress in society while balancing obligations to creative individuals. Historically, intellectual property rights have been primarily (though not exclusively) used to set out the parameters of transactions between commercial organizations, because those organizations play such an important role in the

economy; producing and distributing goods and services that embody information. The role of intellectual property in technology dissemination from non-profit organizations shifts emphasis away from an exchange of control for the generation of revenue or control of markets to other uses.

In the context of university technology transfer, intellectual property rights may also be used to organize and delineate the terms of interaction. However, while commercial norms and goals ease the way in negotiations over intellectual property rights between corporations, universities and commercial actors have very different goals and objectives, which may lead to confusion and difficulties in negotiating intellectual property agreements. To highlight the difference, consider the most basic aspect of an intellectual property right -- such as a patent right -- which is its exclusive nature. For example, a patent gives the patent-holder the right to exclude others from practicing the claimed invention while a license of that right is essentially a promise not to exclude someone. A common commercial use of a patent is therefore to threaten or initiate infringement actions against competitors to protect competitive advantage.

Since universities do not compete in the marketplace (except perhaps in the market for students), the goals of their use of intellectual property rights should be different from the common commercial purpose, namely to control with the intent to exclude competitors. By their nature, universities are pre-disposed to include, encouraging the widespread adoption and use of the knowledge they create and organize. For universities, intellectual property rights are thus more appropriately employed as a means to organize the dissemination of information: to provide quality control, to ensure attribution as to source, to preserve the university's ability to tailor its associations in

pursuit of its public goals and to avoid confusion among recipients as to their permissions to use.

A university may frequently decide that its goals are better served by forbearing from exercising or acquiring intellectual property rights. In fact, a common misconception is that the Bayh-Dole Act requires universities to develop such rights; that is only a requirement if the university chooses to do so by electing title. This means that for a university, a more natural application of intellectual property rights is as a tool to construct the relation between the university and outside groups, rather than merely as a means of appropriating revenue through creating barriers to competition. Examples of uses of intellectual property that promote inclusion and organized dissemination are the Rosetta Commons and the Public Intellectual Property Resource for Agriculture (PIPRA). The Rosetta Commons is a collaborative framework for the management of intellectual property in the bioinformatics of protein folding currently involving ten research institutions. The structure is that of an actively maintained research commons where the members consolidate intellectual property rights under pre-agreed rules and make them available under license to other researchers at both academic and for-profit institutions. The structure utilizes intellectual property to establish norms of behavior among the collaborators as well as to set forth how dissemination with economic potential contributes to the primary research activity.

PIPRA "is an initiative by universities, foundations and non-profit research institutions to make agricultural technologies more easily available for development and distribution of subsistence crops for humanitarian purposes in the developing world and

specialty crops in the developed world" (PIPRA, 2006). As the group notes on its Web site:

> With the introduction of biotechnology in agriculture, researchers have a unique opportunity to contribute to the development of improved staple and specialty crop varieties. However, the development of new crop varieties with biotechnology depends on access to multiple technologies, which are often patented or otherwise protected by intellectual property rights (IPRs). Ownership of these rights is fragmented across many institutions in the public and private sector, which makes it difficult to identify who holds what rights to what technologies, in which countries, and to establish whether or not a new crop variety is at risk of infringing those rights. The current situation creates barriers to commercializing new staple and specialty crop varieties. PIPRA participants believe that if public sector institutions would collaborate in gathering information about and in the use of agricultural IPRs, the collaboration would make it easier for them to fulfill part of their public missions by speeding the creation and commercialization of improved staple and specialty crops (PIPRA, 2006)

The institutions trade off some of the monetary value that could be obtained in licensing of their intellectual property in favor of retaining rights in keeping with their involvement in PIPRA and with their larger missions.

E. Technology Transfer and the Relationship Between a University and its Faculty

The connections between an information view of a university, a dissemination perspective of technology transfer, and intellectual property as a societal control on information in an economic forum may also be useful in helping universities to navigate some difficult questions that may arise about faculty academic freedoms and the relation of those freedoms to the perceived rights of faculty to exploit their own university research for commercial advantage. Tensions can arise between the university's mandate to disseminate knowledge for the public good and the academic freedoms of faculty who seek lucrative outside consulting contracts or entrepreneurial opportunities for private

gain, or even between that mandate and the compromises between autonomy and "paying the bills" that faculty members make in the pursuit of research funding. Furthermore, while we speak of the faculty in this perspective, similar tensions arise for the administration of a university since the underlying questions tie to the ability to control the dissemination of information created within the institution.

In the commercial context, the common practice is for the intellectual property rights to (and hence the control of dissemination and use of) information and knowledge created by individuals within an organization to pass directly to the organization. In copyright law, for example, this happens automatically by legal default under the work-for-hire doctrine. While patent law contains no such automatic assignment of rights, under state laws employment contracts of technical workers in the commercial sector are nearly universal in requiring assignment of patent rights. Thus while employees create industrial knowledge and information, control of the information generally passes to the employing organization by virtue of the employment relationship. This relinquishment of control by individuals to firms is quite consonant with the contours of the commercial employer-employee relationship, the predominant role of organizations in the economy, and the emergence of intellectual property rights to control elements of information within this structure.

With respect to the control of information and the rights associated with it, a university's relationship with its faculty is quite different from the typical employer-employee relationship. Although agreements involving salaries, benefits, and so forth look like other employment contracts, the relationship between a university and its faculty with respect to activities and governance is determined substantially by principles

and norms of academic freedom, rather than by concepts of ownership. As Donna Euben notes in her article on the subject of academic freedom, the U.S. Court of Appeals for the District of Columbia Circuit puts this point nicely in its opinion in Greene v. Howard University: "Contracts are written, and are to be read, by reference to the norms of conduct and expectations founded upon them. This is especially true of contracts in and among a community of scholars, which is what a university is. The readings of the market place are not invariably apt in this non-commercial context."

The basic academic freedoms are freedom of inquiry; freedom of instruction; freedom of skepticism; and freedom to publish (1940 Statement of Principles on Academic Freedom and Tenure of the American Association of University Professors and the Association of American Colleges and Universities). Within an information view of the university, these activities align roughly as:

Knowledge Creation - Freedom & Control of Inquiry

Knowledge Organization - Freedom of Expression

Knowledge Validation - Freedom of Skepticism

Knowledge Dissemination - Freedom to Publish

These academic freedoms establish the default delegation of *control* of activities surrounding the creation, validation, organization and dissemination of knowledge / information to the faculty in an academic setting. However, universities generally do not relinquish their contractual role as employer and owner of intellectual property rights in many faculty creative endeavors within an economic setting. Thus, the technology transfer context not only shifts the traditional audience for knowledge dissemination to

commercial actors, but also implicates the economic relationship between the university and its faculty. Not only are there difficulties in delineating the external relationships between academic and commercial entities, but conflicts may arise between a university and its faculty because of differing visions of the appropriate approach to knowledge dissemination when economics enters as a key element. These conflicts may reverse the traditional situation in which academic freedom protects the independence and autonomy from potential university interference. While sometimes conflicts may stem from the fact that an individual researcher favors free distribution of technology from which a university hopes to derive economic benefit, there may also be situations in which faculty members seek private economic benefit in conflict with university goals.

Customarily, universities delegate control of research to individual faculty in accordance with the principle of freedom of inquiry. In instances where funding comes from external sources, control of the research is explicitly delegated within the funding contract or grant to the individual faculty named as principal investigators. Unlike corporate research laboratory policies, and consistent with academic freedom of inquiry, university policies typically state that the university may not direct a faculty member to undertake or conduct a particular research project. However, university department chairs and deans generally do have a responsibility to approve faculty research activities as appropriate to the academic mission. Though disapproval is rare in practice, the purpose of this oversight is to ensure that university research activities have academic merit, comply with university policies in areas such as the use of human subjects and freedom to publish, do not expose the university to undue legal liability, and provide appropriate vehicles for graduate education.

The typical progress of a university research project involves the creation of new results (information) and the analysis of that information to create an expanded understanding. Results may be in many forms, including research tools. When a faculty member determines that informal standards of the research community have been met, the information is assembled and the knowledge codified through publication, presentation, and instruction. The control of the timing of dissemination, subject to contractual constraints to which the faculty member has agreed in advance, is determined by the faculty consistent with the academic freedom to publish.

The expectations or norms of behavior underlying this dissemination activity are set by the behavior and expectations of a community of scholars – which extends far beyond an individual university -- over the course of their interactions. The target audience of scholarly publication consists of scholars and individual professionals interested in the subject of the research – an academic audience. The central expected benefits to the faculty publication of research results are career advancement in its various forms such as promotion, tenure, research funding and professional recognition; the ability to participate in the scholarly "conversation;" and the satisfaction of the researcher's personal tastes for autonomous scholarly inquiry into a particular subject.

Traditional university teaching also accommodates academic freedom in reasonably well-established ways. Conflicts may arise over the extent to which faculty members may determine the contents of their courses and to what extent they may insert their political or other personal views into the classroom, and there are certainly conflicts between faculty and university administration over teaching loads and curricular design. Nevertheless, for the most part the parameters of the teaching role – both in the classroom

and in the graduate context -- and the balance between academic freedom and university control over curriculum are understood by all parties involved.

Bringing technology transfer into the equation raises new issues because it shifts not only the target audience for dissemination from individuals to organizations but also shifts the purpose / practice of knowledge dissemination to a predominantly economic, not academic, forum. The tension between academic freedom and actions outside the academic forum often emerge as "conflicts-of-interest." For example, faculty consulting for a company while simultaneously performing research sponsored by that company may not be amenable to a university unless the intellectual property rights from consulting flow through the institution and not through the consulting agreement. These university constraints may be seen by the faculty researcher as an affront to academic freedom, but may in fact reflect the potential for conflicts-of-interest between the goals of university research and the private economic incentives of consulting. Similarly, is software dissemination a publication activity of a computer science group or an intellectual property rights transfer to be done by the technology transfer office? It may be either or both. If the predominant target audience for the activity is academic peers then it is a publishing activity under the control of the faculty. If the target audience for dissemination is economic players and its motivation is personal economic gain, then the basis for the activity has shifted from one to which traditional academic norms (and freedoms) apply to one where the institution is properly delegated control, if for no other reason than to mediate in a situation where conflict of interest arises.

If the technology transfer office sees its goal (or has it set) as primarily the raising of revenue through an ancillary activity, faculty members may either object to or simply

be uninterested in the "meddling" in their research and time taken from other pursuits that obtaining intellectual property protection and arranging technology licensing may require (Thursby and Thursby, 2002). On the other hand, if a technology transfer office contributes to activities surrounding the organizing and disseminating knowledge to organizations, as we advocate here, there may be conflicts with faculty members who believe they should have the freedom to control the use of their research results in pursuit of personal financial gain (Eisenberg, 1988; Stuart, 2004). The knowledge dissemination approach suggests that conflict of interest principles may be important in navigating these disputes. Academic freedom is a means of policing a university's commitment to public goals. In the technology transfer context, however, those same public interest goals may necessitate the development of conflict of interest policies that limit the use of "academic freedom" as a cover for private pecuniary interests.

III. Conclusion

In summary, we have presented a view of technology transfer as part and parcel of a university's core mission of knowledge organization and dissemination. This view shifts the focus away from expectations of technology transfer as simply a side activity with the primary goal of raising revenue -- an expectation which is unrealistic in most cases. It provides a framework within which technology transfer activities can be strategic to the institution, and structured and evaluated in ways that are consistent with core university values and principles. It also explains why, given the lack of traditional norms and practices for technology dissemination to commercial actors, explicit contracts and intellectual property rights are likely to play an important role in facilitating and structuring this particular form of "teaching" in ways that are effective for the industrial

target audience but also true to the principles of university actors. Finally, the perspective of technology transfer as teaching can help to inform debates about academic freedom and the roles of various university actors in the dissemination of the results of university research.

References

The American Association of University Professors and the Association of American Colleges and Universities, 1940, '1940 Statement of Principles on Academic Freedom and Tenure,' http://www.aaup.org/redbook/1940stat.pdf.

Bayh-Dole Act, 35 U.S.C. § 200 (2000).

Cohen, W.M., D.A. Levinthal, 1989, 'Innovation and Learning: The Two Faces of R&D,' *Economic Journal* **99**, 569-610

Cohen, W.M. and D.A. Levinthal, 1990, 'Absorptive Capacity: A New Perspective on Learning and Innovation,' *Administrative Science Quarterly* **35**, 128-152.

Cohen, W.M., R.R. Nelson, and J.P. Walsh, 2002, 'Links and Impacts: The Influence of Public Research on Industrial R&D,' *Management Science* **48** (1), 1-23.

Eisenberg, R.S., 1988, 'Academic Freedom and Academic Values in Sponsored Research, *Texas Law Review* **66**, 1363-1404

Euben, D.R., 2002, 'Academic Freedom Of Individual Professors And Higher Education Institutions: The Current Legal Landscape,' http://www.aaup.org/com-a/aeuben.htm.

Graff, G., A. Heiman, D. Zilberman, F. Castillo and D. Parker, 2001, 'Universities, Technology Transfer, and Industrial R&D,' http://are.berkeley.edu/~ggraff/Graff-et-al-University-TT.pdf.

Greene v. Howard University, 412 F.2d 1128, 1135 (D.C. Ct. App. 1969).

Hellmann, T.F., 'The Role of Patents for Bridging the Science to Market Gap,' NBER Working Paper 11460.

Jensen, R. and M. Thursby, 2001, 'Proofs and Prototypes For Sale: the Tale of university Licensing,' American Economic Review **91** (1), 240-259.

Kieff, F.S., 2001, 'Property Rights and Property Rules for Commercializing Inventions,' *Minnesota Law Review* **85** (3), 697-754.

Lemley, M.A., 2004, 'Ex Ante Versus Ex Post Justifications for Intellectual Property,' *University of Chicao Law Review* **71** (1), 129-149.

Mowery, D., R.R. Nelson, B.N. Sampat and A.A. Ziedonis, 2004, *Ivory Tower and Industrial Innovation: University-Industry Technology Transfer Before and After the Bayh-Dole Act,* Stanford: Stanford University Press.

Mowery, D.C., and B.N. Sampat, 2004, Universities in National Innovation Systems in J. Fagerberg, D.C. Mowery, and R.R. Nelson, (eds.), *Oxford Handbook of Innovation.* Oxford: Oxford University Press.

National Institute of Environmental Health Sciences, 2004, 'Uniform Biological Transfer Agreement,' http://www.niehs.nih.gov/techxfer/ubmta.htm.

Open Source Initiative, 2006, 'The BSD License,' http://www.opensource.org/licenses/bsd-license.php.

Open Source Initiative, 2006, 'The MIT License,' http://www.opensource.org/licenses/mit-license.html.

Owen-Smith, J. and W.W. Powell, 2003, 'The Expanding Role of University Patenting in the Life Sciences: Assessing the Importance of Experience and Connectivity,' *Research Policy* **32**, 1695-1711.

PIPRA, 2006, 'Public Intellectual Property Resource for Agriculture,' http://www.pipra.org/.

PIPRA, 2006, 'Purpose,' http://www.pipra.org/index.htm.

PIPRA, 2006, 'Purpose,' http://www.pipra.org/main/purpose.htm.

Rosetta Commons, 2006, 'Rosetta Commons,' http://www.rosettacommons.org/.

Sampat, B.N., 2002, Private Parts: Patents and Academic Research in the Twentieth Century. Paper Prepared for AAAS/CSPO Research Symposium for the "Next Generation" of Leaders in Science and Technology policy.

Stevens, Ashley J., 2004, The Enactment of Bayh-Dole, *Journal of Technology Transfer, 29, 93-99.*

Strandburg, K.J., 2005, Curiosity-Driven Research and University Technology Transfer in G.D. Libecap, (ed.), *Advances in the Study of Entrepreneurship, Innovation, and Economic Growth*, Greenwich: Elsevier Science/JAL Press

Stuart, J., 2004, 'The Academic-Industrial Complex,' *University of Colorado Law Review* **75**, 1011-.1064

Thursby, J.G. and M.C. Thursby, 2002, 'Who is Selling the Ivory Tower? Sources of Growth in University Licensing,' *Management Science* **48** (1), 90–104.

Thursby, J.G. and M.C. Thursby, 2003, 'University Licensing Under Bayh-Dole: What are the Issues and Evidence?' http://opensource.mit.edu/papers/thursby.pdf.

Thursby, J. and Thursby, M., 2006, Here or There? A Survey on the Factors in Multinational R&D Location, *National Academies Press, Washington, DC*.; and Thursby, J., and Thursby, M., 2006, Where is the New Science in Corporate R&D?, *Science 8 Vol. 314. no. 5805, pp. 1547 – 1548*.

University of Washington Tech Transfer, 2006, 'Instructions for Licensing Phred, Phrap, and Consed-Autofinish,' http://depts.washington.edu/ventures/UW_Technology/Express_Licenses/Ph red_Phrap.php.

Washburn, J., 2005, *University Inc.: The Corporate Corruption of Higher Education,* New York: Basic Books.

[1] The Bayh-Dole Act, 17 U.S.C. § 201(b), was intended "to use the patent system to promote the utilization of inventions arising from federally supported research or development; . . . to promote the commercialization and public availability of inventions made in the United States by United States industry and labor; to . . . protect the public against nonuse or unreasonable use of inventions."