

INSTITUTIONAL CHANGES FOR TRANSDISCIPLINARY RESEARCH AND LEARNING

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Summary

This chapter examines transdisciplinarity in American research universities as it has manifested itself in university management of intellectual property. It begins by tracing the history of university patent administration from its earliest roots, in which patents seemed to threaten traditional university values, to the present, when most major universities are actively selling their patentable intellectual property on the open market. This history reveals some patterns for development of organizational units designed to carry out transdisciplinary activity.

The chapter continues with an examination of current issues surrounding university-associated copyrightable intellectual property. Unlike the case with patentable university property, considerable confusion and change has characterized university administration of copyrightable property. The stakes may also be higher in this area because of the broad influence of copyrightable material. Two forces - Internet technology and recent changes in U.S. copyright law - compel new attention to copyrightable material today. This contribution concludes by examining the implications for transdisciplinarity of recent changes in university management of copyrightable intellectual property and by making some predictions about the effects of future developments.

1. Introduction

A review of typical U. S. university organizational structures reflects both the traditional classifications of knowledge (disciplines) and the constant need to create interdisciplinary or transdisciplinary structures to compensate for the artificiality the traditional arrangements present when real problems of society need to be addressed. On the academic side, the university organizational structure might be likened to a paleontologist's view of a limestone cliff with early classifications of knowledge displayed in the foundation as schools (letters and sciences, arts and humanities, biological sciences), later specializations appearing as departments (English, art history, molecular biology), and interdisciplinary activities showing up near the top as special centers and institutes (centers for integrative biology or pervasive communications). On the administrative side, traditional organizational units such as registration, counseling, student life, and business offices have been joined by an expanding list of units designed primarily to perform transdisciplinary functions. For instance, most universities now have positions with titles such as provost for research, dean of the graduate division, dean for undergraduate affairs, and director of sponsored programs. These positions perform services, exercise control, and foster cooperation across all disciplines in areas of research and teaching. While these offices are not normally called transdisciplinary in the United States, the term is useful in understanding universities today and the dynamics that influence them.

A relatively recent addition to the list of transdisciplinary university offices is one most frequently and aptly called the Office of Technology Licensing. The number and activity of these offices, which exist primarily to sell the patentable intellectual property created by university researchers, and the need for them has increased dramatically in the last ten years. Between 1991 and 2000, U.S. university licensing income increased from \$186 million to \$1.263 billion (source: AUTM Licensing Survey, 2000). During the same period, the number of patents issued to US universities increased from about 800 per year to about 3,500 per year, rising from .25 percent of the total patents issued to 2.2 percent (source: U.S. Patent and Trademark Office). The story of this increase—why and how it occurred and its effects on research and universities, particularly its relevance to transdisciplinarity—is one element of this paper.

Universities' management and sale of patentable intellectual property has settled into common patterns, and its effects on the institutions and society are now either clear or reasonably predictable. This is not the case with management of copyrightable intellectual property. Both U.S. copyright laws and university policies and management practices related to copyrighted material are currently in a state of flux, partly because Internet technology has dramatically changed the way information can be created and distributed and partly because of historical differences between universities' treatment of patentable intellectual property and their treatment of copyrighted property. Also, whereas patents deal primarily with the products of university research, copyrights often relate to universities' roles in teaching and learning. The prospect of commercialization of elements of teaching and learning evokes feelings very different from those produced by commercialization of university research, which is now widely viewed as a legitimate and important part of the economic and commercial life of our country. A second part of this contribution therefore describes the still-unfolding picture of

university copyright management, how it may follow or deviate from the patterns established for patentable property, and what these similarities and differences tell us about how universities handle transdisciplinary functions.

While the text of this contribution is dominated by the story of why and how U.S. universities have changed and are changing as a result of their management of intellectual property, its purpose is also to describe how universities carry out transdisciplinary activities. Universities have been forced to pay attention to the intellectual property they create because of real concerns in our society that are not addressed through any one discipline. While universities have always been, in some way, viewed as important elements in economic development of nations and regions, the pressures on universities to be increasingly and more directly active in promoting economic development have grown dramatically over the last 30 years (see *Integrating Knowledge in Technology Development*). In order to protect their autonomy and their reputation, and, at the same time, satisfy the society upon which they depend for support, universities have developed a number of strategies, including many that are properly labeled “transdisciplinary,”- that is, strategies that serve, protect, coordinate, control, oversee, or represent all disciplines in their research and teaching roles (see *Transdisciplinarity and Disciplinarity in the University of the Future, Science Policy for Transdisciplinary Research*). Without a transdisciplinary approach, universities would be much less able to respond to the real-world concerns that drive society, of which economic concerns are among the most pressing.

2. The Early History of University Management of Intellectual Property

The history of the university’s intellectual property management begins with the institution’s ability to produce such property. In the United States this capacity appeared first in the research university, an institution that emerged during the First World War. The exigencies of war spurred unprecedented efforts, under the auspices of the newly established National Research Council, to coordinate scientific research among universities, foundations, and the federal government. After the war, partly in recognition of the contributions that universities had made to the war effort, foundations began to provide a few universities with significant funding to do “the best science,” research that was easily distinguishable at that time from the kind of research funded by corporations. Even though this pattern of providing funding for research to universities rather than specialized research institutes was established in the mid to late 1920s, by 1936 there were still only 16 research universities in the country. They received support from a diverse group of funding agencies, with the federal government supporting research only in a very few applied fields.

During this period, as universities’ capacity to produce intellectual property grew, so did concern over their involvement in management of that property. Prior to the 1920s, the term “intellectual property,” while used in the commercial world, seemed a contradiction when associated with universities because a university’s exploitation of the value of the intellectual property produced within its walls seemed to violate the implied contract universities had struck with the larger society, in which universities were supposed to make their intellectual products freely available for the “public good.” As the value of intellectual property grew, extensive efforts were made to protect the

university from the supposedly negative influences that such value might evoke. These attempts at protection came from university researchers, the universities themselves, and from outsiders.

Professor F. G. Cottrell of the University of California is an example of a researcher who sought to secure the economic benefits of intellectual property for his university without infecting the university with the profit motive. In 1907 Cottrell invented the electrostatic precipitator, which was installed in industrial smokestacks to reduce air pollution. He patented the device and set up a company to exploit its commercial potential, but, following the example of Marie Curie, Louis Pasteur, Charles Munroe (smokeless powder), and Marion Dorset (hog cholera serum), he sought no personal financial return from his invention. Rather than working directly through his university, he eventually convinced a group of prominent businessmen to charter a corporation, The Research Corporation, which would hold patents on university inventions and channel the proceeds from the patents back into university research. That corporation still exists and now has a long record of managing university intellectual property.

Another early example of how university management of intellectual property avoided criticism is the University of Toronto's handling of the discovery of a way of producing insulin that F. G. Banting and C. H. Best developed in 1921. The researchers patented the process but assigned the patent before issue to the university, which in turn gave the process away without strings and entered into cooperative agreements for production of the hormone. Widespread appreciation for this unselfish treatment led to the establishment of the Banting and Best Research Fund, which received money to fund support university research from the Canadian government and many other agencies and individuals. Interested outsiders also protected universities by buffering them from commercialization. In 1924, Professor Harry Steenbock of the University of Wisconsin discovered how to use irradiation to activate vitamin D in food. This discovery led to the virtual eradication of rickets as a childhood disease in the United States. When the university refused Steenbock's offer of the patent for the process, a group of concerned Wisconsin alumni formed the Wisconsin Alumni Research Foundation (WARF) to hold the patents and return proceeds from them to the university. The Steenbock patents eventually netted over \$14 million for WARF, which was the first example of a separate entity established to administer university patents.

These three examples have a similarity that may be important in this study of transdisciplinarity. In all three cases, entities outside the university were established to manage intellectual property for and on behalf of the university. Because of university traditions and the institution's inherent resistance to change, external agencies seemed to be necessary to buffer the university from social demands. In these examples we see the beginning of the notion that university research not only has a value and that at least part of this value can be returned to the university. Note that in all three cases, the buffer organizations supported research in any discipline.

3. The Later History and Current Status of Patentable Intellectual Property

These early events established a pattern (the use of external, buffer organizations to manage university-produced intellectual property) that continued through World War II.

The Great Depression of the late 1920s and early 1930s, damaging as it was in many ways, actually strengthened the research capability of the few research universities in existence then. These universities had accumulated some capital and had developed research facilities during the good times, and many of their patrons were not particularly hard hit by the economic downturn. Because jobs were scarce, academic researchers tended to stay in the university, adding human capital to the physical capital (buildings and equipment) that the institutions already possessed. Then, before and during World War II, the government again called a few research universities into action by funding defense-related research with some spectacular results. By the end of the war, the place of the American research university in the institutional framework for basic scientific research in the United States was well established.

3.1. Intellectual Property after the War

The flow of federal research funding into American universities had profound effects on American higher education. One of these effects was a growing awareness of the value of the intellectual property created by this research, including its commercial value. In the early 1940s, therefore, a few universities developed policies related to patentable intellectual property and set up small patent offices, thus moving the management of intellectual property into the university for the first time. Sometimes the impulse for this move was the invention or discovery of something of great promise. At the University of California, for instance, two U.C. Davis scientists formulated calcium pentathenate, a chicken food additive and later a common ingredient in vitamin pills. These scientists assigned their rights in this discovery to the university causing the Regents to adopt the university's first patent policy.

In other cases, dissatisfaction with the external "buffer" organization led a university to decide to manage its own intellectual property. For instance, as early as 1942, faculty members at M.I.T. expressed concern over the ability of the Research Corporation to manage the university's patents. This dissatisfaction culminated in the cancellation of the M.I.T. –Research Corporation contract in the middle of litigation over patents on the first computers created by J. Forrester from the university-sponsored Digital Computer Laboratory.

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Biographical Sketch

Gary Wayne Matkin is dean of continuing education at the University of California, Irvine. In this position he is responsible for University Extension (continuing education) which serves over 22,000 students per year. He is also responsible for Summer Session (7,000 students) and the Distance Learning Center which offers online education. Before becoming dean at UCI, Dr. Matkin served as associate dean of University Extension at Berkeley where he was responsible for distance education and technology initiatives. Matkin is a Certified Public Accountant (California) and received his MBA degree and his Ph.D. in Education from the University of California at Berkeley. He has written three books including *Technology Transfer and the University* (1990) and has numerous articles and book chapters on distance education, university economic development, and education financing. Dr. Matkin regularly serves as a consultant to universities and other organizations about online and e-learning strategy and decision-making.