University Technology Commercialization Case Study
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Introduction

The patenting of university research can be big business. In 2007, technology licensing revenues generated by the top ten universities alone accounted for nearly $1.5 billion.[1] These impressive revenues were built upon a strong foundation of university-based research and development. The National Science Board reported that US academic institutions spent $48 billion on research and development in 2006, accounting for 33% of total research nationally.[2] As the licensing-revenue numbers indicate, this laboratory research can resonate powerfully in our everyday lives. Large corporations like Google, Cirrus Logic, and Genentech have all based their products on university-licensed intellectual property.[3]

The Cohen-Boyer patents for recombinant DNA rank among the most revered and lucrative academic licenses in U.S. history. These licenses were issued on a non-exclusive, rather than the conventional exclusive, basis. Despite the impressive returns that it has generated, the Cohen-Boyer IP strategy of non-exclusive licensing pursued by Stanford and the University of California at San Francisco (UCSF) in the 1980s and 90s has generally not been replicated in large part by universities throughout the United States. Instead, exclusive licensing has become the norm throughout US research universities.[4] This case study explores the incentive structures that characterize university settings through the lens of the Cohen-Boyer Patents.

The Cohen-Boyer Patents

In 1972, Professors Stanley Cohen of Stanford University and Herbert Boyer of UCSF met at an academic conference in Hawaii.[5] Within a decade of the start of their collaboration, they had discovered a method for splicing strands of DNA from different organisms, known as recombinant DNA (rDNA). The technology provided a key part of the foundation for the modern biotechnology industry[6] and several prominent pharmaceuticals that treat cancer, diabetes, HIV/AIDS and heart disease.[7]

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[1] Chronicle of Higher Education, Almanac 2009 pg. 35. The bulk of this revenue came from NYU's whopping $791 million in FY 2007 licensing revenue, of which a substantial part came from a one-time payment of $650 million for rights to the drug Remicade. The average licensing revenue of the top 10 performers, not including NYU, is about $75.7 million.

[2] Saul Lach, Mark Schankerman: "Incentives and Invention in Universities," Rand Journal of Economics, Vol. 39, No. 2, Summer 2008: Pgs. 403-433; pg. 403

[3] John Lipinski, Marcel C. Minutolo, Laura M. Crothers, "The Complex Relationship Driving Technology Transfer: The Potential Opportunities Missed by Universities" *Institute of Behavioral and Applied Management*, 2008 pg. 482

[4] See e.g. Jay P. Kesan, "Transferring Innovation," *Fordham Law Review Vol. 77, pg. 2169; 2009;* pg. 2169.

[5] Rajendra K. Bera, "The story of the Cohen-Boyer Patents," *Current Science*, Vol. 96 no. 6, 25 March 2009. Pg. 760

[6] Kesan. Pg. 2174

[7] Bera pg. 1797.

The first breakthrough occurred in 1977, when professor Boyer created human insulin in his laboratory. The invention would become Genentech's first product as Boyer partnered with venture capitalist Robert Swanson to found the company.

The Cohen-Boyer intellectual property is actually a series of three separate patents for the rDNA process, as well as two rDNA products generated through the use of prokaryotic and eukaryotic cells. Collectively, they have been referred to as "the most successful patent…in the entire history of university licensing,"[8] and the "gold standard"[9] of university technology transfer. The Cohen-Boyer rDNA patents operated from 1980 through 1997 and contributed to the creation of over 2400 products by over 460 companies.[10] This tremendous productivity netted over $250 million in licensing revenues for Stanford and UCSF, off of a base of $35 billion in international product sales.[11]

Convinced by technology transfer pioneer Niels Reimers, founder of the Stanford Office of Technology Licensing (OTL), of the value of patenting their invention, Cohen and Boyer agreed to allow Stanford and UCSF to patent their discovery jointly. In developing a strategy for managing this valuable intellectual property, Reimers sought to balance the diverse goals of Stanford University. In addition to maximizing revenue for future education and research expenditures, Reimers pursued an IP strategy that reflected Stanford's public service ideals, promoted timely commercialization of the technology for public benefit and minimized the potential for biohazard. [12]

To achieve these ends, Reimers opted for a non-exclusive licensing scheme that offered varying rates to companies based on criteria such as firm size and product category. There were four product categories: basic genetic products, bulk products, end products and process improvement products.[13] Under the framework he articulated, Stanford and UCSF would also receive royalties on sales of final drug products in a novel arrangement known as "reach-through" licensing.[14]

Yet despite the tremendous financial, academic and societal benefits associated with Reimers' management of the Cohen-Boyer IP, U.S. research universities have not followed Stanford's lead. Research universities are oft-criticized for their "single-minded focus" on maximizing royalty revenues through exclusive licensing of university-owned patents.[15] To understand why, we must look to the regulatory, cultural and academic framework in which university patenting today occurs.

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[8] Commission on Life Sciences, "Intellectual Property Rights and Research Tools in Molecular Biology: Summary of a Workshop held at the National Academy of Sciences, February 15-16, 1996" 1997. Pg. 41

[9] Maryann P. Feldman, Alessandra Colaianni, Connie Kang Liu, "Lessons from the Commercialization of the Cohen-Boyer Patents: The Stanford University Licensing Program" in Intellectual property management in Health and Agricultural Innovations: A handbook of best practices." 2007 pg. 1797

[10] Feldman pg. 1797.

[11] Mariann Jelinek, Stephen Markham, "Industry-University IP Relations: Integrating Perspectives and Policy Solutions" *IEEE Transactions on Engineering Management, Vol. 54 No. 2, May 2007*. Pg. 259.

[12] Feldman pg. 1798.

[13] Feldman pg. 1800.

[14] Feldman pg. 1800.

[15] See e.g. Kesan 2169. See also, Lipinski.

Universities as a Unique Class of IP Owners

Regulatory Framework

The ability of Stanford and UCSF to patent the Cohen-Boyer technology in the first place turned in part on a landmark Supreme Court case decided in June of 1980, days before the Cohen-Boyer patent was filed[16]. In *Diamond v. Chakrabarty*, the Supreme Court held that genetically engineered microorganisms were eligible for patent protection because they fell into the category of "anything under the sun that is made by man."[17]

Later that same year, the Bayh-Dole Act marked a second major development in university patenting. This law is designed to encourage the commercialization of federally-sponsored research in the basic sciences by granting exclusive patent rights to the university hosting the federally funded researchers. While the Cohen-Boyer patent predates the Bayh-Dole Act by several months, the control exerted by Stanford over the patent prosecution, ownership and licensing previewed the dynamic that would become that norm in university licensing following Bayh-Dole. Typically, the university will retain the rights to the intellectual property, reserving a certain percentage of revenues as royalties for the inventing professor and for his or her laboratory.[18]

Disparate Goals of the University

University leaders, like their counterparts in the non-profit and for-profit worlds, ought to seek IP strategies designed to achieve institutional goals. This strategic process can be difficult to manage. Each university has a variety of goals and a range of views among its leaders as to which is the most important.

Institutions of higher education have traditionally focused on the creation and dissemination of knowledge. At many schools, this historic focus comes into conflict with contemporary goals of technology commercialization and revenue generation through patent licensing.[19] For example, while knowledge dissemination can often best be achieved through publication in a scholarly journal, such public disclosure can affect the manner in which the invention is available for patent protection, thereby jeopardizing potential licensing revenues.[20] Further threatening knowledge dissemination, existing companies seeking exclusive license to a university-developed technology may do so for the sole purpose of keeping the innovation *away* from a competitor or *unavailable* to consumers.[21]

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[16] Bera pg. 761.

17 Arti K. Rai & Rebecca S. Eisenberg, Bayh-Dole Reform and the Progress of Biomedicine, 66 L& Contemp. Prob. 289 (2003) pg. 290.

[18] See Saul Lach, Mark Schankerman: "Incentives and Invention in Universities," *Rand Journal of Economics, Vol. 39, No. 2, Summer 2008: Pgs. 403-433* (discussing the use of inventor-royalties in university-licensing)

[19] See e.g. Risa L. Lieberwitz, "The Marketing of Higher Education: The price of the University's Soul," *89 Cornell L. Rev. 763* (2004). Lieberwitz is highly skeptical of the increased ties between academia and industry, stating "commercialization of the university is a crisis for higher education," pg. 798.

[20] See e.g. Lieberwitz

[21] Jelinek. Pg. 266

Though partner companies such as Genentech petitioned to secure exclusive licenses and accompanying windfall profits, Stanford's Niels Reimers pursued the non-exclusive patent route for Cohen-Boyer in order to pursue knowledge dissemination *through* commercialization.[22] Some credit the decision to license non-exclusively with allowing the entire biotechnology industry to sprout.[23]

In 1989, Reimers incorporated an additional element of the contemporary research university's mission, namely, regional economic development.[24] Recognizing the strength of the Cohen-Boyer technology to generate new start-up companies, Reimers created more affordable royalty-provisions for small firms, yielding licensing agreements with over 200 fledgling firms, many of which were located in the nearby San Francisco bay area.[25]

University IP Valuation and Strategy

There are many reasons why the Cohen-Boyer story does not lend itself to replication in all cases. According to participants in a forum hosted by the National Academy of Sciences, the Cohen-Boyer patent strategy is hard to pursue because the nature of the Cohen-Boyer technology sets it apart from most advances. The invention was inexpensive to re-use; there were no alternative technologies; and the science was truly groundbreaking in nature.[26] Paradoxically, however, technology transfer directors throughout the nation often treat new discoveries as carrying Cohen-Boyer potential, and thereby requiring adequate patent protection to secure potential future revenue streams. No technology transfer director wants to face a university president having allowed the next Google to leave campus without having ensured that there's an ongoing revenue stream or other payment associated with it. An overly aggressive negotiating stance, though, can keep university-based technologies on laboratory shelves.

Some scholars have pointed out the difficulty, if not impossibility, of fair valuation of intellectual property in its early stages in university laboratories.[27] Given this uncertainty, technology transfer officials looking at the historical record have noted that, at schools generating significant licensing revenues, those revenues sprout from relatively few "home run" patents.[28] When the Cohen-Boyer patent expired in 1997, it represented a full 62% of Stanford's licensing revenues and 27% of the entire University of California system's licensing revenues.[29]

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[22] Feldman. Pg. 1798
[23] Rai. Pg. 300
[24] Regional economic development is an especially prominent in public university settings. For example, the State University of New York (SUNY) recently adopted a new strategic plan in which statewide economic development is a central pillar. Private, not-for-profit universities (such as Widener, the link provided above) have increasingly touted their economic development potential as well. Typically, the IP strategies pursued by public and private universities today are far more similar than they are different.
[25] Feldman pg. 1800
[26] Commission on Life Sciences, "Intellectual Property Rights and Research Tools in Molecular Biology: Summary of a Workshop held at the National Academy of Sciences, February 15-16, 1996" 1997. Pg. 41
[27] Jelinek pg. 262
[28] See e.g. Annetine C. Gelijns, Samuel O. Their, "Medical Innovation and Institutional Interdependence: Rethinking University-Industry Connections," *Journal of the American Medical Association, January 2, 2002, Vol. 287 No. 1* pg. 75
[29] Jelinek pg. 259

Despite a general preference for exclusive licenses, some universities have developed interesting alternatives over the years. Carnegie-Mellon employs a standard agreement entitling it to a 5% equity share of any spin-off company resulting from university-generated technology. [30] In 1998, UC Berkeley pursued a controversial but lucrative partnership with Novartis, receiving $25 million in cash over five years in exchange for seats on the Plant and Microbial Biology department research committee and exclusive licenses to one-third of university-owned patents resulting from departmental research. [31] Stanford, for its part, continued to lead IP strategy innovation with its Engineering Portfolio of Inventions for Commercialization (EPIC) program. Instead of charging royalties on the finished product down the road (as Stanford did with Cohen-Boyer), the EPIC program pooled licenses, allowing industry partners to "subscribe" to a portfolio of intellectual property assets and receive non-exclusive license to it in exchange for a single up-front payment.

Looking Forward: the Politics of Innovation

Given the existing incentive structure facing research universities, a wholesale move from exclusive licensing remains unlikely without a fundamental change in perspective or the background law. Such change could be prompted by a larger regulatory shift or a shift in funding methods. The Bayh-Dole Act has been criticized by some for creating an "anticommons" of excessive patenting of upstream technologies, where new technologies cannot be developed due to the high cost of licensing necessary predicate technologies. [32] This kind of impact could be imagined if the Cohen-Boyer patents had been exclusive rather than widely disseminated. After 30 years and significant technological development, the Act could be ripe for reform with more open licensing identified as a goal.

Funders may also affect the range of approaches that universities take when it comes to licensing. Agencies such as the National Institutes of Health, the National Science Foundation and Department of Energy all require elaborate applications from researchers seeking grants. As the federal government increasingly focuses on innovation and technology commercialization, these grant applications could begin to require upfront commitments on creative strategies to deploy intellectual property to as to speed widespread commercialization.

Even absent changes in these external factors, universities ought to think broadly about the range of options with respect to intellectual property licensing beyond the standard exclusive license, with a view toward fulfilling institutional goals beyond revenue maximization. This kind of experimentation can lead to dividends that may or may not be easily captured on a university's balance sheet, but may benefit humankind in ways that help to fulfill our universities' deeper missions.

[30] Lipinski pg. 119
[31] See e.g. Lieberwitz pg. 789
[32] Kesan pg. 2180