Communicating the Full Value of Academic Technology Transfer: Some Lessons Learned

John Fraser

The following article is derived from "Communicating the Full Value of Academic Technology Transfer: Some Lessons Learned," originally published in the January 2008 edition of the Licensing Journal *and based on a presentation in January 2007 in Tokyo, Japan.*

Since the 1980 passage of the Bayh-Dole Act, academic technology transfer has gained profile, globally, as a key component of knowledge-driven economic development. The following article provides information on this phenomenon in the U.S. and summarizes some of the lessons I've learned.

Lesson 1: Clearly Written Policies Accelerate the Activity: Purpose of the Bayh-Dole Act

Academic technology transfer received a major boost in 1980 with the passage of the Bayh-Dole Act by Congress.[1] Essentially, by pre-assigning the option to acquire ownership of intellectual property (IP) created using federal grants, universities and small U.S. businesses would have certainty of ownership. Senator Birch Bayh (D-IN), co-sponsor of the act, believed that such certainty would increase the commercialization of academic and small-business discoveries into products that would improve the U.S. economy and U.S. competitiveness. At the time of passage of the act in 1980, the U.S. auto and steel industries were reeling under foreign competition. As Bayh said, "We had lost our no. 1 competitive position in steel and auto production. In a number of industries we weren't even no. 2."[2]

A number of universities in the U.S. enthusiastically supported this law and in 1980 took up the challenge of technology transfer. Interest expanded until, in 2006, AUTM's *Licensing Survey*™ identified technology transfer activities in 189 universities, hospitals, and research institutes.

With the passage of Bayh-Dole, many universities adopted written policies to clarify the conduct of commercial activities on their campuses. Specifically, these addressed disclosure mechanisms, intel-

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lectual property protection, commercialization responsibilities, and, in the case of success, profit distribution from successful technology transfer. Such policies established technology transfer as an acceptable academic pursuit and a creative vehicle for the benefit of society, in line with the Bayh-Dole Act. (See Figure 1.)

Lesson 2: Academic Technology Transfer Works!

Yes, it does. In fact, it is quite amazing to consider the far-reaching advances developed through this process and their profound impact, both on the economy as well as society. Some of the older, better-known products include:

- Taxol, an anticancer drug made by a process invented at Florida State University;
- Gatorade, a sports drink, developed at the University of Florida;
- Pablum, a baby food from the University of Toronto;
- Vitamin-enriched milk, created from research at the University of Wisconsin;
- Stannous fluoride, used in some brands of Crest toothpaste, first combined at Indiana University;
- Bufferin, the buffers in buffered aspirin, from the University of Iowa; and
- Mosaic, browser software prior to the Netscape browser, both from people from the University of Illinois.

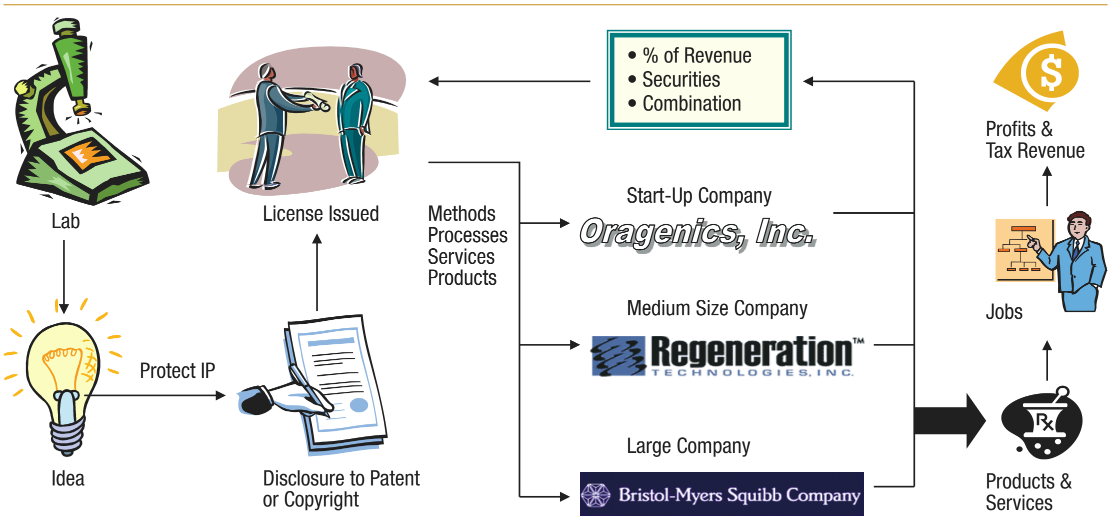
More recent products, highlighted in the Better World Project, published by AUTM, include:[3]

- Farecast, a Web site that helps travelers save money by forecasting the best time to buy airline tickets, designed at the University of Washington;
- ALEKS, intelligent student tutoring software from the University of California;
- ADEPT, a diagnostic system to detect early-stage Alzheimer's disease, credited to the University of Glasgow; and
- Levulan, a light-based therapy for skin conditions, including some cancers, invented at Queens University.

Invention disclosures, patents, and licenses, etc., are all parts of the process, but the ultimate goal is to help create products that benefit people.

The aforementioned innovations are only examples. AUTM reports in its FY2006 *Licensing Survey* that 697 new products were introduced into the market in 2006 for a total of 4,359 introduced from FY1998 through FY2006.[4] These well-known products all have at least one thing in common: Each and every one of them originated from discovery and invention at an academic institution. Some of them were patented, some of them are protected by copyright. All were licensed to a company as an idea/prototype that the

Figure 1: Lab to Market: A Chain of Value



Source: Florida Research Consortium

company then commercialized and brought into the marketplace.

The stories in the Better World Project illustrate the impact of the thousands of such products on society and the economy and show, without question, that academic technology transfer really works.

Lesson 3: The Impact of Technology (How to Measure Success)

For a number of years, observers of the field generally assumed that the best way to measure the impact of technology transfer was through the licensing income received each year. This approach bred an assumption that the most successful technology transfer offices were those that pushed for the highest payment and made the most money on deals. This may make sense in a commercial setting, but it overlooks key concerns in an academic setting, where the core mission of the institution is education, research, and community service. As Kevin Cullen elegantly points out in his article in the December 2006 issue of *Milken Institute Review,* universities will continue with an activity even if it generates a financial loss, as long as it has positive impacts in the local and larger community.[5]

Current thinking supports that the impact of technology transfer should be measured more comprehensively by taking into account a number of different factors. These include: increased financial support of the academic research activity, the number of licensing deals concluded, the number of products and services introduced to the marketplace, the number of companies and jobs created as a result of a license (spinout companies), as well as induced financial investment for product development, etc. Other measures include the impact of testing facilities, research parks, and incubators in the area around the academic center.

From the academic perspective, licensing income represents an isolated indicator of overall success; important, to be sure, but not the sole end of a licensing office. Frankly, the amount of licensing income generated is not under the control of the university at all. Rather, it is entirely dictated by market pressures, the usefulness of the actual product, and how adeptly the company brings the two together. Because the inherent risks and monetary costs of developing basic research into a marketable product are so high, a school's technology transfer office generally considers the commitment and capabilities exhibited by a commercial company, first and foremost, not how much they are willing to pay.

Lesson 4: Inputs, Outputs, Outcomes, and Impacts

Increasingly in America, the success of academic technology transfer is not registered through *inputs*—the number of disclosures or patents realized. Nor is it measured by *outputs,* the number of licensing agreements signed. Instead, considered more significant are the *outcomes*—reflected in the benefits of products brought to the marketplace—and the *impacts* that these products have on society, in terms of increased productivity and competitiveness, lives saved, and improved quality of life. This recognition is occurring despite the fact that universities exercise no influence over the *outcomes* and *impacts,* but only the *inputs* and *outputs.*

Personal experience has also shown that the metrics of an academic technology transfer program depend upon the age of that program. For example, an office that is less than five years old should measure progress by the number of disclosures, patents filed, confidentiality agreements signed, and licensing or research contracts signed. An office between five and ten years old should place less emphasis on these variables *(inputs)* and begin to look at the *outputs,* such as deals signed, increased funding to the research base of the university, and licensing income. After ten years, more emphasis should be placed on measuring the *outcomes* of the

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activity, such as the number of products in the marketplace. The previous *inputs* and *outputs* are still relevant measures, but of importance to managing the office, not measuring success. After ten years, the *impacts* of the activity can be meaningfully measured through the number of lives saved, improvements to the lives of patients, and also increased competitiveness and productivity as a result of the products introduced to the marketplace.

In summary, early in the life of a technology transfer office, measuring *inputs* provides a valid testament to the relative success of that program. Later, *outputs* receive more consideration (assuming the university has dedicated enough resources to allow this to happen). As the office and its relationship with faculty and corporate partners mature, *outcomes* produced by the licensed companies become increasingly important. Ultimately, once a number of products have been in the market for some time, *impacts* represents the truest barometer of success.

Lesson 5: Return on Investment (ROI)

I am often asked: What is the return on investment in technology transfer? Before answering, I stop and remind myself that the person is really asking about the *financial* return on *financial* investment. I usually start my answer by pointing out that my ROI calculation always begins by recognizing that the financial aspect is only one element (and usually not the most revealing) of a determination of ROI. Other elements include: the enhanced reputation of the university in the local economy, student enrichment through association with the activity in research labs and the licensing offices, and, not least of all, the national and international credibility gained by the institution.

The financial return depends on the financial investment. Many observers look at the major investment of public funds in research and look to the academic technology transfer for a return, as its purpose is to move research discoveries into products. The financial ROI depends as well on the investment in the office of technology transfer and whether or not there are sufficient resources to affect the outcome of commercialization. Calculations using a decade of AUTM *Licensing Surveys* show that, for all the reporting university programs, the average annual licensing income amounts to 3.2 percent of the annual reported research expenditures.[6] By any measure, this is a modest financial return, based on licensing deals done years before. The full impact and ROI are only truly understood once all other elements are taken into account.

Lesson 6: How Academic Discoveries Develop into Products that Benefit People

Universities do not undertake product development or product sales. Commercialization, therefore, occurs through licensing commercial rights to a company for development, or, in 15 percent of all yearly licenses, by creating a new company and basing its product development on a license from the university.

The process of developing a product in a corporation is complicated and extensive. Over the last several decades, the basic research and proof-of-concept activities (steps 1 and 2 in Figure 2) can occur in a university setting and are licensed into a company for further evaluation, then development and distribution of a product. Technology transfer offices act as conduits between the companies and the universities.

Lesson 7: Academic Technology Transfer Is an Enormous Activity in the United States

This is an enormous activity, fuelled by annual U.S. university research expenditures in the billions ($45 billion in U.S. research and development expenditures [FY2006]).[8] U.S.-based *AUTM Licensing Survey* respondents signed 4,963 new licenses, transfer-

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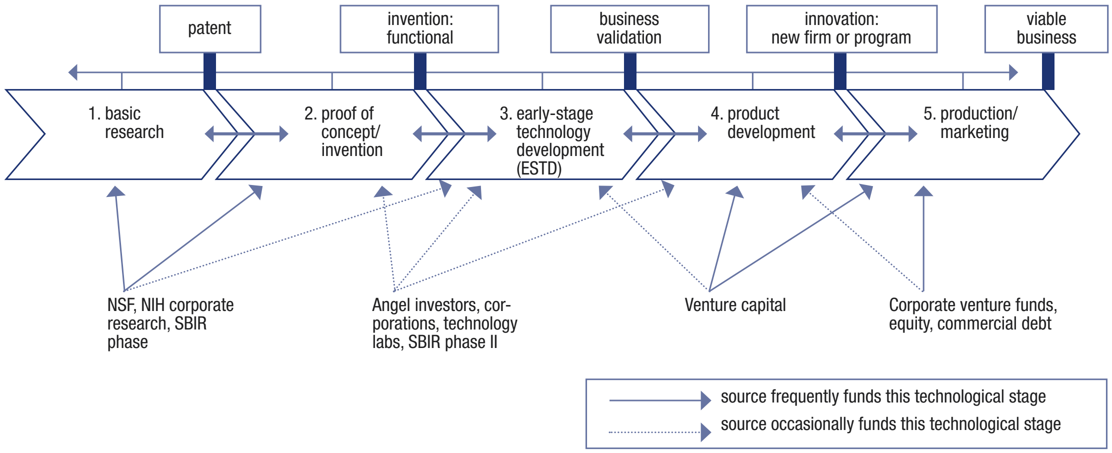
Figure 2: Sequential Model of Development and Funding

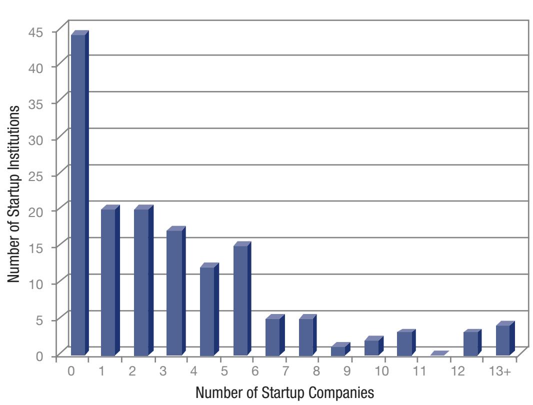


Source: National Institute of Standards and Technology[7]

ring commercialization rights to companies in FY2006. At any one time, respondents report there are more than 12,600 active U.S. licenses yielding income, each representing a one-on-one relationship between a university and a company.[9] Such arrangements exist in every state and every part of the country.

Of the 4,963 licenses above, 553 were used to create a newly incorporated spin-out company. Survey respondents reported 5,724 new spinouts since 1980. Six hundred ninety-seven new products were introduced into the market in 2006, bringing the total entering the market to 4,350 from FY1998 through FY2006 alone.[10]

Figure 3: Startup Companies Formed By U.S. Universities, 2006



Source: AUTM Licensing Survey Summary™, FY2006[11]

Lesson 8: Startup Companies: One Aspect of Economic Impact

Figure 3 shows that many institutions are assisting their faculties in this activity, and the number of startups, per institution, is very diverse. For FY 2006, 17 universities created three startup companies each, and four universities each created more than 13 startups. Naturally, the universities with the largest research expenditures are clustered on the right side of the chart. Clearly, not every university functions at the same level of technology transfer activity. There were 44 universities that reported no startups that year.

While slightly dated, Table 1 shows another fascinating aspect of academic startups: Individuals represent almost half of the initial investors. Professional, institutional investors, whether venture capital groups, government, or corporate investors, do not dominate the initial investor groups. The largest fraction of reported funding came from neighbors, friends, and family.

Lesson 9: New Metrics

Academic technology transfer has gained profile through the publishing of the *AUTM Licensing Survey.* This gold standard report has provided consistent definitions and reports on the U.S. and Canadian activity for the past 15 years. The number

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Table 1: US-18 Sources of Funding for New Startups Formed by U.S. Respondents in 2004

Individuals	**Number**	**%**
Friends and Family	94	20.5%
No External Funding	57	12.4%
Individual Angel(s)	49	10.7%
Angel Network	26	5.7%
Institutional Sources		
Venture Capital	85	18.6%
State Funding	36	7.9%
SBIR/STTR	32	7.0%
Corporate Partner	25	5.5%
Institutional Funding	26	5.7%
Other	28	6.1%
Total	**458**	**100.1%***
Number of U.S. Respondents	155	

**Because of rounding, total does not equal 100%.*

Source: AUTM Licensing Survey Summary, FY2004[12]

of disclosures, the number of patents, the number of licenses, and the gross licensing income are presented. The easiest measure to track in the survey is the gross licensing income total across the United States. Over time, readership expanded while the notion of universities as local engines of economic development gained momentum. Academic technology transfer was one interface of the university and the local economy. Given the data presented and the emphasis, readers assumed that the purpose of technology transfer was simply lucrative licenses–income. Overlooked and underemphasized were the economic benefits attributable to startup companies, research parks, bolstering the research base, and new products entering the marketplace—or what I would call the *impacts.*

AUTM is moving beyond its traditional metrics to create additional measures of success and provide a broader understanding of the process, as well as the impact. AUTM is undertaking a pilot experiment[13] with counterpart organizations in the United Kingdom (UNICO) and in Canada (Alliance for Commercialization of Canadian Technology [ACCT]). In all three countries, there has been coordinated consultation with senior academic leadership, policy-makers, politicians, and grant providers to help identify new metrics, collect the data, and publish it.

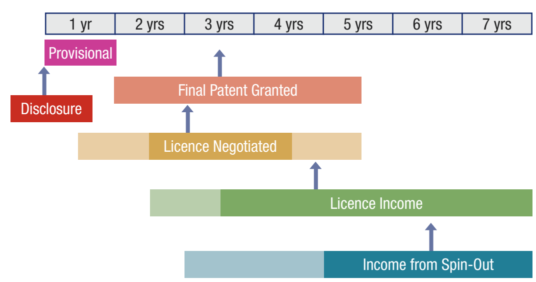
The traditional approach to quantifying this activity no longer provides as complete a picture as the public requires. Table 2 lists some of the additional metrics that AUTM, UNICO, and ACCT might implement to measure the impact of technology transfer. While incomplete, the table provides some sense of the direction.

Table 2: Potential Metrics

Internal to the Institution	**Measured by**
Research partnerships	Numbers and $$ size
Products in market	Case studies
External to the Institution/ Impact in the Community	
Research park, incubators	Local licenses, interactions with university
Local startup companies • With technology licenses • Without technology licenses	Jobs created and sustained Investments in product development Stories and case studies

Lesson 10: Time Is a Major Factor in the Technology Transfer Process

Figure 4: The Phasing of the Value Chain



Difficult to generalize. Averages hide wide variation in individual transactions

Source: Southern African Research and Innovation Management Association[14]

The chart in Figure 4, created by Southern African Research and Innovation Management Association (SARIMA) researchers in 2005, represents a study of data from many countries including South Africa, the United Kingdom, the United States, and Canada. As illustrated, the interval separating disclosure by the university and introduction of the eventu-

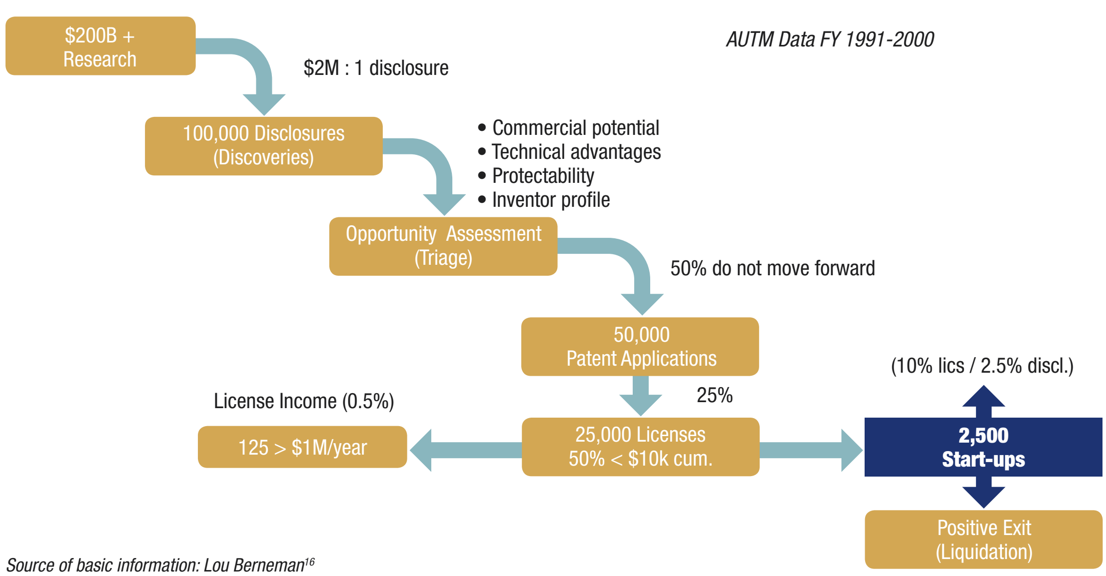
al product into the marketplace by the corporation is measured in many years. The color bars indicate the spread of the data for any measurement. The SARIMA study found that, from the point of disclosure, granting a company a license took well over three years on average in the United Kingdom, the United States, and Canada. Notice the difference between licensing income from licenses granted to existing companies versus successful product introduction by spinout companies; a significant number of years after founding of the spinout. University of British Columbia's Caroline Bruce pointed out that a pharmaceutical product takes much, much longer than indicated in the above chart (personal communication). (As an aside, a necessary characteristic of people active in academic technology transfer is patience and wanting to create a portfolio of licenses.)

A fascinating study is under way, led by Ashley Stevens, Boston University, and Mark Rohrbach, National Institutes of Health, that emphasizes impact and time. Preliminary results were displayed as a poster at the 2007 AUTM Annual Meeting℠. Of the small molecule drugs, vaccines, biologic drugs, and in vivo diagnostics approved by the U.S. Food and Drug Administration (FDA) since 1980, more than 131 are based on a key patented invention from an academic institution.[15] According to Stevens (personal communication), preliminary data showed that, on average, a period of 5.6 years elapsed between receipt of an external grant to perform research, the disclosure of the invention, and filing the key patent. On average, a further 12 years passed until the patented invention was developed into a drug and received approval from the FDA.

Lesson 11: Failure Is a Key Characteristic of Academic Technology Transfer

Failure is much too drastic a term, but I use it to make a point. Not everything the technology transfer office handles turns into gold. The flow diagram in Figure 5 was created by Lou Berneman from the *AUTM Licensing Surveys* conducted during the 1990s. He found that, of the reported disclosures that resulted from the $200 billion in funded research and development, 50 percent of them led to patents and 50 percent did not. Only 50 percent of the filed patents were licensed. The other 50 percent stayed in the filing cabinet. Of the signed licenses, 10 percent went to startup companies (15 percent in 2006). Of the 25,000 licenses in place in FY1999, only 125 had royalties

Figure 5: From Disclosure to Patent Royalties



Source of basic information: Lou Berneman[16]

of more than $1 million that year. Small numbers! This reflects a great deal of work and expenditure, which for the most part, generate only modest financial returns (if that is all you measure).

Over 99.5 percent of the licenses in place generated a yearly amount less than $1 million each (*AUTM Licensing Survey,* and above). It was reported recently that, in the enormous University of California system, only slightly more than 4 percent of all licenses earned more than $100,000 per year.[17] Therefore, universities engaging in technology transfer for the sole purpose of making money, or to replace declining state or federal financing, are in for a major disappointment, based on the statistics.

Lesson 12: The External Environment Is Changing

Recently, a significant number of recent U.S. Supreme Court cases have changed the landscape of academic technology transfer. R. Polk Wagner commented on the following cases:[18]

- ***MedImmune v. Genentech:*** Companies can obtain a license and later sue to have the licensed patent invalidated or declared non-infringing. This ruling represents "a big shift of power to licensees and away from patentees."
- ***e-Bay v. MercExchange:*** "This is a big loss for patentees because injunctions are no longer almost automatic, so patents are naturally weaker and enforcement is much more costly," says Wagner.
- ***KSR v. Teleflex:*** Wagner continues, "The fact that KSR is out there gives challengers another crack at the patent." People will "need to think through very carefully in terms of patenting strategy whether [a potential patented technology] is indeed something that no one had thought of before, and that nobody could have thought of before even though all elements of it were preexisting. That's the key argument you're going to have to make—the same argument as before *KSR,* but I think it will be a little bit harder to win those cases today, particularly with simplistic technologies." His advice is to keep papers or other documents from people, who at the time of the invention, did not think what was being proposed as an invention would work.
- **Patent Reform Act 2007:** Wagner noted many elements, but pointed to the "establishment of postgrant opposition procedures, which will create a system of 'mini-trials' at the U.S. Patent and Trademark Office that would attempt to resolve patent disputes before going to the expense of full-scale litigation." Major players in the professional venture-capital community have written Congress and pointed out that the open-endedness of this element will greatly add to the risk of an early-stage startup based on recently patented technology, in that a challenger has a relatively inexpensive way to call the validity of the patent into question. (In my opinion, this Patent Reform Act element, if passed as is, will have a devastating effect on the willingness of seed-stage investors to invest in university startup companies.)
- **U.S. Patent and Trademark Office rule changes:** While an injunction has delayed implementation, Wagner states that the changes will "radically alter the way people do patent prosecution; change the nature of examination; and make [patenting] harder, more costly, and more risky."

Overall, the presumption of patent validity that strengthened significantly starting during the term of President Reagan seems to be significantly weakening during the term of President Bush, 25 years later.

Lesson 13: After 25 Years, Big Players Are not the Only Players

As seen in Table 3, the distribution of deals with different-sized companies has

remained relatively steady in the last eight years. Note particularly the drop in licenses with large companies (more than 500 employees) and the significant number of licenses to startup companies (defined as companies founded on the license). But the bulk of the action remains with small companies (under 500 employees).

Table 3: Where the Action Is

FY	Total Licenses/ Options	To Startups	To Small Companies	To Large Companies
1999	3,792	12%	50%	38%
2006	4,963	15%	49%	33%

Source: AUTM Licensing Survey Summary, FY 1999, FY 2006[19]

Lesson 14: Having a Large Institutional Research Base Matters

Table 4 includes the top U.S. research universities, reporting to AUTM by yearly research expenditure, and separates those reporting the most research expenditures (the Top 20); the 10 next largest (for the Top 30); then all the 141 universities that reported in FY 2005.

In Table 4 the Top 20 line of the table reads: The Top 20 universities (representing 14 percent of the 141 institutions) employed 35 percent of the licensing professionals (full-time employees), generated 77 percent of the three-year royalty averages, and were older than the other 86 percent of the reporting universities. This table shows that it takes time to build up a significant royalty cash flow (no surprise), that a large research base is important, and that the royalty cash flow is highly concentrated in the very large schools with the oldest programs.

Lesson 15: Know Your Commercial Partner

Jack Sams has worked with me at FSU for the past decade. While an IBM employee, he licensed the DOS operating system from Bill Gates at Microsoft for IBM to power the early IBM PC in 1980. He has pointed out that, while there are different approaches to academic licensing to the information technology community compared to the pharma/biotechnology sector, the more important cultural differences exist between the academic sector and the private sector, not within the industry sectors. In a 2007 workshop he pointed out several differences in perspective.

PRIVATE SECTOR PERSPECTIVE

Everyone is an employee, thus,

- Each employee works on assigned portions of a problem.
- Research results belong outright to employer.
- Royalty payments to employees are rare to nonexistent.
- Results are kept secret.
- Attribution of the research is largely anonymous.
- Management controls use of research.
- And, the above statements are the assumed starting point for collaborations with universities.

UNIVERSITY PERSPECTIVE

Employees are primarily teachers and/or professors, thus,

- Research is self-directed, not assigned.
- Research funds are personally solicited.
- Results are the property of the researcher.

Table 4: Size Matters*

Universities FY2005	Percent	FTEs	Percent	3-Year Royalty Totals (B $$)	Percent	Median Age
Top 20	14	234	35	2,357	77	1983
Top 30	21	322	48	2,597	85	1983
All 141	100	667	100	3,064	100	1989

Source: AUTM Licensing Survey FY2005[20]

*See text for further explanation.

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- Academic publication and personal attribution are the primary goals.
- Researchers are required to assign rights to university.
- Researchers are entitled to share in revenue thus obtained.

- Researchers may retain control of use/revision of works.[21]

The key point is that corporate attitudes in negotiating an academic license are based on the above common practices (usually unstated) inside the company. The successful academic technology transfer officer will recognize this and clarify the differences for all parties.

Lesson 16: Expect Problems

In an enterprise as vast as U.S. academic technology transfer, with 12,000 active relationships between one university and one company (all involving cultural differences, egos, time zones, and generational differences), expect problems. Recently, Congressional hearings and articles have purported to show that not all is well with regard to Bayh-Dole. There have been articles stating that the system does not work, that a major overhaul of academic technology transfer is required, and the Bayh-Dole Act needs to be changed and "improved." These authors point to a number of stories and presume to project anecdotal instances into a general condemnation of the entire system. Mark Crowell, a former AUTM president, reminded the audience in a 2006 Council on Governmental Relations workshop that "the plural of anecdote is not data"[22] on which to make solid decisions.

It would be a real surprise if there were not problems in a system this large and complex with so many different players. This is a human interaction activity, with many people involved. Change is constantly occurring; sometimes internally driven, other times in response to external pressures. Problems are an unavoidable part of this activity.

Lesson 17: Communicating the Value of Public Sector Technology Transfer

AUTM's *Better World Reports*[23] are a new tool for communicating the value of academic technology transfer. Combined, the reports contain hundred of stories of products in the marketplace, all based on academic inventions. Behind it is a database of almost 500 stories from the U.S., the UK, Canada, and, increasingly, other countries. Collectively, these stories supplement the data in the *Annual Licensing Survey.*[24]

Lesson 18: The Nine Points to Consider—Neglected Diseases

In the summer of 2006, representatives from twelve of the leading U.S. universities wrote a document entitled "In the Public Interest: Nine Points to Consider in Licensing University Technology"[25] that identified certain shared perspectives emerging within the U.S. academic community. In it, they stated:

> Recognizing that each license is subject to unique influences that render 'cookie-cutter' solutions insufficient, it is our aim in releasing this paper to encourage our colleagues in the academic technology transfer profession to analyze each licensing opportunity individually in a manner that reflects the business needs and values of their institution, but at the same time, to the extent appropriate, also to bear in mind the concepts articulated herein when crafting agreements with industry. We recognize that many of these points are already being practiced. In the end, we hope to foster thoughtful approaches and encourage creative solutions to complex problems that may arise when universities license technologies in the public interest and for society's benefit.

The ninth point, in particular, illustrates one of the new currents shaping activities in the community:

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Consider including provisions that address unmet needs, such as those of neglected patient populations or geographic areas, giving particular attention to improved therapeutics, diagnostics, and agricultural technologies for the developing world.

Summarized from the nine points text: Universities share a social compact with society. As educational and research institutions, they share a vested responsibility to generate and transmit knowledge, both to students and society at large. Centers of higher learning assume a specific and central role in helping to advance knowledge in many fields and to manage the deployment of resulting innovations for the public benefit. In no field is the importance of doing so clearer than it is in medicine.

Around the world, millions of people suffer and die from preventable or curable diseases. The failure to address this serious problem has many causes. However, there is an increased awareness that responsible licensing demands consideration of human needs in developing countries and underserved populations. This includes a responsibility, on behalf of both academia and industry, for finding a way to share the fruits of what we learn globally at sustainable and affordable prices, for the benefit of the world's poor.

The details involved in any agreement attempting to address this issue are complex, requiring expert planning and careful negotiation. The application will vary in different contexts. The principle however is simple. Universities should strive to construct licensing arrangements in ways that ensure that these underprivileged populations have low- or no-cost access to adequate quantities of essential medical innovations.

Conclusion

Today, academic technology transfer licensing is recognized as successful and a key component of knowledge-driven economic development. It is having a substantial economic and social impact in our society, as measured by products that save lives, improve the quality of life, and increase the competitiveness and productivity of the licensed corporations. Just what the Bayh-Dole Act wanted.

Former AUTM President John Fraser is the assistant vice president for research and economic development and executive director of the Office of Intellectual Property Development and Commercialization at Florida State University. He can be reached via e-mail at jfraser@research.fsu.edu.

Notes

[1]Birch Bayh, "Don't Turn Back the Clock," *les Nouvelles* (December 2006). In this article, the former senator reminisces about the purpose of the bill and the cut and thrust around its passage. It can be downloaded at http://www.lesi.org/BirchBayh/Bayh.pdf.

[2] Ibid.

[3] AUTM publishes the *Better World Report* series, which lists modern products based on discoveries at academic centers and commercialized by companies around the world. They can be downloaded at http://www.betterworldproject.net/. Like many universities, Florida State University has a Product Showcase page of discoveries that led to products. It can be found at http://www.techtransfer.fsu.edu/.

[4] The *AUTM Licensing Survey* can be found at http://www.autm.net/about/dsp.Detail.cfm?pid=214.

[5] Kevin Cullen, "Big Ideas: The Squeeze on Universities," *Milken Institute Review* (December 2006): 215–218.

[6] This information is harvested from 10-year data (FY1997–FY2006, *AUTM Licensing Survey*), available online from STATT, a data warehouse created under the leadership of Dana Bostrom during her tenure as AUTM's vice president for metrics and surveys. It is available at http://www.autm.net/directory/index.cfm.

[7] Lewis M. Branscomb and Philip E. Auerswald, "Between Invention and Innovation: An Analysis of Funding for Early-Stage Technology Development," http://www.atp.nist.gov/eao/gcr02-841/contents.htm.

[8] The *AUTM Licensing Survey,* FY2006, located at http://www.autm.net/about/dsp.Detail.cfm?pid=214.

[9] Ibid, 5.

[10] Ibid, 5.

[11] Ibid, 38.

[12] The *AUTM Licensing Survey,* FY2004 located at http://www.autm.net/about/dsp.pubDetail2.cfm?pid=28.

[13] *AUTM Licensing Survey,* FY2006, 9.

[14] This information was developed by the Southern African Research and Innovation Management Association and presented at the 2005 AUTM Annual Meeting in Phoenix, Arizona.

[15] Ashley Stevens and April Effort, "Using Academic License Agreements to Promote Global Social Responsibility," *les Nouvelles* (June 2008): 1.

[16] Lou Berneman presented at a National Council of University Research Administrators Summer Workshop, Colorado, 2002. "Academic Technology Transfer." Bottom three boxes modified by author, 2005.

[17] *Chronicle of Higher Education* (November 23, 2007): A21. G Blumenstyk

[18] R. Polk Wagner, "The Rapidly Evolving Patent Law Landscape: Practical Impact for Tech Transfer Professionals," *Technology Transfer Tactics,* August 2007.

[19] As per Table US-6, *AUTM Licensing Survey,* FY2006, 31. Note rounding error.

[20] From *AUTM Licensing Survey* FY2005 data, at the

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suggestion of Ashley Stevens.

[21] Jack Sams, Florida State University, CREATE presentation, 2007.

[22] Found at http://www.sysprog.net/quotdata.html.

[23] Found at http://www.betterworldproject.net/.

[24] A favorite story of mine involves an antistuttering device, invented at East Carolina University, brought to market by a startup company. Search at http://www.betterworldproject.net/.

[25] Found at http://www.autm.net.