Technology Survey of 20 Universities

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An examination of differing modes of technology transfer to private industry by leading universities

The decade of the 1980s ushered in a substantial increase in technology transfer activities for U.S. universities. Several larger U.S. universities have been involved in technology transfer since the turn of the century and based on their activity, it is certain that the new development of interest in technology transfer will not in any way displace the two primary missions of the U.S. university: (1) scholarly research and publication and (2) student education and training. Spurred by recent federal legislation, new potential sources of research funding, and an increased awareness on the part of the university to return the fruit of federally funded research to the public, technology transfer operations and strategy have sprung up in many different forms that can be confusing to the corporation interested in examining, analyzing and acquiring the technology. A telephone survey conducted by the University of Southern California Office of Patent and Copyright Administration between April and June 1989 of 20 U.S. leading universities (based on R&D expenditures) examined the different modes of technology transfer to private industry.

The survey examined two groups of 10 U.S. universities: Group I, listed in Figure 1A, comprised of the top 10 U.S. universities based on total R&D spending in 1987, and Group II, comprising the 10 universities ranking from the top 50th to the top 59th university in terms of R&D spending in 1987 as listed in Figure 1B.

Group I U.S. universities had R&D spending ranging from $188,682,000 to $510,896,000 in science and engineering, while Group II universities had R&D spending ranges at approximately one-third and less of Group I levels: from $65,341,000 to $79,090,000.

GROUP I INSTITUTIONS
Total R&D Spending for 1987

1. THE JOHNS HOPKINS UNIVERSITY	$510,896,000
2. MASSACHUSETTS INSTITUTE OF TECHNOLOGY	264,416,000
3. UNIVERSITY OF WISCONSIN, MADISON	254,493,000
4. CORNELL UNIVERSITY	244,840,000
5. STANFORD UNIVERSITY	240,885,000
6. UNIVERSITY OF MICHIGAN	224,890,000
7. UNIVERSITY OF MINNESOTA	222,381,000
8. TEXAS A&M UNIVERSITY*	219,853,000
9. UNIVERSITY OF CALIFORNIA, LOS ANGELES*	188,831,000
10. UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN	188,682,000

*Technology transfer information based on system wide statistics

Source: Chronicle of Higher Education
"Fact File: The Top 100 Institutions in Total Research-and-Development spending for fiscal 1987" (Expenditures in science and engineering)

Figure 1A

GROUP II INSTITUTIONS
Total R&D Spending for 1987

50. UNIVERSITY OF IOWA	$79,090,000
51. IOWA STATE UNIVERSITY	78,351,000
52. YESHIVA UNIVERSITY	73,773,000
53. UNIVERSITY OF ALABAMA, BIRMINGHAM	72,692,000
54. CASE WESTERN RESERVE UNIVERSITY	70,850,000
55. STATE UNIVERSITY OF NEW YORK, BUFFALO*	70,474,000
56. UNIVERSITY OF UTAH	68,194,000
57. THE ROCKEFELLER UNIVERSITY	66,760,000
58. UNIVERSITY OF TEXAS SYSTEM CANCER CENTER	65,417,000
59. INDIANA UNIVERSITY	65,341,000

*Technology transfer information based on system wide statistics

Source: Chronicle of Higher Education
"Fact File: The top 100 Institutions in Total Research-and-Development spending for fiscal 1987" (Expenditures in science and engineering)

Figure 1B

◄ Transfer Methods ►

Three methods of technology transfer management are possible for the U.S. university: an internal university office, a foundation or an outside management organization. Figure 2 illustrates that 79% of the universities in Group I budgeted for an internal university office. Only one of the Group I universities opted for an outside management organization as compared to three of the Group II universities. The

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TECHNOLOGY TRANSFER MANAGEMENT SYSTEMS

	Group I	Group II
INTERNAL UNIVERSITY OFFICE	7	4
FOUNDATION	2	6
OUTSIDE MANAGEMENT ORGANIZATION	1	3
	10	13*

**Some institutions/foundations utilize an outside management organization in addition to an internal office.*

Figure 2

foundation system was actually utilized more by Group II universities than Group I, and basically allows for an entity separate from the university to operate, in certain instances, in a more market oriented and quicker mode than universities are accustomed.

The corporation attempting to locate the university office responsible for technology transfer must often have patience with the university telephone directory or operator due to the diversity of technology transfer office names as illustrated in Figures 3A and 3B, which list the various names given to the office by the universities of Groups I and II. Only one name, Technology Transfer Office, was utilized by two different universities, and in every other case a different name was given to the technology transfer organization.

Figures 4 and 5 illustrate the decision-making and reporting entities of the various technology transfer offices. Both Group I and Group II universities, in the majority of cases (60%), have signature authority within the office. However, 40% of Group I and Group II universities must go to higher authority at the university, which often can take considerable time and often there are several administrators at the university responsible for agreeing to a technology transfer agreement.

Sometimes it is not obvious to the potential licensee as to who the appropriate decision makers are and in some instances the university itself is not certain at the beginning of negotiations. In the case of equity arrangements the university administration and/or trustees may have to give approval.

OFFICE NAMES
Group I

Cornell Research Foundation
Intellectual Properties Office
Office of Patents and Licensing
Office of Technology Licensing
Office of the Vice-Chancellor, Research
Patent Management Office
Patent, Trademark, and Copyright Office
System Office
Technology Licensing Office
Wisconsin Alumni Research Foundation

Figure 3A

OFFICE NAMES
Group II

Indiana University Foundation
Iowa State University Research Foundation
Office of General Counsel
Office of Technology Development
Office of Technology Liaison
Technology Transfer Office - 2
UAB Research Foundation
University Technology Incorporated

Figure 3B

REPORTING ENTITIES

Group I

Vice-President, Research
Vice-Chancellor, Research and Corporate Relations
Vice-President, Administration
Associate Vice-President, Finance

Group II

President
Vice-President, Research
Executive Vice-Chancellor
Vice-President, Administration
Vice-President, Business Affairs

Figure 4

DECISION MAKERS
Signature Authority: Licensing Agreements

	Group I	Group II
Within Office (University/ Foundation)	6	6
Other	Chancellor-1	VP Business Affairs-2
	Director of Sponsored Research-1	VP Research-1
		General Counsel-1

Signature Authority: Equity Arrangements-Administration

Figure 5

In the Group II universities the technology transfer office typically has more visibility to top management, with reporting requirements that may include the president, where as in the Group I universities, the vice-president of administration or research is typically the highest university administrator involved with technology transfer activities.

The professional personnel of the university technology transfer office represent a wide background of educational and corporate experiences. Although there are occasionally senior industry experienced technology transfer personnel at universities, many of the professional technology transfer university personnel are young with little or no industry experience. University technology transfer offices seem to be either technical and market oriented, or are legally oriented, staffed solely with patent attorneys or patent agents.

Turnover at university technology transfer offices is moderate to high as many of the young people, after obtaining university experience, transfer into a private corporate or venture capital environment. Figures 6A and 6B illustrate the diversity of titles of professionals at the technology transfer office. Figure 7 illustrates the professional staff ranges at the Group I and Group II universities. There is a constant need for qualified technical- and marketing-trained professionals, however, severe constraints in the university budget systems make it often difficult to adequately staff the office at the same level as a similar corporate licensing office.

◄ Government Incentive ►

The United States Government incentive captured through Public Law 96-517 and Public Law 98-620 and later codified to 37 CFR Part 401 (Figure 8) provided the motivation for many U.S. universities to aggressively budget and staff a technology transfer office in the early 1980s. The ability of the university to retain title, grant exclusive licenses, and use the balance of royalty income after expenses for scientific research helped motivate the large inertial forces of U.S. universities to establish technology transfer offices.

A timeline with three distinct phases starting with the passage of Public Law 96-517 can categorize the university technology transfer

POSITION TITLES
Group I

Associate Vice-Chancellor for Research
Director
Associate Director
Intellectual Property Counsel
Patent Attorney
Resident Counsel
Manager, Technology Licensing
Technology Licensing Associate
Technology Licensing Officer
Associate
Manager, Market Research
Marketing Representative
Manager, Technology Evaluation
Patent Management Officer
System Patent Administrator
Technology Evaluation Associate
Manager, Sponsor Relations
Policy, Legislation & Governmental Relations
Sponsor Relations Associate
Business Manager
Manager, Administration
Manager, Software Distribution Center

Figure 6A

PROFESSIONAL STAFF (RANGES)

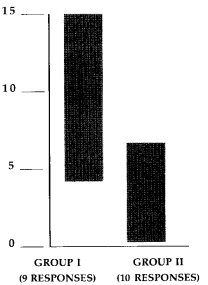

Figure 7

THE UNITED STATES GOVERNMENT INCENTIVE
37 C.F.R. Part 401
(P.L. 96-517/P.L. 98-620)

1. University may elect to retain title.
2. University may grant nonexclusive or exclusive licenses.
3. Preference for U.S. industry.
4. U.S. Government retains nonexclusive, world-wide, royalty free license.
5. Rights flow down to lower-tier subcontractors.
6. Royalty income must be shared with inventor(s).
7. The balance of royalty income, after expenses, must be utilized for scientific research or education.
8. U.S. Government retains "march-in" rights.

Figure 8

ANNUAL BUDGET FOR LEGAL EXPENSE (RANGES)

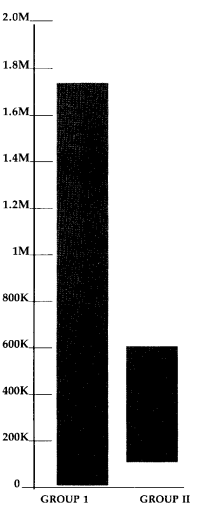

Figure 9

POSITION TITLES
Group II

President
Vice-President and General Counsel
Executive Director
Associate Director
Assistant General Counsel
Legal Assistant
Industrial Liaison
Licensing Associate
Licensing Manager
Technology Liaison Officer
Marketing Representative
Patent Manager
Technology Analyst
Research Administrator
Office Business Manager

Figure 6B

development. Phase 1, a five-year period from 1981 to 1986, can best be characterized as the initial stage for most U.S. universities where technology transfer offices were first established or given sufficient budget to recruit fulltime personnel and provide minimal resources for carrying out the university technology transfer function. During this first phase only several option and license agreements were executed and, except in a few special situations, no royalty payments were being received as no products were actually commercialized. A second five-year phase from approximately 1987 to 1992 can be categorized as a growth stage with an increase in option and license agreements and the beginning of royalty income streams as several products, licensed in Phase 1, are starting to be commercialized. Also, a number of the license agreements entered into during Phase 1 may have been discontinued. Income is moderate, and many university technology transfer offices would still be in the "red" from the financial viewpoint. Phase 3, beginning in 1992, should herald the onset of large increases in the number of license agreements executed, increasing royalty income from the influx of commercializable products and substantial increase in staff as the university technology transfer office provides a noticeable source of income for the university. Because substantial research funding sometimes accompanies a license agreement, an increase in funding from private industry may also be an indicator of Phase 3 activity. With the exception of several large deals, the technology transfer activities at the U.S. university will still play a minor, but important role as compared to the primary missions of the U.S. university which were outlined at the beginning of this paper.

Annual budgets for the technology transfer office varied tremendously as depicted in Figure 9. Group 1 U.S. universities with the exception of the university using an outside management organization had budgets from $200,000 to $1,700,000 just for outside legal ex-

pense which primarily consists of filing patent applications, assisting in licensing negotiations, and some limited litigation. Group II U.S. universities were able to allocate only up to $600,000 for outside legal expense. The balance of budget which could be from one to three times the legal expense was allocated for salaries, equipment, training, travel and various administrative assignments.

ROYALTY DISTRIBUTION

	GROUP I	GROUP II*
Inventor	10	9
Institution's General Fund Research	8	9
Administrative Cost Recovery/Office/Foundation	7	4
Inventor's Department	6	3
Inventor's College or Division	4	1
Inventor's Laboratory	1	1
Sliding scale distribution applied	3	3
Flat rate distribution	7	6

Inventor's share ranged from 10%-50% of net income.
Several universities allow the inventor to have equity.
* *9 Group II Institutions replied*

Figure 11

ANNUAL INCOME FROM LICENSING ACTIVITY (RANGES)

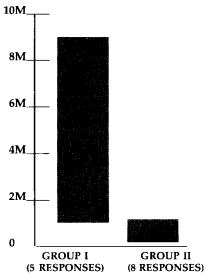

Figure 10

Annual income from licensing activities is accelerating, and as listed in Figure 10, ranges in the case of Group I universities from slightly less than $1,000,000 to more than $9,000,000. Group II universities, however, show substantially less licensing income from less than $100,000 up to less than $1,000,000. From licensing income royalties were distributed, as listed in Figure 11, both in Group I and Group II universities, to the inventor as well as to the institution's general fund, inventor's department, college/division, or laboratory, and to administrative cost-recovery.

Most universities have a flat rate distribution, and some provide as high as 50% of the net licensing income to the inventor, while others provide only 15% of net licensing income to the inventor. Only 30% of each Group of universities have sliding scale royalty distribution schemes (as increasing amounts of royalty income is received by the university, the university receives a proportionately larger share). Although the conflict of interest problem is a sensitive issue to the U.S. university, several universities will allow the inventor to have equity as well as licensing income from technology transfer arrangements.

◄ Larger Budget ►

In Group I universities, the larger legal budget for outside counsel filing patent applications resulted in a proportionately larger share of U.S. patents issued per year, ranging from approximately 10 to 90 issued U.S. Patents (Figure 12). Group II universities, because of the limited monies for filing, had a proportionately smaller number of U.S. patents issued per year. The number of licensing agreements executed per year, including both patentable inventions and copyrightable intellectual property ranged in Group I, as listed in Figure 13, from approximately 10 agreements to 90 technology transfer agreements. Group II universities typically experienced from approximately 8 to 30 executed license agreements on intellectual property per year.

The U.S. university relies on several marketing strategies to reach its corporate partner. Figure 14 describes the various methods of university technology transfer marketing. Several universities have become aggressive marketers and have produced catalogs and made company visits. Others rely solely on faculty contacts and provide lists of only patent application titles with no accompanying marketing information. Increasingly, companies are sending "wish-lists" to university technology transfer offices in the hope that as soon as something crosses the desk of the university technology transfer professional the company will be alerted.

ANNUAL INCOME FROM LICENSING ACTIVITY (RANGES)

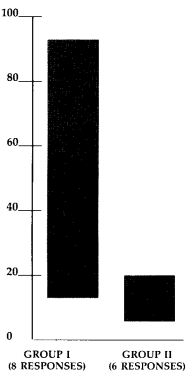

Figure 12

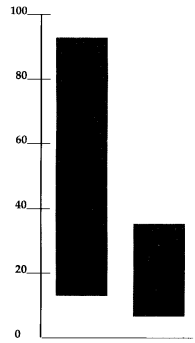

Figure 13

MARKETING EFFORTS

A. Direct contact with licensing, new product development or research departments of industry leaders. Sources for contacts:
   - Industry Directories
   - Product lists
   - Wish lists
   - Reference books
   - Faculty contacts
   - Company visits to university technology transfer offices
   - Member lists and directories of various organizations and societies
   - Specialized purchasing manuals

B. Participation in national and international conferences, seminars and meetings such as LES.

C. Publication in technology transfer journals.

D. Contacts made through technology transfer agencies and companies.

E. Market intelligence, i.e., review of new products and companies in the marketplace in business journals and technical publications.

Figure 14

Almost uniformly, once an interested corporate licensing executive has been contacted, the university requires the execution of a secrecy agreement by the company. A period of technical interchange then occurs and provided the technology seems marketable to the company, negotiations begin on an option and license agreement perhaps with some research funding. The survey indicated that option and license fees range from several thousand dollars up to $1,000,000, and royalties range from .5% to over 20%. In certain states of the United States, indemnity and product liability insurance are deal breaking issues, especially for smaller companies attempting to obtain university technology. Faculty consulting is sometimes part of the license agreement although typically handled by a separate document in most universities. Development agreements for work performed at the university may also be part of the technology transfer.

Companies often complain about the high initial option and license fees as well as royalty rates that universities require for very often embryonic technology. Universities are realizing that many of their licensable technologies need substantial additional development, engineering and often governmental approval. The universities realize these tasks are risky and that the university is not contributing monies to these additional developments. If a company clearly outlines the risks associated with the technology to be licensed, the university technology transfer professional can often be convinced to accept a financial arrangement in the patent license agreement that makes sense for the company. There is pressure in a university technology transfer office for the "big hit" and a company's response to outrageous proposed license fees should be a thorough and persuasive marketing analysis and/or business plan.

◄ Success Stories ►

The licensing success stories of U.S.universities are reiterated constantly when university technology transfer professionals meet at their various professional societies. The Stanford/U.C. Cohen-Boyer patents *Process for Producing Biologically Functional Molecular Chimeras* (U.S. Patent No. 4,237,224, issued December 2, 1980) and *Biologically Functional Molecular Chimeras* (U.S. Patent No. 4,468,464, issued August 28, 1984) currently have approximately 91 licensees paying $10,000 per year in a nonexclusive arrangement with royalty positions varying from 0.5% to 2% depending on the end product. The anti-cancer drug Platinol (cisplatin) marketed by Bristol-Myers and developed at Michigan State University currently has an annual world market of more than $100,000,000. Other U.S. universities have recently been very successful in selling their equity positions or patent pending positions in superconductivity and various biotech ventures yielding several million dollars and more to come. The U.S. university realizing the potential of Japan and other Pacific Rim countries has in some cases established relationships with trading companies, investment bankers, or made marketing trips to the Orient. Similar activities are also taking place in the European community.

The U.S. university technology transfer office is responsive to the corporate needs and interests in finding commercially valuable new products, but probably will never be able to provide a finished turnkey product nor will it be able to provide a timely response similar to what a corporation is accustomed to dealing with in terms of licensing technology from another entity. Nevertheless, the nature of the U.S. university during the last few hundred years has established a premier world entity for creativity and development of many new exciting ideas.