20 Years Of Academic Licensing– Royalty Income And Economic Impact

BY ASHLEY STEVENS, D.PHIL (OXON)*

I. Executive Summary

The Bayh-Dole Act of 1980 allowed US Universities to own inventions made with federal funding—previously, the government had usually held title and was responsible for licensing the resultant patents. After the Act, academic licensing became an important component of the licensing profession. In the US and Canada, almost 1,500 professionals were employed in academic licensing in 2001 and the AUTM Annual Meeting now rivals the LES Annual Meeting in attendance. Academic inventions have impacted all aspects of industry but have made particularly important contributions to, first, the biotechnology industry and, a decade later, the Internet.

Starting with its 1991/92 survey, AUTM has devoted considerable effort to compiling reliable, comprehensive statistics on all aspects of the technology transfer process. There are now consistent, high-grade data covering 11 years for almost 150 major universities, teaching hospitals and research institutes. Relatively few organizations with major technology transfer programs are not now reporting. However, data for the years prior to 1991 are far less comprehensive and have been published in a variety of places.

Royalty income is an important measure of technology transfer performance and is the basis for economic impact analyses. In contrast to the wealth of data available since the AUTM Survey was started, good data is hard to find for 1990 and earlier. Royalty income data is particularly hard to find. This article summarizes all of the data that the author, assisted by many senior members of the profession, has been able to identify prior to initiation of the AUTM Survey and relates it to the subsequent AUTM data. It particularly focuses on royalty income but also identifies other measures of technology transfer performance. In addition, it improves the comprehensiveness of the coverage of the data by (a) carrying out a meta analysis of groups of studies that give different, partial snapshots of the same year and (b) correcting for significant under- and over-counting of royalty figures.

In total, at least one royalty figure is available for 102 different institutions in this period, approaching that of the first AUTM Survey. This analysis was first carried out and reported in 1993[1] and correctly predicted that the initial AUTM Survey would show total royalty income of well over $200 million for 1992, even though several surveys carried out as recently as 1990 had reported total royalty income of only $60 million. Finally, correction factors are proposed for the first two years of the AUTM Survey to account for changes in the survey methodology made in 1993 so that the royalty data from the first two surveys is consistent with subsequent years.

Reflecting the prominent role that leading Canadian institutions have always played within AUTM, a number of the studies reported herein included a data for several Canadian institutions. However, this study focuses on the US and was originally driven by estimating the economic impacts of academic technology transfer on the US economy. Canadian data are excluded from the detailed analyses contained herein. There may, therefore, be some differences between total figures quoted from specific studies and the totals in the detailed table. Regrettably, Canadian coverage is too intermittent to allow a meaningful "pre-AUTM Survey" analysis to be carried out for Canada.

II. The Pre-AUTM Survey Years

A. Meta-Analysis Methodology

The first part of this study compiles all the surveys of royalty income that the author has been able to identify, assisted by many colleagues with greater seniority in the profession and Michael Odza, the founder of *Technology Access Report*, and compares the institutions that reported to the survey for a given year. Several of the surveys that gave similar figures for total royalty income in fact came to these bottom line results by including data from different sets of institutions that only partially overlapped. Therefore, combining the non-overlapping reporting institutions gives a more complete figure for that year. In one or two cases, figures are reported for the same institution and are different. In these cases a judgment was made as to which figure to use. Further, by putting all the surveys for every year on a single spreadsheet, plausible es-

1. "Economic Impact of Academic Technology Transfer" Newsletter, Association of University Technology Managers, September, 1993.

*Ashley Stevens, D.Phil. (Oxon)
Director, Office of Technology, Transfer
Community Technology Fund, Boston University, Boston, MA 02118.

timates can be made for institutions that reported to early surveys but not to later ones.

Up until 1994, the second year of the AUTM survey, some institutions appeared to have had a degree of concern about releasing their royalty income, particularly if it was substantial, unless the survey was being carried out by a federal agency, generally the General Accounting Office (GAO), to which they had no choice but to respond. This meta-analysis therefore examines GAO surveys particularly closely.

1. Pre-Bayh-Dole

In the years before Bayh-Dole, the Government held automatic title to the results of federally funded research and Universities only received royalties from research that they, corporations or foundations had funded, or if they had managed to obtain an institutional patent agreement (IPA).

While there had been a few isolated big hits the focus at the time was to try and interest corporations in developing the results of academic research. Norman Latker, the patent counsel to Health, Education and Welfare (HEW) and then National Institutes of Health (NIH) and one of the fathers of Bayh-Dole, in testimony to Congress between 1968 and 1978,[2] focused not on royalty income but rather on the investment that corporations were starting to make in developing academic inventions in those instances where an IPA had permitted a degree of exclusivity.

2. 1980 and 1981

Data for 1980 and 1981 is available from a study carried out by the National Science Board of the National Science Foundation (NSF) on the state of University-Industry relations.[3] The report provides a comprehensive view of all aspects of the state of industry-university relations at the start of the Bayh-Dole era. It was based on a survey carried out in 1982. The authors note that there is no prior data on the subject. They developed a list of 36 institutions based on recommendations from patent and research administrators, officials of NACUBO and of the Society of University Patent Administrators (the predecessor organization of AUTM) and sent them a survey. Twenty-five responded with data for 1980, while only 22 had data compiled for 1981 by the study deadline, but the identity of both the institutions surveyed and of the responders is not reported. They found that in 1980 royalty income was $7,316,915, while by 1981 it had risen to $9,178,276, a 25% increase despite the incomplete data for 1981. The study already identified the phenomenon of "big hits," with six programs in 1980 and eight in 1981 reporting income over $500,000 while ten and seven programs respectively reported income under $100,000.

3. 1981 – 1985

The author was not able to identify any sources of data for this period.

4. 1986

a) General Accounting Office

The next year for which good quality data exist is 1986. In 1987 the General Accounting Office carried out a study at the request of Senator Lloyd Bentsen (D., TX) on foreign sponsorship of U.S. university research.[4] Questionnaires were sent to the top 150 universities with the highest R&D expenditures. One hundred and thirty four responded. The report was published in March 1988. The primary focus of the report is foreign sponsorship of R&D at U.S. universities and the royalty data is only reported in the survey questionnaire on page 33 of the appendix, and isn't actually discussed in the body of the text. However, 112 institutions reported royalty income of $27,741,936 from US corporations and $2,622,819 from foreign corporations, for a total of $30,364,755. The institutions responding to the royalty income question were not identified.

This report also has useful data on other aspects of technology transfer activity that are currently reported in the AUTM Survey and hence provide a useful benchmark for comparison with the AUTM Survey. (See Table 1)

Table 1: Technology Transfer Activity

Total R&D Funding	**$6,808,171,922**
Total Industrial Funding of R&D	**$540,129,436**
Number of Invention Disclosures	**3,105**
Number of Patent Applications Filed	**1,149**
Number of Copyright Applications Filed for Software	**295**
Number of Inventions Licensed	**737**
Number of Licences Issued	**745**

b) University of Colorado

Also for that year, the University of Colorado reported to an AUTM meeting[5] on the research budgets,

2. Norman Latker, Personal Communication.

3. "University-Industry Research Relations – Selected Studies." National Science Foundation, Lois Peters, Herbert Fusefeld with Laurence Berlowitz, Harold Kaufman and Eli Pearce. Royalty income are reported on page 105.

4. "R&D Funding: Foreign Sponsorship of U.S. University Research," Sarah Frazier Jaggar, General Accounting Office, *GAO/RCED-88-89BR*, March 1988. The royalty data are on page 33.

invention disclosures and royalty income of the Big Eight Universities[6] comparing them with seven major universities.[7] These 15 institutions alone reported income of $15,037,000, half that of the $30,364,755 reported by the 112 institutions that reported to GAO. In addition, the research budgets of the 15 institutions totaled $2,779 million, 41% of the GAO figure, while invention disclosures totaled 1,902, 61% of the GAO total.

c) Kettelberger Study

A third study with data for 1986 was carried out by Denise Kettelberger, then of the Houston law firm Pravel, Gambrel, Hewitt, Kimball & Krieger[8] and now with Merchant & Gould in Minneapolis. The survey instrument was distributed at the 1989 Society of University Patent Administrators Annual Meeting and collected data for 1986,1987 and 1988. Fifty institutions responded, including a teaching hospital, the Cleveland Clinic, and a research institute, The Jackson Laboratory. There was consistent data for 23 institutions that was quantified and analyzed in detail. Seventeen reported royalty income of $8,660,000 in 1986, rising to 18 reporting royalty income of $11,660,000 in 1987 and 19 reporting royalty income of $17,33,000 in 1988. The growth rate from 1986 to 1987 was 31.2%, and from 1987 to 1988 was 52.5%. These are helpful data points of the growth rates being experienced at that time. Other data reported in the Kettelberger study are the number of faculty at each institution, the numbers of pending and issued patents held by each institution, the number of start-up companies formed and equity ownership in these companies.

A meta analysis of the Kettelberger and Colorado data yields royalty income of $18,540,000 from 30 institutions in 1986. However, since the GAO study did not identify which institutions were included in the survey, the Kettelberger and Colorado studies can't be used to expand the coverage of the GAO study.

5. 1987

Only one study is available for 1987, the Kettelberger study, reporting royalty income of $11,364,000 from 18 institutions. Applying its 31% growth rate over 1986 to the GAO figures would give a figure of $39,841,000 for 1987. While this figure is certainly on the overall growth curve, it stretches the methodology. However, it is the best estimate available at this stage.

6. 1988

Four studies reported data for 1988. The first was a very comprehensive survey carried out by Marjorie Forster of the University of Maryland at Baltimore.[9] While never formally published under AUTM's auspices, it was made available at the May 1990 AUTM Conference on Technology Transfer Performance Assessment organized by Bill Ragan.[10] 70 institutions, 63 US and 7 Canadian, reported to this survey. The US institutions included one National Laboratory (Brookhaven) and two research institutes (the Institute for Cancer Research and the Wistar Institute). The survey collected data on research funding, broken down between federal, state, industry and foundations, disclosures, number of licensed technologies, number of licensed technologies earning royalties, age of program, and gross royalty income. The reporting institutions received royalty income of $60,028,000. Of the US institutions, 26 allowed their royalty income to be individually reported, totaling $34,073,000 and the others reported royalty income totaling $24,670,000 on a confidential basis, for a total of $58,743,000. (See Table 2)

Forster calculated a number of comparative measures of performance. Her primary hypothesis was that age of a technology transfer program was the primary predictor of success and she analyzed her data accordingly:

- Well established programs, 10 or more years old

5. 1986 Research/Invention Statistics, AUTM Meeting; Personal Communication from unknown individual.
6. Kansas State, University of Kansas, Oklahoma University, University of Nebraska, Oklahoma State, University of Missouri, Iowa State, University of Colorado.
7. University of Arizona, University of Minnesota, Harvard University, Stanford University, University of Washington, MIT, University of California.
8. "Technology Transfer Survey," Denise M. Kettelberger, 1989, Personal Communication. According to Ms. Kettelberger, the survey was not published independently of its distribution at the May 1990 AUTM Conference on Technology Transfer Performance Assessment organized by Bill Ragan, but was extensively quoted in "Performance Assessment of Technology Transfer Programs – Part One: Universities," Michael Odza, *Technology Access Report*, III-9, June 1990. A typewritten copy of the copy of the study is in the possession of the author.
9. AUTM Survey, Marjorie Forster, 1989; Personal Communication.
10. The proceedings of the conference were discussed in "Performance Assessment of Technology Transfer Programs – Part One: Universities," Michael Odza, Technology Access Report, III-9, June 1990.

Table 2: Other Data Reported

Total R&D Funding	**$4,561,520,000**
Total Industrial Funding of R&D	**$467,427,000**
Number of Invention Disclosures	**2,252**
Number of Licensed Technologies	**1,275**
Number of Licensed Technologies Earning Royalties	**611**

- Established programs, 6-9 years
- New Programs, 0-5 years

The analysis certainly confirmed her hypothesis.

The second survey was a personal survey carried out by John Preston, Director of Technology Transfer at MIT[11] and quoted by him in a number of talks on technology transfer. He surveyed seven of the largest recipients of royalties, who reported total royalty income of $38,300,000. He also identified the number of licenses executed by these institutions.

Teri Willey at the Indiana Corporation carried out the third study for Science and Technology, to identify common elements of success of university technology transfer programs.[12] Data was collected for 28 universities. The survey was carried out between February and June 1990 and was published in July 1990, so the data may have been for either 1989 or 1988. The survey is, therefore, included in the 1988 analysis, not the 1989 analysis. Many of the individual figures are very similar to those in the 1988 Forster survey (and an AUTM Survey is acknowledged in the main data table), but one or two additional institutions were included. The study collected data on program age, number of disclosures, number of licenses, sponsored research funding and gross royalty income. For a subset of the data for which detailed interviews were conducted, data was collected on staffing levels and program costs. The data was divided between New Programs (0-6 years) and Established Programs (6+ years). The study showed Gross Royalty Income of $39,286,000, heavily weighted to Established Programs.

The fourth study was the Kettelberger study. For 1988, 19 institutions reported total royalty income of $17,331,000.

Meta analysis significantly improves coverage. Taking the Forster study as the base study, with $58,743,000 from 63 institutions the Preston study adds one institution, with income of $3,000,000, the Wiley study adds six additional institutions with income of $5,800,000 and the Kettelberger study adds three institutions with income of $1,800,000. The final figure for 1988 is therefore $70,100,000 from 73 institutions.

7. 1989

Two studies are available for 1989.

The first is a survey carried out by Marjorie Forster and Steve Atkinson, then of Harvard Medical School, and reported to the 1992 AUTM Annual Meeting in San Francisco.[13] This survey focused solely on royalty income and included data for 19 universities and four hospitals for 1989, 1990 and 1991. For 1990, data was included on an additional 6 US universities, one US research institute and either two or three Canadian universities (the University of British Columbia is represented twice, with different royalty income figures!) Royalty income in 1989 was $43,730,000.

The second source was a GAO study[14] carried out at the request of Senator Ted Weiss' Subcommittee on Human Resources and Intergovernmental Relations of the Committee on Government Operations. This report focused on institutions receiving funding from the NIH and NSF and included data for 31 institutions (5 campuses of the University of California reported separately). Data was collected on invention disclosures, patent applications filed, patents issued, licenses granted (separated between patent licenses and other licenses) and license income. The study combined the figures for 1989 and 1990 into a single total. Royalty income for the two years was $113,055,000. For the purposes of this analysis, the two years data were desegregated by assuming that 45% of the total ($50,880,000) pertained to 1989 and the remaining 55% ($62,190,000) pertained to 1990. This is in line with the growth rate of 20-30% in royalties throughout the 1980s that this analysis shows. Importantly, some of the institutions with high royalty income, such as Michigan State and Wisconsin, who had not reported to Forster and Atkinson, were obligated to report to GAO. An interesting component of this study is the differentiation between the results from technology funded by NSF and NIH on the one hand and results from technology based all other funding sources on the other, with $82,090,000 of the $113,055,000 was derived from NSF and NIH funded technology. The study also reported that 197 exclusive licenses were granted in 1989 and 1990 versus 339 exclusive licenses, while royalty income from exclusive licenses in 1989 and 1990 was $29,290,000, and royalty income from nonexclusive licenses in the same time period was $52,734,000.

Again, meta analysis improves the coverage considerably. If the Forster/Atkinson study is used as the base study, the GAO study adds 13 institutions with income of $17,430,000 for a total of $61,700,000. This is below the 1988 figure of $70,100,000 and reflects the fact that the base study, the 1992 Forster/Atkinson study, was narrower (22 institutions, $43,730,000) than the 1988 Forster study (46 institutions, $59,400,000). The extent of the coverage can be extended if the same 1988 income figures for institutions that did not report to the 1992 study are added to the 1989 data. This is probably a reasonably conservative assumption since royalty income was on a steeply rising curve for most institutions at that time and looking at the overall data set, very few institutions showed year-on-year declines at that time.

11. Various presentations on university technology transfer, 1989, John Preston, Personal Communication.
12. "A Study of Selected University Technology Licensing and Technology Transfer Programs," Teri Willey, Prepared for The Indiana Corporation for Science and Technology, July 1990.
13. "Royalty Income for US Universities and Teaching Hospitals," Marjorie Forster and Stephen Atkinson, Presentation at the AUTM Annual Meeting, San Francisco, February 1992; Personal Communication.
14. "University Research — Controlling Inappropriate Access to Federally Funded Research Results," *GAO/RCED-92-104*.

The expansion of coverage can be done in several ways. First, individual figures for an additional 21 institutions are available for 1988, with 1988 income of $12,160,000. Second, it turns out that there is very little overlap between this group and Forster's confidential group of 21 institutions. They can therefore be added to the total, adding a further 21 institutions and $24,630,000. Finally, even within this group of 21 institutions, individual figures for two (as it happens, two with a relatively large royalty income) are available for both years, so the increment for the second year for the two can calculated, adding $3,320,000.

The final figure for 1989 is therefore $85,430,000 for 71 institutions.

8. 1990

The same two studies used for the 1989 study also provide data for 1990. The GAO study supplies the same coverage as for 1989 and showed royalty income of $62,190,000 for 31 institutions. The 1990 Forster/Atkinson study additionally included data for seven non-AUTM members who chose to respond to a questionnaire. Their study showed total royalty income of $120,220,000. This figure included the $46 million lump sum payment to Memorial Sloan Kettering from Amgen for the partial buy-down of Amgen's G-CSF royalty obligations from 7% to 3%. In order to generate a time series with a meaningful trend, the lump sum payment was excluded from the current analysis, which gave income of $70,220,000 for the 29 institutions.

There was relatively little overlap between the institutions surveyed by GAO and by Forster and Atkinson, so meta analysis considerably improved the data. The final figure is $107,050,000 for 65 institutions.

9. 1991

The Forster/Atkinson study included data for 20 institutions totaling $76,230,000. However, the first AUM Survey superceded this study.

10. 1991-2002

Starting in 1993, AUTM has carried out an annual survey of its members. The first survey covered FY1991 and FY1992.

Table 3: RCT Royalty Receipts and Distributions

Year	Total	Retained	Distributions
1987	$13,478,000	$9,295,000	$4,183,000
1988	18,575,000	12,560,000	6,015,000
1989	24,736,000	16,490,000	8,246,000
1990	32,273,000	21,259,000	11,014,000
1991	43,291,000	28,210,000	15,081,000
1992	50,661,000	32,649,000	18,012,000
1993	57,664,000	36,085,000	21,579,000

Table 4: City of Hope Royalty Income

Year	Royalty Income
1981	N/a
1982	N/a
1986	$3,298,546
1990	$15,068,310
1992	$20,861,915

B. Adjustments

Two types of further adjustments can improve the coverage and accuracy of the data. First, a few adjustments can be made for known undercounting of royalties without essentially carrying out a complete retroactive survey. Second, there is some well documented double reporting of royalties that can be readily corrected for.

1. Undercounts

a) Research Corporation Technologies

Research Corporation was founded in 1917 and so has one of the longest track records in academic technology transfer. It takes title to academic technologies and assumes responsibility for patent prosecution and licensing in return for a substantial share of eventual income. In 1987, in the wake of the 1986 tax reform act, Research Corporation underwent a reorganization. The technology transfer activities were spun off into Research Corporation Technologies (RCT) which is a tax paying not-for-profit. As such, it publishes an annual report that includes its gross income and the amount distributed to the institutions that provided the technology that generated the income.

Separate figures for RCT were not included in the earlier studies, though RCT has reported to the official AUTM surveys.

Prior to the start of the official AUTM surveys, the portion of RCT's royalty proceeds that was distributed to institutions will have been included in the reported royalty income of those member institutions. However, the portion retained by RCT was not captured in any of the prior surveys. This portion should therefore be added to the individu-

ally reported figures in order to capture the actual total.

RCT's results since their 1987 reorganization are as follows:[15]

(See Table 3)

b) City of Hope

Commencing in 1976, City of Hope Hospital in Los Angeles carried out the genetic engineering of both insulin and human growth hormone for Genentech before Genentech had its own laboratories and has substantial royalty income from these agreements. They also receive income from the Cabilly patents for recombinant antibody production. In 1999, City of Hope filed a lawsuit against Genentech over payments due under the agreement. Newspaper reports indicated that City of Hope had received $285 million in payments from Genentech under the agreement.[16] In June 2002, a jury awarded City of Hope $300,164,030 in actual damages[17] and $200 million in punitive damages,[18] making this agreement by far the most valuable agreement ever entered into between an academic institution and a biotechnology or pharmaceutical company.

15. Research Corporation Technologies Annual Reports.

City of Hope did not report to any of the surveys before the first official AUTM survey but has reported to all surveys since. City of Hope received royalties as follows:[19] (See table 4)

For the missing years, values have been calculated assuming a linear growth rate.

2. Overcounts

a) Research Corporation Technologies

With the 1991 and 1992 AUTM surveys, the opposite problem to that described above pertains. RCT reported to the survey, so their total royalty income is included in the total. Since the recipient institutions also included the amounts they received from RCT, the distributed portion of RCT's income is double counted and must be subtracted from the total. Starting with the 1993 AUTM Survey, there has been an explicit adjustment for royalties collected on behalf of and paid to other reporting institutions, so this correction will not be necessary after 1992.

16. *http://www.nytimes.com/2001/08/29/business/29HOPE.html*, visited 5/7/03.
17. *http://www.cityofhope.org/presspass/Archive_MSN%5CCOH_genetech_compensatory.htm*; visited 5/7/03.
18. *http://www.cityofhope.org/presspass/Archive_MSN%5CCOH_genentech_punitive.htm*; visited 5/7/03.
19. Eric Jurrus, Director, Office of Technology Transfer, City of Hope, Personal Communication, 5/24/93.

b) Cohen-Boyer

The Cohen-Boyer patent, one of the leading academic royalty generators during the late 1980s, is paid jointly assigned to Stanford and the University of California, San Francisco. Royalties are paid to Stanford, which subtracts a 15% management fee and pays half of the remainder (i.e. 42.5% of the amount received) to the University of California. Both institutions report their gross receipts in their royalty income, so the University of California component is double reported and must be removed. Stanford has freely published the Cohen-Boyer income,[20] so this adjustment can be made. As noted above, starting with the 1993 AUTM survey, there has been an explicit adjustment for royalties collected on behalf of and paid to other reporting institutions, so this adjustment does not need to be made after 1992. (See Table 5)

III. The Official AUTM Annual Surveys, 1991-2001

20. Stanford Office of Technology Licensing Annual Reports; Shawn Harlan, Personal Communication.

Table 5: Stanford Royalty Income – Total and Royalty Income from Cohen-Boyer

Year	Cohen-Boyer	Other	Total
1986	$1,200,000	$3,930,528	$5,130,528
1987	1,700,000	4,351,125	6,051,125
1988	3,400,000	5,779,767	9,179,767
1989	4,780,000	6,817,867	11,597,867
1990	6,900,000	7,200,000	14,100,000
1991	16,900,000	8,800,000	25,600,000
1992	14,700,000	10,800,000	25,500,000
1993	20,100,000	11,200,000	31,200,000
1994	23,500,000	14,700,000	38,200,000

Table 6: AUTM Survey Participation Levels

Year	#Reporting	Royalty Income
1991	120	$218,293,210
1992	120	283,231,529
1993	146	317,581,488
1994	147	355,263,725
1995	157	414,290,517
1996	159	502,520,163
1997	159	600,759,522
1998	159	711,946,492
1999	170	848,811,129
2000	168	1,239,192,369
2001	171	1,029,738,041

Table 7: Adjusted Total Academic and Federal Royalty Income					
Year	# of Institutions	Royalty Income	Undercount	Overcount	Adjusted Royalty Income
1980	25	$7,316,915			$7,316,915
1981	22	9,178,276			9,178,276
1982	-	N/a			N/a
1983	-	N/a			N/a
1984	-	N/a			N/a
1985	-	N/a			N/a
1986	112	30,364,755	3,298,546		33,663,301
1987	112	39,841,000	18,478,428		58,319,428
1988	73	70,100,000	18,800,987		88,900,987
1989	71	85,430,000	28,615,869	(2,040,000)	112,005,869
1990	65	107,050,000	36,327,310	(2,932,500)	140,444,810
1991	120	218,293,210		(22,263,500)	196,029,710
1992	120	283,231,529		(24,259,500)	258,972,029
1993	146	317,581,488			317,581,488
1994	147	355,263,725			355,263,725
1995	157	414,290,517			414,290,517
1996	159	502,520,163			502,520,163
1997	159	600,759,522			600,759,522
1998	159	711,946,492			711,946,492
1999	170	848,811,129			848,811,129
2000	168	1,239,192,369			1,239,192,369
2001	171	1,029,738,041			1,029,738,041

AUTM started carrying out its Annual Survey in 1993, covering FY1991 and FY1992 and has carried out a Survey annually since. The Survey for 2001 was published in May 2003.[21]

Institutions are grouped into four categories:

- US Universities
- US Hospitals and Research Institutions
- Canadian Universities and Hospitals
- Patent Management Firms

The data below exclude Canadian Institutions.

With one major exception discussed below, AUTM has used a consistent methodology, so the data are self-consistent. The main differences between successive surveys has been a steady increase in the data being collected—for instance, information about start-up companies was added in 1993 and about research support obtained linked to a license agreement was added in 1994. There are breakdowns between the degree of exclusivity and company size. Income is broken down between running royalties, cashed-in equity and all other. For several years, data was collected for physical sciences and life sciences inventions.

For the purposes of this study, the most important change was the addition in the FY1993 survey of a question to identify royalties collected by one institution and paid out to another institution that co-owns the technology pursuant to a patent management agreement. This eliminates the need for the Research Corporation Technologies and Cohen-Boyer adjustments described above and also adjusts for one or two smaller double counts.

The other issue with the AUTM surveys that must be considered is the level of participation. There was a degree of nervousness about participating in the first survey, as evidenced by about a third of the participants requesting anonymous treatment. As there appeared to be only positive comment about the survey, this nervousness dissipated and most participants allowed their

21. Association of University Technology Managers.

names to be used in subsequent surveys. Participation has also increased, from 120 participants in 1992 to 171 in 2001. However, not every institution has reported in every year. The most significant variable has been the New York Blood Center, which developed a viral decontamination process for blood products that has been non-exclusively licensed and is widely used. NYBC overall has reported only about half the time. In 1999, the last time it reported, income was $35,000,000, about 4% of the total. (See Table 6)

IV. Results

When these components are added together, the following figures are obtained for total royalty receipts by US academic institutions:

(See Table 7)

Over the 21 years covered by this study, royalty income to US universities, hospitals and research institutes has risen from $7 million to over $1 billion. While this is an impressive rate of growth, royalty income is still a relatively minor contributor to the finances of these institutions, amounting to just 3% of total sponsored research funding and dwarfed by tuition income, patient care revenues and charitable donations. A recent analysis[22] showed that the royalty return to universities on their research activities is one seventh that of a major corporation with an aggressive out-licensing program, IBM.

Under the Bayh-Dole Act, universities are obliged to share their royalty income with their inventors and then to use the balance left after payment of expenses for research and education.

V. Economic Impact

Although royalty income of US academic institutions has reached impressive levels, the impact on the overall economy is much more important. Academic royalty rates are typically in a range of from 2% to 5%, which means that 95% to 98% of the economic impact remains in the economy external to the university. An economic impact model has been progressively developed.

First Stevens[23] used royalty income to estimate sales of the licensee companies, and then translated this back to estimate employment levels. Then Pressman and her colleagues at MIT calculated the employment impact of the pre-sales development phase. Several studies at other universities replicated this methodology.[25,26,27] The last time AUTM ran this model, as part of the 1999 Survey, it showed that sales of products resulting from academic inventions totaled $26 billion and had created 260,000 jobs.

Finally, a study by MIT[28] showed that in 1996, the tax revenues at the State and Federal level resulting from this economic impact amounted to almost $5 billion. The model extrapolates linearly, so that at the royalty levels of 2001, tax revenues would have been almost $10 billion, implying that the tax revenues resulting from the economic spin-off of academic research is paying for over a third of the current annual federal investment in academic research.

22. "Guest Essay: In Defense of University Patent Licensing," Ashley J. Stevens, Technology Review, April 2003 *http: //www.technology-review.com/forums/forum.asp?forumid=259.*

23. "Economic Impact of Academic Technology Transfer," Ashley Stevens, Newsletter, Association of University Technology Managers, September, 1993; "The Economic Impact of Academic Technology Transfer on the US Economy," Ashley Stevens, Testimony to US Department of Commerce hearings into the Bayh-Dole Act, Washington, DC, October 1993; "Technology Transfer for Economic Development," expert panel organized by Ashley Stevens at Annual Meeting, Association of University Technology Managers, Phoenix, AZ, February, 1994; "Measuring Economic Impact," presentation by Ashley Stevens at AUTM Advanced Licensing Course, Scottsdale, AZ, December 1994.

24. "Pre-Production Investment and Jobs Induced by MIT Exclusive Patent Licenses: A Preliminary Model to Measure the Economic Impact of University Licensing," Lori Pressman, Sonia K. Guterman, Irene Abrams, David E. Geist and Lita Nelsen, *Journal of the Association of University Technology Managers,* Vol. VII, 1995, 49-82.

25. "A Study of the Economic Impact of the Commercialization of Ohio State University Technologies," Personal Communication, Robin Rasor, December, 1996.

26. "Induced Investments and Jobs Produced by Exclusive Patent Licenses—a Confirmatory Study," Peter B. Kramer, Sandy L. Scheibe, Donyale Y. Reavis and Louis P. Berneman, Personal Communication, Center for Technology Transfer, University of Pennsylvania, July, 1997.

27. "Economic Impact of Technology Licensing: Estimation of Pre-Commercialization Investment and Post-Commercialization Sales from the University of Minnesota," Christopher S. Meldrum, Christopher J. Alban, Paul M. Edwards, David W. McMahon, Gary Stamper and James A. Severson, Research Policy, 1999.

28. "Licensed Patents Generate 7 Times More US Taxes than Royalties," Ken Campbell; MIT Press Release, April 10, 1998.