Technology Transfer at Canadian Universities: Fiscal Year 2001 Update

A Report for the Canada Foundation for Innovation

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Bruce P. Clayman
clayma2@attglobal.net
(604) 942-7600

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Summary

This report is an update and extension of the author's original November 19, 2000 study of the transfer of technology from Canadian universities to the private sector *Technology Transfer at Canadian Universities*, and its first update dated January 11, 2002. This report may be read in conjunction with the previous studies and incorporates and analyzes new quantitative data from the Fiscal Year (FY) 2001 Survey by the Association of University Technology Managers (AUTM) on performance indicators of technology transfer. Virtually all North American universities with high levels of research funding respond to the AUTM Survey. Included herein are updated comparisons with overall quantitative Canadian results and with individual and overall quantitative results from the U.S.

The analysis was somewhat hampered by lack of response to the AUTM Surveys by a small number of universities with significant research funding. Changes to the composition of the groups used in the comparisons due to non-response to the AUTM Survey make impossible precise year-to-year comparisons for all the responding universities; however, a core group of 14 representative universities that responded in all three years permit short-term longitudinal comparisons. Longer-term year-to-year comparisons are also attempted using somewhat incomplete datasets; these produce results that are generally consistent with the more precise comparisons.

The key findings of the previous studies remain:

1. The amount of technology that is measurably transferred from universities to the private sector is roughly a linear function of research expenditures. This is the case cumulatively for responding Canadian universities and for responding U.S. universities, with virtually identical constants of proportionality applicable in both countries. This applies over time, over a very wide range of institutional settings and over a very wide range of performance by the individual institutions.
2. The effectiveness of technology transfer (measured in terms of the full range of outputs, per research dollar) at the top 10 responding Canadian universities collectively is somewhat lower than it is collectively at the universities ranked 11 – 19. Separation of Canadian universities into "G-10" and non-G-10 groups reveals that the latter group has overall better performance on a per research dollar basis. A similar disparity does not exist in the U.S.
3. No evidence emerged to support the idea that ownership of intellectual property (IP) by universities, rather than by the creator of the IP, results in more or better technology transfer. Analysis of the AUTM reports suggests clearly that universities that claim ownership of IP do not have a record of more successful exploitation of IP – in fact, the opposite appears to be true. Instead, local long-term commitment to and support for technology transfer appear to be the critical components.
4. There is a need for more complete, publicly available information on the performance of Canadian universities in technology transfer, upon which informed, evidence-based decisions about public policy can be made. In addition, methods of assessing the effectiveness of non-traditional means of technology transfer should be developed and applied.

One concludes from point 1 above, as confirmed in this update, that increases to the direct funding of university research via the three federal Granting Agencies, the Canada Foundation for Innovation and other funding agencies, accompanied by payment of the full indirect costs of university research – including the costs of technology transfer itself - would benefit the Canadian economy through increased production of transferable technologies and the enhanced means to commercialize them.

Introduction

This report is essentially a second update and extension of the author's November 19, 2000 study of the transfer of technology from Canadian universities to the private sector *Technology Transfer at Canadian Universities.* That study was based mostly on the FY 1999 Licensing Survey conducted by the Association of University Technology Managers (AUTM) and previous AUTM Licensing Surveys. The present report may be read in conjunction with that study and focuses primarily on presentation, analysis and interpretation of new quantitative data from the FY 2001 AUTM Survey and comparisons with the results in the previous reports.

The AUTM Survey

AUTM carries out its Licensing Survey each year, consistent with its mission to collect information on its members' programs. The Survey provides objective information, in consistent format, related to technology transfer from the academic sector. The FY 2001 report contains annual and some cumulative data for the eleventh consecutive year of data collection. The results of the FY 2001 Survey were released confidentially to the author on May 4, 2003, for inclusion in this report to the Board of the Canada Foundation for Innovation. To respect AUTM's wishes, public release of data and analysis thereof was delayed until May 16, 2003.

The data on which the *AUTM Licensing Survey: FY 2001* is based comprise individual entries for 22 Canadian universities, the Canadian particle and nuclear physics national laboratory TRIUMF, several hospitals and other health-institutes, plus 168 universities and other research institutions in the United States. The Canadian universities that responded to the previous AUTM Surveys included the University of Northern British Columbia and University of Guelph in 2000, but not in 1999 or 2001, and included Carleton University in 1999, but not in 2000 or 2001. Newly responding in 2001 are:

University of Saskatchewan
Malaspina University College
École de technologie supérieure
University of Ottawa
Université Laval
University of New Brunswick
Memorial University of Newfoundland

Some points/cautions that must be considered when interpreting the data:

- University of Calgary / UTI, Inc entries include commercialization of non-University IP as well as that flowing from the University of Calgary,
- The inclusion of IP generated at research hospitals affiliated with universities is not treated in a consistent manner at all institutions. One example is the University of Toronto for which Research Expenditures at its affiliated hospitals are reported but technology transfer outputs are not,
- The AUTM definition of "Spin-Off Company" is interpreted differently at different universities and differs from that used by Statistics Canada.

The five specific performance indicators from the AUTM report used for further analysis herein are Disclosures of Inventions, Licenses and Options Executed, U.S. Patents Issued, License Income Received, and Start-Up Companies Formed – all on a per annum basis.

The full FY 2001 AUTM data set for Canadian universities is reproduced in Appendix B of this report. The institutions are listed in descending order of their Total Research Expenditures. The fiscal year used by AUTM was July 1, 2000 - June 30, 2001. The mismatch between this fiscal year and that used in most Canadian institutions (April 1 - March 31) has occasionally caused confusion; AUTM brought all institutional reports into consistency in 1998, resulting in repeated entries of data for a few universities that year. Note also that the "LICENSE INCOME RECEIVED" in Appendix B and in later tables refers to the gross royalty revenue from licenses and from sale of equity in spin-off companies, less amounts that were transferred to other institutions under existing agreements. In Appendix B "PROG. YEAR" is the first year that an institution had personnel devoted to technology transfer, "TIME OF TECH TRF" is the number of years since then, and that "FTE" refers to number of full-time-equivalent personnel in the technology transfer office.

Statistics Canada Survey

As in the November 2000 report to CFI, some results from the *Survey of Intellectual Property Commercialization in the Higher Education Sector, 1999* published by Statistics Canada are included for comparison with the FY 1999 AUTM results. The Statistics Canada reports aggregate responses to their FY 1999 survey of 84 Canadian institutions (universities, colleges and university-colleges); these are unspecified, except for the aggregated results from 12 largest universities from among the 104 members of the Association of Universities and Colleges of Canada (AUCC) to which survey forms were sent.

In 2001, Statistics Canada administered another survey of intellectual property commercialization in the higher education sector. 85 (unspecified) Canadian AUCC member institutions (universities and colleges) responded, 58 of which (unspecified) reported that they were actively managing IP. Some preliminary, aggregated, partial results were released by Statistics Canada in November 2002 and April 2003. These indicated, for example, that the 58 cumulatively achieved gross revenues of almost $50,000,000, netting almost $22,000,000. Comparisons with data from the 1999 survey showed cumulative increases in output measures mostly in the range of 20% - 50%, with the exception of royalties which increased by 135%.

At the time of writing of the present report, the full Statistics Canada results are unavailable so that only a few comparisons with the aggregated AUTM data are possible. As noted below, detailed comparisons would be impossible in any event, due to the differences between the two surveys in:

- responding populations
- reporting periods (i.e. different definition of fiscal years)
- definitions of some of the measures and
- ways that associated hospitals are treated.

Analysis

We first consider the results from the most recent AUTM Survey.

The effects of institutional diversity are amply demonstrated in a casual scan of the data in Appendix B. There is great variability of the results for most of the measures, even among institutions of similar size and with similar levels of research funding. The institutions are unique, in terms of program mix, size and age, and length of time actively promoting technology transfer, among other attributes. This is evident from casual inspection of the AUTM results and is quantified in the very large standard deviations to be found later in the distributions of the results in our analysis.

As in previous reports, we attempt to reduce or eliminate the effects of some of these differences by normalizing the data. One can normalize for size of the institution in a number of ways – for example, by number of faculty members or students, by operating budget or by Research Expenditures. The most common and most useful normalization is by Research Expenditures. This involves dividing the output indicator – for example, number of Invention Disclosures at a particular institution – by that institution's Research Expenditures for that period to get Invention Disclosures per dollar of Research Expenditure.

We apply this approach to the FY 2001 AUTM data and find the ratios given in Table 1 for the 19 Canadian universities with the greatest Research Expenditures; we omit reference to the last three since their Research Expenditures are much less than the others (by more than a factor of three), as are most of their output measures. Table 2 contains the same ratios for the FY 2000 and FY 1999 AUTM data, for comparison. Note the differences in which Canadian universities responded to the AUTM Surveys for each of these years.

Tables 1 and 2 are provided as Excel spreadsheets (cfi01tab1.xls and cfi01tab2.xls) for ease of further analysis by the reader.

Also included in the second parts of Tables 1 and 2, are the normalized AUTM results for the top 19 or 15 U.S. universities in terms of Research Expenditures (for FY 2001 and FY 1999 & 2000 respectively). We note that the Canadian university with the largest Research Expenditures in FY 2001 (University of Toronto at $312.0 M) expends less per annum than does the 27th ranked U.S. university (University of Alabama at Birmingham at $312.7 M). The non-payment of indirect costs of research in FY 2001 by almost all Canadian funders of research distorts the comparison, as we shall see below.

For the top 19 Canadian and the top 19 U.S. universities in Table 1, statistical information about the distributions follows the individual institutional listings. In the first row below the individual listings (Rows labeled A and I for Canada and the U.S. respectively) are shown in **bold type** the **total**s of institutional values of the directly measured data (Research Expenditures, Disclosures, etc.) that are presented in the columns directly above them. Shown in those same rows (A and I), in *italics,* are the derived, *cumulative* results - that is, the results of dividing, for example, the

total number of Disclosures by the **total** Research Expenditures for those 19 institutions. In the next three rows (B, C and D for the Canadian universities and J, K and L for the U.S.) are shown basic statistical attributes (average, median and standard deviation) of the distributions of the individual institutional data themselves. In addition, we compile in row N of Tables 1 and 2 the **total** and *cumulative* figures for all responding U.S. universities (virtually all of which had Research Expenditures in excess of $10 million).

At the bottom of the third page of Table 2 are the normalized, *cumulative* N = 84 and N= 12 results from the Statistics Canada 1999 survey (reported in November 2000), for the variables that can be matched. To assist in comparisons with the N = 12 universities in 1999 Statistics Canada survey, the *cumulative* AUTM data on the top 9 Canadian universities are also normalized separately in row E. Data on Université Laval, the University of Guelph, and the University of Ottawa are not included in the FY 1999 AUTM data, but are present in Statistics Canada 1999 survey; this prevents any precise comparisons. Since the FY 1999 AUTM report used (current) US$ exclusively, we convert the Cdn$ used by Statistics Canada using the historical conversion rates for the periods used by Statistics Canada: FY1996/97 for Research Expenditures at a rate of 0.735 and FY 1999/2000 for License Income Received at a rate of 0.665 (historical rates from the O & A Corporation's web site www.oanda.com). The reader is referred to the Statistics Canada November 2000 report for a more detailed description of their results.

Canadian Results

In the first page of Table 1, the comparison of the *cumulative* Canadian data from AUTM between the top 10 (in row E) and the top 19 (in row A - which of course includes the top 10) is informative. We note that all the *cumulative* measures (in *italics*) agree fairly closely. This shows the dominance of the sums by the nine largest institutions whose **totals** comprise between 60% and 81% of the overall **totals** for the top 19. However, there are differences noted and all are in the direction of larger outputs for the top 19 compared with the top 10. This suggests a separate calculation (results shown in row F of Table 1) of the *cumulative* results for the "last 9." This shows clearly that cumulatively, they are better performers than are the top 10 (ref. Row E), in terms of all of the outputs per million dollars of Research Expenditure.

These results are fully consistent with those obtained in the previous two reports (based on the FY 1999 and FY 2000 AUTM Survey results) for the somewhat smaller data sets of responding universities.

The distributions of individual, unnormalized Canadian results for Research Expenditures and License Income Received are strongly skewed, as evidenced by medians (row C) displaced below the averages (row B) and by large (in some cases statistically meaningless) standard deviations (row D) in relation to the averages. Upward skewing of Research Expenditures is due mostly to the very large Research Expenditures at the University of Toronto and skewing of License Income Received is skewed most significantly by the very high incomes at Université de Sherbrooke.

It is worth digressing to point out that the lion's share of the income at Université de Sherbrooke is derived from one core technology - speech compression within wireless and internet applications - which has been adopted into hundreds of millions of devices world-wide. Other universities have had similar experiences with one "big hit" producing prodigious amounts of continuing royalty revenue. McGill enjoyed another type of "big hit" in FY 2001 in the (one-time) sale of equity in a start up. There will be further discussion of these phenomena later in this report.

Returning to Table 1, we note that the distributions of the normalized results are slightly better behaved. There are still large variations in the normalized measures, but the normalized result for Licenses and Options Executed and for Invention Disclosures Received are somewhat closer to normal distributions, with standard deviation smaller than the average and with the median fairly close to the average. However the other three measures display wide variations, even after normalization by Research Expenditures. This is also readily apparent from inspection of the normalized results for the individual institutions.

These results are also fully consistent with those obtained in the previous two reports. They also vividly point out the difficulty of using averages of these types of measures – normalized or unnormalized – to draw any meaningful conclusions from aggregated data. The difficulty is compounded when comparing surveys taken over a period of time, especially when the composition of the survey respondents changes from survey to survey. These are the main shortcomings of the otherwise excellent surveys performed by Statistics Canada and will be pursued further below.

The observations above about the top 10 versus that of the last 9 prompt a separate analysis of the outputs from the universities from the "G-10" group of large Canadian universities. For the first time, all ten are represented in the AUTM Survey for FY 2001 - they are those ranked 1 - 5, 7 - 11 and 12 in Table 1 and are marked with an asterisk. The results for these ten - labeled "G-10" - are shown in Row G of Table 1, along with the results for remaining nine respondents, in Row H. We see that all the normalized outputs measures are higher for the second group and in most cases significantly higher. This confirms the suggestion based on the FY 2000 results (that include only nine of them) that the "G-10" group under-perform other research universities that are active in technology transfer.

Examination of the Statistics Canada 1999 data summarized at the bottom of Page 3 of Table 2 reveals a fairly high degree of consistency with those *cumulative*, normalized results of the 1999 AUTM Survey that are comparable. This is somewhat surprising on one hand in view of the differences in the surveys and the responding institutions but encouraging on the other hand since it supports the view that commercialization outputs are linearly related to research expenditures.

U.S. FY 2001 Results and Comparison with Canadian FY 2001 Results

The distributions of U.S. top 19 results in Table 1 are qualitatively similar to those of Canadian top 19 results. We again see skewing of the distributions of most of the unnormalized (absolute) results with averages significantly higher than the means and very large standard deviations. However, the variations in both the absolute and the normalized measures are somewhat less extreme, due no doubt to the more homogeneous nature of the top 19 U.S. universities.

In contrast to the Canadian data set, the top 19 results do not dominate the overall group of 168: their contributions to any of the measures comprise well less than half the national **total**. This is especially significant when we note that the *cumulative* results for the top 19 in the U.S. (row I of Table 1) agree very closely with those for the overall data set of 168 in row N, again in marked contrast to the Canadian data. This is remarkable and implies that as a group, U.S. universities commercialize their intellectual property at a consistent rate, virtually independent of the size and research intensity of the institution.

We turn now to a comparison between the FY 2001 Canadian and U.S. data in Table 1. The Table below, with data extracted from Rows A, I and N of Table 1, is a summary.

	Cumulative Normalized Measure FY 2001				
Universities	Invention Disclosures Received per $1M	License & Options Executed per $1M	License Income Received per $1M	U.S. Patents Issued per $1M	Start-up Companies Formed per $1M
Canada All 19	0.539	0.190	$25,270	0.095	0.040
US Top 19	0.417	0.124	$32,833	0.132	0.012
US All 168	0.408	0.121	$33,668	0.115	0.014

We note initially that, both for the top 19 and the overall data sets, the *cumulative* results for output measures at the U.S. universities are similar in magnitude to the Canadian results, with some higher and some lower. Specifically and significantly, patenting activity and license income are cumulatively greater in the U.S., while there are more disclosures, more licenses executed and many more start-ups formed (per $1M) in Canada.

However, these data should be adjusted to take into account one very significant difference between the two countries: U.S. Research Expenditures include explicit recognition of the indirect costs of research whereas Canadian data do not. The rates charged by universities in the U.S. for indirect costs range from 15% to 115%, with an average value of 52.3% of total direct costs (reference: *Indirect Costs Reimbursement in the U.S.A.: Facts and Fiction,* AUCC Research File, June 2000).

Although imprecise, since it is an average taken over a different set of universities than reported here and because some, relatively minor, sponsors of FY 2001 Canadian research did pay indirect costs, applying an adjustment to the U.S. figure for Research Expenditures based on this

average value is a reasonable approximation. The results are shown in the Table below, with data extracted from Rows A, M and O of Table 1.

Universities	*Cumulative* Normalized Measure FY 2001				
	Invention Disclosures Received per $1M	License & Options Executed per $1M	License Income Received per $1M	U.S. Patents Issued per $1M	Start-up Start-Ups Formed per $1M
Canada All 19	0.539	0.190	$25,270	0.095	0.040
US Top 19 Adjusted	0.638	0.190	$50,300	0.202	0.019
US All 168 Adjusted	0.624	0.185	$51,579	0.177	0.021

We now note that on this basis the U.S. results for Patents Issued and Income Received (per $1M) exceed the Canadian results by substantial margins (a factor of two) and that Canada forms twice many more start-ups (per $1M).

Trends

Comparison of the Canadian FY 2001, FY 2000 and FY 1999 Results

Based on the results shown in Tables 1 and 2, one can note from FY 1999 to FY 2001 for Canadian institutions that:

- There were steady increases in input measure Research Expenditures and in output measures Invention Disclosures and Licence Income Received, in absolute terms, from 1999 to 2001
- The only consistent trend among the normalized cumulative output measures was a slight increase in Licences and Options executed per $1M
- No other consistent shifts occurred over the three year period in the absolute or normalized measures.

These initial observations must be tempered by recognition of the change in the number and identity of the responding institutions. Here, as in the Statistics Canada survey, the changes in composition of the responding group limit the usefulness of the results.

Therefore, in order to refine better the year-to-year comparison the Canadian AUTM data for these three years were re-analyzed. We consider only the 14 institutions that reported in each of the three years, omitting data from Guelph, Laval, Ottawa, Saskatchewan, Memorial, New Brunswick and Carleton from the annual reports wherever they occur.

The results of this are shown in Tables 3 and 4 (provided as spreadsheets cfi01tab3.xls and cfi01tab4.xls). The last three rows of Table 3 provide year-to-year comparisons. With respect to the overall (N = 14) cumulative results, there are increases from 1999 to 2001 in the input measure Research Expenditures (33% overall) and in output measures Licenses and Options Executed (37% overall) and Licence Income Received (215% overall), in absolute terms, from 1999 to 2001. This latter change was driven primarily by huge increases in Licence Income at

McGill (12-fold), Université de Montréal and UBC (over seven-fold each), as well as some very substantial increases at a few other universities. The other cumulative output measures are essentially flat, in absolute terms, over that period, although there were substantial positive and negative variations in the results at individual institutions.

The normalized output measures are essentially flat or slightly decreasing over the period, with the dramatic exception of the cumulative Licence Income Received per $1M Expenditures which increased by 137%, following the large increases noted above for the absolute measure.

Following the approach taken in the previous years' reports, we also compare the cumulative, normalized results for the top 8 to those for the last 6, making the separation above Queens, as in the previous analyses. We first note, by comparing lines E and F in Table 3, that the performance of the last 6 in FY 2001 with respect to all the normalized measures is better than the performance of the top 8 institutions. The differences in the normalized measures in favour of the last 6 are quite significant; they are as high as a factor of 3.8, for the License Income Received per $1M. This latter result is due largely to the $372,727 received (per $1M) at Université de Sherbrooke; if they are removed from the calculation, the results for License Income Received per $1M for the two groups become more comparable.

Comparing the relative performance of the top 8 to the last 6 in the cumulative, normalized results over the three-year period (see lines E and F in Tables 3 and 4), we note that very little changed over that period, although there have been some year-to-year fluctuations in the measures. Again, Sherbrooke is responsible for much (but not all) of the differences in License Income Received per $1M in each of these years. Thus the patterns described above are again confirmed for this more comparable data set: the universities with the highest research expenditures under-perform those with lower research expenditures, on a cumulative basis.

Comparison with the trends in the results for the U.S. whole data set over the same three-year period is somewhat startling. For ease of comparison, the U.S. Total and Cumulative results from Tables 1 and 2 are reproduce in Rows J- L of Table 3. Over the three years, most of the normalized U.S. measures change relatively little and the trends are similar to those of their Canadian counterparts. However, the exception is License Income Received, both in absolute terms and normalized by Research Expenditures. In Canada, these measures increase rapidly, while in the U.S., they both increase sharply from 1999 to 2000 and then fall back significantly in 2001. This drop is accompanied by smaller drops in Licenses Executed and Patents Issued; these parallel the results in Canada. It is of course likely that the drops are due to the bursting of the “dot.com” bubble during FY 2001, but it is intriguing that the U.S. results were so strongly affected while Canadian results apparently show no such effect. Clearly further study is required.

Comparison with Statistics Canada Surveys

Despite the difficulties cited previously with the Statistics Canada survey results, comparison of their results for changes between their 1999 and 2001 surveys could be informative. The last five rows of the following Table compare the results for the input and output indicators their survey

has (at least roughly) in common with the AUTM Survey results which are the main topic of this report.

	Statistics Canada	AUTM
Number of Institutions 1999	52	15
Number of Institutions 2001	58	19
Measure	**Percentage Change 1999 to 2001**	
Sponsored Research	49%	52%
Invention Disclosures	21%	29%
Patents Issued	23%	0%
New Licenses	47%	52%
Royalties From Licensing	135%	220%

Interestingly, there is a reasonable correlation between most of the results of the two surveys, despite the difficulties with comparability. The very likely explanation for the correlations is that the 15 (or 19) AUTM universities undertake the lion's share of commercialization activity in Canada. The extreme difference in Patents Issued is slightly puzzling. Of course, AUTM Surveys reported only U.S. Patents while Statistics Canada reported (in April 2003) all patents, which could likely explain the apparent discrepancy.

Longer Multi-Year Trends

The other quantitative analysis that can be applied to AUTM data is an attempt to determine longer-term trends. This was done initially for a seven-year period (1991 – 1997) in a report prepared for the Expert Panel on the Commercialization of University Research of the Advisory Council on Science and Technology (ACST) by Gu and Whewell of Industry Canada (1999). We have updated their figures using data from the 1998 - 2001 AUTM reports and added the adjustment to the U.S. results for inclusion of indirect costs as described above. The results are shown in Table 5, which is available as an Excel spreadsheet (cfi01tab5.xls).

The U.S. results are for universities only; the Canadian results include one or two hospitals in some years since it was not possible to disaggregate all the results. Note also the generally increasing numbers of institutions that reported in both countries as the decade progressed. Because of these variations and inconsistencies, the results should not be taken as precise indicators – however, they provide some insights into overall levels of technology transfer activity among the most active institutions in each country. The right-most column contains both the original Canadian results and the U.S. results adjusted by the removal of indirect costs.

The overall Canadian and U.S. results in Table 5 and the accompanying Figure 1 show only slight differences in the average Disclosures per $1M Research Expenditures over time and between the two countries, when the funding of the indirect costs of research is taken into account. The latter is consistent with our observations drawn from the 2001 data alone. However, it is a striking result and will provide the basis for one of our conclusions.

Table 6, which is available as an Excel spreadsheet (cfi01tab6.xls), concentrates on the individual, normalized performance of some Canadian universities over the last seven years with respect to Disclosures and License Income Received. Only those universities that responded in at least four of the seven years are included, so the average figures differ from those in Tables 1 and 2. Note also that some 1997 data were repeated in 1998 as AUTM brought fiscal years into harmony.

The variation in both measures over time for most of the universities is quite dramatic, pointing again at the idiosyncratic nature of technology transfer. However, the aggregate data, expressed as the average or median in Figures 2 and 3, show much less fluctuation. Figure 3 comprises another manifestation of the increases in Licence Income over the last three years that was cited above: the very significant increases in the average Income is driven by very large increases at a few universities, while the median stays at a lower value – typical of the skewed distribution cited in the full data set shown in Table 1.

Discussion

High Variability

Among the Canadian results, there is no apparent correlation between institutional size, type ("medical/doctoral" versus "comprehensive," to use the categories used by Maclean's magazine), or age and an individual institution's performance on any one of the measures, whether normalized by Research Expenditures or not. This points to the highly idiosyncratic nature of the process of technology transfer, with relatively small numbers of outputs (Disclosures, Patents, Licenses, Start-Ups Formed) emerging in a given time period, wide variations in the degree of commercial success of the technologies transferred and large variations from one FY to another. There are an increasingly large number of instances in which the commercialization of one or two technologies is responsible for the large variations. This may occur in one of two modes:

- A technology is successfully commercialized via license(s) to one or more established firms and the technology is widely adopted, generating large royalty streams. Two examples are the licensing of a particular pharmaceutical by UBC to QLT Inc. and the licensing of ACELP Speech Compression Technology by Université de Sherbrooke to a total of 72 companies worldwide. In each case, the commercial success of the technology led to multimillion dollar increases in revenue from FY 2000 to FY 2001.
- A technology is successfully commercialized via a start-up company in which the university holds an equity position. When the university "cashes in" its equity holding, a major one-time rise in revenue can occur. At SFU, the sale of NCompass Labs to Microsoft was responsible for most of a 12-fold increase in revenue between FY 1998 and FY 1999. At McGill, a similar (but larger) sale of equity in a spin-off was responsible for the almost 10-fold increase in their revenue between FY 2000 and FY 2001.

Another contributor to the inter-institutional variation seen in these data must be variation in institutional commitment to technology transfer and variation in support for these activities from internal and external sources – especially when an institution is seen to "under-perform" consistently over a number of years. Further discussion of this point will follow in a section below.

As noted above, the cumulative performance in technology transfer of the ten members of the "G-10" varies widely among measures and among institutions. In some cases, it falls markedly below the non-G-10 universities on an absolute basis, even before normalization by Research Expenditures.

Large-scale studies that report *cumulative* results from similar types of universities may still be helpful in pointing at the factors that lead to success at technology transfer, but performance by individual institutions remains difficult to correlate with input measures, especially for the small, diverse Canadian data set.

Start-Up Formation Rate

We suggest that the higher rate of start-up formation in Canada compared to the U.S. can be linked to Canada's lower receptor capacity. This lack of capacity has been amply documented in previous studies by the Conference Board of Canada and by ACST. In Canada, especially as compared with the U.S., there are few pre-existing firms that can use their own existing R & D structures to take intellectual property generated in the universities to the next steps in the process of commercialization. In addition to the well-documented difficulties in attracting venture capital, especially since the "dot.com" crash, start-ups are well known to have endemic cash-flow and managerial problems, which threaten the successful exploitation of IP that they own or acquire.

Income

The lower normalized Licensing Income in Canada versus the U.S. likely stems mainly from two factors:

- the increasingly prevalent taking of equity holdings in start-up companies by Canadian universities, as an alternative to licensing income from larger, better established firms; gains take much longer to realize through this route than via license income and do not show up in these reports until they do occur. It is worth noting that this sort of delay makes difficult the assessment of the effects of both increases in research funding and increases in commercialization efforts, since cause and effect can be widely separated in time.
- several huge "hits" (financial successes) by some U.S. universities that result in license incomes in the range of $30M - $70M per annum. The most striking example is the $62M earned by Florida State University almost exclusively from a licensing agreement for a semi-synthetic process for the production of the cancer-fighting drug taxol. There has not been such a "hit" in Canada.

Taking these factors into account, we conclude that Canadian university researchers appear to be every bit as creative and inventive as their U.S. counterparts (citing equivalent disclosure rates) and that Canadian universities are every bit as aggressive in licensing IP generated in the institutions (citing equivalent Licenses Executed). Differences in patenting rates are less significant since much IP is protected via other means, especially recently. In addition, we have no disaggregated data - only some aggregated data from Statistics Canada - on patents issued to Canadian university inventors. As noted above, the missing ingredients in Canada are larger scale core research funding and a large domestic industrial base to exploit the IP efficiently and effectively.

Despite these shortcomings, it appears that some long-term commitments to technology transfer are beginning to bear fruit. The time lag between investment in research and in technology transfer – noted above – may well be a factor. The large increases in Licensing Income over the last three years in Canada is very impressive, as is the contrast with the three-year trend in the U.S., as described above and shown in Table 3. Further study of the reasons for the differences and longer time sequences are needed to determine the validity of this conclusion.

Intellectual Property Policies

It is worthwhile to test for correlation between effectiveness of technology transfer and a university's policy on the ownership of intellectual property. Three of the universities in our top 10 group by Research Expenditures claim ownership of all intellectual property created by their faculty members. They are UBC, Université de Montréal and McMaster University. The tables below present normalized data for these three universities in the last three years, along with the average values of each parameter, calculated over the whole data set.

	FY 1999 Measures per $1M of Research Expenditures / Average Value				
University	Disclosures	Licenses Executed	License Income Received	U.S. Patents	Start-Ups
UBC	1.32 / 0.69	0.15 / 0.26	$8,267 / $18,276	0.52 / 0.16	0.06 / 0.06
Montréal	0.28 / 0.69	0.11 / 0.26	$2,710 / $18,276	0.10 / 0.16	0.06 / 0.06
McMaster	0.55 / 0.69	0.17 / 0.26	$6,890 / $18,276	0.04 / 0.16	0.00 / 0.06

	FY 2000 Measures per $1M of Research Expenditures / Average Value				
University	Disclosures	Licenses Executed	License Income Received	U.S. Patents	Start-Ups
UBC	1.12 / 0.80	0.29 / 0.28	$25,024 / $29,279	0.20 / 0.11	0.07 / 0.08
Montréal	0.39 / 0.80	0.22 / 0.28	$1,997 / $29,279	0.08 / 0.11	0.06 / 0.08
McMaster	0.76 / 0.80	0.33 / 0.28	$5,202 / $29,279	0.04 / 0.11	0.00 / 0.08

	FY 2001 Measures per $1M of Research Expenditures / Average Value				
University	Disclosures	Licenses Executed	License Income Received	U.S. Patents	Start-Ups
UBC	1.05 / 0.66	0.33 / 0.26	$43,279 / $36,174	0.23 / 0.10	0.10 / 0.06
Montréal	0.08 / 0.66	0.08 / 0.26	$12,254 / $36,174	0.05 / 0.10	0.02 / 0.06
McMaster	0.40 / 0.66	0.32 / 0.26	$6,820 / $36,174	0.01 / 0.10	0.01 / 0.06

It is clear that there is no pattern of above-average performance by these universities. In fact, with the exception of UBC's strong results for Disclosures and Patents in 1999 and most categories in 2001, most of the other measures for them and the others are below the Canadian average and in most cases very significantly so. This pattern supports the view that, as long as there is an active, well-supported and well-staffed technology transfer office, ownership of IP is not an issue with respect to success in the commercialization of university research.

Commitment to Technology Transfer

To test this view, correlations were sought between measures of the institutional level of commitment to technology transfer and the output measures. Several relevant output measures are plotted against the length of time that all 22 reporting Canadian institutions have been actively engaged in technology transfer and the staffing in their technology transfer offices in Figures 4 through 7, using information from Appendix B. One data point was removed from Figures 6 and 7 for clarity of presentation of the other data points: Université de Sherbrooke, with License Income Received per $1M of $372,727, has 17 years of technology transfer experience and seven staff members.

Not surprisingly, institutions with larger staff and more experience at technology transfer tend to have better records of success. However, in addition to the obvious positive effects of more staff members with more experience seeking out and evaluating technologies, an intangible aspect is the creation of an "institutional culture" of innovation, deriving from both the explicit and implicit messages about the importance of innovation generated by institutional support for the activity.

Other Output Measures

It is unfortunate that there are no readily quantifiable performance measures related to other forms of technology transfer than Patents, License Income Received and Start-Ups Formed. Especially in the rapidly moving area of information technology, much of the technology transferred is in the form of trade secrets and other types of 'know-how.' Reports such as this tell only part of the story since they omit any direct reference to these forms of technology transfer, although Start-Up Formation is loosely correlated to them. Development of means of quantitatively assessing technology transfer is highly desirable and it is hoped that AUTM and/or Statistics Canada will devote effort in this direction.

Conclusions

A number of conclusions can be drawn from the results. Most have been touched on in the discussion sections above; they are presented here with some elaboration of the rationale behind them.

1. The amount of technology that is measurably transferred from universities appears to be roughly a linear function of Research Expenditures. This is the case cumulatively for Canadian universities and for U.S. universities. It is evidenced clearly by the essentially constant rates of Disclosures per $1M presented in Table 5. The output rate - that is technology outputs (as exemplified by Disclosures) per research expenditure input - is approximately the same in both countries and has been over the last decade, once indirect costs are factored out of the U.S. Research Expenditures (*cf.* Figure 1). This applies over the very wide range of institutional settings and over a very wide range of performance by the individual institutions. It is noted again that there are significant year-to-year fluctuations in the normalized measures – e.g. the increases and decreases seen in the last three rows of Table 3 comparing 2001, 2000 and 1999 results. Whether there is an underlying longer-term trend remains to be seen.

2. The average effectiveness of technology transfer (measured in terms of the range of outputs per research dollar) at the top 10 Canadian universities collectively is noticeably lower than it is collectively at the universities ranked 11 - 19. This surprising result is clearly illustrated in the results presented in Tables 1 and 2. It is confirmed in the results presented in Table 3 for the fully comparable data set. This suggests that a stronger commitment to technology transfer, evidenced by more resources devoted to the effort, could reap major benefits at those of the top 10 universities that are performing below the average for the country. It is worth noting that a similar disparity does not appear to exist in the U.S. It is a reasonable conjecture that the passage in 1980 of the Bayh-Dole act, which gave all U.S. universities the responsibility for commercializing IP generated in federally-funded research, stimulated broadly-based activity in universities of all sizes and types.

3. Local conditions, especially an institutional commitment to technology transfer, as evidenced by long-term provision of resources and support for employees dedicated to technology transfer, are a major determinant of the effectiveness of technology transfer. It has been pointed out in several recent reports that the provinces of B .C. and Alberta have had long-standing commitments to technology transfer, backed by financial support, and this effect shows clearly in the results shown in Tables 1 and 2 for UBC, SFU, Alberta and Calgary. However important commitment by provincial governments is, institutional commitment is critical. For example, the University of Manitoba received no direct provincial support for its UILO, but its patenting, licensing and income figures are all well above average. Other local conditions, such as the ready availability of venture capital and tax credits are also important, especially where start-up companies are part of the innovation strategy.

4. We found no evidence to support the idea that ownership of intellectual property by universities results in more or better technology transfer. Probably the most controversial recommendation of the ACST Report of the Expert Panel on the Commercialization of University Research related to changes to university IP policies proposing that in all cases the universities would be the owners of IP produced by their employees. Their recommendation was apparently based on cumulative data in the Statistics Canada survey cited here and some anecdotal evidence of technologies either being exploited outside of Canada or not being properly exploited at all. While it is certainly true that both these regrettable things do sometimes happen, the data on individual institutions gathered from the AUTM reports suggest clearly that universities that claim ownership of IP do not have a record of more successful exploitation – in fact the opposite appears to be true!

5. There is much opportunity for further analysis of the AUTM data sets and the Statistics Canada results (once the full results from their 2001 survey are available). Longitudinal studies of the effectiveness of technology transfer at those institutions which have reported in all of AUTM's eleven Surveys would be interesting, as would more detailed analysis of the impacts of long-term, well-staffed technology transfer offices. This would include contact with the offices themselves and access to their records – well beyond the scope of the present study.

6. There is a need for more publicly available, comprehensive information on the performance of Canadian universities in technology transfer, upon which informed decisions on public policy can be made. Although the AUTM Surveys captured most of the universities that attract most of the research funding (approximately 90%) in Canada, the 22 university respondents comprised only about half the universities in the country and may have omitted some significant players. Statistics Canada surveys appear to gather information from most of the universities in Canada, but do not make public any information on individual institutions – only aggregated data, which do not reveal any information about the tremendous variation that clearly exists among the universities. In addition, future surveys should seek information about technology transfer via means other than patents and licenses, since these other means comprise a large and increasing avenue, especially in the area of information and multimedia technologies.

Appendix A

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Technology Transfer at Canadian Universities:
Fiscal Year 2002 Update

FY2002 AUTM Survey Results for All Responding Canadian Universities

Appendix B - Page 1 of 4

INSTITUTION	MEDICAL SCHOOL?	PROG. YEAR	TIME OF TECH TRF	LICENSING FTES	OTHER FTES	TOTAL FTES	RESEARCH EXPENDITURES : INDUSTRIAL SOURCES	RESEARCH EXPENDITURES: FED GOVT SOURCES	TOTAL RESEARCH EXPENDITURES (USD)	Licenses & Options Executed
Université de Montréal*	Yes	1990	14	10	15	25	$41,010,382	$129,603,114	$ 209,707,922	25
McGill University*	Yes	1990	14	6	11	17	$16,749,961	$69,673,072	$ 184,117,034	21
University of Alberta*	Yes	1987	17	9	19	28	$28,948,408	$78,171,975	$ 174,035,669	17
University of British Columbia*	Yes	1984	20	12	9	21	$29,029,355	$69,779,337	$ 165,340,018	45
University of Toronto*	Yes	1980	24	15	6	21	$10,868,304	$91,654,639	$ 163,853,322	24
University of Calgary / UTI, Inc.	Yes	1989	15	7	5	12	$18,871,301	$29,473,950	$ 109,618,573	33
Université Laval*	Yes	1986	18	4	5	9	N.A.	N.A.	$ 93,670,064	9
University of Western Ontario*	Yes	1995	9	3	7	10	$2,556,231	$2,554,140	$ 90,063,694	28
McMaster University*	Yes	1987	17	1	6	7	$7,084,553	$39,616,406	$ 85,068,202	38
Queen's University*	Yes	1984	20	7	5	12	$14,458,599	$31,528,662	$ 80,987,261	6
University of Saskatchewan	Yes	1990	14	4	1	5	$5,856,688	$34,591,720	$ 76,796,178	22
University of Waterloo*	No	1990	14	3	1	4	$13,439,490	$56,369,427	$ 70,445,860	20
University of Guelph	No	1996	8	2	2	4	$10,474,420	$7,838,261	$ 65,208,414	13
University of Ottawa	Yes	1987	17	3	1	4	$4,458,599	$35,414,013	$ 63,375,796	4
Carleton University	No	1979	25	0	1	1	$11,464,968	$35,031,847	$ 46,496,815	0
University of Manitoba	Yes	1983	21	2	8	10	$1,847,934	$20,019,036	$ 43,127,859	8
Universite de Sherbrooke	Yes	1986	18	5	3	8	$6,352,217	$25,491,549	$ 31,843,766	23
Memorial University	Yes	1987	17	3	3	6	$9,554,140	$17,197,452	$ 30,573,248	2
Simon Fraser University	No	1985	19	5	2	7	$1,323,646	$15,452,310	$ 21,207,687	1
University of New Brunswick	No	1999	5	2	0	2	N.A.	$7,776,683	$ 16,221,800	3
Lakehead University	No	1995	9	2	1	3	$408,790	$2,847,134	$ 6,037,580	1
École de technologie supérieure	No	1996	8	1	3	4	$1,948,646	$1,470,032	$ 4,188,404	1
Acadia University	No	1999	5	1	0	1	$636,943	$636,943	$ 1,273,885	N.A.
Mount Allison University	No	2002	2			0	$47,771	$218,121	$ 1,235,220	1
Malaspina University College	No	1995	9			0	$6,369	$127,389	$ 191,083	0

* = "G-10" university

Technology Transfer at Canadian Universities:
Fiscal Year 2002 Update

FY2002 AUTM Survey Results for All Responding Canadian Universities

Appendix B - Page 2 of 4

LICENSES EXECUTED WITH EQUITY	CUMULATIVE ACTIVE LICENSES THROUGH	LICENSES EXECUTED IN ON EXCLUSIVE BASIS	LICENSES EXECUTED IN ON NON-EXCLUSIVE BASIS	LICENSES EXECUTED IN TO START-UP COMPANIES	LICENSES EXECUTED IN TO SMALL COMPANIES (EXCL. START-UPS)	LICENSES EXECUTED IN TO LARGE COMPANIES	LICENSES/ OPTIONS TO START-UP: EXCLUSIVE	LICENSES/ OPTIONS TO START-UP: NON-EXCLUSIVE	LICENSES/ OPTIONS TO SMALL COMPANIES: EXCLUSIVE
3	121	16	9	5	11	9	5	0	9
0	113	8	13	6	9	6	6	0	0
2	87	12	5	4	10	3	4	0	6
7	210	41	4	5	36	4	5	0	32
7	159	18	6	10	5	9	9	1	5
3	135	21	12	4	9	20	4	0	5
1	43	8	1	6	0	2	6	0	0
0	46	3	25	0	23	5	0	0	2
1	11	2	36	1	6	32	1	0	0
0	49	1	5	1	4	1	1	0	0
0	98	22	0	0	1	21	0	0	0
1	186	4	16	0	5	15	0	0	4
0	N.A.	11	2	0	N.A.	N.A.	0	0	N.A.
2	21	4	0	2	1	1	2	0	1
0	1	0	0	0	0	0	0	0	0
0	73	7	1	0	4	4	0	0	4
1	141	2	21	2	0	21	2	0	0
0	10	2	0	0	2	0	0	0	2
0	58	1	0	0	1	0	0	0	1
0	12	1	2	0	2	1	0	0	1
0	2	0	1	0	0	1	0	0	0
1	4	1	0	1	0	0	1	0	0
0	0	N.A.	N.A.	0	0	0	0	0	0
1	1	1	0	0	1	0	0	0	1
0	0	0	0	0	0	0	0	0	0

Technology Transfer at Canadian Universities:
Fiscal Year 2002 Update

FY2002 AUTM Survey Results for All Responding Canadian Universities

Appendix B - Page 3 of 4

LICENSES/ OPTIONS TO SMALL COMPANIES: NON-EXCLUSIVE	LICENSES/ OPTIONS TO LARGE COMPANIES: EXCLUSIVE	LICENSES/ OPTIONS TO LARGE COMPANIES: NON-EXCLUSIVE	RESEARCH FUNDING RELATED TO LICENSES/ OPTIONS	Total License Income	License Income per $1M Research Exp.	LICENSES/ OPTIONS GENERATING LICENSE INCOME	LICENSE INCOME REC'D PAID TO OTHER INSTITUTIONS	LICENSE INCOME REC'D: RUNNING ROYALTIES
2	2	7	$2,349,117	$349,143	$1,665	31	$16,496	$171,389
9	1	5	N.A.	$973,375	$5,287	40	$0	$650,799
4	2	1	$100,238	$1,343,267	$7,718	40	$0	$996,519
4	4	0	N.A.	$7,572,638	$45,800	73	$137,015	$5,850,558
0	4	5	$140,127	$1,203,180	$7,343	21	$210,469	$1,116,382
4	4	16	$461,241	$1,729,615	$15,778	73	$8,940	$646,725
0	1	1	$62,606	$146,076	$1,559	10	$0	$70,606
21	1	4	$101,911	$516,734	$5,737	46	$0	$142,217
6	1	31	N.A.	$465,814	$5,476	43	$0	$382,158
4	0	1	$0	$2,784,547	$34,383	29	N.A.	N.A.
1	21	0	$2,547,771	$613,341	$7,987	65	$2,415	$589,540
1	0	15	N.A.	$517,452	$7,345	30	N.A.	$485,605
N.A.	N.A.	N.A.	N.A.	$500,637	$7,677	N.A.	N.A.	$500,637
0	1	0	$1,430,573	$33,117	$523	5	$0	$1,270
0	0	0	$0	$38,217	$822	1	$0	$0
0	3	1	N.A.	$1,565,004	$36,288	29	$0	N.A.
0	0	21	$1,473,810	$10,244,024	$321,696	129	$254,525	$8,459,969
0	0	0	$369,427	$143,312	$4,687	3	$0	$63,694
0	0	0	$0	$468,417	$22,087	7	$0	$2,640
1	0	1	$21,831	$18,916	$1,166	6	$0	$1,066
0	0	1	$0	$0	$0	0	$0	$0
0	0	0	$0	$10,669	$2,547	3	$0	$10,669
0	0	0	$0	$0	$0	0	$0	$0
0	0	0	$9,554	$3,185	$2,578	0	$0	$3,185
0	0	0	$0	$0	$0	0	$0	$0

Technology Transfer at Canadian Universities:
Fiscal Year 2002 Update

FY2002 AUTM Survey Results for All Responding Canadian Universities

Appendix B - Page 4 of 4

LICENSE INCOME REC'D: CASHED-IN EQUITY	LICENSE INCOME REC'D: OTHER INCOME	LEGAL FEES EXPENDED	LEGAL FEES REIMBURSED	Invention Disclosures Received	TOTAL PATENT APPLICATIONS	New Patent Applications Filed	U.S. Patents Issued	Start-Ups Initiated	START-UPS INITIATED OPERATING IN HOME PROVINCE
$112,462	$65,292	$504,858	$143,340	113	42	33	17	7	7
$0	$322,576	$1,058,485	$322,576	145	120	52	19	4	5
$0	$346,748	$552,467	$194,133	64	43	24	18	5	5
$859,436	$862,644	$1,074,352	$901,987	125	153	102	29	5	5
$67,690	$19,108	$349,099	$137,615	130	49	27	11	8	8
$98,548	$984,342	$394,225	$87,555	89	32	7	14	4	3
$0	$75,470	$250,720	$7,643	39	36	22	9	6	6
$0	$374,518	$126,729	$63,494	23	18	18	1	0	0
$0	$83,656	$63,730	$0	41	18	17	5	0	0
N.A.	N.A.	$454,605	N.A.	27	49	13	17	0	0
$0	$23,801	$87,613	$16,232	35	10	7	2	0	0
$0	$31,847	$138,771	$8,892	10	7	4	2	N.A.	N.A.
$0	$0	$329,299	$170,162	120	10	7	4	0	0
$0	$31,847	$64,395	$27,389	10	8	7	3	2	2
$0	$38,217	$11,465	$0	16	1	1	0	0	0
N.A.	N.A.	$129,609	N.A.	21	28	22	4	1	1
$0	$1,784,055	$436,731	$310,245	19	6	3	1	2	2
$0	$79,618	$63,694	$0	28	3	3	0	0	0
$279,794	$185,983	$77,187	$12,716	28	20	15	4	2	2
$0	$17,850	$35,773	$1,320	11	7	3	0	0	0
$0	$0	$357	$0	2	2	0	0	0	0
$0	$0	$16,103	$0	2	7	7	0	1	1
$0	$0	$0	$0	3	0	0	0	0	0
$0	$0	$9,554	$0	2	1	1	0	N.A.	N.A.
$0	$0	$0	$0	1	0	0	0	0	0

Technology Transfer at Canadian Universities: FY 2001 Update
Table 1 - Page 1

FY2001 AUTM Survey Results for Responding Canadian Universities (Top 19)

Survey Results Normalized by Sponsored Research Expenditures (All figures in US$)

	Canadian University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of Toronto*	$312,034,059	132	0.423	17	0.054	$1,926,033	$6,173	13	0.042	6	0.019
2	Université de Montréal*	$225,796,380	19	0.084	18	0.080	$2,766,826	$12,254	11	0.049	4	0.018
3	University of Alberta*	$139,534,062	53	0.380	15	0.108	$4,916,654	$35,236	13	0.093	8	0.057
4	University of British Columbia*	$129,050,007	135	1.046	42	0.325	$5,585,186	$43,279	29	0.225	13	0.101
5	McGill University*	$122,591,229	81	0.661	28	0.228	$6,404,573	$52,243	28	0.228	5	0.041
6	University of Calgary/UTI, Inc.	$86,892,479	137	1.577	29	0.334	$1,964,752	$22,611	13	0.150	3	0.035
7	McMaster University*	$85,775,141	34	0.396	27	0.315	$584,983	$6,820	1	0.012	1	0.012
8	Université Laval*	$82,959,320	31	0.374	8	0.096	$108,879	$1,312	5	0.060	5	0.060
9	University of Western Ontario*	$74,548,400	23	0.309	25	0.335	$133,086	$1,785	3	0.040	2	0.027
10	University of Ottawa	$62,855,800	20	0.318	3	0.048	$59,626	$949	4	0.064	2	0.032
11	Queen's University*	$51,873,800	44	0.848	3	0.058	$2,709,737	$52,237	17	0.328	1	0.019
12	University of Waterloo*	$50,323,400	5	0.099	21	0.417	$755,820	$15,019	4	0.079	1	0.020
13	University of Saskatchewan	$45,155,400	38	0.842	13	0.288	$530,553	$11,749	0	0.000	3	0.066
14	University of Manitoba	$35,062,835	21	0.599	12	0.342	$1,222,755	$34,873	3	0.086	1	0.029
15	Université de Sherbrooke	$28,424,000	16	0.563	30	1.055	$10,594,400	$372,727	2	0.070	1	0.035
16	Memorial University	$27,778,000	31	1.116	4	0.144	$145,350	$5,233	2	0.072	0	0.000
17	Simon Fraser University	$17,171,991	22	1.281	5	0.291	$170,050	$9,903	3	0.175	6	0.349
18	Concordia University	$16,604,205	11	0.662	0	0.000	$31,008	$1,867	1	0.060	2	0.120
19	University of New Brunswick	$13,188,373	13	0.986	6	0.455	$13,687	$1,038	0	0.000	1	0.076
A	Can. **Totals** & *Cumulative:* Top 19	**$1,607,618,881**	**866**	*0.539*	**306**	*0.190*	**$40,623,958**	*$25,270*	**152**	*0.095*	**65**	*0.040*
B	Can. Average: Top 19	$84,611,520	45.6	0.661	16.1	0.262	$2,138,103	$36,174	8.0	0.096	3.4	0.059
C	Can. Median: Top 19	$62,855,800	31	0.599	15	0.288	$755,820	$11,749	4	0.070	2	0.035
D	Can. Standard Deviation: Top 19	$76,591,446	43.2	0.404	11.7	0.237	$2,858,824	$83,366	8.9	0.087	3	0.077
E	Can. **Totals** & *Cumulative:* Top 10	**$1,322,036,877**	**665**	*0.503*	**212**	*0.160*	**$24,450,598**	*$18,495*	**120**	*0.091*	**49**	*0.037*
F	Can. **Totals** & *Cumulative:* Last 9	**$285,582,004**	**201**	*0.704*	**94**	*0.329*	**$16,173,360**	*$56,633*	**32**	*0.112*	**16**	*0.056*
G	"G-10" (*) **Totals** & Cumulative	**$1,274,485,798**	**557**	*0.437*	**204**	*0.160*	**$25,891,777**	*$12,332*	**124**	*0.097*	**46**	*0.036*
H	Non-G-10 **Totals** & Cumulative	**$333,133,083**	**288**	*0.865*	**102**	*0.306*	**$14,732,181**	*$47,860*	**28**	*0.084*	**19**	*0.057*

FY2001 AUTM Survey Results for Responding U.S. Universities (Top 19)

Survey Results Normalized by Sponsored Research Expenditures (All figures in US$)

	U.S. University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of California System	$2,319,003,000	957	0.413	262	0.113	$72,899,000	$31,435	298	0.129	25	0.011
2	Johns Hopkins University	$1,218,888,300	360	0.295	78	0.064	$7,043,458	$5,779	95	0.078	6	0.005
3	Massachusetts Inst. of Technology	$787,700,000	446	0.566	119	0.151	$77,040,976	$97,805	163	0.207	29	0.037
4	University of Illinois	$627,242,760	204	0.325	63	0.100	$9,451,228	$15,068	33	0.053	6	0.010
5	University of Washington	$622,054,438	145	0.233	101	0.162	$26,446,297	$42,514	49	0.079	4	0.006
6	University of Wisconsin	$604,143,000	333	0.551	118	0.195	$24,230,361	$40,107	81	0.134	3	0.005
7	University of Michigan	$591,702,514	182	0.308	64	0.108	$8,199,000	$13,857	65	0.110	12	0.020
8	Stanford University	$514,020,574	277	0.539	150	0.292	$41,167,000	$80,088	109	0.212	6	0.012
9	Harvard University	$487,249,600	162	0.332	95	0.195	$24,793,720	$50,885	37	0.076	5	0.010
10	SUNY	$477,730,136	174	0.364	39	0.082	$14,666,539	$30,700	52	0.109	5	0.010
11	Penn State University	$472,482,000	203	0.430	37	0.078	$803,782	$1,701	65	0.138	4	0.008
12	University of Minnesota	$462,011,000	229	0.496	76	0.164	$16,727,250	$36,205	37	0.080	11	0.024
13	North Carolina State University	$444,487,786	211	0.475	44	0.099	$3,545,000	$7,975	27	0.061	6	0.013
14	Cornell University	$414,600,000	190	0.458	76	0.183	$12,260,000	$29,571	115	0.277	1	0.002
15	Washington University in St. Louis	$406,642,000	76	0.187	45	0.111	$7,687,253	$18,904	74	0.182	1	0.002
16	University of Pittsburgh	$386,371,000	85	0.220	20	0.052	$1,494,542	$3,868	49	0.127	4	0.010
17	California Institute of Technology	$384,000,000	476	1.240	48	0.125	$13,552,000	$35,292	132	0.344	12	0.031
18	University of Florida	$379,500,000	196	0.516	37	0.097	$28,683,282	$75,582	68	0.179	3	0.008
19	University of Colorado	$367,665,087	79	0.215	13	0.035	$2,238,792	$6,089	27	0.073	3	0.008
I	U.S. Totals & Cumulative: Top 19	**$11,967,493,195**	**4,985**	*0.417*	**1,485**	*0.124*	**$392,929,480**	*$32,833*	**1,576**	*0.132*	**146**	*0.012*
J	U.S. Average: Top 19	$629,868,063	262.4	0.430	78.2	0.127	$20,680,499	$32,812	82.9	0.139	7.7	0.012
K	U.S. Median: Top 19	$477,730,136	203	0.413	64	0.111	$13,552,000	$30,700	65	0.127	5	0.010
L	U.S. Standard Deviation: Top 19	$454,531,778	202.1	0.231	57.3	0.062	$21,930,296	$27,418	64.2	0.078	7.5	0.009
M	U.S. Totals & Cumulative: Top 19 adjusted for indirect costs @52.3%	**$7,811,679,631**	**4,985**	*0.638*	**1,485**	*0.190*	**$392,929,480**	*$50,300*	**1,576**	*0.202*	**146**	*0.019*

FY2001 AUTM Survey Results for <u>All</u> Responding U.S. Institutions (N = 168)

N	U.S. **Totals** & *Cumulative:* N=168	**$29,969,349,415**	**12,215**	*0.408*	**3,625**	*0.121*	**$1,009,006,694**	*$33,668*	**3,453**	*0.115*	**420**	*0.014*
	U.S. **Totals** & *Cumulative:* N=168	**$19,562,238,522**	**12,215**	*0.624*	**3,625**	*0.185*	**1,009,006,694**	*$51,579*	**3,453**	*0.177*	**420**	*0.021*

Technology Transfer at Canadian Universities:
FY 2001 Update
Table 2 - Page 1

FY2000 AUTM Survey Results for Responding Canadian Universities (Top 15)

Survey Results Normalized by Sponsored Research Expenditures (All figures in US$)

	Canadian University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of Toronto*	$280,629,917	127	0.453	25	0.089	$1,869,095	$6,660	13	0.046	9	0.032
2	University of Alberta*	$145,381,635	64	0.440	16	0.110	$1,099,369	$7,562	12	0.083	4	0.028
3	Universite de Montréal*	$142,295,929	55	0.387	32	0.225	$284,155	$1,997	12	0.084	8	0.056
4	McGill University*	$132,156,436	102	0.772	28	0.212	$485,566	$3,674	20	0.151	6	0.045
5	University of British Columbia*	$112,987,357	127	1.124	33	0.292	$2,827,372	$25,024	23	0.204	8	0.071
6	University of Calgary/UTI, Inc.	$73,296,630	119	1.624	23	0.314	$3,304,585	$45,085	13	0.177	2	0.027
7	University of Western Ontario*	$64,840,617	16	0.247	23	0.355	$22,462	$346	3	0.046	1	0.015
8	University of Guelph	$63,025,461	117	1.856	18	0.286	$1,019,507	$16,176	3	0.048	1	0.016
9	McMaster University*	$53,901,868	41	0.761	18	0.334	$280,378	$5,202	2	0.037	0	0.000
10	Queen's University*	$52,586,148	33	0.628	10	0.190	$5,454,921	$103,733	19	0.361	3	0.057
11	University of Waterloo*	$48,664,446	8	0.164	11	0.226	$420,788	$8,647	5	0.103	0	0.000
12	University of Manitoba	$35,960,877	9	0.250	11	0.306	$903,959	$25,137	4	0.111	1	0.028
13	Université de Sherbrooke	$32,284,374	14	0.434	26	0.805	$5,709,237	$176,842	3	0.093	5	0.155
14	Simon Fraser University	$16,774,393	36	2.146	5	0.298	$174,073	$10,377	3	0.179	9	0.537
15	Concordia University	$11,476,557	8	0.697	1	0.087	$31,265	$2,724	0	0.000	1	0.087
A	Can. **Totals** & *Cumulative:* Top 15	**$1,266,262,645**	**876**	*0.692*	**280**	*0.221*	**$23,886,732**	*$18,864*	**135**	*0.107*	**58**	*0.046*
B	Can. Average: Top 15	$84,417,510	58.4	0.799	18.7	0.275	$1,592,449	$29,279	9.0	0.115	3.9	0.077
C	Can. Median: Top 15	$63,025,461	41	0.628	18	0.286	$903,959	$8,647	5	0.093	3	0.032
D	Can. Standard Deviation: Top 15	$69,595,894	47.2	0.617	9.6	0.171	$1,897,180	$48,597	7.5	0.090	3	0.133
E	Can. **Totals** & *Cumulative:* Top 9	**$1,068,515,850**	**768**	*0.719*	**216**	*0.202*	**$11,192,489**	*$10,475*	**101**	*0.095*	**39**	*0.036*
F	Can. **Totals** & *Cumulative:* Last 6	**$197,746,795**	**108**	*0.546*	**64**	*0.324*	**$12,694,243**	*$64,194*	**34**	*0.172*	**19**	*0.096*
G	"G-9" (*) **Totals** & Cumulative	**$1,033,444,353**	**573**	*0.554*	**196**	*0.190*	**$12,744,106**	*$12,332*	**109**	*0.105*	**39**	*0.038*
H	Non-G-9 **Totals** & Cumulative	**$232,818,292**	**303**	*1.301*	**84**	*0.361*	**$11,142,626**	*$47,860*	**26**	*0.112*	**22**	*0.094*

Technology Transfer at Canadian Universities:
FY 2001 Update
Table 2 - Page 2

FY2000 AUTM Survey Results for Responding U.S. Universities (Top 15)

	U.S. University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of California System	$2,084,623,000	865	0.415	313	0.150	$267,765,000	$128,448	324	0.155	26	0.012
2	Johns Hopkins University	$1,033,801,604	355	0.343	127	0.123	$14,606,510	$14,129	106	0.103	10	0.010
3	Massachusetts Inst. of Technology	$727,600,000	425	0.584	102	0.140	$31,479,921	$43,265	152	0.209	31	0.043
4	University of Washington	$652,100,000	209	0.321	123	0.189	$30,303,963	$46,471	59	0.090	6	0.009
5	University of Illinois	$568,861,000	191	0.336	78	0.137	$5,386,195	$9,468	31	0.054	5	0.009
6	University of Wisconsin-Madison	$554,361,000	277	0.500	127	0.229	$22,935,726	$41,373	92	0.166	6	0.011
7	University of Pennsylvania	$529,554,951	223	0.421	63	0.119	$27,784,972	$52,469	50	0.094	6	0.011
8	University of Michigan	$499,700,000	168	0.336	51	0.102	$3,976,000	$7,957	77	0.154	8	0.016
9	SUNY Research Foundation	$448,525,468	186	0.415	35	0.078	$16,523,098	$36,839	72	0.161	4	0.009
10	Stanford University	$444,274,655	252	0.567	162	0.365	$36,944,000	$83,156	98	0.221	8	0.018
11	Penn State University	$440,259,000	204	0.463	22	0.050	$1,299,915	$2,953	43	0.098	4	0.009
12	Harvard University	$430,780,600	133	0.309	70	0.162	$16,541,234	$38,398	56	0.130	1	0.002
13	North Carolina State University	$415,617,075	169	0.407	47	0.113	$2,558,479	$6,156	45	0.108	6	0.014
14	University of Minnesota	$411,380,000	218	0.530	86	0.209	$23,143,317	$56,258	65	0.158	11	0.027
15	Texas A&M University System	$397,268,000	140	0.352	58	0.146	$6,049,298	$15,227	24	0.060	4	0.010
I	U.S. **Totals** & *Cumulative:* Top 15	**$9,638,706,353**	**4,015**	*0.417*	**1,464**	*0.152*	**$507,297,628**	*$52,631*	**1,294**	*0.134*	**136**	*0.014*
J	U.S. Average: Top 15	$642,580,424	267.7	0.420	97.6	0.154	$33,819,842	$38,838	86.3	0.131	9.1	0.014
K	U.S. Median: Top 15	$499,700,000	209	0.415	78	0.140	$16,541,234	$38,398	65	0.130	6.0	0.011
L	U.S. Standard Deviation: Top 15	$432,119,887	182.9	0.091	71.4	0.075	$65,736,940	$33,713	73.5	0.049	8.3	0.010
M	U.S. **Totals** & *Cumulative:* Top 15 adjusted for indirect costs @52.3%	**$6,291,583,781**	**4,015**	*0.638*	**1,464**	*0.233*	**$231,593,182**	*$36,810*	**1,294**	*0.206*	**136**	*0.022*

FY2000 AUTM Survey Results for <u>All</u> Responding U.S. Institutions (N = 169)

N	U.S. **Totals** & *Cumulative:* N=169	**$28,143,181,398**	**12,075**	*0.429*	**4,025**	*0.143*	**$1,241,099,887**	*$44,099*	**3,598**	*0.128*	**389**	*0.014*
O	U.S. **Totals** & *Cumulative:* N=169 adjusted for indirect costs @52.3%	**$18,370,222,845**	**12,075**	*0.657*	**4,025**	*0.219*	**$1,241,099,887**	*$67,560*	**3,598**	*0.196*	**389**	*0.021*

Technology Transfer at Canadian Universities:
FY 2001 Update
Table 2 - Page 3

FY1999 AUTM Survey Results for Responding Canadian Universities (Top 15)

	Canadian University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of Toronto*	$209,121,012	90	0.430	17	0.081	$844,175	$4,037	6	0.029	5	0.024
2	Universite de Montreal*	$133,658,635	37	0.277	15	0.112	$362,229	$2,710	13	0.097	8	0.060
3	McGill University*	$125,454,301	95	0.757	24	0.191	$539,433	$4,300	17	0.136	8	0.064
4	University of Alberta*	$115,918,697	59	0.509	15	0.129	$2,434,907	$21,005	11	0.095	4	0.035
5	University of British Columbia*	$95,341,717	126	1.322	14	0.147	$788,209	$8,267	50	0.524	6	0.063
6	University of Calgary /UTI, Inc.	$71,519,412	77	1.077	29	0.405	$1,871,917	$26,174	15	0.210	3	0.042
7	University of Western Ontario*	$60,573,428	29	0.479	7	0.116	$43,556	$719	4	0.066	5	0.083
8	McMaster University*	$53,059,239	29	0.547	9	0.170	$365,589	$6,890	2	0.038	0	0.000
9	Queen's University*	$46,556,737	38	0.816	8	0.172	$674,660	$14,491	12	0.258	0	0.000
10	University of Waterloo*	$38,026,652	8	0.210	17	0.447	$459,348	$12,080	6	0.158	0	0.000
11	University of Manitoba	$31,192,381	22	0.705	15	0.481	$969,731	$31,089	7	0.224	0	0.000
12	Universite de Sherbrooke	$26,921,524	21	0.780	22	0.817	$2,692,152	$100,000	3	0.111	2	0.074
13	Carleton University	$18,425,175	20	1.085	2	0.109	$97,698	$5,302	0	0.000	1	0.054
14	Simon Fraser University	$15,601,834	17	1.090	6	0.385	$556,350	$35,659	5	0.320	4	0.256
15	Concordia University	$10,624,157	3	0.282	1	0.094	$15,130	$1,424	2	0.188	1	0.094
A	Can. **Totals** & *Cumulative:* Top 15	**$1,051,994,901**	**671**	*0.638*	**201**	*0.191*	**$12,715,084**	*$12,087*	**153**	*0.145*	**47**	*0.045*
B	Can. Average: Top 15	$70,132,993	44.7	0.691	13.4	0.257	$847,672	$18,276	10.2	0.164	3.1	0.057
C	Can. Median: Top 15	$53,059,239	29	0.705	15	0.170	$556,350	$8,267	6	0.136	3	0.054
D	Can. Standard Deviation: Top 15	$55,862,818	36.4	0.341	8.0	0.208	$833,230	$25,211	12.1	0.134	3	0.064
E	Can. **Totals** & *Cumulative:* Top 9	**$911,203,178**	**580**	*0.637*	**138**	*0.151*	**$7,924,675**	*$8,697*	**130**	*0.143*	**39**	*0.043*
F	Can. **Totals** & *Cumulative:* Last 6	**$140,791,723**	**91**	*0.646*	**63**	*0.447*	**$4,790,409**	*$34,025*	**23**	*0.163*	**8**	*0.057*
G	"G-9" (*) **Totals** & Cumulative	**$877,710,418**	**511**	*0.582*	**126**	*0.144*	**$6,512,106**	*$7,419*	**121**	*0.138*	**36**	*0.041*
H	Non-G-9 **Totals** & Cumulative	**$174,284,483**	**160**	*0.918*	**75**	*0.430*	**$6,202,978**	*$35,591*	**32**	*0.184*	**29**	*0.166*

Statistics Canada 1999 Survey Results for Responding Canadian Universities and Colleges

I	Can. **Totals** & *Cumulative:* N= 84	**$1,361,220,000**	**829**	*0.609*	**218**	*0.160*	$12,539,240	*$9,212*	**168**	*0.123*		
	Using FY97 Revenue with Cdn$ = 0.735 US$											
J	Can. **Totals** & *Cumulative:* Top 12	**$965,055,000**	**570**	*0.591*	**130**	*0.135*	$7,647,500	*$7,924*				

Technology Transfer at Canadian Universities:
FY 2001 Update
Table 2 - Page 4

FY1999 AUTM Survey Results for Responding U.S. Universities (Top 15)

	U.S. University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of California System	$1,864,901,000	818	0.439	219	0.117	$74,133,000	$39,752	281	0.151	13	0.007
2	Johns Hopkins University	$1,010,088,344	250	0.248	106	0.105	$10,353,453	$10,250	111	0.110	7	0.007
3	MIT	$725,600,000	381	0.525	95	0.131	$16,131,334	$22,232	154	0.212	17	0.023
4	University of Michigan	$499,722,000	158	0.316	42	0.084	$3,472,671	$6,949	56	0.112	2	0.004
5	University of Washington	$479,654,994	226	0.471	115	0.240	$27,878,900	$58,123	36	0.075	N.A.	
6	University of Pennsylvania	$477,000,000	244	0.512	57	0.119	$2,984,000	$6,256	82	0.172	6	0.013
7	University of Wisconson, Madison	$421,600,000	278	0.659	106	0.251	$18,011,400	$42,722	79	0.187	4	0.009
8	University of Minnesota	$417,556,493	219	0.524	71	0.170	$5,662,088	$13,560	55	0.132	5	0.012
9	Stanford University	$417,037,000	236	0.566	147	0.352	$27,699,355	$66,419	90	0.216	19	0.046
10	North Carolina State University	$413,369,278	148	0.358	83	0.201	$7,761,000	$18,775	30	0.073	8	0.019
11	SUNY Research Foundation	$413,369,278	201	0.486	46	0.111	$13,538,619	$32,752	53	0.128	3	0.007
12	Texas A&M University System	$402,203,000	145	0.361	53	0.132	$5,180,510	$12,880	19	0.047	0	0.000
13	Harvard University	$401,849,500	109	0.271	48	0.119	$9,886,404	$24,602	72	0.179	2	0.005
14	Penn State University	$393,462,000	188	0.478	40	0.102	$2,830,448	$7,194	46	0.117	3	0.008
15	Cornell University	$376,784,000	172	0.456	150	0.398	$6,070,000	$16,110	70	0.186	4	0.011
I	U.S. **Totals** & *Cumulative:* Top 15	**$8,714,196,887**	**3,773**	*0.433*	**1378**	*0.158*	**$231,593,182**	*$26,577*	**1,234**	*0.142*	**93**	*0.011*
J	U.S. Average: Top 15	$580,946,459	251.5	0.445	91.9	0.176	$15,439,545	$25,238	82.3	0.140	6.6	0.012
K	U.S. Median: Top 15	$417,556,493	219	0.471	83	0.131	$9,886,404	$18,775	70	0.132	4.5	0.009
L	U.S. Standard Deviation: Top 15	$392,543,418	170.0	0.114	50.7	0.096	$18,170,434	$18,934	64.5	0.052	5.8	0.011
M	U.S. **Totals** & *Cumulative:* Top 15 adjusted for indirect costs @52.3%	**$5,688,118,072**	**3,773**	*0.663*	**1,378**	*0.242*	**$231,593,182**	*$40,715*	**1,234**	*0.217*	**93**	*0.016*

FY1999 AUTM Survey Results for <u>All</u> Responding U.S. Institutions (N = 139)

N	U.S. **Totals** & *Cumulative:* N=139	**$21,386,650,472**	**9,555**	*0.447*	**3,078**	*0.144*	**$576,889,538**	*$26,974*	**2,681**	*0.125*	**279**	*0.013*
O	U.S. **Totals** & *Cumulative:* N=139	**$13,959,954,616**	**9,555**	*0.684*	**3,078**	*0.220*	**$576,889,538**	*$41,325*	**2,681**	*0.192*	**279**	*0.020*

Technology Transfer at Canadian Universities: FY 2001 Update
Table 3

FY2001 AUTM Survey Results for the 14 Canadian Universities Responding in All Three Years and U.S. Results

Survey Results Normalized by Sponsored Research Expenditures (All figures in US$)

	Canadian University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of Toronto*	$312,034,059	132	0.423	17	0.054	$1,926,033	$6,173	13	0.042	6	0.019
2	Université de Montréal*	$225,796,380	19	0.084	18	0.080	$2,766,826	$12,254	11	0.049	4	0.018
3	University of Alberta*	$139,534,062	53	0.380	15	0.108	$4,916,654	$35,236	13	0.093	8	0.057
4	University of British Columbia*	$129,050,007	135	1.046	42	0.325	$5,585,186	$43,279	29	0.225	13	0.101
5	McGill University*	$122,591,229	81	0.661	28	0.228	$6,404,573	$52,243	28	0.228	5	0.041
6	University of Calgary/UTI, Inc.	$86,892,479	137	1.577	29	0.334	$1,964,752	$22,611	13	0.150	3	0.035
7	McMaster University*	$85,775,141	34	0.396	27	0.315	$584,983	$6,820	1	0.012	1	0.012
9	University of Western Ontario*	$74,548,400	23	0.309	25	0.335	$133,086	$1,785	3	0.040	2	0.027
11	Queen's University*	$51,873,800	44	0.848	3	0.058	$2,709,737	$52,237	17	0.328	1	0.019
12	University of Waterloo*	$50,323,400	5	0.099	21	0.417	$755,820	$15,019	4	0.079	1	0.020
14	University of Manitoba	$35,062,835	21	0.599	12	0.342	$1,222,755	$34,873	3	0.086	1	0.029
15	Université de Sherbrooke	$28,424,000	16	0.563	30	1.055	$10,594,400	$372,727	2	0.070	1	0.035
17	Simon Fraser University	$17,171,991	22	1.281	5	0.291	$170,050	$9,903	3	0.175	6	0.349
18	Concordia University	$16,604,205	11	0.662	0	0.000	$31,008	$1,867	1	0.060	2	0.120
A	Can. **Totals** & *Cumulative:* 14	**$1,375,681,988**	**733**	*0.533*	**272**	*0.198*	**$39,765,863**	*$28,906*	**141**	*0.102*	**54**	*0.039*
B	Can. Average: 14	$98,262,999	52.4	0.638	19.4	0.282	$2,840,419	$47,645	10.1	0.117	3.9	0.063
C	Can. Median: 14	$80,161,771	29	0.581	20	0.303	$1,945,393	$18,815	8	0.083	3	0.032
D	Can. Standard Deviation: 14	$84,407,104	48.6	0.429	11.8	0.261	$3,047,067	$95,277	9.5	0.091	4	0.088
E	Can. **Totals** & *Cumulative:* Top 8	**$1,176,221,757**	**614**	*0.522*	**201**	*0.171*	**$24,282,093**	*$20,644*	**111**	*0.094*	**42**	*0.036*
F	Can. **Totals** & *Cumulative:* Last 6	**$199,460,231**	**119**	*0.597*	**71**	*0.356*	**$15,483,770**	*$77,628*	**30**	*0.150*	**12**	*0.060*
G	1999 Can. **Totals** & Cumulative: 14	**$1,033,569,726**	**651**	*0.630*	**199**	*0.193*	**$12,617,386**	*$12,208*	**153**	*0.148*	**46**	*0.045*
H	2000 Can. **Totals** & Cumulative: 14	**$1,203,237,184**	**759**	*0.631*	**262**	*0.218*	**$22,867,225**	*$19,005*	**132**	*0.110*	**57**	*0.047*
I	2001 Can. **Totals** & Cumulative: 14	**$1,375,681,988**	**733**	*0.533*	**272**	*0.198*	**$39,765,863**	*$28,906*	**141**	*0.102*	**54**	*0.039*
J	1999 U.S. **Totals** & *Cumulative* : 139	**$13,959,954,616**	**9,555**	*0.684*	**3,078**	*0.220*	**$576,889,538**	*$41,325*	**2,681**	*0.192*	**279**	*0.020*
K	2000 U.S. **Totals** & *Cumulative* : 139	**$18,370,222,845**	**12,075**	*0.657*	**4,025**	*0.219*	**$1,241,099,887**	*$67,560*	**3,598**	*0.196*	**389**	*0.021*
L	2001 U.S. **Totals** & *Cumulative* : 139	**$19,562,238,522**	**12,215**	*0.624*	**3,625**	*0.185*	**$1,009,006,694**	*$51,579*	**3,453**	*0.177*	**420**	*0.021*

U.S. Research Expenditures adjusted for indirect costs @52.3%

Technology Transfer at Canadian Universities:
FY 2001 Update
Table 4 - Page 1

FY 2000 AUTM Survey Results for the 14 Canadian Universities Responding in All Three Years

Survey Results Normalized by Sponsored Research Expenditures (All figures in US$)

	Canadian University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of Toronto*	$280,629,917	127	0.453	25	0.089	$1,869,095	$6,660	13	0.046	9	0.032
2	University of Alberta*	$145,381,635	64	0.440	16	0.110	$1,099,369	$7,562	12	0.083	4	0.028
3	Universite de Montréal*	$142,295,929	55	0.387	32	0.225	$284,155	$1,997	12	0.084	8	0.056
4	McGill University*	$132,156,436	102	0.772	28	0.212	$485,566	$3,674	20	0.151	6	0.045
5	University of British Columbia*	$112,987,357	127	1.124	33	0.292	$2,827,372	$25,024	23	0.204	8	0.071
6	University of Calgary/UTI, Inc.	$73,296,630	119	1.624	23	0.314	$3,304,585	$45,085	13	0.177	2	0.027
7	University of Western Ontario*	$64,840,617	16	0.247	23	0.355	$22,462	$346	3	0.046	1	0.015
9	McMaster University*	$53,901,868	41	0.761	18	0.334	$280,378	$5,202	2	0.037	0	0.000
10	Queen's University*	$52,586,148	33	0.628	10	0.190	$5,454,921	$103,733	19	0.361	3	0.057
11	University of Waterloo*	$48,664,446	8	0.164	11	0.226	$420,788	$8,647	5	0.103	0	0.000
12	University of Manitoba	$35,960,877	9	0.250	11	0.306	$903,959	$25,137	4	0.111	1	0.028
13	Université de Sherbrooke	$32,284,374	14	0.434	26	0.805	$5,709,237	$176,842	3	0.093	5	0.155
14	Simon Fraser University	$16,774,393	36	2.146	5	0.298	$174,073	$10,377	3	0.179	9	0.537
15	Concordia University	$11,476,557	8	0.697	1	0.087	$31,265	$2,724	0	0.000	1	0.087
A	Can. **Totals** & Cumulative: 14	**$1,203,237,184**	**759**	*0.631*	**262**	*0.218*	**$22,867,225**	*$19,005*	**132**	*0.110*	**57**	*0.047*
B	Can. Average: 14	$85,945,513	54.2	0.723	18.7	0.275	$1,633,373	$30,215	9.4	0.120	4.1	0.081
C	Can. Median: 14	$59,371,243	39	0.540	21	0.259	$694,763	$8,104	9	0.098	4	0.039
D	Can. Standard Deviation: 14	$71,961,492	46.0	0.563	10.0	0.177	$1,961,914	$50,291	7.6	0.092	3	0.137
E	Can. **Totals** & *Cumulative:* Top 8	**$1,005,490,389**	**651**	*0.647*	**198**	*0.197*	**$10,172,982**	*$10,117*	**98**	*0.097*	**38**	*0.038*
F	Can. **Totals** & *Cumulative:* Last 6	**$197,746,795**	**108**	*0.546*	**64**	*0.324*	**$12,694,243**	*$64,194*	**34**	*0.172*	**19**	*0.096*

FY 1999 AUTM Survey Results for the 14 Canadian Universities Responding in All Three Years

Survey Results Normalized by Sponsored Research Expenditures (All figures in US$)

	Canadian University	Total Sponsored Research Expenditures	Invention Disclosures Received	Invention Disclosures Received per $1M	License & Options Executed	License & Options Executed per $1M	License Income Received	License Income Received per $1M	U.S. Patents Issued	U.S. Patents Issued per $1M	Start-up Companies Formed	Start-up Companies Formed per $1M
1	University of Toronto*	$209,121,012	90	0.430	17	0.081	$844,175	$4,037	6	0.029	5	0.024
2	Universite de Montreal*	$133,658,635	37	0.277	15	0.112	$362,229	$2,710	13	0.097	8	0.060
3	McGill University*	$125,454,301	95	0.757	24	0.191	$539,433	$4,300	17	0.136	8	0.064
4	University of Alberta*	$115,918,697	59	0.509	15	0.129	$2,434,907	$21,005	11	0.095	4	0.035
5	University of British Columbia*	$95,341,717	126	1.322	14	0.147	$788,209	$8,267	50	0.524	6	0.063
6	University of Calgary /UTI, Inc.	$71,519,412	77	1.077	29	0.405	$1,871,917	$26,174	15	0.210	3	0.042
7	University of Western Ontario*	$60,573,428	29	0.479	7	0.116	$43,556	$719	4	0.066	5	0.083
8	McMaster University*	$53,059,239	29	0.547	9	0.170	$365,589	$6,890	2	0.038	0	0.000
9	Queen's University*	$46,556,737	38	0.816	8	0.172	$674,660	$14,491	12	0.258	0	0.000
10	University of Waterloo*	$38,026,652	8	0.210	17	0.447	$459,348	$12,080	6	0.158	0	0.000
11	University of Manitoba	$31,192,381	22	0.705	15	0.481	$969,731	$31,089	7	0.224	0	0.000
12	Universite de Sherbrooke	$26,921,524	21	0.780	22	0.817	$2,692,152	$100,000	3	0.111	2	0.074
14	Simon Fraser University	$15,601,834	17	1.090	6	0.385	$556,350	$35,659	5	0.320	4	0.256
15	Concordia University	$10,624,157	3	0.282	1	0.094	$15,130	$1,424	2	0.188	1	0.094
A	Can. **Totals** & *Cumulative:* 14	**$1,033,569,726**	**651**	*0.630*	**199**	*0.193*	**$12,617,386**	*$12,208*	**153**	*0.148*	**46**	*0.045*
B	Can. Average: 14	$73,826,409	46.5	0.663	14.2	0.268	$901,242	$19,203	10.9	0.175	3.3	0.057
C	Can. Median: 14	$56,816,334	33	0.626	15	0.171	$615,505	$10,173	7	0.147	4	0.051
D	Can. Standard Deviation: 14	$56,038,781	37.1	0.335	7.6	0.212	$837,449	$25,896	12.3	0.131	3	0.066
E	Can. **Totals** & *Cumulative:* Top 8	**$911,203,178**	**580**	*0.637*	**138**	*0.151*	**$7,924,675**	*$8,697*	**130**	*0.143*	**39**	*0.043*
F	Can. **Totals** & *Cumulative:* Last 6	**$122,366,548**	**71**	*0.580*	**61**	*0.499*	**$4,692,711**	*$38,350*	**23**	*0.188*	**7**	*0.057*

Technology Transfer at Canadian Universities: FY 2001 Update
Table 5

Inventions Disclosed Per $1 Million Research Expenditures, Canada and the U.S. (1991 - 2001)

	Year	Number of Reporting Institutions	Total Sponsored Research Expenditures (U.S. $)	Ave. Sponsored Research Expenditures per Institution	Invention Disclosures Received	Average Disclosures per Institution	Disclosures per $1M US Research	Disclosures per $1M US Research Direct Costs*
Canada	1991	10	$484,021,929	$48,402,193	250	25	0.517	0.517
	1992	10	$472,250,978	$47,225,098	284	28	0.601	0.601
	1993	12	$687,047,338	$57,253,945	393	33	0.572	0.572
	1994	12	$684,158,438	$57,013,203	445	37	0.650	0.650
	1995	16	$943,247,718	$58,952,982	578	36	0.613	0.613
	1996	14	$855,217,872	$61,086,991	509	36	0.595	0.595
	1997	16	$1,046,898,769	$65,431,173	690	43	0.659	0.659
	1998	20	$1,118,629,108	$55,931,455	797	40	0.712	0.712
	1999	20	$1,122,387,230	$56,119,362	717	36	0.639	0.639
	2000	18	$1,282,314,177	$71,239,677	886	49	0.691	0.691
	2001	19	$1,607,618,881	$84,611,520	866	46	0.539	0.539
								U.S. Adjusted
U.S.	1991	98	$11,479,381,778	$117,136,549	4,880	50	0.425	0.651
	1992	98	$12,799,045,236	$130,602,502	5,700	58	0.445	0.682
	1993	117	$14,875,667,330	$127,142,456	6,598	56	0.444	0.680
	1994	120	$16,058,644,323	$133,822,036	5,597	47	0.349	0.534
	1995	127	$17,211,913,185	$135,526,875	7,427	58	0.432	0.661
	1996	131	$18,688,253,796	$142,658,426	8,119	62	0.434	0.666
	1997	132	$19,858,137,581	$150,440,436	9,051	69	0.456	0.698
	1998	132	$21,386,650,472	$162,020,079	9,555	72	0.447	0.684
	1999	139	$23,565,568,068	$169,536,461	10,052	72	0.427	0.653
	2000	169	$28,143,181,398	$166,527,701	12,075	71	0.429	0.657
	2001	168	$29,969,349,415	$178,388,985	12,215	73	0.408	0.624

Source: Results of AUTM annual surveys FY1991 - 2001

* Direct costs inferred in US data by dividing expenditures by 1.532

Technology Transfer at Canadian Universities: FY 2001 Update
Table 6

Normalized AUTM Survey Results for Selected Canadian Universities (1995 - 2001)

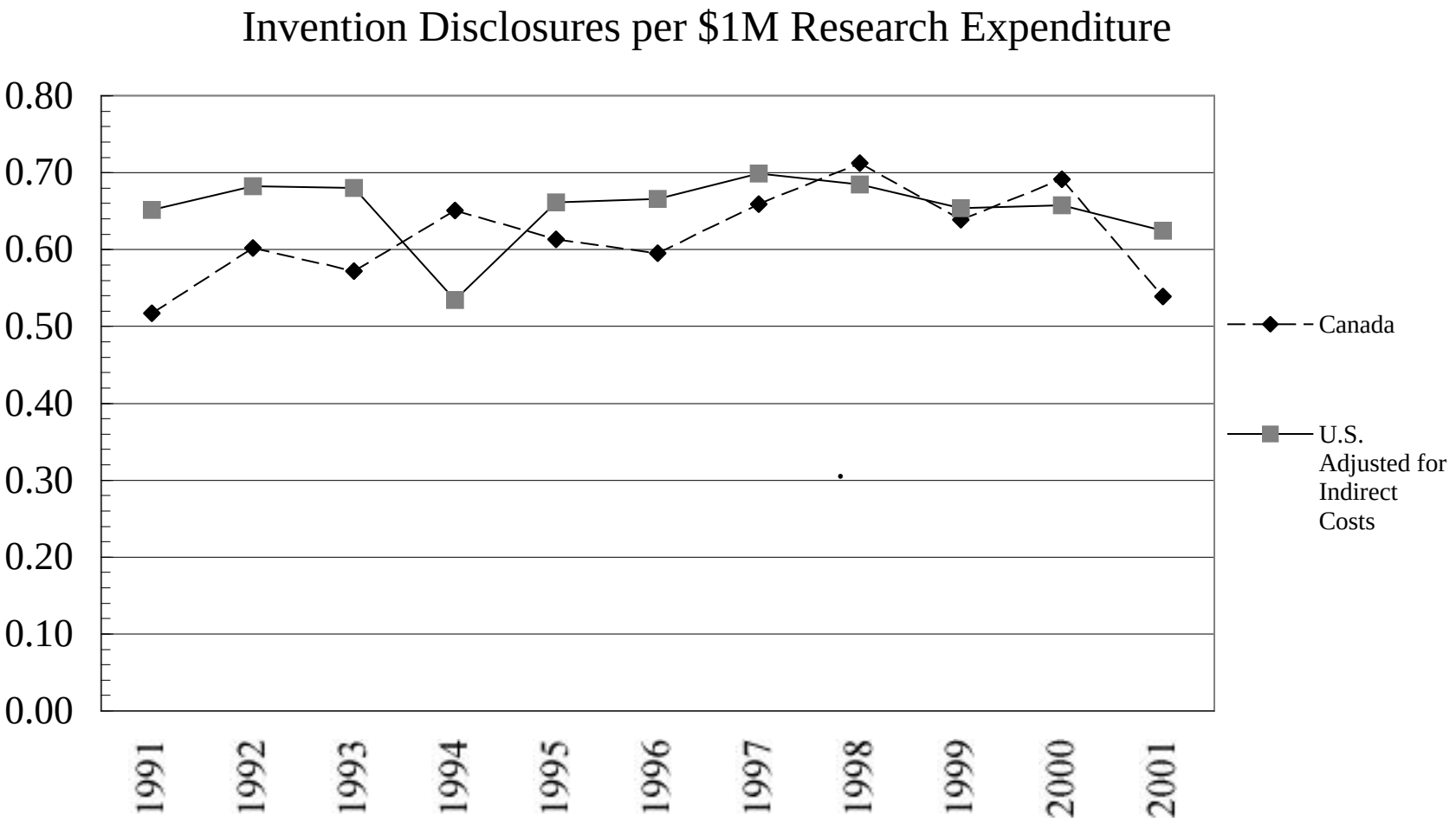
University	FY 1995		FY 1996		FY 1997		FY 1998		FY 1999		FY 2000		FY 2001	
	Inv. Discl. per $1M*	License Income per $1M*	Inv. Discl. per $1M	License Income per $1M	Inv. Discl. per $1M	License Income per $1M	Inv. Discl. per $1M	License Income per $1M	Inv. Discl. per $1M	License Income per $1M	Inv. Discl. per $1M	License Income per $1M	Inv. Discl. per $1M	License Income per $1M
University of Toronto	0.44	$10,973	0.51	$11,986	0.54	$7,805	0.55	$7,330	0.43	$4,037	0.45	$6,660	0.42	$6,173
Universite de Montréal	0.15	$3,195	0.31	$2,934	0.22	$2,439	0.31	$3,710	0.28	$2,710	0.39	$1,997	0.08	$12,254
University of Alberta	0.07	$8,208	0.93	$35,044	0.90	$32,246	0.91	$32,246	0.51	$21,005	0.44	$7,562	0.38	$3,236
University of British Columbia	1.17	$9,465	1.10	$5,551	1.01	$8,737	1.02	$8,197	1.32	$8,267	1.12	$25,024	1.05	$43,279
McGill University					0.48	$2,488	0.81	$3,596	0.76	$4,300	0.77	$3,674	0.66	$52,243
University of Calgary / UTI, Inc	1.31	$22,078	0.95	$35,063	1.00	$28,702	1.01	$28,616	1.08	$26,174	1.62	$45,085	1.58	$22,611
McMaster University					0.27	$5,351	0.28	$5,454	0.55	$6,890	0.76	$5,202	0.40	$6,820
University of Western Ontario	0.21	$229	0.25	$165	1.27	$911	0.13	$911	0.48	$719	0.25	$346	0.31	$1,785
Queen's University	0.78	$8,581	0.56	$20,636	0.75	$12,143	0.75	$12,143	0.82	$14,491	0.63	$103,733	0.85	$52,237
University of Waterloo					0.41	$23,307	0.13	$41,985	0.21	$12,080	0.16	$8,647	0.10	$15,019
University of Manitoba	0.30	$10,667	0.49	$13,190	0.95	$16,030	0.96	$13,387	0.71	$31,089	0.25	$25,137	0.60	$34,873
Simon Fraser University	1.16	$5,460	2.03	$8,457	1.87	$2,768	1.89	$2,768	1.09	$35,659	2.15	$10,377	1.28	$9,903
Concordia University	0.17	$1,327	0.08	$2,146	0.36	$3,878	0.36	$3,202	0.28	$1,424	0.70	$2,724	0.66	$1,867
Average	0.57	$8,018	0.72	$13,517	0.77	$11,293	0.70	$12,580	0.66	$12,988	0.75	$18,936	0.64	$20,177
Median	0.37	$8,394	0.54	$10,222	0.75	$7,805	0.75	$7,330	0.55	$8,267	0.63	$7,562	0.60	$12,254

*1996 Sponsored research amounts used to normalize, due to lack of 1995 data

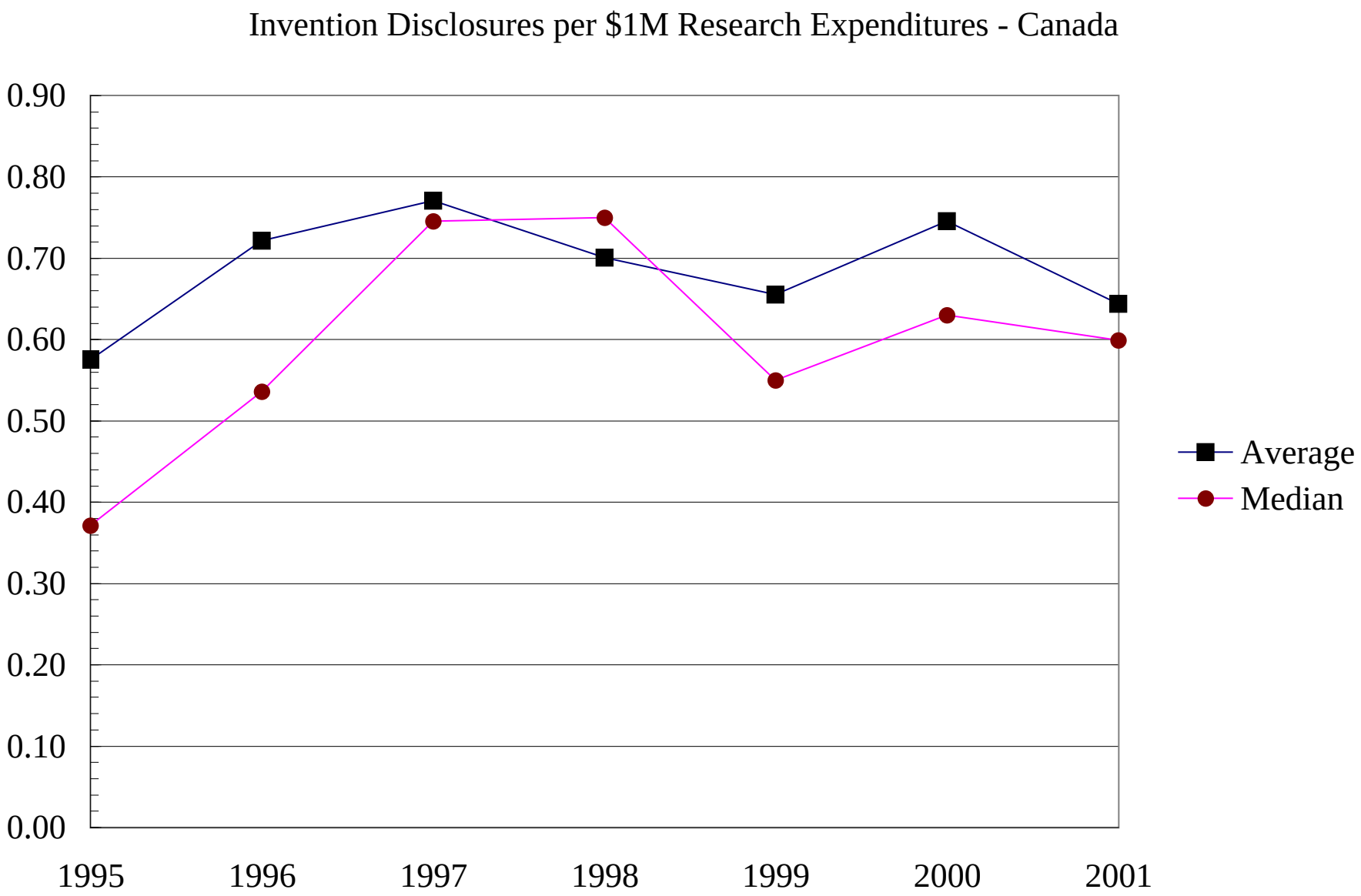
Technology Transfer at Canadian Universities: FY 2001 Update
Table 6

Fiscal Year		Average Ave. Inv. Discl. per $1M	Ave. License Income per $1M	Median Median Inv. Discl. per $1M	Median License Income per $1M
	1995	0.57	$8,018	0.37	$8,394
	1996	0.72	$13,517	0.54	$10,222
	1997	0.77	$11,293	0.75	$7,805
	1998	0.70	$12,580	0.75	$7,330
	1999	0.66	$12,988	0.55	$8,267
	2000	0.75	$18,936	0.63	$7,562
	2001	0.64	$20,177	0.60	$12,254

Technology Transfer at Canadian Universities: FY 2001 Update
Figure 1



Technology Transfer at Canadian Universities: FY 2001 Update
Figure 2



Technology Transfer at Canadian Universities: FY 2001 Update
Figure 3

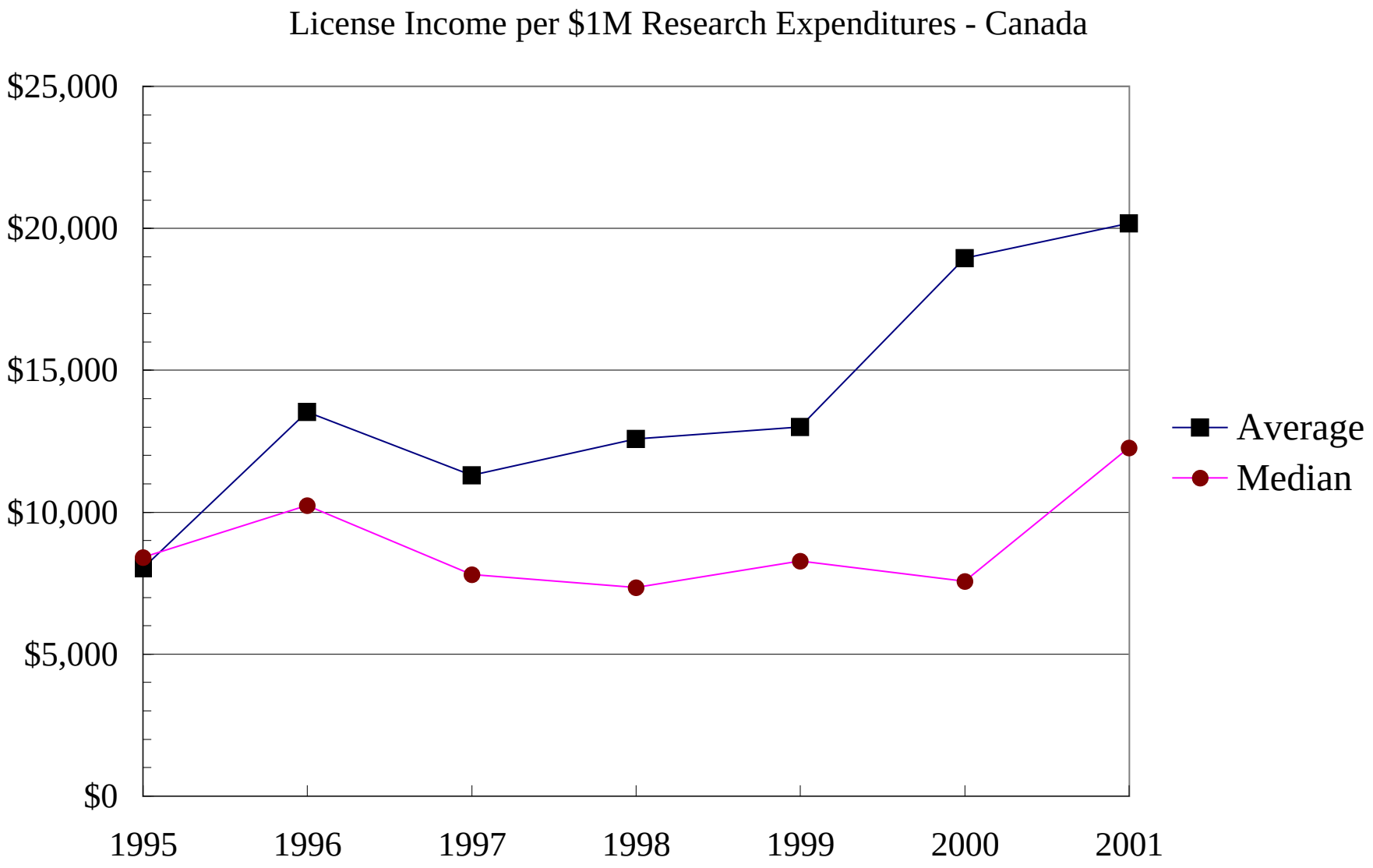
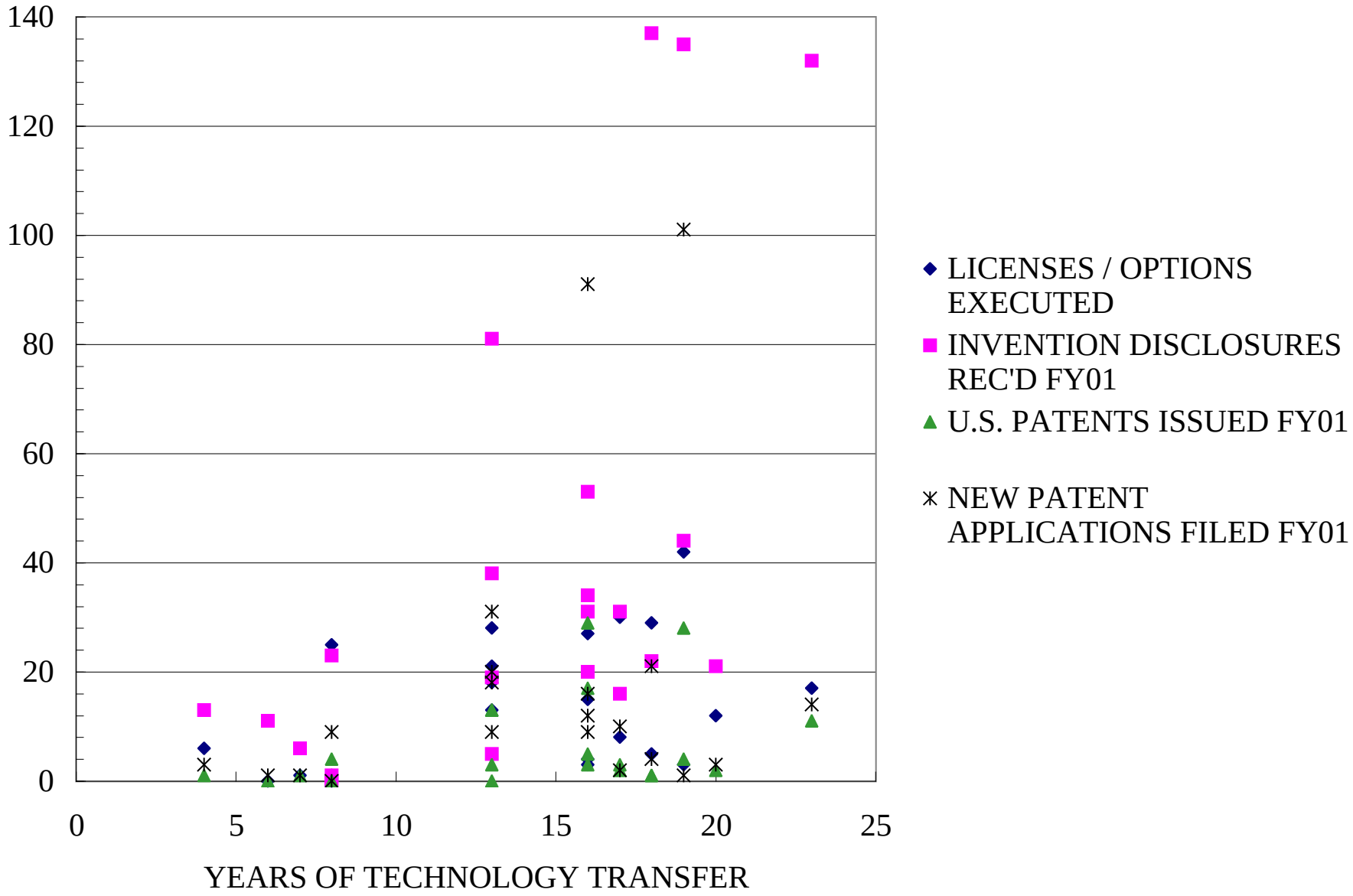
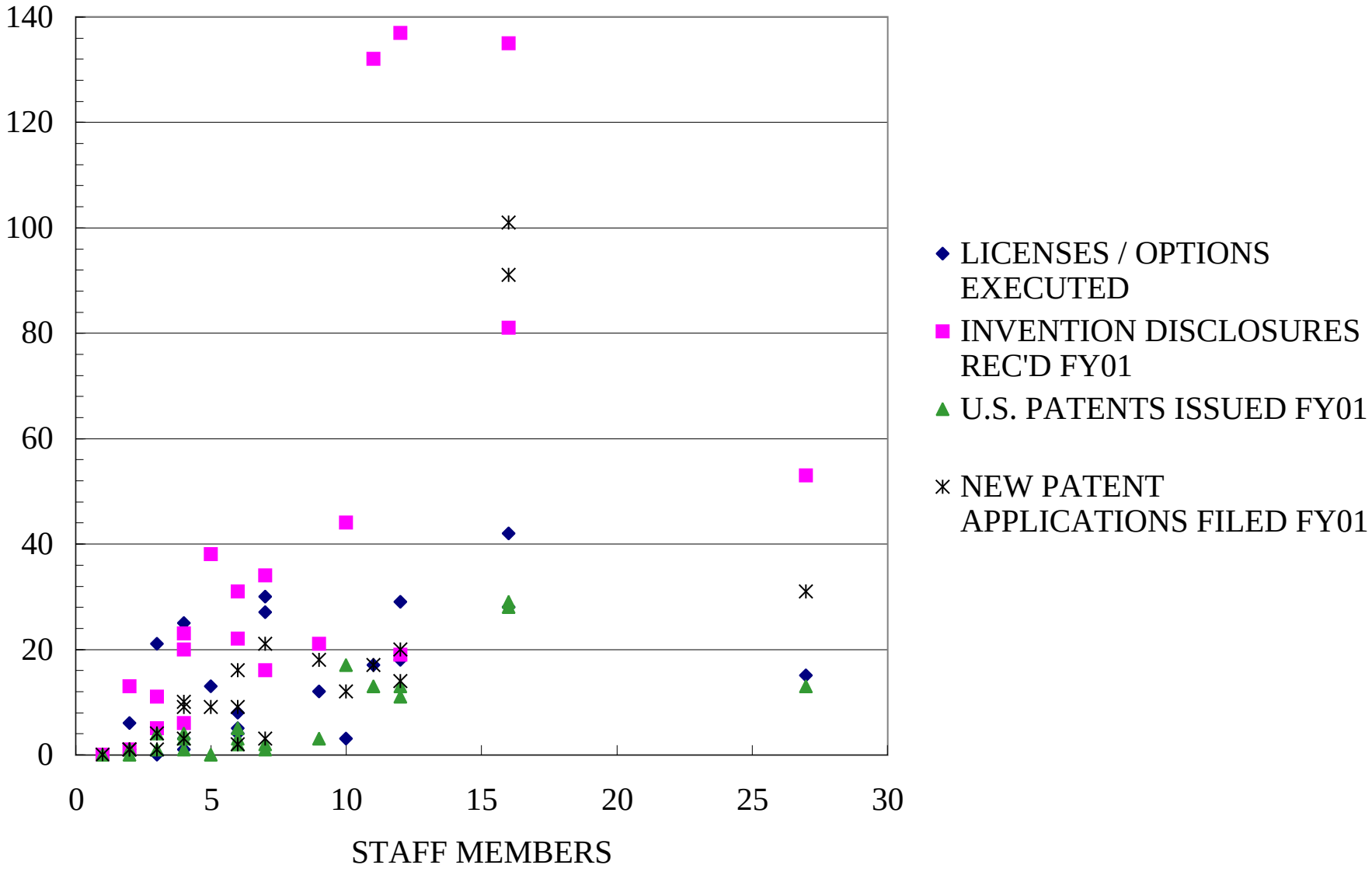


Table 6 Chart 4 7/10/03

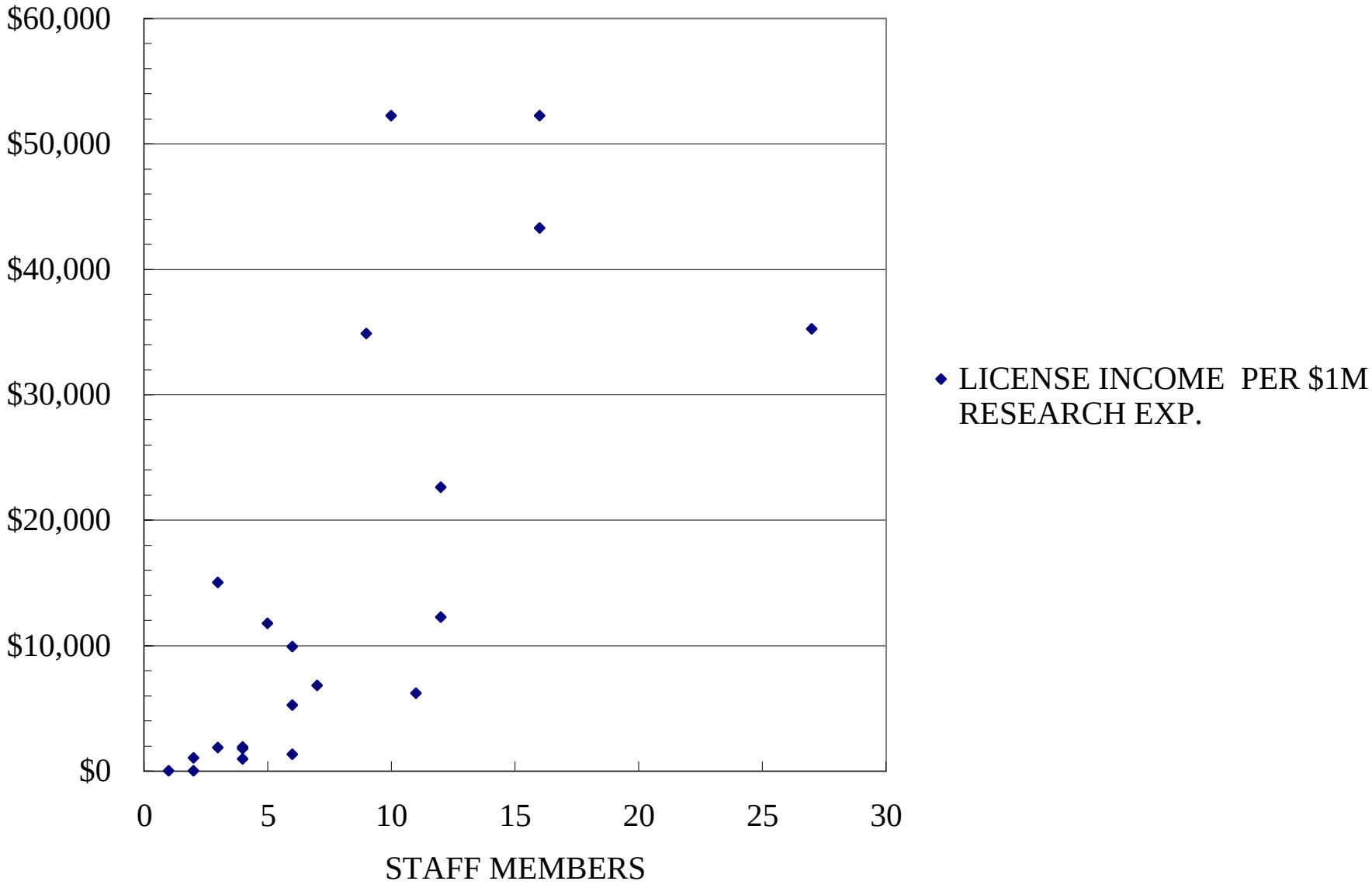
Technology Transfer at Canadian Universities: FY 2001 Update
Figure 4



Technology Transfer at Canadian Universities: FY 2001 Update
Figure 5



Technology Transfer at Canadian Universities: FY 2001 Update
Figure 6



Technology Transfer at Canadian Universities: FY 2001 Update
Figure 7