Technology Transfer at Canadian Universities: Fiscal Year 2000 Update

A Report for the Canada Foundation for Innovation

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Summary

This is an update 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*." It is intended to be read in conjunction with that study and focuses on new quantitative data from the Fiscal Year (FY) 2000 Survey by the Association of University Technology Managers (AUTM) on performance indicators of technology transfer. Most North American universities with high levels of research funding report to AUTM. Included herein are updated comparisons with overall quantitative Canadian results and with individual and overall quantitative results from the U.S. The analysis was hampered lack of response to the AUTM Surveys by a number of universities with significant research funding. In addition, changes to the composition of the groups used in the comparisons due to non-response to the AUTM Survey make precise year-to-year comparisons difficult.

However, it remains clear from the results of this study that:

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 9 responding Canadian universities collectively is somewhat lower than it is collectively at the universities ranked 10 – 15. 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 appear to 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 commitment to technology transfer appears to be the critical component.
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 indirect costs of university research, would benefit the Canadian economy through increased production of transferable technologies and the enhanced means to transfer and to commercialize them.

Introduction

This report is essentially an update 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 is intended to be read in conjunction with that study and focuses primarily on presentation and interpretation of new quantitative data from the FY 2000 AUTM Survey.

AUTM Survey

AUTM carries out a 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 academic technology transfer. The FY 2000 report contains annual and cumulative data for the tenth consecutive year of data collection.

The data on which the "AUTM Licensing Survey: FY 2000" is based comprise individual entries for 17 Canadian universities, plus 169 in the United States. The Canadian universities that responded to the Survey included the University of Guelph in 2000, but not in 1999, and included Carleton University in 1999, but not in 2000. The results of the FY 2000 Survey were released confidentially to the author on December 19, 2001, for inclusion in this report to the Board of the Canada Foundation for Innovation. To respect AUTM's wishes, any public release of data and analysis thereof is delayed until February 4, 2002.

The five specific performance indicators from the AUTM report used 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 2000 AUTM data set for Canadian universities is reproduced in Appendix B of this report. The fiscal year used by AUTM was July 1, 1999 - June 30, 2000. 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. Note also that in Appendix B "PROG. YEAR" is the first year that an institution had personnel devoted to technology transfer and that "FTE" refers to full-time-equivalent personnel in the technology transfer office.

Statistics Canada Survey

As in the November 2000 report, results from the "Survey of Intellectual Property Commercialization in the Higher Education Sector, 1999" by Statistics Canada are included for comparison

with the FY 1999 AUTM results. Statistics Canada reports aggregate responses to their FY 1999 survey of 84 Canadian institutions (universities, colleges and university-colleges - unspecified, except for the 12 largest universities) from among the 104 members of the Association of Universities and Colleges of Canada (AUCC) to which survey forms were sent.

Analysis

We first consider the most recent AUTM Survey Canadian results in Appendix B.

The effects of institutional diversity are amply demonstrated by the 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 before, 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 often the most useful normalization is by Research Expenditures. This involves dividing the 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 2000 AUTM data and find the ratios given in Table 1 for the top 15 Canadian universities; we omit reference to the last two since their research funding is much less than the others, as are most of their output measures. Table 2 comprises the same ratios for the FY 1999 data, for comparison. Note again that the Canadian universities that responded to the AUTM Survey included the University of Guelph in 2000, but not in 1999, and included Carleton University in 1999, but not in 2000.

Tables 1 and 2 are provided as Excel spreadsheet (cfi00tab1.xls and cfi00tab2.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 15 U.S. universities in terms of Research Expenditures. We note that the Canadian university with the largest Research Expenditures in FY 2000 (University of Toronto at $281M) expends considerably less per annum than does the 15th ranked U.S. university (Texas A & M at $397M). The non-payment of indirect costs of research by most Canadian funders of research distorts the comparison. With indirect costs taken into consideration as described below, direct expenditures on research at Texas A & M are comparable to those at Toronto.

For the top 15 Canadian and the top 15 U.S. universities in Tables 1 and 2, statistical information about the distributions follows the individual institutional listings. In the first row below the in-

dividual listings (Rows 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 is 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 15 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).

In rows G and H respectively of Table 2 are the normalized, *cumulative* N = 84 and N= 12 results from the Statistics Canada 1999 survey, for the variables that can be matched. To assist in comparisons with the N = 12 universities in 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 OANDA Corporation's web site). The reader is referred to the November 2000 report for a more detailed description of the Statistics Canada report.

Canadian Results

In Tables 1 and 2, the comparison of the *cumulative* data from AUTM between the top 9 (row E) and the top 15 (row A - which of course includes the top 9) is informative. We note that all the *cumulative* measures agree fairly closely. This shows the dominance of the sums by the nine largest institutions whose **totals** comprise between 47% and 88% of the overall **totals** for the top 15. However, the differences noted, with the exception of Invention Disclosures, are all in the direction of larger outputs for the top 15 compared with the top 9. This suggests a separate calculation (results shown in row F of Tables 1 and 2) of the *cumulative* results for the “last 6.” This shows clearly that cumulatively, they are better performers than are the top 9 (ref. Row E), in terms of outputs (Licenses Executed, License Income Received, Patents Issued and Start-Ups Formed) per million dollars of Research Expenditure.

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 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 that of License Income Received mostly by the high incomes at Sherbrooke, Queens, Simon Fraser University and Manitoba. This latter point is con-

sistent with our observations above about the relatively lower *cumulative* results for outputs at the top 9 versus that of the last 6.

The distributions of the normalized results are somewhat better behaved. There are still large variations in the normalized measures, but the normalized result for Licenses and Options Executed and for U.S. Patents Issued are 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 casual inspection of the normalized results for each individual institution.

The observations above about the top 9 versus that of the last 6 prompt a separate analysis of the outputs from the universities from the "G-10" group of large Canadian universities. Nine of the ten are represented in the AUTM Survey - they are those ranked 1-5, 7, and 9-11 in Table 1 and are marked with an asterisk. The tenth is Université Laval, which did not respond to the AUTM Survey. The results for these nine - labeled "G-9" - are shown in Row G of Table 1, along with the results for remaining six respondents, in Row H. We again see that all the normalized outputs measures except U.S. Patents Issued are significantly higher for the second group.

Comparison of the Canadian FY 2000 and FY 1999 Results

Based on the results shown in Tables 1 and 2, three significant differences exist between the FY 2000 and FY 1999 results for Canadian institutions:

- There were increases in all the cumulative input and output measures, in absolute terms, from 1999 to 2000
- There were increases in all the normalized (i.e. per $1M) cumulative output measures, except U.S. Patents Issued, from 1999 to 2000
- With the exception of Invention Disclosures Received per $1M, the differences in the normalized cumulative output measures between the top 9 and last 6 institutions remain in favour of the last 6 institutions.

These initial observations must be tempered by recognition of the change in the responding institutions – i.e. substitution in FY 2000 of the University of Guelph for Carleton University among the top 15.

To refine better the year-to-year comparison, the Canadian AUTM data for these two years were re-analyzed, for precisely same 14 institutions in each of the two years, omitting both Guelph and Carleton. The results are shown in Tables 3 and 4 (provided as cfi00tab3.xls and cfi00tab4.xls). With respect to the overall Canadian (N = 14) results, there are increases from 1999 to 2000 in both the absolute and normalized output measures with the exception of U.S. Patents Issued where there is a 14% (absolute) decrease. The increases in other measures however are quite substantial, led by the 81% (absolute) increase in License Income Received.

We compare the top 8 to the last 6, making the separation between McMaster and Queens, as in the previous analysis. We first note, by comparing lines E and F in Table 3, that the performance

of the last 6 with respect to all the normalized measures except Disclosures is again comparable to or better than the performance of the top 8 institutions; the exclusion of Guelph and Carleton has no major effect. The differences in the normalized measures in favour of the last 6 are very significant; they are as high as a factor of 6.3, for the License Income Received per $1M.

The year-to-year changes in performance are shown in percentage terms in the last three rows of Table 3, for the whole data set and for the top 8 versus the last 6. The changes vary markedly from measure to measure. The year-to-year changes in Disclosures Received and in Licenses and Options Executed by the top 8 exceed those by the last 6. For the remaining measures the performance of the last 6 is more positive than that of the top 8 – in the cases of License Income Received and Start-Up Companies Formed, much more so. Thus we see the major trends of the comparisons noted in Tables 1 and 2, confirmed in this more refined comparison.

U.S. Results and Comparison with Canadian Results

The distributions of U.S. top 15 results in Table 1 are qualitatively similar to those of Canadian top 15 results. We again see skewing of the distributions of most of the unnormalized results with averages significantly higher than the means and very large standard deviations. However, the variations in the normalized measures are somewhat less extreme, due no doubt to the more homogeneous nature of the top 15 U.S. universities. In contrast to the Canadian data set, the top 15 results do not dominate the overall group of 169: 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 15 in the U.S. (row I) agree closely with those for the overall data set of 169 in row N, again in contrast to the Canadian data.

We turn now to a comparison between the FY 2000 Canadian and U.S. data in Table 1. We note initially that, both for the top 15 and the overall data sets, the *cumulative* results for output measures at the U.S. universities (row I) appear to be consistently lower than the Canadian results (row A). For example, the top 15 in the U.S. produced 0.42 Disclosures per $1M, versus the Canadian top 15 figure of 0.69 Disclosures.

However, the *cumulative* results for Disclosures and Licenses Executed per $1M become very similar when one very significant difference between the two countries is taken into account: U.S. funding figures include explicit recognition of the indirect costs of research whereas Canadian figures 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 and because some, relatively minor, sponsors of Canadian research do 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 row M of Tables 1 (and 2) for the top 15 U.S. universities and in row O for the full U.S. data set. Incorporation of this adjustment for FY 2000 increases the *cumulative* 0.42 Disclosures per $1M for the top 15 in the U.S. to 0.64 Disclosures and the 0.15 Licenses Executed per $1M in the U.S.

to 0.23 – in both cases, very similar to the Canadian figures of 0.69 and 0.22 respectively (row A).

More significant differences between Canadian and U.S. *cumulative* measures exist in the other three areas. Even after correction for indirect costs, License Income Received and Patents Issued per $1M are factors of 2 lower in Canada than in the U.S. for the top 15 of each country. On the other hand, start-up companies were formed at a rate 2.5 times higher in Canada than in the U.S. per $1M of research expenditure.

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 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 the 1998 - 2000 AUTM reports and added a correction to the U.S. results for inclusion of indirect costs. The results are shown in Table 5, which is available as an Excel spreadsheet (cfi00tab5.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 corrected by the removal of indirect costs as described above.

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, as noted above, is taken into account. The latter is of course consistent with our observations drawn from the 2000 data alone. However, it is a striking result and will provide the basis for one of our conclusions.

Table 6 concentrates on the individual normalized performance of some Canadian universities over the last six years with respect to Disclosures and License Income Received. Only those universities that responded in at least four of the six 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, show much less fluctuation.

Discussion

Among the Canadian results, there is no apparent correlation between institutional size, type ("medical/doctoral" versus "comprehensive," to use the Maclean's magazine categories), or age and an individual institution's performance on any one of the measures, whether normalized by Research Expenditures or not. As noted above, the cumulative performance in technology transfer of nine of the ten members of the "G-10" varies widely among measures and among institutions. In many cases, it falls markedly below the non-G-10 universities on an absolute basis, even before normalization by Research Expenditures.

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. It also likely implies variation in institutional commitment to technology transfer and variation in support for these activities from internal and external sources.

Large-scale studies of *cumulative* results from similar types of universities should 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.

Turning to our specific results for Canadian universities, we suggest that the higher rate of start-up formation can be readily 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 of the pre-existing firms that can use their existing R & D structures to take intellectual property generated in the universities to the next steps in the process of commercialization. Start-ups are well known to have endemic cash-flow and managerial problems, which threaten the successful exploitation of IP that they acquire.

The lower normalized licensing income in Canada versus the U.S. likely stems 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. Equity holding, however, has the potential for a very large "pay-off" for the university in a particular year if the spin-off company becomes very successful and its shares can be sold for a profit. For example, the University of British Columbia's (UBC's) tremendous improvement in License Income Received from 1999 to 2000 is due mostly to a $1.6M US$ infusion from cashed-in equity. This occurred at the height of the now-defunct "high-tech boom," so it will be interesting to see if the large year-to-year increases in this measure will be maintained;
- 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 $46.6M

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. Another huge "hit" is Gatorade, which was licensed by the University of Florida. They continue to receive $7M/year in royalties on the Gatorade trademark as their share.

From this analysis, we see 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 aggregated data from Statistics Canada - on Canadian 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.

It is worthwhile noting that there is no apparent correlation between effectiveness of technology transfer and a university's policy on the ownership of intellectual property. Of the universities in our top 9 group by Research Expenditures, three claim ownership of all intellectual property created by their faculty members. They are UBC, Université de Montréal and McMaster University. The tables below present the normalized data for these three universities in the last two 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

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 all categories in 2000, most of the other measures for them and the others are below average and in most cases very significantly so. This pattern is consistent with results in previous years and 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.

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 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. This applies over a 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 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 9 Canadian universities collectively is noticeably lower than it is collectively at the universities ranked 10 - 15. This surprising result is clearly illustrated in Tables 1 and 2. It 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 9 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 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 in 1999, but its patenting, licensing and income figures are all well above average. Other local conditions, such as the ready availability of venture capital 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 may be true.

5. 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 85%) in Canada, the 17 university respondents comprised fewer than half the universities in the country and omitted some significant players. Statistics Canada surveys 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 the tremendous variation that 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

Bibliography

Advisory Council on Science and Technology, 1999. *Public Investments in University Research: Reaping the Benefits; Report of the Expert Panel on the Commercialization of University Research*, May 4, 1999. http://www.acst-ccst.gca.ca.

Association of Universities and Colleges of Canada. *Indirect Costs Reimbursement in the U.S.A.: Facts and Fiction*, AUCC Research File, June 2000

Association of University Technology Managers. *AUTM Licensing Survey: FY 2000*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey: FY 1999*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey: FY 1998*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey: FY 1997*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey: FY 1996*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey: FY 1991-FY 1995: Five-Year Summary*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey: FY 1991-FY 1994*. Edited by Daniel E. Massing.

Association of University Technology Managers. *AUTM Licensing Survey Executive Summary and Selected Data, Fiscal Years 1993, 1992 and 1991*. Prepared by Dianne C. Hoffman, Inc.

Association of University Technology Managers. *AUTM Licensing Survey Executive Summary and Selected Data, Fiscal Years 1992 and 1991*. Prepared by Dianne C. Hoffman, Inc.

Conference Board of Canada. *Collaborating For Innovation*. Annual Innovation Report, 2000.

Gu, W. and Whewell, L. *University Research and the Commercialization of Intellectual Property in Canada: A Statistical Overview.* Prepared for the Expert Panel on the Commercialization of University Research. Micro-Economic Analysis Directorate, Industry Canada, Ottawa, ON, 1999.

Olsen & Associates, Zürich, Switzerland. *Currency Converter, 2000*. http://www.oanda.com/converter/classic.

Read, Cathy. *Survey of Intellectual Property Commercialization in the Higher Education Sector, 1999*. 88F0006XIB No. 01, Statistics Canada.

Technology Transfer at Canadian Universities: FY 2000 Update
Appendix B

FY 2000 AUTM Survey Report - Complete Data on Canadian Universities

INSTITUTION	MEDICAL SCHOOL?	PROG. YEAR	LICENSING FTES FY00	OTHER FTES FY00	RESEARCH EXPENDITURES: INDUSTRIAL SOURCES FY00	RESEARCH EXPENDITURES: INDUSTRIAL SOURCES FY00 (CDN$)	RESEARCH EXPENDITURES: FED GOVT SOURCES FY00	RESEARCH EXPENDITURES: FED GOVT SOURCES FY00 (CDN$)
University of Toronto	YES	1980	3.5	2	$39,724,690	$58,446,937	$119,635,690	$176,019,990
University of Alberta	YES	1987	7.3	15.2	$22,995,310	$33,833,000	$47,932,441	$70,523,000
Universite de Montreal	YES	1990	6	3.5	$32,624,210	$48,000,000	$82,165,432	$120,890,000
McGill University	YES	1990	4	8	$20,089,497	$29,557,677	$56,795,067	$83,562,582
University of British Columbia	YES	1984	9	6.5	$27,050,420	$39,799,283	$52,874,847	$77,794,763
University of Calgary/ UTI, Inc.	YES	1985	7	5	$14,775,820	$21,739,664	$21,197,063	$31,187,239
University of Western Ontario	YES	1995	4.2	2.7	$2,392,442	$3,520,000	$23,781,690	$34,990,000
University of Guelph	NO	1983	4.2	6.4	$17,306,646	$25,463,268	$45,718,815	$67,266,093
McMaster University	YES	1987	1.25	4.75	$6,325,985	$9,307,422	$24,603,965	$36,199,814
Queen's University	YES	1984	5	5	$10,206,620	$15,017,000	$24,666,621	$36,292,000
University of Waterloo	NO	1990	2	1	$18,826,888	$27,700,000	$29,837,559	$43,900,000
University of Manitoba	YES	1983	2	7	$2,275,810	$3,348,399	$17,283,449	$25,429,138
Universite de Sherbrooke	YES	1986	4	3	$4,825,664	$7,100,000	$27,458,710	$40,400,000
Simon Fraser University	NO	1985	3.5	2.75	$1,151,408	$1,694,066	$11,896,316	$17,503,049
Concordia University	NO	1997	1	0.25	$1,395,214	$2,052,779	$6,232,045	$9,169,208
Lakehead University	NO	1995	1	0.5	$280,024	$412,000	$1,440,903	$2,120,000
University of Northern British Columbia	NO	1999	0	3	$67,967	$100,000	$883,572	$1,300,000
Totals			64.95	76.55	$222,314,615	$327,091,495	$594,404,185	$874,546,876

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FY 2000 AUTM Survey Report - Complete Data on Canadian Universities

TOTAL RESEARCH EXPENDITURES FY00	TOTAL RESEARCH EXPENDITURES FY00 (CDN$)	LICENSES / OPTIONS EXECUTED	LICENSES EXECUTED WITH EQUITY	CUMULATIVE ACTIVE LICENSES THROUGH FY2000	LICENSES EXECUTED IN 2000 ON EXCLUSIVE BASIS	LICENSES EXECUTED IN 2000 ON NON-EXCLUSIVE BASIS	LICENSES EXECUTED IN 2000 TO START-UP COMPANIES	LICENSES EXECUTED IN 2000 TO SMALL COMPANIES (EXCL. START-UPS)	LICENSES EXECUTED IN 2000 TO LARGE COMPANIES
$280,629,917	$412,890,797	25	1	116	16	9	8	4	13
$145,381,635	$213,900,000	16	1	60	11	5	1	9	6
$142,295,929	$209,360,000	32	12	124	24	8	13	17	2
$132,156,436	$194,441,764	28	15	122			8	7	13
$112,987,357	$166,238,299	33	7	166	32	1	11	17	5
$73,296,630	$107,841,332	23	0	100	13	10	1	13	9
$64,840,617	$95,400,000	23	3	43	5	18	2	14	7
$63,025,461	$92,729,361	18	0	40	15	3			
$53,901,868	$79,305,819	18	0	30	10	8	2	8	8
$52,586,148	$77,370,000	10	3	50	8	2	4	2	4
$48,664,446	$71,600,000	11	1	160	4	7	0	5	6
$35,960,877	$52,909,239	11	1	59	8	3	1	7	3
$32,284,374	$47,500,000	26	0	93	4	22	5	11	10
$16,774,393	$24,680,165	5	3	57	3	2	3	1	1
$11,476,557	$16,885,458	1	0	8	1	0	0	1	0
$2,957,928	$4,352,000	0	0	0	0	0	0	0	0
$2,514,783	$3,700,000	0	0	0	0	0	0	0	0
$1,271,735,356	$1,871,104,234	280	47	1,228	154	98	59	116	87

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LICENSES/ OPTIONS TO START-UP: EXCLUSIVE	LICENSES/ OPTIONS TO START-UP: NON-EXCLUSIVE	LICENSES/ OPTIONS TO SMALL COMPANIES: EXCLUSIVE	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 FY00	RESEARCH FUNDING RELATED TO LICENSES/OPTIONS IN FY00 (CDN$)	LICENSE INCOME REC'D FY00	LICENSE INCOME REC'D FY00 (CDN$)
5	3	0	4	11	2	$691,905	$1,018,000	$1,869,095	$2,750,000
1	0	7	2	3	3	$173,447	$255,193	$1,099,369	$1,617,502
13	0	10	7	1	1	$290,899	$428,000	$284,155	$418,077
								$485,566	$714,413
11	0	16	1	5	0			$2,827,372	$4,159,912
0	1	8	5	5	4	$402,268	$591,857	$3,304,585	$4,862,036
2	0	1	13	2	5	$1,135,815	$1,671,125	$22,462	$33,048
						$608,007	$894,560	$1,019,507	$1,500,000
2	0	4	4	4	4	$0	$0	$280,378	$412,520
4	0	1	1	3	1			$5,454,921	$8,025,826
0	0	4	1	0	6			$420,788	$619,105
1	0	6	1	1	2	$663,858	$976,734	$903,959	$1,329,995
4	1	0	11	0	10	$951,539	$1,400,000	$5,709,237	$8,400,000
2	1	0	1	1	0			$174,073	$256,114
0	0	1	0	0	0	$0	$0	$31,265	$46,000
0	0	0	0	0	0	$0	$0	$0	$0
0	0	0	0	0	0	$680	$1,000	$0	$0
45	6	58	51	36	38	$4,918,418	$7,236,469	$23,886,732	$35,144,548

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LICENSES/ OPTIONS GENERATING LICENSE INCOME IN FY00	LICENSE INCOME REC'D PAID TO OTHER INSTITUTIONS FY00	LICENSE INCOME REC'D PAID TO OTHER INSTITUTIONS FY00 (CDN$)	LICENSE INCOME REC'D FY00: RUNNING ROYALTIES	LICENSE INCOME REC'D FY00: RUNNING ROYALTIES (CDN$)	LICENSE INCOME REC'D FY00: CASHED-IN EQUITY	LICENSE INCOME REC'D FY00: CASHED-IN EQUITY (CDN$)	LICENSE INCOME REC'D FY00: OTHER INCOME	LICENSE INCOME REC'D FY00: OTHER INCOME (CDN$)	LEGAL FEES EXPENDED FY00
27	$298,376	$439,000	$531,113	$781,426	$21,387	$31,467	$1,316,595	$1,937,107	$334,975
30	$0	$0	$787,234	$1,158,258	$0	$0	$312,135	$459,244	$441,300
22	$0	$0							$255,159
48	$0	$0	$150,676	$221,689	$0	$0	$334,890	$492,724	$450,883
70	$66,363	$97,640	$720,258	$1,059,715	$1,665,718	$2,450,771	$441,396	$649,426	$910,074
	$154,730	$227,654	$1,123,913	$1,653,613	$0	$0	$2,180,672	$3,208,423	$393,383
7	$0	$0	$11,265	$16,574	$0	$0	$11,197	$16,474	$97,219
45	$407,803	$600,000	$509,753	$750,000	$0	$0	$509,754	$750,000	$271,868
15	$0	$0	$258,275	$380,000	$0	$0	$22,103	$32,520	$55,339
28	$0	$0	$46,327	$68,161	$0	$0	$5,408,594	$7,957,665	$506,470
28			$410,882	$604,531	$0	$0	$9,906	$14,574	$125,210
25	$0	$0	$770,926	$1,134,264	$0	$0	$133,033	$195,731	$245,922
83	$0	$0	$4,553,796	$6,700,000	$0	$0	$1,155,441	$1,700,000	$268,703
9	$0	$0	$6,323	$9,304	$0	$0	$167,750	$246,810	$41,851
2	$0	$0	$0	$0	$0	$0	$31,265	$46,000	$12,720
0	$0	$0	$0	$0	$0	$0	$0	$0	$3,550
0	$0	$0	$0	$0	$0	$0	$0	$0	$0
439	$927,272	$1,364,294	$9,880,741	$14,537,535	$1,687,105	$2,482,238	$12,034,731	$17,706,698	$4,414,626

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FY 2000 AUTM Survey Report - Complete Data on Canadian Universities

LEGAL FEES EXPENDED FY00 (CDN$)	LEGAL FEES REIMBURSED FY00	LEGAL FEES RI	INVENTION DISCLOSURES REC'D FY00	TOTAL PATENT APPLICATIONS FY00	NEW PATENT APPLICATIONS FILED FY00	U.S. PATENTS ISSUED FY00	START-UPS INITIATED FY00	START-UPS INITIATED FY00 OPERATING IN HOME PROVINCE
$492,849	$237,958	$350,108	127	20	14	13	9	8
$649,284	$178,341	$262,393	64	40	27	12	4	4
$375,416	$129,005	$189,805	55	26	9	12	8	8
$663,384	$334,890	$492,724	102			20	6	6
$1,338,992	$936,347	$1,377,648	127	86	76	23	8	8
$578,785	$100,949	$148,526	119	20	5	13	2	2
$143,038	$0	$0	16	25	11	3	1	1
$400,000	$108,747	$160,000	117	18	9	3	1	1
$81,420	$0	$0	41	15	15	2	0	0
$745,170	$308,026	$453,198	33	36	8	19	3	3
$184,222	$84,507	$124,335	8	7	3	5	0	0
$361,825	$126,594	$186,258	9	24	20	4	1	1
$395,343	$193,817	$285,163	14	3	1	3	5	5
$61,576	$27,028	$39,766	36	8	8	3	9	9
$18,715	$0	$0	8	7	5	0	1	1
$5,223	$0	$0	2	1	0	1	1	1
$0	$0	$0	2	1	0	1	0	0
$6,495,242	$2,766,209	$4,069,924	880	337	211	137	59	58

Technology Transfer at Canadian Universities: FY 2000 Update
Table 1

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

FY2000 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*	$280,629,917	127	0.45	25	0.09	$1,869,095	$6,660	13	0.05	9	0.03
2	University of Alberta*	$145,381,635	64	0.44	16	0.11	$1,099,369	$7,562	12	0.08	4	0.03
3	Universite de Montreal*	$142,295,929	55	0.39	32	0.22	$284,155	$1,997	12	0.08	8	0.06
4	McGill University*	$132,156,436	102	0.77	28	0.21	$485,566	$3,674	20	0.15	6	0.05
5	University of British Columbia*	$112,987,357	127	1.12	33	0.29	$2,827,372	$25,024	23	0.20	8	0.07
6	University of Calgary/UTI, Inc.	$73,296,630	119	1.62	23	0.31	$3,304,585	$45,085	13	0.18	2	0.03
7	University of Western Ontario*	$64,840,617	16	0.25	23	0.35	$22,462	$346	3	0.05	1	0.02
8	University of Guelph	$63,025,461	117	1.86	18	0.29	$1,019,507	$16,176	3	0.05	1	0.02
9	McMaster University*	$53,901,868	41	0.76	18	0.33	$280,378	$5,202	2	0.04	0	0.00
10	Queen's University*	$52,586,148	33	0.63	10	0.19	$5,454,921	$103,733	19	0.36	3	0.06
11	University of Waterloo*	$48,664,446	8	0.16	11	0.23	$420,788	$8,647	5	0.10	0	0.00
12	University of Manitoba	$35,960,877	9	0.25	11	0.31	$903,959	$25,137	4	0.11	1	0.03
13	Universite de Sherbrooke	$32,284,374	14	0.43	26	0.81	$5,709,237	$176,842	3	0.09	5	0.15
14	Simon Fraser University	$16,774,393	36	2.15	5	0.30	$174,073	$10,377	3	0.18	9	0.54
15	Concordia University	$11,476,557	8	0.70	1	0.09	$31,265	$2,724	0	0.00	1	0.09
A	Can. **Totals** & *Cumulative:* Top 15	**$1,266,262,645**	**876**	*0.69*	**280**	*0.22*	**$23,886,732**	*$18,864*	**135**	*0.11*	**58**	*0.05*
B	Can. Average: Top 15	$84,417,510	58	0.80	19	0.28	$1,592,449	$29,279	9	0.11	3.9	0.08
C	Can. Median: Top 15	$63,025,461	41	0.63	18	0.29	$903,959	$8,647	5	0.09	3.0	0.03
D	Can. Standard Deviation: Top 15	$69,595,894	47	0.62	10	0.17	$1,897,180	$48,597	7	0.09	3	0.13
E	Can. **Totals** & *Cumulative:* Top 9	**$1,068,515,850**	**768**	*0.72*	**216**	*0.20*	**$11,192,489**	*$10,475*	**101**	*0.09*	**39**	*0.04*
F	Can. **Totals** & *Cumulative:* Last 6	**$197,746,795**	**108**	*0.55*	**64**	*0.32*	**$12,694,243**	*$64,194*	**34**	*0.17*	**19**	*0.10*
G	"G-9" (*) **Totals** & Cumulative	**$1,033,444,353**	**573**	*0.55*	**196**	*0.19*	**$12,744,106**	*$12,332*	**109**	*0.11*	**39**	*0.04*
H	Non-G-9 **Totals** & Cumulative	**$232,818,292**	**303**	*1.30*	**84**	*0.36*	**$11,142,626**	*$47,860*	**26**	*0.11*	**22**	*0.09*

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Table 1

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

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	0.41	313	0.15	$267,765,000	$128,448	324	0.16	26	0.01
2	Johns Hopkins University	$1,033,801,604	355	0.34	127	0.12	$14,606,510	$14,129	106	0.10	10	0.01
3	Massachusetts Inst. of Technology	$727,600,000	425	0.58	102	0.14	$31,479,921	$43,265	152	0.21	31	0.04
4	University of Washington	$652,100,000	209	0.32	123	0.19	$30,303,963	$46,471	59	0.09	6	0.01
5	University of Illinois	$568,861,000	191	0.34	78	0.14	$5,386,195	$9,468	31	0.05	5	0.01
6	University of Wisconsin-Madison	$554,361,000	277	0.50	127	0.23	$22,935,726	$41,373	92	0.17	6	0.01
7	University of Pennsylvania	$529,554,951	223	0.42	63	0.12	$27,784,972	$52,469	50	0.09	6	0.01
8	University of Michigan	$499,700,000	168	0.34	51	0.10	$3,976,000	$7,957	77	0.15	8	0.02
9	SUNY Research Foundation	$448,525,468	186	0.41	35	0.08	$16,523,098	$36,839	72	0.16	4	0.01
10	Stanford University	$444,274,655	252	0.57	162	0.36	$36,944,000	$83,156	98	0.22	8	0.02
11	Penn State University	$440,259,000	204	0.46	22	0.05	$1,299,915	$2,953	43	0.10	4	0.01
12	Harvard University	$430,780,600	133	0.31	70	0.16	$16,541,234	$38,398	56	0.13	1	0.00
13	North Carolina State University	$415,617,075	169	0.41	47	0.11	$2,558,479	$6,156	45	0.11	6	0.01
14	University of Minnesota	$411,380,000	218	0.53	86	0.21	$23,143,317	$56,258	65	0.16	11	0.03
15	Texas A&M University System	$397,268,000	140	0.35	58	0.15	$6,049,298	$15,227	24	0.06	4	0.01
I	U.S. **Totals** & *Cumulative:* Top 15	**$9,638,706,353**	**4,015**	*0.42*	**1,464**	*0.15*	**$507,297,628**	*$52,631*	**1,294**	*0.13*	**136**	*0.01*
J	U.S. Average: Top 15	$642,580,424	268	0.42	98	0.15	$33,819,842	$38,838	86	0.13	9.1	0.01
K	U.S. Median: Top 15	$499,700,000	209	0.41	78	0.14	$16,541,234	$38,398	65	0.13	6.0	0.01
L	U.S. Standard Deviation: Top 15	$432,119,887	183	0.09	71	0.07	$65,736,940	$33,713	73	0.05	8.3	0.01
M	U.S. **Totals** & *Cumulative:* Top 15 adjusted for indirect costs @52.3%	**$6,291,583,781**	**4,015**	*0.64*	**1,464**	*0.23*	**$231,593,182**	*$36,810*	**1,294**	*0.21*	**136**	*0.02*

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**	**9,555**	*0.34*	**4,025**	*0.14*	**$1,241,099,887**	*$44,099*	**3,598**	*0.13*	**389**	*0.01*
O	U.S. **Totals** & *Cumulative:* N=169 adjusted for indirect costs @52.3%	**$18,370,222,845**	**9,555**	*0.52*	**4,025**	*0.22*	**$1,241,099,887**	*$67,560*	**3,598**	*0.20*	**389**	*0.02*

Technology Transfer at Canadian Universities: FY 2000 Update
Table 2

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

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	0.43	17	0.08	$844,175	$4,037	6	0.03	5	0.02
2	Universite de Montreal	$133,658,635	37	0.28	15	0.11	$362,229	$2,710	13	0.10	8	0.06
3	McGill University	$125,454,301	95	0.76	24	0.19	$539,433	$4,300	17	0.14	8	0.06
4	University of Alberta	$115,918,697	59	0.51	15	0.13	$2,434,907	$21,005	11	0.09	4	0.03
5	University of British Columbia	$95,341,717	126	1.32	14	0.15	$788,209	$8,267	50	0.52	6	0.06
6	University of Calgary /UTI, Inc.	$71,519,412	77	1.08	29	0.41	$1,871,917	$26,174	15	0.21	3	0.04
7	University of Western Ontario	$60,573,428	29	0.48	7	0.12	$43,556	$719	4	0.07	5	0.08
8	McMaster University	$53,059,239	29	0.55	9	0.17	$365,589	$6,890	2	0.04	0	0.00
9	Queen's University	$46,556,737	38	0.82	8	0.17	$674,660	$14,491	12	0.26	0	0.00
10	University of Waterloo	$38,026,652	8	0.21	17	0.45	$459,348	$12,080	6	0.16	0	0.00
11	University of Manitoba	$31,192,381	22	0.71	15	0.48	$969,731	$31,089	7	0.22	0	0.00
12	Universite de Sherbrooke	$26,921,524	21	0.78	22	0.82	$2,692,152	$100,000	3	0.11	2	0.07
13	Carleton University	$18,425,175	20	1.09	2	0.11	$97,698	$5,302	0	0.00	1	0.05
14	Simon Fraser University	$15,601,834	17	1.09	6	0.38	$556,350	$35,659	5	0.32	4	0.26
15	Concordia University	$10,624,157	3	0.28	1	0.09	$15,130	$1,424	2	0.19	1	0.09
A	Can. **Totals** & *Cumulative:* Top 15	**$1,051,994,901**	**671**	*0.64*	**201**	*0.19*	**$12,715,084**	*$12,087*	**153**	*0.15*	**47**	*0.04*
B	Can. Average: Top 15	$70,132,993	45	0.69	13	0.26	$847,672	$18,276	10	0.16	3.1	0.06
C	Can. Median: Top 15	$53,059,239	29	0.71	15	0.17	$556,350	$8,267	6	0.14	3.0	0.05
D	Can. Standard Deviation: Top 15	$55,862,818	36	0.34	8	0.21	$833,230	$25,211	12	0.13	3	0.06
E	Can. **Totals** & *Cumulative:* Top 9	**$911,203,178**	**580**	*0.64*	**138**	*0.15*	**$7,924,675**	*$8,697*	**130**	*0.14*	**39**	*0.04*
F	Can. **Totals** & *Cumulative:* Last 6	**$140,791,723**	**91**	*0.65*	**63**	*0.45*	**$4,790,409**	*$34,025*	**23**	*0.16*	**8**	*0.06*

1999 Statistics Canada Survey Results for Responding Canadian Universities and Colleges

G	Can. **Totals** & *Cumulative:* N= 84	**$1,361,220,000**	**829**	*0.61*	**218**	*0.16*	$12,539,240	*$9,212*	**168**	*0.12*
	Using FY97 Revenue with Cdn$ = 0.735 US$									
H	Can. **Totals** & *Cumulative:* Top 12	**$965,055,000**	**570**	*0.59*	**130**	*0.13*	$7,647,500	*$7,924*		
	Using FY97 Revenue with Cdn$ = 0.735 US$									

Technology Transfer at Canadian Universities: FY 2000 Update
Table 2

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

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	0.44	219	0.12	$74,133,000	$39,752	281	0.15	13	0.01
2	Johns Hopkins University	$1,010,088,344	250	0.25	106	0.10	$10,353,453	$10,250	111	0.11	7	0.01
3	MIT	$725,600,000	381	0.53	95	0.13	$16,131,334	$22,232	154	0.21	17	0.02
4	University of Michigan	$499,722,000	158	0.32	42	0.08	$3,472,671	$6,949	56	0.11	2	0.00
5	University of Washington	$479,654,994	226	0.47	115	0.24	$27,878,900	$58,123	36	0.08	N.A.	
6	University of Pennsylvania	$477,000,000	244	0.51	57	0.12	$2,984,000	$6,256	82	0.17	6	0.01
7	University of Wisconson, Madison	$421,600,000	278	0.66	106	0.25	$18,011,400	$42,722	79	0.19	4	0.01
8	University of Minnesota	$417,556,493	219	0.52	71	0.17	$5,662,088	$13,560	55	0.13	5	0.01
9	Stanford University	$417,037,000	236	0.57	147	0.35	$27,699,355	$66,419	90	0.22	19	0.05
10	North Carolina State University	$413,369,278	148	0.36	83	0.20	$7,761,000	$18,775	30	0.07	8	0.02
11	SUNY Research Foundation	$413,369,278	201	0.49	46	0.11	$13,538,619	$32,752	53	0.13	3	0.01
12	Texas A&M University System	$402,203,000	145	0.36	53	0.13	$5,180,510	$12,880	19	0.05	0	0.00
13	Harvard University	$401,849,500	109	0.27	48	0.12	$9,886,404	$24,602	72	0.18	2	0.00
14	Penn State University	$393,462,000	188	0.48	40	0.10	$2,830,448	$7,194	46	0.12	3	0.01
15	Cornell University	$376,784,000	172	0.46	150	0.40	$6,070,000	$16,110	70	0.19	4	0.01
I	U.S. **Totals** & *Cumulative:* Top 15	**$8,714,196,887**	**3,773**	*0.43*	**1378**	*0.16*	**$231,593,182**	*$26,577*	**1,234**	*0.14*	**93**	*0.01*
J	U.S. Average: Top 15	$580,946,459	252	0.44	92	0.18	$15,439,545	$25,238	82	0.14	6.6	0.01
K	U.S. Median: Top 15	$417,556,493	219	0.47	83	0.13	$9,886,404	$18,775	70	0.13	4.5	0.01
L	U.S. Standard Deviation: Top 15	$392,543,418	170	0.11	51	0.10	$18,170,434	$18,934	65	0.05	5.8	0.01
M	U.S. **Totals** & *Cumulative:* Top 15 adjusted for indirect costs @52.3%	**$5,688,118,072**	**3,773**	*0.66*	**1,378**	*0.24*	**$231,593,182**	*$40,715*	**1,234**	*0.22*	**93**	*0.02*

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**	*0.45*	**3,078**	*0.14*	**$576,889,538**	*$26,974*	**2,681**	*0.13*	**279**	*0.01*
O	U.S. **Totals** & *Cumulative:* N=139 adjusted for indirect costs @52.3%	**$13,959,954,616**	**9,555**	*0.68*	**3,078**	*0.22*	**$576,889,538**	*$41,325*	**2,681**	*0.19*	**279**	*0.02*

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Table 3

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

FY2000 AUTM Survey Results for Responding Canadian Universities (Top 14, excluding Guelph))

	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	0.45	25	0.09	$1,869,095	$6,660	13	0.05	9	0.03
2	University of Alberta	$145,381,635	64	0.44	16	0.11	$1,099,369	$7,562	12	0.08	4	0.03
3	Universite de Montreal	$142,295,929	55	0.39	32	0.22	$284,155	$1,997	12	0.08	8	0.06
4	McGill University	$132,156,436	102	0.77	28	0.21	$485,566	$3,674	20	0.15	6	0.05
5	University of British Columbia	$112,987,357	127	1.12	33	0.29	$2,827,372	$25,024	23	0.20	8	0.07
6	University of Calgary/UTI, Inc.	$73,296,630	119	1.62	23	0.31	$3,304,585	$45,085	13	0.18	2	0.03
7	University of Western Ontario	$64,840,617	16	0.25	23	0.35	$22,462	$346	3	0.05	1	0.02
8	McMaster University	$53,901,868	41	0.76	18	0.33	$280,378	$5,202	2	0.04	0	0.00
9	Queen's University	$52,586,148	33	0.63	10	0.19	$5,454,921	$103,733	19	0.36	3	0.06
10	University of Waterloo	$48,664,446	8	0.16	11	0.23	$420,788	$8,647	5	0.10	0	0.00
11	University of Manitoba	$35,960,877	9	0.25	11	0.31	$903,959	$25,137	4	0.11	1	0.03
12	Universite de Sherbrooke	$32,284,374	14	0.43	26	0.81	$5,709,237	$176,842	3	0.09	5	0.15
13	Simon Fraser University	$16,774,393	36	2.15	5	0.30	$174,073	$10,377	3	0.18	9	0.54
14	Concordia University	$11,476,557	8	0.70	1	0.09	$31,265	$2,724	0	0.00	1	0.09
A	Can. **Totals** & *Cumulative:* Top 14	**$1,203,237,184**	**759**	*0.63*	**262**	*0.22*	**$22,867,225**	*$19,005*	**132**	*0.11*	**57**	*0.05*
B	Can. Average: Top 14	$85,945,513	54	0.72	19	0.27	$1,633,373	$30,215	9	0.12	4.1	0.08
C	Can. Median: Top 14	$59,371,243	39	0.54	21	0.26	$694,763	$8,104	9	0.10	3.5	0.04
D	Can. Standard Deviation: Top 14	$71,961,492	46	0.56	10	0.18	$1,961,914	$50,291	8	0.09	3	0.14
E	Can. **Totals** & *Cumulative:* Top 8	**$1,005,490,389**	**651**	*0.65*	**198**	*0.20*	**$10,172,982**	*$10,117*	**98**	*0.10*	**38**	*0.04*
F	Can. **Totals** & *Cumulative:* Last 6	**$197,746,795**	**108**	*0.55*	**64**	*0.32*	**$12,694,243**	*$64,194*	**34**	*0.17*	**19**	*0.10*

Year-to-Year Comparisons (FY 2000/ FY 1999 %)

Can. **Totals** & *Cumulative:* Top 14	116.4%	116.6%	100.1%	131.7%	113.1%	181.2%	155.7%	86.3%	74.1%	123.9%	106.4%
Can. **Totals** & *Cumulative:* Top 8	116.3%	120.1%	103.3%	152.3%	131.0%	140.3%	120.7%	83.1%	71.4%	97.4%	83.8%
Can. **Totals** & *Cumulative:* Last 6	117.1%	99.1%	84.6%	92.8%	79.2%	236.5%	202.0%	97.1%	83.0%	271.4%	231.9%

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Table 4

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

FY1999 AUTM Survey Results for Responding Canadian Universities (Top 14, excluding Carleton)

	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	0.43	17	0.08	$844,175	$4,037	6	0.03	5	0.02
2	Universite de Montreal	$133,658,635	37	0.28	15	0.11	$362,229	$2,710	13	0.10	8	0.06
3	McGill University	$125,454,301	95	0.76	24	0.19	$539,433	$4,300	17	0.14	8	0.06
4	University of Alberta	$115,918,697	59	0.51	15	0.13	$2,434,907	$21,005	11	0.09	4	0.03
5	University of British Columbia	$95,341,717	126	1.32	14	0.15	$788,209	$8,267	50	0.52	6	0.06
6	University of Calgary /UTI, Inc.	$71,519,412	77	1.08	29	0.41	$1,871,917	$26,174	15	0.21	3	0.04
7	University of Western Ontario	$60,573,428	29	0.48	7	0.12	$43,556	$719	4	0.07	5	0.08
8	McMaster University	$53,059,239	29	0.55	9	0.17	$365,589	$6,890	2	0.04	0	0.00
9	Queen's University	$46,556,737	38	0.82	8	0.17	$674,660	$14,491	12	0.26	0	0.00
10	University of Waterloo	$38,026,652	8	0.21	17	0.45	$459,348	$12,080	6	0.16	0	0.00
11	University of Manitoba	$31,192,381	22	0.71	15	0.48	$969,731	$31,089	7	0.22	0	0.00
12	Universite de Sherbrooke	$26,921,524	21	0.78	22	0.82	$2,692,152	$100,000	3	0.11	2	0.07
13	Simon Fraser University	$15,601,834	17	1.09	6	0.38	$556,350	$35,659	5	0.32	4	0.26
14	Concordia University	$10,624,157	3	0.28	1	0.09	$15,130	$1,424	2	0.19	1	0.09
A	Can. **Totals** & *Cumulative:* Top 14	**$1,033,569,726**	**651**	*0.63*	**199**	*0.19*	**$12,617,386**	*$12,208*	**153**	*0.15*	**46**	*0.04*
B	Can. Average: Top 14	$73,826,409	47	0.66	14	0.27	$901,242	$19,203	11	0.18	3.3	0.06
C	Can. Median: Top 14	$56,816,334	33	0.63	15	0.17	$615,505	$10,173	7	0.15	3.5	0.05
D	Can. Standard Deviation: Top 14	$56,038,781	37	0.33	8	0.21	$837,449	$25,896	12	0.13	3	0.07
E	Can. **Totals** & *Cumulative:* Top 8	**$864,646,441**	**542**	*0.63*	**130**	*0.15*	**$7,250,015**	*$8,385*	**118**	*0.14*	**39**	*0.05*
F	Can. **Totals** & *Cumulative:* Last 6	**$168,923,285**	**109**	*0.65*	**69**	*0.41*	**$5,367,371**	*$31,774*	**35**	*0.21*	**7**	*0.04*

Technology Transfer at Canadian Universities: FY 2000 Update
Table 5

Inventions Disclosed Per $1 Million Research Expenditures, Canada and the U.S. (1991 - 2000)

	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	0.52	0.52
	1992	10	$472,250,978	$47,225,098	284	28	0.60	0.60
	1993	12	$687,047,338	$57,253,945	393	33	0.57	0.57
	1994	12	$684,158,438	$57,013,203	445	37	0.65	0.65
	1995	16	$943,247,718	$58,952,982	578	36	0.61	0.61
	1996	14	$855,217,872	$61,086,991	509	36	0.60	0.60
	1997	16	$1,046,898,769	$65,431,173	690	43	0.66	0.66
	1998	20	$1,118,629,108	$55,931,455	797	40	0.71	0.71
	1999	20	$1,122,387,230	$56,119,362	717	36	0.64	0.64
	2000	18	$1,282,314,177	$71,239,677	886	49	0.69	0.69
U.S.	1991	98	$11,479,381,778	$117,136,549	4,880	50	0.43	0.65
	1992	98	$12,799,045,236	$130,602,502	5,700	58	0.45	0.68
	1993	117	$14,875,667,330	$127,142,456	6,598	56	0.44	0.68
	1994	120	$16,058,644,323	$133,822,036	5,597	47	0.35	0.53
	1995	127	$17,211,913,185	$135,526,875	7,427	58	0.43	0.66
	1996	131	$18,688,253,796	$142,658,426	8,119	62	0.43	0.67
	1997	132	$19,858,137,581	$150,440,436	9,051	69	0.46	0.70
	1998	132	$21,386,650,472	$162,020,079	9,555	72	0.45	0.68
	1999	139	$23,565,568,068	$169,536,461	10,052	72	0.43	0.65
	2000	169	$28,143,181,398	$166,527,701	9,555	57	0.34	0.52

Source: Results of AUTM annual surveys FY1991 - 2000

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

Technology Transfer at Canadian Universities: FY 2000 Update
Table 6

Normalized AUTM Survey Results for Responding Canadian Universities With More Than $10 Million US Research Expenditures (1995 - 2000)

	FY 1995		FY 1996		FY 1997		FY 1998		FY 1999		FY 2000	
University	Invention Disclosures Received per $1M*	License Income Received per $1M*	Invention Disclosures Received per $1M	License Income Received per $1M	Invention Disclosures Received per $1M	License Income Received per $1M	Invention Disclosures Received per $1M	License Income Received per $1M	Invention Disclosures Received per $1M	License Income Received per $1M	Invention Disclosures Received per $1M	License Income Received 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
McGill University					0.48	$2,488	0.81	$3,596	0.76	$4,300	0.77	$3,674
Universite de Montreal	0.15	$3,195	0.31	$2,934	0.22	$2,439	0.31	$3,710	0.28	$2,710	0.39	$1,997
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
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
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
University of Guelph	0.07	$6,312	0.28	$8,022	0.52	$12,500	0.53	$6,250			1.86	$16,176
McMaster University					0.27	$5,351	0.28	$5,454	0.55	$6,890	0.76	$5,202
University of Western Ontario	0.21	$229	0.25	$165	1.27	$911	0.13	$911	0.48	$719	0.25	$346
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
University of Waterloo					0.41	$23,307	0.13	$41,985	0.21	$12,080	0.16	$8,647
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
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
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
Average	0.53	$7,863	0.68	$13,018	0.75	$11,379	0.69	$12,128	0.66	$12,988	0.89	$18,739
Median	0.30	$8,208	0.51	$8,457	0.64	$8,271	0.65	$6,790	0.55	$8,267	0.67	$8,105

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

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Figure 1