

AUTM 2017 Canadian Licensing Activity Survey

A Survey of Technology Licensing and
Related Activity for Canadian Academic
and Non-profit Research Institutions



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Executive Summary

Every year, universities, hospitals and research centers around the globe develop inventions – from lifesaving drugs to strawberry varieties. Many have undoubtedly touched your life.

Technology transfer is the essential process of transitioning scientific findings from one organization to another with the aim of development and commercialization. This process involves identifying new technologies; safeguarding them with patents, copyrights or other types of intellectual property protection; and licensing those rights to industry.

As a membership organization supporting the efforts of the thousands of professionals within the technology transfer industry, AUTM has been collecting data for more than 26 years. We have seen our profession mature, our core functions no longer experiencing double-digit growth trends as measured in this report from year to year. We have also seen an expansion of functions and remits mirroring the increasing sophistication of the academic-industry juncture.

For this year's Licensing Activity Survey, 34 Canadian research institutions responded. The highlights of the survey are thought-provoking.

Start-ups Flourishing

According to the survey, start-up formation increased 11 per cent in 2017 from the 100 start-ups formed in 2016, and grew 95 per cent since 2012. In addition, 907 start-ups were reported to be still operational, an increase of nearly 62 per cent over 2016. Given those facts, the role a technology transfer office (TTO) plays within an entrepreneurship ecosystem is growing and impactful. Recognizing that most university start-ups are formed around patented technology, this prolonged growth and increased survival rate reflect research showing that start-ups with patents are 35 times more likely to be successful.

While patents have been shown to be a major driver of long-term economic growth, recent court decisions have significantly increased the uncertainty of their value. This concern can be illustrated by examining the invention disclosure and new patent application rates. In 2017, Canadian research institutions reported 1,882 disclosures, 4.1 per cent lower than the all-time high reported in 2013. At the same time, the 687 new applications filed in 2017 were the fewest in more than a decade.

Fewer Shots on Goal

Commercial success is a lagging indicator in technology transfer – the impact of decisions made today may not be realized for five to 10 years. Technology transfer offices should have a two-pronged strategy for success: increase shots on goal and diversify their licensing portfolios. In 2017, we witnessed a decline in the number of “shots” - the total licences executed fell to 528, a decline of 30.5 per cent from 2016.

Changing Risk Attitudes

Canadian institutions may also be becoming more selective with the patents they file. In 2017, the ratio of patent applications to disclosures (40.3 per cent) was its lowest in more than a decade.



Olivia Novac
Committee Chair
Canadian Licensing Survey Committee



Acadia's Pest vs. Pesticide Challenge

Partnership Seeks 'Green' Ways to Save Trees, Crops

Acadia University

If insects had their way, you wouldn't be able to see the forest or the trees.

Every year beetles and like-minded pests chomp their way through millions of hectares of forest and farmland, according to Canadian government figures. But with rising concerns about the adverse environmental and health effects of traditional pesticides, a major push is underway to develop more "green" approaches to pest management — not just in Canada, but around the world.

Researchers at Acadia University in Nova Scotia are in the forefront of this movement. The effort is led by biology professor Kirk Hillier, an internationally recognized expert in how insects use naturally produced semiochemicals such as pheromones to communicate with one another. Pheromones can signal alarm, attract prey, repel enemies and lure potential mates.

It's that last category that interests those working to protect the country's crops and forests. Hillier's team and its partners have developed and marketed several products that disrupt the mating behaviours of targeted groups of pests, among them the brown spruce longhorn beetle, the emerald ash borer and the jack pine budworm. These products include traps, lures and sprays to attract, repulse or confuse their targets.

In 2017 Canada committed nearly \$3 million from the Atlantic Canada Opportunities Agency to the project, which supporters hope will reduce the billions of dollars in damage caused by native and foreign insects, while protecting the environment.

One of Acadia's key partners is Forest Protection Limited, a non-profit company that operates customized aircraft for firefighting, aerial surveys, and vegetation and pest management. Other partners include National Resources Canada, the University of New Brunswick, and Dalhousie University.

Catherine McKenna, Federal Minister of Environment and Climate Change, said the research "has the potential to create effective and environmentally responsible, pheromone-based products that will be marketed in Canada and internationally."

Research Funding

Research conducted in academic institutions provides the foundation for the innovation economy in Canada — leading to ground-breaking technologies and lifesaving medical treatments.

Total research expenditures were down in 2017, falling to \$5.7 billion after surpassing \$6 billion in 2010, 2015 and 2016. Funding from federal and other sources declined, while industry funding rose more than 4 per cent compared to 2016.

Looking at research funding from 2008 through 2017 reveals important trends that are affecting both Canadian and US research institutions. During that time, federal research dollars fluctuated between \$2 billion and \$3 billion, reaching a high point of \$2.7 billion in 2011 and a low of \$2.1 billion in 2017. Compared with 2008 levels, federal research support was down more than 12 per cent in 2017 (to \$2.1 billion from \$2.4 billion).

Support from industry and other sources helped make up for the decline in federal research dollars. Industry funding increased 12 per cent, from \$606 million in 2008 to \$680 million in 2017, while funding from other sources jumped nearly 17 per cent over the same period, from \$2.5 billion to \$2.9 billion.

As a result of ongoing efforts to seek non-traditional and novel sources of research funding, TTOs have helped maintain the support for academic research and innovation. From 2008 to 2017, total research expenditures increased 3 per cent, from \$5.5 billion to \$5.7 billion.

Key Findings

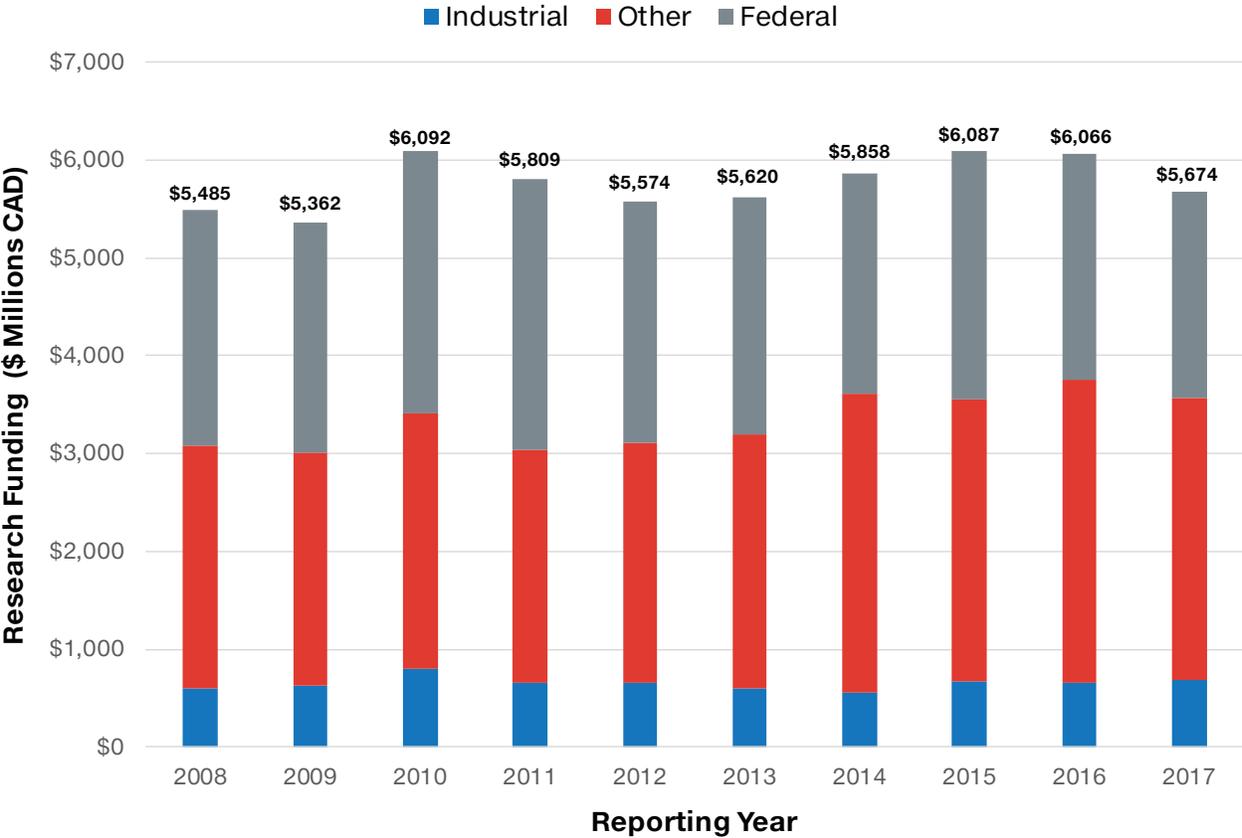
- Total research expenditures declined from \$6.1 billion in 2015 to \$5.7 billion in 2017.
- Federal funding and funding from other sources also decreased in 2017.
- Although industry funding increased slightly in 2017 compared with 2015, the 10-year trend is relatively constant with the share of funding from industry ranging from 10 to 13 per cent of total research funding.

Research Funding (\$ Millions CAD)

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Industrial | \$606 | \$625 | \$795 | \$656 | \$659 | \$594 | \$564 | \$667 | \$652 | \$680 |
| Other | \$2,468 | \$2,389 | \$2,611 | \$2,380 | \$2,455 | \$2,601 | \$3,048 | \$2,887 | \$3,109 | \$2,885 |
| Federal | \$2,411 | \$2,348 | \$2,686 | \$2,773 | \$2,460 | \$2,425 | \$2,246 | \$2,534 | \$2,306 | \$2,109 |
| Total | \$5,485 | \$5,362 | \$6,092 | \$5,809 | \$5,574 | \$5,620 | \$5,858 | \$6,087 | \$6,066 | \$5,674 |

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Research Funding Declines





An Unconcealed Success Story

McMaster Team Hones Weapons Detection System

McMaster University

Deter. Detect. Defend.

That's the motto of Patriot One Technologies Inc., an Ontario company that has come up with a revolutionary way of spotting concealed weapons — quickly and unobtrusively.

Not surprisingly, the security world is keen to know more. Schools and police forces are among those expressing interest.

The technology was developed over eight years by a McMaster University team headed by Professor Natalia Nikolova, an expert in high-frequency electromagnetics. It combines short-range radar with machine learning algorithms to scan passersby for guns, knives, grenades and other threatening objects.

Each PATSCAN Cognitive Microwave Radar unit is about the size of a brick, so it can be easily hidden in walls, turnstiles and other high-traffic areas. As people pass the sensor, an antenna emits electromagnetic radiation pulses. Some of that energy bounces back to a second PATSCAN antenna and is analyzed to determine its source.

“We call it an object’s radar signature,” said Nikolova. The technology is particularly proficient with metal detection. In tests, accuracy readings have topped 90 per cent. “The computer can actually tell what sort of metallic object is on your body,” she said. It also can take a photo of a person being scrutinized.

The first-of-its-kind PATSCAN system has been certified by both Industry Canada and the US Federal Communications Commission, paving the way for a phased commercial rollout. Orders have been received from around the globe, and Patriot has licensed six international patent applications.

“Initial feedback from our pilots [program] and ... leading customers is that this is going to be quite disruptive, quite transformative” in enhancing security, said Dinesh Kandanchatha, Patriot One’s chief technology officer. The company and McMaster are working to extend the device’s range beyond 3 metres.

A major selling point is that people pass the sensor unaware of its existence. “People are prepared to give up a measure of convenience for safety,” said Patriot One CEO Martin Cronin. “But people don’t want to live in a fortress.”

With PATSCAN, they don’t have to. Life seemingly goes on as normal — even in these uncertain times.

“Essentially this is about saving lives,” said Cronin. “Patriot One technology will save lives.”

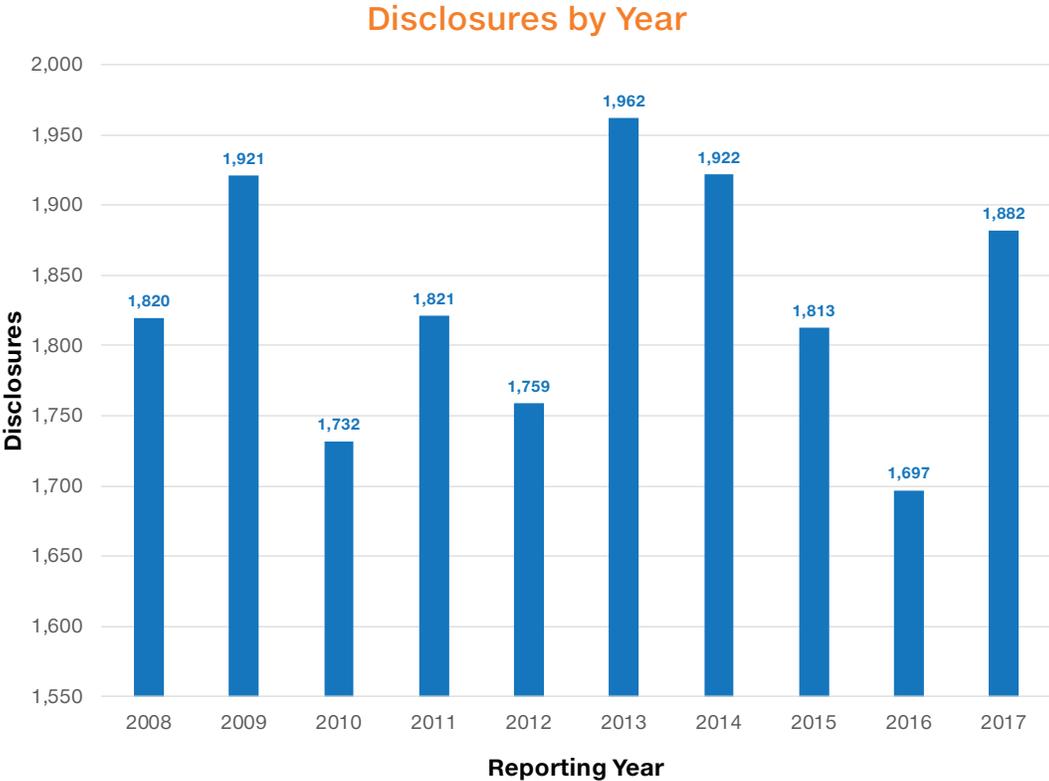
Disclosures

The technology transfer process begins when the inventor discloses an invention to the university. The invention disclosure is the launching pad for evaluating the technology, analyzing the market and developing strategies for protecting the intellectual property.

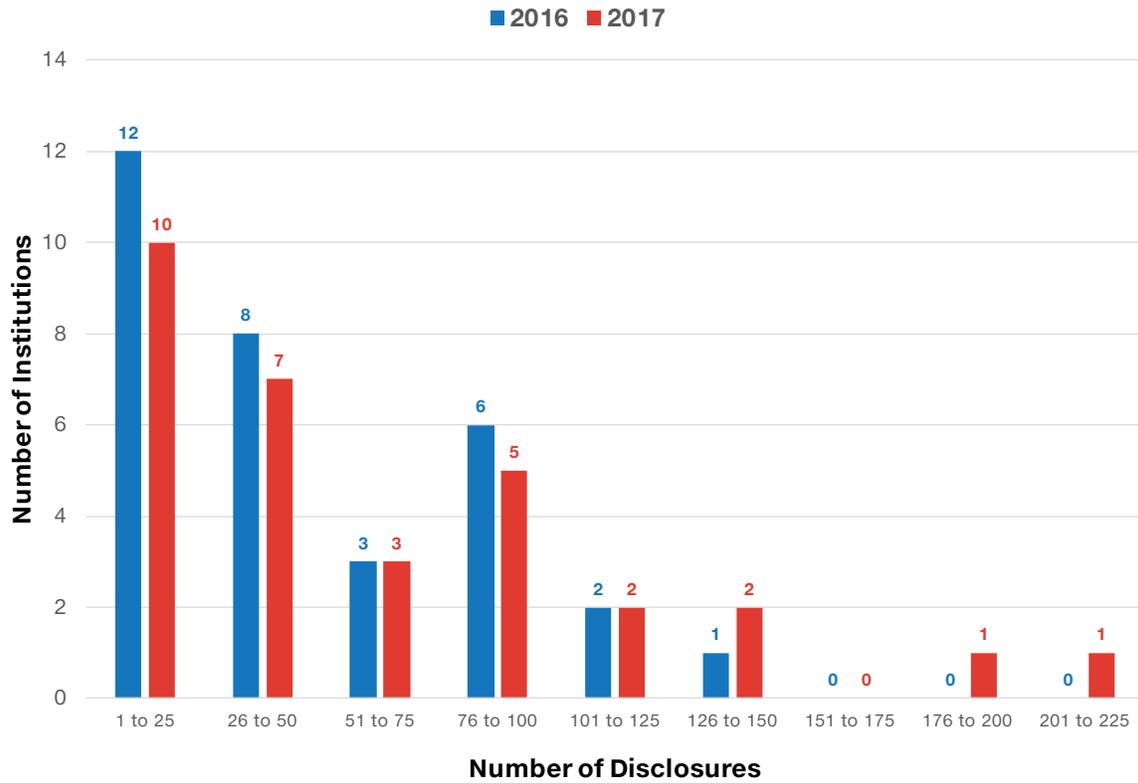
The 1,882 disclosures reported in 2017 represent a 11 per cent increase over 2016, reversing a three-year downward trend from an all-time high of 1,962 disclosures in 2013. This is an especially promising trend in light of the relatively low response rate to the survey. In 2008, 37 institutions reported 1,820 disclosures; in 2017, just 34 institutions reported 1,882 disclosures.

Key Findings

- Disclosures increased significantly to 1,882, from 1,697 in 2016.
- The number of reported disclosures peaked in 2013, followed by a three-year decline.
- The biggest increases in disclosure rates occurred at institutions reporting 126 – 150, 176 – 200 and 201 – 225 disclosures.
- Institutions reporting 26 – 50 and 76 – 100 disclosures reported fewer disclosures in 2017 than in 2016.
- Disclosures increased despite the low number of survey respondents. Just 34 institutions reported 1,882 disclosures; in 2008, 37 institutions reported only 1,820 disclosures.



Disclosures by Institution



Canadian Survey Response Rate

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Respondents | 37 | 37 | 40 | 39 | 35 | 37 | 39 | 36 | 35 | 34 |
| Surveyed Population | 83 | 83 | 87 | 70 | 69 | 69 | 70 | 70 | 70 | 70 |
| Response Rate | 44.6% | 44.6% | 46.0% | 55.7% | 50.7% | 53.6% | 55.7% | 51.4% | 50.0% | 48.6% |



Getting a Charge Out of Nature

Microturbine Uses Water, Wind to Power USB Devices

Memorial University of Newfoundland

At Seaformatics Systems Inc., they think both big and small.

That's how a proposal from an engineering professor at Memorial University of Newfoundland to create a power-harvesting system for oceanographers at sea ultimately led to a portable microturbine for use in rivers and streams by backpackers, canoeists and outdoor workers needing to power up their USB devices.

After eight years working on Professor Vlastimil Masek's suggestion, four Memorial graduates founded Seaformatics in 2013 to commercialize their new ocean-monitoring technology called SeaLily.

Then a funny thing happened. With funding from Genesis Centre, the university's innovation hub for tech-based projects, Seaformatics built a small prototype of SeaLily for trade show demonstrations. They named their mini-version WaterLily.

Almost on a whim, the team posted a video of WaterLily on Facebook to gauge interest among outdoor enthusiasts. Within two days the video had notched 22,000 views, and pre-orders began to pour in from more than a dozen countries.

WaterLily quickly became popular with consumers wanting to recharge their phones, cameras and other personal devices while on the go. And it had an advantage over its competition.

“The real novel piece about WaterLily is that you can put it in a river ... but it will also work in wind. So on a nice windy day, you can hang it from a tree and recharge your devices that way,” said company CEO Andrew Cook.

A typical phone recharge takes two to four hours, depending on water or wind conditions.

Canadian adventurer TA Loeffler used both methods on a 90-day canoe expedition from Jasper, Alberta, to the Arctic Ocean. She gave her WaterLily two thumbs up for its performance on the 3,080-kilometre trip along the Athabasca, Slave and Mackenzie rivers.

Seaformatics has added a hand crank to its product line. “So if it's an emergency situation and you don't have water and wind, you can hand-crank it and get enough power to make a call,” said Cook.

With other add-ons in the works, “I think our future is very bright,” he said. Even if it all began somewhat by accident.

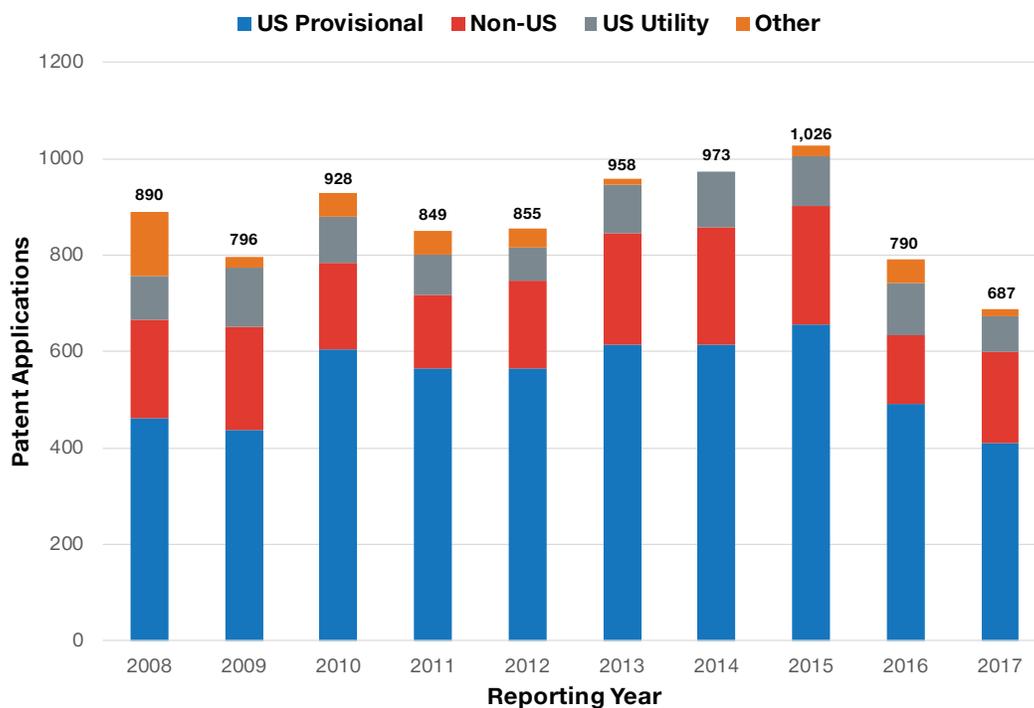
Patents

A key step in the transfer of technology is the protection of potentially useful ideas as intellectual property. Patent protection provides both economic opportunities for sponsoring research institutions and an incentive for entrepreneurs and companies to invest in new technologies. This is especially important for inventions that require a commitment of significant financial and technical resources over a long period to develop marketable products.

Key Findings

- Canadian institutions continue to engage in a high volume of patenting activities, filing 875 applications per year, on average, during the past decade.
- Despite this high volume, 2017 saw the fewest new applications filed since 2008 (from 890 to 687). 2017 also had the lowest patent application-to-disclosure ratio since 2008 (40.3 per cent vs. 48.9 per cent). This may point to Canadian institutions being more selective with the patents they file, leading to a higher success rate.
- This trend was echoed in the United States, where the number of US patent applications filed in 2017 was the lowest in a decade — while the number of new US patents issued more than doubled in the same period.

New Patent Applications

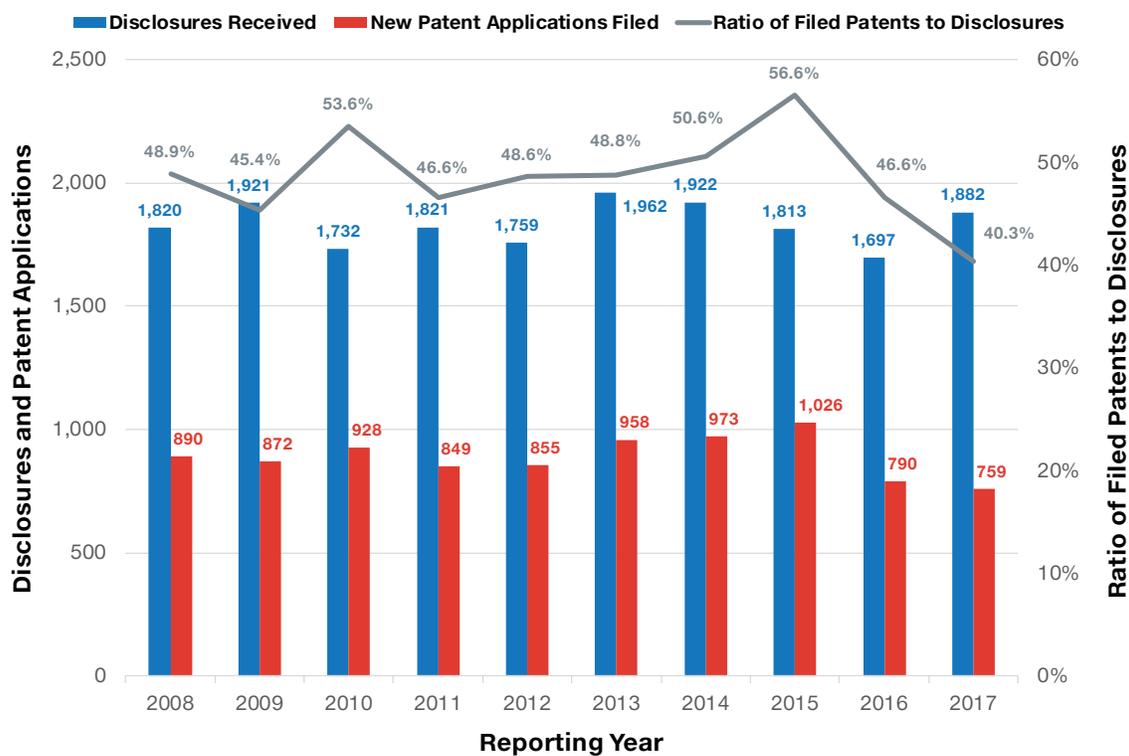


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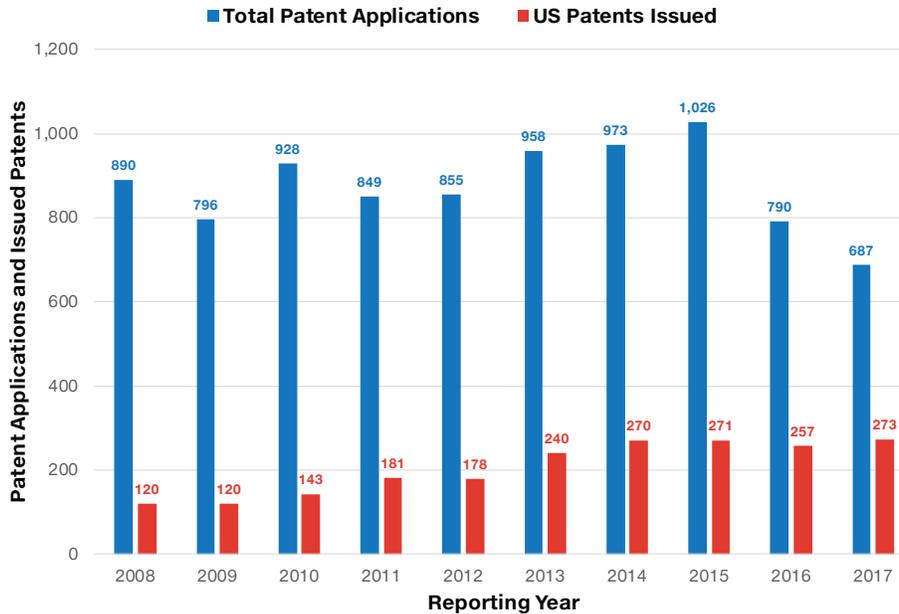
New Patent Applications

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------------|------------|------------|------------|------------|------------|------------|------------|--------------|------------|------------|
| US Provisional | 461 | 438 | 604 | 564 | 565 | 613 | 614 | 657 | 491 | 409 |
| Non-US | 206 | 213 | 181 | 154 | 183 | 233 | 243 | 246 | 143 | 190 |
| US Utility | 90 | 122 | 94 | 82 | 67 | 99 | 116 | 102 | 109 | 73 |
| Other | 133 | 23 | 49 | 49 | 40 | 13 | 0 | 21 | 47 | 15 |
| Total | 890 | 796 | 928 | 849 | 855 | 958 | 973 | 1,026 | 790 | 687 |

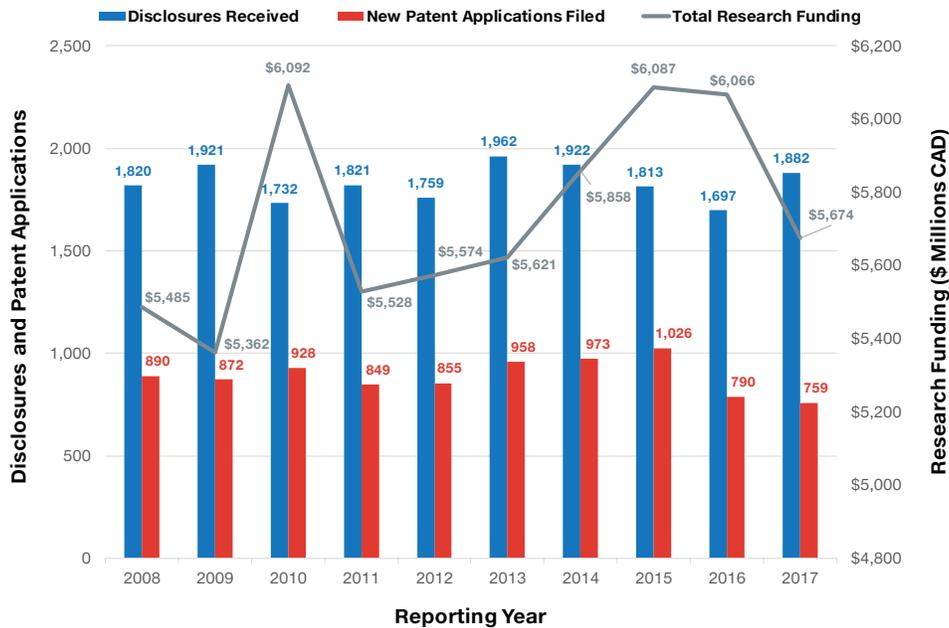
New Patent Fillings and Disclosures



Institutions Becoming More Selective with Patents



Research Funding, Disclosures and Filed Patent Applications



| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|--|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Total Research Funding (\$ Millions CAD) | \$5,485 | \$5,362 | \$6,092 | \$5,528 | \$5,574 | \$5,621 | \$5,858 | \$6,087 | \$6,066 | \$5,674 |
| Disclosures Received | 1,820 | 1,921 | 1,732 | 1,821 | 1,759 | 1,962 | 1,922 | 1,813 | 1,697 | 1,882 |
| New Patent Applications Filed | 890 | 872 | 928 | 849 | 855 | 958 | 973 | 1,026 | 790 | 759 |



The Prognosis on Breast Cancer

Alberta, BC Now Using Risk Assessment Test

University of British Columbia

The year 2017 ushered in some milestones for breast cancer research in British Columbia, Alberta and the United States.

The attention centered on a test called Prosigna, which assesses the 10-year risk of recurrence of breast cancer in some postmenopausal women. The test evolved from years of research by the BC Cancer Agency, the University of British Columbia (UBC) and three US university labs.

Prosigna, the first in vitro diagnostic product to assess the prognosis of early-stage breast cancer, has been approved by health officials in Europe and the United States for about five years. Health Canada licensed it soon after.

In 2017 Alberta and British Columbia became the first provinces to approve its active clinical use. Their decisions followed an economic health evaluation; Alberta, for instance, is looking to save on the \$1 million it spent annually on Prosigna's predecessor. Unlike Prosigna, that molecular testing had to be done out of the country, running up the cost.

Several major US insurers, including Blue Cross Blue Shield, also came on board in 2017, with the result that 95 per cent of affected women in the United States now have insurance coverage for the test.

Prosigna is a rare example of the complete bench-to-bedside development of a new medical diagnostic; it represents the successful transfer of a fundamental research finding from the lab to the clinic. The test is now in use in more than a dozen countries.

The assay analyzes genetic activity in some forms of early-stage breast cancer and uses that information, along with clinical variables, to assess a woman's 10-year risk of distant breast cancer recurrence (metastasis). The test results can be useful when determining the potential benefit, or even the necessity, of hormonal therapy or chemotherapy.

Prosigna, marketed by Seattle-based NanoString Technologies, "is the result of a decade of research, in which Canadian researchers have had a major role as co-inventors and leaders in multinational research and development programs," said Torsten Nielsen, a pathologist at BC Cancer and UBC who helped lead the effort.

As a result, people with breast cancer now have improved access to state-of-the-art molecular tests to help them make informed decisions about their treatment.

Licences and Options

The next step in the commercialization process for protected intellectual property is licensing. TTOs have developed deep knowledge and extensive resources to determine the best way to transfer new technologies to the marketplace through licence or option agreements. The number of exclusive licences executed is a leading indicator of licensing revenue and the commercial development of new products and services five to 10 years later.

In 2017, the number of licences executed by responding institutions was down from 2016, including declines in both exclusive and non-exclusive licences. However, option agreements were up slightly (from 167 to 178). Since 2008, the number of both licence and options agreements has been trending upward.

Gross reported licensing income jumped to \$75 million, up 6 per cent over 2016 and 31 per cent from 2008.

The majority or 61 per cent of licensing income in 2017 came from running royalties (\$47.6 million). “Other income,” including milestone payments, annual licensing fees and signing fees, accounted for 31 per cent of the total. As a category, other income has increased 146 per cent since 2008.

Key Findings

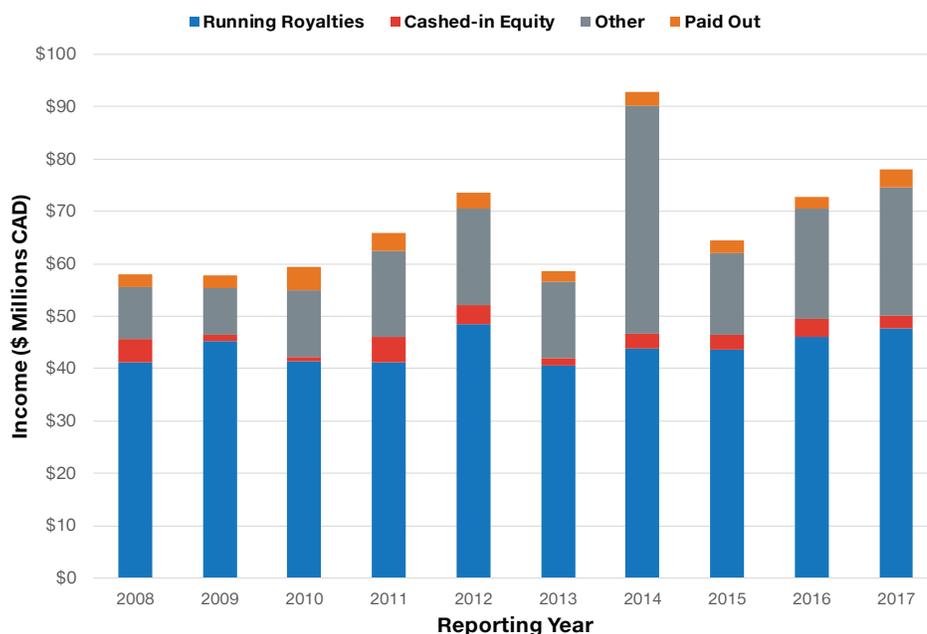
- Licences executed in 2017 declined from 2016 levels. However, executive options and licences have been increasing since 2008.
- Option agreements increased (to 178 from 167 in 2016).
- Reported active licences in 2017 totalled 3,343.
- Cashed-in equity remained low in 2017 (\$2.5 million), and other income (including milestone payments, annual license fees and signing fees) accounted for 31 per cent of the total reported licensing income. A record \$24.47 million in other income was reported, a significant increase since 2008 (\$9.9 million in 2008).
- The number of licences executed (28) with equity was significantly below those reported in 2015 and 2016 and closer to 2008 levels.
- Most licensing agreements executed in 2017 were with established companies — 47 per cent with small companies and 39 per cent with large companies. Licensing to new start-ups remained low at 14 per cent.

Licenses and Options Executed and Active

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Licences Executed | 490 | 621 | 449 | 459 | 462 | 361 | 493 | 588 | 760 | 528 |
| Options Executed | 141 | 69 | 90 | 119 | 76 | 72 | 84 | 112 | 167 | 178 |
| Total Licences/Options Executed | 631 | 690 | 539 | 578 | 538 | 433 | 577 | 700 | 927 | 706 |
| Cumulative Licences Active | 3,109 | 3,144 | 3,249 | 3,428 | 3,551 | 3,484 | 3,298 | 3,337 | 3,417 | 3,343 |

AUTM 2017 Canadian Licensing Activity Survey

License Income by Source



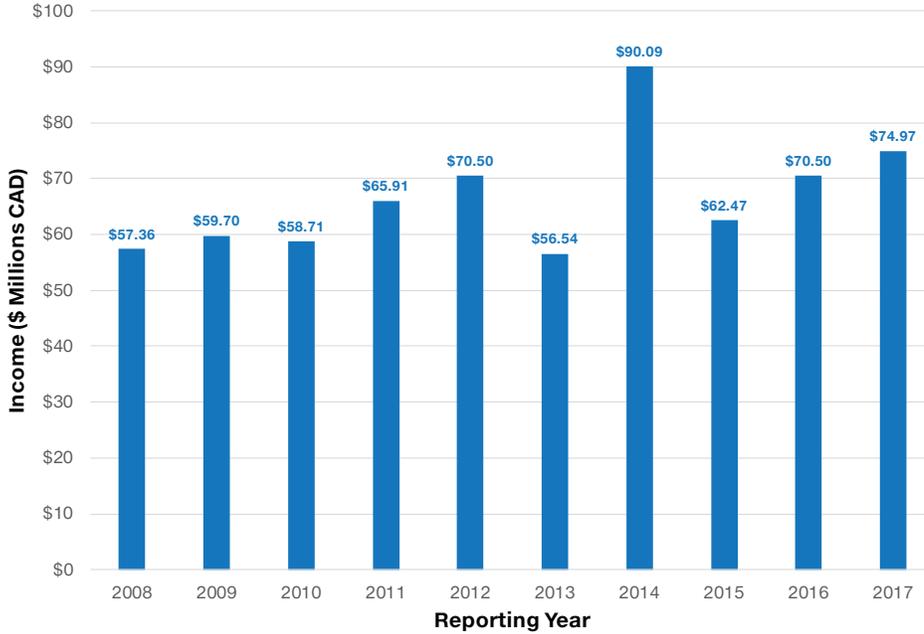
Licensing Income by Source (\$ Millions CAD)

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|-------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Running Royalties | \$41.12 | \$45.25 | \$41.30 | \$41.12 | \$48.56 | \$40.61 | \$43.86 | \$43.58 | \$45.96 | \$47.60 |
| Cashed-in Equity | \$4.56 | \$1.25 | \$0.85 | \$4.86 | \$3.50 | \$1.45 | \$2.87 | \$2.82 | \$3.48 | \$2.53 |
| Other | \$9.93 | \$8.82 | \$12.78 | \$16.48 | \$18.43 | \$14.48 | \$43.36 | \$15.55 | \$21.05 | \$24.47 |
| Paid Out | \$2.33 | \$2.44 | \$4.42 | \$3.40 | \$2.97 | \$1.97 | \$2.80 | \$2.42 | \$2.16 | \$3.39 |
| Total | \$57.93 | \$57.77 | \$59.34 | \$65.86 | \$73.47 | \$58.51 | \$92.89 | \$64.36 | \$72.67 | \$78.00 |

Licences with Equity

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|----------------------|------|------|------|------|------|------|------|------|------|------|
| Licences with Equity | 26 | 15 | 22 | 24 | 22 | 22 | 28 | 68 | 75 | 28 |

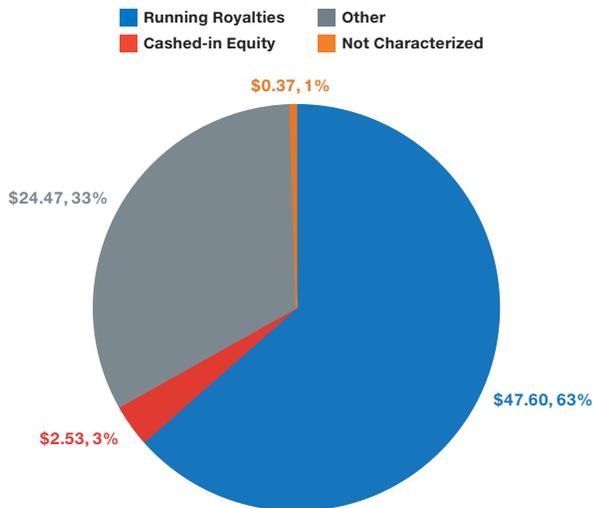
Gross Licensing Income



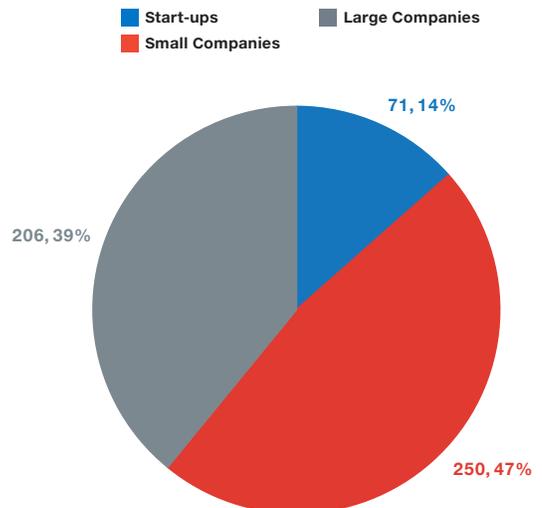
Gross Licensing Income (\$ Millions CAD)

| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Gross Licensing Income | \$57.36 | \$59.70 | \$58.71 | \$65.91 | \$70.50 | \$56.54 | \$90.09 | \$62.47 | \$70.50 | \$74.97 |

Source of Gross Licensing Income, 2017



Licences and Options Executed with Start-ups, Small and Large Companies, 2017





Building a Safer Isotope *BC Scientists Solve Health Care Dilemma*

University of British Columbia

Hundreds of thousands of people around the globe have benefited from something they've never heard of: technetium-99m. Tc-99m, as it's known in scientific circles, is the world's most popular diagnostic imaging isotope.

When injected into a patient, isotopes allow medical specialists to closely examine target areas noninvasively, with special equipment. Tc-99m is used in more than 80 per cent of all nuclear medicine procedures – some 30 million times a year – to diagnose cancer, Parkinson's disease and other serious conditions.

Historically, valuable medical isotopes like Tc-99m have been produced worldwide at nuclear reactors such as Ontario's Chalk River. But a series of outages in recent years at key, often aging reactors led to a shortage of Tc-99m and significant health care disruptions.

The Chalk River reactor shut down in March 2018 after more than 60 years online, leaving Canada without a major source of medical isotopes. Chalk River had produced 40 per cent of the world's supply of Tc-99m.

Since 2009 the search has been on to bypass nuclear reactors and develop new ways to produce radioisotopes. TRIUMF, a renowned subatomic physics laboratory based at the University of British Columbia, headed a partnership that eventually came up with breakthrough technology.

The method uses cyclotrons, a type of particle accelerator found worldwide in hospitals, clinics and radiopharmacies that provide medical imaging. This means that Tc-99m and other radioisotopes such as copper-64 and gallium-68 can now be produced locally as needed. And by employing nonradioactive elements, the cyclotron process eliminates the use of enriched uranium and results in no long-term radioactive waste.

This technology is "a viable alternative that allows for a safe, reliable and environmentally sound supply of a critical medical isotope," said Paul Schaffer, CEO of ARTMS Products Inc., a Vancouver-based company launched by the TRIUMF consortium to market the technology worldwide.

ARTMS, recipient of the BC Tech Association's 2017 award for Most Promising Pre-Commercial Technology, has now taken a big next step on the world stage, partnering with UK-based Alliance Medical, the leading independent provider of diagnostic imaging services across Europe.



Shedding Light on Counterfeiting

Toronto Company Uses Embedded Crystals to Foil Fraud

University of Toronto

Counterfeiting is as old as money itself. In the 6th century, a counterfeiter known as Alexander the Barber was so skilled at it that Byzantine Emperor Justinian gave him a job in the government finance department.

Governments are unlikely to do that today. Instead, they turn to high-tech security firms staffed by engineers, scientists and other professionals dedicated to keeping paper currency and vital documents such as passports safe and secure.

One such company is Opalux, a leader in the research, development and application of photonic color technology. Born more than a decade ago at the University of Toronto, Opalux has developed interactive security features that use light (photons) to deter counterfeiters and other fraudsters.

“These features are driven by ‘tunable’ photonic crystals” whose appearance changes — like a chameleon’s — “in response to a range of stimuli, including laser energy, pressure, electric current and chemicals,” said Opalux CEO Andrew Binkley. For example, banknotes embedded with the crystals change colour when users squeeze or scratch them. On passports, the feature protects the holder’s portrait with a colour-shifting image that makes tampering tough.

“We are the only people in the world who make this material,” said Binkley. “It is so advanced that counterfeiters and competitors simply don’t have the knowledge and resources to copy it.”

“When I met them, they were doing fantastic research in the [university’s] department of chemistry,” said Pauline Walsh, an industrial technology advisor with the National Research Council. “The science created overwhelming opportunities.”

The idea of specializing in sophisticated safeguards for currency and identity documents coalesced more recently. One hurdle: “Our key market is government, and it can be difficult for a young company to attract global government business,” Binkley said.

Opalux got a big boost in 2018 when it received a federal contract from the Build in Canada Innovation Program. About the same time, it launched a next-generation security product in partnership with De La Rue, the world’s largest commercial producer of banknotes and passports.

“Our business is based largely on trust,” said Binkley, “so partnering with someone who has been operating for almost 200 years and can vouch for a small newcomer is a major coup.”



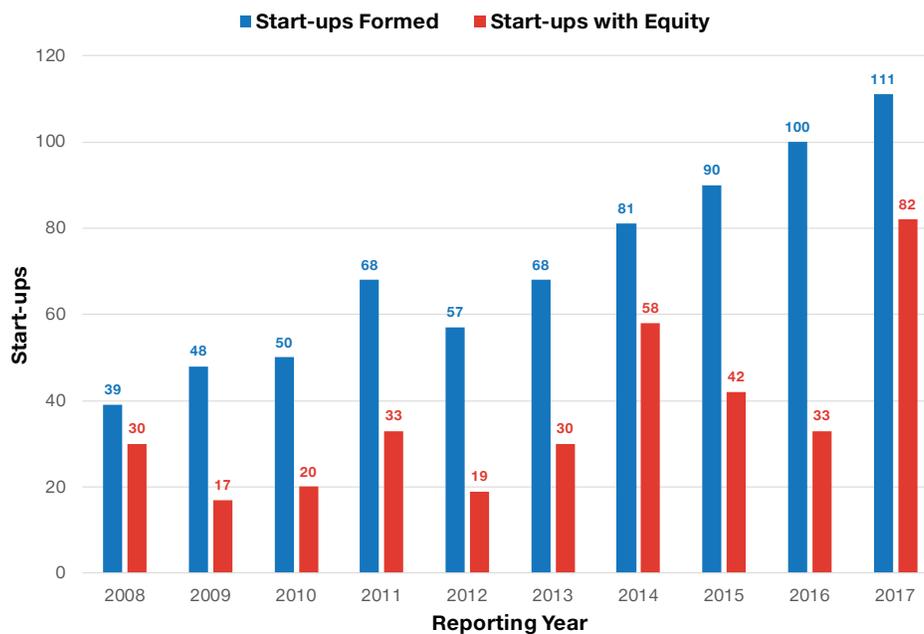
Start-ups

The innovations born out of academic research often lead to the formation of new companies that develop new products, create jobs and spark economic growth.

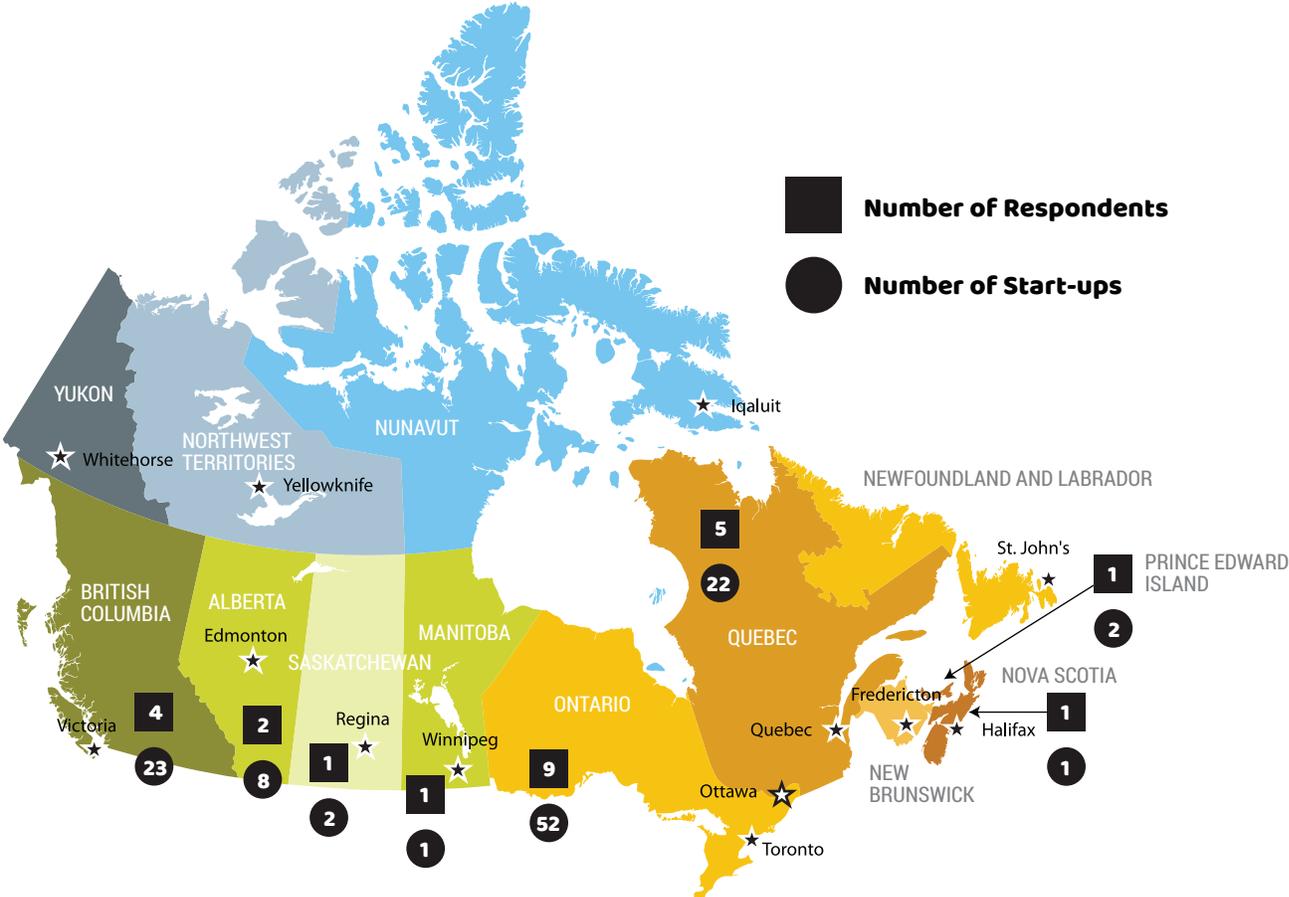
Key Findings

- 2017 was another record high for start-ups. Respondents reported the formation of 111 start-ups, up from 100 in 2016 and 90 in 2015. Start-ups have been on a mostly upward trend since 2009.
- Institutions reported equity in 73.8 per cent of start-ups in 2017.
- Of the 111 start-ups, institutions retained an equity stake in 82. This compares to just 33 start-ups with equity in 2016.
- Ontario led the creation of start-ups with 52, followed by British Columbia (23) and Quebec (22). The three provinces also had the greatest number of institutions reporting (nine, four and five, respectively).
- Since the annual licensing survey began collecting relevant data in 1994, 907 start-ups were still operational in 2017, an increase of 61.8 per cent from 2016.

Start-ups Flourishing



Start-ups Formed per Province, FY2017





PEI Grad Students Harvest a Winner

Oyster Cage Flipper Saves Time, Money

University of Prince Edward Island

Wanted for hire: Physically strong individuals capable of lifting and turning large wire cages weighing up to 300 pounds for 10 hours a day over several months in all weather conditions.

That less-than-ideal job description is reality for the oyster farmers of Atlantic Canada. For generations, mollusk harvesting has provided their livelihood. In the 1990s it was discovered that oysters taste better when grown suspended in the water in cages. Large oyster farms now have thousands of submersible cages.

Tiny Prince Edward Island accounts for nearly 30 per cent of Canada's oyster aquaculture. In 2016, the latest year for which statistics are available, the province produced a record crop of 3,672 tonnes.

But these cages need to be flipped every 10 to 14 days, allowing the sun to kill the algae, barnacles and other parasites that attach to them and compete with the oysters for food. Oysters take three or four years to mature. A plentiful food supply over that time results in meatier oysters, which command higher prices at market.

That's what led three graduate students at the University of Prince Edward Island (UPEI) to a practical, and potentially profitable, second-year engineering project. They built a machine that attaches to a boat and does the work of two or three men by gently flipping the oyster cages.

Earlier cage-flipper designs used hydraulics and were too costly for farmers. Grad students Jordan Sampson, Brett McDermott and Dylan MacIsaac, all of whom grew up on PEI, took a different tack. Their machine uses the forward motion of the boat, which lowers the cost. The result, Sampson has said, is "you don't need a guy standing in the water doing the labour-intensive work."

The trio formed a company, Island AquaTech Inc., and got a patent with assistance from Synapse, a company that helps turn UPEI ideas into useful products and services. They received \$25,000 in start-up funding from PEI's Ignition Fund and \$28,000 from UPEI and Springboard, a network that supports technology transfer at 19 Atlantic Canadian universities and colleges.

The company will run further tests in 2019, with commercial sales to follow. In the meantime, it's back to grad school to finish those degrees.

AUTM 2017 Canadian Licensing Activity Survey

Data Appendix

| INSTITUTION | | | | KEY METRICS | | | | | | | CUMULATIVE, 2015–2017 | | | | OTHER BENCHMARKS | | |
|---|--------------------------|---------------|--------------------------------|-------------------------------------|----------------|---------------|---------------------------------------|-------------|-------------------------|----------|-------------------------------------|-------------|-------------------------------|-------------------------------|-----------------------------|---------|---------------------------|
| Name of Institution | Type of Institution | Program Start | Licensing Full-time Equivalent | Total Research Expenditures (\$CAD) | Total Licenses | Total Options | Gross License Income Received (\$CAD) | Disclosures | New Patent Applications | Startups | Total Research Expenditures (\$CAD) | Disclosures | Adjusted Gross Income (\$CAD) | Adjusted Gross Income (\$CAD) | Active Licenses and Options | Patents | Running Royalties (\$CAD) |
| Athabasca University | University | 2013 | 0.5 | | 0 | 0 | \$0 | 1 | 0 | 0 | | | | \$0 | | 0 | |
| British Columbia Cancer Agency | Hospital/ Research Inst. | 2000 | 1 | \$68,513,971 | 1 | 1 | \$533,859 | 47 | 5 | 1 | \$243,158,169 | 138 | \$1,997,054 | \$468,427 | 45 | 33 | \$320,034 |
| Dalhousie University | University | 1990 | 6 | \$137,082,517 | 10 | 99 | \$244,606 | 23 | 4 | 1 | \$411,752,531 | 80 | \$1,514,845 | \$244,606 | 96 | 45 | \$160,285 |
| Gestion Socpra Inc. | Hospital/ Research Inst. | 2007 | 4.00 | | 7 | 6 | | 29 | | 3 | | 71 | | | | | |
| Innovate Calgary | Hospital/ Research Inst. | 1989 | 16.00 | \$360,870,274 | 18 | 3 | \$739,784 | 123 | 3 | 4 | \$1,050,676,151 | 356 | \$1,826,087 | \$678,077 | 101 | 26 | \$404,564 |
| Institut de recherches cliniques de Montréal | Hospital/ Research Inst. | 2003 | 2.00 | \$26,940,292 | 1 | 2 | \$122,858 | 7 | 0 | 2 | \$77,995,792 | 18 | \$1,212,419 | \$122,858 | 15 | 1 | \$42,680 |
| McGill University | University | 1990 | 5.00 | \$431,668,318 | 16 | 9 | \$3,074,151 | 108 | 14 | 8 | \$1,253,453,766 | 377 | \$7,449,108 | \$2,669,362 | 201 | 108 | \$1,646,324 |
| McMaster University, Hamilton Health Science & St. Joseph's Healthcare Hamilton | Hospital/ Research Inst. | 1987 | 6.80 | \$354,632,229 | 105 | 1 | \$6,811,705 | 81 | 6 | 3 | \$982,910,511 | 246 | \$15,086,370 | \$6,777,877 | 131 | 26 | \$199,633 |
| Mount Allison University | University | 2002 | 0.10 | \$3,080,969 | 0 | 0 | \$0 | 2 | 0 | 0 | | | | \$0 | 0 | 0 | \$0 |
| Queen's University | University | 1984 | 6.50 | \$141,914,000 | 6 | 1 | \$4,192,452 | 43 | 8 | 1 | \$422,609,000 | 144 | \$13,177,362 | \$4,192,452 | | 11 | \$4,010,833 |
| Red River College | University | 2004 | 0.00 | \$2,754,235 | 0 | 0 | \$0 | 0 | 0 | 0 | \$8,490,737 | 0 | \$0 | \$0 | 0 | 0 | \$0 |
| Ryerson University | University | 2004 | 1.50 | \$47,525,261 | 0 | 0 | \$1,598,302 | 59 | 0 | 1 | \$139,404,853 | 144 | \$2,025,445 | \$1,598,302 | 23 | 8 | \$1,598,302 |
| Simon Fraser University | University | 1985 | 5.00 | \$125,631,000 | 4 | | \$341,692 | 18 | 12 | 1 | \$306,660,000 | 49 | \$1,410,122 | \$341,692 | 27 | 42 | |
| St. Michael's Hospital | Hospital/ Research Inst. | 2005 | 0.00 | \$77,095,628 | 0 | 0 | \$238,597 | 13 | 2 | 3 | \$228,725,895 | 49 | \$596,662 | \$238,597 | 4 | 10 | \$238,597 |
| Sunnybrook Health Sciences Centre | Hospital/ Research Inst. | 2003 | | \$98,971,181 | 3 | 0 | \$1,310,573 | 22 | 0 | 0 | \$295,965,779 | 66 | \$4,514,251 | \$1,310,573 | 22 | 3 | \$1,160,573 |
| The Hospital for Sick Children | Hospital/ Research Inst. | 1985 | 8.10 | \$245,425,277 | 33 | 3 | \$3,323,933 | 52 | 6 | 0 | \$702,684,677 | 212 | \$10,517,886 | \$2,811,324 | 258 | 10 | \$3,068,963 |
| Université de Montréal | University | 1990 | 17.00 | \$379,115,000 | 13 | 5 | \$5,573,873 | 138 | 17 | 6 | \$1,118,836,000 | 338 | \$12,092,899 | \$4,791,634 | 116 | 33 | \$3,298,391 |
| Université de Sherbrooke | University | 1986 | 4.00 | \$136,480,553 | 7 | 6 | \$227,216 | 29 | 36 | 3 | | | | \$227,216 | 39 | 22 | \$176,389 |
| University Health Network | University | 1998 | 6.00 | \$390,570,742 | 96 | 1 | \$3,155,568 | 94 | 16 | 1 | \$1,099,258,224 | 321 | \$6,414,056 | \$3,045,340 | 311 | 24 | \$1,648,708 |
| University of Alberta | University | 1985 | 9.50 | \$513,312,042 | 20 | 12 | \$1,144,944 | 95 | 21 | 4 | \$1,436,223,042 | 307 | \$2,931,147 | \$1,144,494 | 201 | 52 | \$365,075 |
| University of British Columbia | University | 1984 | 10.00 | \$580,211,097 | 55 | 5 | \$6,680,053 | 139 | 33 | 17 | \$1,710,479,321 | 412 | \$22,389,988 | \$6,650,773 | 455 | 72 | \$2,823,433 |
| University of Guelph | University | 1986 | 2.75 | \$146,124,710 | 27 | 4 | \$2,675,011 | 177 | 7 | 0 | \$419,651,492 | 304 | \$7,575,556 | \$2,628,852 | 265 | 8 | \$2,445,578 |
| University of Manitoba | University | 1983 | | \$172,885,000 | 5 | 0 | \$1,451,732 | 39 | 10 | 1 | \$499,032,285 | 141 | \$4,299,014 | \$1,451,732 | 127 | 11 | \$707,317 |
| University of New Brunswick | University | 1999 | 3.50 | \$51,472,028 | 15 | 0 | \$154,428 | 21 | 4 | 0 | \$136,031,781 | 55 | \$347,570 | \$154,428 | 61 | 7 | \$67,286 |
| University of Ottawa | University | 1987 | 7.50 | \$324,000,000 | 9 | 7 | \$2,167,126 | 77 | 10 | 4 | \$940,969,000 | 209 | \$2,800,452 | \$2,126,233 | 81 | 42 | \$382,151 |
| University of Saskatchewan | University | 1990 | 7.70 | \$177,708,511 | 15 | 1 | \$18,448,449 | 29 | 3 | 2 | \$501,541,984 | 67 | \$51,694,031 | \$18,448,449 | 192 | 26 | \$18,196,310 |
| University of Toronto (excluding affiliated hospitals) | University | 1980 | 8.00 | \$468,001,953 | 29 | 9 | \$6,941,198 | 209 | 25 | 15 | \$1,320,425,517 | 546 | \$8,644,055 | \$5,645,489 | 266 | 72 | \$1,290,968 |
| University of Victoria | University | 1992 | 4.00 | \$108,143,000 | 3 | 0 | \$28,547 | 99 | 6 | 4 | \$302,453,000 | 181 | | \$22,804 | 14 | 35 | \$15,780 |
| University of Waterloo | University | 1990 | 6.00 | \$205,684,472 | 6 | 0 | \$55,327 | 29 | 11 | 20 | \$574,389,321 | 101 | \$308,793 | \$55,327 | 140 | 11 | \$55,327 |
| Western, Lawson and Robarts | Hospital/ Research Inst. | 1995 | 7.00 | \$243,031,997 | 23 | 2 | \$3,702,970 | 54 | 14 | 0 | \$696,522,793 | 189 | \$13,147,880 | \$3,702,970 | 148 | 11 | \$3,279,349 |
| York University | University | 2003 | 2.50 | \$96,039,606 | | 1 | \$22,263 | 19 | 0 | 4 | \$232,850,896 | 46 | \$40,583 | \$22,263 | 2 | 9 | |



About the Survey

AUTM invited 70 Canadian research institutions, not all research intensive, to participate in the AUTM 2017 Canadian Licensing Activity Survey. AUTM received 34 completed responses for a response rate of 48.6 per cent. This compares to the 2016 survey, which had 35 responses and a response rate of 50.0 per cent. It is important to note that not all respondents reply to all the questions. Therefore, response rates to any given question will vary, and some subcategories are not completely represented.

Most of the data collected in this survey is also available in AUTM's Statistics Access for Technology Transfer (STATT) database. To access this searchable database of 27 years of academic licensing data, visit www.autm.net/statt.

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About AUTM

AUTM is the non-profit leader in efforts to educate, promote and inspire professionals, throughout their careers, to support the development of academic research that changes the world. AUTM's community comprises more than 3,000 members who work in more than 800 universities, research centres, hospitals, businesses and government organizations around the globe.



One Parkview Plaza, Suite 800
Oakbrook Terrace, Illinois 60181
Phone: +1-847-686-2244
Fax: +1-847-686-2253
info@autm.net