Emerging Researchers and Intellectual Property: Law, Policy and Practice

FINAL REPORT

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Preface

This report will begin by outlining the goals of the project, which are primarily to review the relevant literature about the interactions of graduate students and post-doctoral fellows (post-docs) with intellectual property (IP) issues and compare IP policies at Canadian academic institutions. The introduction will discuss intellectual property in higher education with some historical information about the growing importance of academic IP and the policy-landscape in Canada with regard to IP and higher education. This will be followed by a discussion of the legal context of IP in Canada and review of the relevant scholarly literature. The report will then present our comparative analysis of IP policies at a sub-set of Canadian Universities and identify key considerations related to IP and related practices for graduate students, post-docs and their relevant institutional departments. Finally, we present a discussion of our findings and provide a list of short and longer term recommendations.

Table of Contents

Definitions

Intellectual property – an umbrella category of diverse forms of legally recognized property, each of which share an element of intangibility. That is, each type of intellectual property (IP) exists apart from a tangible, material good. For example, a person can still own the copyright that exists in a story even after he or she sells the story, printed in a book, to another person. IP includes copyright, patents, trademarks, trade secrets, and confidential business information. Each type of IP has its own legal criteria and parameters of use.

Emerging Researchers – a term we use to refer to graduate students and post-doctoral fellows collectively in this report. The term is used to distinguish "grad students" and "post-docs" from more established, faculty-level researchers.

Patent – a form of IP that protects inventions from being made, used, sold, etc. without the permission of the owner of the invention. Patents can be granted to any form of knowledge, technology, or process, provided it is novel (new to the world), not obvious to someone with training in the same field, and has a basic level of usefulness, unless the knowledge, technology, or process has been exempted from patent eligibility by the courts (e.g. "laws of nature").

Copyright – a form of IP that protects various creative works (e.g. literary, dramatic, musical or artistic works) from being reproduced, performed, translated, or published without the permission of the owner of the creative work. Copyright extends to any recognized category of creative work provided the work in question has been fixed in some way (e.g. recorded) and meets a minimal level of original expression.

Commercialization – the process by which knowledge, technology, or processes, which may or may not be encompassed by one or more forms of IP, is converted into a marketable product or service.

Thesis Embargo – a time period during which a thesis or dissertation generated for the purpose of fulfilling a degree programme, is sequestered by a university (typically at the request of the student that authored the thesis or dissertation) from publication.

Project Goals

- Produce a white paper on IP, graduate students, and post-docs in Canada.
- Review the relevant Canadian and international literature about the interactions of graduate students and post-docs with IP issues.
- Review pertinent legal issues related to IP in an academic setting.
- Undertake a comparison of IP policies at a sub-set of Canadian Universities, to identify the range of practice.
- Provide key considerations for Canadian post-secondary institutions regarding IP, particularly with respect to graduate students and post-docs.

Introduction

Intellectual Property (IP) is a growing concern for Canadian Universities. It is one component of a broader shift in university research taking place globally over the past forty years, in which universities have become more closely aligned with the private sector in order to capitalize from research discoveries and contribute to the "knowledge economy." Graduate students and post-docs, which we refer to at times collectively as "emerging researchers," are highly valuable in this knowledge economy because they contribute significantly to the research conducted at universities, and because they are considered to be a key source of knowledge transfer between academia and industry. They are also possibly vulnerable in this context, as researchers who are not yet established in an increasingly competitive sector. Through a review of the legal context, scholarly literature, and in-depth university IP policy comparison, this report will identify several key concerns for emerging researchers with respect to IP. To set the stage for that analysis, this introduction will offer a brief historical account of the rise in IP issues in an academic setting, provide an overview of IP policies in Canada, and briefly situate emerging researchers within the contemporary context.

Intellectual Property and Higher Education

Research has long been central to the purpose of the modern university. Throughout the history of post-secondary academic institutions there have been instances of universities and university-based researchers securing IP, frequently as a means to work closely with private industry. In recent decades, however, there has been a growing convergence or collaboration between universities and industry (Newson and Buchbinder 1988; Gibbons et al 1994; Leydesdorff and Van den Besselaar 1994; Slaughter and Leslie 1997; Etzkowitz et al 2000) and an attendant increase in IP generated by universities and university researchers during the same period. Much university-industry interaction still occurs outside of formal agreements related to IP such as a patent licenses (Fini and Lacetera 2010). But increasingly, the opportunity to seek IP is the motivation for, or expressly protected in, university-industry agreements. Thus, there is substantial overlap in practice between the growing emphasis on university-industry partnership and the pursuit of IP as part and parcel of academic research inquiry.

The increasing amount of university-industry collaboration co-mingled with university-generated IP is visible on several levels. In Canada, the federal government has progressively scaled back public funding for research while encouraging 'matched' funding from private partners or 'industry-driven' research (Polster 2002, Polster 2007, CAUT 2015). Provincial governments have similarly sought to promote commercialization of university of research through a variety of funding arrangements and policies (For example, the Ontario Centres of Excellence and Alberta Innovates). At the institutional level, the majority of Canadian universities and colleges have put into place mechanisms to facilitate the acquisition, management, and commercialization of IP. Technology Transfer Offices or "TTOs" (sometimes called Industry Liaison Offices) today populate most post-secondary campuses in Canada. According to the Statistics Canada's most recent Survey of Intellectual Property Commercialization in the Higher Education Sector, 88 percent of Canadian universities were actively engaged in intellectual property management through IP offices by 2008 (Statistics Canada 2010: 10). Finally, on the ground, academic researchers' exposure to and pursuit of IP appears to be an increasingly frequent and normalized

part of the research process (Crespo and Dridi 2007; Azoulay et al 2009, Cooper 2009; Hong & Walsh 2009).

The move toward greater university-industry collaboration and IP emanates from the United States (US). In 1980 the US Congress passed what became known as the *Bayh-Dole Act*, which, along with related legislation, allowed universities and corporations – as opposed to the government – to claim ownership of IP relating to products and processes discovered during the course of federally funded research. Coupled with increased funding for research and other changes in US law, which opened up the range of patentable subject matter, *Bayh-Dole* enabled US universities to secure a steadily increasing number of patents and licensing agreements since the 1970s and '80s. In the US, patents granted to American universities in a year rose from 300 in 1980 to 2000 in 1995 (Nelsen 1998). Between 1991 and 1996, the number of university license agreements in the US rose by nearly 70 per cent and the amount of royalties received (in real terms) doubled in that period (Thursby & Kemp 2002).

The details of the Canadian legal framework are different from the US but parallel increases in, and growing emphasis upon, IP and commercializing university-based research have occurred in Canada. Canada does not have an equivalent to the US' *Bayh-Dole*. Thus, apart from IP generated by federal public servants, which the federal government owns pursuant to the *Public Servants Invention Act*, IP ownership between universities and individual academic researchers differs across academic institutions (whereas in the US, universities generally own IP instead of individual academic researchers). Despite this varying picture, Canadian research funding agencies, academic organisations such as the Association of Universities and Colleges of Canada (AUCC) (AUCC 2002) and the Council of Canadian Academies (CCA 2009), and individual post-secondary institutions have embraced IP and commercializing research as important goals. For example, the AUCC committed to tripling the commercialization outputs (e.g. number of patents) of universities over a ten-year period (AUCC 2002). In response to these and other governmental policies and incentives, many, if not most, university administrations have overtly embraced commercialization or entrepreneurialism as central components of the academic mission, allocating significant institutional resources to building university-industry relationships and securing IP.

In this context it is important to observe that this shift in favour of commercialization and securing IP has been the subject of significant debate. Whereas some have argued that the shift is an important and necessary transition (Gibbons et al 1994; Leydesdorff and Van den Besselaar 1994; Etzkowitz et al 2000), others have raised concerns, noting the tensions between the research mission of the university and the distinct incentives and goals that commercialization and partnership with the private sector can entail (Newson and Buchbinder 1988; Slaughter and Leslie 1997; Slaughter and Rhoades 2004). For instance, the Canadian Association of University Teachers has identified problems with secrecy resulting in the push for IP (CAUT 2007), addressed conflicts of interest that can emerge from intellectual property agreements (CAUT 2008), and generally defended free and open intellectual exchange. The National Graduate Caucus of the Canadian Federation of Students has also been critical of increasing commercialization of university research (CFS 2007). Others still have suggested that far more evidence is needed about the advantages and disadvantages of commercialization and IP in the academic environment. (Downie and Herder 2007)

Intellectual Property Policies in Canada

In the absence of federal legislation, some federal research funding bodies have put IP policies in place. All of these policies disavow any interest on the part of the funding body in IP ownership, deferring instead to researchers, academic institutions, and third party sponsors to work out IP ownership. For example, the current Memorandum of Understanding (MOU) between the three federal granting agencies and academic institutions stipulates that the granting agencies "shall not claim any intellectual property rights in respect of the research or related activities which they fund" (Tri-Agency 2013). Similarly, Genome Canada's IP policy states that IP "shall belong to the researchers by whom the work was completed and/or their institutions, as the case may be" (Genome Canada 2000).

Apart from IP ownership, some of these policies do specify some important parameters around IP. The IP policy of the Natural Sciences and Engineering Research Council of Canada (NSERC) is noteworthy. It mandates that any and all IP agreements arising from NSERC-funded research address five key "elements"; namely, setting out timelines and due diligence requirements for commercial exploitation of IP; respecting parties' confidential information; precluding secrecy of research results; preventing delays to student thesis defences; and, ensuring that universities and researchers retain rights for future non-commercial research and teaching (Natural Sciences and Engineering Research Council, 2009). Other federal agency IP policies state that grant recipients may be required to implement "proper mechanisms for the protection of [IP]" (Genome Canada 2000) which is indicative of federal research funding bodies' growing appetite for IP and commercialization noted above. But no details about such mechanisms are provided.

Without a uniform, nationwide IP law or policy, almost every Canadian academic institution has developed some form of agreement, policy or guidelines to govern IP issues. These agreements, policies and guidelines, and the resulting norms or rules surrounding IP, vary considerably across institutions. Consider IP ownership. At most (42%), the creator of the IP (e.g. the inventor of a patented invention) is the presumptive owner; at others (22%), the institution is the presumptive owner of any IP generated in the course of research; finally, 17% of Canadian institutions have a model of presumptive joint ownership (Statistics Canada, 2010: 16). These differences in model of IP ownership matter. As Fisher and Atkinson Grosjean report in their study of TTOs in Canada "the key determining factor in the operation of the [TTO] was the [IP] policy of the university" (463). Tasked with translating research results into commercial applications, TTOs can face greater challenges at institutions where creators presumptively own the IP because researchers have the option of working independently (Fisher & Atkinson Grosjean 2002).

The form of Canadian IP polices also tends to differ across institutions, which also has practical implications. In many cases, IP policies are articulated in faculty Collective Agreements (CA). Some institutions also have institution-wide IP policies. Depending on the source, the rules pertaining to emerging researchers and other members of the university that are not represented in the CA may be unclear.

Emerging Researchers, Growing Exposure to Intellectual Property, and Shifting Norms

Although emerging researchers are increasingly likely to be exposed to commercialization given systemic increases in IP and other commercialization activities (Herder 2013), they have been understudied in the literature on IP and higher education. From our own research it is clear that there are numerous informal exposures to IP throughout graduate education and post-doctoral work. Federally organized and funded programs such as MITACS, designed to build partnerships between academia and industry and targeted to graduates students and post-docs, hold regular campus workshops on topics ranging from "Discovering the Entrepreneur Within" and "Writing Strategic Business Reports." In just the past year Dalhousie has hosted lunch-time sessions on topics ranging from "Transforming Discovery to Opportunity," "Protecting Medical Inventions," "Dealing with the media" (in the context of forming a start-up company) and "How to Pitch your Research and Capabilities to Industry." While IP is not the central topic in all of these voluntary workshops and sessions, it is consistently raised as a matter that must be addressed in the context of academic research.

These educational offerings about how to commercialize research, become an entrepreneur, and protect IP speak to the shift that has occurred on Canadian campuses and a potential underlying trade-off. IP and industry collaboration are not new to the academic sphere. But instances of university patenting (a form of IP) and industry collaboration triggered controversy through much of the twentieth century (Hughes 2001; Weiner 1987; Marier and Piper 2010). Our view is that the controversy IP and commercialization triggered was, on balance, beneficial. It helped motivate a sustained conversation amongst academic researchers and institutions about when, why, and how to seek IP or partner with industry. Banting and Best's discovery and commercialization of insulin is perhaps the most famous example. The researchers' decision to patent their research was highly controversial, yet the researchers used their IP to maintain safe production of insulin (in the absence of federal oversight at that time) and ensure affordable access through a non-exclusive manufacturing license with Eli Lilly company (Marier and Piper 2010).

Today, it is not clear whether academic researchers are well versed in the nuances and tradeoffs of pursuing IP and collaborating with industry. According to some of the literature in this area (Tyers et al 2005, Young 2005, Thompson et al 2001), current funding models, which require partnership with the private sector and pressure researchers to choose projects that will lead to results with commercial potential are a source of concern for some academic researchers. But our own research (Holloway and Herder [in review]; Herder et al. [in process]) suggests that emerging researchers are far less aware of any potential tradeoffs of working with industry and pursuing IP. More opportunities to inform and engage academic researchers, especially emerging researchers, about the potential benefits and risks associated with IP and commercialization would appear to be beneficial for the university and the academic community as a whole; we address this matter briefly in our recommendations.

Emerging researchers' apparent appetite for working from industry and/or IP may follow from the increasingly competitive academic job environment. Throughout this report we attempt to situate the growing emphasis upon, and exposure of grad students and post-docs to IP and related commercialization activities, within the increasingly grim reality that such emerging researchers face. Gaining a foothold in academia is becoming a more costly, time-consuming and competitive during which emerging researchers endure an "extended period of limited intellectual autonomy" (Collins, 2010) (Herder 2013:462) with a very low rate of success for obtaining work as an academic. Therefore, in this report we intend to highlight the discrepancies between emerging researchers and faculty when it comes to university policies addressing IP.

The remainder of this report is divided into four main sections: an explanation and discussion of the relevant legal context; a literature review of issues relevant to IP and emerging researchers; a comparison of IP policies at seventeen Canadian Universities; a discussion of key considerations regarding IP for emerging researchers at Canadian Universities; and recommendations for both short-term and long-term IP policy reform.

Legal Context

In this section we outline some general principles regarding intellectual property under Canadian law and provide a succinct overview of caselaw (i.e. court decisions) in Canada as well as the United States involving graduate students and post-docs.

Points of Interest: Patents, Copyright, Other Forms of IP, and Related Legal Issues

Intellectual property (IP) law encompasses several discrete kinds of IP, including, patents, copyright, trademarks, trade secrets, and confidential business information. Legislatures and courts have, over time, developed criteria to define each form of IP—from the types of knowledge, technology, or creative works that are eligible for one or more forms of IP protection, how they are obtained or come into existence, to their respective boundaries of use in the real world.

The differences between the various forms of IP matter. For example, to obtain a patent on an invention a formal application must be filed and reviewed by a country's patent office. The review process can consume considerable time and resources, creating significant costs. In contrast, copyright in a creative work (e.g. script for a film) essentially comes into existence the moment the work does, provided the work satisfies copyright law's requirements of originality and fixation. No office screens upfront against those criteria, however, so copyright carries zero upfront costs. Therefore, taking into account this and other differences across types of IP may be important for university IP policies.

It is beyond the scope of this report to set out the details of each form of IP, but the following four points merit special attention in the university setting: To begin, IP law generally differentiates between the (human) persons that are responsible for a given piece of knowledge, technology, or creative work, and the persons (human or corporate) that own it. Credit and ownership of IP are, in other words, not necessarily one and the same.

Secondly, the legal standards for taking credit and claiming ownership can differ by type of IP. To be credited with an invention, a person must contribute to the "inventive concept" behind the patented invention. Someone who runs a set of experiments to test a hypothesis that he or she did not develop will not, for instance, qualify as an inventor. In other words, "mere verification" of someone else's insight does not qualify as invention. (Apotex v. Wellcome Foundation, Ltd. 2002 SCC 77) Taking credit for a copyrighted work, i.e. satisfying the legal test for authorship, is less onerous. The person does not have to be responsible for the key argument, idea, or concept behind the work. He or she simply has to contribute some level of "original expression". (Kantel v. Grant, [1993] Ex. C.R. 84, Dolmage v. Erskine, [2003] O.J. No. 161) That does not extend to someone who merely edits or drafts on the instruction of someone else, but it is otherwise fairly inclusive as a threshold.

Ownership, that is, control, of IP also depends on the type of IP. In the case of patents, historically, courts tended to presume that the person(s) responsible for the invention were the rightful owners, even in the context of employer-employee relationships. (Bloxam v. Elsee

(1825), 1 C.&P. 558 (K.B.). More recently, however, courts have been more willing to reverse that presumption, granting ownership of patented inventions to employers, as an implied term of the employment relationship. (Spiroll Corp. v. Putti, [1975] B.C.J. No. 992, Comstock Canada. V. Electec Ltd., [1991] F.C.J. No. 987)[1] This shift is therefore relevant for post-docs and graduate students engaged in paid research assistant work. For copyrighted works, the Copyright Act, R.S.C. 1984, c. C-42, s. 13(3), specifies a presumption of employer ownership "in the absence of an agreement to the contrary." Yet, courts have determined that an academic exception to this statutory rule exists given the importance of ownership over one's work in terms of academic freedom. (UBC. v. UBC Faculty Assn., (2004) 125 L.A.C. (4th) 1, Dolmage v. Erskine, (2003), 120 A.C.W.S. (3d) 127) There has not been a Canadian case involving graduate students employed as research assistants or post-docs on this point, but presumably the same exception would apply. (Note: students that are *not* in an employment relationship in respect of their research would, by virtue of the Copyright Act, s. 13(1), be the presumed owners of any work they personally author). Thirdly, data per se is not a recognized form of IP in Canada. Data can theoretically be claimed as part of a copyrighted work, a trade secret, or confidential business information, but each of those forms of IP carries specific legal requirements that must be met in order for data to be equated with IP. University IP policies and materials provided online by university TTOs sometimes list data as a type of IP, which is not accurate.

Finally, each form of IP can be the subject of a contract between two parties, which can raise additional legal issues. The most obvious example of this is university IP policies. Such policies are, in effect, contracts between the institution and its faculty, employees, and students, which purport to set out some basic parameters around who owns IP, how any resulting rewards are to be shared, and what processes to be followed in the event of a dispute. At their best, university IP policies can significantly clarify a number of important issues such as ownership. As shown in the next section and the university IP policy comparison later in this report, these policies can also create new ambiguities, perpetuate hierarchies in the academy, and thus motivate legal actions for breach of contract.

Relevant Caselaw from Canada and the United States

The foregoing four points of interest are by and large fact-specific. Determining, for example, who is an inventor of a given patented invention depends on who actually was responsible for the "inventive concept." The outcome of any dispute about the above IP issues is thus likely to vary. The small body of caselaw in which these issues have been litigated in Canada and the US is illustrative of this variability. A sampling of US caselaw in which the issue of inventorship was in question is included here because that issue has yet to surface in a Canadian court case involving a graduate student or post-doc.

US caselaw on inventorship in the academic setting[2]

[1] Notably, however, in 2011 the US Supreme Court restored the historical common law principle, ruling that ownership vests in the inventor(s) absent an agreement otherwise, to be construed as a matter of state law. Bd. of Trs. of the Leland Stanford Junior Univ. v. Roche Molecular Sys., 131 S. Ct. 2188 (2011). It remains to be seen whether this US ruling will influence Canadian law.

[2] Note, the contents of this subsection is substantially derived from Herder (2013).

There have been a handful of US cases on inventorship. The first in this line of cases, In re Katz (687 F.2d 480 (C.C.P.A. 1982)), involved a Harvard University medical school professor whose patent application was rejected by the US patent office, in part, because of an article he had previously published with two graduate student co-authors. That rejection was overturned when a court concluded that the fact that the graduate students were "working under the direction and supervision" of the professor worked against any inference of joint inventorship. This underscores the high threshold of inventorship in US, as well as Canadian, law – a threshold which maps onto the hierarchical relationship between supervisor and student.

The facts behind a second case, Chou v. Univ. of Chicago (254 F.3d 1347 (Fed. Cir. 2001)) were different, precipitating a different outcome. Chou worked a total of fourteen years for a professor of molecular genetics, first as a graduate student and then as a post-doc. Her supervisor, Dr. Roizman, enforced a policy of confidentiality; no laboratory work could be publicly disclosed without his say so. Yet he assured Dr. Chou that she would be "fairly treated for the research which she conducted." Chou and Roizman worked collaboratively for a significant period of time, producing several publications and patent applications (in which they both named as inventors) in the process. On one occasion, however, without Chou's knowledge, Roizman filed a patent application based upon a series of research papers that listed Chou as the lead author. Roizman also founded a company to exploit the patented technology. When Chou learned of these developments and began to complain, Roizman forced Chou to resign her position, prompting her to sue Roizman, the university, and the company he had formed. A court later ruled in Chou's favour on the issue of inventorship. In addition, the court noted that the supervisor and university could also have been liable for fraudulent concealment (of the patent application and start-up company), breach of contract, and breach of fiduciary duty. These other potential bases of liability in the context of an IP dispute have surfaced in Canada, as noted below.

The outcome of a third US dispute, Univ. of W. Va. Bd. of Trs. v. VanVoorhies (278 F.3d 1288 (Fed. Cir. 2002)), was different again because the post-doc was knowledgeable of patent law. In fact, he was a registered patent agent and was intimately involved in patent related decision-making. His lawsuit against West Virginia University and a professor for, amongst other things, breach of fiduciary duty thus failed. The facts of this case and the post-doc's expertise in patent law are especially exceptional, however.

Indeed, relative to universities and established academic researchers, graduate students and post-docs are obviously less well positioned to marshal facts and law to their advantage. Coupled with the disincentive of destroying the very relationships upon which her or his future career depends, a lack of knowledge about IP law presumably explains why so few IP disputes have arisen in Canada to date.

Canadian caselaw related to IP, graduate students and post-docs

The Canadian caselaw also underscores the fact-specific nature of IP disputes. The first Canadian case involving a graduate student is Boudreau v. Lin. ([1997] O.J. No. 3397 (Ont. Gen. Div.)) Boudreau was a part-time M.B.A. student at the University of Ottawa, as well as an employee of

a local "high tech" company (Nortel). Lin was Boudreau's professor, whom Boudreau alleged published a paper that he had written without attribution. The student and professor disagreed about who had come up with the key concept behind the paper in question, as well as the extent of the changes that were made to the paper after Boudreau submitted it to Lin to fulfill class requirements. The court found the testimony provided by the student, Boudreau, more credible, determining that he was the sole author of the paper in question. Interestingly, the University of Ottawa (also a defendant in the case for publishing the paper as a case note) attempted to argue that Nortel, not Boudreau, was the true owner of the copyrighted work as a means of defending against liability for copyright infringement. The University argued that Nortel, as Boudreau's employer while he was a student, was the owner because Boudreau created the work in the course of his employment. However, the court rejected this argument by finding the opposite, the "work was not created in the course of Mr. Boudreau's employment." The court was likewise unimpressed with the claim that this was a "minimal mistake", emphasizing:

> Plagiarism is a form of academic dishonesty which strikes at the heart of our educational system. It is not to be tolerated from the students and the University has made this quite clear. It follows that it most certainly should not be tolerated from the professors, who should be sterling examples of intellectual rigour and honesty.

A second case centered on a patented dental varnish, which a dentist invented in collaboration with his supervisor while doing post-graduate research at the University of Toronto during the 1980s. (Balanyck v. University of Toronto, [1999] O.J. No. 2162 (Ont. S.C.)) The invention was, in accordance with the university's IP policy, assigned to the university, which it subsequently commercialized through a series of agreements with private companies. Balanyck sued the university on several grounds, alleging fraud, breach of trust, breach of contract, misrepresentation, conspiracy, and breach of fiduciary duty. The only ruling in the case was procedural as the university petitioned the court to strike out the case because, on the facts, Balanyk had no grounds for legal action. The court essentially agreed as Balanyk had little to no evidence to support his claims. The point worth noting, however, is that the court gave significant weight to the university's IP policy; by acting in accordance with its policy, the court found that the university was not at fault.

The third dispute arose at the University of Alberta between a Master's level student and his supervisor. (Plews v. Pausch, [2006] A.J. No. 998 (Alta. Q.B.)) The student, Plews, alleged that his supervisor, Pausch, appropriated his ideas for a publication thereby infringing his copyright and that the university was, by extension, vicariously liable for failing to rectify these violations. Unlike the Balanyk case where there were not sufficient facts to even warrant a court hearing, this case reached trial. But the court found that the facts simply did not comport with the student's claims. On the facts, the student and supervisor had only briefly communicated about the ideas in question before the student switched to another supervisor. Also, in contrast to the Boudreau case, where the student submitted a complete paper, here the student had simply informed the professor about his intended research direction in general terms. So the court was not persuaded that the supervising professor had done anything wrong legally. Importantly, the court did note that the university could have been liable for failure to meet its fiduciary duties toward the student, but on the facts it had taken a number of diligent and fair steps to investigate the student's complaint.

The final reported and most recent case involving a post-doc and the commercialization of a patented invention is Corporation de l'École polytechnique de Montréal v. Fardad (2010 QCCA 992). The dispute arose from a joint research project carried out by academic researchers at Montreal's Polytechnique school and McGill University where the post-doc, Fardad, was employed (paid by research grant funds from the Natural Sciences and Engineering Research Council of Canada). The research was productive and led to a number of articles as well as a patented invention, which was assigned by all the inventors (Fardad was one of three named inventors) to McGill. Shortly afterwards Fardad accepted a new academic position in the US, meanwhile unbeknownst to Fardad the patented invention was licensed to a private company that subsequently became listed on a public stock exchange, increasing significantly in financial value. When Fardad finally learned of these developments he sued for a share of the royalties that he claimed he was entitled to under the applicable university's IP policy. The court found that he was, by the express terms of the IP policy, owed royalties and, at trial, Fardad was awarded > $1.5 million (although the amount was later modified on appeal).

Review of Literature

There is a sparse but growing literature specifically addressing graduate students and post-docs and IP issues in academic research. In the empirical work the subject is interwoven into research investigating graduate and post-doc training, mentorship and career development, and authorship. Most of the literature has addressed IP in the context of medicine, biotechnology, natural sciences and engineering. There is far less literature on IP in fields related to the social sciences and humanities, but there is a growing interpretation of scholarly papers as IP and all scholars are increasingly being encouraged to think about their work as 'commercializable', or at least 'tranferrable' to sectors outside the university..

This review will begin with emerging researchers' experiences of IP, which reveals a tension between the benefits of engaging in IP-related activities for the sake of the success of their career in an ever-competitive academic work environment, and disadvantages for their education, their ability to share their findings freely, and the risk of being perceived negatively by scientists who have an objection to increasing IP in academia. There are few studies that explore the perspectives of emerging researchers themselves; much of this literature draws on what professors say about emerging researchers. It will then explore attribution and hierarchy, demonstrating through several empirical studies on authorship and credit that negotiations over who owns data and who gets credit for work are sometimes uneven, weighted in favour of established researchers. It will then explore the literature on emerging researchers' career paths, which bears a fairly consistent assumption that graduate students and post-docs are a form of knowledge transfer, without considering the impact on the actual emerging researchers' goals and choices.

Emerging Researchers' Experiences of IP

There is some literature on the impact that increasing attention to IP can have on students and graduate education. A series of papers investigate how increased emphasis on patenting has changed university research (Azoulay et al 2007, 2009; Baldini et al 2006, Baldini 2011; Calderini et al 2007; Davis et al 2011; Di Gregorio and Shane 2003; Etzkowitz and Leydesdorff 2000, Etzowitz et al 2000; Fabrizio and DiMinin 2005; Guena & Nesta 2006; Goktepe-Hulten and Mahagaonkar 2009; Heller and Eisenberg 1998; Meyer 2006; O'Shea et al 2005, Shane 2004). A few of these specifically mention the experience of emerging researchers. For instance, Stephan (2001) reflects on the effect that technology transfer can have on the curriculum and on students directly. In her estimation, positive outcomes of technology transfer for graduate students include effective transfer of students to work for industry, and extra funds for students' research. A negative effect lies in potential conflicts with faculty – she documents a case in which a student was included in a patent by her mentor without her knowledge. Empirical work in this area shows that faculty members feel conflicted about their ability to train their students in disinterested inquiry in a context of increasingly industry-oriented research (Owen-Smith and Powell 2001), that faculty who are more aligned with industry have to educate students to excel in industry while avoiding conflicts and stigma of pursuing science for commercial gain (Owen-Smith and Powell 2001), and that established researchers navigate their shifting identities as both researchers and entrepreneurs, sometimes ensuring the primacy of their academic identity by delegating commercialization activity to their graduate students (Jain et al 2009: 930). This kind

of work speaks to a shift in scientific norms and its manifestation in what is passed on to new generations of scientists through academic training.

There have been some empirical studies that focus specifically on patenting and graduate training (Azoulay et al 2009), concluding that academic patenting might alter the career trajectories of graduate students and post-docs who work in laboratories where their supervisor is patenting (670). There are a few studies that register a concern with the increasing entrepreneurialism of graduate education and post-doctoral training, specifically that the research and educational mission of the universities is not successfully balanced against the push to foster commercialization (Toole and Czarnitzki 2010). Along these lines, Slaughter and colleagues (2002, 2004) have found that one of the quandaries raised by many professors engaged with industry was a concern about whether graduate education was compromised by commercialization, and about how to ensure graduate students were credited for their work, and that they were not exploited when involved in start-ups (Slaughter et al 2002). Another work specifically devoted to discussing the "traffic" in graduate students argues that industry and academia are two different systems, which respectfully reward product development and profit taking, and publications and the training for university positions. "When professors entered into partnerships with industry, students became products, purchased by corporations; yet they were also students, part of academe's learner-graduate student system" (Slaughter et al 2002: 289). When it came to IP rights, graduate students were 'tokens of exchange" (Slaughter et al 2002: 294). Furthermore, graduate students were the lightning rods in negotiations over IP because they were the ones at the bench side. The authors detail the potential for exploitation of graduate students that involve secrecy demanded by corporations when research had the potential for profit, withholding of the publication of graduate student research results to enable patenting, and the sequencing and 'sanitization' of data (Slaughter et al 2002).

An understudied but increasingly popular issue related to emerging researchers' IP is the thesis embargo, the period during which a thesis or dissertation generated for the purpose of fulfilling a degree programme is sequestered from publication by a university while in many cases it is the student that authored the thesis or dissertation that would request an embargo, anecdotally we have been informed that embargos have on occasion been requested by faculty supervisors, in some instances, where the supervisor has signed a contract with an industry funder requires a delay in publication. It is also possible that the student may wish to extend the embargo so as to keep confidential his or her work (whether data from experiments of potential interest to a company, or a book-length manuscript for submission to a commercial publisher). The motivation for and duration of embargoes likely differs across academic disciplines and institutions but, to our knowledge, there are no empirical studies of emerging researchers' experiences and attitudes toward embargos., but there is some literature on the significance of this practice (Hawkins et al 2012).

Anecdotally, we have been informed that thesis embargos may frequently be requested by faculty supervisors rather than students. Presumably, the purpose of such embargoing is strategic; faculty may be aiming to preserve additional publication and/or collaborative research opportunities by temporarily sequestering the data or information embedded in a student's thesis. However, doing so may be at odds with the student's interests in completing his or her work, or utilizing the data/information in the context of his or her next degree programme and/or

employment. Clearly, further study of whether, to what extent, and how thesis embargos are being (mis)used, and whether such (mis)uses are justifiable, is needed.

Attribution and Hierarchy

Receiving proper credit for one's work is an issue of fundamental importance in academia. The issue arises often in relation to authorship of publications. The issue is particularly challenging for for emerging researchers, who sometimes hesitate to question authorship practices because of the power imbalance with their supervisor. Several empirical studies have addressed authorship and the hierarchy of academic research, indicating that emerging researchers do not always receive appropriate recognition for their work (Fine and Kurdek 1993; Geelhoed et al 2007; Karani et al 2013, Nguyen & Nguyen 2006, Street et al 2010).

As IP has become more commonplace in the university, allocation of credit for other types of creative outputs, such as being named an inventor on a patent, can also precipitate confusion and dispute. One empirical study in fact found that high status within an organization's hierarchy increases the likelihood of inventorship, but not of authorship (Haeussler & Sauermann 2013: 689). The literature exploring power imbalances between emerging and established researchers in relation to IP speaks to the difficulty that graduate students' may face in asserting their interests when it comes to publishing and patenting. For instance, Seymore highlights the essential work that graduate students do in conducting the bulk of "bench work" that goes into academic science, and stresses the importance of publication for advancement in science, and the lack of power that graduate students have to challenge their supervisor's decisions on this matter (Seymore 2005: 11). He stipulates the legal claim to inventorship but then outlines how inventorship can be determined through social relationships, particularly ones in which post-docs and graduate students are not able to challenge professors inventorship decisions (Seymore 2006: 166).

Inventorship is often attributed more sparingly than authorship, meaning that co-authors of a scientific publication are not included in the list of inventors of related patents (Lissoni et al 2013). The legal standard of inventorship, which requires contribution to the inventive concept behind the patent, may partially explain this trend. But other research suggests emerging researchers are marginalized for other reasons as well. Lissoni et al. (2014) found that junior and female co-authors were at times "convinced to give up inventorship, other things being equal, due [to? Sic] their lower incentives to reclaim this type of attribution right, as opposed to authorship" (Lissoni et al 2013: 50). Lissoni & Montobbio (2014) followed this study with a review of the literature on inventorship and authorship in academic science in which they sketch categories of authors at risk of being "excluded" from inventorship, including laboratory technicians and other "assistant figures" (graduate students and junior scientists), and junior and female scientists.

Emerging researchers may also be denied credit for their research contribution where they are effectively denied access to the research they helped carry out. One study has demonstrated that doctoral students and post-doctoral fellows in life sciences, computer sciences, and chemical engineering are sometimes denied access to information, data, materials or programming associated with research, which had a negative effect on the progress of their research, the rate of

discovery in their lab/research group, the quality of their relationship with other academic researchers and the quality of their education, as well as the level of communication in their lab (Vogeli 2006).

Some of the literature offers solutions to address these problems of credit. For instance, Welsh et al (2008) suggest that the American Psychological Association (APA), the Office of Research Integrity (ORI), and the American Educational Research Association (AERA) should have ethical guidelines that address these very problems. Their recommendations for how to prevent and resolve disputes between students and faculty include resolution of authorship issues at the outset of the relationship, ideally before collecting data; a detailed written policy for research assistants; clear explanation to students about expectations for publication and payment for work (Welsh et al 2008). On an institutional level, they recommend departmental policies about student involvement in faculty research; dispute resolution process; and protocol for student and faculty disputes (ibid). It is recommended that students inquire about issues of authorship as well as any policies regarding data ownership (ibid). To this effect, there have been measures to address some of the above issues in institutional and governmental policy. For instance Canada's Tri-Council representing research funding agencies requires all Canadian institutions to have Responsible Conduct of Research policies, which explicitly identify impeding a graduate students' degree progress as a break of research integrity. Many universities also have research integrity policies that encourage ethical research. Our policy comparison investigates the extent to which Canadian academic institutions address dispute resolution processes.

Career Paths

In the literature on post-doctoral training one consistent theme is that there has been an increase in post-docs ,partly attributed to adverse job-market conditions (Stephan and Ma 2005). Stephan (2012) emphasizes the 'lag' between university research and innovation in her book on *How Economics Shapes Science*, but stresses that there is almost no lag in the training of people to work in industry where PhDs can use their scientific expertise to evaluate and seek R&D opportunities or market and distribute new products. Furthermore, as Stephan notes, PhDs represent the translation of knowledge (particularly tacit knowledge) from academia to industry (2012: 221). She says close to 40 percent of all PhDs trained in science and engineering work in industry in the United States (2012: 218).

Stephan claims that the academic job market is overcrowded, and thus despite the preferences of many new PhDs to work in academia they have been forced to look elsewhere for jobs (2012). Universities across Canada and the US seem to accept this trend as an inescapable fact, and are now turning their attention to providing training for emerging researchers to be able to succeed in the industry job market. For instance, Janero (2013) stresses education and mentorship that extends beyond the laboratory and includes people management and communication competencies so that doctoral science students can enhance their market competitiveness and navigate research, commercial and occupational challenges of contemporary preclinical drug discovery. There are several empirical studies that attempt to demonstrate the value of programs that are specifically designed to train post-docs to work for industry (Shah 2013, Yazdi & Acharya 2013, Amsen 2011, Grimes et al 2012). In Canada this has been a key component of the federal government's science policy direction. For example, this is a mandate of The Networks

of Centres of Excellence Highly Qualified Personnel training program (Networks of Centres of Excellence, 2011).

Whether destined for industry or other employment contexts, characterizing graduate students and post-docs as the primary outputs of academic research is both laudable and problematic. It's laudable in the sense that it recognizes the primacy of actual researchers – their expertise, talents and sensibilities – over other, more discrete research outputs potentially codified as IP. On the other hand, characterizing emerging researchers as outputs risks reducing them to what Slaughter and colleagues (2002; 2004) have described as mere 'tokens of exchange' between academia and industry. It is therefore essential to pay close attention to whether emerging researchers' transition in and out of academic environments is consistent with their stated preferences and interests. Do they actually wish to pursue a career in industry, and why? If not, there is a risk that describing emerging researchers as outputs will help preserve the status quo.

Equity and Emerging Researchers

While the uneven power dynamics between supervisor and emerging researcher have been explored in some of the above studies, power relations involving gender and visible minorities have not been explored very extensively. A few studies demonstrate a pressing necessity for more work in this area with respect to emerging researchers. Ding and colleagues (2006, 2009) and Azoulay and colleagues (2007) explore the gender gap in patenting and entrepreneurial activity among life scientists; Colyvas and colleagues (2012) find that women disclose fewer inventions than their male counterparts. Several equity-related studies do not address IP-related matters, but demonstrate that more attention should be paid to the overlap between equity-related issues and patents, publishing and credit in academic research (Jacobs 2011, West et al 2013, Tao 2007, Beech et al 2013, Mori 2000, Yeh & Inose 2003, Poyrazli et al 2004).

Conclusion

The literature on experiences related to IP for emerging researchers is not particularly thorough or conclusive, but there is evidence of tensions in mentoring students in the context of shifting norms of academia. On one hand, emerging researchers are taught to think about patenting and working with and for industry in order to be successful and move ahead in their careers; but they also can apparently experience stigma if they pursue that path. Another theme in the literature is that emerging researchers are used for technology transfer without any ability to engage with that process or express their own desires and hesitations about that choice. Some emerging researchers may feel that it is not in fact a choice. And this speaks to another theme, that in a context where there are clear power differentials between emerging researchers and established researchers (and this is further complicated by equity issues) there do not seem to be resources for emerging resources to discuss or address grievances when it comes to IP-related matters; mainly, credit, i.e. attribution, in publishing and patenting.

Analysis & Key Considerations

Approach and Methodology

Between September 2014 and January 2015 we compared IP-related documents from 17 Canadian academic institutions and generated analysis and key considerations from this comparison. We made an effort to select a sample of academic institutions from different Canadian regions that varied on three dimensions: 1) size of graduate student enrolment; 2) the presence or absence of a medical school (given the IP intensity of medical research); and, 3) the institution's ownership model when it came to IP. The sample is listed in *Table 1*, with these fields specified along with the name of the Technology Transfer Office of each institution.

Table 1: Sample Institutions

Institution	**Full time grads**	**Med school**	**Ownership Model** Faculty/ Students/ PDFs	**TTO**	**Response**
Emily Carr	30	No	Joint ownership/ Joint ownership/ Joint ownership	Research and Industry Office	No
Brandon	120	No	University owned/ Not addressed/ Not addressed	Research and Innovation Services	No
Trent	380	No	Creator owned/ University owned/ Not addressed	Office of Research	No
Lethbridge	430	No	Creator owned/ Creator owned/ Not addressed	Research and Innovation Services	No
U Regina	830	No	Creator owned/ Creator owned/ Unclear	Office of Research, Innovation and Partnership	No
Ryerson	2,060	No	Creator owned/ Unclear/ Not addressed	Research and Innovation Office	Yes
Memorial	2,310	Yes	University owned/ Creator owned/ University owned	The Genesis Group	Yes
Manitoba	2,970	Yes	Creator owned/ Creator owned/ Creator owned	Technology Transfer Office	Yes
Carleton	3,000	No	Creator owned Unclear/ Unclear	PARTEQ Innovations	No
Queen's	3,900	Yes	Creator owned/ Creator owned/ Creator owned	PARTEQ Innovations	Yes
Dalhousie	3,220	Yes	Creator owned/ Not addressed/	Industry Liaison and Innovation	Yes

Institution	Full time grads	Med school	Ownership Model Faculty/ Students/ PDFs	TTO	Response
			Not addressed	Office	
University of Alberta	6,130	Yes	Creator owned/ Creator owned/ Creator owned	TEC Edmonton (UAlberta and Edmonton Economic Development corp)	Yes
University of British Columbia	9070	Yes	University owned/ Creator owned/ Not addressed	University-Industry Liaison Office	No
U Toronto	14,800	Yes	Joint ownership/ Joint ownership/ Unclear	Innovations and Partnerships Office	No
Waterloo	3,900	No	Creator owned/ Creator owned/ Creator owned	Waterloo Commercializatio n Office (Watco)	Yes
Ottawa	5,600	Yes	University owned/ University owned/ University owned	Technology Transfer and Business Enterprise	No
McGill	6,960	Yes	Joint ownership/ Joint ownership/ Joint ownership	Office of Technology Transfer	Yes

After settling on a sample we contacted the research departments of 25 Canadian academic institutions by email and asked them to provide any policies at their institution that address IP, broadly understood, including institution-wide policies on IP; CAs for faculty, post-docs, staff and students; IP policies from the school of graduate studies; and policies of the institution's governing body that are relevant to IP (e.g. Research Integrity policies); and finally, any policies pertaining to thesis or dissertation embargoes. *Table 1* also notes the institutions that responded to our request for IP policies. We heard back from ten of 17 institutions, six of which directed us to contact their TTO.[3] Where the institution did not respond, we searched their website materials in order to find the relevant information. To ensure comprehensiveness, in some cases we had to search the websites of institutions that did respond in order to gather all relevant documents. We came up with a final sample of 17 institutions based on those that responded to our inquiry, and those for which we were able to obtain all relevant documents on the institution's website.

For eight of the institutions in the sample a university-wide policy appears to address IP for any and all 'inventors' or 'creators' of IP, in that the terms inventor and/or creator are either explicitly defined broadly to include faculty, students and post-docs, or are left undefined, and as such, theoretically include any individual that satisfies the legal standard of inventorship for

[3] In Table 1 only eight institutions are listed as having responded to our email. The two that are missing from this sample are the University of New Brunswick and the University of Calgary. While we have had correspondence with these institutions, we do not yet have access to all of their policies related to IP. If we do obtain access to these policies we plan to include them in our sample.

patents, or, in the case of a copyrighted work, authorship. For others, policies are only outlined clearly in the faculty's CA. Graduate students do not usually have a CA that addresses research or intellectual property. If they are unionized it is most commonly as teaching assistants. Four universities in Canada have unionized post-docs but only three have a CA at this point. In some cases the post-doctoral fellow's CA does make some mention of IP.

The type of IP policies in place at each institution and the relative ease in locating them thus became a first point of comparison for our analysis. Further, more substantive fields of comparison, fall under the headings of ownership, commercialization, procedure, and access. Below we explain each field and, in the ensuing section of the report, present our comparison in a series of tables.

Ownership

IP Ownership Model: Measures whether the institution has joint University-Inventor ownership over IP, Creator-Owned IP, or University-owned IP.[4] Note: each model is a model of presumptive ownership, meaning it determines which person or entity owns the IP *in the absence* of an agreement that specifies some other rule around ownership. All policies we examined allow for the possibility that ownership can be transferred or modified by contract on a case-by-case basis.

IP Ownership Specificity: Measures whether the institutional policy utilized a catch-all term such as 'creator' in order to address ownership of all forms of IP, or instead used more specific, legal terms such as inventor or author.

Commercialization

The following fields of commercialization related to patents only, hence the policies tend to refer to the inventor(s) rather than creator(s) or author(s).

Independent Commercialization: Measures whether a Creator can commercialize their findings on their own, or whether they must commercialize with the university, most commonly through the TTO. We came up with two categories of evaluation for this topic; Ex Ante, meaning that the Inventor (or Creator or Author, depending on the wording of the policy) could choose to commercialize on their own without the involvement of the university, and Ex Post, meaning that the Inventor must first approach the university about the prospect of commercialization and, in the event the university is not interested n doing so, may commercialize independently.

Commercialization Veto: Measures whether a Creator can choose to not commercialize their idea. Some universities have a policy that Inventors must disclose to the TTO as soon as they are aware that they have a discovery that could be protected through IP. As an addendum to this field we also measured whether there was any formal education specified in the policies about how to recognize a patentable discovery, and how to disclose.

[4] The universities in our sample varied in the use of 'creator' or inventor where they had an overall policy addressing IP. Most generally use the term 'creator' when addressing IP, but when specifically discussing patents and commercialization use the term 'inventor.'

Commercialization Reward: Measures who gets the royalties from IP that makes a profit. Usually university IP policies outlines some division of royalties between the university and the inventor.

Procedure

Dispute Mechanism: Measures whether there is a formal committee or institutional body to which members of the university can report IP-related disputes.

Dispute Resolution: Measures the dispute resolution procedure, including who is on the committee, how disputes come forward, and what happens if there is a stand-still.

Consent: Measures whether there is any mechanism by which students and post-docs give formal consent to have their ideas used in IP-related activities. Within this category we also measured institutional responsibility for ensuring consent; supervisor responsibility in ensuring consent; and any kind of institutional oversight for the consent procedure.

Student-Specific Rules

Statement of Non-Interference for Graduate Education: Measures whether there is a policy that outlines a students' right to publish and share their course work, thesis or dissertation without interference or penalty.

Thesis Embargo: Measures the existence of any policy by which students can delay the publication of their thesis or dissertation.

Analysis

Ownership

IP Ownership Model

If an institution has an overall policy on ownership of IP, it often covers faculty, students and post-docs. Of the seventeen institutions sampled here, less than half of them have an overall IP policy. In most cases ownership of IP is outlined clearly for faculty in a CA. Where post-docs have a CA, there is brief mention of their rights to own IP. Only a few institutions have an IP policy from the Faculty of Graduate Studies that clearly outlines the Masters and PhD students' ability to own IP.

> **Key Consideration 1**: An institution's IP policy is not always clearly laid out in an institution-wide document, and in some cases IP policies are difficult to locate.

> **Key Consideration 2:** Not every institution has an overall policy that clearly addresses whether emerging researchers can own IP.

IP Ownership Specificity

Eight of the institutions in the sample had an overall policy on IP, and these tended to refer to 'creator' when discussing IP ownership generally. However, when discussing patents and commercialization specifically, some referred more specifically to inventor. These policies tended to define the creator or inventor with specific reference to the applicable university constituency; employees, students, post-docs and faculty.

Commercialization

Independent Commercialization

Of the sample discussed here, most (ten of seventeen) have an 'Ex Ante' policy for faculty when it comes to the commercialization of IP (See *Table 2*). In those cases, faculty members are not required to commercialize through the University. In cases where the policy is 'Ex Post,' faculty members must enter into a negotiation with the university about how to proceed. This process requires the member to disclose their invention or discovery to the university as soon as they are aware that it might be a patentable invention. Education on how to recognize a patentable invention is rarely outlined in the policy documents, and possibly takes place informally, or through presentations organized by the TTO. There are six universities in the sample with an 'Ex Post' policy, and each of them has a policy of university-owned or joint-ownership of IP for faculty. Faculty members' ability to commercialize independently is typically clearly defined in IP policies, or in their CA. In contrast, whether emerging researchers may commercialize independently is often unclear. Student and post-doc's rights to commercialize independently are often not addressed in university policies. Seven of the seventeen universities did not address this issue for students, or their policy was unclear. Ten of the seventeen universities did not address this issue for post-docs, or the policy was unclear.

Table 2: Independent Commercialization

Institution	Ownership Model	Faculty	Students	Post-docs
Emily Carr	Joint ownership	Ex Post	Not addressed	Not addressed
Brandon	University owned	Ex Post	Not addressed	Not addressed
Trent	Inventor owned	Ex Ante	Ex Post	Not addressed
Lethbridge	Inventor owned	Ex Ante	Not addressed	Not addressed
U Regina	Inventor owned	Ex Ante	Ex Ante	Ex Ante
Ryerson	Inventor owned	Ex Ante	Ex Ante	Not addressed
Memorial	University owned	Ex Post	Unclear	Not addressed
Manitoba	Joint ownership	Ex Ante	Ex Ante	Ex Ante
Carleton	Inventor owned	Ex Ante	Not addressed	Not addressed
Queen's	Inventor owned	Ex Ante	Ex Ante	Ex Ante
Dalhousie	Inventor owned	Ex Ante	Not addressed	Not addressed
U of Alberta	Inventor owned	Ex Ante	Ex Ante	Ex Ante
UBC	University owned	Ex Post	Not addressed	Not addressed
U Toronto	Joint ownership	Ex Post	Ex Post	Unclear
Waterloo	Inventor owned	Ex Ante	Ex Ante	Ex Ante
Ottawa	University owned	Ex Post	Ex Post	Ex Post
McGill	Joint ownership	Ex Post	Ex Post	Ex Post

Key Consideration 3: In cases where faculty members have the choice to commercialize independently it is outlined in overall university policy or through the CA; many institutions have no clear policy about whether emerging researchers have the choice to commercialize independently.

Commercialization Veto

In most institutions (13 of 17) faculty can either veto or abstain from commercialization (See *Table 3*). A couple of policies do not state this outright, but rather note that there are no restrictions on a faculty member's ability to publish any of their findings, which can be an effective veto of patenting because it constitutes public disclosure. For students and post-docs, again there is far more ambiguity. In eight of the seventeen institutions this matter was not addressed for students, and in ten of the seventeen institutions the matter was not addressed or unclear for post-docs.

Table 3: Rights to Veto or Abstain from Commercialization

Institution	Faculty	Students	Post-docs
Emily Carr	Yes	Not addressed	Not addressed
Brandon	No	Not addressed	Not addressed
Trent	Yes	No	Not addressed
Lethbridge	Yes	Not addressed	Not addressed
U Regina	Yes	Yes	Yes
Ryerson	Yes	Not addressed	Not addressed
Memorial	Technically (publishing)	Not addressed	Not addressed
Manitoba	Yes	Yes	Yes
Carleton	Yes	Not addressed	Not addressed

Institution	Faculty	Students	Post-docs
Queen's	Yes	Yes	Yes
Dalhousie	Yes	Not addressed	Not addressed
U of Alberta	Yes	Yes	Yes
UBC	Yes	Not addressed	Not addressed
U Toronto	No	No	Unclear
Waterloo	Yes	Yes	Yes
Ottawa	Yes	No	No
McGill	Yes	No	Yes

Key Consideration 4: In cases where faculty members have the right to veto commercialization it is outlined in overall university policy or through the CA; for the most part there are no clear policies about whether emerging researchers have the right to veto commercialization.

Commercialization Reward

The most common arrangement for royalty entitlements for IP specified in the institutional policies is 50 per cent for the inventor and 50 per cent for the university – although there are several caveats and conditions – for instance, the division alters after the first $100K of revenue (See *Table 4*). This matter was not addressed for students in eight of the institutions, and it was not addressed for post-docs in eight of the institutions. In some cases, policies for students and post-docs mentioned their right to share in royalty entitlements, but there was no specific division of sharing between inventors, or between the inventors and the institution.

Table 4: Royalty Entitlement Specified

Institution	Faculty	Students	Post-docs
Emily Carr	50/50	Not addressed	Not addressed
Brandon	50/50 (conditions)	Not addressed	Not addressed
Trent	Shared (unclear)	75I/25U	Not addressed
Lethbridge	75I/25F	Not addressed	Not addressed
U Regina	50/50	50/50	50/50
Ryerson	50/50 (conditions)	Yes (no amount)	Not addressed
Memorial	50/50 (conditions)	Not addressed	Yes (no amount)
Manitoba	50/50	50/50	50/50
Carleton	50/50 (conditions)	Not addressed	Not addressed
Queen's	75I/25U (conditions)	Yes (no amount)	Yes (no amount)
Dalhousie	50/50	Not addressed	Not addressed
U of Alberta	33I/33U/33C	33I/33U/33C	33I/33U/33C
UBC	50/50	Not addressed	Not addressed
U Toronto	Inventor:75I/25U University:0I/100U	Inventor:75I/25U University:0I/100U	Inventor:75I/25U University:0I/100U
Waterloo	Shared	Shared	Shared
Ottawa	80I/20U ($100K) 50/50 (after)	80I/20U ($100K) 50/50 (after)	80I/20U ($100K) 50/50 (after)
McGill	60I/40U (after first $10K)	Not addressed	60I/40U (after first $10K)

Key Consideration 5: In cases where faculty members have the right to share in royalty entitlements derived from IP it is outlined in overall university policy or through the CA; for the most part there are no clear policies about whether emerging researchers have the right to share in royalty entitlements derived from IP.

Procedure

Dispute Mechanism

For most institutions faculty have a dispute mechanism set out in the CA, either through a committee made up of both faculty and administration specifically organized to address IP issues, or through the general grievance and arbitration procedure (See *Table 5*). For eight institutions, there was no dispute mechanism for students mentioned. In some institutions, where it was mentioned, students were encouraged to settle the dispute with their supervisor. Four institutions had some kind of committee that students could appeal to. Five institutions indicated that students could take a dispute to a Dean – either within the department or a specific Dean or Vice President tasked with addressing IP disputes. In two institutions in the sample, post-docs were unionized and therefore had access to a formal dispute procedure outlined in the CA. Where this did not exist, similarly to students they were directed to either a committee that addressed IP issues, or a Dean or Vice President.

Dispute Resolution

For most institutions faculty have a dispute resolution procedure that is outlined in the CA. Often the committee assigned to resolve a dispute was made up of members of the administration and the faculty union. In contrast, at most institutions the procedure resolving IP disputes involving students and post-docs did not involve any representation from these constituencies. That is, if a dispute was not resolved by the supervisor or at the departmental level, it was resolved by an Administrative Head or Dean.

Table 5: Dispute Mechanism and Resolution

Institution	Faculty	Students	Post-docs
Emily Carr	Committee on IP CA	Committee on IP	Committee on IP
Brandon	CA	NA	NA
Trent	IP Committee CA	NA	NA
Lethbridge	Committee CA	NA	NA
U Regina	Committee CA	Committee	Committee
Ryerson	CA	IP Committee Academic Council	NA
Memorial	CA	Dean of SGS, appeal to a committee	Administrative Head, Collective Agrmt
Manitoba	CA	Faculty Dean and Dean of SGS, VP Research	Faculty Dean, VP Research
Carleton	Senate IP Committee	NA	NA

Institution	Faculty	Students	Post-docs
	CA		
Queen's	CA	NA	VP Research Collective Agrmt
Dalhousie	CA Committee	NA	NA
U of Alberta	Arbitration Act CA	Arbitration Act	Arbitration Act PostDoc Policy
UBC	Industry Liaison Office, VP Research	Dean of Graduate Studies	NA
U Toronto	Copyright: Arbitration Inventions: Panel, Dean of Law	Faculty Graduate Affairs, Dean of Grad Studies, VP Research, Panel, Dean of Law	Panel, Dean of Law
Waterloo	VP Research Grievance Process	VP Research	VP Research
Ottawa	Patents Committee CA	NA	NA
McGill	VP Research Intellectual Property Appeals Committee	Graduate Faculty appeals cttee Office of Tech Transfer VP Research	VP Research Intellectual Property Appeals Committee

Note: CA means Collective Agreement; NA means Not addressed

Key Consideration 6: Formal dispute procedures related to IP are uneven across institutions, and while most outline a dispute procedure for faculty through the CA, most do not have a clear procedure for emerging researchers.

Consent

Only eight institutions had some mention of consent for emerging researcher participation in IP related activities (See *Table 6*). For instance, at Memorial University there are provisions for graduate students to consent to use of IP that are outlined in the School of Graduate Studies IP Policy:

> In cases where there are IP restrictions integral to the intended research project, a graduate student is responsible for deciding to participate in the program under these circumstances and it is the role of the School to provide the students with all of the information that is available and support in evaluation of the impact of such restrictions on their programs (SGS IP Policy 4.4).

The policy also states "It is the responsibility of the School to ensure that any restrictions are reasonable before approving the graduate student's program and to review and approve subsequent changes to the intellectual property environment in the same light." Furthermore, the supervisor has a responsibility to ensure that "any restrictions are reasonable before approving the graduate student's program and to review and approve subsequent changes to the intellectual property environment in the same light."

In contrast to Memorial's strongly worded, directive provisions, other institutions have more suggestive language. For example, Dalhousie University's Research Accountability Statement

contains a statement that encourages supervisors to inform their students of every aspect of the project, including any IP implications:

> As Principal Investigator, I acknowledge and accept my responsibility to do the following, to the best of my knowledge and ability" and number 6 is "inform every person working on the Project, including students, of the terms and conditions of the award/agreement and, where appropriate, have them acknowledge in writing any conditions with respect to publications, confidentiality, and intellectual property.

Similarly, some institutions have guidelines for advisor-student relations. The University of Manitoba Graduate Studies program has such guidelines with a specific section for "Intellectual Property, Academic Integrity, and Ethics." Ten categories are listed alongside a box, and students and advisors are encouraged to click each box to acknowledge that the category was discussed. Categories include "The Student will hold the copyright of his/her thesis"; "The Advisor and Student will abide by the specific guidelines and rules for copyright and intellectual property at the University of Manitoba, including the Intellectual Property Policy"; and "Student will keep orderly records of all research data produced or developed."

Table 6: Consent Procedure

Institution	Consent Required
Emily Carr	No
Brandon	No
Trent	No
Lethbridge	No
U Regina	No
Ryerson	Yes
Memorial	Yes (directed)
Manitoba	Yes (directed)
Carleton	No
Queen's	No
Dalhousie	Yes (suggested)
U of Alberta	Yes (suggested)
UBC	Yes (suggested)
U Toronto	No
Waterloo	Yes (directed)
Ottawa	No
McGill	Yes (suggested)

> **Key Consideration 7**: Most institutions do not have a procedure by which emerging researchers can consent to participation in IP-related activities.

Student-Specific Rules

Statement of Non-Interference

Only five institutions have a clear statement of non-interference when it comes to graduate student thesis work and its use for IP-related purposes (See *Table 7*). For instance, the University of Manitoba has the following policy:

> Student and Theses: Notwithstanding any provision in this Policy, and subject to the rights of a student to assign any Work owned exclusively by him/her, any Work created exclusively by a student in the course of completing the requirements for an academic degree or certificate is owned by the student, to the extent that the Work comprises part of the requirements for the degree or certificate. Nothing in this Policy shall preclude a student from publishing his/her thesis in any form at any time. In this Policy, "Works" does not include raw data unless it is organized or expressed in an original format. Prior to commencing research required for an academic degree or certificate, students who are not employed by the University in connection with that research shall enter into an agreement, with their supervisor(s), in a form approved by the University, which will contemplate authorship and access to and use of raw data arising from the research (Intellectual Property Policy, 2.11)

Other institutions include protections for emerging researchers under professional ethics guidelines. The University of Lethbridge Research Manual's includes the following as Conflicts of interest in research:

> -Failure to respect the ideas and achievements of others and to give full credit to others for their ideas and accomplishments.
> -A failure to keep the supervision, evaluation and advising of students and subordinates independent of the private interests of the person responsible for these activities.
> -Exploitation of employees and students used in research activities.
> -The use of research funding to support the private interests of a researcher.

In some cases, an institution has a policy that recognizes that the student owns copyright to all original work, but with conditions. At Queen's University, Article 11 of the Research Agreement between Queen's and [Insert name of company] states:

> In the event a graduate student of Queen's works on the Project and that student completes a thesis or academic report relating to the Project, the student will own the copyright in that thesis or report. Nothing in this Agreement shall require a student to delay a thesis examination or submission of an academic report beyond the thirty (30) day review period. However, at the request of the Company such thesis or report may be withheld from deposit in the library for a period of up to six months to allow for the statutory protection of Intellectual Property.

Table 7: Statement of non-interference

Institution	**Existence of Policy**
Emily Carr	No
Brandon	Yes
Trent	No
Lethbridge	Yes
U Regina	No
Ryerson	No

Institution	Existence of Policy
Memorial	Yes
Manitoba	Yes
Carleton	No
Queen's	Unclear
Dalhousie	No
U of Alberta	No
UBC	No
U Toronto	No
Waterloo	Yes
Ottawa	No
McGill	No

Key Consideration 8: Most institutions do not have a statement of non-interference for graduate student educational and thesis work and its use for IP-related purposes.

Thesis Embargo

Eight institutions allow for an embargo on a student's thesis or dissertation, and they are all larger more 'research-intensive' schools. At Queen's University students can request a 'closed' thesis examination if patent protection has not been initiated before the examination. An embargo on publication of the thesis can be requested for up to a five year period. At Ryerson and the University of Alberta, students can request an embargo to protect the IP for up to one year. Dalhousie also allows for a one year embargo with a possible extension of one year.

Table 8: Thesis Embargo

Institution	Existence of Policy	Duration Allowed
Emily Carr	No	N/A
Brandon	No	N/A
Trent	No	N/A
Lethbridge	No	N/A
U Regina	No	N/A
Ryerson	Yes	1 year
Memorial	No	N/A
Manitoba	No	N/A
Carleton	No	N/A
Queen's	Yes	5 years
Dalhousie	Yes	1 year (with 1 year extension)
U of Alberta	Yes	1-2 years
UBC	Yes	Not specified
U Toronto	Yes	2 years
Waterloo	Yes	1 year (with possible extension)
Ottawa	Yes	Not specified
McGill	No	N/A

Key Consideration 9: Larger institutions tend to have a policy on thesis or dissertation embargo for graduate students. For most, the period is one to two years, with the exception of Queen's University at five years.

List of Key Considerations from Policy Analysis

Key Consideration 1: An academic institution's IP policy is not always clearly laid out in an institution-wide document, and in some cases IP policies are difficult to locate.

Key Consideration 2: Not every institution has a policy that clearly addresses whether emerging researchers can own IP.

Key Consideration 3: In cases where faculty members have the choice to commercialize independently it is outlined in overall university policy or through the CA; many institutions have no clear policy about whether emerging researchers have the choice to commercialize independently.

Key Consideration 4: In cases where faculty members have the right to veto commercialization it is outlined in overall university policy or through the CA; for the most part there are no clear policies about whether emerging researchers have the right to veto commercialization.

Key Consideration 5: In cases where faculty members have the right to share in royalty entitlements derived from IP it is outlined in overall university policy or through the CA; for the most part there are no clear policies about whether emerging researchers have the right to share in royalty entitlements derived from IP.

Key Consideration 6: Formal dispute procedures related to IP are uneven across institutions, and while most outline a dispute procedure for faculty through the CA, most do not have a clear procedure for emerging researchers.

Key Consideration 7: Most institutions do not have a procedure by which emerging researchers can consent to participation in IP-related activities.

Key Consideration 8: Most institutions do not have a statement of non-interference for graduate student educational and thesis work and its use for IP-related purposes.

Key Consideration 9: Larger institutions tend to have a policy on thesis or dissertation embargo for graduate students. For most, the period is one to two years, with the exception of Queen's University at five years.

Discussion

This report raises a number of IP-related issues for emerging researchers. The literature review reveals that first, the increasing use of IP in academia means graduate training may be leaning toward encouraging emerging researchers to seek out IP and industry partnerships in order to be successful. This extends as far as encouraging emerging researchers to pursue careers with industry instead of academia, given the troubled academic job market. While understanding inventions and discoveries as potential IP is encouraged, it does not appear to be discussed as a choice with possible pitfalls in the context of training or other potential tradeoffs, including limiting access to that knowledge. This shifting training environment seems to be lacking in its discussion of the possible long-term effects of increasing IP in academic research. There is a substantial and fast-growing empirical literature regarding the impact, both positive and negative, of IP in the academic setting. Greater attention to this existing body of empirical evidence and the intersection of IP and emerging researchers' experience is needed.

Although the literature review suggests that IP issues are an area of increasing concern for emerging researchers and academic institutions in general, this has not translated into a spike in court litigation. There are some notable court decisions in Canada and the US involving grad students, post-docs, faculty, and their home institutions. These cases tend to arise where there is disagreement over who ought to be credited with the work (e.g. the Chou, Boudreau cases) and how the commercialization process unfolded (e.g. the Fardad case). Litigation is, however, a poor measure of the extent to which IP problems arise in university settings, especially problems that involve grad students and post-docs, given the powerful disincentives emerging researchers are apt to face in initiating any form of complaint (e.g. impact on relationship with supervisor; threat to academic career; cost of litigation). We suspect that any IP related issues involving emerging researchers are much more frequently resolved, dealt with in some way, or possibly ignored, by the parties immediately involved on the ground. There is a lack of information about these processes, whether formal or informal, and their outcomes. This supports our call for proactive information and evidence gathering by academic institutions about IP related concerns raised by emerging researchers, whether or not they trigger formal complaints or disputes.

In theory, institutional IP policies and processes could help to address such concerns or disputes. Accordingly, we undertook an in-depth, document-based analysis of IP policies, broadly understood, at a diverse sample of Canadian academic institutions. Locating all the relevant policies from each institution in our sample was not straightforward. Not every institution we included in our sample responded to our requests for assistance, and in some cases IP documents were not easily found on institutional websites. Thus, it is possible that we have incomplete information on any given academic institution. We invite institutions to communicate with us in this case so that we can revise our analysis to appropriately reflect their policies. In acknowledging this possible limitation we underscore the need for better accessibility of IP-related documents.

More substantively, perhaps the most glaring finding of our policy comparison is that emerging researchers are often effectively absent from institutional IP policies. Some institutions have a policy that is institution-wide and includes graduate students and post-docs, and some have quite

comprehensive policies that address these emerging researchers. But even where these policies exist, in most cases there is no formal process for emerging researchers to express consent to participate in the pursuit of IP as part of a commercialization strategy; statements of non-interference when it comes to graduate student thesis and dissertation work are sparse; and formal procedures for addressing disputes for graduate students and post-docs are not comprehensive. In some cases emerging researchers are directed to address any IP-related problems with their supervisor, or their department, or even their Dean of Research, but this process does not consider the extent to which the vulnerable position of the emerging researcher (who has no job security, tenure, or academic freedom) may impact their decision to come forward within their own institution. This general inattention to emerging researchers in the policies would appear to place graduate students and post-docs at serious disadvantage in terms of the overall clarity of IP rules, resources and procedures available to them. Other avenues may be available to students and post-docs to address IP issues, for instance, through an Ombuds office. But without policy to specify what matters could be addressed by that office and how, it is not clear whether emerging researchers are aware of these other options. In contrast, most faculty members have the benefit of the CA, which sets out a formal procedure for grievance and arbitration.

Given the power-imbalances between emerging researchers, faculty and academic institutions, it is disconcerting to observe that institutional IP policies may contribute to inequalities rather than mitigate them. Consider two examples – first, where emerging researchers want to participate in turning their discoveries into IP, they do not have a clear claim to inventorship, which is concerning given the literature points to instances where emerging researchers' contributions are not fully recognized. Policies do not clearly address their right to ownership of IP, their right to commercialize alone, or to share in the royalties from IP related ventures. Second, where emerging researchers do not wish to participate in turning their discoveries into IP, they are similarly disadvantaged. They do not have a clear indication of their ability to veto or abstain from IP and commercialization if, for instance, their supervisor goes ahead with these processes. Further, in some cases there is no clear policy addressing their ability to publish their findings without recourse from their supervisor, any company involved with the research, or the institution (in cases where disclosure is required). It is possible that emerging researchers may be encouraged or pressured to keep their research data confidential if it is part of a larger study where the researchers want to preserve opportunities for filing a patent.

In this regard, academic institutions must carefully consider how and for what purposes embargoes on grad student theses and dissertations are being used. There is limited literature on this subject to date. But in the course of preparing our report we were repeatedly told that there is a growing tendency, particularly among larger research-intensive universities, to accept student requests to embargo their theses and dissertations. Multiple factors may underlie these embargo requests. To the extent that some of these requests are the result of pressure from faculty or others (including parties outside the university such as research sponsors) that place their interests in commercializing research over the interests of grad students in utilizing the research data in future projects, this would mark a deeply troubling trend. Grad students, too, may have an interest in embargo extensions, for example, to market their work to a commercial publisher. Thus, going forward, universities must carefully scrutinize why thesis and dissertation embargos are being sought and for how long. There are competing ethical obligations, for example, where

the grad student's research is publicly funded or derives from participation by individuals and communities in the project, where extended embargos may not be justifiable.

It is important to note that our policy comparison identified some laudable institutional approaches to IP and emerging researchers. A few institutional procedures in our sample outline a formal process for obtaining emerging researchers' consent to have their ideas used in IP-related activities, however, it was not clear that academic institutions were prepared to commit sufficient resources to sustain these procedures. Further reflection about the development and sustainability of such procedures is needed. In the absence of a sustainably resourced consent procedure, there may be a need to set out hard-fast rules or presumptions about how other IP agreements cannot interfere with students' work, and possibly post-doctoral work as well. This could mean stronger, more comprehensive statements of non-interference. At present, such statements do not appear to be common.

Finally, our observations to this point are a response to the current context – and the recommendations we articulate above (and distil under 'IP Policy Recommendations' in the final section of the report) are meant to help protect the interests of emerging researchers in that current context. But it is also essential to underscore the need for a) further education about existing evidence about the impact of IP upon universities and academic research, b) evidence gathering by academic institutions about IP, academic research, and emerging researcher's experiences, and c) open dialogue about whether the increasing pursuit of IP and commercialization should be embraced or instead challenged.

As universities' embrace of IP, commercialization, and entrepreneurialism norms has grown over the last several decades, so too has the evidence base examining the impact of this shift. There is a voluminous literature regarding the challenges encountered in commercializing university research (Rothaermel et al 2007). Some of this literature attests to the importance of IP to the commercialization process. At the same time, some studies suggest that particular forms of IP may actually undermine, rather than facilitate, the use of knowledge and/or its commercialization into a product like a diagnostic test (Williams 2010). Other threads of this literature document several negative outcomes that can flow from IP and/or undue emphasis upon commercializing academic inquiry, including researcher and institutional conflicts of interest (Downie and Herder 2007), "skewing research priorities towards commercially viable, marketable research at the expense of fundamental research, effectively curbing scientists' ability to pursue their curiosity-driven academic agendas" (Davis et al 2011:17), and withholding research data (Hong and Walsh 2009; Blumenthal et al (2006); Vogeli et al 2006).

It is not clear to what extent key administrators at academic institutions and researchers, whether emerging or more established in their careers, are aware of this body of important evidence. Our own ongoing research suggests that most of the education that occurs on academic campuses focuses primarily on how to protect IP or commercialize research without also considering the potential tradeoffs with pursuing IP or commercialization. We cannot stress the importance of this shortcoming enough. Even when the institution and researchers' goal is to commercialize, the available evidence suggests that some IP strategies may actually undermine the likelihood of commercialization and/or carry other important tradeoffs that the institution and researchers should carefully consider, including potential constraints on their own research agenda, their

ability to share research materials with colleagues at other institutions, and the accessibility and affordability of any products that result as the commercialization process unfolds. These IP related tradeoffs raise fundamental questions about the mission and values of the university and free academic inquiry and must be the subject of continuous, open, and evidence-based debate. The longer-term risk is that the public loses confidence in universities as they begin to operate, or are seen to operate more like commercial competitors than non-profit enterprises that promote knowledge in the public interest (Triggle 2005).

We therefore suggest it is imperative that the academic institutions facilitate greater dialogue about IP, commercialization and entrepreneurialism. As a start, it is important to diversify and expand the educational opportunities on campus on the subject. At present it appears that there is a great deal of informal education about IP on Canadian campuses, but this informal education is often delivered by representatives of the university TTO that have a specific interest in securing and exchanging IP for the purpose of commercialization. In our view, there is a need for a broader range of perspectives in the ongoing, informal education of researchers, emerging and established, around IP, its boundaries, uses, and tradeoffs, known and unknown.

We hope that this report will inspire the members of the Canadian Association of Graduate Studies to further reflect on the significance of IP for emerging researchers and academic institutions more generally. This report is meant to point to pragmatic considerations about whether existing policies on IP sufficiently extend to graduate students and post-docs, but more generally our aim is to instigate thoughtful consideration of the role of IP in academia and the place of emerging researchers in the shifting context of university research.

Recommendations

The recommendations of this report will be split into two lists that, in a broad sense, are in tension with one another. On one hand, we provide a list of recommendations that aim to address gaps and shortcomings of university IP policies with a view to extending the privileges that most faculty enjoy to emerging researchers as well. We advocate more clarity with respect to how emerging researchers should approach the topic of IP, and more clear and directly accessible policies that would enshrine their ability to choose to seek IP for their work or abstain from seeking IP for their work without penalty. Our first set of recommendations, in short, takes the university setting and close embrace of IP 'as it is'. We offer recommendations to improve that situation, as it is, in the immediate to short term.

On the other hand, our second set of recommendations call for greater attention to the evolving evidence base surrounding IP in academia with a view to motivating a broader dialogue about the impact, both positive and negative, of IP upon universities and academic research. We are cautious about the wholesale acceptance of IP as a necessary and inevitable part of university research, particularly when commercialization is such a key component of the federal and provincial governments' policy platform for academic research. We thus recommend quite extensive consultation and education about IP, not in terms of what it is and how to do it, a task that technology transfer offices have taken on, but more importantly in what the push for IP means for academic research, how emerging researchers could be advantaged or disadvantaged by seeking IP, and the attendant social, political and ethical matters related to the commercialization of academic research more broadly. There is a large and fast-growing body of empirical evidence regarding the impact of IP and commercialization on the character and conduct of academic research. Yet, there is little indication that that evidence base is informing the policies, practices and discussion of IP and commercialization on Canadian campuses.

IP Policy Recommendations:

Given the gaps and shortcomings identified in the foregoing IP policy comparison, we recommend that:

1. Each academic institution review its policies related to IP to ensure that,
    a. one or more policies govern emerging researchers and IP
    b. the IP norms, rules, and processes that are applicable to emerging researchers are clearly defined;
    c. the IP policy or policies that exist are made readily accessible online;
2. Each academic institution that is currently lacking a policy or policies that clearly defines the norms, rules, and processes applicable to emerging researchers immediately initiate a process for developing such a policy;
3. Each academic institution take immediate steps to remedy any discrepancies found to exist between the options and protections afforded to faculty versus emerging researchers;
4. Each academic institution review its current IP policy(ies) with a view to assessing whether emerging researchers are afforded the ability to veto or abstain from

commercialization, to commercialize independently, and to receive an equal share of any IP royalties;

5. Each academic institution give serious consideration to implementing a consent procedure for emerging researchers, whereby the researcher is informed upfront (before commencing his or her programme of study and/or research employment) of all components of the process of obtaining intellectual property for the research they are working on within the institution, and offered the opportunity to participate in this process or not, at the outset, with no consequences to their employment or performance evaluation;
    a. For greater clarity, any such consent procedure may be carried out centrally (e.g. through the Faculty of Graduate Studies) or by individual faculties and departments;
6. Each academic institution, at a minimum, provide a checklist that assists Principal Investigators / Supervisors and emerging researchers to consider every aspect of the IP and commercialization process;
7. Each academic institution create a policy of strict non-interference from faculty, university, or outside parties regarding the completion of graduate theses for reasons relating to IP and/or the commercialization of research;
8. Each academic institution re-examine the available procedure(s) for resolving IP related disputes for emerging researchers with careful consideration of the career related disincentives that may prevent many emerging researchers from raising concerns or filing a formal complaint about their supervisor(s);
9. The Canadian Association of Graduate Studies explore mechanisms to resolve IP related disputes involving emerging researchers, including, but not limited to, the creation of a standing IP ombudsperson, an ad hoc committee, or a grievance and arbitration procedure with representation from graduate students and post-docs;
10. The Canadian Association of Graduate Studies establish a shared, openly accessible online repository to house institutional IP policies, best practices, and any other relevant materials to assist academic institutions with respect to IP issues.

Education and Evidence Related Recommendations

Given the concerns identified in the above literature review and our own ongoing research related to IP and commercialization in the academic setting, we recommend that:

1. Each academic institution seek to diversify the types of educational opportunities surrounding IP available to emerging researchers; presently, such educational opportunities tend to be focused upon commercializing academic research and provided by technology transfer office representatives; and,
2. Each academic institution form a committee of emerging and established researchers to examine and document researchers' experiences and concerns associated with IP and commercialization; and,

3. All academic institutions promote further dialogue about the impact of IP and commercialization upon graduate education and academic research by:
    a. Performing a review of educational offerings, whether formal or informal, about IP that are offered to members of the university community; and,
    b. Developing a knowledge sharing strategy (e.g. a concise ‘reader’ on IP and academia) that aims to better inform graduate students, post-doctoral fellows, faculty researchers and university administrators of the evolving evidence base surrounding the impact, advantages and disadvantages of IP in the academic setting.

Appendix 1.

*Documents that can be found online are hyper-linked for accessibility.

	Overall Policy	**List of Policies**
Emily Carr	Yes	-Collective Agreement (Faculty) (2010-2014) -Board of Governors 5.2 "Intellectual Property" (November 2008)
Brandon	No	-Collective Agreement (Faculty) (2011-2015) -Board of Governors "Research Contract and Overhead Policy" (1987 – updated 2013)
Trent	No	-Collective Agreement (Faculty) (2013-2016) -Confidentiality and Data Release -Commercialization Handbook (2005) -"Guidelines for the use and ownership of intellectual property developed by graduate students at Trent University."
Lethbridge	No	-Faculty Handbook (2014) -A practical guide to conducting research at the University of Lethbridge (2014-15)
U Regina	Yes	-Collective Agreement (Faculty) (2011-2014) -Policy 10.95 Intellectual Property Policy (2006)
Ryerson	Yes	-Collective Agreement (Faculty) (2011-2015) -School of Graduate Studies Intellectual Property Guidelines -Policy on Ownership of Student Work in Research (1989)

Memorial	Yes	-Collective Agreement (Faculty) (2014-2017) -Collective Agreement (Postdocs) (2014-2016) -IP Policy (2008) -School of Graduate Studies Policy on IP (2007) -Responsibilities of Supervisors and Graduate Students (2000)
Manitoba	Yes	-Collective Agreement (Faculty) (2010-2013) -IP Policy (2010 – revised 2013) -Advisor Student Guidelines (2013) -Research Agreements Policy (2006 – revised 2014)
Carleton	No	-Collective Agreement (Faculty) (2012-2014)
Queen's	Yes	-Collective Agreement (Faculty) (2011-2015) -Collective Agreement (Postdocs) (2013-2016) -Report of the Senate Ad Hoc Committee on Intellectual Property (1992) -Intellectual Property Guidelines (2013) -Research Agreement -Integrity in Research (Senate) (2009 – revised 2012)
Dalhousie	No	-Collective Agreement (Faculty) (2011-2014) -Research Accountability (2013)
University of Alberta	No	-Collective Agreement (Faculty) (2006) -Patent Policy (2007) -Postdoctoral Fellows Policy (2006 – revised 2013) -Research and Scholarly Integrity Policy -Intellectual property guidelines for graduate students and supervisors (2004) -Distribution of Royalty Revenue Policy (2004) -Declaring Best Interest of Inventor -Commercialization of Patentable Intellectual Property Procedure (2007)
University of British Columbia	No	-Collective Agreement (Faculty) (2012-2014) -Graduate and post-doctoral studies Intellectual Property Guide

		- Inventions Discoveries Policy (2013) -Scholarly Integrity (1995 – revised 2013) -Research (1993 – revised 1995)
U Toronto	No	-Memorandum of Agreement (Faculty) (2006) -Inventions Policy (2013) -Copyright Policy (2007) -Intellectual property guidelines for graduate students & supervisors (2007)
Waterloo	Yes	-Memorandum of Agreement (Faculty) (2014) -IP Policy (1997 – revised 2000) -Researcher agreement – patents or copyright -Researcher agreement - software
Ottawa	No	-Collective Agreement (Faculty) (2012-2016) -Policy 29 Invention and Technology Transfer Policy (2011)
McGill	Yes	-Policy on Intellectual Property -Student Guide to Intellectual Property at McGill University (2004)

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