PROMOTING A HEALTHY LAB CULTURE AT THE UNIVERSITY OF TORONTO

A Report submitted

to the Dean of the School of Graduate Studies

and

Vice-President – Research & Innovation

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2020

I want to work where:

Image kindly provided by the Department of Physical Therapy

The Healthy Labs Initiative

Executive Summary

The University of Toronto is the leading research-intensive university in Canada and ranks in the top 20 internationally. A healthy lab environment in traditional research laboratories, individual or shared office space or field work is central to the well-being of all those involved in the research enterprise, and the quality of research depends on it. Our ability to attract the best and brightest students and new faculty members and support staff depends on it. Indeed, our reputation as a research-intensive university and international ranking depends on it. There are, however, a number of tensions where the interests of the various individuals and groups are not always aligned or well-communicated, and where conflicts may arise. This report outlines some suggestions for how individuals, departments, faculties, and the university can facilitate this alignment through better training, enhanced communication, and incorporation of identified best practices. The integration of Dimensions, a national initiative based on equity, diversity and inclusion (EDI), as the basis of a Healthy Lab Charter is recommended. The call is for a cultural shift from considering graduate students and post-doctoral fellows strictly as employees working on their supervisor's project to scholars or mentees enrolled in graduate programs where research training is central but includes time for course work, teaching, professional development and family, all within an open, supportive, collaborative, and healthy lab environment that recognizes wellness and EDI as core values.

A Proposed Healthy Lab Charter

The University of Toronto is dedicated to promoting a healthy lab culture that provides a creative, aware, and supportive environment of diverse teams where research goals are clearly and openly articulated with flexible, realistic, and achievable expectations, where all members feel valued, respected, and included, where opportunities are provided for both professional and personal development for all, and where concerns are addressed in a fair and timely manner.

Promoting a Healthy Lab Culture

We suggest a multi-pronged approach to promoting a healthy lab culture:
1. Provide leadership to integrate Dimensions as a foundation of a healthy lab culture
2. Provide positive incentives for healthy lab practices
3. Provide lab management training for post-doctoral fellows and faculty members
4. Provide enhanced support for early career researchers
5. Provide procedures to help researchers raise and deal with concerns safely

1. Dimensions as a Foundation of a Healthy Lab Culture

The goal of the Dimensions program (https://www.nserc-crsng.gc.ca/NSERC-CRSNG/EDI-EDI/Dimensions_Dimensions_eng.asp) is to foster increased research excellence, innovation and creativity within the post-secondary sector across all disciplines, through greater equity, diversity and inclusion (EDI).   The University of Toronto (U of T) has endorsed the Charter and became an affiliate member in 2019. It is recommended that the U of T prepare to become a full member of the Dimensions program and create an internal reward system that recognizes individuals, research teams, graduate units, and multi-disciplinary collaborative programs that demonstrate a commitment to living and working by the eight principles of the Dimensions Charter. This report recommends that Dimensions be embedded internally within U of T as an integral part of the Healthy Labs Initiative, and that, as a first step, a Dimensions Ambassador be appointed to take a leadership role in this initiative. See the Appendix for more details on the federal tri-agency Dimensions initiative.

2. Positive Incentives for Healthy Lab Practices

There are a number of suggestions to promote a healthy lab culture:

- Use the principles of Dimensions to create an internal award system.
- Highlight the essential features of a healthy lab culture and the Healthy Lab Charter in a publicity and poster campaign.
- Establish a fund to support new initiatives designed to promote a healthy lab culture.
- Create awards recognizing excellence in graduate mentorship at the individual, research team, departmental, faculty and university levels.

3. Lab Management and Leadership Training

While there is a need to recognize different models of supervision, the autonomy of labs can create an isolating and unhealthy work environment: "*It's my lab, I'll run it the way I want!*" Supervisors have little or no formal training in research team management or conflict resolution. They often replicate the training environment under which they were trained. As one post-doctoral fellow observed, "*A lot of post-docs want to be PIs, and they teach us that in order to be PI is to publish a crazy amount of papers. The only way to do that is to keep yourself cooped up, always work, never share your project. But the skills you need to be a PI—to talk to people, lead a group, people skills—these are the opposite skills! It's forcing people into behaviors that are*

then toxic when they're running labs. I am absolutely sure—that every PI once they get their labs should have to have management classes, classes on how to manage a budget, hire people, etc."
The on-boarding of new faculty members provides an opportunity to provide lab management and leadership training as part of their orientation. In reality this training should begin at the post-doctoral stage, if not earlier, as outlined in the Best Practices Appendix of this document. The training could take various forms, such an annual 1-day retreat, a series over a term, or as an integral part of orientation. A series of on-going interactive workshops on selected topics open to all researchers could be provided. The workshops would be designed to help faculty members build successful research teams and to deal with issues they may encounter. A comprehensive and inclusive approach is recommended. Some possible topics include:

- Using the principles of Dimensions to promote EDI
- Fundamentals of lab and research team management
- Managing teams and collaborative projects
- Working in a unionized environment
- Using emotional intelligence to build successful research teams
- Starting out in academia
- Persuasive communication and grant writing
- Developing a writing culture
- How to mentor young scientists
- Communicate, communicate, communicate
- How to provide constructive feedback on student writing and speaking
- Conflict resolution and restorative principles
- Developing your leadership competencies:
  - Being self-aware
  - Working with others
  - Working with organizations

We see good supervisory practices and the development of lab management skills as two sides of the same coin, both integral to creating a healthy lab culture. It is not our intention to be too prescriptive in terms of the details of partners or program delivery, however there are a number of administrative and support units such as the Vice-President Research and Innovation (V-PRI) Centre for Research and Innovation Support (CRIS) and School of Graduate Studies (SGS) Centre for Graduate Mentorship and Supervision (CGMS) that could form an effective partnership to lead the Health Labs Initiative, with contributions from the Offices of the Vice-Provost Faculty & Academic Life (V-PFAL), Associate Vice-President Research Over-sight and Compliance (V-PROC) and other units like the Division of Human Resources & Equity (HRE) and Environment Health & Safety (EHS) as appropriate. Workshops focused on trainees could be integrated with on-going professional development programming offered in departments, Faculties, the SGS Graduate Professional Skills Program (GPS) and Post-doctoral Fellow Office, Student Life and other student support units.

4. Enhanced Support for Early Career Researchers

Early career researchers include senior graduate students, post-doctoral fellows, and new faculty members. Promoting a healthy lab culture requires supporting graduate students and post-doctoral fellows as they transition to the workplace and providing a healthy start for new faculty.

The on-boarding of new faculty members in orientation sessions provides an opportunity to provide lab management training, including supervision, mentoring and conflict resolution, and to socialize new faculty to a healthy lab culture. Programming throughout the year for all early career researchers could be organized by CRIS and CGMS and include dedicated workshops on graduate student supervision, conflict management, and mental health and professionalization resources for both trainees and faculty. Supporting faculty at the divisional level in developing fundable research projects and building successful research teams should be a priority. The Centre for Teaching Support and Innovation (CTSI) could assist new faculty members develop best practices in their new teaching duties as they do for Teaching Assistants. New faculty could also be connected to faculty mentors, including retired professors, who can serve as a resource for questions about supervision, lab management, and department and university resources, if such programs do not already exist in their department.

5. Procedures to Help Researchers Raise and Deal with Concerns Safely

Graduate students remain reluctant to bring forward concerns for fear of negative consequences to their degree progression and careers. When concerns are brought forward, they are often dismissed out-of-hand, not taken seriously, or ignored. As graduate coordinators have noted, in some cases the policies and rules designed to protect trainees and students lack teeth, and department chairs and graduate coordinators may be unable to take effective action to censure or remove abusive or ineffective PIs from positions of power over trainees. This needs to change. Clearly, there must be zero tolerance for bullying, harassment, or intimidation. Graduate students and their supervisors need to be better equipped with the tools to recognize and deal with conflicts. Many conflicts can be avoided if there is open and honest communication, but open communication requires the hierarchical nature of graduate supervision to change. Expectations must be clearly articulated and they must be realistic and achievable. Feedback, a major concern of graduate students, needs to be provided in a timely manner. Feedback should be a 2-way street. Student-supervisory committee meetings and reports provide an opportunity for students to provide feedback and communicate issues to faculty members. The Vice-Chairs Graduate should be much better trained to be able to provide an informed point of contact for graduate students to raise concerns in confidence and to provide expert advice on next steps.

Recommendations

1. The University, at the appropriate administrative level in close consultation with key stake-holders, prepare to become a full member of **Dimensions**, based on the Athena Swan Program in the UK, to support the broader aspects of EDI and wellness and appoint a Dimensions Ambassador to lead this initiative. Athena SWAN and its descendants are structured as voluntary programs that individual PIs and, later, departments and universities, can opt to join. Because the programs seek to facilitate and reward best practices, they offer a means of motivating faculty and administration to invest in healthy labs without further regulations or punitive measures. We recommend that the Healthy Labs Initiative incorporate elements from the structure of these programs, most especially the creation of different levels/measures (Bronze, Silver, Gold) of success in the program. We suggest that the program implement a stepped process, whereby each level requires increased education and implementation of best practices. PIs will have a set period of time after achieving each level to either apply for the next level or re-apply to maintain their current level. Athena Swan provides a good model for this initiative (See Appendix for details).
2. The University, led by CRIS and CGMS and in consultation other units as appropriate, provide training in leadership, supervision, mentoring, lab management and conflict resolution for new faculty members. Per our consultations with the university ombudsperson, graduate coordinators, graduate students, post-doctoral researchers, and lab technicians, competency with conflict resolution is uneven across the university. As faculty and researchers are hired for their research capability rather than their experience in management, it is important that the university provide the necessary resources for faculty to develop healthy relationships and conflict management processes within their labs. This programming should be made available to post-doctoral fellows as part of their training as this is a best practice at other institutions
3. SGS provide training for new Graduate Coordinators/Graduate Chairs including best supervisory practices with meaningful feedback, conflict resolution, and information on the pathways available to students and faculty to help resolve disputes.
4. SGS in consultation with other units create single guidebook "Building a Healthy Student-Supervisor Relationship" with a self-assessment and action section to replace the two current guide books one each for supervisors and students. Consultations with graduate students, graduate coordinators, and the ombudsperson have demonstrated that unhealthy lab cultures often begin with or involve mis-communication or conflicts between faculty supervisors and their students. A guidebook that explains student and faculty rights and responsibilities, processes for conflict management and complaint, and examples of reasonable expectations for each would be welcome by faculty and students alike.
5. SGS in consultation with other units provide clear guidelines and pathways for graduate chairs and graduate coordinators to follow in cases of conflict or misbehaviour where escalation beyond the department is necessary.
6. SGS through CGMS organize an annual workshop on "Best Practices in Graduate Supervision" that includes faculty <u>and</u> students based on case studies.

7. SGS create a Pathways Program (e.g., using Progress Tracker) to encourage regular supervisory committee meetings, reports that provide meaningful feedback of the performance of the student to facilitate the timely completion of MSc and PhD programs.
8. SGS and VPRI work in collaboration with other units and U of T Communications to launch a publicity campaign promoting the Healthy Lab Charter.

There are also a number of additional recommendations based on concerns raised by graduate students and recognized best practices to be considered at the Divisional (Faculty) and Departmental levels:

1. Departments include the elements of EDI and wellness in all that they do.
2. Departments within Faculties adopt a uniform nomenclature and clearly-defined roles for their Graduate (Vice/Associate) Chairs/Coordinator and contact information for the position, as well as the name of the person currently holding the position who should serve as a trusted advisor and advocate for graduate students.
3. Departments within Faculties adopt a uniform Student-Supervisory Committee Progress Report that clearly details progress towards degree completion and provides an opportunity for meaningful feedback.
4. Departments track and ensure that graduate students meet with their Supervisory Committee every 6 months and monitor the thesis writing process to ensure timely completion.
5. Departments use Individual Development Plans (IDPs) such as provided by CIHR in conjunction with professional development activities to facilitate a wholesome discussion of the career pathways open to graduate students and post-doctoral fellows.
6. Departments engage their graduate alumni as mentors and in offering experiential learning and internship opportunities.
7. Departments consider recruiting and training a team of senior/emeritus faculty members as mentors (Mentors-in-Residence) and to serve as arms-length advisors to enhance student-supervisor relationships.
8. Departments and Faculties create awards to recognize excellence in graduate supervision and mentorship, perhaps through the Dimension Program.
9. Graduate students are provided with the opportunity to meet regularly with the Departmental Chair and/or Graduate Coordinator in an informal and confidential manner.
10. Graduate students are made aware of the various pathways to resolve disputes, with priority given to resolution mechanisms at the departmental level.
11. Graduate students are provided with the necessary support, including funding new initiatives to enhance their success in graduate school, including their mental health and transitions into diverse careers.
12. Graduate students are provided with the opportunity to provide meaningful feedback on their graduate program (E.g., an exit survey), upon completion of their degree requirements.

Introduction

The University of Toronto is ranked among the top 20 research-intensive universities in the world. U of T researchers bring in over $1B annually in funding. The university is ranked second in the world in terms of the number of publications its faculty, researchers, and students successfully publish. Research takes place in different environments including laboratories, facilities, individual or shared offices, and in the field. Research done in labs is typically carried out under the supervision of a faculty member by teams of graduate students and post-doctoral fellows, often with the assistance of experienced technicians and research associates. U of T's success in funding, research, and publications relies on the labor of its graduate students and postdoctoral fellows, and on the ability of research teams to function efficiently and collaboratively. Graduate programs provide the vehicle to train the next generation of researchers but also impart skills critical for gaining future employment in academia and beyond.

Canada is a country rich in diversity and continues to attract people from around the world. Toronto is the most diverse city in the world and this diversity is reflected in the student population at U of T, but not as much in the faculty, many of whom were hired decades ago. There has been a lot written about women in science and engineering (STEM), more precisely about the continued lack of women in certain disciplines, and about the "glass escalator", a metaphor for the continued barriers to promotion that women face in many male-dominated fields. This is changing. U of T graduates about the same number of women and men with PhDs and a similar number find employment as professors. There are programs to address unconscious bias in hiring, promotions, and grant reviewing that attempt to address the issue of the glass escalator. Women have assumed leadership positions in universities as Chairs, Deans, Vice-Presidents and Presidents. But diversity goes beyond gender and there is much work to be done in bringing under-represented and historically excluded groups into graduate school and the professoriate. A healthy lab culture can ensure that wellness, equity, diversity and inclusion are core principles in graduate education and research.

Why a Healthy Labs Initiative?

About 25% of the new cases brought forward to the U of T Ombudsperson Office in 2018-19 were from graduate students. In the 2018 report (https://governingcouncil.utoronto.ca/annual-reports-and-administrative-responses), the Ombudsperson stated:

 "*My **third recommendation** concerns longstanding problems in some basic science laboratories. While the University has many outstanding supervisors and laboratory environments for graduate students in the basic sciences, the students in these excellent learning environments are not the ones who bring complaints to our Office. Students who seek our help because of harassment, bullying, and intimidation, have come from a variety of laboratories. Many if not most students are justifiably reluctant to pursue formal complaints, knowing they could be putting their funding, their graduate work, and their future careers in jeopardy." with the following recommendation:*

*"**The School of Graduate Studies should consider developing and implementing a strategy which identifies, celebrates, and effectively communicates the characteristics of optimum learning environments for students in basic science laboratories.**"*

Many of the referrals to the Office of the Associate Vice-President Research, Oversight and Compliance (V-PROC) have their roots in lack of clear expectations, poor communication, authorship, and fractured student-supervisor relationships. SGS and the Office of the V-PRI have responded to these serious concerns with the **Healthy Labs Initiative**.

A Healthy Lab Culture is a Global Concern

The U of T is not the only organization to recognize a healthy lab culture as a major factor in producing great research. This factor was recognized in a 2020 Report from **Wellcome** entitled *"What Researchers Think About the Culture They Work In"*. This thorough report was based on a literature review, interviews, workshops and an online survey of over 4,000 researchers. While recognizing that research is competitive, the best working environments are collaborative, inclusive, supportive and creative - terms to include in a healthy lab charter. They highlight that the incentives from government, funders, and institutions often focus on quantity of research and a narrow view of impact rather than quality. As a result, there is intense pressure to publish with little regard to how the results are achieved and the human costs. Long working hours and unrealistic expectations of supervisors and students themselves are often the norm. There is widespread concern among faculty and graduate students about job security. Critical aspects of good management such as feedback are often missing. As also highlighted in the Ombudsperson's Report, *"many have experienced exploitation, discrimination, harassment and bullying"* with negative impacts on researchers, their work, and society. For researchers, poor research culture leads to stress, anxiety, isolationism, a strain on personal relationships, and mental health problems. Many are not comfortable speaking out due to risk of personal retribution, including a refusal to write good letters of reference. They are reluctant to make formal complaints. Gender, followed by race, was the most common identity to be targeted for bullying, harassment, and discrimination. In addition to the significant psycho-social impacts of this treatment, it also impacts victims' research. For research there is a loss of quality, research that is superficial or conservative, problems with reproducibility, even data manipulation and fraud. About ¼ of students felt pressure by their supervisor to produce a particular result. For society, there is a loss of talent, lack of real innovation and impact, and a loss of trust in science.

The Report offers a number of suggestions that are echoed in this report:
- *"changes of funding structures and incentives*
- *better support for early-career researchers*
- *training to strengthen managing and mentoring*
- *identifying and deterring bad behaviour*
- *procedures to help researchers raise concerns safely*
- *policies to share and promote good practice."*

The Report recommended longer-term funding and rewarding exploratory research and creativity. Collaboration is seen as an important aspect of good research culture, but increased competition for funding and publishing creates conditions for aggressive behaviour and crowds

out collaboration. There is also concern about how metrics are used - a caution for our university. "*Not everything that can be measured counts and not everything that counts can be measured.*" – attributed to Einstein. Many respondents found that leaders did not communicate clear expectations regarding behaviours or culture in the working environment. There is a disconnect between the supervisor's perception of their management skills and the reality. Few respondents had discussed alternative career options with their supervisor. Initiatives such as Athena SWAN in the United Kingdom have led to small improvements in the working environment for women but have not necessarily resulted in improvements for racialized or LGBQ+ researchers. The initiative found that there was a lack of diversity among university STEM researchers that is not reflective of society in general. There was also concern about the lack of action on the part of institutions to make real change, although individual researchers have a role to play.

What a good lab culture and research environment looks like:

- *"diversity is encouraged and celebrated*
- *collaboration is encouraged and celebrated*
- *individual contributions are valued*
- *individuals feel supported*
- *leadership is transparent and open*
- *time to think is valued"*

The **World Economic Forum** in a September 18, 2018 posting (https://www.weforum.org/agenda/2018/09/7-ways-to-promote-better-research-culture/) entitled "*7 ways to promote better research culture*" provided seven things to promote research integrity and improve research culture:

1. *Small steps can make a big difference*
2. *Establishing support systems can boost morale and enhance a positive research culture*
3. *Ensure that everyone is on the same page*
4. *Research culture 'cafes' are an excellent way to share best practices*
5. *Leading by example in promoting an excellent research culture*
6. *Discuss training gaps for all team members*
7. *Embed research culture at an institutional level.*

A Mental Health Crisis in Graduate Education

A 2017 survey of graduate students by **Nature** magazine (https://www.nature.com/articles/nj7677-549a) reported that 25% of students listed mental health as a concern and 45% of those students had sought help for anxiety and depression. **Nature** (https://www.nature.com/articles/d41586-019-03489-1) has called on institutions to address the graduate student mental health crisis. A survey of US PhD students published in **Nature Biotechnology** (https://www.nature.com/articles/nbt.4089) found moderate to severe rates of anxiety (41%) and depression (39%), which were more than six times as high as the rates in the general population (6% for both anxiety and depression).

A February 2020 posting in **Nature** (https://naturecareerscanada.com/insight/analysis-of-natures-2019-phd-survey-for-students-in-canada-1427866) focuses on the response to a graduate student survey from a small number (182) of PhD students in Canada. While most students (69%) were satisfied with their relationship with their supervisor, 29% of students had experienced bullying and about 25% felt discriminated against, mostly based on their gender.   *"Many Canadian students feel under-equipped and underprepared to explore the full range of job options. Forty-six percent reported being dissatisfied with career training and advice, putting them about on par with the rest of the world."*

In a January 19, 2020 posting the **World Economic Forum** (https://www.weforum.org/agenda/2020/01/7-ways-to-make-the-workplace-better-for-our-mental-health/) they dealt with mental health in the workplace and again offer seven strategies:

- ***"Leadership:*** *Visibly position leaders to be proactive champions of a diverse and inclusive culture that supports a mental health-friendly workplace.*
- ***Organizational and Environmental Support:*** *Develop and implement a Mental Health Plan that is easy to access and easy to digest for all employees.*
- ***Communications:*** *Communicate clearly and often to employees about the organization's mental health policies, medical benefits, programs, education resources, and training opportunities.*
- ***Programs and Benefits:*** *Offer a comprehensive package of employee-centered medical benefits and programs.*
- ***Engagement:*** *Involve employees in all aspects of mental health-related workplace decision-making.*
- ***Community Partnership:*** *Leverage community partnerships to promote the internal and external objectives of the Mental Health Plan.*
- ***Reporting Outcomes:*** *Identify evidence-based opportunities to continually improve the mental health and well-being of employees."*

The high level of anxiety felt by many graduate students does not end with graduation. Post-doctoral fellows are anxious about their career prospects, especially those whose goal is an academic position. Professional and career development is equally important for post-doctoral fellows who are employed in precarious contract-limited positions. Technical support staff report that they are often assigned duties beyond what is detailed in their contracts. Their job description varies enormously, ranging from independent researcher to lab manager responsible for the day-to-day running of the lab, training of students, grant and financial management, etc. Many are supported by research grants and do not have job security even after many years of employment. Professors, especially early career researchers, are under enormous pressure to succeed. They are high achievers and have had the benefit of excellent training. Suddenly, they are given an empty lab and expected to fill it with equipment and productive people without any formal lab management training, apply and get grants, and to teach at the undergraduate and graduate level (again without any formal training!). No wonder they are anxious and stressed, strong feelings that are often transmitted to their trainees. This report calls for more support for early career researchers to better prepare them for success as independent scientists.

The Canadian and Global Research Landscape Today

The research enterprise is the result of the complex intersection of various interest groups; students, post-doctoral fellows, supervisors, departments, universities, funding agencies, publishers, industry and the public. A common goal is to produce new knowledge but also to produce the highly-qualified personnel that our country requires to prosper. These are also common goals of graduate education and research.

Central to the research enterprise are graduate students and post-doctoral fellows, who carry out the bulk of research supported by technical staff, research associates, and undergraduate project students. Graduate students pursue PhD studies to accumulate a solid knowledge base in their discipline to teach at the university level and to advance their discipline. Many are interested in becoming university professor themselves. While many PhD graduates (~25%) do become professors, the majority work in different sectors of the economy. This creates a tension where graduate students are trained under a traditional apprenticeship model that provides the PhD credentials necessary for the professoriate. Supervisors are well-equipped based on their own career path and experience to reinforce this training model but are often unable or unwilling to give career advice beyond the professoriate. Master's students typically continue their education in professional programs like Medicine or enter the work-force upon graduation. The expectations of Master's students are quite different from PhD students, although some do go onto PhD studies.

Supervisors typically have well-defined research projects supported by grants. A main focus is to generate enough high-quality data to publish papers in high profile journals in order to get their grants renewed. Funding is tight. Tenure and advancement through the ranks depends on publications as does their reputation in the field, invitations to meetings, and awards. "Publish or perish" remains a truism, even today. In short, papers remain the currency of success. There is also increasing pressure on supervisors to translate their research into useful products or services. These expectations can generate a high level of anxiety among supervisors that is often transmitted to trainees.

The reputation of departments, faculties and universities depends on the research enterprise. The university's international ranking depends on the success of its faculty members in research, less so in teaching or service. Research is often carried out in large multi-disciplinary teams funded by team grants where individual contributions are often difficult to discern, especially for trainees and early-career researchers. This can lead to tensions and mismatched expectations around authorship and credit for lab results and publishing, a common concern for trainees and administrators.

Funding agencies are another interest group. The federal government is a major supporter of the research enterprise through the tri-agencies (CIHR, NSERC, SSHRC), Genome Canada, MITACS and a growing number of boutique salary programs such as CRCs, CERCs, and the Canada 150 Chairs. While the Federal government's mandate includes research and innovation, education falls under the purview of provinces who provide funding to support universities. The combination of the funding provided by the two layers of government affects the size and scope of the university research enterprise. For example, graduate student support can come through

direct research grants to faculty and individual scholarships or awards. Funding from the province supports faculty, graduate student stipends, TAships, and the indirect costs of research. The charitable sectors and donations play an important role in the support of the research enterprise. Indeed, many research facilities now bear the names of generous donors, who also have a deep interest in supporting the research enterprise.

The scientific publishing industry is highly dependent on the research output of universities. Top journals use publications to sell ads and subscriptions. Predatory publishers use the research output as raw material for their industry. Open access publishing puts the costs onto the researchers to reach a wider audience. Journals that are supported and published by scientific societies through memberships and subscriptions are almost extinct. Expensive library subscriptions provide easy on-line access to the vast scientific literature. Many faculty members aspire to publish their best work in highly-ranked journals, which puts tremendous pressure on trainees.

Canadian industry is highly dependent on universities for research and to provide highly-trained personnel. The extent to which the private sector in Canada support R&D is well below that of our OECD competitors and much of the burden and cost of research has been shifted to universities, who have expanded their capacity to support not only research, but its translation through innovation. As a result, graduate students can be supported by contracts with industrial partners, sometimes companies created by their supervisor, with an emphasis on commercialization of their research. Some of these labs are industrial-sized with limited opportunity for meaningful interactions between students and their supervisor. Some students have commented that their research is more focused on industrial applications and the supervisor's start-up companies rather than on discovery and learning -a misalignment and potential source of conflict.

Ultimately, in this model, it is largely the public that supports research through their taxes or charitable donations. Communicating science to the public in a meaningful and accessible way is an obligation of all in the research enterprise, but most are poorly trained to do so, a gap that needs to be filled.

In conclusion, the research landscape is complex. This complexity affects all layers of the research enterprise including the day-to-day operation of individual laboratories and the pressures that are applied to all in the research enterprise. Are expectations realistic and achievable and communicated clearly? Are the interests of supervisors and their graduate students aligned? What if they are in conflict? Do students and supervisors have the necessary skills to resolve conflicts? Are there clear pathways available without negative consequences for the student?

The Current Research Culture

A healthy student-supervisor relationship is central to the research enterprise. Yet, most professors have little or no formal training in two key elements: graduate student supervision and lab management. Most often they use the same methods under which they were trained. They certainly are not trained to deal with personal or mental health issues or even to recognize them

when lab members begin to struggle. Students often work on projects designed by their supervisors who have received funding to carry them out. While there is common interest in research and using the latest methods and technologies to produce results that can be published in top journals, there may not be an alignment beyond this scholarly activity. Is the research the end-game or is research an essential tool to train high-qualified personnel? Good supervisory practices are a responsibility of all faculty members in keeping with their appointment to the SGS. Good lab management skills -including setting clear goals, giving positive feedback and managing people and projects, creates a healthy, vibrant and high-performing research environment.

PhD students and many Master's students in research programs are required to produce and defend a thesis as the central requirement for their degree. SGS defines a PhD thesis as: "*The candidate, through the graduate unit, shall present a thesis embodying the results of original investigation, conducted by the candidate, on the approved topic from the major field. The thesis, which is a piece of scholarly writing, shall constitute a significant contribution to the knowledge of the field and must be based on research conducted while registered for the PhD program."* What constitutes "*a significant contribution*" varies across fields, is not always well-defined, or is governed by unwritten rules that vary with the discipline (e.g., three first-author papers in appropriate journals). Lack of clarity can result in conflict, especially when a student is nearing the end of their studies and is keen to write up, while the supervisor insists on "*one more experiment*" or "*one more paper*".

There is certainly a strict hierarchy in most research labs, with the supervisor at the top directing daily activities, although some labs operate using a more cooperative team approach. Supervisors may view their students as employees, trainees, mentees, and/or scholars. Problems can occur when the supervisors' view and the view of the students are not aligned. Graduate students often ask "*Am I just a source of cheap labour or am I a scholar*?"

How students are funded can affect how they are viewed and the nature of the student-supervisor relationship. If students are supported by a stipend from a research grant held by the supervisor they may be viewed as workers beholden to their supervisor. The same is true of post-doctoral fellows, some of whom are classified at the U of T and hospital-based research institutes as contract employees. Students supported by TA funding are clearly employees of the university and have duties beyond their research. Students can also be paid by funds provided by their departments through their Faculty and the university. In contrast, prestigious national awards like a Vanier Scholarship can give students a sense of independence both financial and intellectually. We need more awards that recognize the abilities and potential of individuals.

The nature of the research environment varies. Traditionally, and this is often still the case, labs are self-contained with an internal faculty office. This provides the opportunity for supervisors to interact closely with their lab members and lab members with each other. Newer lab constructions (e.g., Donnelly-CCBR, MaRS) are often based on open concept designs to facilitate interactions and collaborations, with faculty offices clustered together away from the lab. In some cases, student desks are not in the lab but arranged together in an open concept office space. In this case, supervisors may need to make a deliberate effort to spend time out of their office and in the lab or with students at their desks. An open concept may mitigate bad

behaviour as it provides a public space for personal interactions. Future lab designs should be mindful of how the environment may affect lab culture. Research field trips, common in some disciplines, can create an isolated and risky lab environment. A safe and healthy research environment, whether in a lab or in the field, should be an expectation for all graduate students and post-doctoral fellows.

Times-to-completion are a major concern for students, departments, and universities but often not for supervisors, unless funding is limited. This is a major mis-alignment that needs to be addressed. As students approach the ill-defined end of their studies, they are experts in their field and in the best position to advance it. Some supervisors recognize them as such and are reluctant to encourage them to graduate, because the senior student is often replaced by a novice student. From the student's perspective they are fully trained and ready to move to the next stage of their career either as a post-doctoral fellow or into a job. In addition to blocking student advancement to the next phase of their lives, extended training also has financial repercussions for students, who continue to pay tuition and may be beyond the funded cohort. This is a major misalignment that is often the cause of conflict between students and their supervisors.

The 10,000 PhDs Project (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0209898) showed that about 15% of physical and life science students who graduate with a PhD from the U of T end up as tenure-track professors. Yet, universities still train students using an apprenticeship model. This is a clear mis-alignment. Professors are well positioned to serve as role models for students interested in the professoriate. However, faculty members are often unable or unwilling to provide career advice beyond the professoriate. While professors are not trained as career counsellors, at a minimum they should be more open to the likely possibility that their trainees will not follow in their foot-steps. "*Oh, our best students still become professors*" is a common refrain. Students who intend to leave academia for industry may be reticent to share these plans with their supervisors out of fear it will impact the supervisory relationship. Individual Development Plans (IDPs) (https://myidp.sciencecareers.org/) are highlighted as a best practice that if properly implemented can be used to clearly articulate the career goals of graduate students and facilitate an open discussion with supervisors.

Some Negative Student Comments*

"I can't get out! My supervisor continues to ask me to do additional experiments."

"My work hours and vacation times are not clear."

"What are my general duties in the lab? Who does what?"

"My supervisor won't let me TA."

"I'm interested in volunteering for my grad student association but am afraid to ask my supervisor."

"There seems to be a power structure in my lab."

"I haven't had a committee meeting in over a year."

"My supervisor is very slow to review my draft thesis chapters and I am concerned about completing my PhD".

"Where do I go if I have concerns about my mental health?"

"I'm not sure about my rights as a graduate student."

"I have an interview coming up with a company and am afraid to ask my supervisor for a reference".

"*My supervisor asks me to provide all of my raw data and does all of the writing of the papers.*"

"I noticed that my supervisor modified some of the data I provided for a grant and don't know what to do."

"We all know who the bad professors are in the department."

*Positive comments are considered below as examples of a healthy lab culture.

Supervisor as Mentor?

An article in **Nature** (https://www.nature.com/articles/447791a) highlights the positive attributes of a good mentor. These include: enthusiasm, sensitivity, appreciation for individual differences, respect, unselfishness, support for students not their own, and strong abilities in teaching and communication. Many of these attributes are integral to building relationships with individual students and teams, and they require that supervisors not only know and appreciate who their students are, but see themselves as mentoring their future colleagues and the next generation of scientists. We would add that the mentors also need to be open to diverse career choices and this remains a major challenge. Indeed, there is a call (https://www.nature.com/articles/nj7677-549a ; https://www.nature.com/articles/d41586-019-03535-y) for more one-on one mentoring and better career guidance. Post-doctoral fellows often fulfill a mentoring role and are "*the new PIs*" in terms of teaching and guiding graduate students (https://www.insidehighered.com/news/2019/10/11/study-says-when-it-comes-everyday-mentoring-and-training-sciences-postdocs-are-new).

A comprehensive 2019 report (https://www.nap.edu/catalog/25568/the-science-of-effective-mentorship-in-stemm) by The National Academies of Sciences, Engineering and Medicine entitled "*The Science of Effective Mentoring in STEMM*". It defined mentorship as *"Mentorship is a professional, working alliance in which individuals work together over time to support the*

personal and professional growth, development, and success of the relational partners through the provision of career and psychosocial support."

The Report likened mentoring to a Pilot - Co-pilot relationship with key features:

- Build **trust** and mutual **respect** over time
- **Both parties** guide the relationship and destination
- Conditions will **change**
- **Turbulence** may occur
- **Communication** is essential
- Transfer knowledge and skills to build **independence**
- Provide **feedback** and **professional development** to optimize working relationship
- **Identity** influences mentorship and academic and career development

"Trust—an essential element of effective mentorship—develops when mentors and mentees work together to identify and respond to mutual goals, needs, and priorities, which can change over time and thus may require adjustment."

The Report also comments on the benefits of diversity, particularly encouraging the engagement of under-represented groups in STEMM: *"More diverse and inclusive STEMM workplaces will be more creative, innovative, and responsive to current and emerging problems because teams comprising individuals with diverse experiences and areas of expertise often ask different questions and tend to be more creative and innovative in how they answer those questions. More diverse research teams also, on average, produce higher-impact research and make better decisions than less diverse teams."*

"Effective mentorship may play a critical role not only in retaining students in STEMM fields, but also in producing a more diverse population of graduates who are ready to take on the role of STEMM professionals in the workplace and feel comfortable and accepted in those roles. "

Graduate Education and Research at U of T

Role of the School of Graduate Studies

SGS provides a central role in the administration of graduate education at U of T in partnership with other divisions and graduate units. Most of its role has traditionally focused on policies, rules and regulations, although this is changing with a focus on enhancing the graduate student experience with initiatives such as the Graduate Professional Skills (GPS) program, The Graduate Centre for Academic Communication (GCAC), Grad Life and the new Centre for Graduate Mentorship and Supervision (CGMS). The Healthy Labs Initiative aligns with the mission of SGS:

Our mission is to foster excellence in graduate education by supporting and promoting outstanding graduate learning and research in an environment that encourages an exceptional student experience. The School of Graduate Studies achieves its mission by:

- *Working collaboratively to advance excellence and innovation in graduate research and education.*
- *Fostering an outstanding graduate experience for our diverse student population.*
- *Creating and promoting opportunities for graduate student professional development.*
- *Advancing integrity and ethical conduct in graduate research and education.*
- *Establishing policy and promoting best practices for graduate research and education.*
- *Providing registrarial and support services for the graduate community.*

Understanding Policies, Guidelines, Rules and Regulations

Graduate education and research at U of T is carried out in a highly-regulated environment and a bewildering array of policies, guidelines, rules and regulations. A university appointment is required to apply for a research grant and an appointment to SGS is required to supervise graduate students. Consultations with relevant parties at U of T indicates that clearly outlining the rights and responsibilities of graduate faculty and graduate students would go a long way to reducing conflict. In addition to the rules and regulations detailed in the SGS Calendar (https://sgs.calendar.utoronto.ca/message-dean), the SGS website lists an astonishing 75 items under the Policies and Guideline tab (https://www.sgs.utoronto.ca/policies-guidelines/). Topics that are covered include: Academic Integrity, Ethics and Conduct, Appeals, Constitution and By-laws, Courses; Doctoral Program Guidelines, Examinations, Financial Support, Governance & Quality Assurance, Grading, Intellectual Property, Leave, Library Carrels, Publishing, Research, Student Academic Record, Supervision and Termination of Registration.

It is not clear that most graduate students and their supervisors are sufficiently aware of the policies and procedures that govern graduate studies at U of T or if there is enough expertise within graduate units to inform them or to direct them to the proper documentation. For example, there is a "*Supervision Guidelines for Students*" document that includes a checklist, but its use by students and faculty is uneven across departments. Students are reluctant to bring problems forward for fear of negative consequences for their program, especially if they are having problems with their supervisor. This includes an informal process let alone a formal complaint. Neither of these pathways is clearly outlined in this document.

Per SGS guidelines, supervisors are responsible for a number of aspects of their students' scholarly and professional development. A supervisor is thus not just an employer or lab manager, but a mentor and guide with a duty to prepare their students for their next career steps. A supervisor is required to guide their students through planning their projects and pathways through their graduate study, offer guidance and training, provide feedback on student progress and learning, be accessible for regular meetings and communication, and help students select their committee prior to the second year of graduate study. Supervisory committees are comprised of the supervisor and a minimum of two other faculty members, and are expected to meet a minimum of once per year with the student. Committees are required to prepare an annual report of the student's progress, and are responsible for determining whether the student is ready to defend their dissertation. Supervisory committee meetings and reports not only provide an opportunity to track the progress of a student through their graduate program, but are also a chance for the student to provide feedback. Prompt feedback from supervisors and committee members is critically important during the thesis writing phase to ensure timely completion of a

graduate program. Clarifying the rights and responsibilities of holding a graduate appointment and best supervisory practices through orientations, workshops, webinars and retreats is an essential element of promoting a healthy lab culture.

Recognizing Post-doctoral Fellows

While some postdoctoral fellows are supported by individual fellowship awards, most post-doctoral fellows at the U of T and at hospital-based research institutes are contract employees and work in a unionized environment. Ensuring that supervisors and post-doctoral fellows are familiar with the details of the contract and its implications for duties, hours of work, work conditions, etc. would create a healthier lab environment. Additionally, post-doctoral fellows, due to the transitory nature of their positions, can often feel sidelined, the "last to know" about events and goings-on in their labs and departments, or left out of lab and department culture and resources. Post-docs expressed frustrations with what they framed as a lack of resources and attention to their continued training and professional development, noting that there is less or no funding for their conference travel, continuing education, or other expenses. As one post-doctoral fellow said, "*We feel invisible*". The creation of a Post-doctoral Office at SGS and formalization their employment status is a positive step in addressing the concerns of this valued group of scholars. Some institutions (https://esp.umontreal.ca/english/postdoctoral-fellow/attestation-of-postdoctoral-fellowship/) register post-doctoral fellows and provide a formal post-doctoral fellow certificate attesting satisfactory completion of the training period – an example of a best practice.

Clarifying Lab Technician Duties

The duties and responsibilities of technicians are defined in the employment contract that are governed by negotiated agreements. However, staff indicated that they are often assigned new and varied duties ranging from lab manager to running their own project. They are commonly involved in the training of undergraduate and graduate students, ordering supplies, and maintaining equipment and lab safety. They typically have a direct report to faculty members but sometimes are supervised by post-doctoral fellows. A number of technicians indicated that the duties outlined in their contracts or stipulated by their formal job titles were inaccurate reflections of their actual responsibilities. Some were aware that they were funded by "soft money" and were reluctant to seek promotion to a higher technician levels, fearing they would become too expensive to be supported by limited research grants.

Mandate and Training of Graduate Coordinator/Associate Chairs

All departments/graduate units appoint a faculty member to serve as Graduate Coordinator/Vice Chair-Graduate supported by an administrative assistant. The title, term, and mandate of this position varies. Indeed, searches to identify the relevant individual in some departments were not straight-forward. The role of the Graduate Coordinator varies greatly. Some see themselves as advocates for the students, others as enforcers of rules and regulations. The term of the appointment varies greatly. None had <u>any</u> formal training specific to the role. Yet, most saw themselves as the first line of contact for students who were having difficulties or concerns.   We suggest a uniform nomenclature for this position should be used, such as Vice-Chair Graduate

Studies, as well as training for new appointees, coordinated by SGS. Indeed, graduate Coordinators indicated that they would value additional support and resources from SGS in the form of training and advice.

Best Practices at U of T

In our consultations we were made aware of many best practices in individual labs (See box below) and some examples at the departmental and divisional level. U of T also provides many resources to promote student success with expertise not found in academic units themselves (See Appendix). One of the major determinants of student success is a healthy and vibrant work-place where student well-being is front and centre. Indeed, there is a recognized link between the well-being of employees and the success of an organization. A positive and healthy lab culture with inclusive leadership and a shared vision that supports trainees working together to succeed in their projects, develop their skills, and have a balanced life results in high-performing and sustainable research teams. Long hours, poor communication, and lack of support can lead to stress, conflict and burn-out. Of course, a healthy lab culture starts with buy-in from supervisors, supported at the departmental/graduate unit level and at the divisional and university levels. SGS has an essential leadership role to play in establishing and recognizing best supervisory practices and promoting a healthy lab environment.

Best Practices from Individual Labs at U of T

Conversations with graduate students, post-doctoral fellows, support staff and supervisors revealed a number of best practices:
Weekly meetings with trainees
Lab retreats
Collaborative team approach
Open to career choices
Reasonable and flexible working hours
Sharing of ideas
Discussions about authorship
Quick turnaround of manuscripts
Clear expectations
Positive reinforcement
Technical training and support
Feeling respected and valued

GEMS Agreement

The Office of Graduate and Life Sciences Education (GLSE) in the Faculty of Medicine launched GEMS in 2017. All doctoral-stream Master's and Ph.D. students in the Faculty of Medicine use this on-line Supervisor-Student Agreement Form, which provides details of a

graduate student's funding. Data are entered on an annual basis into GEMS by students, supervisors, and administrators in the Faculty's graduate units. As a result, graduate students have clarity as to their funding, a major source of anxiety. The contract does not however provide details of the required hours of work, sick leave or annual holidays. The stipend level is uniform across departments in the Faculty of Medicine and is adjusted on regular basis to cover increases in tuition fees and cost of living -an example of a best practice.

Student-Supervisory Committee Meetings

The Department of Immunology provides a clear guideline for supervisory committees, committee meetings and reports, meeting timelines and a clear pathway on resolving disputes on their web-site (https://www.immunology.utoronto.ca/supervisor-and-supervisory-committee) – an example of a best practice. The committee report also provides an opportunity for feedback from the student. Students often are asked to step outside while the committee discusses their progress or any issues. A practice employed by some graduate units is that the supervisor steps out before the meeting so the student can raise any issues or concerns with the supervisory committee. Feedback on the committee report provides an opportunity for the students to raise any issues and provide feedback in a safe and open environment. Course evaluations are commonly used in undergraduate teaching but there is little formal evaluation by students of graduate supervision. Good supervisory practices should be recognized, but poor practices are often not raised or dealt with until a serious issue arises.

Every department keeps a record of their graduate student progress through student-supervisory committee meetings and reports. Some of these reports are completed in electronic forms, which simplifies record keeping – best practice. The forms vary and few provide an opportunity for feedback from the graduate student. Some forms provide tracking towards completing a MSc or PhD degree rather than an evaluation. While most graduate students have meetings on an annual basis, there are some who delay, often because they feel they have not made much progress since the last meeting. Other students are unable to secure meetings with their supervisors and committee due to faculty travel schedules or disinterest. It is precisely in this circumstance that a meeting is necessary. Timely feedback from the supervisor and supervisory committee members at all phases of project including the writing the thesis is key to reducing times to completion.

Individual Development Plan (IDP)

My IDP (https://myidp.sciencecareers.org/) is "*a unique, web-based career-planning tool tailored to meet the needs of PhD students and postdocs in the sciences*" developed by FASEB, AAAS/Science and several universities. NIH strongly encourages institutions to develop and use IDPs for graduate students and postdoctoral researchers. CIHR has created its own version (https://cihr-irsc.gc.ca/e/50516.html) to help graduate students incorporate their personal values, strengths, skills, experiences and identify any skill gaps. IDPs are now in common use in graduate professional development courses by departments in the Faculty of Medicine. Faculty and Graduate Coordinators in departments that have formally adopted the use of IDPs have credited them with improving communication and managing expectations between supervisors and trainees, two elements that were broadly identified by stakeholders as major sources of conflict.

Anthropology Graduate Students' Union (AGSU) Conflict Resource Chart

There needs to be a clear and apparent pathway to address graduate student concerns. The AGSU created a resource document for students in the form of a chart with different scenarios (harassment by faculty member, sexual assault, issues with supervisor, harassment in the context of TA work, etc.) and a list of offices and administrators that students can reach out to for assistance, arranged in order of escalating severity. Students have reported that the chart has been extremely useful in demystifying the myriad de-centralized resources for students who are suffering harassment and conflicts. The department now includes the chart in welcome packets that new students receive at orientation -a best practice.

Best Practices at Other Institutions

The question of how to promote a healthy lab culture is getting more attention recently. Early initiatives in this area primarily focused on improving women's involvement and advancement in STEM, but now broader concepts of equity, diversity and inclusion (EDI) are getting serious consideration. Work-life balance, mental health and wellness are increasingly recognized as key components of EDI. Of direct relevance promoting a healthy lab culture at U of T is the application of the principles of Dimensions (See Appendix for details of this Canadian EDI initiative).

As outlined in the Appendix, examples of best practices at other institutions reveal two major themes. The first theme is a recognition that the health and well-being of individuals is key to the success of a research team. The second theme is the need for the development of formal training programs for early career researchers focused on leadership, supervision, and lab management. A common element in these training programs is a focus on post-doctoral fellows and new faculty members. U of T is well positioned to offer such programming that would involve coordinating a range of central services offices such as CGMS and CRIS listed in the Appendix to share best practices that are already in place at the university and from other institutions to promote a healthy lab culture. A number of organizations have created work-place charters to address this issue and it is recommended that U of T develop a Healthy Labs Charter.

Conclusion

A strong student-supervisor relationship is built on trust and a shared vision, with open lines of communication to ensure a clear alignment of expectations and a recognition that well-being is linked to performance. The U of T has the opportunity to promote a healthy lab culture that supports excellence in graduate education and research while addressing long-standing concerns in the treatment of graduate students. This requires a cultural shift from the student viewed solely as trainee and the professor as supervisor to a mentor-mentee relationship. This can be accomplished by providing supervision and lab management training, enhanced support to early career scientists, promoting and recognizing best practices in lab management, and providing clear pathways to resolve conflicts. By becoming a full member and implementing the principles of Dimensions, the U of T will recognize that "equity, diversity and inclusion strengthen the

research community, the quality, relevance and impact of research, and the opportunities for the full pool of potential participants."

Authors

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APPENDICIES

A) Best Practices in Developing a Healthy Lab Charter

Athena SWAN

In 2005, The Athena SWAN program was founded in the UK to address systemic barriers to women's involvement and promotion in STEM fields. It is owned by The Equity Challenge Unit, a unit of Advance HE. Participation is voluntary and requires that individual researchers and their institutions commit to ten principles supporting gender equity. In 2015, the program was expanded to address barriers faced by the LBGTQ community and to incorporate humanities and social science disciplines, as well as business and law. Since its founding, over 143 institutions in the UK have committed to the charter's principles. The ten updated principles include:

1. We acknowledge that academia cannot reach its full potential unless it can benefit from the talents of all.
2. We commit to advancing gender equality in academia, in particular addressing the loss of women across the career pipeline and the absence of women from senior academic, professional and support roles.
3. We commit to addressing unequal gender representation across academic disciplines and professional and support functions. In this we recognise disciplinary differences including the particularly high loss rate of women in science, technology, engineering, mathematics and medicine (STEMM).
4. We commit to tackling the gender pay gap.
5. We commit to removing the obstacles faced by women, in particular, at major points of career development and progression including the transition from PhD into a sustainable academic career.
6. We commit to addressing the negative consequences of using short-term contracts for the retention and progression of staff in academia, particularly women.
7. We commit to tackling the discriminatory treatment often experienced by transgender people.
8. We acknowledge that advancing gender equality demands commitment and action from all levels of the organisation and in particular active leadership from those in senior roles.
9. We commit to making and mainstreaming sustainable structural and cultural changes to advance gender equality, recognising that initiatives and actions that support individuals alone will not sufficiently advance equality.
10. All individuals have identities shaped by several different factors. We commit to considering the intersection of gender and other factors wherever possible.

As Athena SWAN is an accreditation scheme, it focuses on building capacity for equity projects and the elimination of discrimination in academia, rather than on punitive measures. Faculty and institutions may choose to apply for the first level of the program, and then must continue to actively engage with the ten principles by increasing their education and equity activities and re-applying to either maintain their accreditation or ascend to the next level. Members who are awarded a level in recognition of their success are provided with further resources to continue to

engage with the program, and to publicize their commitment to the public and their research community.

Different iterations of Athena SWAN have been implemented in Ireland, Australia (SAGE), and the United States (SEA Change).

Australia
In Australia, SAGE (Science in Australia Gender Equity) is the pilot of Athena SWAN, co-hosted by the Australian Academy of Science and the Australian Academy of Technology and Engineering. It was initiated in 2015 and there are currently three cohorts of applicant-members. At this phase, SAGE is focused on piloting the bronze level awards for STEMM units in higher education and research institutions. SAGE is primarily an initiative to improve the representation and inclusion of women, trans, and non-binary people within STEMM.

USA
In the United States, SEA Change is hosted by the American Association for the Advancement of Science, and is focused on increasing diversity and inclusion in science, technology, engineering, mathematics, and medicine (STEMM). It was founded in 2018 as a pilot project; three universities received bronze status in 2019. The pilot is ongoing, and universities or institutions interested in joining the pilot do not need to be members of SEA Change. SEA Change is focused on eliminating bias and increasing inclusion of communities historically excluded from or under-represented in STEMM, such as racialized peoples, Indigenous peoples, people with disabilities, members of the LBGTQ community, women, and people from underprivileged backgrounds. The SEA Change principles build on the 10 principles of Athena SWAN, but emphasize in particular that under-representation in STEMM is the result of broader structural factors that must be addressed through a variety of governance and culture change processes, and that marginalized individuals are not responsible for changing the institutions that exclude them (https://seachange.aaas.org/principles). Like Athena SWAN and SAGE, SEA Change offers a process of bronze, silver, and gold awards to individuals and institutions that commit to SEA Change principles and steps. It also offers staff for consultations, continuing education opportunities in the form of workshops and webinars, and an online community space to connect with others committed to the same work in other spaces.

Canada
Jointly administered by NSERC, CIHR and SSHRC, Canada is currently pilot-testing Dimensions (https://www.nserc-crsng.gc.ca/NSERC-CRSNG/EDI-EDI/Dimensions_Dimensions_eng.asp), a broader version of Athena SWAN that also prioritizes racial equity, and the elimination of barriers and discrimination against people with disabilities, visible minorities, and Indigenous people in STEM. While SAGE is an application of Athena SWAN in the Australian context, Dimensions is slightly more similar to SEA Change in the United States, in that it considers racial, economic, and gender disparities in STEMM, in addition to barriers to inclusion faced by people with disabilities, people from underprivileged backgrounds, and Indigenous people. The Dimensions pilot began in September 2019, and there are currently 17 Canadian universities participating. U of T is has endorsed the Charter and became an affiliate member in 2019 and is will prepare to become a full member in 2022.

Principles of Dimensions

"Participation in the Dimensions pilot program is voluntary. By choosing to endorse this charter, institutions commit to adopting these principles throughout their practices and culture to achieve greater equity, diversity and inclusion (EDI). Institutional commitment is understood to reflect ongoing and productive engagement with their community.

1. *The post-secondary research community has the greatest potential to thrive when members experience equitable, inclusive and unbiased systems and practices.*
2. *To advance institutional equity, diversity and inclusion, specific, measurable and sustainable actions are needed to counter systemic barriers, explicit and unconscious biases, and inequities. This includes addressing obstacles faced by, but not limited to, women, Indigenous Peoples, persons with disabilities, members of visible minorities or racialized groups, and members of LGBTQ2+ communities.*
3. *Institutions require qualitative and quantitative data to measure, monitor, understand and publicly report on challenges and progress made. The analysis of the data should inform a comprehensive, in-depth, intersectional understanding of the contexts, manifestations and experiences that result from inequities, underrepresentation and exclusion among all post-secondary community members.*
4. *When equity, diversity and inclusion considerations and practices are integral to research participation, to the research itself, and to research training and learning environments, research excellence, innovation and creativity are heightened across all disciplines, fields of study and stages of career development.*
5. *To contribute to reconciliation, research with, by or impacting Indigenous Peoples must align with the research policies and best practices identified through ongoing engagement with First Nations, Métis and Inuit Peoples and their organizations.*
6. *Advancing equity, diversity and inclusion is a shared responsibility that requires dedicated resources and strong leadership at all levels. Senior leadership demonstrates commitment through public endorsement, by ensuring the work involved is resourced and distributed fairly, and by embedding changes in institutional governance and accountability structures.*
7. *Issues of institutional and individual safety, trust, belonging, privacy and power differentials must be recognized and pro-actively addressed; this will be most successful when those impacted are directly engaged in defining the actions.*
8. *Achieving the overall objective of the Dimensions program—to foster increased research excellence, innovation and creativity within the post-secondary sector across all disciplines through increased equity, diversity and inclusion—involves institutional collaboration, transparency, and the sharing of challenges, successes and promising practices."*

NIH Office of Intramural Training and Education (OITE)

The National Institute of Health Office of Intramural training and Education (https://www.training.nih.gov/home) offers a broad range of career and professional development resources for career trainees within its labs. For example under Leadership and Management Training (https://www.training.nih.gov/leadership_training) "*The OITE has a set of*

workshops and resources to help you be a better leader and manager, deal with conflicts, and thrive in a team environment. The topics have all been developed with a focus on science, using examples taken straight from research groups. Our Leadership and Management training has two parts. The first is leadership, which consists of the four sessions in our Workplace Dynamics Series and Resiliency for Scientists, as described below. These workshops are for any level of intramural trainee, and we often bring these to other NIH campuses. OITE Management training builds on knowledge gained in the Leadership series. Therefore, completion of the entire Leadership series is a prerequisite for admittance into the Management Bootcamp (described below). Management Bootcamp will also be offered twice a year. Travel funds are available for NIH intramural trainees from other campuses." Topics include:

- Self-awareness
- Conflict and feedback
- Team skills
- Diversity in a multicultural society
- Resiliency for scientists

They even have a Handout ([handout](#)): "*Speaking Up: Asking for what you Need in Lab and Life*".

Cold Spring Harbor Laboratory (CSHL) Workshop on Leadership in Bioscience

The Cold Spring Harbor Laboratory (CSHL) Workshop on Leadership in Bioscience (https://meetings.cshl.edu/courses.aspx?course=C-LEADER&year=19) was created and run for a decade by Carl and Suzanne Cohen co-authors of the guide book *Lab Dynamics: Management and Leadership Skills for Scientists* with a focus on emotional intelligence training for scientists.

"*CSHL's Workshop on Leadership in Bioscience is a highly interactive four-day workshop that provides a comprehensive introduction to essential tools needed for managing science research groups and project teams, in both academic and industry settings.*"

"*In this workshop, you will gain a solid experience-based foundation in managing others, negotiating win/win outcomes, running effective meetings, selecting the best team members, and setting goals with mentees, direct reports, and teams. The workshop focuses on techniques, situations, and challenges that relate specifically to leading and managing in the scientific workplace. It emphasizes learning by doing and involves role playing, giving and receiving feedback, and group problem solving. Much of the learning is peer-to-peer. You will have the opportunity to share your leadership experiences and challenges, and to receive feedback and guidance from others who have led scientists in a variety of settings. In doing so, you will identify areas where you need guidance and growth, as well as how to capitalize on your strengths.*"

"*Key focus areas of the workshop include:*"

- *Recognizing and understanding leadership in science*
- *Using negotiation as a tool in scientific discussions and problem solving*
- *Identifying and resolving conflicts in the lab*

- *Dealing with difficult people and situations in a scientific setting*
- *Communicating your ideas and plans in a way that engages others*
- *Leading productive meetings for scientific teams and projects*
- *Setting goals for and giving useful feedback to mentees and direct reports*
- *Creating a positive lab culture*
- *Identifying, interviewing and hiring the best people for your team"*

EMBO Lab Leadership Courses

Laboratory Leadership for Group Leaders (http://lab-management.embo.org/dates/ell-gl-2020) is a 4-day interactive workshop (€2,650) held at the EMBL in Heidelberg, Germany. The topics covered include: leadership, impact of the working environment, working with values, research integrity, communication, giving feedback &criticism, impact of personality on leadership, team dynamics, motivation, conflict in the lab, coaching and interviewing. Importantly, the EMBO Leadership Courses can be run locally by two experienced trainers from EMBO Solutions for up to sixteen participants (http://lab-management.embo.org/organise-an-event).

Memorial University, Centre for Innovation in Teaching and Learning

The MUN Centre for Innovation in Teaching and Learning offers trainings for faculty through the Program in Graduate Student Supervision, which is available to faculty across Canada (https://citl.mun.ca/PGSS.php). The program's goal is to "support educators across Canada on effective graduate supervision in hopes of better supporting graduate students, reducing time-to-completion rates and program attrition, and increasing optimal student outcomes."

Program components include:

- "Reviewing influential supervisory frameworks
- Highlighting specific indicators of effective supervisors
- Providing supervision recommendations for distinct graduate student populations (i.e., cross-cultural students), and
- Providing resources for effective supervision practices.

Topics investigated in the program include:

- Models of Supervision
- The Supervisory Relationship
- Attributes of Effective Supervision
- Cross-cultural Supervision"

UCSF

The Office for Post-doctoral Scholars at the University of California San Francisco offers "The Scientific Leadership and Management Skills Course (https://postdocs.ucsf.edu/slms). *"The SLMS Course provides 16 hours of training and is targeted at senior postdocs, clinical research fellows, and junior faculty. The Course is recommended for those who are about to lead research*

groups in an academic environment or those who have just begun to lead. It's modeled after the successful course designed by Howard Hughes Medical Institute and makes use of the HHMI publication [Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty.](#) "

"*Course topics include:*

- *Introduction to the [Myers-Briggs Type Indicator](#)*
- *Using MBTI to Improve Performance*
- *Influencing Others: Motivating, Managing Conflict, "Leading Up"*
- *Vision: Advancing Your Research Program*
- *Staffing Your Research Group: Recruiting the Best*
- *Managing Your Time Effectively*
- *Influencing Others: Difficult Conversations and Negotiations"*
- Goal Setting

Registration Fees:

$95 for UCSF postdoctoral scholars
$250 for UCSF clinical research fellows
$275 for UCSF faculty members
$400 for eligible registrants not affiliated with UCSF

University of Wisconsin-Madison

 The mission of the Centre for the Improvement of Mentored Experiences in Research (CIMER) is: "To improve the research mentoring relationships for mentees and mentors at all career stages through the development, implementation and study of evidence-based and culturally-responsive interventions. CIMER will: *Facilitate research mentor and mentee training for mentees and mentors at all career stages:*
- *Develop and study new approaches and resources for advancing mentoring relationships*
- *Promote cultural change that values excellence in research mentoring*
- *Build a network of mentors, mentees, and those engaged in enhancing and studying research mentoring relationships*
- *Advance diversity in the research enterprise"*
CIMR delivers training to other institutions to optimize research mentoring.

University of Copenhagen

The University of Copenhagen has created a Department of Science Education (https://www.ind.ku.dk/english/course_overview/teacher_training/phd_supervision/) that delivers a course *"Supervision of PhD Students- The overall aim of the course is to help supervisors make their supervision practices more effective, targeted at the individual PhD student and at the same time supportive of the PhD student's competence development. You will get the opportunity to meet with other PhD supervisors and exchange ideas, concerns and experiences regarding PhD supervision.*

Intended learning outcomes

Throughout the course, you are provided with tools, ideas and a range of techniques in order to:

- *navigate in the rules and regulations of PhD supervision in general and in the faculty*
- *adapt your supervision to the needs of the doctoral student and the phase in the doctoral studies*
- *align expectations with PhD students, thus preventing problems*
- *provide feedback on texts and presentations*
- *engage in cross-cultural supervision*
- *use questioning techniques and active listening in the supervision situation*
- *develop your supervision practice continuously*
- *engage in discussions about research education at the participant's institution and faculty while drawing on theoretical justifications and reasoning"*

The course is designed on site for all PhD supervisors including new faculty members and post-doctoral fellows and is delivered over a full day followed by two half day about 30 h in total instruction time for a fee of DKK: 2000 ($420).

Individual Best Practices

There are a number of best practices in lab management based on an analysis of successful principal investigators (https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0214595). These include:

- Holding regular team meetings
- Share responsibility
- Provide supervision and feed-back
- Ensure sufficient training
- Foster positive attitudes
- Scrutinize data, verify findings and report accurately
- Express values and expectations
- Establish and document standard operating procedures
- Encourage teamwork

As detailed above, few supervisors have had any formal training in lab management, but this is changing (https://www.asbmb.org/asbmb-today/careers/121509/effective-laboratory-management). There are a number of lab management training programs run by professional organization and at universities that are available to researchers including for those working as post-doctoral fellows (https://www.ascb.org/careers/learning-art-leading-lab/). To be clear, we are not referring to technical lab management programs or certificate programs such as are required to run a clinical diagnostic lab, but rather programs focused on leadership, mentorship, and people management functions to run a high performing research lab.

Schloss Lab Contract

Public-facing lab contracts that clearly outlined rights and responsibilities of supervisors and trainees are rare. The Schloss Lab at the University of Michigan Department of Microbiology and Immunology web-site (http://www.schlosslab.org/lab_business/social_contract.html) is an example of clear communication of expectations of students and of the supervisor. Schloss lays out in plain language what students may expect of him, in terms of mentorship, their employment and funding in the lab, and his behavior and attitudes. Schloss also describes the work output, behaviors, and collegiality he expects of his students, and is clear that he respects his students' work-life balance. This information is available to potential students, and they are directed by Schloss to read it thoroughly and use it to vet his lab and any others they may be considering, permitting an informed choice. We see this declaration of expectations as an example of a best practice that could be included in the web-site of faculty members as a tool to recruit graduate students and ensure clear mutual expectations and a "good fit".

B) Some Example Charters

https://www.mindfulemployer.ca/charter/

The Mindful Employer Charter is a set of principles designed to help employers bring their practices into line with the National Standard of Canada on Psychological Health and Safety in the Workplace. Its goals are to promote mentally healthy workplaces, increase manager competency and inclusiveness around mental health issues, and eliminate the stigma of mental illness in the workplace. The Mindful Employer provides resources, educational materials, and support for employers to revise their practices to better support diverse mental health needs.

https://excellence.ca/healthy-workplace-standard/

Excellence Canada offers a tiered certification process to guide organizations to achieve their goals of professionalization. Their services include consulting and coaching, assessment, and trainings.

https://wellbeing.ubc.ca/okanagan-charter

The Okanagan Charter is an international charter for higher education institutions. It is a call to action to embed health and health awareness into every stage of university planning, protocols, and policies. The Charter calls on universities to consider health holistically, and to address the social determinants of health that impact students and employees. It offers language and frameworks for universities to adopt a "health promoting" framework.

C) Available Resources at U of T

Professional Development at SGS

SGS provides a number of programs to support the professional development of graduate students (https://www.sgs.utoronto.ca/resources-supports/gpd/) and post-doctoral fellows (https://postdoc.sgs.utoronto.ca/) through it GPS program, the GCAC, and for faculty members in the newly-formed CGMS.

The signature program is the GPS Graduate Professional Skills Program. "*The Graduate Professional Skills (GPS) program, an initiative of the School of Graduate Studies, is designed to help all graduate students become fully prepared for their future. GPS contains over 100 free and optional professional development courses, workshops, and seminars. The program will help you communicate better, plan and manage your time, and work effectively in teams and as leaders.*"   They also provide customized workshops within departments or Faculties on topics such as:

- Conflict Management
- Myers-Briggs Type Indicator (MBTI)
- Strength Finder Assessments
- Making the Most of Graduate School
- Managing Your Time
- How to Design an Individual Development Plan (IDP)
- Introduction to Solution-Focused Coaching
- Transitioning to a New Role
- Networks and Networking
- Introduction to Narrative Coaching
- Exploring PhD Career Pathways with the 10,000 PhD Project
- Using Design Thinking to Design Your Life

Graduate Centre for Academic Communication (GCAC)

GCAC offers five types of support designed to target the needs of both native and non-native speakers of English: non-credit courses, single-session workshops, individual writing consultations, writing intensives, and a list of additional resources for academic writing and speaking. By emphasizing professional development rather than remediation, GCAC can help students cultivate their ability to diagnose and address weaknesses in oral and written work.

Centre for Graduate Mentorship and Supervision (CGMS)

This proposed Centre could be the lead organization to create a healthy lab culture. The Centre could create a certificate program in Leaders in Lab Management and Mentorship – a train-the-trainers model.   It could organize the orientation session for the on-board on new faculty members and well as a series on on-going workshops. The Centre would provide recognition for

best practices in graduate mentorship and supervision as well as a publicity campaign for health lab practices. The Centre could be the internal training and accreditation mechanism for Dimensions. The Centre could also collaborate with the Graduate Centre for Academic Communication to develop a series of workshops to train faculty to provide quality, constructive feedback on trainees' writing.

Centre for Research and Innovation Support (https://cris.utoronto.ca)

 "The Centre for Research and Innovation Support (CRIS) is anew resource that serves as visible hub where researchers can learn about and easily access services, training, research tools, and expertise offered across the university. CRIS is a university-wide, researcher-centred unit that provides coordinated support for faculty and divisional research offices in order achieve the following.

- Enhance visibility and access
- Enable collaboration and partnerships
- Address emerging unmet needs"

This Centre could take the lead in supporting early career researchers, particularly new faculty members, but also post-doctoral fellows and senior graduate students interested in an academic research position. On-boarding should include a discussion of the importance of developing a healthy lab culture and provide training in lab management, conflict resolution and mentoring.

Centre for Teaching Support and Innovation (https://teaching.utoronto.ca/)

"The Centre for Teaching Support & Innovation (CTSI) provides leadership in teaching and learning at the University of Toronto and provides support for pedagogy and pedagogy-driven instructional technology for all teaching staff and teaching assistants (primarily through the **Teaching Assistant's Training Program**) across the university's campuses and divisions."

CTSI could develop programming within the TATP program to provide graduate students with the tools to deal with and resolve conflicts.

Career Exploration & Education

The Career Exploration & Education Unit of Student Life (http://www.studentlife.utoronto.ca/cc/grad-students) provides programming for graduate students, including a graduate dossier service for those doctoral students conducting an academic job search. *"Career Exploration & Education offers a full range of career-related programs open to graduate students. We also deliver extensive customized career programming for graduate students and postdoctoral fellows. Learn about diverse careers, explore your interests, plan your career, build resilience and identity, participate in experiential and peer-to-peer learning, and learn how to authentically represent yourself in the job application process."*

Centre for Faculty Development (https://cfd.utoronto.ca/)

"The Centre for Faculty Development (CFD) is a partnership between the [University of Toronto](#) (UofT) and [St. Michael's Hospital](#) (SMH) - a fully affiliated teaching hospital. The CFD is committed to enhancing the academic development of faculty in the Faculty of Medicine, additional Health Science Faculties (i.e. nursing, pharmacy, etc.) at UofT, and other institutions through innovation, capacity building and scholarship in the design, implementation and evaluation of faculty development.

Our current working definition of faculty development is as follows:

Faculty Development is a broad range of activities that institutions use to renew or assist faculty, supervisors, preceptors, field instructors, clinical educators, and status appointees in their roles. These activities are designed to improve an individual's knowledge and skills in teaching, education, administration, leadership and research."

CFD runs the New and Evolving Academic Leadership (NEAL) Program and Education Scholars Program (ESP) programs as well as a series of workshops and best practices on topics such as *Developing Skills as a Mentor*. CFD has a focus on health professional educators but could also expand its portfolio to include faculty members running research labs and training graduate students. CFD could organize workshops and programs dedicated to the development of leaders who could provide a local and embedded resource in developing healthy lab cultures at the departmental level. A certificate program in Leaders in Lab Management and Mentorship could be created using the Cohen and Cohen book "*Lab Dynamics: Management and Leadership Skills for Scientists"* as a primary resource and guide. This unit is ideally situated to provide training for faculty members located in hospital-based research institutes.

Centre for Learning Leadership and Culture

"OUR NEW MANDATE IS TO SUPPORT THE UNIVERSITY'S BOLD VISION FOR THE FUTURE THROUGH TALENT DEVELOPMENT. SPECIFICALLY, OVER THE NEXT FIVE YEARS, WE WILL:

1. Foster an inclusive workplace culture anchored in employee development

2. Cultivate the University's leaders of the future

3. Architect the development resources to support all employees in reaching their career potential"

The Centre focus on staff development through organizational competencies providing "*learning options for a variety of **professional skills** that everyone across the university might need to be successful. These include communications, interpersonal skills, and personal effectiveness skills.*" The goal is to "*rethink how managers and employees work together to build talent for our future.*" This Centre could focus on the career development of graduate assistants, lab technicians and managers providing them with tools to advance their careers.

D) Consultations and Comments

The authors of this report consulted broadly within the U of T community and had informal and formal meetings with various groups and individuals including graduate students, post-doctoral fellows, graduate chairs, departmental chairs, technical support staff service providers and senior leadership. We thank these individuals for their insights and comments that are summarized below.

Graduate Students

-In order to be considered for other departmental and university awards, PIs must have or be working towards the first tier of the Dimensions program.
-Students should be made aware of resources their supervisors have available for lab social outings and bonding activities, and this information should be more visible to PIs, they should be encouraged to use it.
-SGS should create a centralized database of funding that students can apply to in order to facilitate and support professionalization workshops, trainings, and other events in their labs and departments.
-GSU can help train and develop student advocate positions in course unions, who can accompany students to meetings with faculty, etc.
-Consider limiting the number of students a PI can have, to ensure that it's possible for every student to receive adequate mentoring and support.
-Student proposal: Consider "taxing" PI grants a small percentage to go into a fund to pay promising undergraduate students for their lab work. This would resolve equity issues of unpaid labor/internships and allow talented students with plans to attend graduate school the chance to grow their skills.

> Words graduate students used to describe a Healthy Lab Culture: Respected, Supported, Collaborative, Research, Excellence, Valued, Culture, Awards, Shared, Teams, People, Teaching, Recognition, Innovation, Opportunities.

Post-Doctoral Fellows

-Post-docs, due to the transitory nature of their positions, can often feel sidelined, the last to know, or left out of lab and department culture and resources. There is less or no funding for conference travel or other kinds of funding available to graduate students. Post-doctoral fellows often referenced "feeling invisible" within the university community.
-Contracts are extremely variable between labs and departments, and post-docs are often uncertain about their rights.
-Post-doctoral fellows are often called to mediate disputes within labs, or are expected to shoulder much of the responsibility for building and maintaining a healthy lab culture, but without access to training or resources to support these activities.

Research and Lab Technicians

-Job descriptions are often inaccurate and do not reflect the true breadth of responsibilities shouldered by lab techs of all levels.
-Additional responsibilities are often added as lab techs become more skilled and trusted, but without concurrent promotions or pay raises.
-Many PIs don't have the skill set to manage trainees or deal with conflict in productive ways.
-Lab techs are often asked by students to mediate conflicts, talk to the PI on their behalf, and handle conflict resolution, without training or resources.
-No financial support to develop or acquire new research or analytic skills.

Faculty Supervisors and Principal Investigators

-Healthy labs are marked by collaboration, not competition between students.
-PIs of healthy labs care about lab sociality and recognize that good science relies on nurtured relationships within the lab
-In healthy labs, mentorship relationships between members of the lab are formalized, recognized with resources and training, and are an integral part of lab functioning.
-PIs have regular career planning meetings with trainees and set expectations and goals based on student aspirations. IDPs are extremely important.
-Healthy labs celebrate the successes of their members
-In healthy labs, all trainees have the opportunity to build a relationship directly with the PI.
-It's important for PIs to be familiar with different mental health and conflict resolution resources and encourage students to use them.
-The comfort and quality of the physical lab environment is important and makes a difference to trainee mental health.
-PIs can do a lot to prevent toxic conflict by paying attention to their labs and getting to know their trainees on a personal level.

Graduate Coordinators/Chairs

-Grad coordinator office hours for students to meet casually to chat and build relationships and trust is important for keeping an eye on developing and potential issues.
-Grad coordinators wish they had additional training, resources, and onboarding to support their work advocating for graduate students and resolving conflicts.
-Graduate coordinators are frustrated with their lack of power to solve supervisory issues or prevent poor supervisors from taking on more students. Need policies with teeth from SGS.
-"Supervising trainees is a privilege, not a right"

Graduate Student Support Professionals

-In the past year, the Graduate Conflict Resolution Centre has seen a sharp increase in the number of cases of lab conflicts that graduate students have brought to the centre.
-Mismatched or uncommunicated expectations are the source of much conflict between supervisors and students.
-Another common cause of the most extreme cases of supervisory and trainee conflict is at the intersections of accessibility accommodation and disability accommodation.

-Graduate Centre for Academic Communication would like to develop and host courses for faculty on how to give appropriate and productive feedback on student writing, but requires the resources to do so.

E) Guidebooks

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Firestein, S. (2019) *Failure: Why Science is so Successful*, Oxford University Press, New York, N.Y., U.S.A.

Lee, N. and Reithmeier, R.A.F. (2016) *Success After Graduate School*, NR Publishing, Toronto, Canada.

Lowe, G. (2020) *Creating Healthy Organizations: Taking Action to Improve Employee Well-being.* University of Toronto Press, Toronto, Canada.

McInnes, R., Andrews, B. and Rachubinski, R (2005) *Guidebook for New Principle Investigators*, CIHR, Canada.

Sukhai, M. and Mohler, C. (2017) *Creating a Culture of Accessibility on the Sciences*, Academic Press, UK.