A Research Lab Manual Template

This template and the accompanying guidelines provide general guidance on important decisions for your lab and offer a framework for essential components to consider in the effective management of your research environment. Review all comments, they provide explanations and suggestions. *[The sections in square brackets are guidance or are to be replaced for your own use – they should all be removed/replaced as you develop your own manual from this]*.

Note that this is intended to be a living document, you should review it at least annually.

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# Introduction

This document summarizes the expectations for students and trainees, it outlines the various roles within the lab and it describes how the lab works.

*[Insert an Indigenous Land Acknowledgement here.]*

*[Insert equity, diversity and inclusion (EDI) vision/mission statement here.]*

We are called *[name]*. We are part of *[Department and Faculty etc.]* at Western.

## Core Values

Here are our core values about mentoring and science.

* We value equity, diversity and inclusion in this lab and in what we do. We are committed to ensuring that everyone is respected and treated fairly and is able to engage in learning and discovery.
* The opinions and insights of trainees and collaborators are valued.
* We value each other’s career decisions and eventual success in whatever field that might be - academia, industry or elsewhere.
* We value interesting, creative and informative research.
* We value careful analysis, thorough and detailed record-keeping and good writing.
* We value open and reproducible science. We strive to make our work accessible, clear and documented.
* We commit to treat each other with the professional and personal respect and appreciation that we would want to receive ourselves. Conduct in meetings, as well as outside of meetings, will be inclusive, appropriate and sensitive to others' roles, knowledge, skills, background and the cultural or historic structural barriers that otherwise prevent full and equal participation.
* We work hard to undertake science as carefully, as honestly and as accurately as possible. If you make a mistake, tell your collaborators, correct things, learn from the mistake and move on – mistakes shouldn’t be caused by careless or rushed work.
* If you’re struggling, tell someone. Take care of your mental and physical health. Remember to also spend time and value pursuits outside of the lab.

[Consider creating a poster to display these core values in your laboratory]

# General Lab Practices

The following is an overview of some of the practical aspects of being a member of this lab.

## Training

All lab members will complete the following training upon joining the lab and annually (or as otherwise directed) thereafter:

* Western’s required training - <https://www.uwo.ca/hr/learning/required/index.html>
* All study team members listed on research projects submitted to the human research ethics boards at Western must provide evidence of completion of human research ethics training (completed through TCPS2 CORE or CITI Program) by [uploading their certificate in OWL](https://uwo.us11.list-manage.com/track/click?u=40cfcb0b0d019d188c7049670&id=6c1ea0103e&e=873eb58597) prior to starting any study-related activities.
* Western’s Office of Equity Diversity and Inclusion certificates in Anti-Racism and Anti-Oppression https://www.edi.uwo.ca/trainings-and-certificates/certificates/
* The seven-part Implicit Bias Video Series from UCLA’s Office of EDI is good *[it’s only half an hour total for all seven parts]* - <https://equity.ucla.edu/know/implicit-bias/>
* *[SfN’s Neuronline -* <https://neuronline.sfn.org/> *- has many articles and videos on Diversity as well as other topics – they have a very extensive library of material although membership is required to get the most out of it.]*
* Review Western Library’s website on copyright in full – <https://copyright.uwo.ca>. It goes through copyright terms and ownership, fair dealing, educational and personal use exceptions – all aspects of copyright that everyone should understand as a member of this lab.
* Review Western Library’s statement on open access and become familiar with Scholarship@Western, Western’s open access platform to disseminate the scholarship created by Western researchers - <https://www.lib.uwo.ca/scholarship/index.html>
* ‘Introduction to Knowledge Translation’, e-learning module from The Hospital for Sick Children: <http://melaniebarwick.com/modules/Introduction-KT/story_html5.html> (13 minutes)
* ‘How to Prepare a Knowledge Translation Plan’ e-learning module from The Hospital for Sick Children: <http://melaniebarwick.com/modules/How-to-Prepare-KT-Plan/story_html5.html> (25 minutes)
* Read this article on unconscious bias from Ivey: <https://www.ivey.uwo.ca/academy/learning-centre/2019/09/unconscious-bias-what-it-is-and-how-to-avoid-it-in-the-workplace/>
* *[Any lab- or field- specific training]*

Keep a record of your training, such as in the appendix of this manual. Keep your completion certificates with this manual *[unless there is a team-specific location that is more appropriate]*. A training record will be useful when undertaking an annual appraisal.

## Open Science

Open science endeavours to make scientific research and its dissemination accessible to all stakeholders. It strives to increase the rigour, accountability, and reproducibility of research by making scientific inputs, outputs and processes freely available to all with minimal restrictions.

A key way open science increases the efficiency of discovery while maintaining research quality and integrity is by promoting the reproducibility of scientific results. When supported by an institutional framework, research conducted on an open science platform allows more researchers to access resources for novel use and/or verification, while encouraging opportunities for domestic and global participation in the research process. Furthermore, when discoveries and the inputs and outputs of research are openly shared, it enables others to rapidly build upon those discoveries, enabling a swifter path from research to innovation.

Beyond the scientific benefits of open science, embracing this philosophy promotes economic and societal benefits by making research from publicly funded institutions available to the whole of society; enabling the most efficient use of research and building confidence in the investment society makes through supporting research. Furthermore, open accessibility of research is a necessary first step in enabling the public to actively participate in meaningful discourse about the importance of research and in helping the public to take an active role in research itself. Perhaps an even more vital aspect of ensuring the general public has access to our research products in an approachable and digestible form is that it allows increased awareness and conscious choices. In a society where knowledge and information are valuable resources, open science plays a key role in promoting knowledge economies.

*Specific Actions:*

* Contact Western Libraries to avail yourself of the open access resources such as their open access repository [Scholarship@Western](https://ir.lib.uwo.ca/).
* Review the **Open Science Guiding Principles** developed jointly by the Western Neuroscience Institute (WIN) and BrainsCAN, in collaboration with the Tanenbaum Open Science Initiative (TOSI). This document provides the core values of open science with best practices.
  + *Open Science Guiding Principles are currently available upon request to* [*brainscan@uwo.ca*](mailto:brainscan@uwo.ca)*, and will be posted publicly shortly.*

[Develop an Open Science Policy that fits the direction and goals of your lab. Make sure open science expectations are clearly defined and made available to all lab members.]

## Knowledge Mobilization & Impact

Knowledge mobilization encompasses the activities that move research to people or organizations that can benefit from it, and our engagement with those people, groups, audiences and organizations before, during and after the research. It is far more than just different forms of dissemination. Engaging with those groups, people and organizations can change the shape of our projects, the questions we ask, the success of our work and the adoption of our findings.

Impact is the demonstrable contribution that excellent research makes to society and the economy. It is the outcome of successful and effective knowledge mobilization; when researchers and stakeholders engage and collaborate, research is able to impact other researchers, patients, industry and society. We aspire to impactful research and as part of our research we will identify impact goals, plan strategies to achieve those goals and evaluate whether the strategies were successful. Not all research is going to impact all parts of society, but we should always understand who will or who should be impacted. It may be the general public, it may be a specific patient population, or it may be a very targeted group of other researchers. However broad or narrow that group is, we will take actions to realize the potential impact and maximize the value of funding excellent research.

Tri-agencies are increasingly interested in knowledge mobilization/translation (KMb/KT) in grant applications and expect applicants to include details and plans on how it is incorporated into grant projects. Reach out to the support available at Western as you prepare grants (such as the [Knowledge Exchange & Impact Team](https://uwo.ca/research/services/kex/index.html) in Western Research).

## Record-keeping

Good record-keeping is essential in science. Although there are a variety of ways to take notes and keep records, it is important to have a centralized and accessible record-keeping system for current projects. *[Detail any common or standard processes in use in this lab, such as Dropbox, MS OneDrive or Google Docs.]*

We use *[any lab-specific process such as Google Docs]* for writing all papers. We use a standard template that is available in *[location]*.

A reference management system shall be used on all research projects. This lab uses *[a system, such as Paperpile, Mendeley, Zotero or End Note]* to manage and store references *[because… justification if appropriate]*.

This lab uses *[any data management tools such as Ripple or Red Cap]* to manage research data.

## Social Activities

*[Does your lab have any typical/regular social activities outside of the lab that it enjoys doing together? Describe them here. Examples might be Grad Club Fridays, Potluck once a month, Christmas party, etc. Consider any cultural or other challenges that these activities may create for some lab members. For example, caring responsibilities or other family commitments. Be mindful to schedule social activities around religious holidays (e.g., Ramadan, Yom Kippur) and consider activities that do not centre on or require alcohol consumption. Consider varying the days and times of events to allow as many people as possible to attend. Sticking to the same day and time, especially if the event is in the evening, may exclude some people from attending. Encourage all lab members to share any special requests or restrictions so that the lab can focus on inclusivity and all members are able to attend.]*

## Other items

Consider:

* All research in this lab involving human participants needs to be approved by the Western Research Ethics Board – go to <https://www.uwo.ca/research/ethics/human/index.html> (and if you are new to this, be sure to check out the Workshops & Seminars page). If you are conducting human research, you will need to create a WREM account to be able to access protocols - <https://www.uwo.ca/research/ethics/human/WesternREM.html>. If your human research involves the hospitals, Lawson Health Research Institute and any of its researchers, and/or you already know that you are affiliated with Lawson/the hospitals, you will likely require a ReDA/LORA account as well (<https://westernlawsonresearch.ca>).
* All research involving animals needs to be approved by the Animal Care Committee (ACC) – go to <https://www.uwo.ca/research/ethics/animal/index.html>. This lab will review all open protocols to ensure compliance at the start of each academic term (May, Sept, Jan).
* Create and maintain a Google Scholar page as a matter of course when something is indexed or published. Learn how to use Google Scholar alerts to keep up with developments in your field and review its recommendations.
* Create and maintain an ORCID profile & ID
* Make sure you know how to log into Western Libraries with your Western account when you are off campus so that you can still access journal articles.
* Keep commitments and show up to meetings/studies/classes on time. Flexible working hours and work-from-home accommodations may be possible – these are individual arrangements but your lab director is receptive and willing to discuss them.
* If you’re sick, stay home. Reschedule meetings and appointments, take care of yourself and return when you are well.
* Keep the lab tidy and deal with your trash, lock the door if there is no-one in the lab, turn the lights off if you are the last one to leave, dress code is casual (but not too casual).
* *[Describe any software, hardware or other resources that the lab uses/provides. Include any booking processes necessary, location or other details that lab members should know.]*

# Lab and Individual Meetings

All lab, team and individual meetings are to be held between the core hours of 9:30am and 3pm, to accommodate any personal scheduling that individuals might have established (e.g. family/school transport needs).

We hold a *[length of time]* lab meeting every *[frequency]* in *[location]*. The attendees are *[typical, the core lab members – the lab director, graduate students, postdocs and honours students when possible]*. Occasionally, others will be invited to attend as well.

The purpose of these meetings is to discuss current projects, to engage in debate or discussion about topics in the literature or relevant to the team/field, discuss topics such as diversity or inclusion, to plan future studies and so on. Mostly, the purpose of the lab meeting is to solve problems. The student leading a discussion will prepare an informal presentation of slides, handouts or notes. This helps the rest of the group to follow the work and is also an opportunity to practice presentation skills. There is no such thing as too much practice. Lab meetings may also include lab-specific methods or technical tutorials.

*[Note any expected variations in frequency, time or location – e.g. reduced frequency during summer months?]*

Lab meeting announcements, agendas and planning will be *[how are these items communicated – distributed by email, say? Shared somewhere centrally such as a Slack or MS Teams channel?]*.

It is important to stay current with literature. Some lab meetings will be set aside for journal club or for the presentation of interesting and relevant literature. Each member will get a chance to present a paper; paper choice should be discussed in advance with your supervisor.

From time to time, there will be professional development workshops. This could include improving CVs, discussing conferences, job opportunities, etc. Many resources and workshops are also available elsewhere on campus (such as the Centre for Teaching and Learning or SPGS).

# Lab and Office Space

Space is provided for all research activities (data collection, analysis, writing, etc.) as well as personal workspace. Collaborative rooms *[or other space]* can be booked for project teamwork via *[detail process - shared calendar/individual responsible for resource booking/etc.]*. The best way to get the most out of the research space is to be present doing research work and interacting with other trainees from the other labs. However, circumstances can sometimes make in-person research practices difficult. Please be patient with each other and with yourselves.

We respect all COVID-19 protocols and guidelines – departmental, institutional, regional, provincial and federal. When you are present in the lab, follow physical distancing guidelines, keep your distance from others and follow any traffic plans. Wear an appropriate face covering when entering/exiting buildings, in indoor shared spaces and wherever else is advised.

The open office space should not be used to hold TA office hours because it is an open office. Graduate students who are working as TAs may wish to reserve *[some other specific space]* for this purpose. You may also wish to hold office hours in a set location at Weldon Library where you can book small study rooms for this purpose.

Our *[any other relevant space, such as research testing areas]* are located *[location]*. These can be booked *[detail process]*.

# Lab Communication

The following are collaborative platforms and this is a collaborative lab. Use the following for sharing project communication, processes and knowledge.

*[Consider making etiquette rules for communication. You might wish to make clear that collaborative platforms are for lab/research purposes and personal/direct communication should be discouraged.]*

## Slack/MS Teams Channels

*[If you use Slack and/or MS Teams, describe how here – what kinds of communications should take place where]*

## Basecamp

*[If you use Basecamp for project or lab communication, describe how here – what kinds of communication should take place on Basecamp]*

## Wiki

*[If you maintain a wiki, describe it here, including whether maintenance falls to individual members of the lab]*

## Website

*[If your lab maintains a website, detail its use and maintenance, including any expectations for content that fall to individual members of the lab]*

## Email

All students have their own email addresses provided by the University.

*[What kinds of communications should take place by email. If there are other email addresses that students should be aware of, such as participant recruitment or a distribution list for the whole lab, describe them here]*

## Calendar

*[Describe use of any lab calendar(s) here. Don’t forget to mention how calendars are sometimes used to book rooms or equipment as well. Consider including religious holidays to your lab calendar to remind everyone not to schedule meetings on those days. Also consider including such things as Pride month, National Indigenous People’s History month, Black History month, etc. Encourage the lab to celebrate these in some way.]*

## Project Management

*[Describe use of any project management tools such as Trello or Asana]*.

# Conferences

One of the best ways to present current research, to find out about other cutting-edge research and to meet other scientists is at scientific conferences and conventions. Information on conferences relevant to this lab is available *[location, such as a wiki or Slack]*. Many have moved to a virtual format – either temporarily during the COVID-19 pandemic or permanently. This may allow attendance at more conferences than in the past.

In-person conference attendance can be expensive. Look for opportunities to minimize expenses, such as transport costs or accommodation. Save every receipt: hotel, taxi, flight and each meal, etc. These are needed to complete a travel reimbursement submission. Discuss reimbursement prior to attendance so that funding is assured and committed. Funding for conference attendance could come from many sources: PI funding, institutional grants, departmental funding, SOGS or even sometimes grants or travel awards from a conference itself. [If available mention funding to cover childcare costs for those with children aged 2 or under]

Keep a record of your conference or workshop attendance, the appendix of this manual is an ideal place. It can be used during an annual appraisal to ensure that conference attendance opportunities are available to all trainees.

# Research Design

Diversity must be considered in your participant populations and remember that lack of diversity in human and animal participant samples can limit generalizability of results. If your research includes human participants, you should look for any systemic barriers that might limit participation in your research. Unless there is good, robust scientific justification for a single sex or gender in your hypothesis (whether animal or human) to answer your research question, consider if you can avoid it. “Because it’s easier” is not a good, robust scientific justification – explore your assumptions and learn more about best practices in SGBA+.

If your research uses human participants, consider how you select them – for example, if you are often selecting control groups from the campus population you might be recruiting primarily young adults; however, you should be mindful of relevant inclusion/exclusion criteria for your studies. OurBrainsCAN (<https://ourbrainscan.uwo.ca/>) is a research participant registry developed by BrainsCAN. It is a great tool to use because it recruits individuals from communities all over the city and can also allow participants to report prior health conditions or diagnoses that you might be interested in targeting or excluding. Using OurBrainsCAN should result in a more diverse participant pool than simply recruiting undergraduate students from Western’s campus community.

Also consider how the structure of the study, such as time of day/day of the week/number of visits or location, might exclude potential participants – are those justified restrictions or can they be avoided somehow? And what might you have to consider as a result? As a single point of illustration, if you proactively set up study sessions to include an evening, as an attempt to broaden participation, you may then need to consider an arrangement like Western Foot Patrol to escort participants to their cars afterwards, or confirm that public transport is still available. Offering an evening session without additional planning may introduce safety considerations that still discourage people from taking part.

Note that safety considerations apply as much to lab members running the study activities as the participants – no-one taking part in research in any capacity should feel unsafe. If lab members are working alone, ensure that everyone understands what protections are available (campus or building security, for example), what arrangements someone can make to return home safely outside of regular working hours and what they should do and whom to contact if they are concerned at any point.

Lab members should never have to work in unsafe environments. If you are harassed or abused by a study participant, physically or verbally, report it immediately to your lab manager or supervisor and take whatever actions are appropriate to ensure your safety (such as contacting campus or building security). An abusive participant should be reported to the relevant study pool (e.g. SONA, OurBrainsCAN, etc.) and will be ejected from any and all studies.

# Writing and Authorship

This lab carries out scientific investigations. Part of this process is writing up the work for publication.

Writing is not easy and it takes practice. There are a number of ways to gain this practice:

* Class assignments and course work - engage in written course work, such as thought papers, research proposals and research papers. Not all courses have a significant writing component, but many do. *[Western undergrads can explore the following workshops and seminars:* [*http://sdc.uwo.ca/writing/undergrads/wid\_workshops\_and\_seminars.html*](http://sdc.uwo.ca/writing/undergrads/wid_workshops_and_seminars.html)*, grads and postgrads, try here:* [*http://sdc.uwo.ca/writing/gradspostdocs/gradwrite\_seminars.html*](http://sdc.uwo.ca/writing/gradspostdocs/gradwrite_seminars.html)*]*
* Writing short lab reports for each study is doubly useful – it provides writing practice and it will be a record of every study, regardless of whether it is later published, allowing us to track the number of subjects/specific protocol/preliminary analyses. A short write-up can also be included in a manuscript and expanded to a full method section.
* Blog entries - maintaining a professional research blog/website is important for many reasons, but one specific benefit to authoring blog entries is the practice gained and feedback received in describing research for an audience outside the field and outside the department. Note also, this activity is knowledge mobilization.

Authorship on a paper for publication is determined by your role in the research. Authorship is more common for graduate students, but it is possible for undergraduate honours students as well.

This lab supports the principles of DORA <https://sfdora.org/> and as such, journals should be selected on the basis of their suitability for the research and not on their prestige or impact factor. [*list any suitable journals here or provide advice on how to determine which journal to submit an article to*]

Authors on journal articles and chapters are expected to have made a concrete contribution to the project and/or paper. For example, the following are all justification for inclusion as an author:

* You designed one or more of the experiments in the paper,
* You wrote the initial draft for a major section,
* You wrote the entire paper,
* You designed and carried out the analyses.

Not all contributions to a project warrant inclusion as an author. The following are several examples:

* You helped to carry out data collection,
* You created the reference section, table or figure,
* You scored a test or created a data set,
* You helped to proofread or edit.

In these cases, you will be acknowledged by name in the paper.

The order of authorship matters, but there is no consistent agreement how authors should be ordered. One convention is that the first and last positions have special meaning, with last author usually being the P.I. or senior investigator on multi-author projects, and the first author often being the trainee (PhD or postdoc) who wrote much of the paper. Regardless of position, there is also the corresponding author, which is the PI and is ultimately responsible for the contents. The corresponding author could be first or last and, as the name suggests, will correspond with the journal, pay any Open Access fees and correspond with media. *[Include any guidelines specific to this lab.]*

It is important to note, that whilst publishing articles is important, it is not the only important output for a researcher. Aligned with DORA principles, <https://sfdora.org/resource/rethinking-research-assessment-building-blocks-for-impact/>, this lab also values other outputs such as [*add in what is appropriate for your lab such as: learning new techniques and methodologies and developing new datasets, software, reagents or other products. Conference publications, talks, career guidance, mentoring and advocacy roles are all important, as well as research impact through community outreach and collaborations with external organizations*]. Lab members are not expected to engage in all of these, just understand that all outputs are valued.

# Expectations and Roles

The lab director will supervise undergraduate volunteers, undergraduate honours thesis projects, masters students, doctoral students and postdocs. The supervisor role varies according to the specific needs of the trainee. Below are some specifics for this role and the expectations/role for each category of trainee. Many of these overlap (e.g., attendance at lab meetings is expected for many trainees) but in other cases the expectations are specific (e.g., senior PhD students are often expected to play a supervisory role with respect to honours students).

Graduate students will probably receive a tuition scholarship as well as a GTA for fall and winter. They may also receive funding through an external award (NSERC, SSHRC, CIHR or OGS). Departmental funding may be available and information can be found *[link…]*.

## Supervisor Role

The lab director will supervise, guide and advise. While they have their own research interests, their primary role is to be the lab’s director. The lab director does not expect to be an independent researcher above and beyond the scope of the lab. Rather, they set the research agenda and strive to create a culture where all ideas and suggestions are valued. We are all here to engage in fundamental scientific research and are motivated to discover *[describe specific subject matter]*. *[Supervisors also typically have responsibilities outside of research such as teaching, service work or clinical work.]*

As a supervisor, the lab director will:

* Help junior students and undergraduate students decide on, design and implement their research projects,
* Guide senior students in scientific discovery and professional development, reading, editing, suggesting analyses and offering critiques and suggestions,
* Support the career development, personal growth and mental health of all lab members, encouraging both excellence in research and professional development, as well as subjective well-being within an academic environment.

Feedback will be provided by supervisors across a range of domains and should be constructive. Your supervisor might challenge your conclusions from time to time, and may disagree with how you design a study or interpret your work. In this supportive environment, the feedback can be discussed, challenged and positions can change through this process.

If you are a graduate student, the lab director will serve as your academic supervisor and advisor. They will help with course selection, serve as a *de facto* member of your advisory committee, sign official documents and will work with you to ensure that you are aware of and meet your program requirements. They can also be a resource when making career decisions and will support your pursuit of external mentors that can help you fulfill your career goals.

## Research Assistants and Volunteers

Volunteer and work study research assistants work in the lab doing primary data collection, scheduling research participants, undertaking literature searches and engaging in other similar tasks. Research volunteers usually work under the supervision of graduate students. Time commitment is typically 5-10 hours per week and you are encouraged to see if you qualify for work study. See Western’s [Work Study program](https://registrar.uwo.ca/student_finances/bursaries_workstudy.html) for more details.

As a research assistant and/or volunteer, you will have key card access to the office space areas and can request a key for access to *[any specific facilities or other details]*.

## Honours Students

The lab supervises up to *[number]* undergraduate honours students each year. As an honours student, you are expected to carry out an original research project that is related to one of the main themes in the lab. Typically, there will be several projects in development that you can work on. Honours students are often supervised by senior graduate students or postdocs in the lab. The lab director will provide final oversight and *[subsidize the cost of poster printing…]*. If you are submitting the resulting research project to a journal for publication, the supervising trainee and/or the lab director will act as senior (final author) on any journal submissions or conference proceedings.

In addition to the general requirements of the honours thesis course, there are several general milestones and duties that honours students are expected to carry out:

* You are expected to attend the weekly lab meetings as often as classes allow,
* You will select a specific project in the first two weeks of the term. Most projects will be part of the overall focus of the lab and may be related to a project that is being conducted by a graduate student (in which case, you will work with the graduate student on the project),
* You should complete an annotated bibliography for your project that includes 10-15 papers that make up the core literature on the topic. The format is variable, but it is typically a list of each reference followed by a 1-2 paragraph summary of the research and why it is important to the current study. *[See section 2.4 for information on the reference management system used in this lab and reference it again here.]*
* You should give a practice version of your thesis talk and/or poster presentation in a lab meeting.

## MSc Students

Master’s students are bound by the department’s general guidelines *[include the URL]*. The overriding expectation for master’s students is that they will be active participants in the lab - spending time in the lab and attending lab meetings, relevant seminars, departmental talks and so on. Most master’s students are typically planning to apply to the PhD program or medical school. This is not a requirement, though, and acceptance into the PhD program is not guaranteed. There are many good reasons to stay and pursue a PhD and there are also many good reasons to not do so. Discuss this subject with your supervisor during the course of your study.

You should attend lab meetings as often as possible and present research several times each term. The lab director will meet with you individually at least *[frequency, say, once every other week]*, for *[duration]*, to discuss projects, program, course work and plans. Meeting time will be agreed collaboratively and should be protected from encroachment by other duties as much as possible.

In the first year in the lab, you will be assigned an initial project. This project will be related to one of the lab’s primary research themes and you will work with your supervisor to develop the idea into an empirical research project. You must read and master relevant background literature, help design the empirical protocol, apply for or amend ethics protocols (see section 2.6 that includes Ethics issues), collect the data and run the primary analyses. Your supervisor will assist with any of these aspects, as will senior students.

You will present your research (proposed, in progress, and/or completed) at advisory committee meetings. Lab meetings are good venues for practice talks. Conference attendance is encouraged for all graduate students. This is a chance to present to the scientific community and to network with other scientists. See section 6 on Conferences for more information.

The capstone to the master’s program is the master’s thesis. The master’s thesis should be an experimental and/or computational project that you designed, with input from your supervisor. The central work should be within the range of topics that are being investigated in the lab. An experimental thesis will typically contain a literature review introduction, a full write up of two or more experiments that you designed, conducted and analyzed, and your interpretation of the results. The initial project assigned in the first year (above) may or may not evolve into a master’s thesis.

Though it is not a requirement of the master’s program, preregistering your master’s thesis work with the Open Science Framework (see section 2.2 on Open Science for more information on OSF) is encouraged.

Although it is not a formal requirement of the master’s program, students can and should be involved in other research projects as well. This may include scheduling research participants, running experiments, conducting basic analyses, etc. on projects led by the lab director, senior PhD students or projects with honours students. The best way for you to improve your research ability and skill is to keep doing it, to work on research projects and to think about projects that test the predominate theories in the field.

You should publish and/or present your thesis if possible. The outlet will depend on the topic and also on the outcome of the experiments. Preregistration will facilitate the process by having some initial peer review of the project. As you are designing the study, you should discuss this with your supervisor.

During the summer between first and second year, you should discuss your plans for after the master’s degree with your supervisor. The transition from master’s to PhD is a natural progression, but a PhD is not for everyone. Here are several key questions that might help the decision-making process:

* Do you want to commit the next half of a decade to being in a lab?
* Do you want to work on the same projects for month or years?
* Are you passionate about *[field of science]*?
* Have you considered career paths that do or do not require a PhD?

Pursuing a PhD would necessitate answering “Yes” to all four questions. If not, it may be better to consider stopping with a master’s degree. You should not feel pressured into a PhD program.

## PhD Students

Doctoral students are bound by the department’s general guidelines *[include the URL]*. PhD students should be active participants in the lab but be working toward independence as well. They will spend time in the lab, attend and lead lab meetings, attend area seminars and attend departmental talks. PhD students should take the opportunity to help mentor and supervise undergraduate students in the lab (such as honours thesis students), to supervise undergraduate research volunteers and to help mentor more junior graduate students.

Many of the duties of a PhD student are similar to a master’s student, but the level of commitment and expectations are higher as a result of the longer degree duration. You should attend lab meetings as often as possible. You will meet with your supervisor individually *[frequency, say, every other week]* for *[duration]* (or more) to discuss project work, the program, course work and plans. Meeting time will be agreed collaboratively and should be protected from encroachment by other duties as much as possible. It is your responsibility to present your research (proposed, in progress, and/or completed) at regularly scheduled meetings.

During the first term, you will choose an advisory committee. It typically consists of your supervisor and at least two other faculty members *[and any other specific requirements of an advisory committee]*.

The capstone to a PhD, of course, is the dissertation. This is an original research project that should be an experimental and/or computation project that you primarily designed and carried out, with input from your supervisor. An experimental thesis will typically contain a literature review introduction, a full write up of several experiments that you designed, conducted and analyzed, and your interpretation of those results. Though it is not a requirement of the PhD program, preregistration of the master’s thesis work with Open Science Framework (see section 2.2 on Open Science for more information on OSF) is encouraged. Example dissertations from prior students in the lab can be accessed at *[location – e.g., lab DropBox, OneDrive, Google Drive etc.]*.

Although it is not a formal requirement of the PhD program, you can and should be involved in other research as well. This can take many forms – assisting others with their research such as scheduling research participants, running experiments, conducting basic analyses, etc. Collaboration with other PIs is also encouraged. The best way to improve on your research ability and skill is to keep doing it, to work on research projects and to think about projects that test the predominate theories in the field.

You should publish and/or present your thesis if possible. Preregistration will facilitate the process by having some initial peer review of the project. You are encouraged to supervise honours students as well as undergraduate RAs. All graduate students are encouraged to attend conferences. They are a chance to present work to the scientific community and to network with other scientists.

Planning for the future is complex and can be daunting for PhDs. You should discuss your career plans with your supervisor and with your peer group within your program and with students in other programs. The majority of PhD students do not end up in tenure track faculty positions, but rather work in other industries. There are opportunities with technology companies, consulting firms, government groups and university research. If you are considering an academic career, your focus should be on developing a line of research that you are passionate about, to publish and present in that area, to attract funding in that area and to seek out additional training as a postdoc. For a career in scientific research outside the academic world, the planning is similar, but developing non-transferable skills (data science skills, programming, analysis, etc.) is also important. Consider postdoc fellowships that offer internship opportunities, like the Mitacs program. Talk to other graduate students and postdocs about their experiences. Do not be afraid to ask for help and guidance from your supervisor/advisory committee/grad provost’s office (SGPS)/other organizations.

## Postdocs and staff scientists

You will be developing your own line of research, while providing training and mentorship to others in the lab. You will increasingly look like a principal investigator over time, giving talks and writing grants. *[PIs are encouraged to expand this section with their own expectations for postdocs.]*

# Thanks

Development of this lab manual has benefited from the work of:

Paul Minda, Western University - <https://mindalab.com/>

Mariam Aly, Columbia University - <https://github.com/alylab/labmanual>

Jonathan Peele, Washington University - <http://jpeelle.net/peellelab_manual.pdf>

Maureen Ritchey, Boston College - <https://github.com/memobc/memolab-manual>

# Appendix I

Training and professional development record – use this space to record conferences, workshop attendance and similar. Keep any certificates of completion with this document. You may find it useful when carrying out an annual review with your supervisor.

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# Appendix II

Notes