Lab philosophy, policies and objectives

Overview

My lab functions quite differently from most, in part because we find ourselves at the intersection of many research cultures (ecology/evolution, medical, basic biology, social science, math). In most biomedical research, student projects are assigned by the supervisor as small, digestible chunks, usually funded off specific grants with specific goals. Students are thus largely cheap labor. This is to some extent inevitable in basic biology research requiring expensive reagents, etc., but it is not a good way to train young scientists to think independently, and I do my best to avoid this system. If you are an MSc or Ph.D student in my lab, you are not here as labor for my projects. You are here to learn to become a world-class researcher. When possible, I put this approach explicitly in my research grants. This allows me to finance stipends for bright students while offering them the possibility to pursue whatever directions they like. It also helps me avoid a key source of tension in many labs: the need of the supervisor to produce specific results quickly, versus the need of the student to learn independently.

My other primary goal in taking on students and research professionals is to create a world-class research community. The best science often emerges from high-level discussions among many brilliant researchers from different backgrounds, and if I accept you into the lab it is because I think you have something to contribute to – and gain from – that community. I want our lab meetings to generate ideas that none of us would have had alone, and I want us all to learn from the diverse perspectives of the others. I actively seek students from diverse academic fields, as well as with diverse life experiences. Our regular lab meetings are the core of this, but we also regularly go out together for lunch, dinner, or a drink. While participation in social events is obviously optional, participation in the sense of lab community is essential for us all.

Lab principles

Motivation

I expect everyone in my lab to be motivated by some combination of scientific curiosity and a desire to make the world a better place. We all need to make a living, and we all have social/family lives outside work, but if your primary motivation in showing up is to play by the rules and get a paycheck, this lab is not the right place for you. I am not a slave driver and can be flexible about helping you achieve a work life balance, but you need to demonstrate a similar dedication and flexibility. There are often federal, provincial, or university rules governing aspects of how the lab functions (salary/stipend levels, work hours, etc.). These rules are often good, but can also be rigid. We do not openly flout these rules, but we do not hew rigidly to them when this goes against common sense. If you show an appropriate flexibility and dedication from your end, you will find me generous from mine. This principle informs much of what is written below.

Good science is not hierarchical

Or, rather, it is a hierarchy of ideas, not status. My status as professor/supervisor gives me control over budgets, power to decide who to hire/supervise, and access to data, but it does not ensure that my ideas are better than yours. I hope sometimes yours will be better than mine! The lab policies outlined here reflect this tension between the power I inevitably have, and my wish to create a scientifically egalitarian community.

Research skills to acquire with an advanced degree.

An advanced degree is a process of acquiring a variety of specific knowledge and skills. Much of what you will acquire is specific to your project and field, but there are some general skills that all students in my lab are expected to develop. It is your responsibility to develop these skills on your own, in addition to the formal ways I work with you. Here are some of the key skills:

1. **Perform a literature review.** You need to learn how to search online databases of scientific publications and find publications relevant to a certain subject or question. You need to learn how to read large numbers of articles quickly, extracting the key information from each article and making judicious choices about when to read in more detail. It is important also to view articles not as independent entities, but as contributions from a given lab, researcher, or collaborative group. This helps put them in a larger context and identify potential biases.
2. **Get up to speed in your field.** You will need to perform a broad literature review around your principal topic of interest that will sometimes lead you far afield. For example, my Ph.D thesis was on how circulating antioxidant levels in wild birds might be related to the evolution of lifespan. In the process, I became relatively expert in the following fields (much of which I have since forgotten): (1) Antioxidant biochemistry; (2) Measurement techniques for antioxidants in blood and tissue samples; (3) Biological mechanisms of aging; (4) Comparative biology of aging; (5) Avian ecology; (6) Techniques for taking and storing blood samples from wild birds, and biases in that process; (7) Evolutionary biology and techniques like phylogenetic analysis; (8) Basic and mid-level multivariate statistics; (9) Data management and cleaning; (10) Nutrition and micronutrients. This list is likely far from exhaustive, and gives a sense of how widely you will need to read on your chosen topic.
3. **Identify the right scientific question.** This is the key to being a good scientist. Without this, all your efforts are for naught.
4. **Clean and manage data.** This step in research is often forgotten, but is critically important. What do you do with a very strange value, such as a human height of 2.3m? What about missing data? How are the data organized to facilitate analysis? How are different versions of the data stored, and can the steps of management be retraced if an error is found or a different cleaning procedure is desired?
5. **Statistical analysis.** Obviously, this is at the core of much of our lab's research, and we will devote substantial time working on this. The most important principle is that rules are not written in stone, and you need to think through what each analysis means in the context of your question and the possible biases.

6. **Data presentation.** Once the analyses are done, the key results need to be communicated clearly, usually through tables and figures. Arriving at the right presentation format is essential to convey your findings well, and is an art in itself.
7. **Writing a scientific article.** This is one of the hardest tasks for students, and your first article will likely require many revisions before it can be submitted. In most cases, it would be much faster for me to just write the article for you – the goal of the process of revisions is thus for you to learn how to write, and you need to read my comments carefully as part of a learning process, not just changes to be implemented. Critical issues to consider are **audience** (who will read this, and what do they already know?), **content** (what information is needed and what is not?), **structure** (what information goes where to ensure a logical flow?), **angle** (the same data can be presented many ways; what is the best way to convey the key findings?), and **sales** (publishing a scientific article is an exercise in marketing it to reviewers, editors, and readers, and this needs to be considered, distasteful as it may be).
8. **Oral presentations.** You will need to be confident presenting your work and discussing it broadly with colleagues, and to be able to arrive at a logical structure that takes into account the background needed for a given audience.
9. **Time management and prioritization.** If you don't put sufficient attention into the details of your research, you will make big mistakes. But if you lose the forest for the trees, you will never accomplish anything. You will also likely have other tasks in life, and your thesis is unlikely to be pressing (rarely a deadline *tomorrow*). You will need to find the right balance in all these things to advance well.
10. **Be organized.** Whatever your research type (bench, field, statistics), you will need to keep careful track of all the steps of your research and be able to retrace your process. This is essential for finding errors/anomalies, but also for eventually writing methods and reproducing results. You will need to figure out how to be organized.
11. **Independence, collaboration, and how to get help.** None of us can be sufficiently expert in all fields to succeed without collaboration, but you also need to be able to work independently. You will need to learn to motivate yourself, make your own schedule, develop your own ideas and approaches. You will also need to learn when to ask for help and who to ask for it (hint: not always me). You will need to learn to draw on strengths of different people inside and outside the lab, and to work collaboratively when appropriate.
12. **Research ethics.** Most research involves some ethical considerations (treatment of animals, human experimentation, confidentiality of health data, etc.). Because we work largely with existing data sets, these issues often concern our lab less than some others. Nonetheless, you will need to consider ethics in research and the importance of maintaining high standards. One small error that gets publicized can have grave impacts on the whole research community. You will also need to consider ethical issues surrounding honesty in publishing and the tension between advancing one's career and doing the best science. There are many difficult moral questions that arise daily in research, and now is the time to start considering them.
13. **Understanding science as a system, and how to succeed in it.** Like a traffic system or an ecological system, science itself is a system. Just as congestion, traffic lights, and road patterns

affect the routes people take, their commuting times, and the efficiency of transport, in science, career opportunities and incentives structure how science gets done, what questions are asked, and how valid results are. People are drawn toward careers in science by factors such as salary, job availability, and interest. Grants are funded by organizations, public or private, and these organizations impose specific rules. Publications happen in journals through a system of peer-review. The small details of this system have major impacts on how science works and how effective it is at producing new knowledge. They also affect potential biases. You need to be thinking about the system of science and how it impacts everything from your project choice to your results to your career. You need to learn not just that science is a system, but also the details of how that system works. What are reviewers looking for in a manuscript? What kinds of career paths are available? What achievements are necessary to pursue different careers? What is required to succeed in a grant competition? You must not become so expert in working the system that you lose sight of why you are here, but you cannot ignore the system if you wish to pursue a career in it.

Lab policies and functioning

1. Choice of research project

MSc and Ph.D students. As indicated above, students are not cheap labor in my lab. Because my research mostly uses data analysis and simulations, I can allow my students substantial free rein to choose their own projects, and I have made a decision to accept any student into my lab if I think (a) the student is right to be pursuing the degree based on his/her background, interests, and abilities; (b) I have some kind of useful advice to contribute; (c) the resources needed to succeed are present (stable financing, relevant expertise from co-supervisors, etc.), and (d) I have sufficient time to supervise adequately. Note that this means you can come from any discipline and choose any project you want. Many of my students will likely choose projects that use the data resources we have available and tackle questions similar to my main interests, both because this is easy and because access to these questions/data are a primary reason to come to my lab. But there is no need for this to be the case, and I fully expect my best students to come and develop questions I would never have thought of, devise their own ways to answer these questions with or without our data, and to publish articles on which I may or may not be co-author.

I will help in the choice of project by offering suggestions (limited, obviously, by my perspective), and MSc students will likely tend to pursue projects more confined within the kinds of questions I regularly pose. Choice of a project for an MSc or Ph.D thesis is also a challenge in terms of scale: the project must be ambitious yet feasible, with low risk of failure. I will work with you to ensure that the project conforms to these criteria, which are often hard to judge for even the brightest young researchers.

Post-docs. While I would like to apply the same principles above to post-docs as well, post-docs cost enough from my budgets that I don't really have this full luxury. In my experience, post-docs are much more productive when allowed to draw on their strengths. I will thus do my best to allow post-docs free rein to pursue any question in which I have a core interest, though in some cases this may be constrained by the need to complete a specific project. The balance between my specific research goals and the latitude for the post-doc will be established at the outset.

2. **Side projects.** All students (MSc, Ph.D, and Post-doc) are encouraged to pursue side projects in which I may or may not be implicated. You are researchers in your own right, and I do not believe my role as supervisor gives me control over your research, except insofar as it uses data proprietary to the lab (and even then within limits). Having students collaborating on side projects is, to me, a sign of a healthy lab. That said, there are some limits. Post-docs are generally expected to be productive in areas related to my core interests, and time for side projects (generally at least 25%) can be negotiated at the beginning of a contract. MSc and Ph.D students are still learning how long things take (more than you think!) and I reserve the right to intervene if I think that side projects are slowing down the core thesis project too much.

3. **Authorship.** Authorship on scientific articles can be one of the main sources of contention between supervisors and students, and I like to have a clear policy. For students, any article which does not use our lab resources is completely under your control. For example, if you come up with a mathematical modeling paper and write it up yourself, the fact that I am your supervisor does not grant me a right of authorship or control over publication; however, if you use our data, or work on a project I assign you within my core research interests, then I retain final control over authorship decisions. Whenever possible, authorship discussions should be conducted openly and early in the writing of articles. Your name will go on any publication to which you make a substantial contribution, either intellectually, writing, or data analysis. In some cases, it may be sufficient to participate in detailed discussions during lab meetings. I tend to err on the side of being generous with credit, feeling that the best ideas often emerge out of discussions in which it is not clear who gets the credit. Nonetheless, your name will not appear on every paper discussed at lab meeting, only on those to which you have made a substantial contribution. In general, to be first author, you need some convincing combination of the following: (1) coming up with the idea for the paper; (2) carrying out the analyses creatively and exhaustively; and (3) writing at least a draft of the paper. One of these alone is usually not sufficient, but two may be. I reserve the right to take over any paper which has been sitting idle for at least six months, and to put myself or someone else as first author if this is merited based on our eventual contributions. (I would only do this if I don't think you will pursue the article, or if there is an urgent need to publish quickly for some reason.) I will also do my best to ensure that all author lists reflect a basic intellectual honesty: no names for political reasons, order reflecting true contributions, etc. As head of the lab, I do retain some control over publications and authorship, but I try to keep this minimal: students should discuss among each other to determine author order on collaborations, and in discussions between me and my students I consider us intellectual equals, though not necessarily administrative equals. If it should happen that you believe a conclusion based on your analyses that I do not believe, I may allow you to publish the paper without my name on it. And I may publish a rebuttal. This is how science works, and I try to eliminate intellectual hierarchy.

4. **Conferences.** I will try to ensure that all students (MSc, Ph.D, and post-doc) are able to attend at least one scientific conference financed by research grants each year. This is crucial for you to be exposed to a diversity of ideas, perspectives, and new research that you won't find here, as well as for networking (which, unfortunately, is essential to succeeding in a research career). The challenge is that the diversity of interests in the lab mean that there is no single conference that regroups all our interests, and it may be the case that I prefer to have your results presented at a conference I go to regularly (such as the Gerontological Society of America) whereas you prefer to present at a conference that lines up better with your disciplinary career goals (e.g. mathematics, economics). It is usually possible to find a solution or compromise, and I will do my best to help you succeed in your chosen field.

5. **You manage me.** The process of getting a higher degree is relatively bureaucratic, and I supervise students in a number of programs and departments. I generally have no idea about the various rules and systems for these departments, and it is your job to be on top of the paperwork, requirements, and deadlines, and to make sure I do my tasks in your supervision. (Part of this is my lack of attention span for such things (a personal weakness), part of it is the number of programs I am associated with, and part of it is the culture here, which is somewhat more bureaucratic than I am used to dealing with.) I try to respond well to my emails, but some slip by. You can remind me and harass me – I won't take it wrong, and if you don't, important things may not get done. A general rule of thumb is that if you don't have a response within a day, a reminder may be in order.

6. **I will be on your side.** I promise I will have your best interests at heart and do my best to help you. I will offer you honest advice even when this goes against my interests, and I will try to help you succeed in your career and in life. My recommendation letters will be honest (expect me to list both strengths and weaknesses), but will also be structured to help you find a job that you can actually do well at and be happy in. (Don't worry that listing weaknesses will unfairly disadvantage you: I will also make clear in my letters that I am not exaggerating to help my students, which gives my recommendation more credibility. I also give details and stories that help readers get to know you as a person, and that helps a lot.)

7. **I will maintain high standards.** If you get a Ph.D from my lab, but I cannot honestly write a stellar recommendation letter for you, your career will not go far anyway. I also think it does no one any good to grant higher degrees to candidates who will not eventually benefit from those degrees. For this and all the reasons listed above, I think it is important to combat the institutional tendencies toward grade inflation and devaluation of higher education. It can be difficult to judge at the beginning of an MSc or Ph.D which candidates will succeed or fail. I feel I owe it to you to let you know as soon as possible if you are not succeeding, and to encourage you to do other things with your life. Better to get out sooner rather than later, after years of debt and/or low stipends, and after using public money to finance a degree you may not use.

8. **Open door.** My office door is almost always open, and I invite you to come in and chat with me. I am here to discuss your research projects, your writing, your studies, your career direction, random ideas, and even personal problems. However, as much as I would love to chat with you for an hour

every day about your research project (really, I would!), the reality is that I am often writing grants, in committees, and attending to various urgent matters that I would rather not have to deal with (life as a prof is not all it's cracked up to be). I will do my best to give you the time needed to supervise you well, and I promise that I will sometimes be able to devote real attention and time to you. But that will not always be the case, and there may be periods of several months when I am not able to give detailed attention. So you need to be independent, and you need to manage me well (see above).

9. **Lab meetings.** Lab meetings generally happen once every week or two. I don't take attendance and you may occasionally have a good reason to be absent, but you are generally expected to be present. This is the primary formal moment for intellectual exchanges among lab members. Times are generally fixed at the beginning of each trimester depending on everyone's availability.

10. **Lunches.** My lab is part of the larger PRIMUS research group, and we have a large table where members of the group often have lunch. You are welcome to join us.

11. **Social events.** We organize regular social events, both for my lab and for the PRIMUS group. There are regular outings for lunches/beers, and occasional parties (holidays, graduations, etc.). These are completely optional. However, interacting with the lab community is an important part of your learning process, and if you don't come to these events you should be finding other ways to ensure that you benefit from such interactions.

12. **Responsibility to use funds well.** All funds supporting our salaries, stipends, and research come either from public money (taxes) or from non-profit organizations. We have a responsibility to use this money efficiently and for the greater good. This affects many aspects of lab policy. For example, at conferences, you are expected to attend sessions most of your time there (this is NOT free vacation, even if you are allowed to enjoy the trip). You will not be reimbursed the maximum possible, but rather the minimum possible to cover your expenses. It also means that I may cut off funding (i.e. stipend/salary) if I don't feel that you are sufficiently advancing the research mission. That said, a climate of fear helps no one, and I will also ensure that you are paid fairly for your work and given warning of any potential problems.

13. **Working hours.** Based on the motivation statement above, I expect you to make your own hours. For students, this will likely go well beyond the 35-40 hours per week normal for an employee. If you are a morning person or a night owl, you have substantial flexibility to shift your hours so that you can be productive and enjoy your life. I will not keep track of your hours, but I will know how dedicated and productive you are. If you need to run errands or go to the doctor, you are free to do so and I will not be keeping track. You can take vacation when you want to, for as long as you want to. After all, if you are not productive, you are the one with the most to lose. If you need me to manage your time for you, you are not cut out for a career in research.

    Despite this broad flexibility, I do impose some constraints on your presence in the lab. (1) I expect everyone to spend a fair amount of time around the lab during normal working hours (9:30

am – 4:30 pm) to make sure there are sufficient opportunities to interact with the others. (2) I expect regular attendance at lab meetings. (3) I expect you to make yourself available to be here when you are needed (for example, as part of a collaboration). (4) I expect to be informed when you will be absent for longer periods, and that you plan longer absences with me if there is any possibility that your presence might be required.

14. **Language.** For those coming from outside Quebec, language use in Quebec is a sensitive topic. Many people here feel that the French language needs to be protected and encouraged. This is particularly true at the University of Sherbrooke, which is a French-language institution. At the same time, English is the international language of science, and you need to be able to use English for professional communication.

    French is the daily language for communication in our lab, and I expect all lab members to, at a minimum, make a good-faith effort to learn and to function largely in French. However, I strongly encourage francophone lab members to interact with me one-on-one in English if they wish to improve their skills. In short, Anglophones should learn French, Francophones should learn English, and everyone else should do their best to learn both. I will help as I can.

15. **Data security.** Some of our data come from collaborators and are their proprietary data. Other datasets contain confidential patient information. You must be very careful to protect this data. The theft of a laptop with the wrong data on it could cause a major scandal, even if the data are never used for any ill purpose. Please make sure you understand when data can and cannot be removed from the lab, under what conditions. Please follow all security precautions (passwords, etc.) needed to ensure that confidential data are not made public. If you are unsure, consult with someone who is or err on the side of caution.