Advanced Membranes (AM) Lab Manual

(updated Sept. 23, 2020)

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Welcome!

This lab manual is for folks in the Advanced Membranes (AM) Lab, led by Jay Werber, in the University of Toronto Dept. of Chemical Engineering and Applied Chemistry. The goal is for this document to clearly lay out guidelines and expectations for lab members, with the ultimate aim of helping everyone to enjoy their work, be productive, feel safe and respected, and develop new skills.

This lab manual builds off of existing lab manuals (in essence, the manual is a modified version of this one from the Aly Group at Columbia). It is also a living document. If you have any suggestions or comments on changes you'd like to see, please let Jay know!

When you join the lab, you're expected to read this manual and sign a form indicating that you have done so.

Lab Values

The core values of the AM Lab are listed below.

1. **Courage –** Do work that matters. Don't be afraid to try/learn something new.
2. **Respect –** Listen fully. Treat others with dignity. Give credit where credit is due.
3. **Integrity –** Do honest work. No shortcuts.
4. **Openness** – Share thoughts and ideas freely. This is how creative ideas are made.
5. **Humility** – Nobody's perfect. Understand when you need help or need a break.

Expectations and Responsibilities

Everyone

Science in an academic lab can be incredibly rewarding and fun, but in the wrong circumstances, it can become isolating and oppressive. In the AM Lab, we want to make sure that everyone is happy, supported, respected, and understood. It will take our collective effort to maintain a positive and successful work environment.

Passion and Honest Science

- Work on what you care about. Find ways to become (healthily!) obsessed with it. To that end, work with Jay to tailor your project(s) to something that fits your interests.
- Do careful work *with integrity*. In Science, once you've lost your credibility, it's gone forever. Plan your experiments well. Present your data clearly and honestly. Double-check your calculations. Ask others to review your work. And NEVER ever should work be falsely or misleadingly presented. In other words, ***no academic misconduct!***
- But, mistakes do happen. Everyone makes mistakes! The key thing is to own up to your mistakes. Tell your collaborators immediately. And even if the work is being written up or is already published, tell all parties involved (especially Jay) about the mistake so that it can fixed. Corrections happen. The worst thing you can do is try to cover up an error.

Working Together and Communication

- Give honest timelines for when something will be done, and try your best to meet that timeline. If you don't think you can meet a deadline, tell your collaborators asap so that they can plan accordingly.
- Be respectful of others' time.
    - Be on time for meetings.
    - If leading a meeting, prepare an agenda and show up early.
    - If you are sharing data in a meeting, take the time to make your work clear and understandable.
    - If you are in charge of a shared instrument, make sure it's functioning well and has clear instructions.
- Give honest (but respectful!!) feedback to your colleagues. A major goal of the AM Lab is for its members to learn and grow. Honest feedback is essential in that aim.
- Practice your presentations, even for group meeting! Communication skills are essential in any workplace. All members of the AM Lab are expected to become excellent communicators.

Respect, Support, and Conflict

- Support your fellow lab-mates. Help them out if they need help (even if you aren't on the project), and let them vent when they need to. **Science is collaborative, not competitive**. Help others, and you can expect others to help you when you need it.
- Respect your fellow lab-mates. Respect their strengths and weaknesses, respect their desire for quiet if they need it, and for support and a kind ear when they need that. Respect their culture, their religion, their beliefs, their sexual orientation.
- If you're struggling, tell Jay or someone else in the lab. Your health and happiness come first. Research is difficult (life can be too). We are here to support you.
- If there is any tension or hostility in the lab, something has to be done about it immediately. We can't thrive in an environment we aren't comfortable in, and **disrespect or rudeness will not be tolerated in the lab**. Any issues, conflicts, or tensions need to be brought up to Jay, immediately. That said, ideally these issues are avoided in the first place through respectful conversation.
- If you have an issue with how something related to the management of the Lab, tell Jay directly if you are comfortable. If you prefer, talk with the appropriate Departmental or University resources.

Hours, Time Management, Work/Life Balance, and Professionalism

- Some believe that to thrive in Science that you must put in insane work hours. This is nonsense. With efficient, focused work, a normal work-week (~40 h/week) is enough to be highly successful.
- When you are at work, it's best to consider it a job. While breaks are always OK to take, being focused and on-task when you are in lab will go a long way.
- Dress code is casual (and you can dress up if you want!) but not *too* casual. When presenting your work, don't wear pajamas and sweat pants—but jeans are totally fine.
- Research is highly unstructured and self-driven, which can be very challenging. Find systems that work for you in terms of managing your varied tasks in an efficient manner. All are strongly encouraged to read the book "Getting Things Done" by David Allen.
- If you're sick, stay home and take care of yourself. You need it, and others don't need to get sick.
- You aren't expected to come into lab on weekends and holidays, and you aren't expected to stay late at night. You *are* expected to get your work done.

- While each person's schedule will vary depending on preference, all are encouraged to work "normal" hours between ~8 am and ~6 pm. This helps ensure that others are around so that nobody works alone (for safety reasons) and to allow for interaction, discussion, and collaboration.
- Finally, have fun and take care of your physical and mental health. Have a life outside of lab. Take breaks. Take vacations. Go for a run. Go out for lunch. Don't ever feel bad for taking time off of work.

Principal Investigator

All listed in "Everyone", and I promise to also…

- Support you (scientifically, emotionally, financially)
- Give you feedback on a timely basis, including feedback on project ideas, conference posters, talks, manuscripts, figures, grants
- Be available in person and via e-mail on a regular basis, including regular meetings to discuss your research (and anything else you'd like to discuss)
- Give my perspective on where the lab is going, where the field is going, and tips about surviving and thriving in academia
- Support your career development by introducing you to other researchers in the field, promoting your work at talks, writing recommendation letters for you, and letting you attend conferences as often as finances permit
- Support the development of your scientific and non-scientific skills, especially written and oral communication
- Help you prepare for the next step of your career, whether it's a post-doc, a faculty job, or a job outside of academia
- Care for your emotional and physical well-being, and prioritize that above all else

Post-Docs

All listed in "Everyone", and you will also be expected to…

- Help train and mentor students in the lab (both undergraduate and graduate) when they need it – either because they ask, or because I ask you to
- Present your work at departmental events, at other labs (if invited), and at conferences
- Apply for grants and fellowships. Though I will only hire you if I can support you for at least one year, it's in your best interest to get experience writing grants – and if you get them, you'll be helping out the entire lab as well as yourself (because you'll free up funds previously allocated to you)
- Apply for jobs (academic or otherwise) when you're ready. If you think you'd like to leave academia, that's completely ok – but you should still treat your post-doc seriously, and talk to me about how to best train for a job outside academia.
- Challenge me (Jay) when I'm wrong or when your opinion is different, and treat the rest of the lab to your unique expertise

Graduate Students

All listed in "Everyone", and you will also be expected to…

- Take coursework seriously but pragmatically, emphasizing the elements that interface with your research.
- Help mentor undergraduate students in the lab when they need it – either because they ask, or because I ask you to. Undergrads can also help you collect data.
- Present your work at departmental events, at other labs (if invited), and at conferences.
- Apply for grants and fellowships. It's a valuable experience, and best to get it early.
- Think about what you want for your career (academia – research or teaching, industry, science writing, something else), and talk to Jay about it to make sure you're getting the training you need for that career
- Make sure you meet all departmental deadlines (e.g., for your exams and thesis) -- and make sure Jay is aware of them!
- Prioritize time for research. Coursework and TAing are important, but ultimately your research gets you your MASC or PhD and prepares you for the next stage of your career.

Undergraduate Students

All listed in "Everyone", and you will also be expected to…

- Assist other lab members with data collection and analysis (unless you are working on your own independent project under the mentorship of another lab member, in which case you should work on that)
- Develop your weekly schedule by talking to your graduate student mentor or your post-doc mentor. You should be coming in every week, and scheduling enough time to get your work done
- If you are earning course credit for research, you must also attend lab meetings when your schedule permits, present at one of these lab meetings, and submit a write-up of your research by the end of the semester

Lab Safety

Some of the work that is conducted in the AM Lab involves genuinely dangerous chemicals and equipment. ***Safety is not a joke!*** All researchers must take (and follow) the required university training classes on lab safety and chemical waste disposal.

Personal Protective Equipment (PPE)

When entering the lab, even if not actively conducting experimental work, all researchers must wear the minimum PPE, which includes closed-toe shoes, full-length pants or equivalent, safety glasses, and a laboratory coat. However, traditional cotton lab coats provide a minimal barrier. Depending on your work, you may also consider getting flame- and chemical-resistant lab coats. Speak with Jay about this. Additional PPE may also be required for certain activities. Read this story about a legendary chemistry professor and the importance of PPE.

Engineering Safety Measures

While PPE is an essential part of lab safety, the first step is minimizing exposure to unsafe scenarios using engineering controls. Work with organic solvents must be done in fume hoods to prevent exposure to hazardous vapors. Secondary containment must be used to catch leaks.

Labeling and Clutter

One of the biggest contributors to unsafe lab situations is sloppiness, which most often takes the form of clutter, unlabeled chemicals, and unlabeled experiments. It is incumbent upon everyone to maintain a clean and tidy working environment. Leave a shared workspace cleaner than how it was when you arrived. For chemicals, a beaker with a clear liquid might be water, or it could be an acid, base, or organic solvent. **Be respectful of the safety of your colleagues** and label all chemicals. Additionally, all experiments must be labeled using our laboratory experiment cards. Each card will specify important notes such as the experiment goal, researcher name, any specific hazards, what to do in emergency, and researcher email and phone number.

New Experiments and SOPs

When planning out a new or unfamiliar experiment or reaction, researchers must seek guidance from researchers experienced in that experiment (if possible) and look up existing procedures and SOPs, specifically identifying any potential hazards that might occur. If any non-trivial hazards exist, an SOP must be written and then approved by Jay prior to the experiment being conducted. This SOP will help mitigate safety risks for the lab member, but also future lab members seeking to do similar studies.

Code of Conduct

Essential Policies

The lab, and the university, is an environment that must be free of harassment and discrimination. All lab members are expected to abide by the University of Toronto policies on discrimination and harassment. Essential policies of the University of Toronto can be accessed here.

The lab is committed to ensuring a safe, friendly, and accepting environment for everybody. We will not tolerate any verbal or physical harassment or discrimination on the basis of gender, gender identity and expression, sexual orientation, disability, physical appearance, body size, race, or religion. We will not tolerate intimidation, stalking, following, unwanted photography or video recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention. Finally, it should go without saying that lewd language and behavior have no place in the lab, including any lab outings.

If you notice someone being harassed, or are harassed yourself, tell Jay immediately. If Jay is the cause of your concern, then reach out to the department chair or another trusted faculty member in the department.

Scientific Integrity

Research (Mis)conduct

The lab is committed to ensuring research integrity, and we take a hard line on research misconduct. We will not tolerate fabrication, falsification, or plagiarism. Read U of T's policies on the conduct of research carefully.

There is undeniably pressure to succeed in academia (publish a lot, publish in high impact journals) that contributes to the occurrence of misconduct. If you are feeling stressed due to this pressure, you should reach out to Jay and we can talk about it. But this pressure is something we all face and is *never* an excuse

to fabricate, falsify, or plagiarize. Not only is research misconduct doing you a disservice, it's also a disservice to the field. And it risks your entire career. It is never right and never worth it. Don't do it.

Documentation and Reproducible Research

All work must be documented clearly in lab notebooks to enable reproduction of the work as well as for later clarification and verification. Lab notebooks must stay in the lab and will be retained by the Lab upon the departure of any given researcher.

Reproducibility is a key part of science. All efforts must be made to ensure that procedures are written clearly and legibly. In many cases, it will be encouraged or required that certain, key experiments are reproduced by another researcher in the Lab to ensure reproducibility.

Authorship

We will follow the guidelines by PNAS and Nature with respect to authorship:

> *Each author is expected to have made substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data; or the creation of new software used in the work; or have drafted the work or substantively revised it*
>
> *AND to have approved the submitted version (and any substantially modified version that involves the author's contribution to the study);*
>
> *AND to have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.*

As a collaborative research group, researchers will be first authors and co-authors on various papers. Authorship has the potential to be messy. To avoid this, authorship will be discussed as needed throughout the course of a project, and Jay will ultimately have the final call on all authorship issues in the group. Typically, the student or post-doc leading a project can expect to be the first author, with co-first author situations also arising for highly collaborative projects. Co-authorship can be the trickiest situation. In general, assisting a colleague with a routine analysis (e.g., measuring a concentration by HPLC) would warrant acknowledgment, but not co-authorship. In contrast, running more involved or specialized experiments (or providing key ideas essential to a project) would warrant co-authorship.

General Policies

Hours

As discussed earlier, ~40 h/week is expected for members of the lab. It is encouraged (but not required) that work is conducted during typical hours, meaning between 8 am and 6 pm. This is to promote collaboration and discussion, as well as decreasing the chances of someone working in lab alone (safety risk). It is not expected that you work on weekends or evenings. To that end, if you receive an email from Jay on the weekend or evening, it is not expected that you reply until the following work day (although of

course you can reply earlier if you want). Similarly, emails to Jay on the weekend or evening might not be responded to until the next work day.

PI Office Hours

In addition to meetings (see below), Jay will often be in his office and be available for a chat. Feel free to stop by for quick discussions. Longer meetings should be requested by email.

Meetings

Weekly Lab Meetings

Weekly lab meetings (~1.5 h each) provide an opportunity to discuss on-going research, as well as hone presentation skills. Lab members will be expected to present regularly on projects of varying levels of completion. The rest of the lab will ask questions and provide feedback. Feedback must be given by all members. Jay will loosely keep track, and will discuss with group members if they are giving too much or too little feedback. Presentations will also occasionally be on other topics, such as updates on conferences and literature review. Meetings will not be held on official and cultural holidays.

Individual Meetings

Individual meetings will be either regularly scheduled or on an as-needed basis, depending on the preferences of each person. In general, individual meetings between Jay and grad students and post-docs will occur weekly or at least twice per month.

Deadlines

As discussed earlier, providing structure is essential to being productive in academic research. Deadlines are an important part of this. All of us must be considerate when it comes to setting deadlines for others. Jay will do his best to ensure that reasonable time is given for tasks asked of group members. In return, group members must try to give reasonable notice to Jay, as below.

Give Jay at least one week's notice to do something with a hard deadline that doesn't require a lot of time (e.g., reading/commenting on conference abstracts, filling out paperwork, etc).

Give Jay *at least* two weeks' notice (preferably more) to do something with a hard deadline that requires a moderate amount of time (e.g., a letter of recommendation).

If you want feedback on research and teaching statements, or other work that requires multiple back-and-forth interactions between you and Jay before a hard deadline, give him as much time as you can; at the very least three weeks.

Writing and Presentations

As peppered throughout this manual, effective oral and written communication is an essential part of academia and any workplace. If two candidates are going up for a job, and one has 10 papers but gives a terrible presentation, whereas the other has 5 papers (of similar quality) but gives an excellent presentation, it's probably the case that the latter candidate gets the job. It is Jay's expectation that ALL members of the AM Lab will become ***exceptional*** writers and speakers. Each group member must put in the time and effort to make this occur. Jay will provide substantial guidance and feedback.

When it comes to improving writing, group members must spend considerable time reading the literature to get a sense for manuscript structure and presentation. The AM Lab will follow the outline approach given by the Whitesides Group. In this approach, an outline of a potential paper is drafted *while working on a project*, with the outline being edited and updated as needed. Doing so makes sure that your time is focused on tasks that will be useful for the final product (i.e., the manuscript). When the project is paper-ready, figures and the overall structure of a paper will be agreed upon by all collaborators. This process can take awhile!! After finalizing the outline, then the actual text will be written. Another important resource is the ACS Style Guide.

Scientific figures are critical parts of manuscripts and presentations. Most people who "read" a given paper will not actually read the whole thing. Rather, they will read the abstract and skim through the figures. Beautiful, clear, and elegant figures are essential. Members of the AM Lab are strongly encouraged to use Origin for scientific charts (Excel is not acceptable) and the free vector-based drawing software Inkscape (or Adobe Illustrator) for scientific drawings. Taking the time to learn how to make beautiful figures pays huge dividends in the long run.

For presentations, the main thing is to practice. The first few times you give scientific presentations, you're nervous as hell. But as time goes on, it becomes more and more routine. Group meetings are a great opportunity to hone these skills. Various departmental events provide other important opportunities. All group members are encouraged to seek opportunities to give talks outside of the university and at conferences (see below). For all of these presentations, especially those outside of group meeting, the talk must be highly polished, with clear slides and a clear narrative. Jay will attend a practice talk to give feedback for all of these presentations. Group members are encouraged to ask each other for feedback on practice talks as well. It is expected that those asked to provide feedback end up doing so.

Conferences

Conferences are great opportunities to meet other researchers in the field, network to find job opportunities, and learn about on-going science. Each group member should think about what conference(s) they would like to attend in the upcoming 12 months, and discuss these opportunities with Jay. In general, ~1 conference per year is a good rule of thumb. Additionally, it will be expected that you present an oral or poster presentation at the given conference.

Recommendation Letters

Letters of recommendation are extremely important for getting new positions and grants. You can count on Jay to write you a letter if you have been in the lab at least one year (it's hard to really know someone if they have only been around for a few months). Exceptions can be made if students or post-docs are applying for fellowships shortly after starting in the lab.

If you need a letter, notify Jay as soon as possible with the deadline (see Deadlines for guidance), your CV, and any relevant instructions for the content of the letter. If the letter is for a grant, also include your specific aims. If the letter is for a faculty position, also include your research and teaching statements. In some cases (especially if short notice is given), you may also be asked to submit a draft of a letter, which will be modified based on Jay's experience with you, made more glamorous (people are much too humble about themselves!), and edited to add anything you left out that Jay thinks is important. This will ensure that the letter contains all the information you need, and that it is submitted on time.

Funding and Proposals

Jay is, of course, responsible for securing funding for the AM Lab. If you need to buy something, or have to charge a grant for something, let Jay know and he will oversee the process.

Grant-writing is an essential part of a professor's job. Training in this element will be important for students and post-docs considering a career in academia. Members of the lab may be asked to contribute small or large roles in writing of certain grants. If you want to gain this experience, please discuss with Jay. Additionally, members of the lab may read any grant proposal that had been submitted by the lab in years past.

Family and Childcare Duties

Some members of the AM Lab will have important responsibilities and needs outside of the lab, which we will do our best to accommodate. If you have duties outside of lab that may affect your activities in lab, please communicate them with Jay ***if you are comfortable doing so***. Through this communication, we can collectively set expectations and create appropriate plans.

In particular, we will aim to have the AM Lab be welcoming and inclusive of those with children and dependents. "There is no good time to have a child" and graduate school is as good a time as any! Members are again encouraged to speak with Jay about childcare plans **when they are comfortable doing so**. This can be important in redefining research activities to limit exposure risks during labwork. The AM Lab will be fully supportive of all parental leaves, more information of which can be found on the UofT Family Care website.