Lab Manual – The intelligent Cyber-Physical Systems (iCPS) Lab

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1 Introduction

Congratulations on joining our research laboratory. We are delighted to have you here and will do what we can to make your time in the lab joyful and productive. We hope you'll develop solid skills (research, technical, writing, time management, project development, etc.), make new friends, and have a great deal of joy throughout the whole process, and more importantly serve the society with your research.

All new lab members are required to read this manual. You are also encouraged to periodically review this manual during your tenure in the lab. You should always feel free to talk to the PI to clarify anything in this manual or to provide suggestions to improve it. This manual sets the expectations and rules for the lab's experience with the ultimate goal being the success of our lab and of every lab member. Therefore, if a lab member is not following through these expectations, they will be sent a written notice (if it is serious) to have it on record. These records could be used when making decisions on continuing working together.

This manual sets the general expectations and rules for the lab. Specific expectations for a category of lab members, for example the education and research productivity requirements for graduate students, are stated in other documents. Similarly, more specific, technical details on the lab's work processes, such as data and code management, are maintained in other manual documents. All lab members are required to read, understand, and follow the expectations and rules set in all these documents, just like the general ones set in this manual. Below is a list of the other manuals.

- **Mentoring Plan and Expectations for Graduate Students**: all graduate students (master's and Ph.D.) must read.
- **Technology Manuals** (including code and data management, task and project management, etc.): everyone must read this collection of manuals.

2 Broad goals and expectations

As a professor, I am expected to write grants and initiate research that will make tangible contributions to science, the academic community, and to society. You will be helping me and our lab carry out research. It is imperative that we

carry out ***good*** and ***ethical*** research. We must always keep in mind that a critical goal of our research is ***publication*** in scientific conferences and journals. I also value ***outreach and informal science education***, both in the classroom and while engaging with the public. I expect you to participate in these components of our lab mission while you are part of, and a ***good citizen*** of, our lab.

Another part of my job is to train and advise mentees like you, to become future members of the scholarly community, not only in your academic success but also your career and personal development. I must contribute to ***your professional development and progress in your degree/career***. I will ***help you set goals*** and hopefully achieve them. However, ***I cannot do the work for you***. In general, I expect you to:

- Learn how to plan, design, and conduct high quality scientific research
- Learn how to present and document your scientific results (in papers, technical reports, conference presentations, etc.)
- Be honest, ethical, and enthusiastic
- Be engaged within our research lab and your education/training program
- Treat your lab mates, lab funds, equipment, and the university properties with respect
- Take advantage of professional development and supplementary funding/scholarship opportunities
- Obtain your degree (for students) or finish your training/exchange program (for postdocs and visiting scientists), complying with all regulations of the program
- Work hard—never give up!

3 Individual Development Plan (IDP) and Annual evaluation

Each graduate student and postdoc must develop, keep up to date, and track an individual development plan (IDP). This is also a requirement of many funding agencies that support your positions financially. Undergraduate students and other members are encouraged but not required to develop their IDPs.

Each year we will sit down to discuss your progress and goals, at the end of the Spring semester, or during the summer, or at another appropriate time.

- At that time, you should remember to tell me if you are unhappy with any aspect of your experience as a lab member. We should also discuss any concerns that you have with respect to my role as your mentor/supervisor. If you feel that you need more guidance, tell me. If you feel that I am interfering too much with your work, tell me. If you would like to meet with me more often, tell me.
- At the same time, we will evaluate your performance metrics (e.g., your publication, your research results) and your progress towards your final program goals. I will tell you if I am satisfied with your performance and progress (for example, if I think you are on track to graduate by your target date). It will be my responsibility to explain to you any deficiencies, so that you can take steps to fix them. This will be a good time for us to take care of any issues before they become major problems.

For an effective annual evaluation, you must update your IDP (if applicable) and prepare a short self-evaluation report that addresses your performance / accomplishments during the past year, your next year's plan, as well as any concerns / issues you want to discuss. Your evaluation may impact the decision on continuing working together.

4 General Expectations for Everyone

4.1 You will develop strong research skills

Almost all members of the lab will be involved in research as their primary jobs, to different extents and requirements. The higher level/rank you are in, the higher the expectations in research skills, research productivity, and research quality for you will be. Members at the graduate student level and higher are expected to accomplish the following.

- **Strive to develop and refine stellar research skills.** I expect that you will learn how to come up with good ideas and research problems, and to plan, design, and conduct high quality scientific research.
- **Publish and present your research frequently – *Challenge yourself by presenting your work at meetings and seminars as early as you can and by preparing scientific articles that effectively present your work to others in the field.*** The 'currency' in science is published papers. And because our research is supported by taxpayer

dollars, we have an obligation to complete and disseminate our research. I will push you, sometimes very hard, to publish your research as you move through your training program, not only at the end.

- **Keep up with the literature so that you can have a hand in guiding your own research.** Block at least one hour per week to read papers or do literature searches.
- **Be responsible for your own learning.** For students, while you will learn some fundamental knowledge of our field from courses, taking courses alone will not give you the knowledge and skills required for your research, especially at the doctoral level. *Self-learning is therefore critically important*, for example by reading books and taking online courses. You can ask your mentor and more senior/experienced members for advice on what topics to learn and what resources to use; however, it's your responsibility to ask for advice and to learn. If necessary, especially early on, you should reserve a few hours per week outside your required research hours for self-learning.
- **Learn and practice good organization skills for managing your own research and your progress.** These include maintaining research notes for yourself (paper or digital notebooks), maintaining and organizing your bibliography library and your reading notes, good computer hygiene (file management, data backup, code project management, etc.). You should use some techniques or software to manage your tasks and progress, so that you always have a good sense of where you are, what you need to do, and don't miss any deadlines. To streamline how we utilize technologies for our work in the lab, some rules and policies are set in the ***Technology Manuals***, which *everyone must read and follow* – no exception.
- **Be responsive to advice and constructive criticism.** The feedback you get from me, your colleagues (in our lab, department, college, university, and in our research communities), your committee members, and your course instructors (for students) is intended to improve your scientific work. Do not take criticism personally; they are for your work, not you as a person.
- **It is fine to make mistakes, but make sure you learn from them.** I view mistakes as a natural part of gaining mastery and of doing science — but the key is always to draw out those lessons and apply them going forward. *Never make the same mistake more than once*.
- **Be resilient and work hard to make deliberative progress in your research – *never give up.*** This means making a strong commitment to do whatever is needed to push your research and projects forward.

4.2 You will uphold integrity and quality of our research

- **Do not rush work, ensure research quality and correctness.** Scientists must be careful in their work. Don't rush your work. Carefully think about it. Then think about it again. Design it and criticize it. Implement it. Double and triple-check it. Incorporate sanity checks (and smoke testing in code). ***Use critical thinking*** on your own work and results. Ask others to look at your code or data if you need help or something looks off. Making mistakes is ok, but mistakes shouldn't be because of rushed work.
- **Acknowledge and address mistakes immediately and transparently.** If you make a mistake, you should tell your collaborators and PI (if they have already seen the results, primarily if the paper is being written, submitted, or accepted). We admit our mistakes, then we correct them and move on. Always remember, everyone makes mistakes! Again, making mistakes is ok, but mistakes shouldn't be because of rushed work. And make sure to learn from your mistakes and do not make it again.
- **Uphold integrity and honesty in scientific research.** We all want to get papers published and do great things. But we do this honestly. It is never acceptable to plagiarize, tamper with data/results, make up data/results, omit/cherry-pick data/results, or fudge results in any way. Science is about finding the truth. Not only is research misconduct doing you a disservice, but it's also a disservice to the field, our lab, and your team members. And it risks your entire career. ***This can't be emphasized enough: no academic misconduct! The PI and the lab will not tolerate misconducts in research.***

4.3 You will work to meet deadlines

- **I expect that you will do what you said you were going to do.** And you will communicate with me if you cannot. You aren't expected to work days and nights, but you are expected to finish your work.
- **Strive to meet deadlines: this is the only way to manage your progress.** Deadlines can be managed in several ways, but I expect you to work your best to maintain these goals. We will establish mutually agreed upon deadlines for each phase of your work and for publication. As long as you are meeting expectations and deadlines, you can largely set your own schedule. It is your responsibility to talk with me in advance if you are

having difficulty completing your work so we can adjust your deadlines and expectations. I will consider your progress unsatisfactory if I need to follow-up with you about completion of your work.

- **Be mindful of the constraints on my time.** When we set a deadline, I will block off time to read and respond to your work. If I do not receive your materials, I will move your project to the end of my queue. Allow ***a minimum of two weeks prior to submission deadlines*** for me to read and respond to short materials such as conference papers and ***three weeks*** for me to work on journal manuscripts or grant proposals. ***Add two weeks or more*** if you are not yet experienced in scientific writing, or if your work is still in an early stage. Please do not assume I can read materials within a day or two, especially when I am traveling. You should plan ahead accordingly and always state a deadline when sending a draft to me.

4.4 You will communicate clearly

- **I expect you to communicate with me.** The best teams work by open and frequent communication – don't just wait for our regular one-on-one meetings. I don't want to micromanage you or your work, but I also don't want to leave you alone to let you drift. To navigate this balance, please tell me what you need, and don't assume that I know what this is.
- **Maintain regular meetings and communication with me.** Depending on your progress and the state of your research project(s), we will set up regular one-on-one meetings. ***You must be well prepared for each meeting***, typically by having a summary of your work since the last time we met, having a well-thought plan of what you will do next, maintaining a shared log with me on our meetings (i.e., a brief meeting minute of each meeting). The goal is to make each meeting productive and useful, especially for you. Do not cancel meetings with me just because you feel that you have not made adequate progress on your research; these might be the most critical times to meet with and get help from a mentor.
- **Be prompt.** Respond promptly (in most cases, within 24 hours) to emails and messages from anyone in our lab group, especially from me, and show up on time and prepared for meetings. If you need time to gather information in response to an email or message, please acknowledge receipt of the message and indicate when you will be able to provide the requested information.
- **Ask for help when needed.** If you feel uncertain, overwhelmed, or want additional support, please overtly ask for it. I welcome these conversations and view them as necessary.
- **Discuss work hours, sick leave, and vacation with me directly. Consult with me and notify fellow lab members in advance of any planned absences.** I expect that most lab members will not exceed two weeks of personal travel away from the lab in any given academic year (typically from August to May). An absence exceeding three workdays during a summer when you are fully funded / paid to do research must be discussed with me in advance. If you will be absent, e.g., a personal vacation or a conference travel, during workdays when you are paid to do research/work, you must get advance permission from the PI before any firm plans are made. Always inform me and relevant colleagues in advance of your travel plans that happen during workdays or that may impact your and others' work. Plans must be made during any personal travel to ensure progress and deadlines of your projects and your lab mates' projects that depend on you. Be aware that there will necessarily be epochs—especially early in your training—when more effort will need to be devoted to work and it may not be ideal to schedule time away, e.g., a paper deadline or a proposal deadline.
- **Discuss authorship and attendance at conferences with me before beginning a paper or project.** Don't just assume that someone will be the first author without discussing with me and the author team. If you wish to add other individuals as authors to your papers, please discuss this with me first / early on and before discussing the situation with the potential co-authors. Publishing work done, or directly derived from work done, on your time in the lab and/or using the lab resources without the PI's permission or without co-authorship with the PI and other contributing lab members is strictly prohibited.

4.5 You will be a team player

- **Intellectual Property.** ***All the work that you do in the lab or using resources of the lab will belong to the lab, and ultimately the university.*** You shall protect the physical property (equipment) and intellectual property of the lab and shall ask for permission from me before sharing the lab's property (physical or intellectual) with anyone outside the lab.
- **Attend and actively participate in all lab meetings, as well as seminars that are part of your training program.** Participation in group meetings does not mean only presenting your own work but also providing support to

others in the lab through shared insight. You should refrain from using your computer and other electronic devices during research meetings to pay your full attention. Do your part to create a climate of engagement and mutual respect.

- **Ensure that your work schedule overlaps substantially with others, including myself, to enable strong interactions and conversations.** Our core work hours are from 9 AM to 3 PM every workday, meaning that you can set your own hours, but you must strive to be available during the core hours (except for classes and other mandatory events). We will try our best to schedule group meetings and other lab events during the core hours. ***Please indicate the days that you plan to be away from the lab – including vacations, etc. – on the lab calendar.***
- **Strive to be the very best lab citizen.** Take part in shared laboratory responsibilities and use laboratory resources carefully and frugally. Be *respectful, tolerant of, and work collegially* with all laboratory colleagues: *respect individual differences* in values, personalities, work styles, and theoretical perspectives.
- **Be a good collaborator.** Engage in collaborations within and beyond our lab group. Collaborations demand effective and frequent communication, mutual respect, trust, and shared goals. Effective collaboration is an extremely important component of our mission.
- **Participate in lab activities outside of your research and project(s).** You should contribute positively to our lab, not only in research. For example, when requested, you should help with teaching duties of our lab. You should also participate in or help organize social activities in the lab.
- **Take care of yourself and others.** If you're struggling, tell someone (especially the PI). Your health and happiness are important. Our lab looks out for the well-being of all its members. It's ok to go through hard patches, but you shouldn't feel shy about asking for help and taking care for yourself.
- **Foster a respectful and comfortable lab environment.** If there is any tension or hostility in the lab, something must 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. Tell the PI if you don't feel comfortable confronting the person in question.

4.6 Miscellaneous expectations

- **Like any human, I have a few pet peeves.** These include frequently being late for meetings; making the same mistakes multiple times; not listening to feedback; not following through on your commitments; not taking notes during our meetings.
- **If you are eligible, apply**. Always put yourself forward for opportunities that are open to you, such as fellowships, grants, awards, etc. In most cases, I will not require you to obtain your own funding for you to be in the lab, but this is strongly encouraged. As every opportunity is competitive, be sure to put yourself forward whenever there are opportunities. I will always be happy to support you for fellowships, awards, recognition, opportunities to present your work, and job openings if you see something appropriate.
- **Maintain a physically safe and secure lab environment.** ***If you're sick***, stay home and care for yourself (and let the PI know). ***Ensure the lab door is closed and locked if no one is inside***, because you don't want the lab's expensive equipment and your or someone else's expensive electronics stolen. Turn off the lights if you're the last one leaving for the day (for Mother Earth).
- **Keep the lab tidy and clean.** We have common space and a kitchen in the building for eating and hanging out. Therefore, please eat meals in those spaces, not in the lab. Clean up after yourself. Put food or smelly wastes in the bins in the hallways to keep our lab's physical environment clean. Put lab equipment back where they belong. Keep common areas uncluttered. The workplace is our living space for a significant portion of our daily life, so we want to make it as pleasant as possible for everyone and have it ready for any visitor or participant at any time.
- **Keep noise down in the lab and respect others' need for quiet and focus.** Multiple people may need to work in the lab at the same time. Everyone must try their best to keep their noise level at the minimum, for example by wearing a headphone that doesn't leak sound, not humming to music, and moving loud meetings or events to another room or location (except for official lab meetings and events). If someone is wearing a headphone or trying to have quiet and focus to do their work, do not disturb them except for an emergency (like a fire alarm).

5 Additional Expectations for Different Lab Members

5.1 Graduate Students

All the above general expectations, and those in the **Mentoring Plan and Expectations for Graduate Students**.

5.2 Postdocs

All the above general expectations, and you will also be expected to …

- Develop your own line of research, to become a truly independent researcher after your training.
- Help train and mentor students in the lab (both undergraduate and graduate).
- Help recruiting and hiring students into the lab.
- Help managing the lab, including but not limited to: help maintain the physical environment of the lab, help maintain the lab website and manuals, help manage events and the lab calendar, etc.
- Develop your career plan (with my inputs), keep track of it, and strive to accomplish it after your training.
- Develop skills and experience in funding and apply for grants whenever possible. 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 the entire lab as well as yourself.
- Apply for jobs (academic or otherwise) when you're ready, but no later than the beginning of your 4th year. Even if you decide that you'd like to leave academia, you should still treat your post-doc seriously and talk to me about how to best train for a job outside academia.

5.3 Undergraduate Students

All the above general expectations, and you will also be expected to …

- Assist other lab members with research tasks appropriate for you (unless you are working on your own independent project under the mentorship of another lab member, in which case you should work on that)
- Document your work so other people can understand, replicate, and continue your work in the future.
- Develop your weekly schedule by talking to your graduate student or post-doc mentor. It would be best if you came in every week and scheduled enough time to finish your work.
- If you are earning course credits for research or supported by an undergraduate research program, you must attend lab meetings when your schedule permits, present at one of these lab meetings, and submit a report of your work by the end of the semester or your training program.