The Lu Lab Research Philosophy

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Welcome

Welcome to the Lu lab! As the Principal Investigator (PI) and mentor, my goal is to create an environment where everyone can reach their full potential, achieve their career goals, and grow as both scientists and individuals. This document outlines my philosophy and how our lab functions to ensure we achieve these goals together. Please read it carefully before deciding to join the lab. If you have any questions about this document, whether before or after joining, please feel free to come and discuss it with me.

Research Philosophy

> *"Many flee from science because they think it barren and dry; they believe in the 'myth of heroism' of those who practise it as a ritual, and the 'myth of altruism' of those who renounce more lucrative undertakings in order to satisfy their scientific interest in the service of their native country and of humanity, and in the 'myth of genius' which pretends that, in order to achieve scientific discoveries, it is necessary to have a high level of intellect and marvellous cerebral organization. All these myths merit correction: Science is not arid and disagreeable, and the scientists need not be heroes, altruists, or geniuses. Sometimes it is sufficient that they be artists."*
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> - *Pio del Rio-Hortega (1882 – 1945)*

My responsibility as a PI and a mentor

As a PI, it's my responsibility to create an environment where EVERYONE can thrive. To achieve this, I must secure funding (i.e., writing grant proposals), manage laboratory space to make it easy for everyone to perform their work, design research projects that are slightly above your current skill level so you can grow, provide guidance when you struggle, be honest about your mistakes, and celebrate your achievements even more than you do. I also have responsibilities as a UVA faculty member, such as recruiting, teaching, and serving on thesis committees, but I will always strive to prioritize my role as your PI and best. As a human being, I am certain that I will occasionally get lost and make mistakes along the way. Please feel free to (kindly) remind me if I fail to do my job, just as I will do for you.

Your responsibility as a lab member

You might have noticed that I emphasized "EVERYONE" earlier, and I hope you also agree that ensuring our lab is a happy, safe, and productive place for all is also part of your responsibility as a lab citizen. This includes, but is not limited to, always being polite and respectful to your lab mates, fulfilling your lab duties promptly, actively listening when your lab members present in the lab meeting, communicating effectively, apologizing sincerely when you make a mistake, and always cleaning up shared lab space after you finish your experiments. The last point is often overlooked but should not be. "I am busy with X numbers of important experiments" is never an

excuse for leaving a mess. Cleaning is just as important as setting up your experiments and should be integrated into your schedule. You can work in a clean, shared space because others cleaned before you, and you should return the same favor. Being a decent human being comes before being a decent scientist.

Your responsibility as a trainee in learning to perform rigorous science.

You may wonder why I included the quote from Rio-Hortega and why he concluded that artists are sufficient to be scientists – Think about it, and tell me why by the time you leave this lab. I do sometimes view conducting good scientific research as a form of art that you can only master through practice, not textbooks. We are at a place beyond textbook knowledge and some of your research might even rewrite the textbooks one day. Therefore, if you consider mastering the craft of mastering rigorous scientific research (including publishing papers and securing a tenure-track faculty job in 5 – 6 years) as a form of art, know that it will take practice, efforts, and sweat from you when you sit in front of the benches doing experiments. It also requires your undivided attention when performing experiments, collecting data, analyzing results, and interpreting their meanings. While it does not mean you have to work 24/7, including every weekend and holiday, it is also not a 9-to-5 job. It just isn't. Like all the work involving creativity, it also requires time from you to think, listen, and read from others to find inspiration. Learning how to balance all these tasks and use your time efficiently while caring for yourself and others is the most important skill that you need to learn as a trainee.

Everyone is different.

A research laboratory is one of the places where you can meet talented people from all over the world. However, sharing the same passion for science does not necessarily mean sharing the same personalities or life philosophies. I will do my best to prevent problematic and toxic personalities in the lab, but one thing that you will need to learn, and I guarantee it will help you to go a long way in the future, is to work with people who you may not necessarily agree with. Be professional, as this is a workplace. Learn to distinguish issues between morally unacceptable ones or just different personal preferences. Let me know immediately if you believe you encounter a morally unacceptable situation. Please also feel free to come see me if you are unsure and we can discuss it together.

Everyone also has different strengths. weaknesses, and life goals. I will provide individual lab members with distinct support to help them achieve their goals. One important lesson I learned during graduate school is to avoid comparing myself to other lab members/colleagues. Again, I will try my absolute best to avoid having a bad apple that makes the lab smell intolerable, and please do let me know if you think there is one in the lab as I may not spend all my time in the lab as a PI, and I rely on you to help maintain a positive environment. While I am dealing with any issues, try to focus on what you need to achieve during your time here and maintain your standards. As Nietzsche wisely said, "The worst enemy you can meet will always be yourself."

Everyone is different, but experience has value. *(This part is extracted and only slightly modified from the Freeman lab research philosophy, as my PhD mentor, Dr. Marc Freeman, articulated it perfectly. If you are interested in what else he said, and I can share his full philosophy.)*

“The lab is as smart as everyone in it put together, and cumulatively our group has deep expertise in the things you will want to learn. Exploit this fact to your benefit. Ignore it at your peril. If you need to do something new, ask for help. Have others done this before? What is their protocol? Is there anything not written down on the protocol that I need to know? What are the most critical steps? Be persistent and always try to keep things going. **Do not just grab a protocol and try it on your own.** Go through it with someone with experience. It is good to try to be independent, that is encouraged. Trying to get things written down efficiently so you do not have to ask a person the same question over and over shows respect for their time and effort mentoring you. But for experimental approaches, tools, or other lab-related procedures, it is prudent to ask others with more experience and continue to ask questions until you really get it. This openness to learning from those that came before you could save you a lot of wasted time. Always be hungry to learn from the others around you. Be willing to say: ‘I have no idea, please teach me.’ Be a productive receiver of information and tutelage. In the end, you will learn things more quickly, be shown the most efficient protocol on earth to do what you want, get the inside scoop on all its idiosyncrasies, and you will not run into as many protocol roadblocks.

Follow the directions. NEVER change a protocol before you have been through it the first time. It is written the way it is for a reason. Do not think you can just change whatever you want and expect success.” If you accidentally fail to follow the protocol, document it immediately in your notebook. We are all fascinated by the stories of scientists who accidentally made breakthroughs by mistakes, but those are all under the premise that they kept their books and documented their mistakes well.

Vacation policy and working hours.

My personal belief is to “Work hard, play hard.” Take vacation when you need it but remember that if you are receiving paychecks from UVA, you are subject to the standard leave policies. As your supervisor, I also need to know ahead of time if you plan to be away for more than a week. Plan your experiments accordingly to minimize disruptions and arrange for someone to take over your lab duties. Additionally, assign a surrogate(s) to oversee your mouse colony in your absence. Make sure everything is set at least 24 hours before you leave.

As a wet lab, most of our work is done on the bench with in-house equipment. I therefore expect that you will spend most of your workdays in the laboratory. As a former night owl, I do respect your personal schedule and individual biological clock. However, as your supervisor and mentor, I do need to see you often enough to ensure you are on track. There are also seminars, trainee presentations, and lab meetings that you should attend at regular hours. Therefore, please adjust your working schedule to have at least 4 hours of overlap with the society-defined working hours, i.e., 9AM to 5PM, Monday to Friday.

When doing research in this laboratory is not fun anymore...

My biggest hope is that you can have fun while doing research in this lab, because I always did, and I think it is the best driving force for me to continue to finish my PhD, my postdoc, and the crucial force for me now as a faculty and as a PI. The best indicator to determine if you are happy is whether you wake up in the morning feeling excited to come to the lab. It is unavoidable to have setbacks when doing research and solving questions that nobody knows

the answer to, but we can still have fun and enjoy this journey together. With that said, it is OKAY to not feel happy and think that you may have made the wrong decision coming to graduate school/staying in academia as a postdoc/working in this laboratory. Feel free to let me know if you begin to have this idea in mind at any time. If this becomes a consistent pattern, we can discuss what would work best for you moving forward. You define your own success; DO NOT let anybody else tell you the other way.

However, do not quit on a bad day. I can't remember if it's Lindsey Vonn, or the other one of the greatest athletes in the world, who said during the interview that she often cried and wanted to quit when she was still a little kid receiving all the training to become the best in the game. Her mom would always reply, "I get it. Let's do this one more day though. If you still want to quit tomorrow, we will quit." She never felt that again on the next day because she really loved this sport and wanted to be the best. This interview inspired me a lot. Distinguish whether you genuinely dislike it or if it's just a bad day. Give it some time; I can't tell you how many times I've had similar thoughts about quitting, but they all turned out to be just one of those bad days. My favorite science fiction writer, Philip K. Dick, once said, "Don't try to solve serious matters in the middle of the night."

Strictly Prohibited Behaviors (Violators will be immediately banned from the lab)

1. Lie about your experiments or fake/fabricate your data.
2. Sexually harass or abuse any other human being.
3. Discriminate against your lab mates in any way possible.
4. Physically attack your lab mates and anyone in the department under any circumstance.

I (the PI), _____ (print name), hereby recognizes that I have read the Lu Laboratory Research Philosophy and agree to be bound by it.

Signature: _____ Date: _____

I (the trainee), _____ (print name), hereby recognizes that I have read the Lu Laboratory Research Philosophy and agree to be bound by it.

Signature: _____ Date: _____

Appendix A

Advice to young scientists by Dr. David Ho (6/14/2014 in Cambridge, MA)

1. The primary ingredient for success in science is **the passion for science**. In front of you is the century of science and medicine. Challenges and opportunities abound. A strong passion for science will sustain you.
2. **Do not be afraid to take a chance**. Success in research, as is the case in most endeavors, requires bold decision-making and a willingness to take informed risks. As so eloquently stated by Harold Shapiro, the former President of Princeton, “an excessive zeal to avoid all risks is, in the end, an acceptance of mediocrity and an abdication of leadership.”
3. It is a given that you must acquire the knowledge and develop the skills in your chosen field. However, I urge you to **read broadly**. Go to meetings and listen attentively. Talk science with colleagues from other disciplines. Do not narrowly focus only on your own field, for the breakthroughs may, seemingly and unpredictably, come from “left field.”
4. **Always maintain a deep commitment to excellence**. Never permit the quality of your work to be compromised. Never write a bad paper. Never give a bad talk. Never lower your standard of excellence.
5. **Always seek the truth and learn to challenge phony authority**. Blind respect for authority is the worst enemy of truth. Learn to distinguish between truth and dogma. Unsubstantiated dogma restricts the free thinking that is essential to arrive at the scientific truth. Send out “dogma alerts” in your own mind when you hear personal biases presented as established facts. Do not let yourself be boxed in by dogma.
6. **Know the difference between the words “could” and “should.”** Too often young scientists do the experiment they “could” do rather than the experiments they “should” do. Think about this distinction when you come to each critical juncture in your projects. The former could get you stuck in a rut while the latter could elevate you to new heights.
7. **Strike the right balance between thinking and experimenting, and between “vision” and “action.”** All of us were taught to work hard. Thus, too many young scientists grind away relentlessly, carrying out experiments one after another, without ever reserving sufficient time to read and think. Make regular appointments with yourself for a quiet time to think and to strategize. Remember this old Japanese proverb: “vision without action is a dream; action without vision is a nightmare.”

Appendix B

Resource from the BIMS Mentoring Workshop: Define Research Independence

Here is the domain knowledge that constitutes a working scientist, and how PIs think students should perform in each domain at different career levels. It is just for your reference, and we can discuss together to make one that suits your career development the most.

Domain	Beginning PhD Student	3rd Year PhD Student	5th Year PhD Student	At Your Thesis Defense
Knowledge of research area	• Familiar with the papers that are directly related to your research topic. • Know what's known and what's unknown. • Know what you know and what you don't know.	• Be able to point out caveats or weaknesses in both published papers and preprints. • Understand why the knowledge gap in your research field is not resolved yet.	• Be able to design experiments to address the knowledge gap in the field. • Familiar with the work from prominent labs in the field. • Begin to expand readings into other fields.	• You should be THE expert in the field and even more familiar with your research topic than your PI! • Have sufficient knowledge for your next adventure and ready to go.
Research methods and study design	• Know the basics of study design – e.g., including controls, making records. • Familiar with the principles behind the major techniques you are using. • Practice, practice, practice.	• Familiar with most methods used in the lab and able to teach others. • Be able to design troubleshooting experiments. • Be able to optimize methods.	• Be able to bring new methods or establish a new system in the lab. • Be able to design and propose a project. • Know what a "killer" experiment would be and focus on that.	• Be able to design a research project even outside of your own field.
Scientific writing	• Collect papers that you think are written very well. • Attend writing workshop and course. • Establish your Zotero database. • Practice, practice, practice.	• Familiar with the scientific proposal writing style. • Be able to incorporate feedback from others. • Know useful Word skills (textbox, bibliography, high-res figures, etc.)	• Familiar with how to write a research paper from scratch. • Explore other writing styles if interested (e.g., journalist, educator; scientific review, etc.).	• Finish writing a beautiful PhD thesis that you can feel proud of.
Oral communications of research findings	• When attending seminars, note what you like and do not like about the presentation.	• Have accumulated sufficient slide decks for data.	• Know what it takes for you to give a good talk. • Give a good talk at a conference	• Give the best public seminar of your life.

	• After presenting at the lab meeting, think about what you can do better next time when conveying your project/results.	• Have good intro slides for your project. • Practice, practice, practice.	so everyone remembers you as a good speaker after your talk. • Practice, practice, practice.	
Teaching/Mentoring Excellence	• Explore your own learning style, which usually reflects your teaching or mentoring style. • Save all the materials from your courses just in case…	• Focus on your own research first. • Attend workshops or courses if interested. • Explore potential opportunities to mentor or teach and plan ahead.	• Begin to mentor students or teach if interested in teaching career. • Begin to understand what it takes to establish a research lab if interested in this career.	• Have a full understanding of your mentoring style. • Ready to focus on your teaching career.
Leadership management (taking ownership and agency for their research career)	• Try to say yes to things that you have never tried, or you are not familiar with, i.e. learning to step out of your comfort zone. • Be comfortable making mistakes and own the mistakes. • Meet the standard of the graduate program and the lab. • Learn, learn and learn.	• Time to consider quitting if you hate research or can't meet the standard. • Be able to articulate why you are here and why your research can be meaningful. • Explore the next step after PhD.	• Be able to convince your PI your idea is better. • Begin to plan the next step after graduation. • Be able to set priorities and manage your time well in and outside the lab.	• Have a job lined up after graduation (preferably not doing postdoc in the same lab).
Collaboration	• Learn how to work with people in the lab. • Understand what it means to "have the expertise." • Be the expert of what you do first.	• Be the expert of what you do. • Contribute intellectually to other people's projects. • Learn what other labs are doing by attending seminars or happy hours. • Build relationships.	• Help other people's projects if necessary. • Learn what other labs are doing by attending conferences. • Build relationships.	• Have your collaborators cheering for you in the audience!