



Advice for PhD Students: Tips From Professors, Startup Founders, and Industry Professionals

NICK MORDWINKIN¹, JOSHUA NICHOLSON^{2,3}, GARY S. MCDOWELL⁴, LLEWELLYN COX⁵

1. Curium, Oakland, CA 94619

2. The Winnower, Blacksburg, VA, 24061 USA

3. Department of Biological Sciences and Virginia Bioinformatics Institute, Virginia Tech, Blacksburg, VA, 24061 USA

4. Center for Regenerative and Developmental Biology and Department of Biology, Tufts University, 200 Boston Avenue, Medford, MA, 02155, USA

5. Lab Launch Inc., Los Angeles, CA, USA

ABSTRACT

Here we present various pieces of advice from startup founders, academic professors, research scientists, postdoctoral fellows, and industry executives to current and future PhD students.

READ REVIEWS

WRITE A REVIEW

CORRESPONDENCE:

jnicholson@thewinnower.com

DATE RECEIVED:

June 10, 2015

DOI:

10.15200/winn.142628.87584

ARCHIVED:

March 13, 2015

KEYWORDS:

advice, phd, graduate school, student

CITATION:

Nick Mordwinkin, Joshua Nicholson, Gary S. McDowell, Llewellyn Cox, Advice for PhD Students: Tips From Professors, Startup Founders, and Industry Professionals, *The Winnower* 2:e142628.87584, 2015, DOI: [10.15200/winn.142628.87584](https://doi.org/10.15200/winn.142628.87584)

© Mordwinkin et al. This article is distributed under the terms of the [Creative Commons Attribution 4.0 International License](https://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and redistribution in any medium, provided that the

INTRODUCTION

A lot of attention has been given to the bleak employment statistics PhD students and young scientists face today. Funding deficits, an overall lack of academic opportunities for STEM graduates, and salaries, which cannot keep up with inflation rates are just some of the many issues which have been highlighted.

Some blame the scientific funding environment, which they argue favors established professors with long research track records, making it increasingly difficult for newly minted researchers to obtain the necessary funding to run their laboratories (Day). Others have suggested that the fault lies at the institutional level, where universities continue to train far too many PhD students and postdocs for careers in academia that just do not exist. Whatever the reason, it is clear that we need more discussion and advice for those entering into a complex work environment with little guidance outside what is typically given to students.

Here we present various pieces of advice from startup founders, academic professors, research scientists, postdoctoral fellows, and industry executives to current and future PhD students. We hope this piece will begin to foster discussion towards what is best for PhD students.

COLLEEN CUTCLIFFE, CEO, CO-FOUNDER AT WHOLE BIOME

Maintain optimism and wonder. Most of your training will be centered around critical thinking and unraveling the work of others. This is important. But, just as important is to take a new finding and asking yourself, "What if this were true? What could this mean for our future?" Deep down (deeper for some than others), all Ph.D.'s are optimists. Why else would they continue to push forward in the face of constant failure and setbacks? It is this optimism and curiosity that has driven scientists to discover and improve our world beyond imagination. Tap into your inner optimist frequently and without hesitation!

original author and source are credited.



MICHAEL B. EISEN, HOWARD HUGHES INVESTIGATOR AND PROFESSOR OF GENETICS, GENOMICS AND DEVELOPMENT AT UC BERKELEY

Don't believe anything anyone says. Don't work on anything someone else is working on. Don't be afraid of hard problems or hard work. Study something you love and become the world's expert in it. Publish only in open access journals.

JONATHAN EISEN, PROFESSOR OF EVOLUTION AND ECOLOGY AND MEDICAL MICROBIOLOGY AND IMMUNOLOGY AT UC DAVIS

Learn how to tell a good story about your work. Perfection is the enemy of progress, and of finishing your PhD.

MARTIN A. SCHWARTZ, ROBERT W. BERLINER PROFESSOR OF MEDICINE (CARDIOLOGY) AND BIOMEDICAL ENGINEERING AND CELL BIOLOGY AT YALE

My main advice to grad students is the avoid advice from professors. One of the great things about science is that we are each unique, and, if we are any good, our work is unique. Consequently, we each have to find our own unique path. Discovering your own strengths and weaknesses, following your heart are critical parts of the process of becoming a scientist. My answers won't work for you. So stop looking for advice and go find your own answers!

YURI LAZEBNIK, RESEARCH SCIENTIST AT YALE

Develop your scientific intuition, learn how to defend your ideas, including defending from yourself, and keep in mind when nothing seem to work that good ideas and discoveries happen rarely, but they do happen.

KENNETH M WEISS, EVAN PUGH PROFESSOR EMERITUS AT PENN STATE

An academic career can last forty years! All jobs have their unpleasant side, but if you're lucky enough to get one, it can be exhilarating--both teaching and research. Learn as much as you can about the substance of your field, but read very widely beyond, for enjoyment and edification, but also so you can synthesize and ask "What if current explanations have things basically wrong—what might be right instead?" Life is more than work: Don't slide into a routine research or teaching treadmill: that's the easy path the system encourages, and the temptation is great, but the grinding boredom perhaps worse.

HILDEGARD MACK, POSTDOCTORAL FELLOW AT UCSF

If you want to do a postdoc, consider changing your field. You won't become better if you just continue to do what you are good at anyway after years of graduate research. However, the larger your scientific toolbox and background knowledge, the easier for you to find a solution to a challenging problem and the niche in which you can establish your own lab or startup.

LLEWELLYN COX, CEO, CO-FOUNDER AT LAB LAUNCH INC

Understand that there is no such thing as a 'Career in Industry' - that's just an catchall term for hundreds of possible career paths across dozens of industries. Use your time in grad school to research the possibilities: broaden your reading beyond papers in your field, join a meetup group, follow smart people on social media, reach out to people who are working in organizations that you find interesting. Find the path that's right for you; no one is going to do it for you.

Remember that the only way you will ever be truly free in your work is to work for yourself.

If you're interested in founding a startup, start early. You will never be as risk-tolerant as you are right now. Take risks while you can still afford to lose it all and start over!

NICK MORDWINKIN, TECHNICAL SALES CONSULTANT AT MILTENYI BIOTEC

Mentors and professional networks have an enormous impact on a student's future success. Because of this, it is important to surround yourself with a diverse set of mentors who are good listeners: speak with people who are not only in your particular career area of interest, but also in other fields you may not be familiar with. They will help to provide perspective and insight you may have never heard before.

PAUL NURSE, PRESIDENT ROCKEFELLER UNIVERSITY

Make sure your research project is one that you are enthusiastic about and will undertake with passion.

DAVID WINTERNHEIMER, VP MARKETING AT SANGUINE

Always be prepared to explore career paths outside of the box or off the beaten path. A scientific degree actually opens up doors to a multitude of other careers that use the skills you develop as a Ph.D. without requiring you to work in a technically heavy position. Some areas to consider include technology transfer, intellectual property, business development and project management.

Stay connected with the industry and pay attention to new developments. Get involved with local technology incubators, tech transfer offices and networking groups to keep up-to-date on emerging companies, industry trends and potential career opportunities.

Always have a plan for your future. Although life never pans out like you imagined it would, having perpetual goals will inevitably take you somewhere, even if it's not exactly what you had in mind.

BRIAN NOSEK, PROFESSOR AT DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF VIRGINIA

It is never risky to do the right thing.

All theories are wrong in some important way, so don't get caught up in defending yours. The best person to take down your theory and replace it with something better is you.

In writing, lead with the evidence, follow with the explanation. Explanations will change over time, evidence will always persist.

Getting a positive result may be the key incentive in the present academic culture, but you may learn more from your negative results. Innovation blossoms from when our expectations are violated, not when they are confirmed.

Find ways to share all your results, positive or negative, beautiful or ugly, and how you obtained them. Someone, perhaps your future self, will thank you later.

C. GLENN BEGLEY, CONSULTANT AND FORMER VICE-PRESIDENT AND GLOBAL HEAD OF HEMATOLOGY AND ONCOLOGY RESEARCH AT AMGEN

Choose your lab wisely. A higher degree (e.g. PhD) is an apprenticeship; you are learning the trade, and it is crucial to learn from a master. There is no substitute for time and experience, and you will need both from your supervisor. Most importantly, don't choose a lab because it is "famous", with multiple publications in top-tier journals, and especially avoid a lab if the Principal Investigator has more than 5-6 students and postdocs. That PI will simply not have the time to give you the careful, thorough, training required to build a solid, understanding of the research method.

DAVID ZHANG, FOUNDER, GOGGLES OPTIONAL

Don't spend 70 hours in lab every week. Having a life outside of the lab is important as well. Always be on the lookout for what you want to do next. Networking is important. Networking is important. Networking is important. Networking is important. Networking is important.

JORDAN PLEWS, PROJECT MANAGER, BECTON DICKINSON

Have a backup plan. Despite what you may have been lead to believe, grants and papers aren't everything. With only about 1 in 10 PhDs getting permanent positions in academia, putting all your

eggs in one basket is not just risky, but irresponsible. While ambition and hard work may allow you to beat the odds, many top quality PhDs will simply have to look elsewhere or wait it out in interim positions, often at subpar pay. There are a variety of jobs that require the same skill set required to be successful in academia, just be prepared to leverage what you know and don't confine yourself to one path to success.

KEVIN LUSTIG, CEO, ASSAY DEPOT

Graduate school is one of the few times in your career when you can be totally bold and audacious. Pick a research project that if successful will win you and your advisor a Nobel prize.

At every step in a PhD project, one-half of your mind should be focused on achieving your stated goal and producing rigorous results; the other half should be focused on how to tear down the project and rebuild it.

It is really true that research success is 1% inspiration and 99% perspiration.

You wouldn't buy a new phone without checking out reviews and getting references from your friends. Do the same before selecting a PhD advisor. Your advisor choice will affect every aspect of your life for years to come.

Remember that it's good to have an end to journey towards but that it's the journey that matters in the end.

NOUSHIN NABAVI, POSTDOCTORAL FELLOW, UCSF

To survive in grad school, you should be willing to learn even after you think you've already learnt what there is to be learnt. Patience, tenacity, perseverance, and willingness to fail are other important qualities. Reading, writing, and articulating ideas in the best possible way are definitely the key to your craft as well irrespective of your field.

BROOKE ANDERSON-WHITE, INDEPENDENT CONSULTANT

Look at the job descriptions for industry positions you would want in the future and pick a lab where you can acquire the necessary skills with the most current techniques. Pick a lab that stays up-to-date.

VICTOR HENNING, CO-FOUNDER MENDELEY

My number one tip would be to choose your Ph.D. advisor wisely. Mine was great - very open to criticism, encouraging me to speak up when I thought he was wrong, always ensuring to give me credit for the work I did. We became close personal friends as well. However, I have a couple of friends who gave up on their Ph.D.s, or had a terrible time doing them, because their advisors were petty or egomaniacs. (This is in Germany, where you usually have just one Ph.D. advisor and are completely dependent on their evaluation of you.)

My number two advice would be to set yourself the goal to write 15mins each day, no matter how crappy the stuff you produce - it's to break the habit of procrastination and get into the flow.

JOVANA GRBIC, FOUNDER & CREATIVE DIRECTOR, SCRIPTPHD

Always finish your PhD, no matter how difficult, demanding or frustrating the process gets. You can switch advisors, add a needed collaborator, change projects internally or make many changes to address difficulties. But no one can ever take a PhD away from you once you've gone through the process. And with the wealth of expanding careers for scientists and PhDs, it will open doors for you regardless of the career path you choose.

Never get too high or low emotionally through the PhD process. Navigating a 5-6 year endeavor, particularly the most difficult, demanding one you'll encounter in your life, requires an even keel throughout. Regardless of whether you're publishing a paper in Science or just trying to replicate an

experiment for the umpteenth time, go into each day with a level-headed attitude and remember that it's a marathon, not a sprint. That's the only way you can survive.

MARC EDWARDS, PROFESSOR OF CIVIL AND ENVIRONMENTAL ENGINEERING AT VIRGINIA TECH

Good science is about seeking the truth or helping people. If there is another primary motivation for your current work, you might want to consider doing something else.

TIMOTHY MITCHISON, PROFESSOR HARVARD MEDICAL UNIVERSITY

Start out working on a problem your advisor suggests, ideally with an experienced group member as an experimental mentor. Creative, independent ideas are great, but most students need a foundation of successful experimental experience to know what is doable.

Don't read the literature in your own field too obsessively. You need to have a sense of what is known, but you don't want to get channeled into other peoples' ways of thinking about the problem, or into experimental approaches that the field currently favors. Instead, go to seminars and read outside your immediate field. Think broadly about new ideas and new experimental approaches you might bring to your problem.

At a personal level:

Come up with a resonant personal metaphor to motivate yourself. Some might want to hit a ball out of the park, others to grow a verdant garden or climb the highest mountain. Andrew Murray wants to strike a match in Count Dracula's pitch-black castle. I always wanted to peek under Mother Nature's skirt.

And for our times (no-one listens to this one at Harvard Medical School, but its still good advice):

Try to publish early in a minor journal. Once you have a paper, no matter what journal, you are halfway home. Big papers don't come from saving up lots of small results, they start with one big result. Its better to publish early and often than once at the end of your PhD.

And from the old Kirschner lab:

Try to figure out early if you are a pinhead or a fuzz-brain. Either is good, but no-one is both, and you should pick a problem to match.

CLAIRE WALCZAK, PROFESSOR INDIANA UNIVERSITY, BLOOMINGTON

Think about important problems to address in the field that you are in- this should be the driving force for your studies. Think deeply about the best ways to tackle the problem and then design a strategy that addresses the key points of the problem first.

Always prioritize your work to do the most important and informative experiments instead of the ones that are easiest to do.

Many small steps are likely to move you ahead much more quickly than a giant leap- in other words- don't try to tackle some big complex experiment if you haven't made sure that the parts are working.

Accept your limitations- early on in graduate school you may not have developed the appropriate skill set to be successful at some experiments. This is OK and part of the learning process.

Learn a diversity of approaches- it will broaden your education.

Read both within and outside of your field. The same thing applies to seminars that you attend. Other fields have different approaches and thinking that may enhance your own research.

Never put off until tomorrow that which you could do today.

I advise my students to have at least 3 aspects of a project going: 1 part is in the data collection and analysis stage so that you can be accumulating the necessary data, 1 part should be almost optimized so that it can soon move to the data collection stage, and 1 part should be in the troubleshooting and optimization stage. This will help you balance your time more effectively and insure that some aspect of the project is working.”

DANIELA CIMINI, PROFESSOR VIRGINIA TECH

Graduate school is not a race or a competition. You should compete only against the ambitious goals you have set for yourself. However, if you choose to compare yourself to other students, set high standards, pick the best students in your field and try to emulate them.

Learn the difference between “research advisor” and “mentor,” and seek out the right mentors for you. Regardless of whether your graduate advisor is a good mentor or not, he/she should not be the only one.

HENRY BOURNE, PROFESSOR UCSF

When you don't understand something, never be afraid to admit it. Instead, use it as an opportunity to learn something, by asking the question that puzzles you. If the answer you get isn't clear, ask again. And again, albeit perhaps by consulting a different oracle or doing a new experiment.

Similarly, it is not a sin to propose (or even, briefly, to believe) an idea that is wrong. Instead, it is a huge opportunity. If you are wrong (and especially if many others share your mistaken view), you or somebody else can work to find out the correct answer, and you'll have made a real discovery.

Choose one or two or three heroes in science, and try to emulate their examples. If you pick really good ones, you may never match their insights and accomplishments, but you'll have a standard to measure yourself against.

Wherever you are, whatever problem you tackle, try to make sure you work with people who are at least a bit smarter and more knowledgeable than you are. If you pay attention, their ideas, feedback, and examples will make you smarter than you are now.

Do your very best, at every stage of your career, not to bury yourself in a single narrow problem. Instead, stretch your lateral dendrites as far as you can, trying to find the hidden connections between questions and problems that (usually) only appear completely unrelated. Real discoveries come, almost always, when somebody fills in the dots between two apparently separate ‘facts.’”

JULIEN THÉRIER, FOUNDER OF SHAZINO

Go to University (or Engineering school) to do a job that you love, not to earn money. Your salary is often someone else's decision, so your main goal should be to do what you want to.

If possible, try to spend some time abroad in foreign universities.

Be honest with yourself. Identify what you're good at and what you're not (very) good at.

In academia (at least) people succeeds thanks to the system. So don't try to break it down or we'll fail, but try to improve it everyday and we'll have a chance to change it for the better.

ROGER CHEN, VENTURE CAPITALIST AT O'REILLY ALPHA TECH VENTURES

Always have side projects. It's important to focus, but it's also important to evolve, and there are few better ways to do so than having side projects.

HARRY F. NOLLER, PROFESSOR UC SANTA CRUZ

1. Who am I talking to?

First, my comments are directed to grad students who intend to go into an academic research career and run their own labs. Although many of you may be going into industry or pure teaching positions, it is generally the case that the other places will value you most if you prepare as if you are heading for academia.

2. Who should you listen to?

Many students rely mainly on the advice of other students. I am concerned that this is a case of the blind leading the blind. I would recommend asking faculty members for career advice. Pick several faculty whose work and style you admire, and ask them all the same questions. You will of course get different answers, but there will usually be a vein of agreement running through them. Hopefully, my advice will become just one faculty opinion out of many. I don't mean to discourage you from asking other students as well, but their take on things often suffers from lack of experience in the larger world of science, and information that becomes distorted as it passes through many people (the "telephone game").

3. What should your priorities be?

In the world of science, your CV is your credentials. Your value to the world will be, in ascending order, the institution where you did your undergrad training, the institution where you did your graduate and postdoctoral training, who you did your graduate and postdoctoral training with, your letters of recommendation, but most importantly your list of publications (especially your first-author papers). The courses you took, your grades and your GRE scores will eventually vanish from the record.

4. How should you approach your graduate research?

Usually, an incoming grad student is too naive to come up with a project that is (a) not already published or in the works in some other lab; (b) an important addition to the field; (c) can be completed by a grad student in a few years and (d) something that is relevant to the grant that funds your advisor's lab. So, you will usually take on a project that is suggested by your advisor. (So pick an advisor whose suggestions you will like.) Don't worry. Your own intelligence and creativity will soon come into play in attempting to make your experiments work, problem-solving, figuring out your puzzling results and so on. Ask your advisor to direct you to the important published papers in the field and read them carefully. Then look for other papers and read them. In my view, research starts with a question. I find it most helpful to ask, what is the question (or questions) that I am asking in my work? Most students will actually learn how to do their experiments from other students and from postdocs, since their advisors are usually glued to their laptops writing grant applications to support you and your work. You can ask different people how they do the same experiment. Listen most carefully to those golden people whose experiments always seem to work. Most experiments don't work, unless you are doing something very repetitious, so don't despair. If you can't deal with failure, go into another line of work. Work hard. Nights and weekends are when the hard-core researchers can be found in the lab, and when you will learn the most from them. Most advisers do not agree that grad students should have a life, so keep the fun side of your life secret. Being cool does not elevate you in the eyes of the world of science; it is irrelevant. I also recommend always having an interesting result to show your boss when (s)he approaches your bench. Remember that the next stages of your career will depend on what your advisor thinks of you.

5. What are the most important qualities for a great scientist to have?

You will run into a lot of smart people. You will soon realize that being smart and being a successful scientist aren't the same thing. Generally, everybody is smart at this level, and you will meet some very smart people who sit with their feet up on their desks and tell you why your experiments will not work or why they are not interesting. When you run into these kinds of people, always check out what they themselves have accomplished. Once, a bunch of faculty members in my department were standing in the hallway asking this same question. They came up with all of the usual answers:

intelligence, strong work ethic, creativity, attention to detail, etc. etc. Finally, the great geneticist Bob Edgar shook his head and said one word: "Desire."

6. What next?

Your next major step will be to find a postdoctoral position. This will be an even more critical decision than choosing a graduate school. It will usually form the beginning of the trajectory of your own independent research career. Listen to your graduate advisor's advice on this, but also look for possibilities in the published papers you are reading. Be aware that famous labs sometimes have dozens of people in them, meaning that you could need an appointment to talk with your postdoctoral advisor. If this is important to you, find out how big the prospective lab is. Also, don't apply to a lab unless you intend to accept a position there (if offered); this is not like applying to grad school. Your prospective adviser will plan to make space for you and work your salary into his/her limited grant budget. Start your search for a postdoctoral position early - a year in advance is not too soon. There are several reasons for this: (a) Your top-choice labs may be full if you wait too long; (b) You will have time to write a postdoctoral fellowship application, which will endear you to your postdoctoral advisor; and (c) You will have a chance to read the literature relevant to your next lab's research. Your success in finding a great lab for your postdoctoral research will depend on your success as a grad student (i.e., published papers) and on your letters (usually three), so get to know other faculty and keep them up to date on your progress.

In my view, a career of scientific research is one of the more meaningful things to spend your life doing. We are lucky and privileged to be able to do this. And based on my own experience, it never gets old (unlike myself). Go for it.

JOANNE KAMENS, EXECUTIVE DIRECTOR, ADDGENE

Take your career into your own hands so you are still using your science training 10 years after you get your degree. Be open to relationships, research alternative options, choose mentors that support diverse career paths.

ATHENE DONALD, PROFESSOR OF EXPERIMENTAL PHYSICS, UNIVERSITY OF CAMBRIDGE

Don't assume everyone else around you understands what is going on/how to do something just because they look confident. Far more people are uncertain than may be apparent.

ACKNOWLEDGEMENTS

We would like to acknowledge David Juurlink for inspiring this piece, when he wrote, "Advice for Physicians in Training: 40 Tips from 40 Docs" (Juurlink 2014).

REFERENCES

Day, T. E. "The big consequences of small biases: A simulation of peer review." *Research Policy* (0). doi: 10.1016/j.respol.2015.01.006.

Juurlink, D. 2014. "Advice for Physicians in Training: 40 Tips From 40 Docs." *The Winnower* doi: 10.15200/winn.142006.67645.