**General advice for scientists and scientists-to-be**

Your journey in science can be as unique as your fingerprint – albeit, not all fingerprints are unique. Though scientific careers are often paved by fixed paths through prescribed graduate programs, I would argue that the best scientific training is not one that emphasizes the acquisition of foundational knowledge per se, rather one that allows you to uncover your innate curiosities. Finding what motivates you to explore and tinker with the world around you is often the key ingredient that shapes your trajectory as a scientist, scientist-in-training, or hobby scientist.

Throughout your journey, you will find – and may have already experienced as I have – the impact of advice from mentors. This website, *Advice to a Scientist*, attempts to catalogue the perspectives of scientists at various stages in their career so that experts and trainees can engage in virtual mentorship with one another – regardless of geographical, economic, and cultural boundaries – by sharing their insights through articles or through online discussions. Through an inclusive approach, the site serves as a hub of resources and idea-exchange for scientists, scientists-in-training, and future scientists. What follows are some general principles I have come to embrace as I reflect on my scientific journey thus far – I hope that they will resonate with others at various stages of their career.

There is no complete handbook for how to navigate your unique scientific journey but seeking advice from those around you (or those further away) and paying that forward to others seeking your advice is a key part of the scientific process. Not only does the mentorship process reinforce the scientific training pipeline, but it also forces us to solidify our own expertise – *to teach is to master*, after all. And while our journeys may be unique, there certainly exists advice that is applicable more broadly. So, I encourage you to invite and offer advice freely, contributing to the scientific community not only through your science but also on a personal level.

In addition to engaging in the scientific mentorship process, I have also come to appreciate that transparency is a key ingredient of successful and impactful science. The sharing of methods, materials, and skillsets reinforces the reproducibility of scientific studies. In addition, the sharing of data allows for diverse minds to reflect and interpret data, providing feedback and finding inspiration in the results – this is a core principle in the peer-review process. Encouraging transparency and creating a forum where scientists can engage in transparent discussions with one another is, in fact, one of the reasons why *Advice to a Scientist* was born. So, I encourage all scientists to enable open-access sharing of advice and mentorship resources (and their science wherever possible). By utilizing a platform like *Advice to a Scientist* to share and find advice, you will have the opportunity to access more diverse perspectives – not just those immediately around you – from scientists at various stages of their career and those that have emerged from divergent training trajectories. A hub like *Advice to a Scientist* can also serve as a database where we as a scientific community can collectively catalogue resources that have accumulated over the ages. The centralized nature of this online hub will not only enable easier access for all but will also serve as an interesting opportunity to see how advice evolves over time and observe which advice stands the test of time.

**Tangible Tips**

* **Be active in your pursuit of wisdom and advice from others.** Evidence-based decision making is useful in making decisions in your scientific trajectory and daily life, not just your experiments! Treat the advice you get from others as data points that you can interpret and analyze, looking for key trends and commonalities as well as anomalies in the advice you receive. If you’re looking for ways to access advice from scientists, try reaching out to trainees and scientists in your institution. If you don’t have access to a scientific environment, try following some amazing science communicators on Instagram and Twitter – they often share their science as well as advice via social media (see resources section for some examples).
* **Be active in your mentorship of others.** Share what you learn in your scientific journey and help others evolve in their trajectories as well. Mentorship is central to science and much like other skills, our ability to be good mentors is learned by observing our own mentors and by practicing being a mentor.
* **Inclusivity is necessary for scientific success.** We should all seek to make an environment – both virtually and in person – where diverse skillsets, expertise, backgrounds, genders and cultures can come together to do science. We can answer more questions by embracing diverse perspectives than we can in scientific isolation so emphasize inclusivity in the science you do and in your scientific environment. Diversity will ultimately not only strengthen the reach and depth of your science, such as through inter-disciplinary collaborations, but it will also strengthen the future of science in general.
* **Don’t be afraid to cross the often-imaginary boundaries that prohibit experts from applying their skillsets to other fields.** Science is disrupted by experts that can bring new perspectives and ideas, contributing to paradigm shifts and changes in the directions of the field. Of course, this can and has also been done by experts that dedicate their career to a single field of expertise but by exploring new fields, either through new projects or through collaborations, you can explore how your skillset can be applied in new and impactful ways.
* **Use outreach as a means of refueling your own passion for the science you do.** Sometimes the act of explaining your project(s) to youth and the general public can force you to distill your hypotheses and goals to the core curiosities that motivate you in the first place and help you to reconnect with our science’s bigger picture.
* **Challenge yourself by leaving your comfort zone.** Throughout my PhD, whenever I found myself getting too comfortable in my experimental routines, I would make myself take a step back and look for ways to keep myself on my toes – learning new techniques, new ideas, or hobbies. Getting too comfortable can make you plateau so try to leave your comfort zone often in order to keep yourself growing and learning.
* **Scientists are multidimensional beings that can accel or dabble in different activities.** Some of the most interesting results emerge when scientists embrace other activities, including those that use skillsets that are not typically attributed to scientists or may even be considered by some to be mutually exclusive from science. One great example is the intersection of science and art, sometimes called sci-art. Dabbling in sci-art can not only provide you with a creative outlet but also enable you to reach a new population of people (art lovers!) with your science, serving as a tool for science communication as well. You can help new people see the beauty in science and welcome more and possibly diverse members to the scientific community. If you’re looking for an example of this, check out @itslikepudding and @STEAMotype on Instagram for inspiration.
* **Scientific success is not mutually exclusive with a healthy lifestyle.** Science can be grueling, requiring iterative cycles of testing and retesting, and reformulations of hypotheses that often fail. Don’t forget to address your mental and physical health needs – health can be a precursor to your success, allowing you to maximize your scientific output. Studies have shown that a balanced lifestyle, including regular vacation days, increases your productivity (see article by Bloom and Van Reenen in the resources section below). By developing your time management skills, you can maintain a lifestyle that balances work- and you-time. Ignoring your health needs, on the other hand, can have a detrimental impact on your science, reducing your creative problem-solving and making you error-prone when stressed. In fact, graduate students are at an elevated risk of experiencing depression and anxiety (see article by Chris Woolston in the resources section below), so become familiar with your mental health needs as well as the health resources that are available to you and your peers. Don’t be reluctant to ask for help when you need it!
* **Make an informed decision about your trajectory.** Scientific training does not pave a singular career trajectory so don’t be afraid to explore paths less taken. By speaking to those that have come before you, you can make a more informed decision about your career options and find a role that best suits your personal and professional needs and interests. Indeed, the scientific skillset is broadly applicable – we are trained to be quick learners, persistent problem-solvers, and gritty.

By exploring the *Advice to a Scientist* website, you will find various articles written by members of the scientific community that address many of the points I mentioned above. These articles provide more resources and a deeper discussion of some of the points I made, as well as a diverse perspective on various topics such as mental health, work-life balance, sci-art, interdisciplinary science, and much more. I encourage you to explore the site, leaving your comments and asking questions in the interactive forum space on the site – the continued evolution of advice depends on open discussions between the members of the scientific community.

**Useful Resources**

There are a number of resources, including books and artifles, that offer general advice for scientists that are listed in the “General Advice” topics page of *Advice to a Scientist* (<https://advicetoascientist.com/s/general-advice>).

Here are some suggestions of excellent science communicators who you can follow on social media:

@science.sam (Instagram) and @heysciencesam (Twitter) is one of my favourites – she mixes fun science with her daily life as a scientist to give a behind the scenes look as life as a scientist. She’s also quite friendly and eager to answer questions you may have.

@thestemsquad (Instagram) is a community that celebrates people in STEM, with a focus on marginalized groups.

@500WomenScientists (Instagram) is a nonprofit organization whose mission it is to make science open, inclusive and accessible.

@500QueerScientists (Instagram) is a visibility campaign for the LGBTQ+ STEM community.

@AstroKatie (Twitter) is Dr. Katherine J Mack, an astrophysicist and cosmologist from North Carolina State University who is also. an active science communicator.

@ayanaeliza (Twitter) is Dr. Ayana Elizabeth Johnson, a marine biologist and founder/CEO of Ocean Collectiv.

@lab\_shenanigans (Instagram) brings his everyday in science to you in a fun way!

@pondlife\_pondlife (Instagram) is Sally Warring, a biologist and documentarian in New York City. She documents the single cellular life in NYC and beyond.

@science.bae (Instagram) is also a great account to follow – she reminds us that scientists are human and like many of the same things you probably like as well!

@mathematicalmodels (Instagram) shows us how math can be found all around us in daily life.

For examples of sci-artists who use art as a platform for science communication, check out @itslikepudding and @STEAMotype on Instagram.

This article explores the impact of management practices on work-life balance and productivity, showing that better work-life balance practices improve productivity while also showing the large effect of management practices.

“Management Practices, Work—Life Balance, and Productivity: A Review of Some Recent Evidence” by Nick Bloom and John Van Reenen, Oxford Review of Economic Policy, 2016.

https://academic.oup.com/oxrep/article/22/4/457/412109

This article discusses some of the common mental health issues that graduate students face.

“A better future for graduate-student mental health” by Chris Woolston, Nature, Career News.

https://www.nature.com/articles/d41586-019-02584-7