Perspectives of Earth and Space Scientists

PERSPECTIVE
10.1029/2023CN000221

Key Points:

- The world of science can be frustrating and difficult at times. Be kind to yourself. Be kind to others
- Life is short, so go do something more fun than reading this article

Correspondence to:
K. Singha,
ksingha@mines.edu

Citation:
Singha, K. (2023). Giving shape to a meaningful and fulfilling career in science: Some no-nonsense advice. *Perspectives of Earth and Space Scientists*, *4*, e2023CN000221. https://doi.org/10.1029/2023CN000221

Received 5 SEP 2023
Accepted 1 NOV 2023

Giving Shape to a Meaningful and Fulfilling Career in Science: Some No-Nonsense Advice

Kamini Singha[1]

[1]Department of Geology and Geological Engineering, Department of Geophysics, Department of Civil and Environmental Engineering, Colorado School of Mines, Golden, CO, USA

Abstract In this manuscript, I provide ideas that may help early-career colleagues on their paths in science, especially in research and academia. I discuss the inevitability of failure at times, the importance of finding great collaborators and mentors and making time for the things that bring you joy in your life, and suggest a few practices that I hope make us more pleasant human beings. I share a few difficulties I've navigated and advice I've shared with my students, postdocs, and early-career colleagues through the years. I hope such thoughts are useful, and help others find the joy in being a scientist.

I'll admit that when I was asked to write an article for *Perspectives*, I struggled with what that could look like. I'm mid-career, so I'm not waxing philosophical on my past yet as I'm hopeful that I still have decades of work ahead of me. My CV stands for itself at this point in my career—I've been lucky to mentor ~40 graduate students and postdocs, and with them and some great colleagues, I've published more than 100 papers. But if I think about what I'm passionate about, it's not just the science, it's the scientists. The more I thought about this manuscript, the more I realized that the message I'd like to get out there isn't about me or details about my field of research—but about the advice I can give at the vantage point of someone who still has a long way to go but is still experienced enough to see how science and our community has changed over the last decade or so.

In the past years, the science landscape has changed, for better and worse. Science funding and permanent positions have become harder to come by; the call to diversify our ranks so that it's not the same people in the room every time is louder; science is questioned more by the general public, who don't always know what we do; and the problems we face—like climate change—are more pressing than ever before, making what we do more important than ever. I truly love the job I have, mostly because of the students and colleagues I get to engage with. I'm also concerned that future scientists may not have the same opportunities I did given more limited positions, funding, and societal support. This evolving landscape got me thinking about the advice I would give someone starting out today in science research, in a really different world than the one I landed in 2005 after finishing my Ph.D. Below are a few things I often discuss with my students, postdocs, and early-career colleagues, and thought I could share to a broader audience, in the hope that they have value to someone out there.

Failure is a way of learning something, even if it's just about who you are. I have failed a lot (Figure 1). Perhaps one of the worst happened during my Ph.D., after filling a 12,000 L canvas tank full of salty water in preparation for conducting what's known as a "tracer test" in hydrology. In tracer tests, we introduce a proxy for a contaminant (like salt or dye) into the hydrologic system (a stream, an aquifer) and monitor its movement through time. This 12,000-L tank was part of a test that was to be most of my PhD. I was working on a military base and had mixed the salt with water carefully the day before the tracer test was to begin. I went back to the barracks that evening, where I was staying, to get what I thought might be the last good night's sleep before the every-other-hour sampling started the following day. I arrived back on site the next morning, to a surprise: the tank was gone. I was wondering how some pack of humans lifted 10,000 kg of tank and ran off with it when I noticed that it was not, indeed, stolen. There the canvas tank was, like a run-over balloon, deflated on the ground. The thing had popped, shooting the tracer across the field site. Turns out it's not ideal to explode 12,000 L of tracer across a field site where you're hoping to do a tracer test, as the ground is already saturated with the thing you were hoping to track. (A colleague of mine from the US Geological Survey told me that he saw the tracer with some of his monitoring equipment discharging into a downgradient lake years later.) The second attempt of this test didn't go much better—I did manage to get the tracer into the ground, but then it didn't show up. I sat there for hours longer than my model predicted I'd need to see arrival. I decided its no-show was just a sign that I was not cut out to get a Ph.D. I was alone in the field, 5,000 km from my apartment, my friends, my boyfriend, and

10.1029/2023CN000221

Figure 1. Like most scientists, I don't have a lot of photographic evidence of my failures. But if the chili-pepper red color of this stream and my face don't give it away, this was not the concentration we expected to see downstream during this tracer test.

my university, but only a couple of hours from my parents' house. So I drove there, ready to quit my Ph.D. before it quit me. My folks were surprised to see me, given that I hadn't called. I didn't even get in the door before my dad told me that it wasn't a Ph.D. unless I wanted to quit at least three times. So I drove back, just in time to catch the tracer breaking through. The paper that resulted from that test definitely didn't define my career, but that moment might have. I realized that sometimes you just have to sit in uncomfortable situations and things might not go the way you wanted, and that's okay. Heck, if we knew what we were doing all the time, it wouldn't be research. And I still face "failure" frequently; for instance, when having proposals or papers rejected. It's just a part of the process. Failure hopefully leads to improved products if we can frame them as positives and persevere.

Think of yourself in multidimensional space. When I was hired in my first job, on the tenure-track at a big R1 in a nationally ranked department, I was young and intimidated. Five of the faculty in that department are now members of the National Academy. I remember sitting in my first faculty meeting, thinking that I was a total fraud—some kid who squeaked through her Ph.D. because she was too afraid to quit now sitting in a room full of geniuses. During that first year, I realized that I couldn't define myself on the singular axis of "science," because I wasn't going to hang with a group of people decades ahead of me. That axis, let's call it "science prowess," can also be partially replaced by time. It takes time to build a body of work and a reputation. Few early-career scientists get to skip that step. So I started to think of myself more broadly. When I looked around that faculty meeting, if we'd have had a competition to run the mile, I'm pretty sure I would have taken out most of the room. So I had that going for me: my "running speed" axis was pretty good, even in that room of amazing scientists. And then I thought about the other things I was good at—they might not have gotten me tenure, but they made me "me." When I started to look at those other axes, I realized that I had a lot going for me as a human, even if the "science" axis felt close to zero. Which brings me to my next piece of advice.

Find what makes you joyful, and schedule it into your calendar like it matters, because it does. I love learning, as most scientists do, but once things get hard, I have a history of quitting. It took me time to embrace that I am a quitter. I have been a quitter since I was a kid, when my folks got tired of signing me up for things (art classes, dance, swimming, violin, other things I'm sure I'm forgetting but they could tell you about) because I'd quit. I had to beg them to let me be a drummer in junior high school because they were sure they would spend money and time they didn't have on it, and I would quit. They eventually acquiesced, and sure enough, I really wanted to quit about a year later. I stayed on through high school just to prove to them I could see something through…but I *really* wanted to quit (Figure 2).

Figure 2. Me as a kid drummer, probably thinking about quitting.

When I was a pre-tenure faculty member, I wasn't sure that I'd chosen the right job for myself, or whether I'd even be tenured. So I took courses at a local vocational-technical school in residential wiring, hiding the fact that I was an assistant professor. I went to bartending school. I started my pilot's license. I looked into being a yoga instructor and bought my first motorcycle, with some half-baked idea that I'd just drive off into the sunset. I had so many Plan Bs that I would have been set for decades to come. I did get tenure, and I also found a real joy in being in the classroom as a student while a professor, learning to wire a three-way switch. I realized that being a student was just something I'd need (and want!) to make time for in my life. I've learned a lot about myself as a student, perhaps especially when it no longer defined who I was like when I was younger. My flight instructor told me that I was one of the brightest pilots he'd tried to train, but consequently I was not that good at it—I just thought too much and didn't *feel* enough. That's pretty much me in a nutshell, I realized, and that was useful information. Right now, I have a half-finished application in to the local community college, because I want

to take some of their trade classes. I've since learned that being a quitter might be my superpower—I am okay at a remarkable variety of things, because I'm willing to try about anything, at least for a little while. The joy I get out learning the beginnings of something is immeasurable, and it's okay that I then move on. The takeaway for me from being a quitter is that we all have to figure out what brings us joy in our lives and find time for it. We're more than our jobs.

Make the table bigger. I don't know who, if anyone, will read this article, but I'm going to assume that if you're reading this that you are a scientist. Given that, I'll throw out that all of us have some privilege. It might not be the same as someone else's, but you have some if you're sitting around reading AGU's *Perspectives*. So the question I ask is: what will you do with that privilege? An undergraduate student can be incredibly inspiring to a high-school student, who might consider STEM because of an interaction they have. I probably can't do that as well as that undergraduate, the older I get.

That said, as mid-career or senior scientists, we don't have so much to prove anymore. We can do science for the joy of it. I would love to think that everyone works on science for the joy of it, but I know that academia doesn't make that easy. There's a lot of bean counting. There's a lot of rejection. There's a lot of imposter syndrome. Lately, there are public discussions, at least in the US, on the value of universities at all. Some people seem to keep their head above the fray, but for a lot of us, there's a lot of disappointment in the scientific enterprise. But if we tread water long enough to be "senior," it seems like there are a few things we should do, including to make the path a little easier for others. That includes sharing our science to non-scientists as well as our stories of failure and our tips for success with those interested in STEM, and to try, in whatever way feels organic to who we are, to build opportunities for others to launch from our platform. What we do as scientists matters, but we're going to come up with the same questions and the same answers if we continue to see the same people at the table. For example, our climate is changing, and who is impacted by that change is unequal. It's an all-hands on deck moment.

My colleagues in my first university job were not only exceptional scientists, but exceptional people—they looked out for me as a junior colleague in ways for which I am still incredibly grateful. I felt supported and valued, and I see my successes as a reflection of that group of scientists and the way they treated me. It is because of them that I spend the time I do now trying to give what I can to those coming up behind me. One local example is that I started career development workshops at my current institution to the make the academic process of tenure and promotion more transparent. Most academics who have written many letters for promotion and tenure for peer institutions know what a good file looks like. Why wouldn't we share that with our early-career colleagues locally? What we know: Publishing matters. Grants matter in that they turn into students and papers. Teaching matters. Mentoring matters. Service will eat your lunch if you let it, so fall on swords you care deeply about or where you want to establish yourself as a leader. Otherwise, to quote a headline from Tim Herrera's (2016) *New York Times* article that I really liked, "If you're not all-in about a new opportunity, just say no." Which leads me to…

Just say no. Nancy Reagan's 1980s advertising campaign would likely have been more effective as a mantra for early-career scientists. For some of us, we really do enjoy service and giving a piece of ourselves to others makes us happy. But if you're early career, and especially if you come from a historically excluded group, you will be asked to do more service than you ever thought imaginable. I have been asked to be on about every committee I can think of, including one at my current institution that was formerly named "The Committee on Committees." There is no lack of opportunity to waste your time as an academic, but especially if you're from a minoritized group. If you see yourself as someone with some privilege or power and an ally to your female colleagues or colleagues of color (and especially, your female colleagues of color) perhaps consider taking on a little more service than you might want to, knowing that some of your colleagues are bombarded by requests in the current climate of "diversifying" every possible committee. The key for everyone is to dole out our yesses thoughtfully.

Every time we say yes, we implicitly say no to something else. I have learned to be good at saying no, and suggesting names of other colleagues who might be interested but don't have the service responsibilities I do. The question I ask myself when I'm asked to do something is: does it have to be me? And: is this something I care about? If the answer is no to both of these things, then "no" has to be my answer. If I had said yes to the Committee on Committees, it might have meant I didn't have time to take on service I really cared about or take a colleague to coffee to talk about a new idea or to talk with a student about a bad day, and those things would undoubtedly mean more to me than more time in meetings where I wasn't going to inspire or be inspired. I currently serve an

Associate Dean at Mines because I feel like it's an opportunity to make positive change, but that required saying no to a lot of other tasks. I've set a more recent rule for myself lately, which is if there's no agenda sent out in advance of a meeting, I don't attend it. Meetings for the sake of meetings is the reason we all have so little time. That 2-hr meeting with 20 people in it just used up 40 hr. Was what happened in that room better than a full work week?

Find a mentor (or three). Regardless of career stage, everyone can benefit from having a mentor. I moved institutions shortly after getting tenure, and it was strange going from being perceived as junior faculty to mid-career faculty almost overnight. While I play much more of a mentorship role at my current institution than my previous one as a function of both age and career stage, I still look for mentors that I can trust who will be honest with me about what I am doing well and where I need improvement, as well as keep me grounded. Good mentors can provide perspective on your path as well as the greater scientific endeavor. Having a few mentors also means that you have multiple colleagues with different strengths and perspectives to talk to, and that you can also spread out your asks such that you're not a black hole of need with any one person. And my mom was right when she said that "thank you" goes a long way. Most people are happy to serve as someone's mentor—formally or informally—for those words.

Manage your narrative. Share your story, leveraging your interactions and tools to convey who you are. One such tool is social media, which allows us to build connections but is also potentially flattening in that people may think the worst of what we write. Everything we write online is seen by others, so would you email the same thoughts to your students, your colleagues both in your department and at other schools, your provost, and/or your scientific idols? If no, just keep in mind that they might be reading whatever you're posting anyway. I know of folks who haven't gotten interviews because people had a pre-conceived notion of who this person was based on social media. This feels problematic to me, but it happens, so figure out what you are comfortable sharing. We have all kinds of interactions with others—formal and informal, in-person, written, and in the media—and these are powerful vehicles for engaging and connecting with other professionals. Use these to create opportunities to define your individual brands or narrative. Put up a website to control your talking points in a more static way, too, so that's what people find first when searching your name.

If you're thinking about research, treat writing like it's your job…because it's your job. I don't know who originally said that research not published is research not done, but it's true, for better or worse. Figuring out how to get ourselves to write is the crux for many of us. There's no recipe here: set up a writing group, donate to an anti-charity if you don't meet your own deadlines, do writing sprints every week…whatever you need to do to get words down. Don't let perfectionism keep you from getting your work out there. As I ask my students all the time: does your work meaningfully contribute to the conversation? If it does, then maybe it's ready to be out there. Are you afraid you'll come up with a better way to do whatever you're doing a year from now? Well, maybe you write another paper then. Writing can also be made easier by having great collaborators. So:

Find collaborators who are fun to work with. This can be harder at the beginning of one's career, where saying yes to opportunities can be important to launching yourself into new collaborations, even if you don't know the people involved well. But after a while, you'll figure out what you're looking for in collaborators. I love to find folks who, without ego, are willing to spitball plans with me and serve as a sounding board for new ideas. People who, in my case, find joy in field work like I do. Who love to mentor not only their own students, but others'. And, importantly, are the people who get things done. If you're early career, finding other early-career colleagues to collaborate with can be one of the best things you do, as mid-career/senior scientists tend not working on the same timelines as you are. Find other brilliant junior folks who are also hungry to work on ideas and proposals and papers with. Great colleagues are a work and joy multiplier (Figure 3).

Spend a minute putting yourself in someone else's head before you open your mouth. I find the premise of the book *Difficult Conversations* (Stone et al., 2010) helpful. Basically, its idea is that there are three layers to a difficult conversation: (a) the conversation that we think we're having, which is about what happened ("the facts"), (b) the underlying conversation about (often unexpressed) feelings, which might leak into the conversation, and then (c) a yet deeper conversation about our identity, which might feel threatened because of something someone says to us. As an example, I know that I work quickly. I'm also super reliable; if I say I'm going to do something, I'm going to do it. So nothing infuriates me more than someone reminding me that something is due. And then I think: what is my problem? If I step back, I recognize that they're just trying to make sure whatever it is we're doing gets done, and some of my colleagues really like getting reminders. But there's some identity piece for me that they don't mean to touch: the fact I'm getting a reminder from someone, in the primal part of my brain,

Figure 3. As I've moved forward in my career, I've been choosier about the projects I've gotten involved in, which has made my research world both more enjoyable and more fulfilling. This photograph is with colleagues and students from the Dynamic Water Critical Zone Collaboration Network, which has set a high bar for me for quality of collaborative work and mentorship.

says to me that they don't think I'm going to follow through or get something done promptly enough. I know this is all me. Yet that feeling is there, every single time. I use this as an example that when talking with someone else, your suggestion or critique may cut deeper than you thought because it causes some crisis of identity that you wouldn't know about. When I find someone in my presence who seems upset, I do my best to listen and assume the best of intentions, recognizing that there might be more beneath the surface that I don't have access to. Other times, I step back just because it's easier for me than getting involved or upset about something I don't want to fight about. That leads me to my next piece of advice.

Don't be an #*$hole. A friend of mine once told me that the best gift you can give someone is the quality of your attention. It should go without saying to be kind to others. The way we treat people matters, and it especially matters when those folks aren't in the same positional power as we are. Remember what it's like to need help. I try to make time for junior colleagues who are trying to figure out their path. I also try to prioritize the work needs of my students and postdocs over my own and will drop everything I can to get to their papers, their emails, or their needs. They don't need to be waiting on me for weeks for feedback—it serves no one. I've got no more promotion steps to go—it seems right that I should spend part of my time helping others the same way people helped me.

Being kind doesn't cost much, even when delivering hard news. My boss at my first "real" job was the late Pete Haeni, who hired me as a student intern for the USGS. That guy could tell me with the biggest smile on his face how badly I screwed something up, and I felt seen in all the ways. He was never mad, but he wasn't going to let me mess a thing up and not recognize that I had. I learned a lot from those interactions and try my best to emulate his blunt but kind honesty with others. Being kind also means telling people the truth, even if it's not "nice."

Don't take yourself any more seriously than you need to. As my dad has said to me for years: "A Ph.D. is not to be confused with common sense." On any given day, I get up and work with great people on fun, interesting problems. But I'm not conducting spinal surgery on the front lines, and very little in my life is truly urgent such that I need to work after hours to get it done. Mark Manson's (2016) obscenity-laced *New York Times* bestselling book helped me put into perspective what happens we give too many, uh, "thoughts" to things that don't matter—that we don't have time for the things that do matter. We can't and shouldn't care about everything out there. Decide what matters to you, focus on that, and do your best to laugh off other issues so that there is time for the things that really matter: your friends and family and hobbies and wild ideas.

To wrap up, it took me a long time to realize that there are lots of ways to be successful in science, and that I belonged here, despite not being good at all of the things that make scientists great. It turns out we don't need

to be good at all of the things. Some of us are idea people. Some of us can build really cool instrumentation and make unusual measurements. Some of us are great writers. Some of us get things done. Some of us are good at building teams. Some of us are exceptional communicators of complex ideas. Some of us inspire. You don't have to be someone that can do all of these things, but it's important to know where you can contribute and then build a team of colleagues around you that scaffold you on the areas where you need support. The way we think about ourselves and consider the contributions of others defines our community and the impact of our work, which is only going to be of continued importance moving forward. Gandhi said that "the future depends on what you do today," so with that in mind: what can you do today, even if it's just a little thing, that changes your future and the future of science for the better?

Data Availability Statement

No data were used in this article.

Acknowledgments
My time writing this article was supported by NSF Grant EAR-1904527. I want to thank my folks, who really made me think I could do about anything when I was kid (data show that this is not true, but I appreciate that they made me think it). I appreciate that they were not only exceptional parents to my brother and I as kids, but that they made that transition to be exceptional parents to adults so seamlessly. I know not everyone gets that start in life, and for that I am truly grateful. I also want to thank my colleague, friend, and mentor Roel Snieder for providing feedback on early draft of this manuscript, as well as reviews from two anonymous reviewers and the always-thoughtful Liz Hajek. I also thank the countless colleagues, mentors, and students who have made this journey so far so fun. You know who you are.

References

Herrera, T. (2016). *If you're not all-in about a new opportunity, just say no*. New York Times. Retrieved from https://www.nytimes.com/2018/02/26/smarter-living/if-its-not-a-100-yes-its-a-no.html

Manson, M. (2016). *The subtle art of not giving a f*ck: A counterintuitive approach to living a good life*. HarperCollins.

Stone, D., Patton, B., & Heen, S. (2010). *Difficult conversations: How to discuss what matters most*. Penguin.