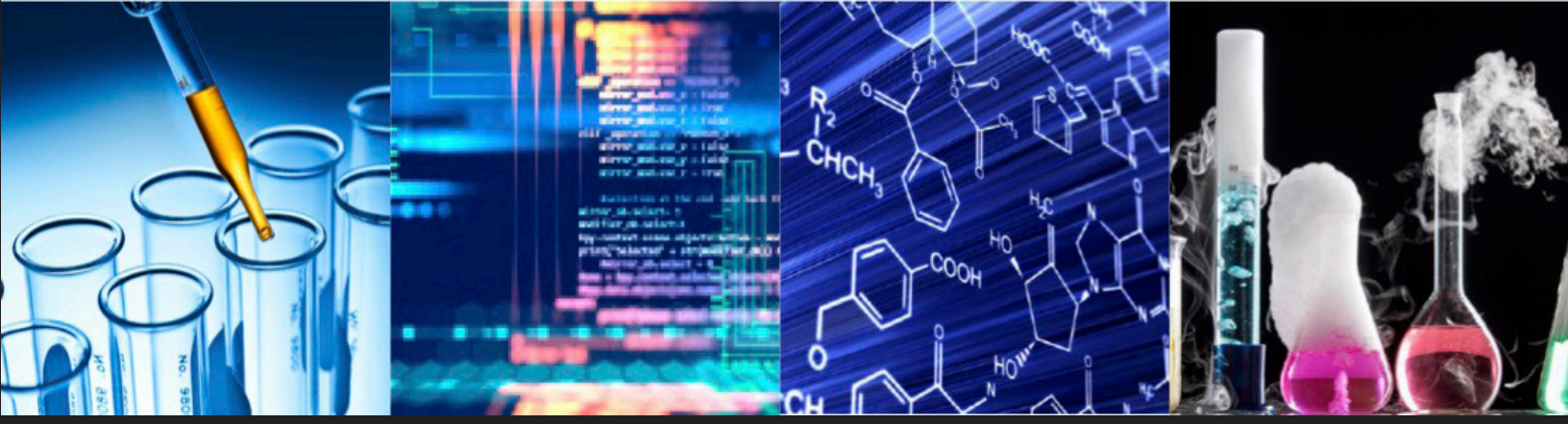

TIPS ON SCIENCE CAREERS:

YOUR GRADUATE STUDENT INSTRUCTORS SHARE WISDOM

BY ARJUN CHANDRAN, NIKHIL CHARI, CASSIDY HARDIN, MICHELLE LEE, ROSA LEE, PHILLIP DE LORIMIER, MOE MIJJUM, MELANIE RUSSO, SONA TRIKA

We asked nine UC Berkeley graduate student instructors (GSIs) to share their post-graduate experiences and give advice to undergraduates who want to pursue a career in science.

BSJ: What has sparked your interest in pursuing graduate school in your field?

AARON BROOKNER: I was always split between math and programming. I knew that I would either go into a math graduate school or software engineering. There was a summer where I did both: I participated in a math research program and a programming internship. While I was doing math, the startup that I was interning for went bankrupt. I had previously decided that summer would guide me to the right choice and it unambiguously pointed to math.

BSJ: How has your perspective on science changed after you entered the world of research?

AARON BROOKNER: Honestly, my perspective on science has not changed at all.

AMANDA KELLER: My first reaction is that there is so much reading. All I do is read. I had no idea about this. You will read 50 articles, and then your project will change completely. Also, I wouldn't say that you get that much freedom in what you want to study—it depends on what funding you're able to get, and for the most part that is out of your control. After I got over my initial shock of how much reading there was in research, I noticed that a lot is lost in research translation. What we do in the lab often doesn't see anything other than the scientific journal that we publish in.

MAZEN HAIDAR: I learned that coming up with results or answers is not always evident or possible. There are times when "no result" is the answer to the research question.

ELIE ALCHEAR: When I first started research, I wanted to get a Ph.D. and become a professor. After a while, I learned that there was a lot of BS involved in the world of academia. Some reviewers seem to care more about how you referenced a previously published paper than about whether you are right or wrong. I also realized that some papers are more a compilation of previous works than anything original. At least in the field of engineering, the impact of professors is evaluated based on how many papers they publish. Consequently, they care more about quantity than quality. This became one of the reasons why I didn't want to continue academia. Because of these issues, I want to finish my masters and become more field-oriented.

ROBERT-MARTIN SHORT: I understand more now about how papers are published—the politics that goes behind publishing papers. But I think science is now more of a human endeavor to me than before. There are problems to be solved, the peer-review process. Before, as an undergrad, I just thought: "Oh, this is a published paper, therefore it must be right." But now, as someone who's seen the process more, I'm a bit more skeptical. If something in the literature you read sounds like garbage, it probably is garbage—but some things are good. In academia, you learn what to believe, and what to take with a grain of salt.

"I think that the best science happens when you have independent ideas but work collaboratively."

MELISSA HARDY: When I first came here, it was somewhat eye-opening to see how fast-paced research is at Berkeley compared to at my liberal arts undergraduate college.

LINDSEY HENDRICKS-FRANCO: I think the thing that I've learned and continued to re-learn over the course of my research career is that at its core, it's a problem-solving process. You have to have the flexibility to confront the individual challenges that come up with any given project and solve them while maintaining the scientific integrity of your work—I think that's what unites all research.

NEHA MITTAL: I appreciated science more from a product perspective before, but now I respect research more as a way to innovate. I don't think innovation can occur just via startups. A large part of innovation is based on people who have the patience and courage to go into something completely new and become an expert in it.

BSJ: What are the most important skills that students need to be successful in your field?

AARON BROOKNER: UC Berkeley has a graduate preliminary exam that actually just tests undergraduate knowledge. So, in the field of mathematics, I think a solid understanding of undergraduate math really helps.

Figure 1. Neha Mittal, Master of Information Management and Systems (MIMS) student at the Berkeley School of Information.

Figure 2. Melissa Hardy, graduate student in Chemistry at the Sarpong Lab in the UC Berkeley College of Chemistry.

ELIE ALCHEAR: Ideally having some field-applicable research, especially in civil engineering, would be great. It not only helps resume-wise, but it also aids in personal growth and helps you make up your mind when it comes to what aspect of civil engineering you want to specialize.

AMANDA KELLER: Toxicology is bench heavy, but I always say that lab skills are something that can be taught. What I think you really need is to be resilient. Science is 99% failure and if you fail and cannot get back up on your feet, this discipline will destroy you. You need to know that if your experiment failed, it wasn't your fault—it was science. If it was your fault, you need to get up and try again. You can teach lab skills but you cannot teach someone to be resilient. Also, creativity is huge in science. I was once asked to come up with 20 new and different project ideas. You have to couple creativity with critical thinking skills to come up with something novel.

PHILJUN KANG: I did my master's degree in organic synthesis, so I have a very strong synthetic background, but that's it. Especially in materials science, you have to know a lot of different things. Sometimes I don't know the value of my materials, because I just focus on their synthesis. But others know that these materials can be very precious, if used in a certain field. So I think, these days, discussion and openness to other researchers are very important to improve prospective knowledge in science.

MAZEN HAIDAR: Students need to be patient; research can be long and even frustrating in certain cases. The other skill I would emphasize is integrity. Referencing others' works or ideas is a requisite to any successful research paper. In addition, just like coursework, research requires time-management skills, organization, and self-discipline. Last but not least, students must be passionate about the topic they are working on: there is no success without passion.

ELIE ALCHEAR: I would put most emphasis on soft skills—communication skills, ability to present, public speaking, and so on—and creativity.

ROBERT-MARTIN SHORT: My field is geophysics and maybe a bit of computational geophysics. In terms of hard skills, you definitely need computer skills—know the Unix command line and maybe also a programming language. In terms of soft skills, you need to be independent in your research, be able to cooperate with people on research projects, and finally, present your work well. Usually, when students go to conferences and workshops, they are asked to stand up and talk about what they have done. So, that's a skill on its own—you can have good research but if you don't talk about it well, then nobody is going to understand and appreciate it.

MELISSA HARDY: In my opinion, persistence is by far the most important trait for successful graduate chemists. Inevitably, there will be times when research doesn't work as you expect it to and your project can get derailed in unexpected ways. Persistence, often coupled with passion, will keep you motivated and moving forward even when the chemistry has a mind of its own.

Figure 3. Philjun Kang, graduate student in Chemistry at the Yagi Lab in the UC Berkeley College of Chemistry.

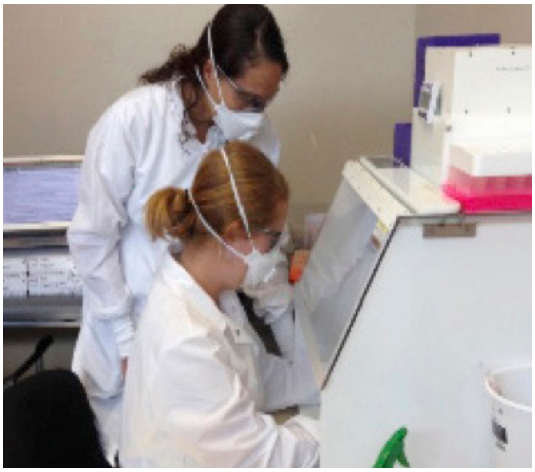

Figure 4. Amanda Keller (front), graduate student in Toxicology at the Smith Lab and Dr. Fenna Sillé (back), Johns Hopkins University professor.

NEHA MITTAL: One core skill, though this might be for an engineering mindset specifically, is it's important for people to get their hands dirty with whatever they're doing. It's important to get involved in projects and even project management, if possible.

BSJ: Do you have any advice for undergraduates?

AMANDA KELLER: As an undergraduate, I worried so much about my future. I was like: "I need to do this, I need to study this…" I wish I had studied abroad instead, which is why I went to Guatemala after graduating. I wish I had known what I know now, to just breathe and live life.

LINDSEY HENDRICKS FRANCO: I encourage anybody who wants to get into research to start by doing some supervised research, where you just work on a graduate student's or a professor's project, and then work toward planning an independent project for either your junior or senior year.

BSJ: What are the biggest lessons you've learned as a graduate student at Berkeley?

LINDSEY HENDRICKS-FRANCO: I think that the best science happens when you have independent ideas but work collaboratively. You can come up with some very creative ideas by having a conversation with other people who are talented and motivated and know a lot about the subject that interests you. Also, make sure to interact with the public. I've enjoyed the opportunity to do interviews with science journalists locally. It's the right thing to do to share what you're learning with the public. The more that you practice it, the better that you get at understanding the public's concerns.

IMAGE REFERENCES

All photos of individuals courtesy of the respective graduate student pictured.