# EARLY CAREER

The Early Career Section is a new community project, featured here in the *Notices*. This column will provide information and suggestions for graduate students, job seekers, junior academics of all types, and those who mentor them. Angela Gibney serves as the editor of this section.
This month's theme is Research. Next month's theme will be Writing.

On Choosing a Thesis Advisor

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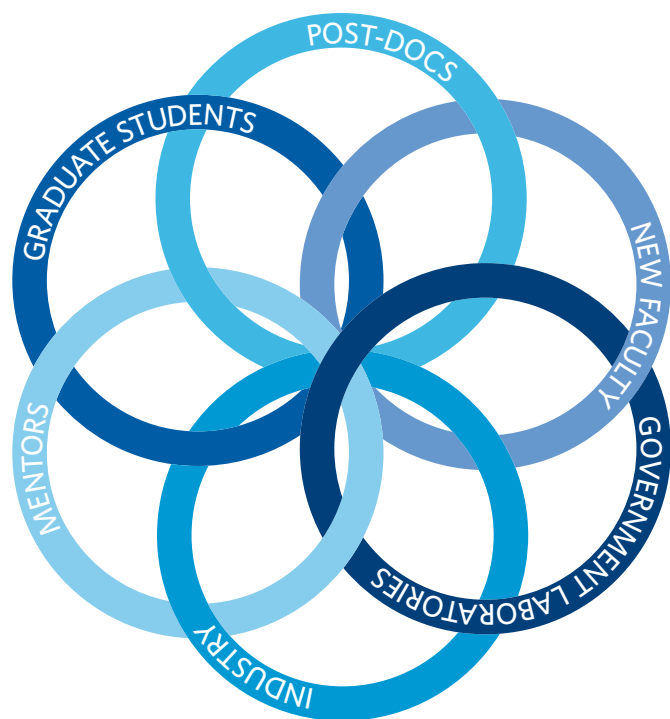
No external factor has as much influence on your graduate career as your PhD advisor. The goal of this article is to help you find an advisor you can work with successfully. I have no particular expertise, beyond being happy with my choice of thesis advisor, and these thoughts are drawn mainly from watching students handle this decision over the years, and some discussions with other mathematicians.

I will focus implicitly on the US academic system, where thesis advisors are usually chosen in the second or third year of graduate school, after students finish some general course work and qualifying exams. At most universities, students take reading courses (formally or informally) with several potential advisors before choosing one, though some departments have other systems. Attending seminars, reading groups, and other events (e.g., seminar dinners) in fields of interest, starting in your first year of graduate school, is another good way to get to know the faculty.

A thesis advisor's role is to help guide students' research, help students navigate the job application process and, to a limited extent, help with other professional issues that may arise, such as questions related to teaching or professional conduct. Many thesis advisors continue to help, as mentors, well after the PhD. The key word throughout is "help": You are most responsible for your success.

Below are some questions to consider about potential advisors *X*. No advisor will be a perfect match, so you will have to balance which questions are most important to you. Once you have chosen an advisor, plan how you will handle areas of concern: again, this is your responsibility, not your advisor's. Some of the questions you should ask potential advisors, some you might get more useful answers from current (or recent) PhD students, and some you will need to figure out on your own.

Are you interested in *X*'s research area? Almost no one is competent to advise a student in a different field, so you will spend about 30 hours per week for at least the next three years thinking about mathematics in your advisor's area. (Over a longer research career, your interests will

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probably evolve.) This is one reason to take a wide range of courses early on: if you have not taken a graduate course in the field, you cannot tell if you like it. When choosing an advisor, ask what kinds of projects you might work on.

Different fields in mathematics also have different cultures, and you might find some more comfortable than others. Writing and speaking style, and level of rigor also vary by field; you can get a feel for this by reading some research papers before choosing an advisor.

Are you comfortable discussing mathematics with X? You must be willing to ask your advisor naive questions and be able to benefit from the answers. Some advisors give detailed answers, while others more often tell students to "go away and think about it"; both can be valuable. You should get used to asking questions, and learn how different faculty address them, by attending office hours starting in your first years. Ask yourself if you feel energized or discouraged after talking to X, and whether talking to X leads you to work your hardest.

What preparation do you need to work in X's area? All mathematics is challenging, but the amount of background required varies enormously. Ask potential advisors what you would need to master to get started on research and how long it should take.

Is X research-active? The cutting edge of mathematics progresses rapidly, so faculty who are not research-active may not know problems of current interest and new techniques. Look for recent papers on MathSciNet® or the arXiv. Some faculty stay active mainly through their students' research, so consider recent students' work as well. The Mathematics Genealogy Project can be useful for finding past students, though your department may have more complete data.

Has X advised other students recently? Advising is a different skill from research or classroom teaching. If possible, ask some of X's recent students about their experiences (positive, negative, and neutral) working with X.

Past students are also important to be able to assess:

Do some of X's other students' career paths match your goals? Keep in mind that this can say more about how selective a thesis advisor is in choosing students to work with than anything else. Most faculty advise students who go on to a range of career paths.

Does your university have a community of researchers (faculty/postdocs/students) in X's area? Seminars, reading seminars, topics courses, and informal conversations help with learning material and staying focused. More senior graduate students are especially valuable.

Does X have tenure? Many junior faculty are focused on getting their own research programs off the ground, and may not be ready to advise others.

Does X expect to be around for the rest of your PhD? Mathematicians move for both personal and professional reasons. Even if they make arrangements for students to move with them or to advise students from afar, moves are

disruptive. Faculty also take sabbaticals and other research leaves, which can also be difficult if you are just starting on a problem. An advisor cannot commit to staying, but you should ask their current plans.

Is X active in the department and mathematical community? This may affect what relevant opportunities X is aware of, as well as X's ability to advocate for you.

How often does X meet with each PhD student? This varies from several times a week to a couple of times per year, with an hour per week being roughly average. What is optimal for you depends on how independent you are, but less than every-other-week may not be ideal.

How does X expect students to find research problems? Most advisors give their students their first research problems, but some run seminars discussing open questions or expect their students to find even their first problems in other ways.

What teaching load and research support can you expect if you work with X? In some departments, all students have roughly the same teaching load. In others, it varies widely from field to field or advisor to advisor, depending on what grants faculty have or how actively they seek internal funding for students.

Would you be comfortable discussing other professional concerns with X? A secondary role of a thesis advisor is to give professional advice—for instance, about writing a research statement when applying for jobs, responding to a referee's report, or, perhaps, coping with instances of implicit or explicit bias. By contrast, personal issues are outside your advisor's purview and, likely, expertise; if personal issues are affecting your work, seek advice first from appropriate staff members or your Director of Graduate Studies.

Other Questions and Remarks

Should I have more than one thesis advisor?
Probably not. Get advice from, and discuss mathematics with, many people, but have one designated thesis advisor who is keeping track of your progress.

Can I change thesis advisors?
Yes, though this will likely set back your research program. In my experience, a handful of students switch advisors for some reason, and another handful have difficulty working with their advisors but do not switch. If your advisor-student relationship is not working, get advice from your Director of Graduate Studies, your Department Chair, or other faculty who know you.

Can I have an advisor at a nearby university?
Yes, especially if no one at your university works in your field of interest. Usually, you also need an advisor at your university monitoring your progress. Consult with your Director of Graduate Studies about how to proceed.

What if X does not want to work with me?
Faculty can decline to advise students, and if X does not want to advise you, it is his/her responsibility to say so.

Beyond that, typically it is better not to second guess how *X* feels: while all faculty are busy, teaching and advising graduate students is an important, and potentially rewarding, part of a mathematician's job. Be bold about talking to faculty, and let them worry about managing their time.

Concluding Remarks

To reiterate, these questions are not requirements for a successful student-advisor relationship, and there are notable exceptions to all of the ideals proposed above. You, not your advisor, are responsible for your academic success. Your advisor will be strong in some areas but not in others. That's okay: there should be other people—your unofficial and unrecognized Board of Advisors—to whom you can also turn. Think about which of the above criteria are most important to you in finding a thesis advisor with whom you will work well. Find other people and other ways to get the remaining help you need to succeed.