

PhD Student Mentoring Committee  
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### **Some Mentoring Advice for PhD Students**

In completing a PhD program, your most important relationship is with your thesis advisor. Your advisor will become your most significant mentor. To become a successful PhD student, you will need to find an advisor. Your advisor will help guide you to a good research problem. As a student researcher, you may have strong technical skills, but that isn't enough for a PhD. You need a good topic that is both doable and of interest to the research community. Your advisor will help you find this topic.

Of course, you and your advisor need to share an interest in a research area but, more than that, your advisor, in the role of a mentor, will shape your research interests, help you develop your research skills and methods, and impart a set of cultural values for what is good research. When you begin working with your advisor, you join your advisor's research community. This community is a collection of professors, students and professional researchers in a broad area, typically using a common collection of analytic or experimental tools. For example, Prof. Gruteser and his students work in Mobile Computing while Prof. Meer and his students work in Computer Vision. Sometimes these distinctions are fuzzy; Prof. Mandayam works in Wireless Networks, a community that substantially overlaps Mobile Computing. In any event, each community has its own set of annual conferences, journals, awards, and community leaders. When you commit to an advisor, you are committing to join your advisor's community for the duration of your PhD and several years of paper writing and reviewing after that. While you may eventually move to a different field, you are likely to spend 10 years in your advisor's community. Your PhD advisor is likely to have profound impact on your professional career.

Thus the most important first step in your research career is getting an advisor. So, how do you find an advisor? While it is possible that you were recruited to Rutgers by your advisor or you are continuing for a PhD with your M.S. advisor, it is more likely that you joined the department without being explicitly matched to an advisor. In this case, there may be a number of faculty members who could be your advisor.

Before offering suggestions and advice for getting an advisor, it will be instructive to learn a little more about the constraints, needs and objectives of faculty researchers. For you to develop a successful relationship with your advisor, it helps to understand the benefits and responsibilities on each side of the relationship.

### **UNDERSTANDING YOUR ADVISOR**

In the School of Engineering, professors supervise PhD students because this improves the research program. Your PhD thesis research will be a collaboration between you and your advisor. Your work will enable your advisor to expand the scope of her research. You will be examining and solving problems that your advisor would not have time to tackle. This benefit is sufficiently great that your advisor may go to considerable trouble to acquire your services.

Specifically, in committing to be your advisor, a professor is making a large investment in you. This investment is in time and money. Once an advisor takes you on as a student, it is in your advisor's interest to ensure that you have the financial support you need to do research. For some of you, this financial support may come from an external fellowship or an employer's tuition assistance program. If so, direct financial support from your advisor may not be a critical issue and you can skip ahead to "GETTING AN ADVISOR." On the other hand, if you are relying on a Teaching Assistant (TA) or Graduate Assistant (GA), the next few paragraphs will give you an idea of how that works.

When you are a TA, your financial support will come from the department. Nevertheless, it is likely that your advisor has made commitments of time to the needs of the department to facilitate your TA. Moreover, as the goal of the department is to move students from TA to GA as soon as possible, your advisor will be looking for opportunities to get you supported as a GA on a research grant. This grant may come from a government agency such as NSF or DARPA, or it may be from a research contract with a private company.

The source of your assistantship is not likely to make a big difference to you. What matters is that you recognize the resources being committed by your advisor. When an advisor hires you as a GA, the financial commitment includes a stipend of \$29,000 per year, tuition support, and Rutgers employee health benefits. With a fringe benefits charge on top of your salary and then a 54% overhead charge paid to the University (for office space, lab facilities, Internet access, library services etc.), and then an additional \$20,000 per year for out-of-state tuition, the cost for a GA in a research grant budget is roughly \$70,000 per year. When you start research, your advisor will also be responsible for your equipment and conference travel.

Your advisor will have written one or more grant or contract proposals to create this funding for you. So when your advisor hires you as a GA, the advisor is counting on you to help meet the commitments made in a funded proposal. Your advisor has to respond with quarterly or annual reports submitted to a program manager. Your advisor may also have committed to providing certain deliverables (papers, software code, hardware etc.) to collaborators at other universities or sponsor companies.

## GETTING AN ADVISOR

Now that we have covered the goals and constraints of your advisor, we return to a key question: How do you get an advisor?

Getting an advisor can be difficult for a number of reasons. First, the best advisors are generally the busiest professors, often supervising as many students as they can handle. Second, as we have observed, agreeing to supervise a student is a major commitment of time and money. Each advisor wants to hire the best possible student, i.e., the student who will accomplish the most and maximize the advisor's return on investment. Your goal is to convince a professor that you are that student.

Assuming you have started with the usual steps of reading about the faculty members and learning a little about their research areas, you need to focus on just a few faculty members in the general area in which you wish to work. To make a choice, you need to get to know them. If you read on the web that that a professor is interested in X and you go meet the professor just to say “I am really interested in X,” then you will likely make a poor impression. Moreover, your judgment of whether you want to work with a professor should depend on more than just thinking X is cool.

Instead take a deeper look at the professor’s research. One way to do this is to scan a professor’s papers and read at least one carefully. See if you can understand the ideas. Furthermore, reading some papers will give you a good opportunity to evaluate your compatibility with the professor. From the paper, you can get a sense of what research effort was needed to produce the paper. Did it require chip fabrication, board assembly, software development, simulations, or certain math methods? Is this the type of work you would look forward to?

After reading a professor’s paper, you will be able to ask questions and talk about research of interest to the professor. Professors are always happy to answer questions about their work. Good questions will make a strong positive impression.

Taking a class with a potential advisor is probably the best way to make a good impression. In class, particularly a small graduate class, a professor gets to learn a lot about how you think and how you meet work requirements. This can give a faculty member a lot of confidence that you will do a good job. As a result, it is quite common for a professor to hire the best student in a class. What this means is that when you choose your classes, you should take into account whether the instructor is a potential advisor. Even if your courses are not taught by potential advisors, working to be the best student in the class can still make a big difference. Professors like to talk and “who is the best student” is a popular topic of conversation.

## WORKING FOR YOUR ADVISOR: A FEW (TOO MANY) SUGGESTIONS

An academic research lab is generally an informal environment in which hard deadlines arise only occasionally. Often, what could be done today can be postponed until tomorrow or the weekend. At the start of a research project, specific goals may be undefined. Depending on schedules, you may often go several days without seeing your advisor. Nevertheless, once you have an advisor, you should keep in mind that your advisor is spending time (and \$70K/year if you have an assistantship) to train you to be contributor to the research program. Although you are still a student, you should view your PhD program as a stepping stone to your next professional position. What you accomplish during your PhD program will be a major factor in your next position. In this sense, your interests are fully aligned with those of your advisor. For your advisor, the more you accomplish, the more you contribute to your advisor’s research program. For you, the more you accomplish, the greater the range and quality of your possible future positions.

So to maximize your success, we have assembled a (fairly long) list of suggestions. Ideally, this advice will be unnecessary as these suggestions come naturally to you. We realize that one or two suggestions are likely to be viewed as constructive but a list of nine suggestions may seem

heavy-handed. However, these nine suggestions reflect the collective advice that members of the mentoring committee have been giving to their students. Some of these suggestions are just ways of saying “Be prepared!” and “Do your best!” but others may give you a better sense of the competition you will face in your research community.

- *Strive to go beyond what your advisor asks for.*

With an advisor who offers “hands-on” supervision, doing just what your advisors asks may be enough to get a PhD. On the other hand, with many advisors, doing the minimum will not be enough. In either case, you and your advisor will be happier and you will be more successful if you go beyond this minimum standard. When you get some preliminary results, try to “think ahead” of your advisor; try to formulate and answer the next question that your advisor would have asked. The first such questions are often sanity checks for what the results should be in the simplest cases or with limiting values of parameters.

- *Don't rely on your advisor to do what you can do yourself.*

For example, before you send a paper draft to your advisor, simply ask yourself if this the best you can do. Did you proofread the draft as carefully as your advisor would? Did you rewrite sentences to maximize the clarity of your writing? Are the figures as readable as possible? Your advisor can tell the difference between an acceptable effort and your best effort. Anything less than your best effort is creating additional work for your advisor and is ultimately wasting your advisor's time.

- *Be prepared for meetings.*

Work out an agenda for topics you want to cover and questions you want to ask. Be ready to remind your advisor what was discussed at the previous meeting. Be ready to spend an hour at the board explaining what you have been doing. If you are not comfortable at the board, consider making viewgraphs. Often this is good practice for giving talks.

- *Distinguish between feedback and criticism.*

Your success is also your advisor's success. Your advisor therefore strives to polish your skills by giving continuous feedback. As a student, you need to understand that such feedback is part of the PhD training process.

- *Know your advisor's expectations.*

At beginning of your PhD study, discuss with your advisor what is expected of you during your PhD program. You and your advisor should have a clear understanding as to

when you can realistically expect to graduate and also what you need to accomplish on the way. For example, your advisor may expect you to have your first paper accepted or published by the end of the second year. Your advisor is likely to tell you how many journal and/or refereed conference papers you are expected to publish. While these expectations will vary across advisors and research fields and are subject to revision during your program, knowing your advisor's expectations will help you keep on track to graduation.

- *Don't be afraid that somebody has your same idea.*

In the course of your thesis, you may have an "Aha!" moment where you see an idea in your work that appears to be very novel. While it will behoove you to work quickly to establish the merits of your idea, a novel idea can encourage two forms of destructive behavior. First, you may try to avoid discussing your idea to avoid "giving it away." This is bad because it keeps you from getting feedback that helps you refine your idea. Second, it encourages you to try to dismiss the related work of others, concluding that work is "different," based on insignificant differences. This is bad because reviewers will see connections to related work and criticize your work if it fails to explain accurately the relationship of your work to that of others.

Instead, you should count on the high probability that if your idea is any good then someone else is also working on some version of it. This is not a bad thing. It is very common for a new idea in a community to occur to several researchers at the same time. Almost invariably, there are enough differences in the details that every variation is published and each will benefit from the citations of the others. In research, your success is measured by the number of other researchers who care about your contributions. A simple metric that estimates your success is your citations. Other researchers citing your work is a sign that they are familiar with it and it matters to them. Moreover, in recognizing the commonality of new ideas, you will be among the researchers contributing to the formation of a new research community.

- *Broaden your horizons.*

Once you have a research topic and have some results, it is likely that you understand your work and the value of your contribution in the relatively narrow scope of your research community. At this point, try to think about what defines your work in the broadest possible terms. Try to form analogies to your work in other settings. Search the web for research in other communities whose broad ideas or goals are similar to your own, but everything else (the system models, the tools they use, the form of the results, etc.) might be completely different.

- *Measure your performance relative to your international academic community.*

When you finish your PhD and look for your next professional position, you will be competing nationally with all the other young PhDs in your research community. That is, your competition is not the other students in your lab, nor even the other PhD students in the department. Your competition consists of the student researchers around the world. When you look at this big group, you will see exceptional achievers, students who have many publications in leading journals and conference proceedings, students with theses that include research contributions in multiple areas, or postdocs who have made research contributions in areas outside the scope of their theses. If you are looking for a position at a university or a premier research lab, your accomplishments need to be at that same level.