Dr. Ramon Lopez - philosophy for mentoring Ph.D. students

Recruitment and Academic Success

Graduate education in physics (and other disciplines as well) is founded on an apprentice model, and such an approach must be tailored to the individual student. First, it is essential to have some sense that the student can be successful before allowing them to join a Ph.D. program. However, I do not only on traditional means of recruiting students, waiting for them to apply and then looking at GRE scores and GPAs. I make an effort to reach out and recruit underrepresented minority US students (both for me and the department) with the ability to succeed in order to provide opportunities to students who might not otherwise have those opportunities.

Once a student is accepted into my group, I am invested in that student's success. I provide not only academic and financial support, but also the understanding that I will partner with them to create an environment where their talents can flourish. In my group everyone works together, and academic mentoring is something that everyone does. All graduate students are expected to mentor undergraduate students, and graduate students are expected to work together and mentor each other in their classes. If anyone has physics content questions in any area they can come to me, especially during preparation for the departmental qualifying exam. In fact, I have mentored not only my own students but also others who had some difficulty in order to help them pass the qualifying exam (two days of written exams in four basic areas: Electomagnetism, Classical Dynamics, Quantum Mech., Statistical Mech,). Out of all my Ph.D. students at UTA and elsewhere only one student did not complete the Ph.D. after joining my group.

I am willing to take a student who, by traditional metrics, would not be admitted to a Ph.D. program, but who shows promise based on broader considerations. One such student was Ximena Cid, who received her B.A. from UC Berkeley, but whose GPA would not get her into most Ph.D. programs. She was introduced to me by a colleague, and I invited her to spend a summer as an intern with my group in Florida. I saw that she had the capacity to succeed despite some academic deficits. I had her apply and I told the department that I would pay for her, so that no department funds were at risk. Only one person opposed this, and she was admitted. We (me and the other students) provided her with academic support so that she could catch up. When I moved from Florida to UT Arlington in 2007, she (and others) came with me. She was soon recognized as a strong student and department leader. She finished her Ph.D., took a postdoctoral fellowship with a colleague of mine. She is now an Assistant Professor of Physics at CalState Dominguez Hills, where she is huge success and is now a valued colleague with whom I continue to work. I have already recruited two of her excellent Hispanic students to the UT Arlington Physics Ph.D. program, one of whom is joining my group this spring.

Becoming a Researcher and Mentor

Getting into a Ph.D. program and succeeding academically is only the first step toward the Ph.D., which is a research degree and which represents the ability of the recipient to generate new knowledge. For each student I identify a problem than can serve as the core of the dissertation. I generally begin with assigning the student some clear and well

laid-out tasks, as well as extensive background reading in the subject, and the student and I have numerous discussions about the readings and the task. This begins the process of investigating something unknown (though there may be a conceptual model that suggests an answer). I also send my students to community workshops that provide background to students, such as the Heliophysics Summer School in Boulder, Colorado.

I assign undergraduates in my group to work with graduate students, and it is the responsibility of the graduate student to mentor the undergraduates in research. I work with the graduate student to break down aspects of the research into digestible bits that undergrads can tackle, and the graduate student has to carry the plan forward. This it allows my group to have a large number of undergraduates engaged in research (typically 8-10 each semester). Second, the graduate student must explain the project work to undergrads, and this helps them understand the science behind the work. Finally, the graduate student gains experience in mentoring students, which is a critical skills that does not appear explicitly in the graduate curriculum.

As a student progresses in his or her research, I look for greater understanding of what are the next steps. Direction becomes less explicit, and the student realizes that they need to come to me and show me what they have been doing and how it relates to the problem in question. Moreover, should anything odd pop up, they should investigate it on their own. Finally, it is the student who starts asking the questions. *What if we change these model parameters in the simulation to do an experiment? These two sets of data are correlated which implies that this other parameter should be correlated in this way, so let's collect those data.* When I hear students talking like this it means that they are intellectually close be being done and reaching the level of expertise needed for a Ph.D.

Scientific Communication, Presentations, and Publications

The requirements for the Ph.D. degree include a dissertation and peer-reviewed publications stemming from the dissertation. I get my students writing early on the Introduction section, just after they start research. I review and mark text in a rather severe fashion because I work at improving my students' writing skills. Elizabeth (Betsey) Mitchell is a case in point. She is an outstanding physicist, but when she began with me, her writing left much to be desired. Over time, with the back and forth on the dissertation, her writing improved dramatically, contributing to her later success in becoming a Staff Scientist at JHU/APL, one of the top research labs in the world.

Presentations are another area where I spend a great deal of time with students. The impression early career scientists make on others at conferences can be critical to creating future opportunities. We spend a lot of time reviewing presentations and practicing them at group meetings. Publications are also critical, and I work closely with my students to turn research results into publications. My students always have at least one first author paper and one or more coauthor papers resulting from the dissertation.

Connecting to the Broader Community and Beginning a Career

I endeavor to connect my students to the broader community primarily through attending conferences with them. I introduce them to my friends and colleagues, including at least

one dinner. This allows my students to begin to build those social linkages that are so important to their future careers. My students generally attend 2-4 meetings per year. For my space physics students, these are the fall AGU meeting (our most important meeting), the NSF-sponsored GEM meeting (which has many tutorial sessions for graduate students), and one or two Texas Section meetings of the APS/AAPT (undergrads also attend these). My physics education students have attended the national AAPT meeting, as well as smaller, specialized meetings like a Gordon Conference. Near graduation, when the dissertation is almost done, I try to find for every student an appropriate international conference or visit to a non-US institution so they can make international connections. My students have been to Austria, Mexico, India, Taiwan, Hungary, and Brazil. In 2017, I am planning to take students to meetings in Dublin and Singapore. I also send students to meetings such as the annual meeting of SACNAS (Society for the Advancement of Chicanos and Native Americans in Science).

NASA includes graduate students and PostDocs on proposal panel reviews as scribes who do not submit reviews, but who assist in organizing material and so get to see the process inside of a proposal panel review. I have been able to get every one of my space physics students onto a panel as a scribe except one by being persistent in my requests to select them. This experience is really important for a young person who might need to prepare winning proposals in the future. I also have tried to get my students directly involved with NASA colleagues by assisting them to apply for NASA opportunities. Betsey Mitchell won a NASA graduate student grant that allowed her to visit and work at Goddard Space Flight Center, which eventually led to a PostDoc position there. I worked with Kevin Pham on a successful NSF proposal that supported a two-week visit to Taiwan to work with one of my colleagues there.

Finally, when it comes time to leave the nest, I am actively involved in finding a good position for the student that can lead to future success. This depends on the ability of the student to be flexible, both in location and specific area of research, as well as ability. However, I have been pretty successful a finding positions for students, or in continuing to support them at UT Arlington as PostDocs after graduation during the transition phase between Ph.D. and PostDoc. Robert Bruntz, for example, stayed at UTA after his Ph.D., publishing papers with the group until an excellent opportunity at JHU/APL opened up.

Summary

For me, being an effective mentor for Ph.D. students begins prior to admission by recruiting students who will succeed, especially underrepresented minorities. Students need to be supported holistically to make sure they do well in class, pass the qualifying exam, and feel that they are respected and valued. Introduction to research begins in a directed fashion, helping the student to grow in confidence and ability until they are the ones asking answerable questions. Significant effort is put into developing mentoring and writing skills, as well as connecting my students to the professional community. I do my best to use my professional network to launch students into productive first jobs. And as they progress in their careers, I still follow and support my former students, providing opportunities when I can. I also continue to work with them as colleagues, collaborating and coauthoring papers and submitting joint proposals.