What do students learn when they start doing research in a university science lab?

As an experienced researcher teaching a new lab member, what do I need to keep in mind?

This short guide provides evidence-based information for graduate students who train undergraduates in science research labs. This compilation of evidence can help graduate students (especially those who have never trained a student before) reflect on how to have a productive mentoring experience with their mentee. Sample supporting evidence is selectively provided.

Fact 1: Trained mentors produce better researchers.

Trained mentors are more likely to do a good job (vs. untrained) in both their and their mentees’ opinions.1,2
Better mentors result in higher quality undergraduate research posters.3
Mentors tend to rate themselves slightly lower in their mentoring skills than their mentees rate them.4

Congratulations; you are making a real difference! Your contributions to your mentee’s development are measurably impactful in tangible and intangible ways. Quality mentoring produces better undergraduate researchers and research outcomes. Your instincts and prior life experiences are a good starting point for guiding you, but training will improve your mentoring abilities. Seek out opportunities for professional training in mentorship from your university, department, professional organizations, and colleagues. Solicit authentic feedback from mentees, peers, and supervisors. If your lack of experience worries you, though, take some comfort in the knowledge that your mentee is likely holding you in higher esteem than you might think you deserve.

Fact 2: The type of mentoring impacts student learning and satisfaction.

The types of mentoring which appear to have the largest impact on mentees’ learning and satisfaction are instrumental/technical support, psychosocial support, role modeling, and negative mentoring.5
Mentees who report receiving lots of psychosocial mentoring tend to report higher satisfaction with the advisor. Lots of instrumental mentoring correlates with higher satisfaction with the mentee-advisor relationship but not the actual advisor themselves.6

Young undergraduates most commonly receive intellectual support rather than emotional or professional, but this differs by mentoring structure and prior research experience. Those receiving only intellectual help might not feel fully supported.7
Socioemotional and culturally relevant mentoring correlates with high satisfaction and career gains. Instrumental mentoring correlates to academic gains, improved research skills, and development of independence. Students who do research for longer report more positive outcomes across all metrics.8

Not all mentoring styles produce the same outcomes. Additionally, different types of mentoring structures and levels of experience result in the mentee’s development of different competencies and feelings of satisfaction. The types of activities and advice you emphasize and the interactions you engage in will have a significant effect on what your mentee learns and how they feel. Discuss their goals together, level of experience, and expected duration of time in the research lab. Based on your mentee’s desired outcomes from their experience in the research lab, you might want to focus on specific areas of your mentee’s development by engaging in correlated activities, especially if the student will not be working in the lab for a long period of time.

5Hernandez, P. R. Landscape of Assessments of Mentoring Relationship Processes in Postsecondary STEMM Contexts; 2018.
Fact 3: Undergraduate students rely heavily on their graduate student mentor.

The most common mentoring structure is when undergraduates are mentored by both a postgraduate and a faculty member. The next most common is when undergraduates are mentored exclusively by a postgraduate who communicates to the faculty member on their behalf.9

Undergraduates benefit more when in direct mentorship with both a postgraduate and a faculty member versus with solely a postgraduate.7,10 PI relationship, mentoring experiences and preferred style, professional stability, lab peers, and research projects play dominant roles in how incoming doctoral students choose a research lab.11

Do not downplay your key role; recognize your importance. Although a student will ideally have multiple mentors in their lives, you are the bridge for integrating them into research and the academic research world, especially if they have no prior experience. The graduate student is essential to the undergraduate’s research experience, as is the faculty member. However, undergraduate students who only have access to one graduate student will not grow as much as students who have access to multiple researchers. One of your key duties is to facilitate your mentee’s access to and successful interactions with other experienced researchers such as faculty and to help your mentee develop the self-awareness and savviness to make good decisions about joining future labs.

Fact 4: In the absence of a positive mentoring relationship, effort is wasted.

There are seven major types of negative mentoring: mentor absenteeism, abuse of power, interpersonal mismatch, lack of career support, lack of psychosocial support, misaligned expectations, and unequal treatment. Negative experiences = absence of positive mentoring or presence of negative mentoring.12

The importance of a positive relationship cannot be overemphasized. It is not enough to just avoid negative interactions since the absence of an actively positive relationship is also perceived negatively by mentees. Though many graduate students are “voluntold” to mentor, make the best of it. Focus on the positives of helping the next generation, having a co-worker to assist you, etc. Even if you are unenthusiastic about mentoring, the experience will be better for you if you can adopt a positive attitude. Otherwise, there is minimal value for either mentor or mentee because a negative relationship hinders meaningful scientific advances. In other words, you do not need to be their best friend, but your efforts are mostly wasted if you cannot establish a good working relationship.

Fact 5: There is no one-size-fits-all mentoring style or matching method.

Mentees of the same mentor give different feedback and ratings about their mentor.14

Some graduate student mentors volunteer to mentor, but others are “voluntold” by their PI. Regardless of whether they want to mentor or not, most graduate students are capable of identifying various reasons for and against mentoring.13

Individual students have individual needs. While certain mentor traits (such as listening or being kind) tend to be commonly valued by mentees, the priorities placed on specific mentor traits and the perception of behaviors differ for each mentee. Although training can help you adopt good common practices, you will also need to tailor your mentoring according to the mentee’s goals, personality, and feedback. Mentees’ and mentors’ demographics (such as race or gender) impact resources and roles in the mentorship. However, similar demographics might not be as important as sharing behaviors, attitudes, and values, especially for long-term pairings. Such interpersonal nuances can make it difficult for faculty to make appropriate mentor-mentee pairings. In some cases, it may be better to end the current mentoring relationship so the mentee (and the mentor) can be paired with someone who is a better fit for them; this is not necessarily an indictment on either party, although everyone involved should engage in healthy reflection.