Keck REU Mentoring Philosophy

A Reflective Guide for Research Mentors

The purpose of this document is to support scientists who are considering, or will be mentoring undergraduate researchers. The reflective guide could be used to clarify your mentoring goals for proposal writing, for planning activities to support undergraduate researchers, or as an opportunity for mid-project reflection.

Undergraduate research experiences (UREs) provide unparalleled opportunities for students to learn research skills that are important to preparation for future study, careers, and participation in scientific communities. Undergraduate research is also more than skill acquisition, and provides powerful contexts for learning how knowledge is generated, developing confidence and agency, and beginning to see oneself as a scientist. Recognizing the time constraints of most research projects, *what do you hope students will gain from engaging in research with you* b*eyond data or results?*

Most students enter research with high potential but uneven preparation and only a limited understanding of how scientists look, act, or think. Many researchers identify practice, feedback, and increasing independence as important to their development. In doing science, adversity (e.g., struggle, confusion, uncertainty and mistakes) is not only expected, it can be a productive part of the research process for the student who feels well-supported. *In this light, how might you take advantage of the developmental moment revealed by a student's apparent confusion or hesitation?*

In reflecting on your own development as a researcher, it is likely that one or more mentors also came to mind. The roles of mentors, which are distinct from supervisors, may include being a guide, a model, a translator of disciplinary norms, a scaffold-builder, or a supporter of professional growth. Mentoring is also a dynamic process that changes over time, beginning with early structure and explicit guidance and gradually shifting to increased autonomy and independent decision-making. *How do you expect that your role as a mentor might shift over the course of the upcoming research experience?*

Time is always limited during research, but many routine research activities (e.g., meetings, data analysis, setbacks) offer powerful opportunities for learning. When research is conceived as a learning environment, the mentor's role is to make expectations explicit, model how scientists think and respond to uncertainty, help students interpret feedback and failure, and connect daily work to broader goals of personal and professional development. *What aspects of your research process already support student learning—and which might be invisible to students?*

Studies of UREs emphasize the importance of social and cultural practice in research. A student's "sense of belonging" is shaped by structures, norms, and interactions (not just personality) and influences their persistence, confidence, and willingness to take intellectual risks. Further, mentors play a critical role in how students see themselves as scientists, understand who "belongs" in science, and imagine their future educational and career trajectories. *What signals might students be receiving, either explicitly or implicitly, about whether they belong in this research community?*

Effective undergraduate research experiences include "soft skills" as core outcomes to support professional and personal development. Professional skills (e.g., communication, time management, collaboration) are integral to most scientific work, so making these more explicit to your student doesn't take much additional time. Research experiences also provide authentic contexts for developing independence, resilience, ethical reasoning, and professional identity, which mentors can support by being intentional about expectations and feedback. *Which professional skills are students practicing in your project, even if you haven't explicitly identified them as such?*

Reflection, feedback, and growth are also hallmarks of transformative undergraduate research experiences. Reflection helps students make meaning of their research experiences and feedback helps students calibrate their understanding of progress, success, and significance. Additionally, undergraduate research experiences also benefit mentors, with many mentors reporting significant growth through reflection on student feedback and learning. *How do you know if your mentoring is having the intended impact?*

If your project is part of the Keck Geology Consortium REU, your project is also part of a larger REU experience and ecosystem of shared values and goals. Keck projects share a common goal of broadening participation in the geosciences through projects that involve students in all aspects of the research process. At Keck, we are convinced that well-structured research projects combined with intentional mentoring, a strong sense of community, and regular reflection promote development of science identity, a strong sense of belonging, and increased persistence and agency. Within this shared framework, flexibility and individuality are viewed as strengths, so mentors play a critical role in ensuring that these goals and values are implemented in authentic and meaningful ways. As part of the Keck REU, h*ow does your project contribute to the broader goals that students experience?*

Finally, there is no single "correct" way to mentor undergraduate student researchers. However, effective mentors share several characteristics, including intentionality, reflection, and a willingness to adapt. Similar to teaching, mentoring is a commitment to an ongoing practice that involves a continual improvement and evolution using scholarly practices. *What kind of mentor do you aspire to be, and how is that aspiration reflected in your daily interactions with students?*