



MENTORING IN AN REU

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REU internship managers know that mentors are like gold, for without them, there would be no program. It is useful to plan a mentoring and project structure that will provide support for students from different places, for example, a research mentor, writing mentor, computing mentor, peer mentor, and/or grad student mentor. Peer mentoring can involve having students work together in pairs or teams. This chapter provides guidance for preparing your mentors and helping them see what kinds of hurdles students may have been or are now facing in their lives, and mentoring them on their project, helping them to network, and guiding them on research and career plans.

➔ What is a mentor?

In REU programs, research advisors have an essential role as mentors to undergraduate students in what is often their first research experience. One of the key factors that REU students cite as impacting the quality and success of their summer is their relationship with their science advisor or mentor. If a student's mentor both supports and challenges their student, a tremendous amount of growth in confidence, skills, and learning can take place.

Mentoring goes beyond research advising and includes personal as well as professional development. Holistic mentoring that addresses a range of needs shores up students' abilities, resources, and resilience, resulting in greater productivity, satisfaction, and career success. Mentoring can be particularly beneficial for underrepresented students, who may lack role models and/or have less access to professional networks.

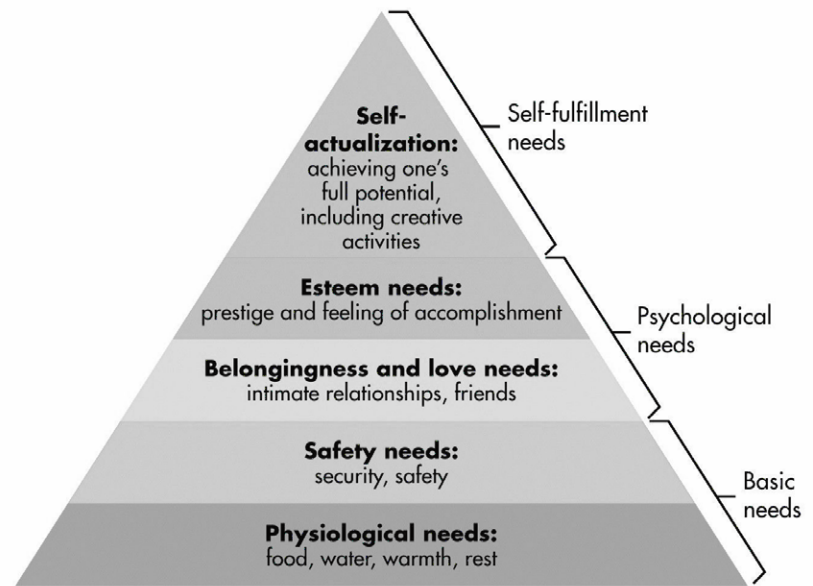


Fig. 1. Maslow's Hierarchy of Needs
(Source: Bulut et al. 2010)

Equally, the mentor benefits from being a mentor and having a mentee. Besides the obvious benefits such as attracting potential graduate students and getting additional research projects completed, mentors often report enjoying being able to teach and to provide career advice. Mentoring students from diverse backgrounds also exposes mentors to new perspectives, experiences, and ideas. It is important to articulate the benefits of mentoring to your REU mentors and to the hosting institution. According to Bulut et al. (2010), mentoring should address more than research itself but also the high levels of the Maslow's Hierarchy of Needs.

→ Which mentoring model will you use?

Apprenticeship Model

Traditionally, REU programs have used the apprenticeship model, where one person is fully responsible for mentoring and advising a student. This is based on the assumption that the mentor has sufficient time, energy, knowledge, and skills to support the mentee.

A benefit of this approach is that the student may get excellent one-on-one mentoring from their advisor. This can help the student to engage in their research and see a way forward in science. A downside to this approach is that it can place a heavy burden on the mentor, and the student may not realize that others can support them in their work.

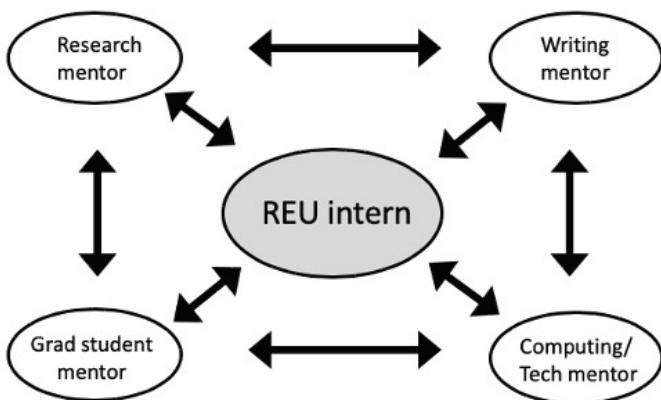


Multiple Mentor Model

More recently the multiple-mentor model has gained popularity. In this design, each student has several mentors, each of whom is responsible for a different area of the intern's professional development. These may include a research mentor or mentoring pair, a writing mentor, and a computer or technical mentor. In some cases, the mentoring team includes a graduate student or postdoc who is involved in the research.

A benefit is that this structure provides the student with a broad sense of support and multiple paths for getting technical assistance and professional guidance, as well as making meaningful personal

connections. It lightens the burden on the research mentor, and it provides a mechanism for teaching grad students and postdocs how to mentor a researcher. This setup requires a clear plan for communication so that the intern doesn't receive contradicting guidance on their project.

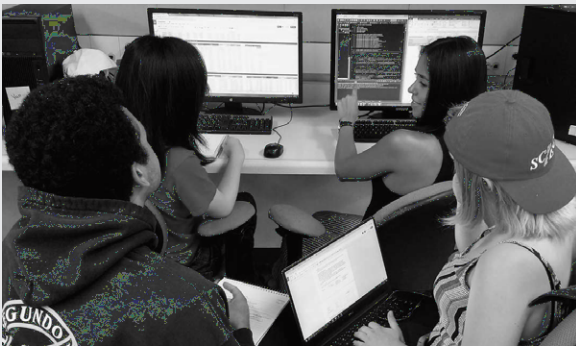


Research Pairs or Teams

Another approach involves having two or more REU students work on the same research project under the supervision of one or two research advisors. A team can be composed of a mosaic of students with different skill sets, which allows them to teach and learn from each other. In some REU programs, the teams themselves have different and interrelated roles as part of a larger project. The teams iterate with other teams to accomplish an overall goal.

Peer collaboration can be highly effective in improving learning outcomes and persistence, decreasing failure rates, and closing the achievement gap amongst undergraduates. Students learn the skills of collaboration, communication, and project management, all of which are helpful in jobs or graduate school. Frequent and clear communication facilitated by team mentors or program directors can help with challenges sometimes associated with group projects such as ensuring that all parties pull their weight and dealing with personality differences.

Small teams solving big problems



We have one overall project looking at earthquake hazards, with four distinctly different teams that each have a specific responsibility. One team creates a library of earthquake data, a second team identifies the probabilities of those earthquakes, a third team produces visual plots of the earthquake hazards, and the fourth team interprets that data to identify the risk involved. Each team is made up of four or five students with varied skills so that there are many strengths and

opportunities for learning. Communication within and between groups is extremely important, and requires facilitation and guidance until the students take on those responsibilities themselves. We have one research mentor and one graduate student guiding each team, and an overall project director who facilitates the project coordination. This structure gives students the chance to learn soft skills needed in the workplace such as working collaboratively, communicating clearly, problem-solving, and being respectful and kind to other team members.

- Gabriela Noriega, Use-IT REU Director, Southern California Earthquake Center

Mentor Mapping Activity

Regardless of which mentoring model you design, it is essential to support students in developing a strong support network, including a peer network. Point out to research mentors that they do not have to be everything to their mentees. A good way to start is by having students map out their support network.

Activity Instructions:

Guide students through a “mentor mapping” exercise to identify mentors and learn how to build their network.

1. Introduce mentoring, and question the myth of the single mentor.
2. Provide the handout of the Support Network Map. Briefly describe the roles that different people play in our professional and personal lives. If you aren't sure about the role of a type of mentor, read the more detailed version provided by the Earth Science Women's Network.
3. Ask the students to write names in the empty spots. Give them at least 10 minutes to do this.
4. Facilitate a discussion and find out what people notice about their results. Are there gaps? Does one person serve in what might be too many roles? Ask how they might seek out mentors to fill in those gaps?

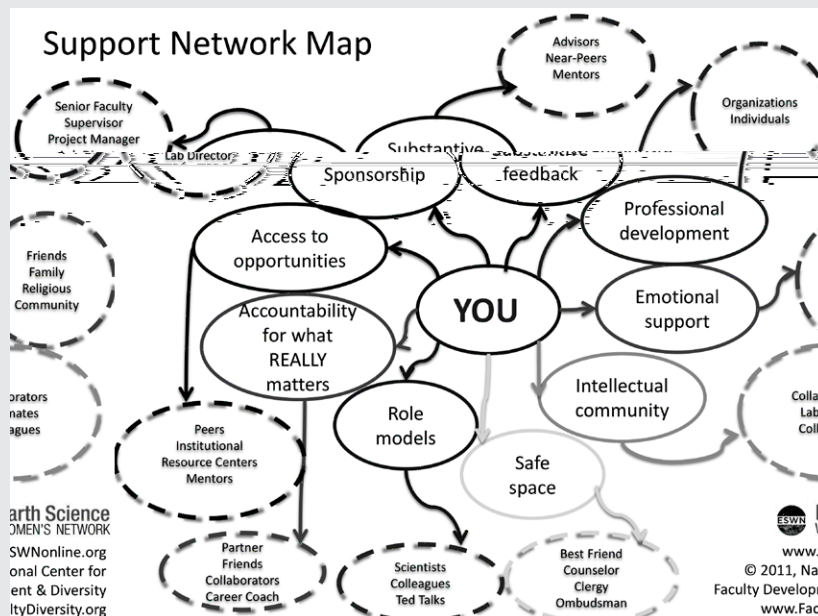


Fig. 2. A support network or mentor map from the Earth Science Women's Network at: <https://eswnonline.org/mentor-mapping/>.

For slides that contain the instructional steps and the mentor maps, go to: <https://eswnonline.org/mentor-mapping/>.

➔ Finding and Preparing Research Mentors

Seeking Mentors

A few months before the start of the program, REU PIs need to recruit mentors. Send out notices seeking mentors, and talk to colleagues. Please see an example of a "Call for Mentors" in this chapter's Appendix.

If it is possible, vet your mentor applicants to ensure respectful and safe treatment of the students. Ask informally about their past mentoring experiences. One can also say in the "Call for Mentors" that you send out that prospective mentors' names will be vetted by HR for any concerns. Supply HR with a list of potential mentors, and if there are any names that HR has concerns about, they would remove them from the list. This approach wouldn't work for mentors that come from outside of your organization.

In talking with prospective mentors, cover these topics:

- » Describe the goals of your program (see your proposal)
- » Outline the timeline and deliverables expected
- » Describe the type of mentoring and effort expected, and time involved
- » Explain that career or professional development activities are an essential part of the program
- » Describe any training on inclusive practices and implicit bias planned for the mentors
- » Articulate your own role in supporting the student and mentor, including regular check-ins

How can I prepare mentors in advance of the program?

Implicit Bias Education

Provide a seminar on implicit bias, employing the help of a campus office of diversity, equity, and inclusion or a contracted workshop facilitator if needed. It's a valuable investment for the summer and for those involved in selecting students - this year or next. This will help mentors to be more supportive and understanding of circumstances that they may not understand or appreciate and of the inherent biases and barriers built in to students' backgrounds and assessment.

Anti-harassment Education & Expectations

Schedule a speaker or session on anti-harassment and anti-discrimination with the help of your HR department or using resources provided in this handbook. Set expectations clearly in your

program. See the [chapter on Sexual Harassment Prevention](#) for more guidance on this and a template for a workshop.

Mentor Orientation

Hold a meeting for mentors before the program to welcome them and make things run more smoothly.

- » Thank them! Remind them of the benefits of mentoring
- » Review the REU program goals and mentoring goals
- » Provide program information including student deliverables, calendar of events, due dates, and logistics, as detailed below
- » If it's a returning group of mentors, invite discussion about last year

Share tips with your mentors

- » Review resources on inclusive practices and implicit biases
- » Treat your mentee with respect and sensitivity
- » Avoid making assumptions about your mentee
- » Invest time to get to know your mentee as a person (not just as a student) and to show that you care. This will build trust.
- » Set clear expectations from the outset – e.g., about communication and professional behavior – and model these expectations through your own behavior
- » Read these essential handouts: "[Tips for Online Mentors and Program Directors](#)," and "[Tips for Science Mentors](#)"

Review the traits of a good mentor

- » Provide effective feedback
- » Use active questioning to lead a mentee toward a solution
- » Foster independence/self-direction
- » Foster confidence
- » Build a scientific community within the research group
- » Build a social community within the research group
- » Convey respect
- » Communicate effectively
- » Appreciate individual differences
- » Expand professional network
- » Celebrate success

Source: Adapted from *Lee et al. 2007*.

Prepare mentors to watch for students under stress

Several [factors can cause stress](#) for research interns, such as:



- » Separation from family and the regular support system, or living with family
- » New freedom to make decisions
- » Competition with peers
- » Peer pressure (to party, etc.)
- » Choosing a career, uncertainty of the future
- » Ongoing current events such as police violence against Black and Brown people

Students may show signs of distress in different ways:

- » Challenges concentrating
- » Irritability
- » Frequently missed deadlines
- » Poor hygiene
- » Noticeable depression or restlessness
- » Excessive indecisiveness or mood swings
- » Direct comments about distress or personal problems
- » Expressions of concern by peers
- » Implied or direct threats of harm to self/others
- » Repeatedly arriving late to work
- » Obvious change in mental state and/or apparent intoxication
- » Behavior that doesn't match the context/setting



Supporting students in a virtual environment is more complicated because it is harder to know what challenges they are facing. This [Stanford University](#) [handout](#) provides good information on the challenges that students are facing today, how to show that we care, and how to respond. More [detailed information is available here](#).

Checklist of Necessary Information for Mentors

- » A list of the student's deliverables and deadlines (e.g., a proposal, talk, poster, report, blog, paper)
- » A calendar/list of important dates such as workshops, poster sessions, poster/talk deadlines, and abstract submission deadlines ([see calendar example here](#)):
- » Student start/end dates
- » Orientation and cohort-building activities
- » Workshops or seminar titles (e.g., on résumé-writing or graduate school)
- » Mid-program meetings with mentor, student, and REU lead
- » Presentation dates for a final poster session or colloquium

Details of Logistics and Expectations

- » Work with the mentor(s) to identify what the student needs in their workplace (desk, computer, phone, software), whether on campus or working remotely
- » Identify the hardware and software that are needed in advance
- » Be clear of what is expected of the student in terms of work hours (e.g., 40 hours per week), and ask mentors to consider what kind of flexibility they are comfortable with on timing and location of work
- » Ask mentors to discuss how and when to communicate with their interns. Using a form such as the [Mentoring Communication Plan](#) can make conversations much easier as this helps to establish expectations for both parties.

Provide guidance on mentoring

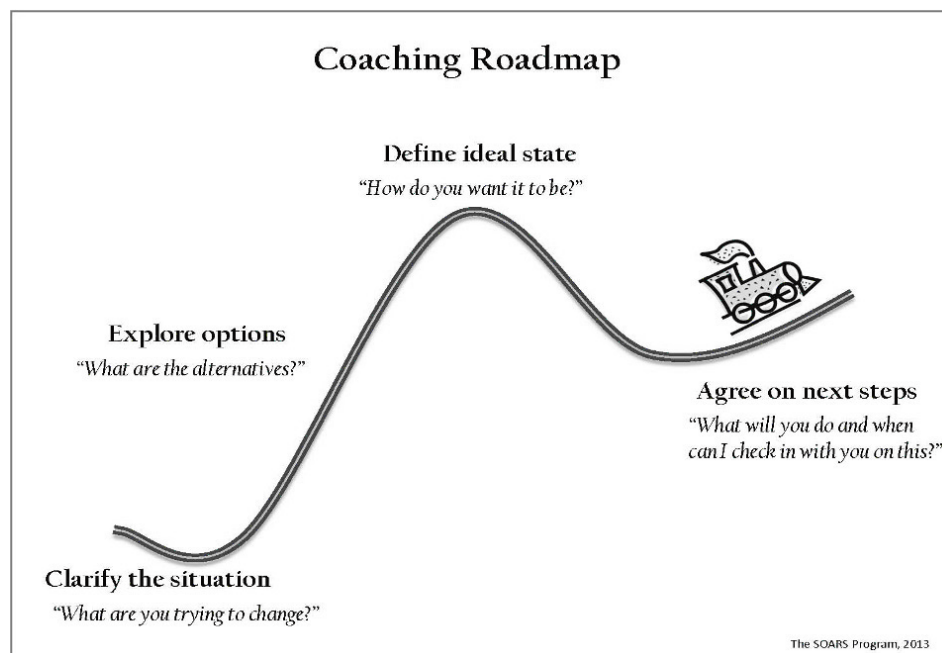
- » Plan to regularly engage with and support your mentors throughout the program
- » Hold a weekly check-in via Zoom or in person or a lunch-chat with mentors to keep everyone on the same page and to provide peer support
- » Send a brief weekly/biweekly email updating mentors on programmatic events and include a few photos if possible
- » Meet with each mentor and their student 3-4 weeks into the program and ask the student to present an update at a white board without PPT slides. This can be very helpful for seeing if things are on track and to assess student understanding of the project. Work with the mentor to do this, or do it on your own.
- » Check in with each mentor individually a few times during the REU program
- » Consider giving a mid-program/end-of-program survey to gather feedback on mentors, compile the feedback, and share with mentors

How can I help a mentor deal with a difficult situation?

Program directors need to have an established plan for mentors regarding when and whom to contact when difficult situations are too complex to handle on their own. Define upfront when you will need to be informed. For all other situations, encourage and support mentors to coach students through challenges. The Coaching Roadmap (SOARS, 2013) provides a simple model for a conversation mentors can have with their students.

After the REU program, meet with your mentors to debrief.

- » Meet with each mentor (or mentoring team) individually. Ask them to share their experiences with their mentee (both successes and challenges). A written mentor reflection could facilitate this process.
- » Bring the mentors together for a post-program celebration if possible. Share evaluation results, if appropriate, and brainstorm on ways to improve the program in future years.
- » Review the good qualities of a mentor and have them reflect upon their own mentoring. If possible, share mentoring successes in a debriefing meeting.



 **Resources**

Center for the Improvement of Mentored Experiences in Research (CIMER). Publications and online resources on research mentoring relationships. <https://cimerproject.org/>

Institute for Broadening Participation. 2012. The Mentoring Manual <https://www.pathwaystoscience.org/pdf/ManualComplete.pdf>

IRIS REU Internship. 2018. [Rubric for assessing student progress on skills](#) for both students & mentors.

Laboratory for Atmospheric Research, Washington State University. 2018. [Student feedback survey on mentors](#).

National Center for Atmospheric Research. 2020. [Program Evaluation](#). GEO REU Resource Center.

Scripps, University of California at San Diego. 2018. [Individual Development Plan](#) for graduate students.

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Science Education Resource Center (SERC), Mentoring diverse students, <https://serc.carleton.edu/integrate/programs/diversity/mentoring.html>

Windham T.L., A.J. Stevermer, and R.A. Anthes. 2004. SOARS: An overview of the program and its first 8 years. Bulletin of the American Meteorological Society. 85(1): 42–47.

 Appendix**A Call for Mentors Sample Letter**

Here is an example template of a letter that could be sent out as a call to potential research mentors for your REU program. This is an edited version of a letter that was kindly shared by the Smithsonian Institute National Museum of Natural History (NMNH) REU site.

February 23, 2021

Dear Colleagues,

We are now seeking projects and mentors for our NSF REU Site *[name of program]*.

In our program, we match you up with an excellent intern *[OR a pair of excellent interns OR work with you on developing a team project]* to work on a research project. We handle ALL the paperwork, we pay the intern's housing and stipend, and we pay associated lab and meeting costs!

This email asks you to identify yourself as a potential mentor. Please email us today! We will be making our placements in the coming weeks.

NSF Research Experiences for Undergraduates *[name of REU]* is a 10-week paid science research internship for undergraduates. **It will run from *[start date]* to *[end date, year]*.** Information about the program can be found here: *[website]*.

The intern[s] will work on research full time Monday-Thursday. They will engage in REU programming (professional development, science communication training, diversity and anti-harassment training, networking, field trips) all day on Fridays.

Members of our research staff should submit projects that can be accomplished by an undergraduate in this 10-week time frame. The project proposal should identify a hypothesis-driven research question *[or how you will engage the student in shaping the research question]* and outline how the student will engage in the research.

Submissions from postdocs are welcome with a co-mentor who is a permanent staff member. **NOTE:** Included in the vetting process for mentors is a review of potential mentors by *[our HR Liaison]*. Should any names be put forth that he/she has concerns about, he/she would remove them from the list.

Sincerely,

[Your name, contact information]

