Mentoring in the Sciences:

Tips, Tools, and Techniques for Being an Effective Mentor

Developed by Stefanie Siller, CTL Lead Teaching Fellow 2019-2020, for use by graduate students in Columbia's E3B Department. Content adapted from Entering Mentoring: Training Scientist Mentors (2005)

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Content

1. What is a mentor?

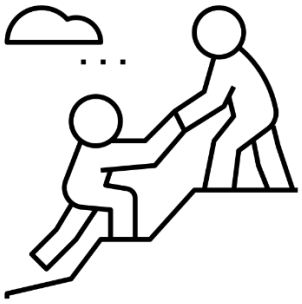
Definitions:

"A wise and trusted counselor or teacher" – Homer, *The Odyssey*

"A scientifically trained person providing advice and personal coaching to a student on a one-to-one basis or to relatively small groups of students in a highly interactive manner that is tailored to specific individual needs" – European Commission 'Technopolis' report on best practice in science mentoring

"Someone who takes a special interest in helping another person develop into a successful professional" – Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering (1997)

"Advisors, people with career experience willing to share their knowledge; supporters, people who give emotional and moral encouragement; tutors, people who give specific feedback on one's performance; masters, in the send of employers to whom one is apprenticed; sponsors, sources of information about and aid in obtaining opportunities; models, of identity, of the kind of person one should be to be an academic" – Morris Zelditch (1995)



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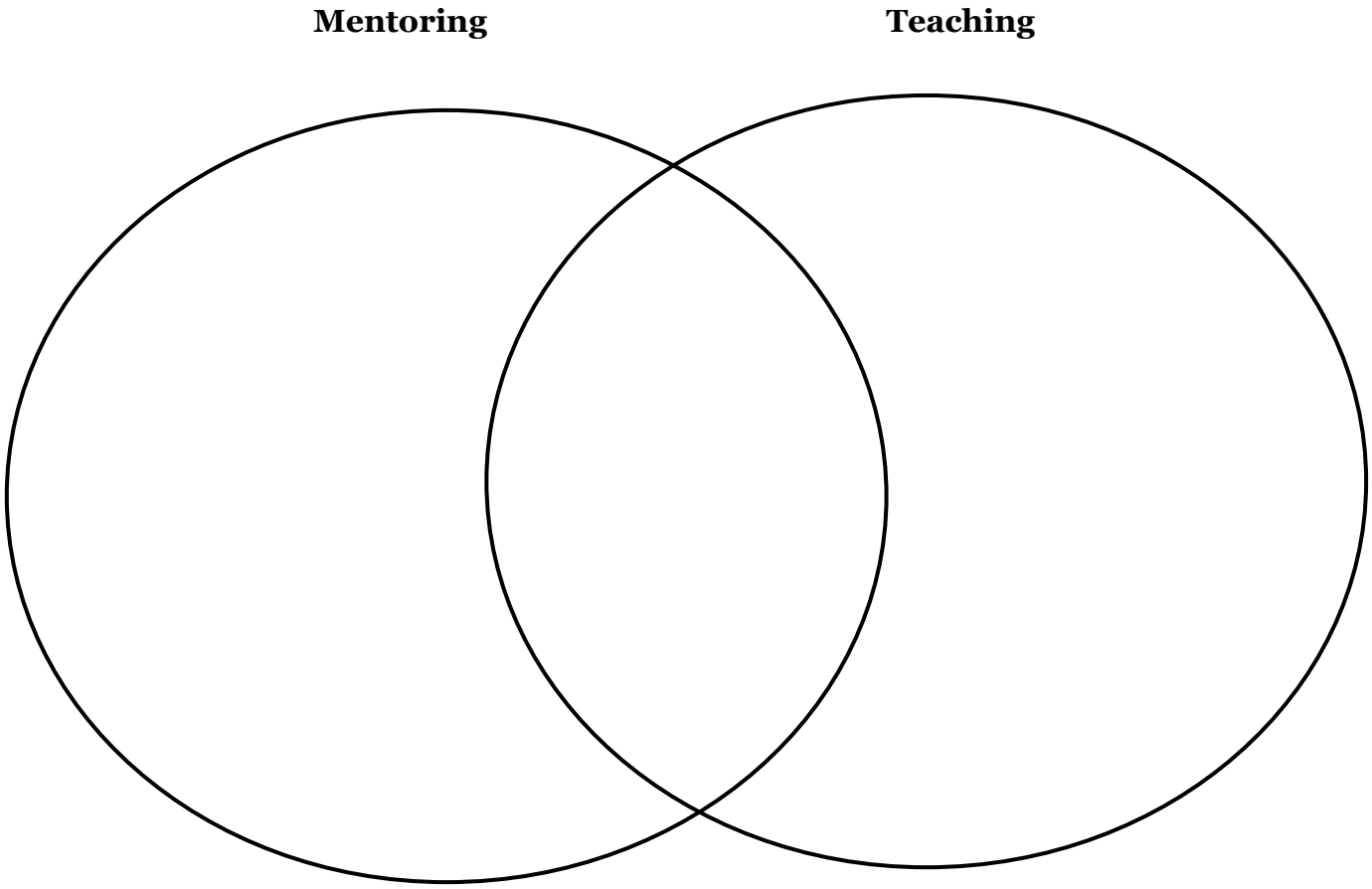
Guiding Questions:

1. Which definition do you most agree with? Why?
2. How does a mentor differ from a teacher? An adviser?
3. What skills are necessary for being a mentor?

Reflection Point

How does mentoring intersect with teaching? In the Venn diagram below, note some of similarities and differences between mentoring and teaching.



2. What is the role of a mentor in the sciences?

Introduction to the field and community

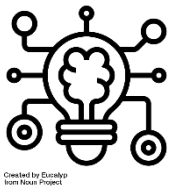
According to *Nature*'s guide for mentors (2007), successful mentors are those that build a sense of community. Research has shown that feeling like one belongs to a community can be critical to success. In particular, a sense of belonging to a specific academic community influences student academic motivation, achievements, and well-being (Trujillo and Tanner 2014). Students feel that they are valued and accepted. This contributes to the development of a "science identity", wherein a person recognizes themselves as a scientist (Trujillo and Tanner 2014). On the other hand, lack of a sense of belonging can create an emotional bottleneck that may prevent a student from pursuing or succeeding in the field (Pace 2017).

For some mentees, this might be their first entry into the scientific field. As a mentor, you can play a critical role in welcoming your mentee into both the lab and scientific community. This is particularly important to consider for including individuals of an ethnicity, culture, sex, or disability who represent a minority in the field.

Consider the following questions:

- How do you create a sense of community in your lab?
- What steps do you take to integrate your mentee into your lab and/or departmental community?
- How does your mentee view their place in your lab? In the scientific field?
- What is your mentee's initial impression of your field? How does this align with your own view?
- How can you extend your network and contacts to encompass your mentee?

Teaching skills and procedures



A crucial component of a scientific identity is competence, defined as "the possession of knowledge about and facility with science content, skills, and practices" (Trujillo and Tanner 2014). These skills and practices may range from general lab procedures, such as the use of PPE, proper handling and disposal of chemicals, or how to use a pipette, to more complex laboratory or field techniques specific to your discipline of study.

Additional skills may include: development of a scientific habit of mind, where mentees learn to ask questions, generate hypotheses, design and carry out experiments, collect and interpret data, and write results (Handelsman et al. 2004); learning to write manuscripts; managing a laboratory; and applying for grants and obtaining funding (Bird 2001).

Consider the following questions:

- What are the general lab procedures that your mentee needs to understand?
- What skills does your mentee have, and what skills do they want to develop?
- What skills do you think are critical for success in this field?
- What is a scientific habit of mind to you? How can you encourage the development of this in your mentee?

Preparation for the future

Effective mentors focus not just on the project or research at hand, but also on ensuring that their mentees are on a pathway to a successful career. Mentoring is "a key mechanism to assist early career academics with career progression" (Iversen et al. 2014). Through the mentoring process, mentees learn about professional standards and practices in the field, such as assigning authorship and contributions to research, communicating findings, and upholding ethical values in research (Bird 2001). In particular, as a mentor, you can help your mentee build their network by connecting them with the colleagues, faculty acquaintances, collaborators, or other professionals in your own network.

Consider the following questions:

- What does your mentee want to do next in their career? Do they have clear steps for how they will achieve this?
- What skills or knowledge can you prepare them with to be most successful in their next step? What skills or knowledge are you unable to prepare them with?
- Who do you have in your network that would benefit your mentee to connect to?

3. What makes an effective mentor?

From *Nature*'s guide for mentors (2007):

Personal characteristics of an effective mentor include:

- Enthusiastic
- Sensitive
- Appreciative of individual differences
- Respectful
- Unselfish
- Supportive

Qualities of value in an effective mentor include:

- Availability
- Ability to inspire and create optimism
- Providing support without micromanaging
- Asking insightful questions while being a patient listener
- Being widely read and open minded
- Helping to identify the right initial project
- Rewarding success

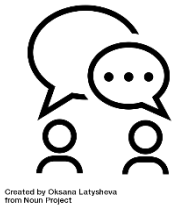
Setting Expectations

What do you expect from your mentee and what do they expect from you? Establishing clear expectations in the beginning of the relationship, and revisiting those expectations often, is key to setting a solid foundation.

Consider the following questions:

- How will the mentee's project be chosen, and how much ownership will they have over the project?
- How much independence do you expect your mentee to have?
- Will there be opportunities for additional work when this project is finished?
- How much assistance, and what kind of assistance, do you expect to provide?
- What do you and your mentee both hope to gain from this experience?
- What are your goals for your mentee? What are their goals for themselves?

Communication



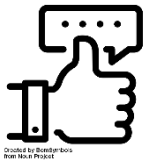
Different mentees require different degrees and kinds of encouragement, advice, and attention. Similarly, mentors have their own approaches and responsibilities. Getting to know your mentee and determining what they need while conveying your own needs requires open communication.

Consider the following questions:

- How does your mentee work and learn best?
- What is your teaching style? How do you prefer to help students learn?
- What does success in this research program look like to you?
- What kind of relationship do you want with your mentee? What boundaries do you need to set?
- How does your mentee feel about their project? How do you feel about your mentee's project?

Assignment Idea:

Interview your mentee and write a brief biography. This assignment helps you get to know your mentee and establish a connection beyond the research project. You can also switch places and have your mentee interview you.



Feedback and Assessment

Frequent check-ins with your mentee help to keep communication open and ensure that you are on the same page regarding project progress and expectations.

Consider the following questions:

- What will you do if your student does not like their project, or develops a new project idea?
- What are your mentee's greatest strengths? What are their biggest areas for development? How can you facilitate improvement of these areas?
- How do you feel the mentee's project is progressing? How does your mentee feel their project is progressing?
- How can you measure if the mentorship was successful or effective for both you and your mentee?
- What tools or methods can you use to improve your mentorship?

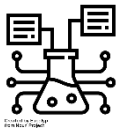
Reflection Point

Who was an effective mentor in your life? What qualities, attributes, or actions made them effective? How can you improve on their mentorship style?

4. Practice your mentoring: case studies

The following section includes a number of case studies from *Entering Mentoring* (2005). Following each case study are some guiding questions to foster your thinking about how you would respond to each situation.

Case Study 1: Project Selection



I mentored an undergraduate student who came from another university for the summer. I explained the project to him and taught him how to make media and grow bacteria. Because my professor and I did not think he had sufficient genetics background for a molecular project, we gave him a microbiology project.

He was very quiet for the first ten days of the project and then he went to my adviser and complained about the project. He said he wanted a project "like Mark's." Mark was a student with a strong genetics background and his project was to clone and sequence a gene. My adviser insisted that my mentee keep the project I had designed for him, but the student became sulky. As the summer went on and he didn't get any of his experiments to work, I began to wonder if he understood what we were doing or even cared about it.

Guiding Questions:

1. If you were the undergraduate student, how would you feel?
2. If you were the graduate student/faculty adviser, what would you do?

<u>The student may feel that:</u>

- Project choice showed favoritism
- Some projects are "cool", others are not
- Some projects are not important to the lab's larger goals
- Some projects are slower than others
- Mark's mentor may be better so the project seems more appealing
- Other projects may be more collaborative, so they seem more appealing
- Overall the student feels insulted and not respected

The mentor and/or the adviser can:

- Be flexible
- Build a molecular element into the project
- Let the student "grow into" the challenge (i.e., if you get "x" to work, you can do "y")
- Let them try other techniques
- Improve communication with the student
- Deal with sulkiness early on

In the Middle:

Navigating Relationships between a Mentee and your Advisor

Mentorship relationships can take many forms. In this case study and the following, the mentor is a graduate student who has been placed in a role between the mentee, an undergraduate student, and their own advisor. This can be a difficult position, and may necessitate navigating and balancing complex interrelationships.

In such an arrangement, consider the following questions:

- What is everyone's specific role and responsibilities?
- How much input will you, your advisor, and your mentee have in the mentee's project?
- How much independence is the mentee expected to have? How much help are you expected to provide?
- What is the line of communication between you, your advisor, and your mentee?
- When the mentee has a question, who will they turn to? Is it clear to the mentee who they will be reporting to?
- When there is an issue with the mentee's project, how will this be resolved?

Discussing and establishing answers to these questions early in the relationship can help prevent future issues from arising.

Case Study 2: Trust

A graduate student mentor was frustrated because her student was not running successful experiments. While the undergraduate had great enthusiasm for the project, each experiment failed because of some sloppy error—forgetting to pH the gel buffer, forgetting to add a reagent to a reaction, or forgetting to turn down the voltage on a gel box.

After a month of discussions, and careful attempts to teach the student habits that would compensate for his forgetfulness, the graduate student was ready to give up. She spoke with her adviser and asked for advice, hoping that she could fix the problem and start getting useful data from her undergraduate. The adviser offered to work with the undergraduate mentee. When the undergraduate walked into his office, the faculty member said, "I hear you're a slob in the lab. You gotta clean up your act if we're going to get any data out of you." Seeing the crushed and humiliated look on the undergraduate's face, he quickly added, "I'm a slob too—that's why I'm in here pushing papers around and not in the lab doing the hard stuff like you guys!"

Guiding Questions:

1. If you were the mentor, how would you feel?
2. How would you talk to your undergraduate after this meeting with the faculty member?
3. How can you assess if communication is failing with your student?

<u>The mentor may feel that:</u>

- Adviser has undermined the mentor's authority
- Mentor will not confide in adviser again
- Adviser has undermined the undergraduate's confidence
- The undergraduate is now labeled as a slob and this may prevent a change in behavior.

<u>Some strategies may be:</u>

- Have them explain their project back to you.
- Have them explain their project to another undergraduate in the lab.
- Have them draw a flowchart or diagram of the project or write a paragraph describing the project.
- Ask another member of the lab to ask the student to explain the project.

- Develop some work sheets for them to complete that assess understanding; work sheets can also be given to accompany scientific papers you ask the students to read.
- If a student makes an assertion in their explanation, have them search the literature to verify it.

Consider the following questions:

- Should the mentor have approached their adviser with this issue?
- What should the graduate student do to alter the outcome?
- If you were the adviser, how would you have handled the situation?
- How does this type of situation affect the lab environment?

Case Study 3: Ethics

Created by monkik from Noun Project

Part I

Your mentee, James, is a high school student who has grand aspirations of one day becoming a doctor. He has participated in science fair opportunities since the seventh grade. He has taken the advice of educational professionals to gain lab experience in order to make his college entrance application look distinguished. He worked with you this past summer and recently has asked if he can do a science fair project in your lab. You are asked to sign the abstract of the project. Because of divergent school and project deadlines, the abstract is due before the experiment is completed.

One month prior to the fair, you notice that he has not really been in the lab doing the work. When you question him, he is vague about what he is doing. It is unclear that he is doing anything at all. On the day of the fair, you are surprised to see him there. His project's results win him a first-place award, giving him the opportunity to go to the state competition. You have the uncomfortable feeling that he has not done the work.

Consider the following questions:

- How do you feel toward this student?
- What would/could you do next?
- How quickly do you have to act?
- When is it not a good time to act?
- What are your objectives and goals in this situation?

Part II

A few days later, you ask to meet with James and his teacher (explaining to the teacher your reservations, but still making no accusations). At that interview, James is very uncomfortable, but rather vaguely answers all of your questions. He brings his overheads from the presentation to that meeting for review, but he does not bring his notebook (which is technically property of the lab). You leave that meeting with stronger suspicions, but no proof. You request that he return his notebook to the lab. He signs a statement that the results of the project were his work and reported accurately.

Consider the following questions

- What would/could you do next?
- How much time can you/should you legitimately spend on this matter?
- What are legitimate actions you can take when you have unsubstantiated suspicions? Is it OK to act on them? Why or why not?
- How do you combat the thought: "but I know lots of others who do the same thing, or have done worse?"

Part III

Through James' teacher, you request the notebook and results again in order to "confirm" his results before they are presented at the statewide competition. Two days later, James comes into your office, and nervously asks to talk to you about the project. He says there was a lot of pressure on him, and he ran out of time, and he is ashamed, but he "twisted" the data. He apologizes, says his teacher is withdrawing his first place award, and he wants to redeem himself in some way; he knows what he did is wrong.

Consider the following questions

- How do you feel toward this student?
- What would/could you do next?
- How quickly do you have to act?
- When is it not a good time to act?
- What are your objectives and goals in this situation?

5. The Mentor Contract

A mentor contract, or mentor agreement, can help set and clarify mentor-mentee goals, communication, and expectations. While it is important to set up at the beginning of the relationship, it is equally important to return to the contract often to assess and evaluate progress (set time intervals to revisit the contract can even be included in the agreement). Confidentiality is also a common element in mentor contracts to ensure development of a trusting relationship.

Created by Larea
from Noun Project

Below are some questions to consider when drafting your own mentor agreement:

Mentee expectations:

1. What are your ultimate goals for this project?
2. What does a realistic timeline look like to achieve these goals?
3. How often do you want/need to meet or communicate?
4. What types of skills, knowledge, and experience are you hoping to gain?
5. What are your expectations in terms of management? How much independence do you want/need?
6. What are your career goals?
7. What do you expect from your mentor beyond research assistance (i.e. networking, recommendation letters, etc.)?

Mentor expectations:

1. What are my ultimate goals for this project? How does this project fit into my larger lab goals?
2. How often do I want/need to meet or communicate?
3. What are my other responsibilities, and how much time can I realistically dedicate to this student (per week/month/semester)?
4. How much time in advance do I need to review and provide feedback on my mentee's writing/research/etc.?
5. What types of skills, knowledge, and experience do I want my mentee to gain?
6. What are my expectations in terms of management? How much independence do I expect my mentee to have?
7. What help or assistance can I provide in helping my mentee achieve their career goals?

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