



RUTGERS UNIVERSITY
School of Graduate Studies

Effective Mentoring of Undergraduates

PLEASE SIGN IN ON GOOGLE FORM IN CHAT



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Rutgers University

Introductions

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Effective Mentoring for Undergraduates Learning Goals

Attendees will be able to:

- 1) Define what mentoring is and the different kinds of mentoring
- 2) Discuss practical ways to mentor an undergraduate
- 3) Actively analyze case studies
- 4) Develop follow-up plan of action / sign up for Microbadge



What is the primary reason you choose to mentor an undergraduate in research?

- Someone is assigned to you
- There is a project that needs help
- You want to give back
- You want to gain supervisory experience

Zoom poll

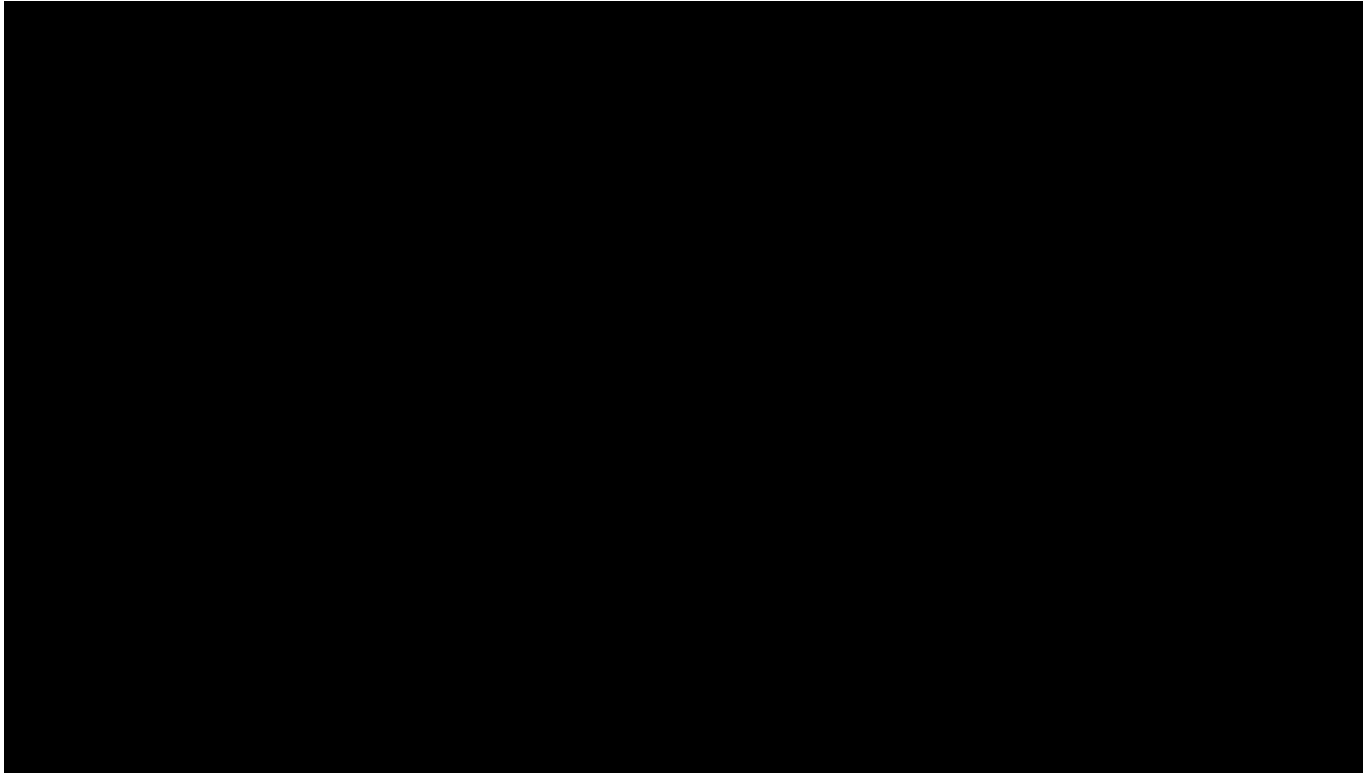


Mentor Defined

- A mentor is a person, often more experienced, who can serve to offer training, advice, and guidance, through discussions, and through interest in the mentee's goals and experiences.
- An effective mentor builds a two-way relationship with a mentee over the long-term based on trust.
- To an undergraduate, a mentor can play a critical role in shaping the experience.



Video: <https://vimeo.com/336213022>



Small Group Discussion in Breakout Room for 10 min

- Introduce yourself
- What challenges and concerns might you face when mentoring undergraduates?
- What principles are important in mentoring relationships?
- Choose a notetaker for the Google Slides and pick a representative to report out your top 2 challenges, concerns, and mentoring principles
- Ground rules for breakout rooms



What challenges, concerns and mentoring principles are important in mentoring relationships?

Share Google slides

What principles are important in mentoring relationships?

1. Aligning Expectations
2. Promoting Professional Development
3. Maintaining Effective Communication
4. Assessing understanding
5. Mentee Self-Efficacy
6. Addressing Diversity
7. Fostering Independence
8. Navigating Mentoring Networks

Mentoring Contract



Template pasted in chat

Undergraduate Mentee Contract*

* Adapted from Branchaw, J. L., Pfund, C., and Rediske, R. (2010), *Entering Research: A Facilitator's Manual: Workshops for Students Beginning Research in Science*, Chapter 2 Aligning Expectations, W.H. Freeman & Company

Undergraduate Mentee:

Graduate or Postdoc Mentor:

This contract outlines the parameters of our work together on this research project.

1. Our major goals are:

A. Research project goals:

B. Mentee's personal and/or professional goals:

C. Mentor's personal and/or professional goals:

2. Our shared vision of success in this research project is:

3. We agree to work together on this project for at least _____ semesters.

4. The mentee will work at least _____ hours per week on the project during the academic year, and _____ hours per week in the summer.

The mentee will propose his/her weekly schedule to the mentor by the _____ week of the semester.

If the mentee must deviate from this schedule (e.g., to study for an upcoming exam), he or she will communicate this to the mentor at least _____(weeks / days / hours) before the change occurs.

5. On a daily basis, our primary means of communication will be through (circle):
face-to-face / phone / email / text

6. We will meet one-on-one to discuss our progress on the project and to reaffirm or revise our goals for at least _____ minutes _____ time(s) per month.

It will be the (mentee's / mentor's) responsibility to schedule these meetings. (circle)

In preparation for these meetings, the mentee will:

In preparation for these meetings, the mentor will:

1. Aligning Expectations

- Setting clear relationship expectations
- Goals of project
- Estimating mentee ability
- Enhancing mentee skills



Suggested discussion:

- Ask why they want to do research
- Determine prior background and skill set of undergrad and tailor project accordingly
- Give background reading, explain repeatedly, and be wary of jargon
- Teach how to critically read the literature
- Explain what skills will be learned
- Discuss what success in this research experience look like to each of you
- Explain policy for authorship on posters and papers

2. Promoting Professional Development

- Helping network effectively
- Setting career goals
- Helping establish a work/life balance
- Helping mentees acquire resources

Suggested approaches:

- Bring them to seminars and introduce them to other scientists
- Help them explore career options and create an Individual Development Plan
- Assist with writing recommendation letter
- Understand that exams or personal issues may require time off from lab
- Ensure they have lab safety including CITI training, IRB approval, IACUC training, and access to buildings
- Make sure that all resources and materials etc...are ready and available for their experiments



3. Maintaining Effective Communication

- Active listening
- Providing constructive feedback
- Developing a trusting relationship
- Accommodating communication style



Suggested discussion:

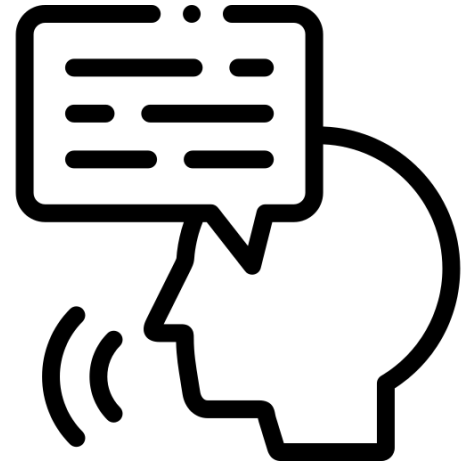
- Be a good listener. Ask how they are doing and if they need anything.
- Explain the communication structure between undergrad, grad student, postdocs and PI
- Discuss what is the preferred mode and frequency of communication
- Discuss the expected schedule
- Discuss how the results be documented
- Provide timely feedback on funding proposals, end of semester papers, honor theses, powerpoints etc... and explain your expectation of lead time to receive these items

4. Assessing Understanding

- Setting research goals
- Developing strategies to meet goals
- Assessing mentee knowledge and comprehension

Suggested approach

- Discuss with PI who will decide project and how much responsibility you have in mentoring
- Ensure undergraduate can
 1. explain rationale (big picture)
 2. state background for project (previous studies)
 3. state hypothesis
 4. explain why chose this technique and how it works
 5. explain steps in protocol
 6. explain how data is analyzed
 7. explain interpretation of data analysis
- Implementation: weekly meetings where one of the above aspects is reported out in in-person meetings or else videotaped and shared
- If problems persist what could be underlying the issue and how would you handle?



5. Mentee Self-Efficacy

- Motivating mentees
- Building confidence

Suggested approaches:

- Be aware of imposter syndrome
- The goal is to give them confidence that they can do some or all of the work by themselves
- Help them see the joys of research but understand that not everybody wants to get a PhD.
How to motivate pre-meds is that cure could help hundreds of patients
- Teach them to accept that failure is OK and that we learn from these mistakes. If you screw up, speak up
- Don't put undue pressure to get positive results and enforce that negative results are still valuable



6. Addressing Diversity

- Considering differences may impact expectations
- Accounting for biases and prejudices
- Accounting for different backgrounds of mentors and mentees



Suggested approach:

- Be aware of unconscious bias - Refers to a bias that we are *unaware of*, and which happens outside of our control. It is a bias that happens automatically and is triggered by our brain making quick judgments and assessments of people and situations, influenced by our background, cultural environment and personal experiences
- Be culturally sensitive (e.g. race, ethnicity, gender identity, sexual orientation)
- Be aware of microaggressions
- Be aware of first generation and college readiness
- Be aware of ageism
- Be aware of people who are differently able (e.g. physical, neurodivergent, color blind)
- Send to CAPS if anxiety is high



What to Do If a Student Shows Signs of Depression or Anxiety

There are professionals who can help our students in the case of more serious concerns.

Be direct with your concerns. Tell them what you are seeing that has you worried.

Helpful responses:

- Listening
- Conveying an understanding
- Expressing that you care
- Normalizing what they are feeling
- Validate the student's experiences and talk to them about helpful resources such as Counseling, Alcohol and Other Drug Assistance Program & Psychiatric Services (CAPS) <http://health.rutgers.edu/medical-counseling-services/counseling/>
"Share-A-Concern" <http://health.rutgers.edu/do-something-to-help/>
"Everyone needs help sometimes."
"It sounds like you are dealing with a lot, it might be helpful to have someone to talk with."
Suicide and Crisis Lifeline 988

Unhelpful responses:

- Judging
- Minimizing
- Implying what they are feeling is their fault



7. Fostering Independence

- Simulating creativity
- Acknowledging mentees' professional contributions
- Negotiating path to independence

Suggested approaches

- Discuss what level of independence is expected
- Encourage them to formulate questions and try to answer them themselves before asking you
- Teach excellent note taking and lab book maintenance
- Agree on how much practice they will need
- Have them watch you several times, then you watch them, and finally they do on their own while you are available for questions
- Have them teach someone else
- Analyze outcomes and have them do it in parallel to see if get same outcomes
- Create a reasonable timeline – make daily task list until they can do it for themselves
- Encourage creating check lists for protocols and locations
- Require “what did you learn this week and how” reports
- Some situations involving undergraduates require mentoring up from grad student to PI



8. Navigating Mentoring Networks

- Coordinating with other mentors

Suggested approach:

- Encourage trainee to find other mentors
- Be aware of other mentors that the trainee may have
- Discuss with those mentors if they have differences in approaches
- No single approach is correct and trainees may benefit from various perspectives





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Case Study #1: “The Sloppy Undergraduate”*

Case study adapted from:

Entering Mentoring, revised edition, by Christine
Pfund, Janet Branchaw, Jo Handelsman

Case Study #1: "The Sloppy Undergraduate"

A graduate student mentor was frustrated because the undergraduate 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, or forgetting to turn down the voltage on a gel box.

After a month of discussions and careful attempts to teach the undergraduate habits that would compensate for forgetfulness, the graduate student was ready to give up. She sought advice from her faculty advisor (the PI), hoping that she could fix the problem. The adviser offered to work with the undergraduate mentee.

When the undergraduate student walked into his office the next day, the faculty adviser said, "I hear you're a slob in the lab, you've gotta clean up your act if we're going to get any data out of you." Seeing the humiliated look on the student'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."

Small group discussion in Breakout Room for 10 min – please select a notetaker and spokesperson

- What is going on in this case study?
- If you were the mentee, how would you feel?
- If you were the graduate student mentor, how would you feel?
- If you were the PI, how would you feel about the mentee?
- If you were the graduate student, how would you have handled this differently?
- Try a role play between the grad student and the PI.
- What is the main takeaway from this case and what are the themes present or missing? – have a spokesperson be prepared to talk to the group.

Large Group Discussion – Google slides

What can we take away from this group discussion?

What elements of mentoring are present?

What elements of mentoring are missing?



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**Preventing ‘small’ but potentially catastrophic mistakes when
working with trainees with little research experience**

OR

**How I learned to stop worrying and
love working with undergraduates**

Benton Purnell 5/1/24



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What can you trust undergraduates with and when?

On the one hand: Getting undergraduates **meaningfully involved** with research is essential to training the next generation of scientists.

On the other hand: Getting undergraduates meaningfully involved with research necessitates some degree of **responsibility and autonomy** and opens the door to **catastrophic mistakes**.

Undergraduate help can advance your research program **quickly** in a way that is **cost effective**.

Undergraduates have the capacity to make mistakes that are **enormously costly** in both time and money.

You can **check your students work** later for any mistakes.

Some of the most troubling mistakes are **difficult to recognize**.

Your students may be able to provide **diverse perspectives** within your research program.

Each student is different and will do things slightly differently. **Many hands make variable work**.



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Can you trust undergraduates with preparing buffers and solutions?

There are few lab tasks simpler than this and having students prepare reagents like this can **save a lot of time**.

Preparing a reagent incorrectly can **ruin** an entire set of experiments.
Bad reagents can be a difficult to recognize if they ever are...

aCSF

REAGENTS AND SOLUTIONS
Use deionized, distilled water in all recipes and protocol steps. For common stock solutions, see APPENDIX 2A; for suppliers, see SUPPLIERS APPENDIX.

Artificial cerebrospinal fluid (aCSF, rat)

10× stock solution

- 0.284 g Na_2HPO_4 (20 mM final)
- 0.952 g MgCl_2 (10 mM final)
- 0.133 g CaCl_2 (12 mM final)
- 0.201 g KCl (27 mM final)
- 8.470 g NaCl (1.45 M final)

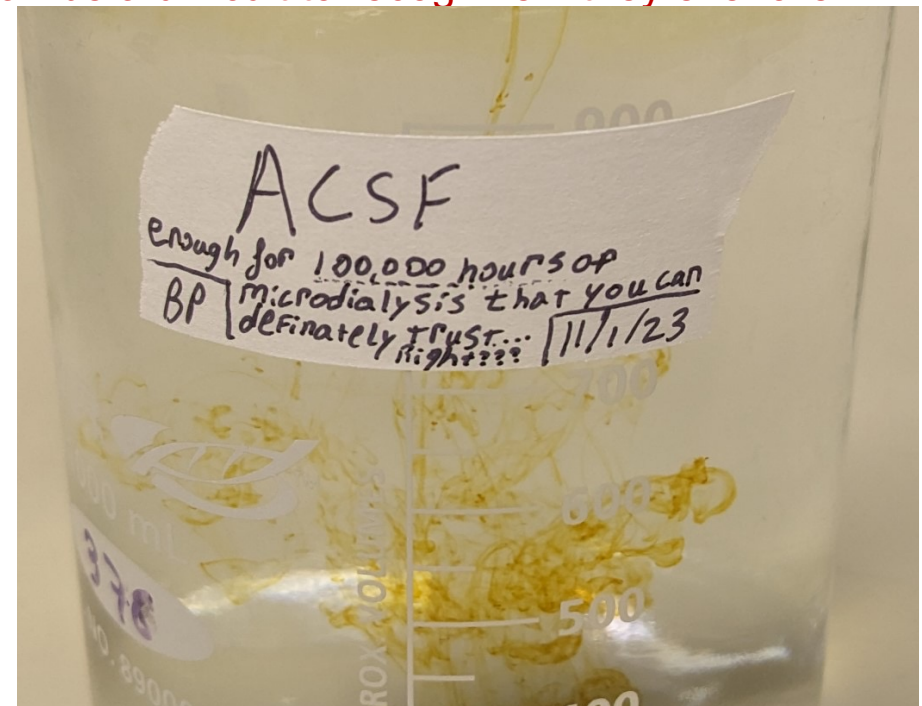
Incorrect, this is 0.145 M final

H_2O to 100 ml

Filter sterilize, adjust to pH 7.4 if necessary with 1 N NaOH or phosphoric acid, and store up to 1 month at 4°C.

Working solution

Dilute the stock solution 1:10, filter sterilize, and adjust to pH 7.4 prior to the start of an experiment.



What is a scientist who is serious about rigor, reproducibility, and mentoring undergraduates to do about this issue?

Involving undergraduates in research is a huge **opportunity** and an **obligation** to the continuation of our craft.

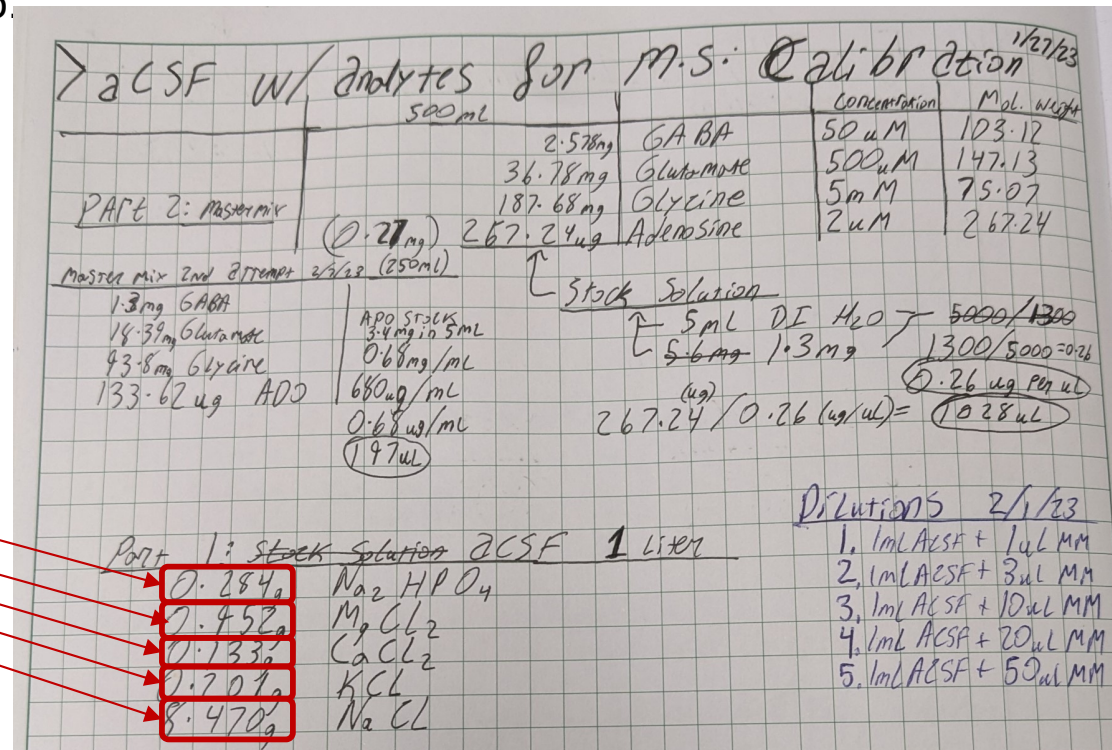
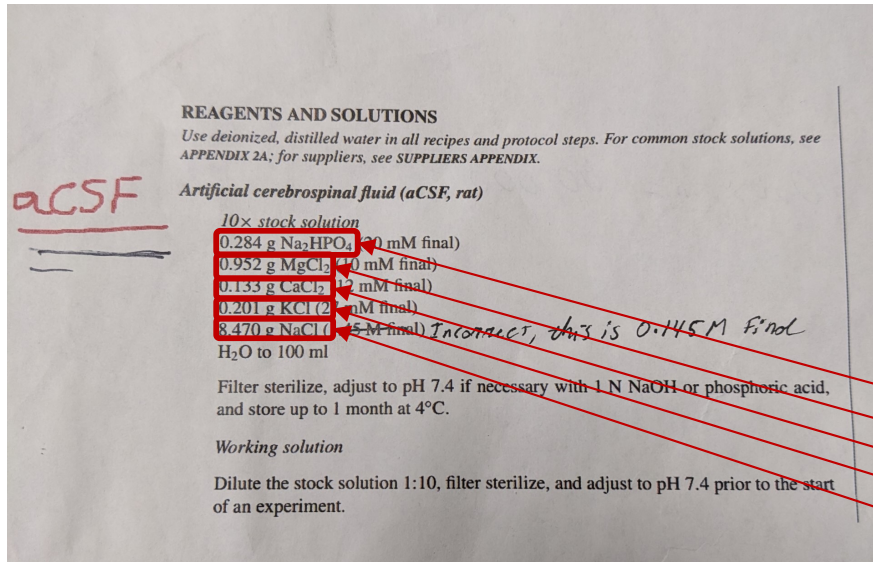
However, **serious precautions** need to be taken to prevent the unnecessary waste of your time, your lab's resources, and taxpayer dollars.

Learning Objective: Pick up some general strategies and specific approaches to ensure undergraduate research endeavors in your lab are edifying, enjoyable, rigorous, and safe.



General strategy: Encourage precise and punctilious notetaking

Specific approach: Do not allow undergraduates to simply follow along with a printed protocol. Insist they write down what they are doing as they go.





General strategy: Encourage precise and punctilious notetaking

Specific approach: Do not allow undergraduates to simply follow along with a printed protocol. Insist they write down what they are doing as they go.

Specific approach: Have specific expectations for how lab notebook entries are structured and review lab notebook entries with their authors retrospectively.

Entry title at the top, 2 lines wide with a 'carrot' symbol

Date of initial entry in the corner

Columns for Date/time & Actions/observations

Animal demographic information on the side

The image shows a handwritten lab notebook page with a table of entries. The title is 'Alc Ado EEG - 48 Acclim/EEG Trials' written across the top two lines. The date '10/30/23' is written in the top right corner. The table has two columns: 'Date/time' and 'Actions/observations'. The entries are as follows:

Date/time	Actions/observations
10/30/23 5:24p	Acclim #1 (5:24p-6:50p)
10/31/23 10:49a	Acclim #2 (10:49a-11:20a)
11/2/23	(28.3g) S. O.C + ALc trial day
11/2/23 10:36a	0.50 mL S. oil (100 mg/kg 5:62 mg/mL)
11/2/23 1:26p	0.90 mL Alc EEG Rec started
// // 2:36:20g	0.90 mL Alc (20%)

Animal demographic information is written on the right side of the page: 'DOB: 8/30/23', 'Surgery: 10/23/23', 'C57Bl6J', 'Male', and '(D. SulF10m)'.



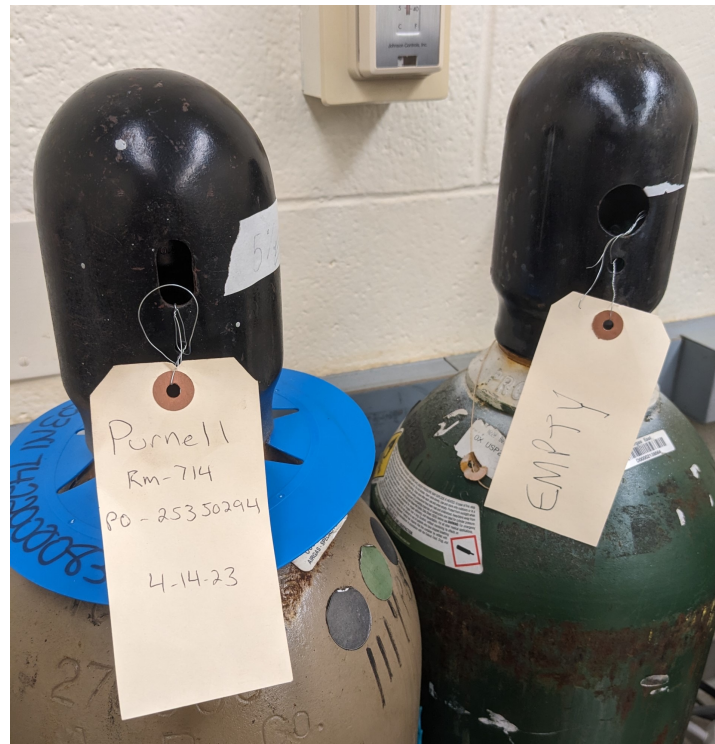
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General strategy: Encourage precise and punctilious notetaking

General strategy: Prevent ambiguous diffusion of responsibility

Specific approach: Make sure the transfer of responsibilities is stated explicitly and verbally acknowledged by the person receiving the responsibility.





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General strategy: Encourage precise and punctilious notetaking

General strategy: Prevent ambiguous diffusion of responsibility

Specific approach: Make sure the transfer of responsibilities is stated explicitly and verbally acknowledged by the person receiving the responsibility.

Specific approach: Be clear with your students that if they expect you or someone else in the lab to do something, they must be totally disinhibited about asking explicitly that it be done.



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General strategy: Encourage precise and punctilious notetaking

General strategy: Prevent ambiguous diffusion of responsibility

General strategy: Create a work culture that emphasizes the adverse results of mistakes and the benefits of recognizing that a mistake has happened

Specific approach: Positively reinforce people coming to you immediately when they suspect they have made a mistake.



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General strategy: Encourage precise and punctilious notetaking

General strategy: Prevent ambiguous diffusion of responsibility

General strategy: Create a work culture that emphasizes the adverse results of mistakes and the benefits of recognizing that a mistake has happened

Specific approach: Positively reinforce people coming to you immediately when they suspect they have made a mistake.

Specific approach: When a mistake happens, emphasize prospective action plans for avoiding future mistakes and deemphasize explanations or excuses.





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General strategy: Encourage precise and punctilious notetaking

General strategy: Prevent ambiguous diffusion of responsibility

General strategy: Create a culture that emphasizes adverse results of mistakes and the benefits of recognizing them

General strategy: Use a level of detail in your instructions that is contextually appropriate to the situation.

Specific approach: Use an outline structure when you make your protocols. An outline structure allows you to put in as much clarifying detail as you would like while making it easy to skip potentially unnecessary details.

Instructions for running an alcohol + Flumazenil or Vehicle Plethysmography Trial

Part 1: Getting the animals and starting the baseline pleth recording

1. Turn on the laptop (power button).
2. Log into the laptop (the pin is "2600").
3. Determine what kind of trial needs to be run.
 - a. Navigate to Desktop>Boison Lab> HCVR Projects > Alc-Flumaz-HCVR Experiment.
 - b. Open the document titled "Trial Checklist_Alc-Flumaz_2023 03 10".
 - c. Look for two animals that have not had a trial in at least 72 hours (3 days)
4. Get those animals from the RT vivarium and bring them to our room on the 7th floor.
 - a. These animals will have their tails marked so we can identify them.
5. Weigh the animals and make a note of their weight on a new line in their lab notebook page (see pages 156-164 of lab notebook #8 [VIII]).
6. Make sure the plethysmography boxes are clean-- clean|and dry them if they are dirty.
7. Take the cap off of the plethysmography temperature/humidity sensor.
8. Turn the plethysmograph on (on button on the front).
9. Start the recording
 - a. Start the "Finepointe" plethysmography software (blue ball icon on the desktop).
 - b. Log in, (Login Name: "Bpurnell", no password).
 - c. Click the "laboratory home" button (it looks like a house).
 - d. Double click the "Alc/ADO trials (Push HCVR)" folder.
 - e. Click "launch station" and launch the data acquisition software.
 - f. Type in the ID numbers of the animals "AlcADO-..."
 - g. Click Finish.
 - h. Put the mice in the correct plethysmography chambers.
 - i. Check the signal, see if it looks good. Troubleshoot for problems if it does not.
 - i. The box flow signal should be between -5 and -15 ml/min
 - j. Press F12 once to begin the recording. After you do so, it should say 'acclimation period'
10. Write down the time you started the recordings in the lab notebook for each animal.



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General strategy: Encourage precise and punctilious notetaking

General strategy: Prevent ambiguous diffusion of responsibility

General strategy: Create a culture that emphasizes adverse results of mistakes and the benefits of recognizing them

General strategy: Use a level of detail in your instructions that is contextually appropriate to the situation.

Specific approach: Use an outline structure when you make your protocols. An outline structure allows you to put in as much clarifying detail as you would like while making it easy to skip potentially unnecessary details.

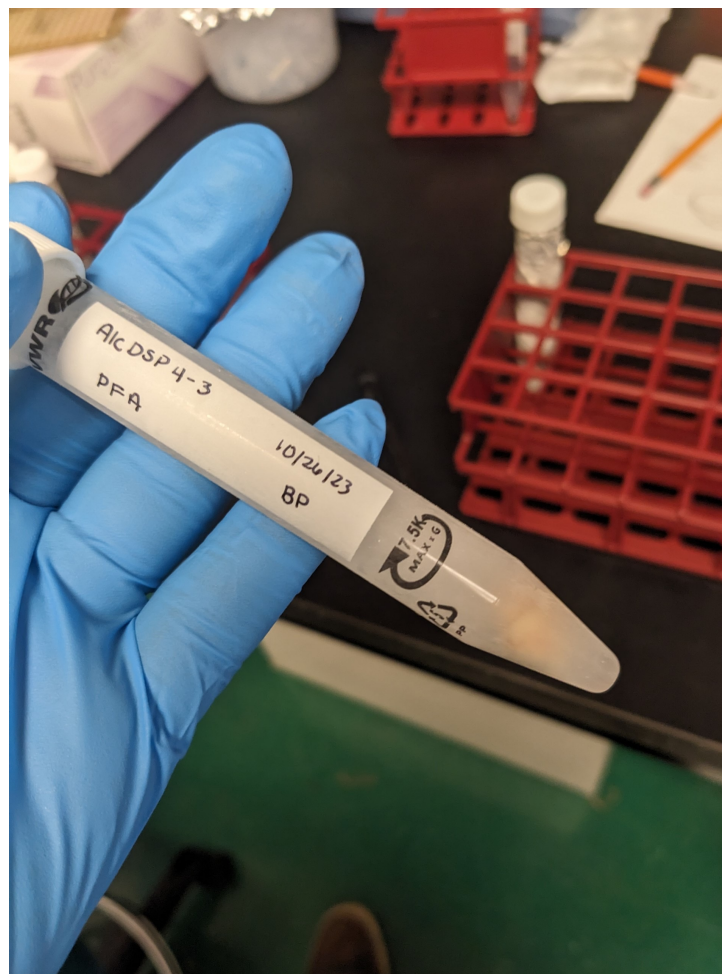
Specific approach: Make sure your efforts to give ancillary insights or to reinforce the ‘big picture’ do not prevent you from giving direct and unambiguous answers to your student’s questions.

Benton: “Hey, Student, could you take the brains from the DSP-4 study over to SPH for me?”

Student: “Sure! They are in the **fridge** now, but we need to **freeze** them soon, right? Should I put them in the **fridge** or the **freezer** when I get to SPH?”

What Benton should have said: “The **fridge**, please.”

What Benton actually said: “The **fridge**, but we will put them in the **freezer** soon. Keep it mind, that will be the **-80 freezer** not the **-20 freezer**. After they are **frozen** we will be able to section them and then do the histology. Frankly I am not sure why they need to be **frozen** in the **-80 freezer** and not the **-20 freezer**. Perhaps the tissue is more stable in the **-80 freezer** long term; however, the **-20 freezer** would probably be sufficient to **freeze** the medium we will suspend the brain in because when we slice the brain we will move it to the cryostat which is essentially a **-20 freezer**. “



Many Thanks



RUTGERS

Boison Lab

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Mentoring Committee

Detlev Boison
Gary Brewer
Gary Aston-Jones
Morgan James

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Rutgers INSPIRE Postdoctoral Program





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Case Study #2: “The Sulky Undergraduate”

Case study adapted from:

Entering Mentoring, revised edition, by Christine Pfund, Janet
Branchaw, Jo Handelsman

Case Study 2: The Sulky Undergraduate

A graduate student was assigned to mentor an undergraduate student, Deja, who came from a local small undergraduate college for the summer.

Because the professor and the graduate student did not think Deja had sufficient background for a more complicated project, a more basic project was chosen.

The graduate student explained the project to Deja and taught her some basic techniques and approaches needed for the project.

The Sulky Undergraduate (continued)

Deja was very quiet for the first 10 days of the project, and then she went to the professor and complained about the project. Deja said she wanted a project "like Michael's."

Michael was a student with a strong disciplinary background, and his project was much more advanced. The professor insisted that Deja keep the project that was designed for her, but she became sulky.

As the summer went on she didn't get much of her work done, and the graduate student mentor began to wonder if Deja understood what she was doing or even cared.



Small Group Case Study 2 Discussion in Breakout room for 10 min - Please select notetaker and spokesperson

- What kind of conversations regarding expectations might have been helpful early in this relationship?
- What kind of conversation would be helpful once the student asked for a different project? Who should be involved in this conversation?
- Try a role play between the grad student and the undergrad in your small groups.
- What are the main themes raised in this case study and the take away? Be prepared to have a spokesperson report out.

Large Group Discussion of Case 2 – Google slides

What can we take away from this group discussion?

What elements of mentoring are present?

What elements of mentoring are missing?

What do you plan to do? Self reflection

- Write down a few approaches you will now use when mentoring undergraduates that you have not used before.
- Share your reflection and plan with your PI to establish clear communication pathways.



Optional follow up activities to earn Microbadge in Mentoring Undergraduates

You will be invited to Canvas site

1. Write a reflection on your mentoring style
2. Take the implicit bias test <https://implicit.harvard.edu/implicit/takeatest.html>
3. Modify and personalize undergraduate contract
4. Plan your first meeting with a new undergraduate considering how you may adapt your style if they come from a different background than you
5. Evaluate a third case study provided to you
6. Compose an original case study using a situation that you have encountered with an undergraduate
7. Write a reflection of your mentoring experience. How has your approach to mentoring changed?

Steps 1-4 should be completed prior to your mentee starting in the lab

Steps 5-7 should be completed by August 31



What principles are important in mentoring relationships?

1. Aligning Expectations

- Setting clear relationship expectations
- Goals of project
- Estimating mentee ability
- Enhancing mentee skills

2. Promoting Professional Development

- Helping network effectively
- Setting career goals
- Helping establish a work/life balance
- Helping mentees acquire resources

3. Maintaining Effective Communication

- Active listening
- Providing constructive feedback
- Developing a trusting relationship
- Accommodating communication style

4. Assessing understanding

- Setting research goals
- Developing strategies to meet goals
- Assessing mentee knowledge and comprehension

5. Mentee Self-Efficacy

- Motivating mentees
- Building confidence

6. Addressing Diversity

- Considering differences may impact expectations
- Accounting for biases and prejudices
- Accounting for different backgrounds of mentors and mentees

7. Fostering Independence

- Simulating creativity
- Acknowledging mentees' professional contributions
- Negotiating path to independence

8. Navigating Mentoring Networks

- Coordinating with other mentors

Material for this workshop

- Pfund, et al. *Entering Mentoring*, revised edition.
- NRMN-CAN workshops
- Lee, Steve "Mentoring Up: Pro-actively managing your mentoring relationship by assessing and applying your strengths". Graduate Diversity Office, UC Davis, University of California. PDF Presentation ABRCMS, November 12-15, 2014.
- Hyun, S.H. et al. Re-validation of the mentoring competency assessment to evaluate skills of research mentors: the MCA-2, *Journal of Clinical and Translational Science*. 10.1017/cts.2022.381 (2022)

Q & A

