# Pathways to Scientific Teaching
# UCSD and Michigan State University
# Postdoctoral
# Winter Quarter 2021 and Spring Semester 2021

Instructor:
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Seminar Overview: I enthusiastically invite postdoctoral fellows in the life sciences to learn to develop and implement state-of-the-art learner-centered instructional materials and teaching strategies for both large and small enrollment undergraduate STEM courses (in person and remotely). During this seminar, we will use scientific teaching to actively engage you in evidence-based instructional methods shown to be effective in helping students learn core disciplinary ideas by using science practices -- so it is not only what students learn, but how they use that knowledge. Importantly, the pathway to scientific teaching integrates the biological research model into a teaching approach by using science practices desired for all students, such as working with data, creating and using models, reasoning analytically, developing arguments, and working collaboratively. Postdocs will gain experience in developing a course framework and class lessons, instructional methods, and assessments directed at improving and assessing students' understanding of biology. Participants will select one or two core scientific concepts in the discipline, and develop an instructional module that is suitable for implementation in an introductory biology course taught at the freshman or sophomore level), and/or in a job interview that requests a demonstration of teaching.

Seminar Format: The seminar meets two hours weekly on Tuesdays, 12:00 – 2 pm ET, beginning on January 12 and continuing weekly until March 9, 2021. I encourage you to enroll with a colleague from your lab, although that is not required, it is just more fun. The topics in the seminar are intended to promote and build learner-centered student instruction in undergraduate science courses. Participants will practice inquiry-based, active learning throughout the seminar.

Upon completion of the seminar, postdocs will receive a certificate of participation which is citable on your CV.

Course Delivery and Technology Platforms: This course will occur ***online.*** Class meetings will be held synchronously (at the scheduled class meeting time) through Zoom. You will access course materials, including notes, homework assignments, supplemental readings, recordings of class meetings, and additional resources on Free Canvas for Teachers. This course management system is a user-friendly platform for us to work with.

Zoom Link: Pathways to Scientific Teaching 2021
Time: This is a recurring meeting Meet anytime

Join Zoom Meeting
https://msu.zoom.us/j/97648584797

Meeting ID: 976 4858 4797
Passcode: SWIM

Since our course is online, it will be helpful to have a reliable ***internet connection***. I understand that this is not always possible, and for that reason I shall make video recordings of each seminar available on Canvas immediately following class. In addition, I have found it useful to have a smartphone with camera for photographing and uploading handwritten work. If you have a tablet with drawing features, you can upload your work from that as well. We will be experimenting with additional technology tools throughout the course – particularly those that facilitate group interactions and collaborative work (e.g., Google Docs). Since the onset of Covid, I have given many departmental seminars and workshops online, but this will be the first time I've taught the entire Pathways course online. I am both excited and nervous –but we do what we have to do, right?

Readings: Assigned during the seminar and I'll send a short article before we begin.

Evaluation: Instructional modules are assessed using criteria developed for edition 2 of *Pathways to Scientific Teaching* (Ebert-May and Hodder eds 2008). Revision of the new edition is in progress.

Goals and Impact of Course: Participants will

- Demonstrate how and why to create inclusive, learner-centered courses in STEM – how do all students learn?
- Practice how to actively engage students in cooperative work and inquiry-based activities in all types of learning environments.
- Construct a unit/module in which objectives, assessments and instruction are aligned and that promote learner-centered instruction by engaging all students in science practices and core concepts during each class meeting.
- Create learning goals and assessments for the course that enable students to demonstrate deep understanding of core ideas and concepts in biology by using science practices (e.g., modeling, arguments).
- Use and evaluate instructional resources, technology and literature.
- Create, analyze and use assessment data to inform and improve instruction.
- Participate in planning and possibly teaching a class session in an introductory biology course.

**Pathways to Scientific Teaching**
**Weekly plan (not cast in stone!)**

| **When?**<br>**Seminar Number** | **Topics** | **Driving questions** | **Readings** |
|---|---|---|---|
| 1<br>Jan 12 | Establishing a learning community | Who are we? Who are your students?<br>What are your teaching and mentoring philosophies?<br>How do people learn? What does a learner-centered classroom look like and sound like? | Handelsman et al 2004<br>How People Learn (Ch1-3) |
| 2<br>Jan 19 | Effective classroom pedagogy -- evidence-based practices that are inclusive | What should we teach? What do students need to learn? What are the big ideas in biology? | Waldrop 2015<br>Vision & Change (Ch 1, 2) |
| 3<br>Jan 26 | Course frameworks and individual lessons/units | Designing course framework and learning outcomes - what are the core ideas/concepts? Use | Cooper et al 2015<br>Canning et al 2019 |

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| | | scientific practices to learn/connect concepts. | |
| 4<br>Feb 2 | Assessment of Learning | How will you know that students have learned? What evidence will you and your peers accept? | Tanner 2010<br>Long et al 2014 |
| 5<br>Feb 9 | Use science practices for assessment | How do we create substantive assessments (e.g., exam questions)? How do we manage scoring and grades?<br>. | Laverty et al 2015 |
| 6<br>Feb 16 | Inclusive learning environments | How do <u>all</u> students learn? What about motivation? How do you think about diversity and scientific teaching? How do you describe that in your teaching philosophy? | Theobald et al 2017 |
| 7<br>Feb 23 | Assessment of Learning – more detail | How do we score and evaluate exams? What to do with the data? | Sellers et al Case 7 |
| 8<br>March 2 | Instructional design | Group peer-review on learning module. Feedback – revise unit. | |
| 9<br>March 9 | Evaluating Instruction | How do we evaluate teaching? What are the criteria? Peer review and feedback. | |