

Neural Circuits of Motivation and Movement

Monday, Wednesday, Friday, 3:30 – 4:30 pm
PSYC394-02 | Fall 2026 | OLRI 301

Emily Twedell, PhD

Email: etwedell@macalester.edu

Pronouns: she/her/hers

Office: OLRI 346A

Student Hours:

Tuesdays, 9:30 – 11:00 am,

Fridays, 1:00 pm – 3:00 pm,

or by appointment

Welcome

Welcome to Neural Circuits of Motivation and Movement! I am so glad you are here. This class is a space for curiosity, exploration, and growth for all of us. This is my second year teaching at Macalester and what I am most looking forward to is getting to know you and exploring ideas together. My hope is this class will be a place where we can learn alongside one another by asking thoughtful questions, making connections, and finding new ways to understand the material.

Whether you are taking this course to fulfill a requirement, to explore an interest, or to build on an existing passion, you belong here. My goal is to support you as you take intellectual risks and discover what excites you most about this topic.



About me: I am a neuroscientist interested in the cellular and circuit mechanisms of motor (dys)function. Before Macalester, I completed my PhD at the University of California, San Francisco (UCSF). Outside of class, you will usually find me working on a knitting project with a cup of tea, swimming, or spending time with my cat, Rhoda. If you ever want to talk about neuroscience, grad school, your favorite local artists, or anything else, I'm always happy to chat. You can call me Emily, Professor Twedell, Dr. Twedell, or any combination that makes you feel comfortable. I use she/her/hers pronouns.

Overview of the Course

What initiates movement, sustains goal-directed behavior, and shapes our actions – and how do these processes break down in the brain and in society?

This advanced seminar examines the neural circuits that support movement and motivated behavior, including the basal ganglia, dopaminergic pathways, and cortical-striatal loops. We'll explore how these systems give rise to flexible behavior and how their dysfunction contributes to conditions such as Parkinson's disease, addiction, obsessive-compulsive disorder, and Tourette syndrome. Alongside neurobiological mechanisms, we'll also consider psychological frameworks and the ways in which these behaviors are shaped by, and interpreted within, broader social contexts.

Course work will center on primary literature, student-led discussion, and a multi-stage research proposal project. Students will engage deeply with experimental design, develop skills in scientific communication, and reflect on the societal relevance of neuroscience research. This is a discussion-based course that emphasizes critical thinking, collaborative learning, and interdisciplinary analysis.

Through close analysis of primary research articles, student-led discussions, and a scaffolded research proposal project, you will develop skills in experimental interpretation, scientific synthesis, and communication. Weekly reflection and structured peer feedback will support your learning and help you grow as a scientific thinker and collaborator.

This course emphasizes interdisciplinary inquiry, critical engagement with research, and real-world relevance within a collaborative, seminar-style environment.

Learning Goals

By the end of this course, you will be able to:

1. **Explain how neural circuits support movement and motivated behavior**, and how their disruption contributes to neurological and psychiatric conditions.
2. **Critically analyze primary neuroscience and psychology research**, including experimental design, data interpretation, and scientific conclusions.
3. **Design a theoretical research proposal**, including clear aims, methods, and predicted results grounded in current literature.
4. **Engage in thoughtful, inclusive scientific discussion**, both as a participant and a facilitator, including giving and receiving constructive feedback.
5. **Connect course concepts to broader psychological, clinical, and societal contexts**.

Community Code of Conduct (* to be amended based on your input)

This class is more than a collection of individuals – it is a learning community. The following expectations are designed to create a space where all students feel welcomed, challenged, and supported in their growth as scientists, thinkers, and people. These principles apply to all in-person and digital interactions in this course.

1. Respect One Another
 - Listen actively and attentively when someone is speaking - everyone's perspective has value.
 - Use names and correct pronouns.

- Critique ideas, not individuals. When offering feedback, be kind, constructive, and specific.
 - Step up, step back: Try to speak up if you're usually quiet and try to make space for others if you tend to talk often.
2. Engage with Openness and Curiosity
 - Ask questions about the material, about each other's ideas, and about how we think.
 - Acknowledge that learning often involves making mistakes and sitting with discomfort.
 - Assume positive intent but be accountable for the impact of your words and actions.
 3. Honor Diverse Ways of Learning and Communicating
 - Recognize that people process and express ideas differently. Some may think aloud, others may prefer to reflect before speaking.
 - Respect alternative forms of participation (e.g., written contributions, partner discussions, collaborative documents).
 - Be patient and inclusive of different backgrounds, levels of experience, and learning needs.
 4. Take Care of Ourselves and Each Other
 - Be mindful of your well-being and ask for support when needed.
 - Respect mental, physical, and emotional boundaries - including in collaborative work.
 - Celebrate each other's contributions and encourage growth, not perfection.
 5. Academic Honesty
 - Academic integrity is part of how we build trust and learn from one another.
 - Collaboration is encouraged, but you are expected to acknowledge all contributors and clearly distinguish your own work from shared ideas.
 - Give proper credit to all sources of information and ideas. Avoid plagiarism and fabrication.
 - For individual assessments (e.g., exams), all work must be completed independently.
 - If you are unsure whether something is acceptable, **please ask me** before submitting your work! Questions about process or citation are *a/ways* welcome.
 6. Co-Create a Safe and Supportive Space
 - If you witness or experience exclusion, disrespect, or harm, speak up or come talk to me - you will be supported.

We will revisit these agreements as needed and adjust them together to reflect the evolving needs of our community.

Assignments and Activities

This course is designed to help you build core skills in scientific thinking, communication, and collaboration. Throughout the semester, you will engage with course resources, analyze primary research, participate in scientific discussion, and develop a research proposal. Assignments are designed to build on one another as you practice interpreting evidence, evaluating research, developing scientific questions, and communicating your ideas clearly.

Participation (15%)

Your active engagement is essential to creating a meaningful learning environment.

Participation can take many forms:

- Asking or answering questions during class
- Submitting discussion questions in advance
- Leading a figure walkthrough
- Contributing during peer feedback sessions
- Engaging thoughtfully in small-group or whole-class activities

You don't need to speak every class session, but regular, thoughtful participation is expected. We all have different communication styles, and participation may look different for different students. If you are not able to participate verbally during class but would like to demonstrate active engagement, you are welcome to email me with a comment or idea you would have liked to share.

Attendance and punctual arrival are part of your participation grade. You are allowed three classroom absences, no questions asked, per semester. Absences for religious observances will not count towards these, so please just let me know in advance so we can plan accordingly. If you are unable to attend class any reason, please email me as soon as possible to discuss how you can stay engaged with the course material and community.

Students with any concerns, questions, or need for consideration for flexibility should connect with me as soon as possible to determine an appropriate plan.

Resource Engagement Questions (REQs, 15%)

To support consistent engagement with course material, you will regularly submit brief responses to questions based on assigned resources (e.g., readings, podcasts, videos) before class. REQs are designed to help you identify key concepts, make connections across topics, and recognize areas of uncertainty so that you arrive prepared to build on the material during class.

Prompts may ask you to explain a concept in your own words, interpret a figure or finding, evaluate an experimental approach, make a connection to prior material, or raise a question about something that remains unclear. Responses are graded for completion and thoughtful engagement rather than correctness; REQs are an opportunity to work through new material before we explore it in class together.

Discussion Leader (10%)

Once during the semester, you will co-lead discussion of a research article with a partner. Together, you will help your classmates work through the study's central question, experimental approach, key findings, and broader significance. You will guide interpretation of the data, encourage thoughtful discussion, and make connections between the article and concepts from across the course. This assignment is an opportunity to practice science communication, collaborative learning, and critical engagement with primary research.

Critical Review (10%)

You will write a 2-3 page critical review of a research article, modeled after the scientific peer-review process. Your review will evaluate the experimental approach, interpretation of the findings, and strength of the authors' conclusions. In addition, you will identify strengths, limitations, and opportunities for improvement.

Annotated Review (10%)

To begin developing your final research proposal, you will identify and engage with 10-15 relevant scientific sources. For each source, you will briefly summarize its main contribution, explain how it informs your developing research question, and identify relevant gaps or open questions. This assignment will help you build a foundation in the literature and refine the direction of your proposal.

Peer-Review and Writing Process (5%)

Scientific writing is an iterative process, strengthened through feedback and revision. Throughout the development of your grant proposal, we will use class time to workshop research questions, experimental ideas, and scientific writing. At several checkpoints, you will give and receive structured peer feedback and complete a brief worksheet documenting your feedback and revision plans. Your grade will reflect thoughtful engagement in these activities and the revision process.

Final Grant Proposal (25%)

The culminating assignment is a theoretical research proposal addressing a novel question related to course themes. You will develop a clear research question and hypothesis, propose experiments to test your ideas, and use conceptual figures to illustrate your predicted results. Your proposal will also consider potential interpretations, future directions, and the broader significance of your research.

Final Presentation (10%)

During the final week of class, you will give a 10-minute presentation of your research proposal. Your presentation will introduce the background and rationale for your project, explain your proposed experiments and predicted results, and discuss the interpretation and broader significance of your work. Presentations will be followed by a brief Q&A.

Weekly Reflections (not graded)

Each week, we will complete a short, written reflection. Prompts may include:

- “What was the most interesting thing you learned this week?”
- “What concept is still unclear?”
- “How does this connect to other things you've learned or observed?”

These will be ungraded but reviewed to help me adapt the course and support your learning.

Late Work

Deadlines are intended to help you stay on track and to ensure that assignments support your learning at the appropriate point in the course. If you anticipate difficulty meeting a deadline, please reach out to me as soon as possible so we can make a plan.

Unless we have made other arrangements, late assignments will be accepted for up to 3 days after the deadline with a 10% deduction per day. Work submitted after that point may not be accepted.

Because REQs are intended to prepare you for our in-class discussions, they must be submitted before the relevant class session to receive credit.

If circumstances arise that interfere with your ability to complete coursework on time, please communicate with me! Life happens, and I understand there may be times when you need additional flexibility. You do not need to share personal details, but please let me know when something is impacting your coursework so that we can make a plan together.

File Format and Submission Naming Conventions

All written assignments must be submitted electronically via Moodle as either a Word document (.docx) or PDF (.pdf) file.

To ensure files can be identified and returned efficiently, please name your files using the following format:

FirstLast_AssignmentTitle_F2026

For example:

EmilyTwedell_CriticalReview_F2026

SantiagoRamónCajal_FinalGrantProposal_F2026

CamilloGolgi_AnnotatedReview_F2026

A note about file names: I teach multiple courses and work with many student submissions each semester. As I teach courses across multiple semesters, consistent file names are especially important for helping me organize, identify, and keep track of your work. This convention is not intended to be rigid for its own sake; it makes managing and returning your work much more reliable.

I also understand that mistakes happen! If you submit an unlabeled file (e.g., 'CriticalReview(1)'), I will remind you of the naming convention. After three reminders, subsequent assignments submitted with incorrect labels will receive a 5% deduction. No deduction will be applied to the first three instances.

Safe Space to Share Your Thoughts

I recognize that there is an inherent imbalance in the power dynamic between us and know that can stand in the way of open communication. For this reason, I have created an anonymous [GoogleForm](#) that will remain open to submissions and be checked regularly for you to ask questions, provide feedback, or share any information without worrying about how it might affect you. If you would like a direct response, you can also provide your name and/or contact information (completely optional).

Accommodations

I am committed to ensuring access to course content for all students, including those with disabilities. If you have a disability, please meet with me early in the semester to discuss your accommodation plan. If you have not yet obtained a plan or are unsure if you have a disability that requires accommodation, please contact Disability Resources: disabilityresources@macalester.edu, or call 651-696-6275. You can learn more about the Center for Disability Resources [here](#).

Health and Wellness

Here at Macalester, we encourage you to make your well-being a priority throughout this semester and your time here. Investing time into taking care of yourself will help you engage more fully in your academic and holistic experience. Sleeping, moving your body in a way that feels supportive to you, and connecting with others can be strategies to help you navigate your time at Macalester. Remember that beyond being a student, you are a human being carrying your own experiences, thoughts, emotions, and identities with you. Acknowledging any stressors you may be facing, which can be mental, emotional, physical, financial, etc., and how they can have an academic impact may be helpful and Macalester offers an array of resources to help you navigate these challenges. If you are having difficulties maintaining your well-being, please feel welcome to reach out to me or to the [Hamre Center](#) directly so we can help connect you to the resources that are supportive of you and your unique experience.

Academic Resources

Macalester has many resources to support students academically. For example, the Writing Center (WC) provides one-on-one peer tutoring for writing at any stage of a project or paper; the Science and Quantitative Center (SciQ) supports group tutoring for many math, science, and econ courses; and Academic Coaching provides one-on-one support for study skills, time management, reading, note taking, and effective learning strategies. Seeking help is a sign of strength and maturity, and everyone is encouraged to take advantage of the (free) resources available. Check out the [Academic Success page](#) for more information about their services.

Academic Integrity

Academic integrity is essential to learning and to building trust in our classroom community. You are expected to follow Macalester College's academic integrity policies and to submit work that reflects your own understanding, reasoning and language. You can learn more about Macalester College's official academic integrity policies [here](#). You can also learn more about how to document sources and how to avoid plagiarism from the [Library website](#).

Use of AI tools:

In this course, you may use AI tools for limited support tasks such as brainstorming, idea generation, outlining, or identifying areas of confusion. However, AI tools may produce inaccurate, incomplete, or misleading information, and overreliance on them can interfere with your own learning.

You may **not** submit AI-generated text, analyses, explanations, or answers as your own work. The scientific reasoning underlying your research proposal, including your research question, hypothesis, and experimental design, must all be your own. All submitted work must be written in your own words and reflect your own reasoning.

If you use AI tools in an appropriate way, you must still:

- Independently evaluate the content for accuracy
- Write the final submission yourself
- Cite the use of AI tools when they contribute to ideas or language, just as you would any other source

If you are unsure whether a particular use of AI is permitted, please ask **before** submitting your work. Questions about process, citation, or boundaries are always welcome.